
Calibration Guide

HP 70340A/70341A
Signal Generators

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The Calibration Guide

This calibration guide provides procedures for testing all of the HP 70340A or the HP 70341A Signal Generators' warranted specifications. All required manual and automated adjustment procedures are also provided for these instruments.

HP 70341A calibrations are incorporated into the procedures. In most cases the procedure for the HP 70340A precedes the procedure for the HP 70341A. If you are testing an HP 70341A only, use the procedure to setup the test equipment and preset equipment, then proceed to the portion of the procedure specifying either the HP 70341A or the frequency range 0.01 to 1 GHz.

In This Book

This book contains the information required to verify and adjust the performance of your Signal Generator.

“Performance Tests” contains procedures which verify all of the instrument hard specifications. A subset of these procedures (as listed in the beginning of the chapter) are sufficient for incoming inspection of the instrument.

“Manual Adjustment Procedures” and “Automated Adjustment Procedures” contain the procedures for adjusting the Signal Generator after certain repairs and for improved performance.

The “Recommended Test Equipment” table contains a list of the equipment necessary for the procedures, along with critical specifications and recommended models.

The “Test Records” chapter contains the worksheets for recording performance test values. There is a separate test record for each of the four Signal Generators covered in this book. The test record should be treated as a master; copies should be made where actual records are kept.

“Specifications” contains a list of the specifications and supplemental characteristics for each instrument: HP 70340A and HP 70341A.

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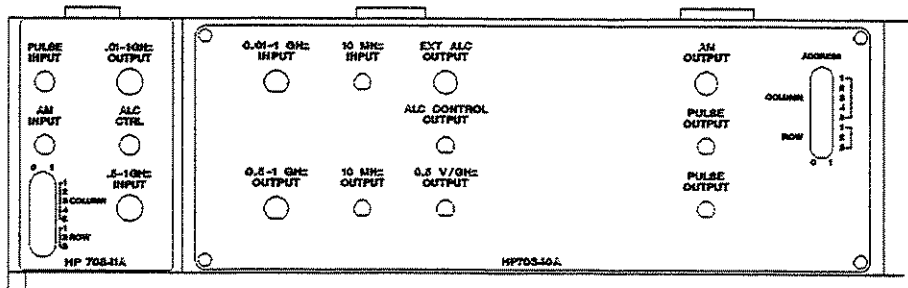
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Performance Tests

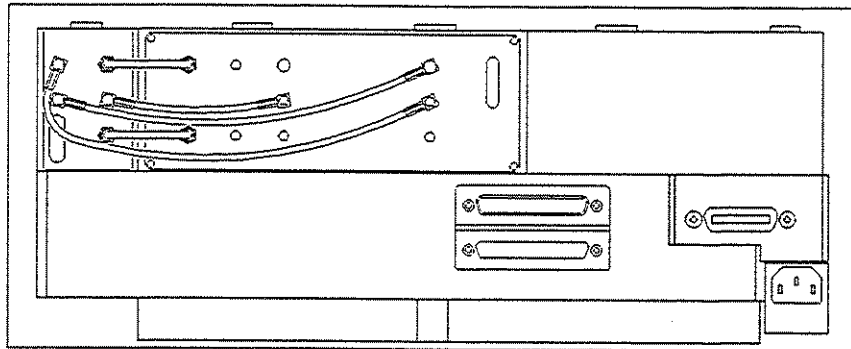
Performance Tests

Introduction The procedures detailed here test the electrical performance of the Signal Generator. These tests do not require access to the interior of the instrument. You may test an HP 70340A, an HP 70341A, or both using these procedures. An MMS display is required for interfacing. You must use the display whether you are testing an HP 70340A or an HP 70341A.

If you are planning to calibrate an HP 70341A, you must have an HP 70340A available for the calibration. Any calibrated HP 70340A can be used in the calibration procedure for an HP 70341A. The connections needed to calibrate an HP 70341A are shown below.



Performance Tests



Notes

1. If these tests are to be considered valid, the following conditions must be met:
 - Allow the Signal Generator to warm up for at least one hour before running any tests.
 - Perform the tests in the order that they appear.
 - Select test equipment as listed in each test or according to the Recommended Test Equipment Table in the Recommended Test Equipment chapter.
 - The tests are performed under normal operating conditions as stated in the specification tables in the Specifications chapter of this book.
2. The person who performs the test supplies whatever cables, connectors, and adapters are necessary.
3. These tests contain a minimum set of data points. The performance of the Signal Generator *can* be checked at other points within the specified range.

Test Records

Calculations and results of the performance tests may be recorded in the appropriate test record of the "Test Records" chapter of this book. Results recorded at incoming inspection can be used for comparison in periodic maintenance and troubleshooting, and after repairs or adjustments.

Calibration Cycle

This instrument requires periodic verification of performance. Under normal use and environmental conditions, the instrument should be calibrated every two years. Normal use is defined to be about 2000 hours of use per year.

Recommended Test Equipment

The Recommended Test Equipment chapter contains a table of equipment that is necessary for operator's checks or incoming inspection, performance tests, adjustments, and troubleshooting.

Test equipment is also listed in each procedure with the test setup. Other equipment can be substituted for the recommended models (except where noted otherwise) if it meets or exceeds the critical specifications listed.

Test Setups

A diagram showing the test setup is included at the beginning of each procedure. The diagrams for procedures apply to both the HP 70340A and

the HP 70341A, even though only the HP 70340A is shown. The instrument is labeled as HP 70340A in these diagrams. Note that arrows in the diagrams indicate a connection to the instrument rear panel and do not indicate signal flow.

Incoming Inspection

The following subset of performance tests are recommended for incoming inspection of the instrument. They are also recommended for operational verification and for post repair verification.

HP 70340A (1 to 20 GHz)

- Self Test
- Frequency Range and Resolution
- External ALC
- Maximum Leveled Power
- Vernier Level Accuracy and Flatness
- Harmonics
- Pulse On/Off Ratio
- Maximum FM Deviation
- Minimum AM Depth

HP 70341A (.01 to 1 GHz)

- Self Test
- Frequency Range and Resolution
- Maximum Level Power
- Vernier Level Accuracy and Flatness
- Harmonics
- Pulse On/Off Ratio
- Minimum Am Depth

The Signal Generator Self Test

The Signal Generator Self Test is designed to determine the functionality of the instrument under normal (room temperature, low humidity) environmental conditions.

This procedure must be performed for all instrument models.

Notes

1. Running the self-test will leave the Signal Generator in the preset state.
2. Error codes generated under conditions of environmental stress may or may not indicate a failure of the Signal Generator circuitry.

1. Disconnect any external connections to the Signal Generator.
2. Check the Signal Generator for any pre-existing error conditions.

For the Signal Generator:

Error conditions are indicated by the MMS display. If the MMS display indicates any errors, read the error messages and resolve any problems before continuing with this procedure.

NOTE

If any problems cannot be resolved (one or more error messages cannot be cleared), go to the troubleshooting chapter of the Service Guide for the instrument.

3. To run the self test routine.

On the MMS display:

- a. Press the **SELF TEST** key. The display reads, "SELF TEST?, PRESS ENTER."
- b. Press ENTER again.

When the self test routine is running, the display will alternately flash "SELF TESTING!" and "PRESETTING INSTRUMENT." After the test completes, the display reads "Self Test passed." If the self test fails, the display will read "TEST XX = YY" where "XX" and "YY" are numbers indicating the error condition.

4. If the self test indicates a true error condition, refer to the troubleshooting section of the *Service Guide*.

If the Procedure Fails

- Check that the display is not flashing an error message.
- Refer to the *Service Guide*.

Frequency Range and Resolution

This procedure uses a frequency counter to verify the frequency range and the tuning resolution of the Signal Generator.

Specification

Specification	Conditions
HP 70340A	
1 kHz	1 to 20 GHz
1 Hz	1 to 20 GHz (Option 1E8)
HP 70341A	
1 kHz res	0.01 to 0.999999 GHz
1 Hz res	0.01 to 0.999999999 GHz (Option 1E8)

Recommended Equipment

HP 5343A Frequency Counter Option 001

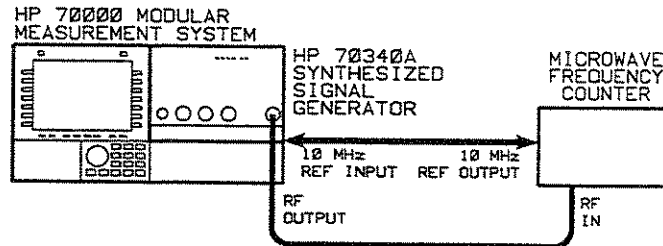


Figure 1-1. Frequency Range and Resolution Test Setup

To Set Up the Equipment

1. Set up the equipment as shown in Figure 1-1.

NOTE

Use a cable that has no more than 20 dB of loss over the frequency range being tested to connect the Signal Generator RF Output to the frequency counter.

2. Preset (or reset) the frequency counter.
3. Set the frequency counter display resolution to 100 Hz (or 1 Hz if your Signal Generator has Option 1ES).
4. Preset the Signal Generator.
5. Set the RF Output level to 0 dBm on the Signal Generator.
6. Set the CW Frequency on the Signal Generator to the following:
 - HP 70340A: 1 GHz
 - HP 70341A: 10 MHz

To Check Frequency Resolution

1. Read the value displayed on the frequency counter and record it in the test record chapter of this book.

The display should read as follows:

HP 70340A: 1 GHz \pm 100 Hz (or \pm 1 Hz for Option 1E8).

HP 70341A: 10 MHz \pm 100 Hz (or \pm 1 Hz for Option 1E8).

2. Increase the Signal Generator CW Frequency by 1 kHz (or by 1 Hz for Option 1E8) *as indicated on the Signal Generator display.*
3. Read the value displayed on the frequency counter and record it in the test record chapter of this book.

To Check Frequency Range

If you are checking an HP 70340A, check the range from 1 to 20 GHz. If you are checking an HP 70341A, check from 10 MHz to 999.999 MHz (or 999.999999 for option 1E8). Check both ranges for a combination of both instruments.

1. For an HP 70340A, increase the Signal Generator CW Frequency to 20 GHz.
2. Read the value displayed on the frequency counter and record it in the test record.

The display should read 20 GHz \pm 100 Hz (or \pm 1 Hz for Option 1E8).

3. For an HP 70341A, increase the Signal generator to 999.999 MHz.
4. Read the value displayed on the frequency counter and record it in the test record.

The display should read 999.999 MHz \pm 100 Hz (or \pm 1 Hz for Option 1E8.)

If the Procedure Fails

- Verify the test setup and instrument settings.
- Refer to the "Performance Test Failures" of the *Service Guide*.

External ALC

External Automatic leveling Control (ALC) capability is verified by using a power meter to level the signal at a point other than the RF OUTPUT connector.

This test must be performed for the HP 70340A only.

Recommended Equipment

HP 437B Power Meter
HP 8481A Power Sensor
HP 8494B 0 to 11 dB Step Attenuator

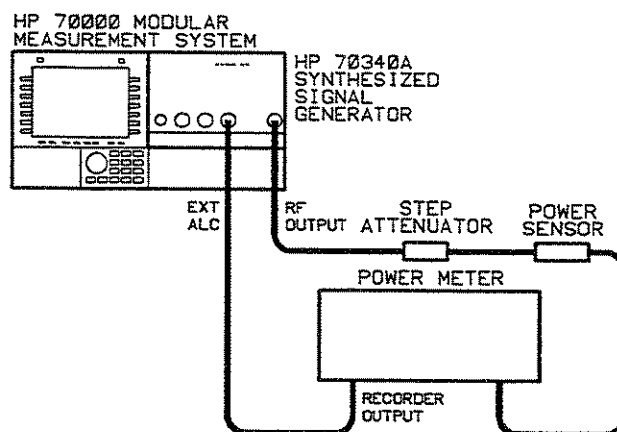


Figure 1-2. External Leveling Test Setup

To Set Up the Equipment

1. Connect the equipment as shown in the Figure 1-2.
2. Set the power meter to dBm mode.
3. Set the step attenuator to 1 dB.
4. Preset the Signal Generator.
5. Set the RF Output level to 5 dBm on the Signal Generator.

To Level the Signal Externally

1. Select the auto-range mode on the power meter.
2. Select range hold mode on the power meter.
For the Signal Generator:
 - a. Press the **Amptd** key.
 - b. Press the **PWR MTR READING** key.
 - c. Enter the power shown on the power meter display into the Signal Generator using the numeric keypad and **dBm** keys.
Once the power meter reading is entered, the Signal Generator enters external power meter leveling mode.

To Verify External Leveling

1. Observe the power meter reading.
2. Set the step attenuator to +2 dB.

Performance Tests

External ALC

3. Observe that the power meter reading changes and then returns to about the same level as in step 1.
4. Set the step attenuator to 0 dB.
5. Observe that the power meter reading changes and then returns to about the same level as in step 1.
6. Record your observations in the test record chapter of this book.

The power meter reading should be about the same as it was in step 1.

If the Procedure Fails

- Verify the test setup and instrument settings.
- Refer to the "Performance Test Failures" of the *Service Guide*.

Maximum Leveled Power

This procedure verifies the maximum power specification over frequency by measuring the power at the output connector of the Signal Generator when it is set for maximum vernier and 0 dB of attenuation.

If you are verifying the maximum power for an HP 70341A, go to the portion of this procedure titled To Measure Maximum Power at 1 GHz, then, after performing that procedure, perform To Measure Maximum Power for 0.01 to 1 GHz. If you are verifying both an HP 70340A and an HP 70341A, perform the entire procedure.

HP 70340A/70341A

Frequency	Standard	with Option 1E1
0.01-1 GHz	+13 dBm	+13 dBm
1-18 GHz	+11 dBm	+10 dBm
18-20 GHz	+10 dBm	+8 dBm

Recommended Equipment

HP 437B Power Meter
HP 8482A Power Sensor (for .01 to 1 GHz, only)
HP 8485A Power Sensor
HP 1250-1744 Type N(m) to APC 3.5 mm(f) Adapter

NOTE

The adapter used in this procedure must be an HP 1250-1744 Adapter that is in good condition. A Type N to SMA adapter is not an acceptable substitute.

Maximum Levelled Power

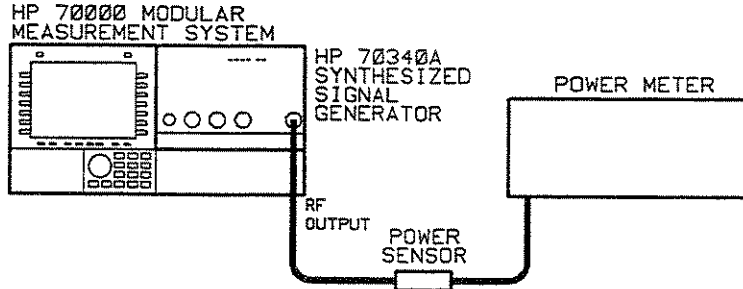


Figure 1-3. Maximum Power Test Setup

To Set Up the Equipment

1. Zero and calibrate the power sensor (HP 8485A) and meter according to the power meter operating manual.
2. Set up the equipment as shown in Figure 1-3.
3. Set the Power Meter to dBm mode.
4. Preset the Signal Generator.
5. Set CW Frequency on the Signal Generator to 1 GHz.
6. Adjust the RF output level of the Signal Generator as follows:

Model	Level Setting	Frequency Range
HP 70340A	+12 dBm	1-18 GHz
HP 70340A Option 1E1	+11 dBm	1-18 GHz
HP 70341A	+14 dBm	0.01-1 GHz

Note that the Signal Generator level setting is 1 dB greater than the specification.

To Measure Maximum Power at 1 GHz

1. Set the calibration factor on the power meter for the Signal Generator's CW frequency.
2. Measure power on the power meter using the HP 8485A Sensor.
3. Check the Unleveled Indicator and the power level indicated on the power meter.
4. If the Unleveled Indicator is off and the power indicated on the power meter is greater than or equal to the maximum leveled power specification shown at the beginning of this procedure, record this observation by circling "yes" in the test record chapter of this book.
5. If the unleveled indicator is on *and* the power meter reading is less than the maximum leveled power specification, the instrument does not pass this test.

Record this observation by circling "no" in the test record chapter of this book. Refer to "If the Procedure Fails" below.

6. If the unleveled indicator is on and the power meter reading is greater than the maximum leveled power specification, *slowly* decrease the Signal Generator RF output level until the unleveled indicator turns off.
7. If the unleveled indicator turns off and the power meter display is still greater than or equal to the maximum leveled power specification, record this observation in the test record by circling "yes."
8. If the power meter display is less than the maximum leveled power specification when the unleveled indicator turns off, the instrument does not pass this test. Record this observation in the test record by circling "no," and refer to "If the Procedure Fails."
9. If the unleveled indicator is off and the power meter reading is less than the maximum leveled power specification, *slowly* increase the Signal Generator RF Output level until the power meter reading is equal to the maximum leveled power specification.
10. If the power meter reading is equal to the maximum leveled power specification, and the unleveled indicator is off, record this observation in the test record by circling "yes."

Performance Tests

Maximum Leveled Power

11. If the unlevelled indicator turns on before the maximum leveled power specification is attained, the instrument does not pass this test. Record this observation in the test record by circling "no," and refer to "If the Procedure Fails."

To Measure Maximum Power between 1 GHz and 18 GHz:

1. For the following CW frequencies, set the cal factor, measure power, and verify that: the Unlevelled Indicator is off and the power meter reading is \geq the specification as in the procedure, "To Measure Maximum Power at 1 GHz."

1.64 GHz
2.74 GHz
4.79 GHz
5.99 GHz
7.99 GHz
9.99 GHz
10.00 GHz
12.79 GHz
13.99 GHz
17.99 GHz

To Measure Maximum Power between 18 GHz and 20 GHz:

1. Set the Signal Generator RF Output level as follows:

Performance Tests
Maximum Leveled Power

Model	Level Setting	Frequency Range
HP 70340A	+11 dBm	18-20 GHz
HP 70340A Option 1E1	+9 dBm	18-20 GHz

- For the following CW frequencies, set the cal factor, measure power, and verify that: the Unleveled Indicator is off and the power meter reading is \geq the specification as in the procedure, "To Measure Maximum Power at 1 GHz."

NOTE

Set the Increment Value for CW Frequency to 1 MHz, and use the Knob or arrow keys to more easily change frequencies.

19.0 GHz
19.1 GHz
19.2 GHz
19.3 GHz
19.4 GHz
19.5 GHz
19.6 GHz
19.7 GHz
19.8 GHz
19.9 GHz
20.00 GHz

To Measure Maximum Power for 0.01 to 1 GHz

(HP 70341A Only)

Performance Tests

Maximum Levelled Power

1. Replace the HP 8485A Sensor with the HP 8482A Sensor for this procedure.
2. Set the Signal Generator RF Output level to 14 GHz.
3. For the following CW frequencies, set the cal factor, measure power, and verify that: the Unleveled Indicator is off and the power meter reading is \geq the specification as in the procedure, "To Measure Maximum Power at 1 GHz."

NOTE

Set the Increment Value for CW Frequency to .1 MHz, and use the Knob or arrow keys to more easily change frequencies.

10 MHz
11.2 MHz
11.3 MHz
15.9 MHz
16 MHz
22.5 MHz
22.6 MHz
31.9 MHz
32 MHz
45.3 MHz
45.4 MHz
63.9 MHz
64 MHz
90.4 MHz
90.5 MHz
127.9 MHz
128 MHz
180.9 MHz
181 MHz
255.9 MHz
256 MHz
361.9 MHz

362 MHz
499.9 MHz
500 MHz
699.9 MHz
700 MHz
999 MHz

If the Procedure Fails

- Verify the test setup and instrument settings.
- Check that the proper sensor is being used for the frequency being tested.
- Check that the sensor and power meter are properly calibrated and zeroed.
- Check that the correct sensor calibration factor is used for the frequency being tested.
- Refer to the “Performance Test Failures” of the *Service Guide*.

Vernier Level Accuracy and Flatness

This procedure tests level accuracy throughout the vernier range with a power meter and sensor.

Flatness is measured at several power level settings by identifying the largest and smallest recorded readings at all of the frequency settings, and determining the difference between them.

Specification	Conditions
Level Accuracy:	
±1.3 dB	HP 70341A, (10–50 MHz) –4 dBm to max power
±1.0 dB	HP 70341A, (50 MHz – 20 GHz) –4 dBm to max power
±1.0 dB	HP 70340A, (1–20 GHz) –4 dBm to max power ¹
Flatness:	
1 dB ²	1 MHz to 1 GHz
1 dB	1 GHz to 20 GHz

¹ Using standard Type N RF Output connectors, level accuracy is not specified above 18 GHz. Level accuracy in this frequency range is typically degraded by about 0.2 dB.

² Total deviation from ideal flatness is ±0.5 dB (a range of 1 dB).

Recommended Equipment

HP 437B Power Meter

HP 8481A Power Sensor

HP 8485A Power Sensor (for Signal Generator with Option 1E9)

HP 1250-1750 3.5 mm to Type N Adapter (to test to 10 MHz with Option 1E9)

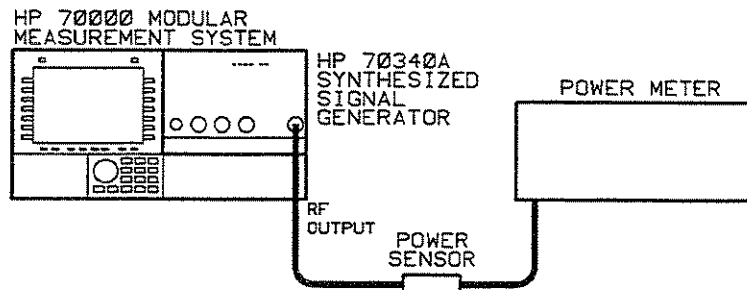


Figure 1-4. Vernier Level Accuracy and Flatness Test Setup

To Set Up the Equipment

1. Select the appropriate power sensor. If you have an Option 1E9 instrument, you will need to use the HP 8481A power sensor and 3.5 mm to Type N adapter to test from 10 MHz to 50 MHz.
2. Zero and calibrate the power sensor and meter according to the power meter operating manual.
3. Set up the equipment as shown in Figure 1-4.
4. Preset the Signal Generator.
5. Set CW Frequency on the Signal Generator to the following
 - HP 70340A: 1.033 GHz
 - HP 70341A: 10.1 MHz
6. Set the RF Output level on the Signal Generator to the following levels:
 - HP 70340A: +8 dBm.
 - HP 70341A: +8 dBm.

To Measure Vernier Level Accuracy

1. Set the calibration factor on the power meter as required for a reading at the selected frequency.
2. Measure the power at each of the following level settings and record it in the test record chapter of this book.

HP70340A	HP 70341A
+8 dBm	+8 dBm
+6 dBm	+6 dBm
-3.9 dBm	-3.9 dBm

If you have an HP 70341A:

For 10 MHz to 50 MHz, power levels should be accurate to ± 1.3 dB. For 50 MHz to 20 GHz, power levels should be accurate to ± 1.0 dB.

If you have an HP 70340A, power levels should be accurate to ± 1.0 dB, 1 to 20 GHz.

3. Repeat steps 1 and 2 for each of the following frequencies:

HP 70341A	HP70340A
10.1 MHz	
18.192 MHz	
329.488 MHz	
657.168 MHz	
984.848 MHz	
	1.033 GHz
	5.225 GHz
	9.487 GHz
	13.75 GHz
	18.00 GHz
	20.00 GHz ¹

¹ 20 GHz flatness and accuracy is specified for Option 1E9 (3.5 mm RF Output) instruments only. Use the HP 8485A power sensor above 18 GHz.

To Check Flatness

1. Review the level readings for the maximum recorded power level at all frequencies in order to determine flatness.

For each RF Level setting, flatness is the absolute difference between the largest recorded level reading and the smallest recorded level reading without regard to frequency. For example, if the recorded level reading is largest at 1.033 GHz (+8.1 dBm, for example) and smallest at +18.00 GHz (+7.9 dBm, for example), then flatness at the +8 dBm setting would be 0.2 dB.

2. Record the calculated flatness in the test record chapter of this book.

Performance Tests

Vernier Level Accuracy and Flatness

For 10 MHz to 1 GHz, the variation between any two recorded power levels should be less than 1.3 dB.

For 1 GHz to 20 GHz, the variation between any two recorded power levels should be less than 1.0 dB.

NOTE

Flatness is not referenced to any particular frequency. Rather it represents the total power variation over the entire frequency range of the signal generator. The maximum to minimum power level difference is less than two times the plus-and-minus specification limits. Thus, for a specification of ± 0.5 dB, the maximum to minimum power level difference will be less than 1.0 dB.

If the Procedure Fails

- Verify the test setup and instrument settings.
- Check that the Sensor and power meter are properly calibrated and zeroed.
- Check that the correct sensor is used for the power level being measured.
- Check that the correct sensor calibration factor is used for the frequency being tested.
- Run the "Frequency Calibration 1" and the "Vernier Calibration" procedures in the "Automated Adjustments" chapter. For frequencies of 1 to 20 GHz, use the automated adjustments for the HP 70340A. If a problem occurs in the 0.01 to 1 GHz range, you should run a "Frequency Calibration 2" for the HP 70340A.
- Refer to the "Performance Test Failures" section of the *Service Guide*.

Low Level Accuracy and Flatness (Option 1E1 Only)

This procedure should be performed for all instrument models with Option 1E1. The procedure measures and verifies low level (-4 dBm to -90 dBm) accuracy using a power meter for -4 to -24 dBm and the HP 8902A Measuring Receiver for levels down to -90 dBm.

Specification	Conditions
Low Level Accuracy	
± 2.3 dB	10 to 50 MHz
± 2.0 dB	50 MHz to 1 GHz
± 2.0 dB	1 to 20 GHz ¹
Flatness:	
1 dB	1 MHz to 1 GHz
1 dB	1 GHz to 20 GHz ¹

¹ With the standard Type N RF Output connector, level accuracy is not specified above 18 GHz. Level accuracy in this frequency range is typically degraded by about 0.2 dB.

Recommended Equipment

HP 71210C Spectrum Analyzer
HP 8902A Measuring Receiver
HP 437B Power Meter
HP 8481A Power Sensor (for Signal Generator without Option 1E9)
HP 8485A Power Sensor (for Signal Generator with Option 1E9)
HP 8493C Option 010 10 dB Attenuator

Performance Tests

Low Level Accuracy and Flatness (Option 1E1 Only)

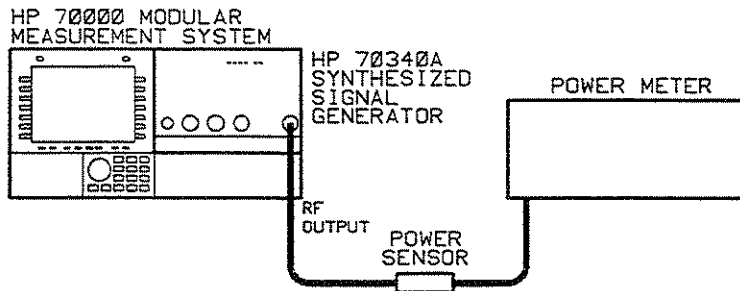


Figure 1-5. Low Level Accuracy Test Setup using Power Meter

To Set Up the Equipment for Levels from -24 dBm to $+5$ dBm

1. Preset the Signal Generator.
2. Set CW Frequency on the Signal Generator 18 GHz.
3. Set RF Output level on the Signal Generator to -24 dBm.
4. Zero and calibrate the power meter and sensor and enter the appropriate cal factor for the frequency.
5. Connect the equipment as shown in Figure 1-5.

To Measure Level Accuracy from -24 dBm to $+5$ dBm with a Power Meter

1. Read the level displayed on the power meter and record in the test record chapter of this book.

NOTE

In this test, data is gathered for accuracy at some frequencies. Data for flatness is gathered at other frequencies. The test record for Low Level Accuracy and Flatness at the end of this book is organized by frequency (from lowest to highest) only.

2. Set the Signal Generator RF Output to the following levels, and read and record the displayed power meter reading for each.

-24 dBm
-14 dBm
-4 dBm
+5 dBm

Note that the power meter reading at the Signal Generator setting of +5 dBm, referred to in the test record as ABS@(frequency) is used later in this procedure as a reference for relative measurements.

3. Repeat steps 1 and 2 for each of the following frequencies:

HP 70341A	HP70340A
42.768 MHz	
960.272 MHz	
	1.033 GHz
	18.00 GHz

Performance Tests

Low Level Accuracy and Flatness (Option 1E1 Only)

To Establish References at -14 dBm and $+5$ dBm with a Power Meter for Level Flatness

1. Read the level displayed on the power meter and record in the test record chapter of this book.
2. Set the Signal Generator RF Output to the following levels, and read and record the displayed power meter reading for each.
 - -14 dBm
 - $+5$ dBm
3. Repeat steps 1 and 2 at the following frequencies:

HP 70341A	HP70340A
	13.75 GHz
	9.487 GHz
	5.225 GHz
632.582 MHz	
304.912 MHz	

To Set Up Equipment for frequencies below 1 GHz and levels from -34 dBm to -90 dBm

This procedure applies to HP 70341A instruments only.

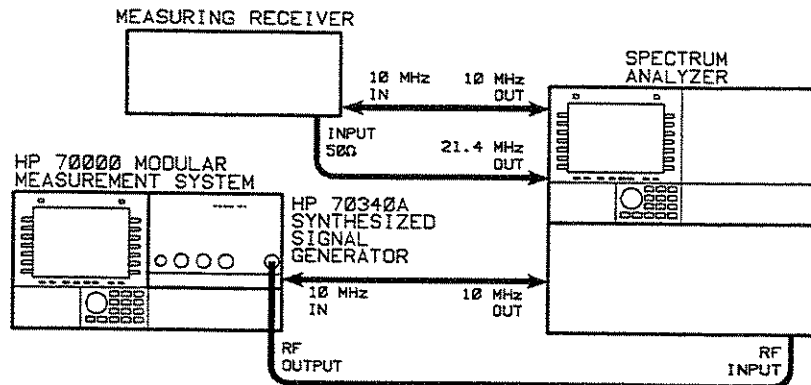


Figure 1-6. 10 MHz to 1 GHz Low Level Accuracy Test Setup using Measuring Receiver

1. Connect the equipment as shown in Figure 1-6.
2. Set the Signal Generator RF Output level to +5 dBm at 42.768 MHz.
3. Set up the HP 8902A Measuring Receiver as follows:
 - a. Press **Blue Shift** and then the green **Instrument Preset** to preset.
 - b. Press **MHz** (INPUT FREQ).
 The display should read
 42.768 MHz
 - c. Press **Gold S** and then **Tuned RF Level** to set the receiver to tuned RF mode.
 Ignore any error indicators such as the UNCAL Annunciator.
 - d. Press **LOG/LIN** in order to display power in dBm.
 - e. Press **Blue Shift** and then **SET REF** (the **ZERO** key) to set the receiver to relative mode.
 The display should read
 0.00 dB
 and no error indicators should be on.

To Measure Relative Level Accuracy below 1 GHz from -34 dBm to -90 dBm

This procedure applies to HP 70341A instruments only.

1. Decrease the Signal Generator RF Output to -4 dBm.
2. Check to see whether the RECAL Annunciator on the Measuring Receiver is on or off.

If the RECAL Annunciator is off, decrease the RF Output by 10 dBm.

If the RECAL Annunciator is on, press the **CALIBRATION** key on the Measuring Receiver, and then, decrease the RF Output by 10 dB.

3. Continue to decrease the Signal Generator output by 10 dB steps, recalibrating the Measuring Receiver whenever the RECAL Annunciator turns on, until you reach -34 dBm.
4. Record the Measuring Receiver relative reading, REL, for the following Signal Generator levels in the test record chapter of this book.

-34 dBm
-44 dBm
-54 dBm
-64 dBm
-74 dBm
-84 dBm
-90 dBm

5. Set the Signal Generator frequency to 960.272 MHz.
6. Set the Signal Generator CW level to +5 dBm.
7. Establish a +5 dBm reference level on the measuring receiver:
 - a. Set up the HP 8902A Measuring Receiver as follows:
Press **Blue Shift** and then the green **Instrument Preset** to preset.
Press **MHz** (INPUT FREQ).
The display should read
960.272 MHz
Press **Gold S** and then **Tuned RF Level** to set the receiver to tuned RF mode.

Press **LOG/LIN** in order to display power in dBm.

Press **Blue Shift** and then **SET REF** (the **ZERO** key) to set the receiver to relative mode.

The display should read

0.00 dB

and no error indicators should be on.

8. Repeat steps 1 through 4 and record the levels in the test record.

To Establish Relative References below 1 GHz at -90 dBm for Level Flatness

This procedure applies to HP 70341A instruments only.

1. Set the Signal Generator to 304.912 MHz.
2. Establish a +5 dBm reference on the measuring receiver.
 - a. Set up the HP 8902A Measuring Receiver as follows:

Press **Blue Shift** and then the green **Instrument Preset** to preset.

Press **MHz** (INPUT FREQ).

The display should read

304.912 MHz

Press **Gold S** and then **Tuned RF Level** to set the receiver to tuned RF mode.

Press **LOG/LIN** in order to display power in dBm.

Press **Blue Shift** and then **SET REF** (the **ZERO** key) to set the receiver to relative mode.

The display should read

0.00 dB

and no error indicators should be on.

3. Decrease the Signal Generator RF Output to -4 dBm.

Low Level Accuracy and Flatness (Option 1E1 Only)

4. Check to see whether the RECAL Annunciator on the Measuring Receiver is on or off.

If the RECAL Annunciator is off, decrease the RF Output by 10 dBm.

If the RECAL Annunciator is on, press the **CALIBRATION** key on the Measuring Receiver, and then, decrease the RF Output by 10 dB.

5. Continue to decrease the Signal Generator output by 10 dB steps, recalibrating the Measuring Receiver whenever the RECAL Annunciator turns on, until you reach -90 dBm.
6. Record the Measuring Receiver relative reading, REL, in the test record chapter of this book.
7. Repeat this procedure for 632.592 MHz.

To Set Up Equipment for Frequencies above 1 GHz and levels from -34 dBm to -90 dBm

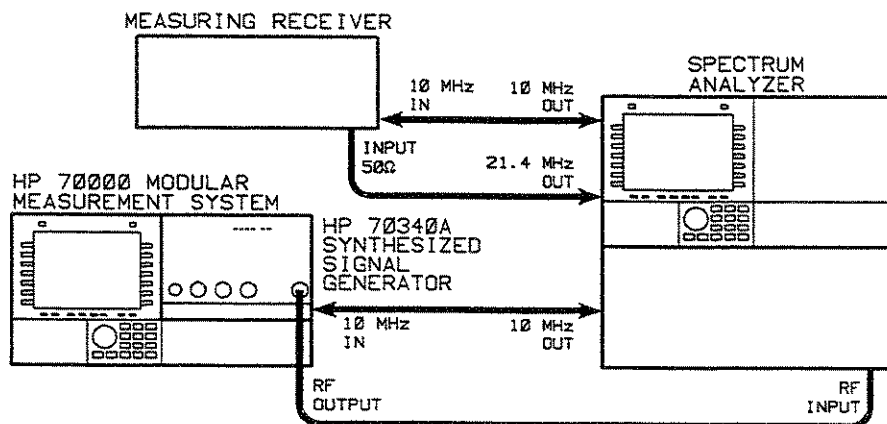


Figure 1-7. 1 GHz to 18 GHz Low Level Accuracy Test Setup using Measuring Receiver

NOTE

It is recommended that you use a rigid or high quality semi-rigid cable that is less than 2 feet long for this procedure. At 18 GHz, the maximum loss of the cable (connecting Signal Generator RF Output to spectrum analyzer RF Input) should be less than 5 dB.

For maximum accuracy, connect the 10 dB attenuator directly to the spectrum analyzer input.

1. Connect the equipment as shown in Figure 1-7.

The Signal Generator frequency should be 1.033 GHz.

The Signal Generator RF Output level should be +5 dBm.

2. Set up the spectrum analyzer as follows:

Preset

Center Frequency = 1.033 GHz

Span = 0

Reference level = 10 dBm

Attenuator = 0 dB

Resolution Bandwidth = 1 kHz

3. Set up the HP 8902A Measuring Receiver as follows:

Press **Blue Shift** and then the green **Instrument Preset** to preset.

Press **MHz** (INPUT FREQ).

The display should read

21.4 MHz

Press **Gold S** and then **Tuned RF Level** to set the receiver to tuned RF mode.

Ignore any error indicators such as the UNCAL Annunciator.

Press **LOG/LIN** in order to display power in dBm.

Press **Blue Shift** and then **SET REF** (the **ZERO** key) to set the receiver to relative mode.

The display should read

0.00 dB

and no error indicators should be on.

To Measure Relative Level Accuracy above 1 GHz from -34 dBm to -90 dBm

1. Decrease the Signal Generator RF Output to -4 dBm.
2. Check to see whether the RECAL Annunciator on the Measuring Receiver is on or off.

If the RECAL Annunciator is off, decrease the RF Output by 10 dBm.

If the RECAL Annunciator is on, press the **CALIBRATION** key on the Measuring Receiver, and then, decrease the RF Output by 10 dB.

3. Continue to decrease the Signal Generator output by 10 dB steps, recalibrating the Measuring Receiver whenever the RECAL Annunciator turns on, until reaching -34 dBm.
4. Record the Measuring Receiver relative reading, REL, for the following Signal Generator levels in the test record chapter of this book.

-34 dBm
-44 dBm
-54 dBm
-64 dBm
-74 dBm
-84 dBm
-90 dBm

5. Change the Signal Generator frequency to 18 GHz.
6. Increase the Signal Generator CW level to +5 dBm.
7. Establish a +5 dBm reference level on the measuring receiver:
 - a. Set the spectrum analyzer center frequency to 18 GHz.
 - b. Set up the HP 8902A Measuring Receiver as follows:
Press **Blue Shift** and then the green **Instrument Preset** to preset.
Press **MHZ** (INPUT FREQ).

The display should read

Low Level Accuracy and Flatness (Option 1E1 Only)

21.4 MHz

Ignore any error indicators such as the UNCAL Annunciator.

Press **(Gold S)** and then **(Tuned RF Level)** to set the receiver to tuned RF mode.

Press **(LOG/LIN)** in order to display power in dBm.

Press **(Blue Shift)** and then **(SET REF)** (the **(ZERO)** key) to set the receiver to relative mode.

The display should read

0.00 dB

and no error indicators should be on.

8. Repeat steps 1 through 4 and record the results in the test record.

To Establish Relative References above 1 GHz at -90 dBm for Level Flatness

1. Set Signal Generator frequency to 5.225 GHz
2. Set Spectrum Analyzer frequency to 5.225 GHz.
3. Establish a +5 dBm reference on the measuring receiver.
 - a. Set up the HP 8902A Measuring Receiver as follows:

Press **(Blue Shift)** and then the green **(Instrument Preset)** to preset.

Press **(MHz)** (INPUT FREQ).

The display should read

21.4 MHz

Ignore any error indicators such as the UNCAL Annunciator.

Press **(Gold S)** and then **(Tuned RF Level)** to set the receiver to tuned RF mode.

Press **(LOG/LIN)** in order to display power in dBm.

Press **(Blue Shift)** and then **(SET REF)** (the **(ZERO)** key) to set the receiver to relative mode.

The display should read

Performance Tests

Low Level Accuracy and Flatness (Option 1E1 Only)

0.00 dB

and no error indicators should be on.

4. Decrease the Signal Generator RF Output to -4 dBm.
5. Check to see whether the RECAL Annunciator on the Measuring Receiver is on or off.
If the RECAL Annunciator is off, decrease the RF Output by 10 dBm.
If the RECAL Annunciator is on, press the **CALIBRATION** key on the Measuring Receiver, and then, decrease the RF Output by 10 dB.
6. Continue to decrease the Signal Generator output by 10 dB steps, recalibrating the Measuring Receiver whenever the RECAL Annunciator turns on, until reaching -90 dBm.
7. Record the Measuring Receiver relative reading, REL, for the following Signal Generator levels in the test record chapter of this book.
8. Repeat this procedure for:
 - 9.487 GHz
 - 13.75 GHz

To Calculate the Actual Power Levels from -34 dBm to -90 dBm

This calculation is an example of how to calculate accuracy at 1.033 GHz. Use this example to calculate level accuracy from -90 dBm to $+5$ dBm at the following frequencies:

Low Level Accuracy and Flatness (Option 1E1 Only)

HP 70340A	HP 70341A
	42.768 MHz
	960.272 MHz
1.033 GHz	
18 GHz	

1. Add the power meter reading at +5 dBm, ABS@(frequency) (dBm) to each recorded relative measuring receiver reading, REL (dB), in order to calculate each actual level, ACT (dBm).
2. To calculate actual power level with a Signal Generator setting of -34 dBm. The following is a hypothetical example:

The power meter reading +5 dBm, ABS@1.033 GHz = +5.25 dB.

The measuring receiver reading REL@-34 dBm = -39.5 dB

$$(+5.25) + (-39.5) = -34.25$$

$$\text{ACT@-34dBm} = -34.25 \text{ dBm}$$

3. Record in the test record chapter of this book:

Each calculated Actual Power Level, ACT, should be within the following specifications:

10 to 50 MHz: ± 2.3 dB

50 MHz to 1 GHz: ± 2.0 dB

1 to 20 GHz: ± 1 dB

To Calculate Actual Power Levels for Flatness

1. Add the power meter reading at +5 dBm for each test frequency, ABS, to each of the recorded relative measuring receiver readings, REL (dB), in order to obtain each Actual Level, ACT (dBm).
2. Record the calculated Actual Levels in the test record chapter of this book.

To Calculate Flatness from 0.01 to 1 GHz

1. Review the recorded power meter readings at frequencies between 0.01 and 1 GHz for a Signal Generator RF Output of -14 dBm in order to determine the minimum value and the maximum value over the frequency range.
2. Subtract the minimum value (dBm) from the maximum value (dBm) in order to obtain the flatness (dB) at -14 dBm.
3. Record the value in the test record chapter of this book.
This value should be ≤ 1 dB.
4. Review the recorded Actual Levels (dBm) for a Signal Generator RF Output of -90 dBm to determine the minimum value and the maximum value.
5. Subtract the minimum value (dBm) from the maximum value (dBm) in order to obtain the flatness (dB) at -90 dBm.
6. Record this value in the test record chapter of this book.
This value should be ≤ 1 dB.

To Calculate Actual Power Levels for Flatness

1. Add the power meter reading at $+5$ dBm for each test frequency, ABS, to each of the recorded relative measuring receiver readings, REL (dB), in order to obtain each Actual Level, ACT (dBm).
2. Record the calculated Actual Levels in the test record chapter of this book.

To Calculate Flatness from 1 to 20 GHz

Low Level Accuracy and Flatness (Option 1E1 Only)

1. Review the recorded power meter readings at frequencies between 1 and 20 GHz for a Signal Generator RF Output of -14 dBm in order to determine the minimum value and the maximum value over the frequency range.
2. Subtract the minimum value (dBm) from the maximum value (dBm) in order to obtain the flatness (dB) at -14 dBm.
3. Record the value in the test record chapter of this book.
This value should be ≤ 1 dB.
4. Review the recorded Actual Levels (dBm) for a Signal Generator RF Output of -90 dBm to determine the minimum value and the maximum value.
5. Subtract the minimum value (dBm) from the maximum value (dBm) in order to obtain the flatness (dB) at -90 dBm.
6. Record this value in the test record chapter of this book.
This value should be ≤ 1 dB.

If the Procedure Fails

- Verify the test setup and instrument settings.
- Run the "Frequency Calibration 2" and the "Attenuator Calibration" procedures in the "Automated Adjustments" chapter. If the problem occurs in the frequency range 1 to 20 GHz, run the "Frequency Calibration 2" for the HP 70340A. If the problem occurs in the 0.01 to 1 GHz range, you should run a "Frequency Calibration 2" for the HP 70340A.
- Refer to the "Performance Test Failures" section of the *Service Guide*.

Harmonics

This procedure must be performed for all instrument models. The test measures and verifies 2nd harmonic power level relative to the carrier power in dBc over the Signal Generator's frequency range at appropriate frequencies.

Specification	Conditions
< -55 dBc	< +6 dBm (HP 70340A/41A)

Recommended Equipment

HP 71210C Spectrum Analyzer

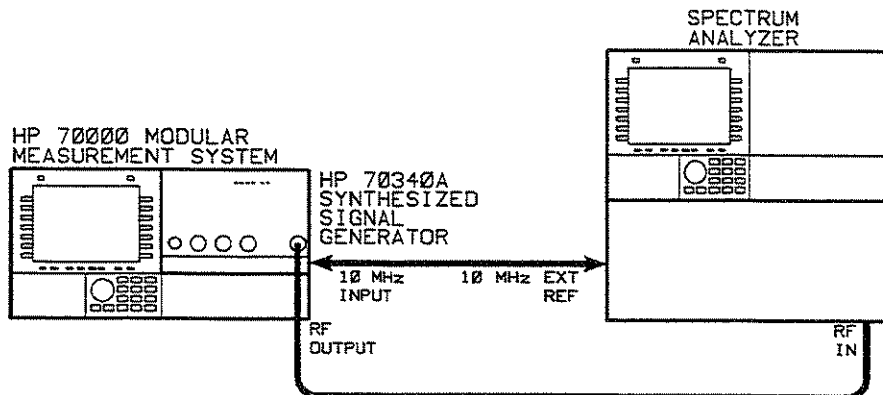


Figure 1-8. Harmonics Test Setup

To Set Up the Equipment

1. Connect the equipment as shown in Figure 1-8.
2. Set up the spectrum analyzer as follows:
 - Preset
 - Center Frequency:
 - For HP 70340A: 1 GHz
 - For HP 70341A: 10 MHz
 - Reference level = 0 dBm
 - Scale log = 10 dB/division
 - Attenuation = 20 dB
 - Span = 100 kHz
 - Resolution Bandwidth = 300 Hz
 - Video Bandwidth = 1 kHz
3. Preset the Signal Generator.
4. Set CW Frequency on the Signal Generator to:
 - HP 70340A: 1 GHz
 - HP 70341A: 10 MHz
5. Set RF Output level on the Signal Generator to:
 - HP 70340A: -3.9 dBm.
 - HP 70341A: -3.9 dBm.

To Measure 2nd Harmonic Level

1. Adjust the spectrum analyzer's frequency and level controls to position the carrier peak on the top graticule line. This is the reference level line.
2. Tune the spectrum analyzer's frequency control to $2 \times$ the fundamental frequency and view the 2nd harmonic, if any.

The 2nd harmonic peak should be below -55 dBc on the spectrum analyzer. -55 dBc lies half-way between the -50 dBc and -60 dBc lines.

Helpful Hint

Many spectrum analyzers will allow you to set markers. This feature is usually accompanied by an automatic comparison of the difference (delta in dBc) between two markers. If your spectrum analyzer has this feature, set your reference marker at the top of the fundamental frequency then at the top of the 2nd harmonic and read the difference (in dBc) from the screen.

3. Record your observation in the test record chapter of this book.
4. Repeat steps 1 through 3 for the following frequencies, and record the results in the test record:

HP70340A	HP 70341A
	11.3 MHz
	16 MHz
	22.6 MHz
	32 MHz
	45.5 MHz
	64 MHz
	90.5 MHz
	128 MHz
	181 MHz
	256 MHz
	362 MHz
	500 MHz
	700 MHz
1.00 GHz	
1.65 GHz	
2.75 GHz	
4.8 GHz	
8.0 GHz	
9.9 GHz	
10.0 GHz	

5. Set CW Frequency on the Signal Generator to:

HP 70340A: 1 GHz

HP 70341A: 10 MHz

6. Set RF Output level on the Signal Generator to:

HP 70340A: +6 dBm.

HP 70341A: +6 dBm.

Performance Tests

Harmonics

7. Repeat steps 1 through 4 and record the results in the test record.

NOTE

Harmonics are not specified for carrier frequencies above 10 GHz.

If the Procedure Fails

- Verify the test setup and instrument settings.
- Refer to the "Performance Test Failures" of the *Service Guide*.

Single-Sideband Phase Noise

This test measures single-sideband phase noise referenced to a 1 Hz bandwidth at 100 Hz, 1 kHz, 10 kHz, and 100 kHz offsets. The Signal Generator RF output and the carrier noise test set IF output are phase locked to a reference oscillator. The IF output noise sidebands are measured on a spectrum analyzer.

This procedure must be performed for all Signal Generator models.

Offsets for HP 70341A, HP 70340A

Carrier Freq.	100 Hz	1 kHz	10 kHz	100 kHz
500 MHz	-70 dBc/Hz	-86 dBc/Hz	-103 dBc/Hz	-119 dBc/Hz
2 GHz	-66 dBc/Hz	-74 dBc/Hz	-91 dBc/Hz	-107 dBc/Hz
10 GHz	-69 dBc/Hz	-75 dBc/Hz	-79 dBc/Hz	-101 dBc/Hz
18 GHz	-63 dBc/Hz	-70 dBc/Hz	-73 dBc/Hz	-99 dBc/Hz

Recommended Equipment

HP 11729C Carrier Noise Test Set
HP 3561A Dynamic Signal Analyzer
HP 8662A Option 003 Signal Generator (Reference Oscillator)
HP 70210C Spectrum Analyzer

Performance Tests
Single-Sideband Phase Noise

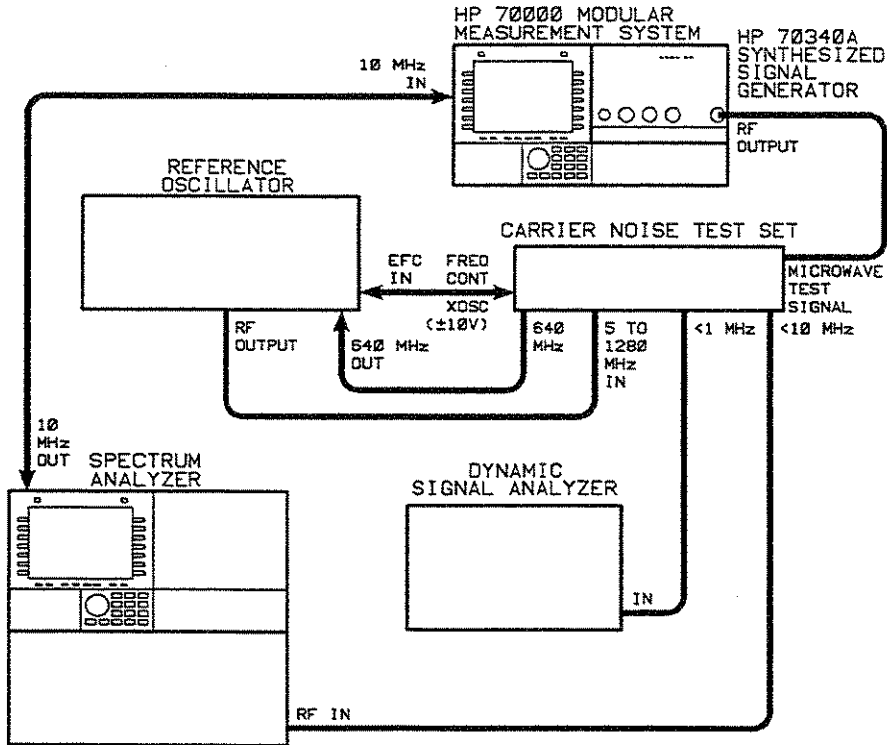


Figure 1-9. Single-Sideband Phase Noise Test Setup

To Setup the Equipment

1. Setup the equipment as shown in Figure 1-9.
2. Preset the instruments and allow them to warm up for at least one hour.
3. On the dynamic signal analyzer, set:

Center Frequency = 10 kHz
Frequency Span = 20 kHz

Averaging = Off

4. On the reference oscillator, set:
 - Frequency = 80 MHz (for the HP 70340A)
 - Frequency = 500 MHz (for the HP 70341A)
 - Power Level = 0 dBm
5. Set the Signal Generator CW Frequency to 2.0 GHz.
6. Set the Signal Generator RF output level to +8 dBm.

To Setup the Spectrum Analyzer and Carrier Noise Test Set

1. On the spectrum analyzer set:
 - Center Frequency = 10 kHz
 - Frequency Span = 20 kHz
 - Resolution Bandwidth = 300 Hz
 - Video Averaging = Off
2. On the carrier noise test set, set:
 - Bandpass Filter = 1.92 GHz (for the HP 70340A)
 - Bandpass Filter = 0.01 to 1.28 GHz (for the HP 70341A)
 - Lock BW Factor = 100

To Calibrate the System

1. Increase the Signal Generator frequency by 10 kHz.
2. Decrease the reference oscillator amplitude by 40 dB.
3. On the dynamic signal analyzer, verify the presence of the beat note at approximately 10 kHz and record its level, V_b , in the test record.

Performance Tests

Single-Sideband Phase Noise

The beat note is the reference level for subsequent phase noise measurements, and represents the frequency translated carrier reduced by 40 dB.

4. Set this peak to the top horizontal graticule.

For the dynamic signal analyzer, use the VERT SCALE, DEFINE FULL SCL, and MKR -> FULL SCL functions.

NOTE

Do not change the vertical controls after establishing this reference.

5. Repeat the above calibration steps for the spectrum analyzer, and be certain to record V_b for the spectrum analyzer in the test record.

To Phase Lock the Sources

This example shows how to phase lock an HP 70340A. The same procedure can be followed when using an HP 70341A.

1. Return the Signal Generator to its original setting (ie. from 2.00001 GHz to 2.00000 GHz) and the reference oscillator to 0 dBm.
2. Press CAPTURE on the Carrier Noise Test Set, and verify that the signals lock.
3. Reduce the Lock BW Factor to 10 Hz while making certain that the instruments remain phase locked.

To Measure Phase Noise at 100 Hz, 1 kHz, and 10 kHz Offsets

1. Set the dynamic signal analyzer display to single if it is not already.
2. Set the dynamic signal analyzer to a center frequency of 100 Hz and a span of 200 Hz.

NOTE

It is not advisable to change the reference level after the system has been calibrated.

3. On the dynamic analyzer, place a marker on the center frequency.
4. Turn on rms averaging with 10 averages.
5. Note the level of the center frequency at the end of 10 averages, and record this level, V_s , in the test record of this book.
6. Convert the dynamic signal analyzer bandwidth to dB using $10\log BW$ as indicated in the test record chapter.
For instance, if the $BW = .750$ Hz, then $10\log BW = 1.25$ dB.
7. Repeat steps 1 through 6 at center frequencies of 1 kHz and 10 kHz.

To Calculate Phase Noise for a Dynamic Signal Analyzer

1. Calculate the phase noise of the Signal Generator as follows:

$$\begin{aligned} \text{Phase Noise} = & V_s \text{ (from "To Measure Phase Noise")} \\ & - V_b \text{ (from "To Calibrate the System")} \\ & - 40 \text{ dB (for attenuation during calibration)} \\ & - 6 \text{ dB (conversion factor)} \\ & - 10 \log \text{Bandwidth in Hz} \end{aligned}$$

For example:

Given: Frequency = 2 GHz at 100 Hz Offset, $V_s = -83.39$ dBm, $V_b = -46.70$, and Bandwidth = 1.9097 Hz.

$$\begin{aligned} \text{Phase Noise} = & - 83.39 \text{ dBm} \\ & - (-46.70) \text{ dBm} \\ & - 40.00 \text{ dB} \\ & - 6.00 \text{ dB} \\ & - 2.81 \text{ dB} \end{aligned}$$

$$\text{Phase Noise} = -85.50 \text{ dBc/Hz}$$

2. Record phase noise in the test record chapter of this book.

To Measure Phase Noise at 100 kHz Offset

1. Set the spectrum analyzer to a center frequency of 100 kHz, span of 200 Hz, and resolution bandwidth of 10 Hz.
2. Place a marker on the center frequency of the spectrum analyzer.
3. Turn on video averaging with 10 samples.
4. Note the level of the center frequency after at least 10 sweeps, V_s for the spectrum analyzer, and record it.

To Calculate Phase Noise for an Analog Spectrum Analyzer

1. Calculate the phase noise of the Signal Generator as follows:

$$\begin{aligned} \text{Phase Noise} &= V_s \text{ (from "To Measure Phase Noise")} \\ &\quad - V_b \text{ (from "To Calibrate the System")} \\ &\quad - 40 \text{ dB (for attenuation during calibration)} \\ &\quad - 6.0 \text{ dB (conversion factor)} \\ &\quad - 10 \log \text{Bandwidth in Hz} \\ &\quad + 2.5 \text{ dB (Analog Analyzer)} \end{aligned}$$

For example:

Given: Frequency = 2 GHz at 100 Hz Offset, Resolution BW = 10 Hz,
 $V_s = -67.60$ dBm, and $V_b = -6.40$

$$\begin{aligned} \text{Phase Noise} &= - 67.60 \text{ dBm} \\ &\quad - (-6.40) \text{ dBm} \\ &\quad - 40.00 \text{ dB} \\ &\quad - 6.0 \text{ dB} \\ &\quad - 10.00 \text{ dB} \\ &\quad + 2.5 \text{ dB} \end{aligned}$$

$$\text{Phase Noise} = -114.70 \text{ dBc/Hz}$$

2. Record phase noise in the test record chapter of this book.

To check Single-Sideband Phase Noise at 18 GHz

1. Set the Signal Generator CW frequency to 18 GHz.
2. Set the bandpass filter to 17.28 GHz.
3. Set the reference oscillator frequency to 720 MHz.
4. Repeat this entire procedure (from "To Setup the Spectrum Analyzer and Carrier Noise Test Set") for a Signal Generator frequency of 18 GHz.

Performance Tests

Single-Sideband Phase Noise

The phase noise calculations are repeated here:

Dynamic Signal Analyzer
Phase Noise Calculation:

Phase Noise = Vs (from "To Measure Phase Noise")
- Vb (from "To Calibrate the System")
- 40 dB (for attenuation during calibration)
- 6 dB (conversion factor)
- 10logBandwidth in Hz

Spectrum Analyzer Phase
Noise Calculation:

Phase Noise = Vs (from "To Measure Phase Noise")
- Vb (from "To Calibrate the System")
- 40 dB (for attenuation during calibration)
- 6.0 dB (conversion factor)
- 10logBandwidth in Hz
+ 2.5 dB (Analog Analyzer)

To check Single-Sideband Phase Noise at 500 MHz (HP 70341A Only)

1. Set the Signal Generator CW frequency to 500 MHz.
2. Select the 0.01 to 1.28 BAND RANGE on the Carrier Noise Test Set.
3. Set the reference oscillator frequency to 500 MHz.
4. Repeat this entire procedure (from "To Setup the Spectrum Analyzer and Carrier Noise Test Set") for a Signal Generator frequency of 500 MHz.

The phase noise calculations are repeated here:

Dynamic Signal Analyzer
Phase Noise Calculation:

Phase Noise = Vs (from "To Measure Phase Noise")
- Vb (from "To Calibrate the System")
- 40 dB (for attenuation during calibration)
- 6 dB (conversion factor)

- 10logBandwidth in Hz

Spectrum Analyzer Phase
Noise Calculation:

Phase Noise = Vs (from "To Measure Phase Noise")
- Vb (from "To Calibrate the System")
- 40 dB (for attenuation during calibration)
- 6.0 dB (conversion factor)
- 10logBandwidth in Hz
+ 2.5 dB (Analog Analyzer)

If the Procedure Fails

- Verify the test setup and instrument settings.
- Check to see if spurious signals are present in the trace.
If spurious signals are present, they may exceed the phase noise specification and should be ignored.
- Refer to the "Performance Test Failures" of the *Service Guide*.

Non-Harmonic Spurious Signals 3 kHz to 30 kHz

This test measures the non-harmonic spurious power level (known, fixed offset spurs) between 3 kHz and 30 kHz relative to the carrier power in dBc. The Signal Generator is set to various CW frequencies where these spurious signals are likely to occur. The Signal Generator RF output and the carrier noise test set IF output are phase locked to a reference oscillator. The IF output spurious response is measured on a dynamic signal analyzer.

This test must be performed for the HP 70340A only.

NOTE

Spurious response greater than 30 kHz is tested in a separate test.

Specification	Conditions
< -60 dBc	>3 kHz

Recommended Equipment

HP 11729C Carrier Noise Test Set
HP 3561A Dynamic Signal Analyzer
HP 8662A Option 003 Signal Generator (Reference Oscillator)

Non-Harmonic Spurious Signals 3 kHz to 30 kHz

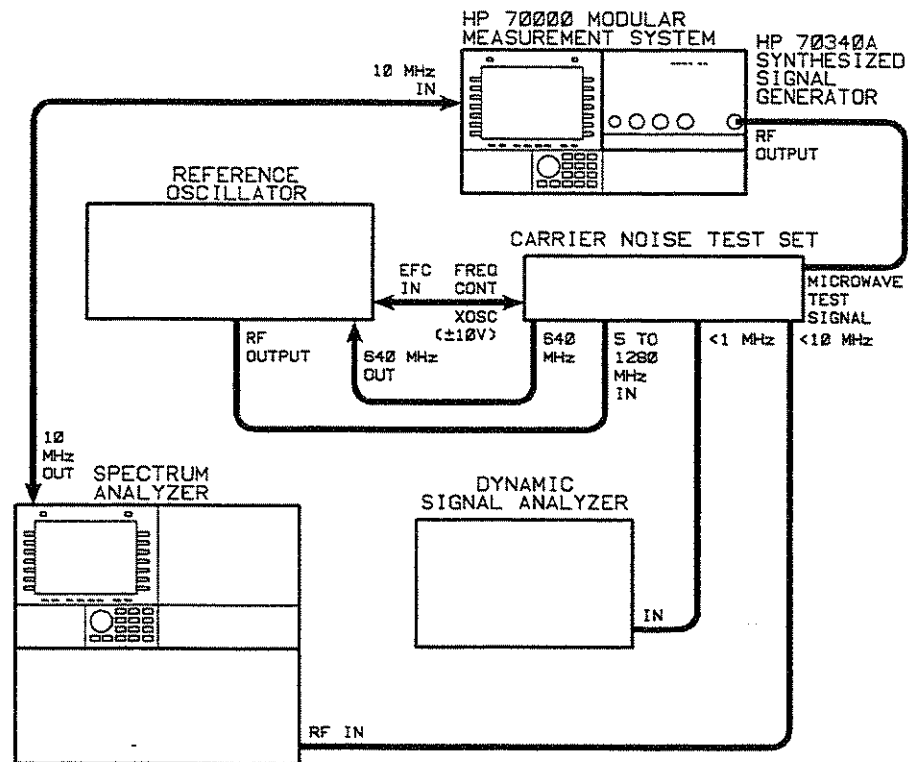


Figure 1-10. Non-Harmonic Spurious Signals 3 kHz to 30 kHz Test Setup

To Setup the Equipment for 17.005111 GHz

1. Connect the equipment as shown in Figure 1-10.
2. Preset the instruments and allow them to warm up for at least one hour.
3. On the carrier noise test set, set:
 - Bandpass Filter = 17.28 GHz
 - Lock BW Factor = 100

Performance Tests

Non-Harmonic Spurious Signals 3 kHz to 30 kHz

4. On the dynamic signal analyzer, set:
Center Frequency = 10 kHz
Frequency Span = 20 kHz
5. On the reference oscillator, set:
Frequency = 274.889 MHz
Power Level = -40 dBm
6. Set CW Frequency on the Signal Generator to 17.005121 GHz
7. Set RF Output level on the Signal Generator as follows:

Model	Level Setting
HP 70340A	+8 dBm

To Calibrate the System

1. Verify the presence of the beat note (at approximately 10 kHz offset from the center frequency) on the dynamic signal analyzer and record the value, V_b , in the test record chapter of this book.
2. Set the beat note level to the top graticule line, and do not change the vertical scale.

The beat note is the reference level for subsequent measurements, and represents the frequency translated carrier reduced by 40 dB.

To Phase Lock the Sources

1. Reduce the Signal Generator frequency by 10 kHz to 17.005111 GHz.
2. Set the reference oscillator level to 0.0 dBm.
3. Press CAPTURE on the Carrier Noise Test Set, and verify that the signals lock.
4. Reduce the Lock BW Factor to 10 Hz while making certain that the instruments remain phase locked.

To Measure Spurious Response at 17.005111 GHz

NOTE

It is not advisable to change the reference level after the system has been calibrated.

1. Set the start frequency to 3 kHz and the span to 5 kHz on the dynamic signal analyzer.
2. Turn on averaging with number of averages equal to 10.
3. Place the marker on any spurious signal, and read the signal amplitude, V_s .

The signal or noise should be at least 14 dB below the top graticule on the dynamic signal analyzer.

4. If the signal is less than 14 dB below the top graticule line, decrease the span and observe the level again.

Non-Harmonic Spurious Signals 3 kHz to 30 kHz

The span can be reduced in this manner until the bandwidth approaches 1 Hz.

NOTE

Turn off video averaging after this procedure is complete.

5. Record the averaged signal (or noise level), V_s , in the test record chapter of this book.

To Calculate Actual Spurious Signal Level

1. Calculate the actual spurious level as follows:

$$\begin{aligned} \text{Corrected Level} = & - V_b \text{ (from "To Calibrate the System")} \text{ in dBm} \\ & - 46.00 \text{ dB (correction)} \\ & + V_s \text{ (Measured Level) in dBm} \end{aligned}$$

For example:

$$\begin{aligned} \text{Corrected Level} = & - (-47.20) \text{ dBm} \\ & - 46.00 \text{ dB (correction)} \\ & + (-63.81) \text{ dBm} \end{aligned}$$

$$\text{Corrected Level} = - 62.61 \text{ dBc}$$

2. If a spurious signal is displayed, record its actual level (corrected level) and frequency offset in the test record chapter of this book.
3. If the signal displayed is noise, record its actual level (corrected level) and the fact that it is noise in the test record.

Non-Harmonic Spurious Signals 3 kHz to 30 kHz

4. Change the dynamic signal analyzer to the following frequency spans and repeat this procedure starting with "To Measure Spurious Response at 17.005111 GHz."

8 kHz to 13 kHz
13 kHz to 23 kHz
23 kHz to 33 kHz

NOTE

Be sure to turn video averaging off before switching to a new span.

To Set up and Calibrate the System for 17.501777 GHz

1. Set the Lock BW Factor on the carrier noise test set to 100.
2. Set the frequency of the reference oscillator to 221.777 MHz.
3. Set the CW frequency on the Signal Generator to 17.501781 GHz.
4. Verify the presence of the beat note (at approximately 10 kHz offset from the center frequency) on the dynamic signal analyzer and record the value, V_b , in the test record chapter of this book.
5. Set the beat note level to the top graticule line, and do not change the vertical scale.

The beat note is the reference level for subsequent measurements, and represents the frequency translated carrier reduced by 40 dB.

To Phase Lock the Sources

1. Reduce the Signal Generator frequency by 10 kHz to 17.501777 GHz.
2. Set the reference oscillator level to 0.0 dBm.
3. Press CAPTURE on the Carrier Noise Test Set, and verify that the signals lock.
4. Reduce the Lock BW Factor to 10 Hz while making certain that the instruments remain phase locked.

To Measure Spurious Response at 17.501777 GHz

NOTE

It is not advisable to change the reference level after the system has been calibrated.

1. Set the start frequency to 3 kHz and the span to 5 kHz on the dynamic signal analyzer.
2. Turn on averaging with number of averages equal to 10.
3. Place the marker on any spurious signal, read the signal amplitude, V_s , and record it in the test record chapter of this book.

The signal or noise should be at least 14 dB below the top graticule on the dynamic signal analyzer.

4. If the signal is less than 14 dB below the top graticule line, decrease the span and observe the level again.

Non-Harmonic Spurious Signals 3 kHz to 30 kHz

The span can be reduced in this manner until the bandwidth approaches 1 Hz.

5. Calculate the actual spurious signal level in the test record chapter, and identify the signal as noise or record the frequency offset.
6. Change the dynamic signal analyzer to the following frequency spans and repeat this procedure starting with "To Measure Spurious Response at 17.501777 GHz."

8 kHz to 13 kHz
13 kHz to 23 kHz
23 kHz to 33 kHz

NOTE

Be sure to turn video averaging off before switching to a new span.

If the Procedure Fails

- Verify the test setup and instrument settings.
- Refer to the "Performance Test Failures" of the *Service Guide*.

Non-Harmonic Spurious Signals >30 kHz

This test measures the non-harmonic spurious power level (known, fixed offset spurs) greater than 3 kHz relative to the carrier power in dBc. The Signal Generator is set to various CW frequencies where these spurious signals are likely to occur. The spectrum analyzer is tuned to the spur frequencies so that their power level can be measured.

This test must be performed for all instrument models.

NOTE

Spurious responses at offsets between 3 kHz and 30 kHz are tested in a separate test.

Specification	Conditions
< -60 dBc	≥30 kHz

Recommended Equipment

HP 71210C Spectrum Analyzer

Non-Harmonic Spurious Signals >30 kHz

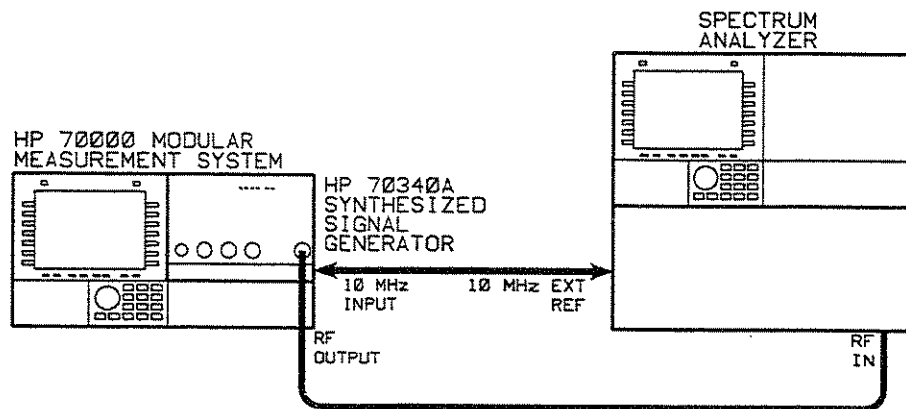


Figure 1-11. Non-Harmonic Spurious Level >30 kHz Test Setup

To Setup the Equipment

1. Connect the equipment as shown in Figure 1-11.
2. Preset the Signal Generator.
3. Set CW Frequency on the Signal Generator to 17005.111 MHz
4. Set RF Output level on the Signal Generator as follows:

Model	Level Setting
HP 70340A	+8 dBm
HP 70341A	+8 dBm

Performance Tests

Non-Harmonic Spurious Signals >30 kHz

5. Setup the Spectrum Analyzer as follows:

Preset
Center Frequency = 17005.111 MHz
Frequency Span = 300 kHz
Reference Level = 10 dBm
Scale Log = 10 dB/div
Resolution Bandwidth = 300 Hz
Video Bandwidth = 300 Hz
Video Averaging = Off
Marker = On

To Check for Spurs from 1 to 20 GHz

1. On the spectrum analyzer, set the marker to the highest peak.
2. Set the spectrum analyzer reference level to the marker amplitude.
This puts the carrier peak on the top graticule.
3. Recheck the carrier peak amplitude, and adjust the reference level if necessary.
The reference level is now the carrier amplitude and all measurements at this center frequency are referenced to this level.
4. Examine the span for points that exceed the -60 dBc level (the sixth horizontal graticule from the top). Ignore the 2 center vertical graticules (± 30 kHz) because offsets that are close to the carrier are tested in another procedure.
5. If any frequencies exceed the -60 dBc limit, turn on video averaging, and set the number of averages to 10.
Do not reset the reference level.
6. If any frequencies still exceed the -60 dBc limit: turn video averaging off, reduce the resolution bandwidth, and after one trace is complete, turn video averaging back on.
Do not reset the reference level.

7. Calculate the relative spurious level in dBc and record this value in the test record chapter of this book:

$$\text{Spur Level(dBc)} = \text{Carrier Amptd(dBm)} - \text{Spur Amptd(dBm)}$$

8. Repeat this procedure for center frequencies of 17501.777 MHz and 19801.511 MHz.

To Check Spurs from 0.01 to 1 GHz (HP 70341A Only)

1. Set the CW Frequency on the Signal Generator to 10 MHz.
2. Set the RF Output level to +13 dBm.
3. Set the center frequency on the spectrum analyzer to 10 MHz.
4. Set the span on the spectrum analyzer to 800 kHz.
5. Set the spectrum analyzer marker to the highest peak.
6. Set the spectrum analyzer reference level to the marker amplitude.
7. Set the resolution bandwidth and the video bandwidth so that the noise floor is >-70 dBc.
8. Adjust the RBW and VBW so that the carrier skirt is less than .5 divisions (40 kHz) wide at -65 dBc.
9. Examine the span for points that exceed the -60 dBc level.

NOTE

Ignore the carrier skirt when measuring spurs.

10. On the spectrum analyzer, set the center frequency as follows, and check each span for spurious signals that exceed -60 dBc.

Performance Tests

Non-Harmonic Spurious Signals >30 kHz

8.74 MHz

11.26 MHz

11. If any frequencies exceed -60 dBc, turn on video averaging, and set the number of averages to 10.

Do not reset the reference level.

12. If any frequencies still exceed -60 dBc: turn video averaging off, reduce the resolution bandwidth, and after one trace is complete, turn video averaging back on.

Do not reset the reference level.

13. If any frequencies still exceed -60 dBc, reduce the span.

Do not reset the reference level.

14. Calculate the relative spurious level in dBc and record this value in the test record chapter of this book:

$$\text{Spur Level(dBc)} = \text{Carrier Amptd(dBm)} - \text{Spur Amptd(dBm)}$$

15. Follow the 13 steps above to check for spurious response >-60 dBc using the Signal Generator CW Frequencies and spectrum analyzer center frequencies that follow.

CW Freq/ Center Freq for Reference	Center Freq for Spurs
63 MHz	61.74 MHz 64.26 MHz
499 MHz	497.74 MHz 500.26 MHz
500 MHz	498.74 MHz 501.74 MHz
999 MHz	997.74 MHz 1000.26 MHz

All spurious signals should be <-60 dBc.

If the Procedure Fails

- Verify the test setup and instrument settings.
- Refer to the “Performance Test Failures” section of the *Service Guide*.

Pulse On/Off Ratio

This procedure verifies the pulse on/off specification of the HP 70340A and 70341A Signal Generators using a spectrum analyzer to measure RF output power with pulse on and then off. The difference in power levels is the pulse on/off ratio.

Specification	Conditions
> 80 dB	

Recommended Equipment

HP 71210C Spectrum Analyzer

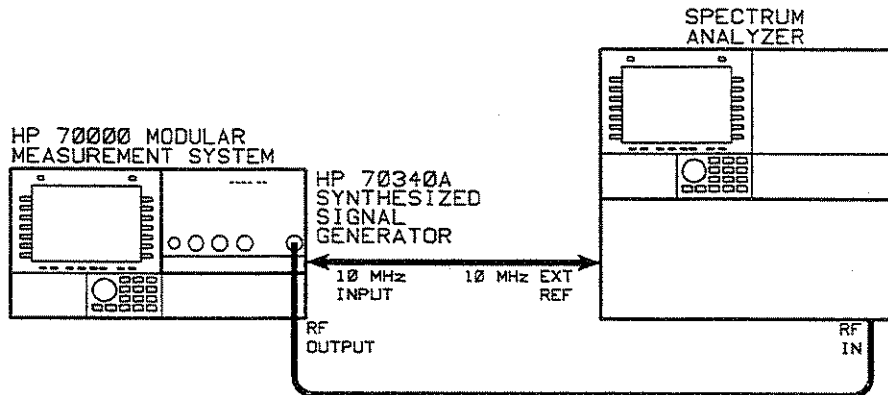


Figure 1-12. Pulse On/Off Ratio Test Setup

To Set Up the Equipment

1. Connect the equipment as shown in Figure 1-12.
2. Preset the Signal Generator.
3. Set CW Frequency on the Signal Generator to 1 GHz for the HP 70340A.
Set CW Frequency to 10 MHz for an HP 70341A.
4. Set RF Output level on the Signal Generator to -3.99 dBm.
5. To turn on inverted external pulse modulation:
 - a. Press the **Modul^{tn}** key.
 - b. Press the **Pulse NML INV** key so that the INV is underscored.
 - c. Press the **Pulse ON OFF** key so that ON is underscored.This generates a pulse on condition.

6. On the spectrum analyzer, set:
 - Preset
 - Center Frequency = 1 GHz
 - Frequency Span = 100 Hz
 - Reference Level = -3.99 dBm
 - Resolution Bandwidth = 10 Hz

To Measure Pulse Modulation On/Off Ratio

1. Center the signal on the spectrum analyzer.
2. Place the peak of the signal on the top graticule line (the reference level).
3. To select normal (non-inverted) pulse modulation on the Signal Generator:
 - a. Press the **Modul^{tn}** key.
 - b. Press the **Pulse NML INV** key so that the NML is underscored.
 - c. Make sure that the ON is underscored on the **Pulse ON OFF** key.

Performance Tests

Pulse On/Off Ratio

This generates a pulse off condition.

4. Observe that any residual signal is more than 80 dB below the reference line on the spectrum analyzer. Record your observation in the test record chapter of this book.
5. Repeat this procedure for the following Signal Generator CW frequencies:

Model	Frequency Settings
HP 70341A	10 MHz
	50 MHz
	300 MHz
	600 MHz
	999 MHz
HP 70340A	20 GHz

If the Procedure Fails

- Verify the test setup and instrument settings.
- Determine the actual power levels of both the pulse on and pulse off states using a marker on a spectrum analyzer, and subtract one from the other in order to manually calculate the pulse on/off ratio.

This calculated pulse on/off ratio should be greater than 80 dB.
- Refer to the "Performance Test Failures" section of the *Service Guide*.

Pulse Rise/Falltime

This test uses a digitizing oscilloscope to measure the HP 70340A or HP 70341A Signal Generator RF pulse rise and falltimes.

HP 70340A

Specification	Conditions
< 10 ns	

HP 70341A

Specification	Conditions
< 500 ns	10-25 MHz
< 350 ns	25-64 MHz
< 50 ns	64-128 MHz
< 35 ns	128-500 MHz
< 20 ns	500-1000 MHz

Recommended Equipment

HP 54121T (HP 54120B with HP 54121A) 20 GHz Digitizing Oscilloscope
HP 8116A Function Generator
HP 8493C Option 020 20 dB Attenuator (2)

Performance Tests
Pulse Rise/Falltime

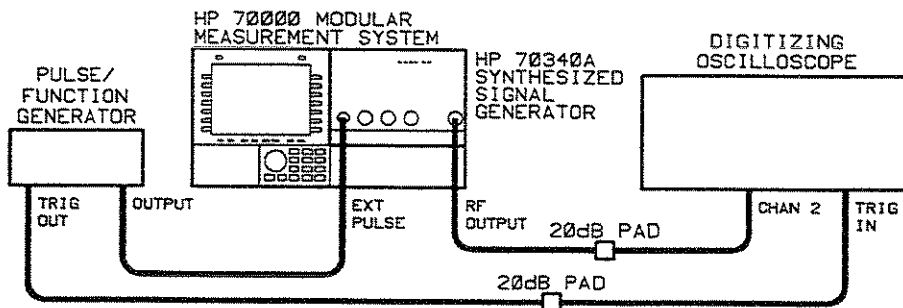


Figure 1-13. Pulse Rise/Falltime Test Setup

To Set up the Equipment

1. Connect the equipment as shown in Figure 1-13.
2. Preset the Signal Generator.
3. Set the CW Frequency of the Signal Generator to 1.649999 GHz for the HP 70340A. Set the CW Frequency to 10 MHz for an HP 70341A.
4. Set the RF Output level of the Signal Generator to -3.99 dBm.
5. Turn pulse modulation On.

On the pulse generator set:

Frequency = 500 kHz
Pulse Width = $1 \mu\text{sec}$
High Level = 3V
Low Level = 0V
Disable = Off (to enable pulse generator)

6. On the oscilloscope:

Press **AUTOSCALE**

Set **TIMEBASE** = 10 ns/div for HP 70340A. Set to 500 ns for an HP 70341A.

Set **DELAY** so that rising edge of pulse is displayed
Set Display Persistence = 1 sec

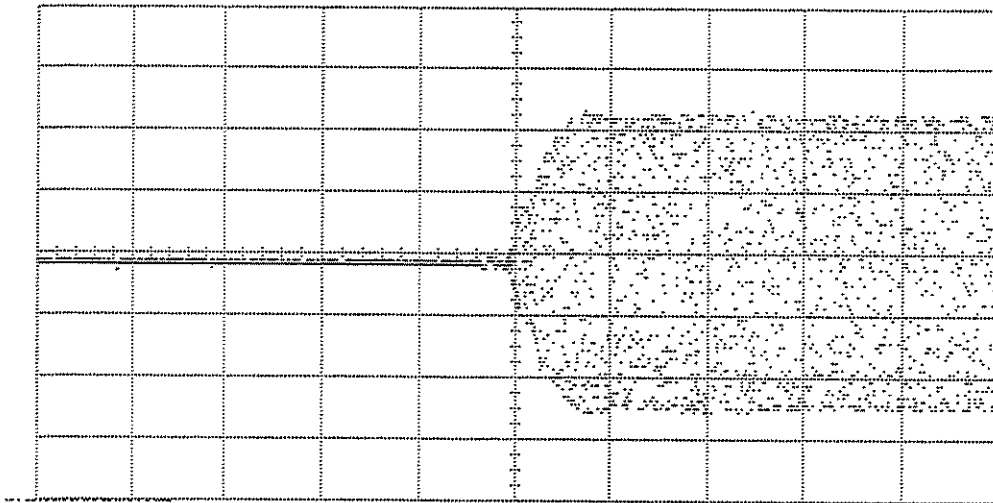


Figure 1-14. Pulse Risetime Measurement

To Measure Risetime

1. Adjust the Signal Generator RF Output level so that the upper half of the envelope spans 2.5 vertical graticules as in Figure 1-14.
2. Adjust the oscilloscope's horizontal DELAY and vertical OFFSET functions in order to position the rising edge of the pulsed RF so that the 10% and 90% points cross horizontal graticules. Refer to Figure 1-14.
3. Measure pulse risetime from 10% to 90% of the rising edge of the waveform using the graticules for reference.

The pulse risetime should be less than one division.

4. Record the measured value in the test record chapter.

Performance Tests
Pulse Rise/Falltime

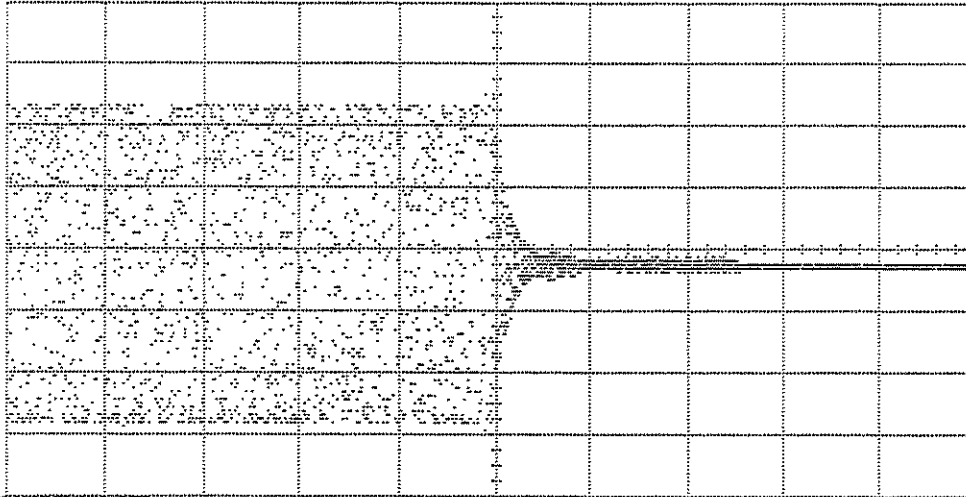


Figure 1-15. Pulse Falltime Measurement

To Measure Falltime

1. Adjust the DELAY on the oscilloscope so that the waveform falling edge is visible on the display.
2. Adjust the Signal Generator RF Output level so that the upper half of the envelope spans 2.5 vertical graticules as in Figure 1-15.
3. Adjust the oscilloscope's horizontal DELAY and vertical OFFSET functions in order to position the falling edge of the pulsed RF so that the 10% and 90% points cross horizontal graticules. Refer to Figure 1-15.
4. Measure pulse risetime from 10% to 90% of the falling edge of the waveform using the graticules for reference.

The pulse falltime should be less than one division.

5. Record the measured value in the test record chapter.

To measure Rise/Falltime for 0.01 to 1 GHz (HP 70341A)

1. Using the following settings, measure risetimes and falltimes as in the procedures "To Measure Risetime" and "To Measure Falltime."

Signal Generator Frequency Setting	Oscilloscope Timebase Setting
10 MHz	500 ns/div
25 MHz	350 ns/div
64 MHz	50 ns/div
128 MHz	35 ns/div
500 MHz	20 ns/div

2. Record the measured values in the test record chapter.

If the Procedure Fails

- Review (verify) the test setup and equipment settings.
- Refer to the "Performance Test Failures" of the *Service Guide* if the performance is out of specification.

Pulse Width

This procedure verifies the pulse width specification for the HP 70340A or HP 70341A by observing the pulsed RF output on a digitizing oscilloscope.

If you are checking an HP 70341A, proceed to To Measure Pulse Width for 0.01 to 1 GHz (HP 70341A).

HP 70340A

Specification	Conditions
< 25 ns	

HP 70341A

Specification	Conditions
< 1 μ s	0.01-0.064 GHz
< 100 ns	0.064-0.5 GHz
< 25 ns	0.5-1 GHz

Recommended Equipment

HP 54121T (HP 54120B and HP 54121A) 20 GHz Digitizing Oscilloscope
HP 8116A Function Generator
HP 8493C (Option 020) 20 dB Attenuator

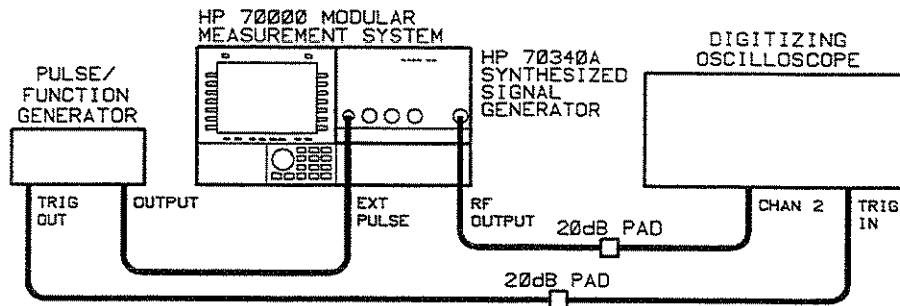


Figure 1-16. Pulse Width Test Setup

To Set up the Equipment

1. Connect the equipment as shown in Figure 1-16.
2. Preset the Signal Generator.
3. Set RF Output level on the Signal Generator to -3.99 dBm.
4. Set CW Frequency on the Signal Generator to 1 GHz.
5. Turn pulse modulation on.
6. On the pulse generator, set:
 - Frequency = 1 MHz (Period = $1 \mu\text{s}$)
 - Pulse Width = 24 ns
 - High Level = 3.0 V
 - Low Level = 0 V
 - Disable = Off (to enable pulse generator)
7. On the oscilloscope:
 - Press **AUTOSCALE**
 - Set Time/Div = 5 ns
 - Set **DELAY** so that 1 full pulse envelope is displayed

Performance Tests
Pulse Width

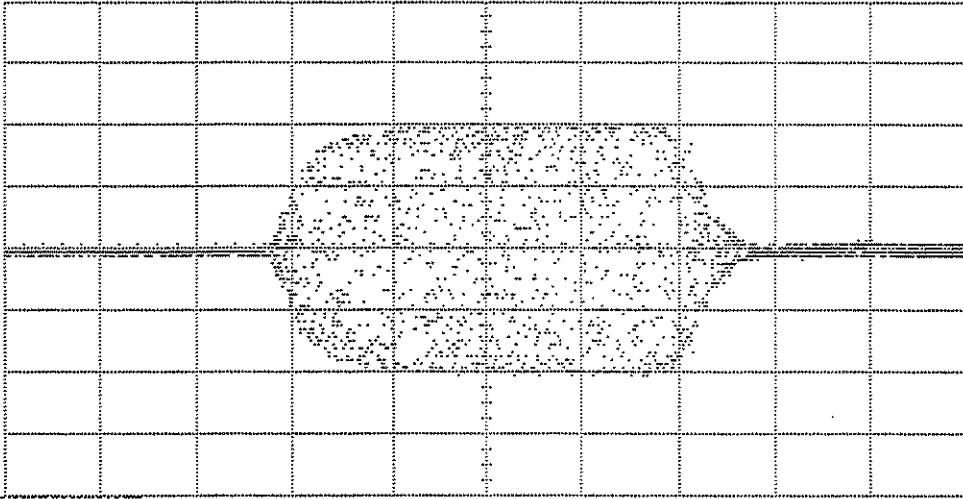


Figure 1-17. Pulse Width Measurement

To Measure Pulse Width

1. Adjust the Signal Generator RF Output level so that the upper half of the pulse envelope spans 2 vertical divisions.
2. Use the DELAY function on the oscilloscope to position the waveform to place the median of the rising edge on a vertical graticule. Refer to Figure 1-17.
3. Record the displayed pulse width in the test record chapter. (Pulse width is measured from the rising edge median to the falling edge median of the pulse.)

The pulse width should be <25 ns.

To Measure Pulse Width for 0.01 to 1 GHz (HP 70341A)

1. Set the Signal Generator to 10 MHz.
2. On the pulse generator:
Set pulse width to 950 ns.
Set pulse period to 2 μ s.
3. On the oscilloscope:
Press **AUTOSCALE**
Set Time/Div = 200 ns
Set DELAY so that 1 full pulse envelope is displayed
Set PERSISTENCE to 900 ms
4. Change the Oscilloscope display to single if it is not already.
5. Adjust the Signal Generator RF Output level so that the upper half of the pulse envelope spans 2 vertical divisions.
6. Use the DELAY function on the oscilloscope to position the waveform to place the median of the rising edge on a vertical graticule. Refer to Figure 1-17.
7. Record the displayed pulse width in the test record chapter. (Pulse width is measured from the rising edge median to the falling edge median of the pulse.)
The pulse width should be <1 μ s.
8. Repeat steps 1 through 6 for the following Signal Generator, oscilloscope, and pulse generator settings:

CW Frequency	Time/Div	Pulse Width	Pulse Period
64 MHz	20 ns	95 ns	200 ns
500 MHz	5 ns	24 ns	50 ns

The pulse width should be <100 ns for a 64 MHz carrier frequency and <25 ns for a 500 MHz carrier frequency.

If the Procedure Fails

- Review (verify) the test setup and equipment settings.
- If the pulse width on the spectrum analyzer is visible and greater than the specification, narrow the pulse generator pulse width until it is less than the specification.
- If the pulse on the spectrum analyzer is not visible (or disappears when the pulse width is narrowed in step 2, above,) refer to the "Performance Test Failures" section of the *Service Guide*.

Maximum FM Deviation

This procedure verifies the FM maximum deviation specification of the HP 70340A Signal Generator and the HP 70341A.

HP 70341A FM performance is completely dependent on the HP 70340A's FM performance.

HP 70340A

Specification	Conditions
≥ 10 MHz peak	2-20 GHz
≥ 5 MHz peak	1-2 GHz

Recommended Equipment

HP 8116A Function Generator
 HP 71210C Spectrum Analyzer

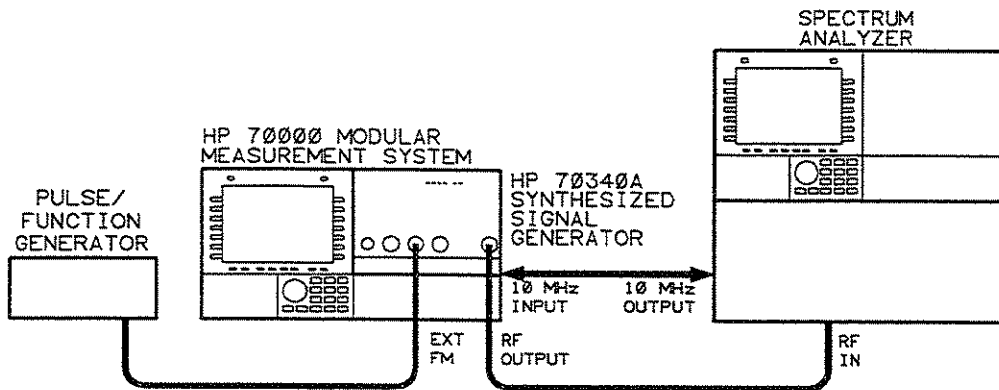


Figure 1-18. Maximum FM Deviation Test Setup

Performance Tests
Maximum FM Deviation

To Set Up the Equipment

1. Connect the equipment as shown in Figure 1-18.
2. Preset the Signal Generator.
3. Set the CW Frequency on the Signal Generator to 2 GHz.
4. Set the RF Output level on the Signal Generator to 0 dBm.
5. Set the function generator as follows:
 - Frequency = 50 kHz
 - Level = 2 Vpk (1.4 Vrms)
6. Set up the spectrum analyzer as follows:
 - Frequency = 2 GHz
 - Span = 25 MHz
 - Resolution Bandwidth = as low as possible for reasonable output

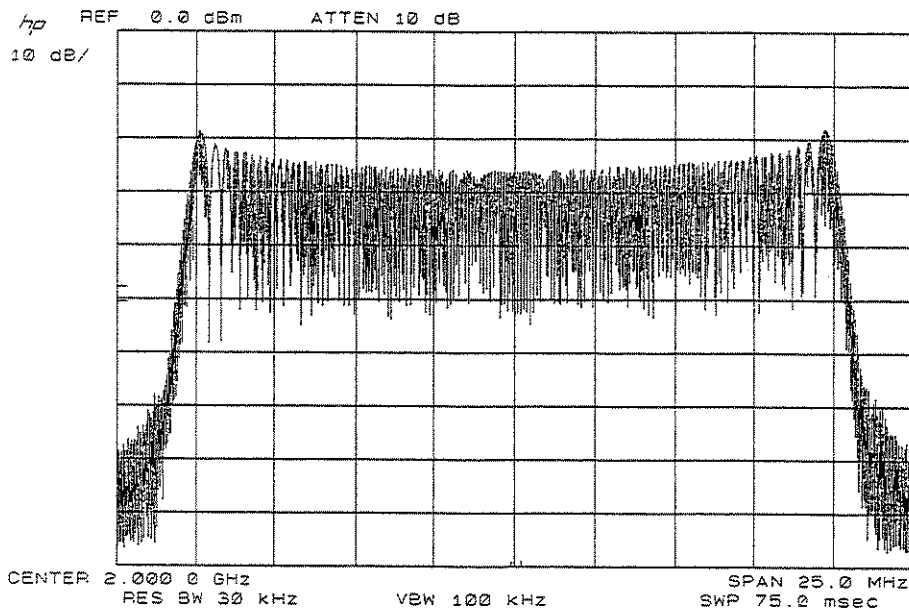


Figure 1-19. Example Signal Spectrum that Passes Test

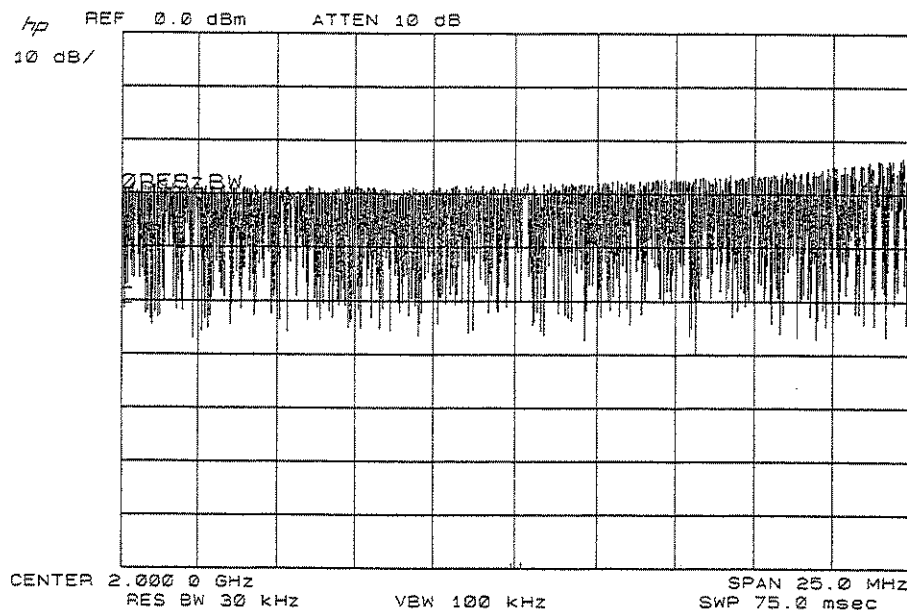


Figure 1-20. Example Signal Spectrum that Fails Test

To Verify 10 MHz Peak Deviation at 2 GHz

1. Verify that the Error Indicator is off. For the HP 70340A, the error indicator is the LED labeled "MSG" that is above the knob.
2. Turn FM On on the Signal Generator.
3. Change the function generator level so that the signal spectrum fills at least the 8 center vertical graticules of the spectrum analyzer display.
Refer to Figure 1-19 for a signal that covers 8 graticules.
4. Observe that the signal is symmetrical on the display.

Maximum FM Deviation

Refer to Figure 1-19 for a signal which is symmetrical. Refer to Figure 1-20 for a signal which is asymmetrical and, thus, fails to meet the specification.

5. Check that the error indicator is not on.

The error indicator is located on the front panel of the Signal Generator.

6. Record your observations in the test record chapter of this book.

To Verify 10 MHz Peak Deviation at 10 GHz

1. Set the Signal Generator CW frequency to 10 GHz.
2. Set the spectrum analyzer center frequency to 10 GHz.
3. Change the function generator level so that the signal spectrum fills at least the 8 center vertical graticules of the spectrum analyzer display.

Refer to Figure 1-19 for a signal that covers 8 graticules. Note that the center frequency is different than that in the figure.

4. Observe that the signal is symmetrical on the display.

Refer to Figure 1-19 for a signal which is symmetrical. Refer to Figure 1-20 for a signal which is asymmetrical and, thus, fails to meet the specification.

5. Check that no errors are present.
6. Record your observations in the test record chapter of this book.

To Verify 5 MHz Peak Deviation at 1 GHz

1. Set the Signal Generator CW frequency to 1 GHz.
2. Set the spectrum analyzer center frequency to 1 GHz.

3. Set the spectrum analyzer span to 12.5 MHz.
4. Set the function generator level to 1 Vpk (.7 Vrms)
5. Change the function generator level so that the signal spectrum fills at least the 8 center vertical graticules of the spectrum analyzer display.

Refer to Figure 1-19 for a signal that covers 8 graticules. Note, however, that the span and center frequency are different from those in the figure.

6. Observe that the signal is symmetrical on the display.
Refer to Figure 1-19 for a signal which is symmetrical. Refer to Figure 1-20 for a signal which is asymmetrical and, thus, fails to meet the specification.
7. Check that no errors are present.
8. Record your observations in the test record chapter of this book.

If the Procedure Fails

- Verify the test setup and instrument settings.

If the error indicator is on:

1. Check the Error Queue for the messages "712, Frequency loop went out of lock; (712)" and "713, Possible FM overmodulation; (713)."

If these messages appear, the FM Deviation test fails.

To check the error queue on the Signal Generator:

Press the **DISPLAY** key.

Press **REPORT ERRORS**. Error messages will be shown on the MMS display.

- Refer to the "Performance Test Failures" of the *Service Guide*.

FM Rate and Flatness

This test measures variations in the Signal Generator's FM sensitivity across the FM band. Measurements are made at 6 and 18 GHz. This test applies to the HP 70340A only.

HP 70341A FM performance is completely dependent on the HP 70340A's FM performance.

Specification	Conditions
4 dB	@ 1 kHz, 5 kHz, 100 kHz, and 1 MHz rates

Recommended Equipment

HP 71210C Spectrum Analyzer
HP 5343A Option 001 Microwave Frequency Counter
HP 3456A Voltmeter
HP 8116A Function Generator
20 dB BNC Attenuator (2)
6 dB BNC Attenuator

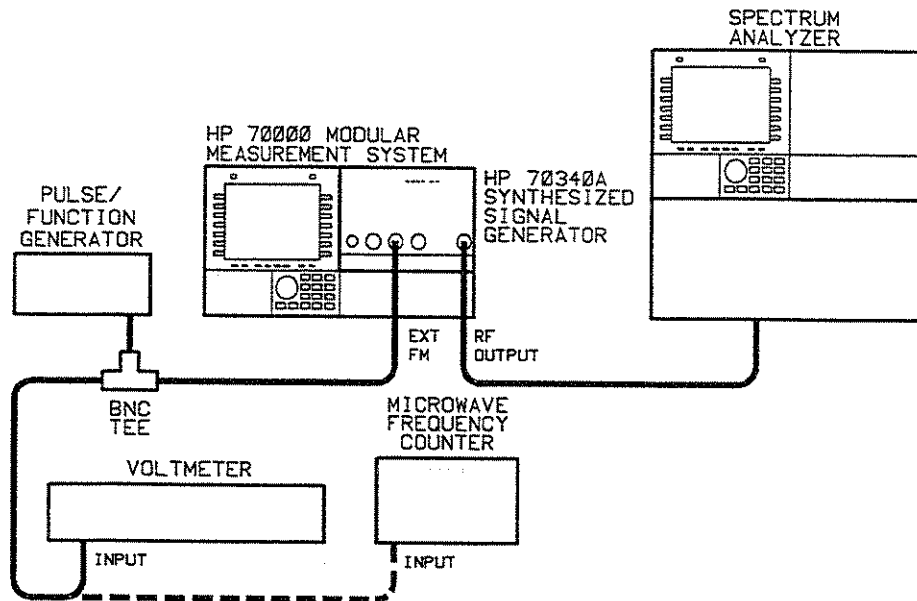


Figure 1-21. FM Rate and Flatness Test Setup

To Set up the Equipment

1. Connect the equipment as shown in Figure 1-21.
2. Preset the Signal Generator.
3. Set the CW frequency of the Signal Generator to 6 GHz.
4. Set the RF Output level of the Signal Generator to 0 dBm.
5. Turn FM on.
6. Set the spectrum analyzer as follows:
 - Preset
 - Center Frequency = 6 GHz

Performance Tests

FM Rate and Flatness

Span = 1 MHz

7. Set the function generator as follows:

Waveform = sinewave

Frequency = 100 kHz

Voltage = 10 mV

output = not disabled

To find the 100 kHz Reference 1st Sideband Nulls

1. Verify the function generator frequency with the frequency counter, and record the measured frequency.
2. Slowly increase the voltage on the function generator until the 1st sideband ($F_c \pm F_m$) nulls.

If the upper and lower sideband null at different voltages, record the average voltage between them. This reference voltage measured at 100 kHz should be around 70 mV.

3. Record the AC voltage indicated on the voltmeter in the test record chapter of this book.
4. Continue to increase the function generator voltage until you find the 4th time the 1st Sideband nulls.

If the upper and lower sideband null at different voltages, record the average voltage between them. This reference voltage measured at 100 kHz should be about 200 mV.

5. Record the AC voltage indicated on the voltmeter in the test record chapter of this book.

NOTE

Use as much attenuation as possible (40 dB) on the output of the function generator in order to improve resolution.

To find the 1st Sideband Null for a 1 kHz Rate

1. Tune the function generator to 1 kHz.
2. Measure the function generator frequency with the frequency counter, and record the measured frequency.
3. Set the spectrum analyzer span to 10 kHz.
4. Reduce the function generator output level to 10 mV.
5. Adjust the function generator output voltage to obtain the first Sideband null.

If the upper and lower sideband null at different voltages, record the average voltage between them. The level should be about 2 mV.

6. Record the measured voltage in the test record.

NOTE

Use as much attenuation as possible (40 dB) on the output of the function generator in order to improve resolution.

To Find the 1st Sideband Null for a 5 kHz Rate

1. Tune the function generator to 5 kHz, measure the function generator frequency with the frequency counter, and record the value in the test record.
2. Reduce the function generator output level to 10 Vrms.
3. Set the spectrum analyzer span to 50 kHz.
4. Adjust the function generator's output voltage to obtain the sixth time the 1st Sideband nulls.

If the upper and lower sideband null at different voltages, record the average voltage between them. The level should be about 10 mV. (Nulls will occur about every 2 mV.)

5. Record the measured voltage in the test record.

NOTE

Use as much attenuation as possible (40 dB) on the output of the function generator in order to improve resolution.

To Find the 1st Sideband Null for a 1 MHz Rate

1. Tune the function generator to 1 MHz, measure the function generator frequency with the frequency counter, and record the value in the test record.
2. Set the spectrum analyzer span to 10 MHz.

3. Set the function generator level to 10 mV.
4. Replace the 20 dB attenuators with a 6 dB attenuator in the test setup.
5. Slowly increase the function generator level until you find the 1st Sideband null.

If the upper and lower sideband null at different voltages, record the average voltage between them. The level should be about 100 mV.

6. Record the AC voltage indicated on the voltmeter in the test record chapter of this book.

To Calculate the Relative FM frequency response:

1. Solve the following equation 3 times using:
first, the 1 kHz 1st null and the 100 kHz 4th null
second, the 5 kHz 6th null and the 100 kHz 4th null
third, the 1 MHz 1st null and the 100 kHz 1st null.

NOTE

Be certain that you have measured the correct nulls. If the nulls are correct, the following relationships hold:

The 1 kHz 1st null measured voltage is approximately 100 times less than the 100 kHz 4th null.

The 5 kHz 6th null measured voltage is approximately 20 times less than the 100 kHz 4th null.

The 1 MHz 1st null measured voltage is approximately 10 times greater than the 100 kHz 1st null.

$$dB = 20 \log \frac{V_x}{V_{100kHz}} - 20 \log \frac{f_x}{f_{100kHz}}$$

where dB = the calculated frequency response

V_x = the voltage at the measured frequency

V_{100kHz} = the reference voltage measured at 100 kHz setting

Performance Tests

FM Rate and Flatness

f_x = the measured frequency

f_{100kHz} = the reference frequency measured at 100 kHz setting

- Record the 3 calculated relative responses in the test record chapter of this book.
- Repeat this entire procedure for a Signal Generator CW frequency of 18 GHz.

To Calculate FM Flatness

- Determine the recorded maximum value and the minimum value of frequency response, dB, for a CW frequency of 6 GHz.
The flatness should be less than 4 dB.
- If one response is negative and the other positive, record the sum of the two in the test record chapter of this book.
The flatness should be less than 4 dB.
- If both responses are positive or both are negative, record the worst case response in the test record.
The flatness should be less than 4 dB.
- Determine the recorded maximum value and the minimum value of frequency response, dB, for a CW frequency of 18 GHz.
- If one response is negative and the other positive, record the sum of the two in the test record chapter of this book.
The flatness should be less than 4 dB.
- If both responses are positive or both are negative, record the worst case response in the test record.
The flatness should be less than 4 dB.

If the Procedure Fails

- Verify the test setup and instrument settings.
- Refer to the "Performance Test Failures" section of the *Service Guide*.

Minimum AM Depth

This procedure verifies the AM depth specification of the Signal Generator by inputting a minimum of 7 Vdc into the EXT AM connector. A spectrum analyzer is used to verify that, when LOG AM is turned on, the RF Output signal drops at least 60 dB.

Specification	Conditions
> 60 dB	

Recommended Equipment

HP 71210C Spectrum Analyzer
HP 8116A Function Generator
HP 3456A Voltmeter

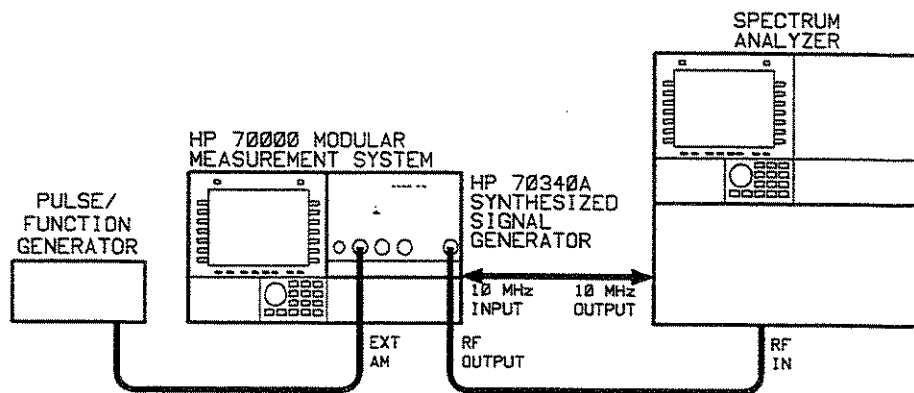


Figure 1-22. Minimum AM Depth Test Setup

To Set Up the Equipment

1. Preset the Signal Generator.
2. Set the CW Frequency on the Signal Generator to:
 HP 70340A: 1 GHz
 HP 70341A: 10 MHz
3. Set the RF Output level on the Signal Generator to 0 dBm.
4. Set the function generator as follows:
 Waveforms = off.
 Offset = 3.5 Vdc
 Disable = off (to enable output)
5. Verify that the function generator output is 7 Vdc using a voltmeter.
6. Connect the equipment as shown in Figure 1-22.
7. Set up the spectrum analyzer as follows:
 Frequency:
 If testing HP 70340A: 1 GHz
 If testing HP 70341A: 10 MHz
 Span = 500 Hz
 Input Attenuation = 10 dB
 Reference Level = 0 dBm
 Resolution Bandwidth = 10 Hz

To Measure AM depth

1. Adjust the spectrum analyzer controls to set the signal peak on the top graticule line (the reference level).
2. Turn the Signal Generator Log AM function on.
3. Observe that the signal peak on the spectrum analyzer drops to about the -60 dB line.

Performance Tests
Minimum AM Depth

4. Record your observations in the test record.

If the Procedure Fails

- Verify the test setup and instrument settings.
- Determine the actual power levels of both the AM on and AM off states using a marker on a spectrum analyzer, and subtract one from the other in order to manually calculate the AM depth.
- Increase the function generator output to 10 Vdc and repeat the test procedure.
This calculated AM depth should be greater than 60 dB.
- Refer to the "Performance Test Failures" section of the *Service Guide*.

Manual Adjustment
Procedures (for HP
70340A)

Manual Adjustment Procedures (for HP 70340A)

The procedures which follow are defined as *manual* because they require operator interaction.

The following lists each procedure and when it should be performed:

Adjustment	When Required
YIG CAL	After replacing either YIG Oscillator (A8G1 or A8G2), the YIG Driver Assembly (A9), or when calibration data is lost
Low Stability Time Base	After replacing the LO Signal Generator and Reference Assembly (A6) or for improved accuracy.
.5V/GHz	After replacing the CPU Assembly (A2) or for improved accuracy.

Instrument Cover Removal

To perform the adjustments in this chapter, you must have access to internal components.

Cover Removal

1. Place the Signal Generator with the top cover up.
2. Unscrew the four screws that attach the handles to the sides of the instrument and remove the handles.
3. Unscrew the eight screws that are under the handles. There are four screws per side.

WARNING

Voltages in the instrument can cause personal injury; be extremely careful. Capacitors can be charged even if the instrument has been disconnected from line power.

4. Unscrew the captive screw at the middle of the rear edge of the cover. This is a captive screw, and will cause the cover to pull away from the front frame.
5. Slide the cover to the rear to remove.

DIP Switch Settings

For many of the adjustment procedures, you must access the DIP switch, A3S1, located on assembly A3 in order to close PG(8). PG(8) must then be opened at the end of the procedure in order to ensure that the calibration data is saved. For the procedures which require access to this switch, refer to the following figure.

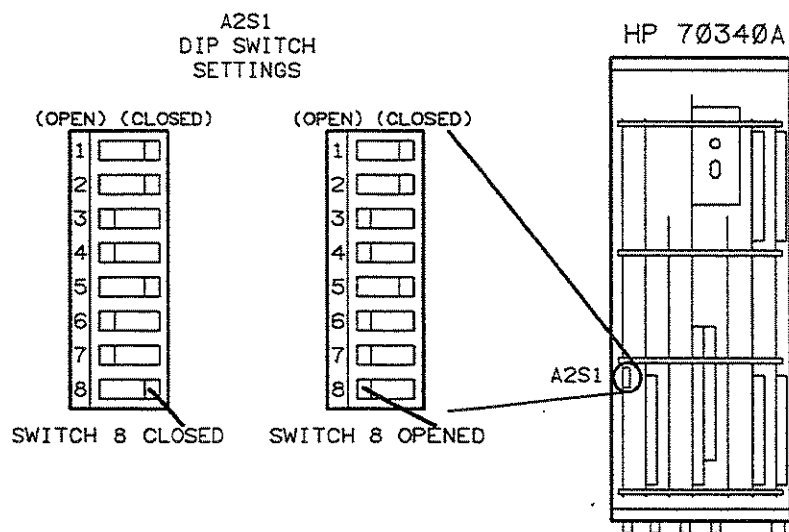


Figure 2-1. DIP Switch, A3S1, Settings

Low Stability Timebase Adjustment

This procedure verifies the operation of the Signal Generator's low stability 10 MHz reference. You should perform this after replacing the LO Synth and Reference Assembly (A6) or when you require improved frequency accuracy.

Recommended Equipment

HP 5334B Frequency Counter
HP 5061A Frequency Standard
HP 8493C Option 010 10 dB Attenuator

Manual Adjustment Procedures (for HP 70340A)
Low Stability Timebase Adjustment

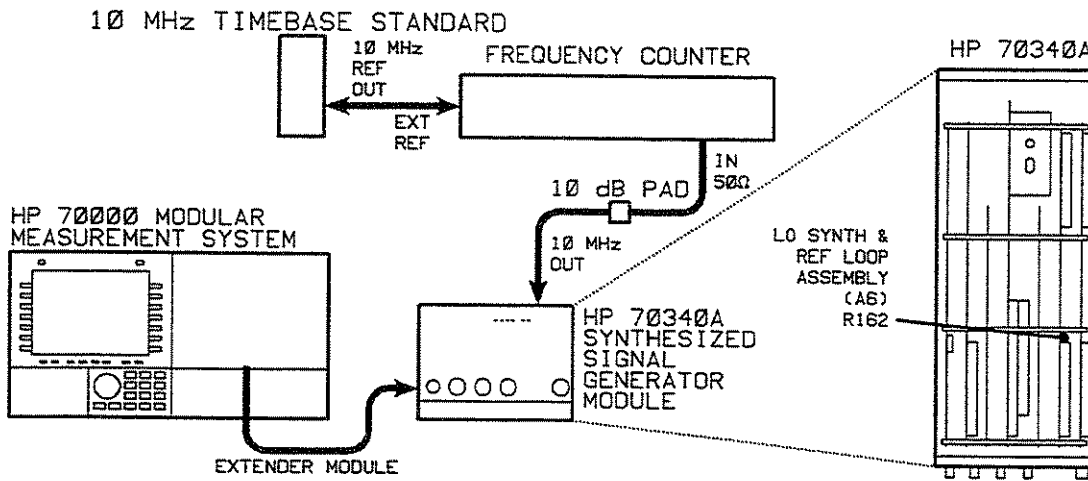


Figure 2-2. Low Stability Timebase Equipment Setup

CAUTION

Be sure that the LINE switch is in the "off" position before removing the Signal Generator cover.

1. Connect the equipment as shown in Figure 2-2.
2. Turn on the equipment and allow it to warm up for one hour.
3. Adjust *R162* slightly on the Signal Generator's LO Synth and Ref Loop Assembly (A6) until the frequency counter displays "10 MHz" ± 1 Hz.

0.5 V/GHz Output Adjustment

This procedure checks and, if necessary, adjusts the output of the Digital to Analog Converter for accuracy. Perform this adjustment after replacing the CPU Assembly or when you desire improved accuracy.

Recommended Equipment

HP 3456A Voltmeter

Manual Adjustment Procedures (for HP 70340A)
0.5 V/GHz Output Adjustment

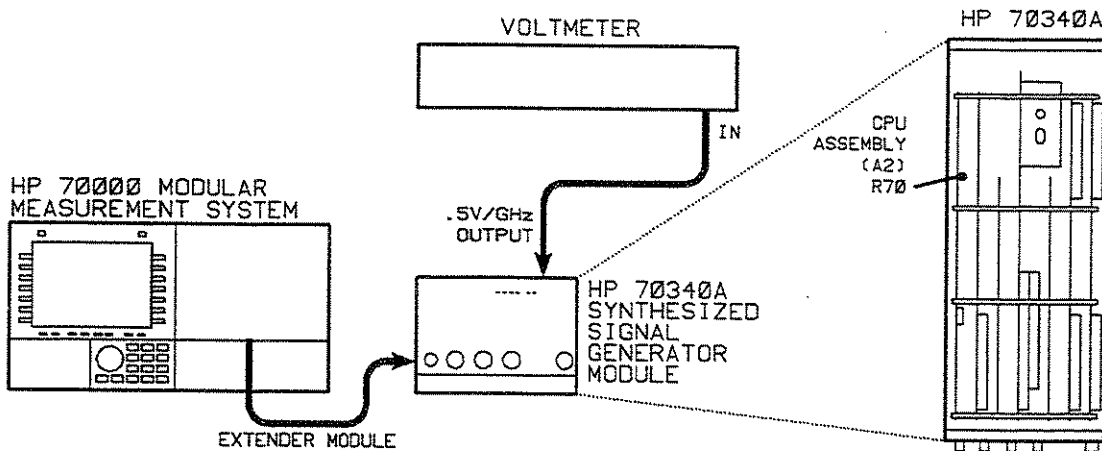


Figure 2-3. 0.5V/GHz Output Equipment Setup

CAUTION

Be sure that the LINE switch is in the "off" position before removing the Signal Generator cover.

1. Turn on the Signal Generator and allow it to warm up at least one hour.
2. Set the Signal Generator CW frequency to 10 GHz.
This sets the DAC to 5 volts.
3. Connect the voltmeter to the .5 V/GHz Output located on the Signal Generator's rear panel as in Figure 2-3.
4. Adjust the *R70* potentiometer on the CPU Assembly so that the voltmeter reads $+5.000\text{ V} \pm 5\text{ mV}$.

Note that *R70* is the only potentiometer on the CPU Assembly.

If the Procedure Fails

- Verify the equipment setup and instrument settings.
- If the potentiometer can not be adjusted for a proper voltmeter reading:
Refer to the *Service Guide* in order to verify the CPU Assembly.

YIG Calibration

This calibration is performed via the front panel of the instrument using special function 71. The calibration traces the hysteresis curve of the YIG Oscillator at 200 MHz intervals and uses the curve to calculate the average values for the DAC. This procedure is performed in two bands, 2 to 10 GHz and 10 to 20 GHz.

It is necessary to perform this procedure after replacing the YIG Driver Assembly (A9) or either YIG Oscillator (A8G1 or A8G2). It is also necessary when calibration data is lost.

CAUTION

Be sure that the LINE switch is in the "off" position before removing the Signal Generator cover.

1. Close PG(8) on the DIP switch, A3S1, as shown in figure 2-1.
2. Turn on the equipment and allow it to warm up for one hour.
3. Check for errors from the error queue:

Press the **DISPLAY** key

Press **REPORT ERRORS**. The error messages will be shown on the MMS display.

4. Run the YIG Calibration:
 - a. Press the **Misc** key.
 - b. Press **CAL YIG OSC**. The display will change.
 - c. Press **CAL YIG OSC** again to start the calibration.

The message "CALIBRATING YIG OSC" is briefly displayed followed by the message, "YTO Cal is starting now."

While the routine is running, DAC values appear on the screen. The message, " Cal Freq xxx, DAC = xxx " is shown with "DAC" in *uppercase* letters, indicating that the calibration is running successfully.

5. When the routine completes, open PG(8) of the DIP switch, S1. Refer to figure 2-1.

The message "YTO Cal successful" should appear when the calibration is complete.

NOTE

This routine completes in about 20 minutes.

6. If you see the message "Cal Freq XXX, dac = xxx" where "dac" is in lowercase letters, abort the routine by pressing the **ABORT YIG CAL** key, open PG(8) of the DIP switch, A3S1, and refer to the troubleshooting section of the *Service Guide*.

If the calibration fails any point or points, the message "Cal Freq xxx, dac = xxx" is shown where "dac" in lower case from the first failed point on. Old data for the failed band remains intact if the calibration fails any point in that band.

7. If the message "YIG Cal failed" appears, the calibration has failed. If this message is displayed:
 - a. Open PG(8) of the DIP switch, S1. Refer to figure 2-1.
 - b. Check the Error Queue for error messages.
 - c. Refer to the troubleshooting section of the *Service Guide*.

NOTE

Within a band, new DAC values are not saved in ROM unless the YIG Calibration completes successfully. It is possible for the calibration to pass in 1 band and fail in the other. In this case the new DAC values are saved for the band that passes and the old DAC values are retained for the band that fails.

Manual Adjustment Procedures (for HP 70340A)
YIG Calibration



Automated Adjustment
Procedures

Automated Adjustment Procedures

The procedures which follow are automated. Each procedure contains information on the equipment setup as well as how to load and run the program. The automated adjustments require the software disks which accompany this book. Note that some user interaction is required during these procedures even though they are automated. The automated procedures include vernier, frequency, attenuator, AM, and low band (.01 to 1 GHz) calibrations.

Perform these adjustments only when directed to do so by the troubleshooting procedures in the *Service Guide* or when a related performance test fails. The following lists each procedure and summarizes when it should be performed:

Automated Adjustment Procedures
YIG Calibration

Adjustment	When Required
HP 70340A	
Vernier, Frequency 1 (0.01 to 1 GHz)	After replacing the ALC Assembly (A10), Output Module (A8A1), Coupler/Detector (A8A5), SLPFA (A8A2), RF Output connector, semi-rigid cables between Output Module (A8A1) and RF Output connector, or Step Attenuator (A8AT1). Calibration is also necessary when calibration data is lost or when the instrument fails the Vernier Level Accuracy and Flatness test.
Frequency 2, Attenuator (0.01 to 1 GHz)	After replacing the ALC Assembly (A10), Output Module (A8A1), Coupler/Detector (A8A5), SLPFA (A8A2), RF Output connector, semi-rigid cables between Output Module (A8A1) and RF Output connector, or Step Attenuator (A8AT1). Calibration is also necessary when calibration data is lost or when the instrument fails the Low Level Accuracy and Flatness test.
Vernier, Frequency 1 (1 to 20 GHz)	After replacing the ALC Assembly (A10), Output Module (A8A1), SLPFA (A8A2), RF Output connector, semi-rigid cables between Output Module (A8A1) and RF Output connector, or Step Attenuator (A8AT1). Calibration is also necessary when calibration data is lost or when the instrument fails the Vernier Level Accuracy and Flatness test.
Frequency 2, Attenuator (1 to 20 GHz)	After replacing the ALC Assembly (A10), Output Module (A8A1), SLPFA (A8A2), RF Output connector, semi-rigid cables between Output Module (A8A1) and RF Output connector, or Step Attenuator (A8AT1). Calibration is also necessary when calibration data is lost or when the instrument fails the Low Level Accuracy and Flatness test.
AM Gain, Am Linearity	After replacing the Pulse and AM Driver Assembly (A5), the SLPFA (A8A2), or the Output Module (A8A1). Calibration is also necessary when AM calibration data is lost.
HP 70341A	
AM, Pulse	After replacing the A3 Power/Mod assembly or when calibration data is lost.

Instrument Cover Removal

To perform the some of the adjustments in this chapter, you must have access to internal components.

HP 70340A Cover Removal

Some of the procedures in this chapter *might* require that you remove the cover from the instrument in order to access internal components. If your instrument is an HP 70340A, in addition to removing the cover, you must remove the instrument from the mainframe and connect it to an extender cable. The following steps detail how to remove the HP 70340A from the mainframe and connect it to the extender module.

1. To remove the Signal Generator from the mainframe:
 - a. Turn the mainframe off by setting the LINE (Mains) switch to the off position.
 - b. Swing the mainframe front panel door down.

On some MMS mainframe models, the door will not open unless the LINE switch is off.
 - c. Loosen the hex-nut module latch using an 8 mm hex-ball driver (HP part number 8710-1307).

The 8 mm hex-ball driver is included with your MMS mainframe or display. It is necessary to use this tool for installation and removal of a module.

CAUTION

Be sure that the LINE switch is in the "off" position before removing the Signal Generator cover.

WARNING

Voltages in the instrument can cause personal injury; be extremely careful. Capacitors can be charged even if the instrument has been disconnected from line power.

- d. Slide the Signal Generator module out of the mainframe.
2. Remove the 16 screws from the Signal Generator cover and carefully remove the cover from the instrument.
3. Connect the Extender Module (HP part number 70001-60013) from the Signal Generator to the mainframe as shown in Figure 3-1.

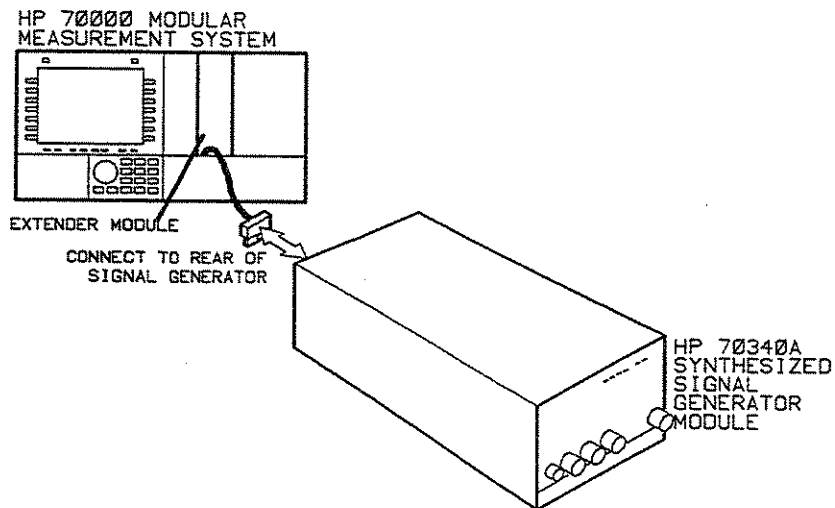


Figure 3-1. Signal Generator and Extender Module Setup

DIP switch, S1, Settings

For many of the adjustment procedures, you must access the DIP switch, S1, located on Assembly A2 (HP 70340A) in order to close PG(8). PG(8) must then be opened at the end of the procedure in order to ensure that the calibration data is saved. PG(8) can be accessed through the hole in the top of the HP 70340A instrument cover *without* removing the cover from the instrument. For procedures which require access to this switch, refer to the following figure (Figure 3-2) which shows the location of the PG(8) with the cover removed.

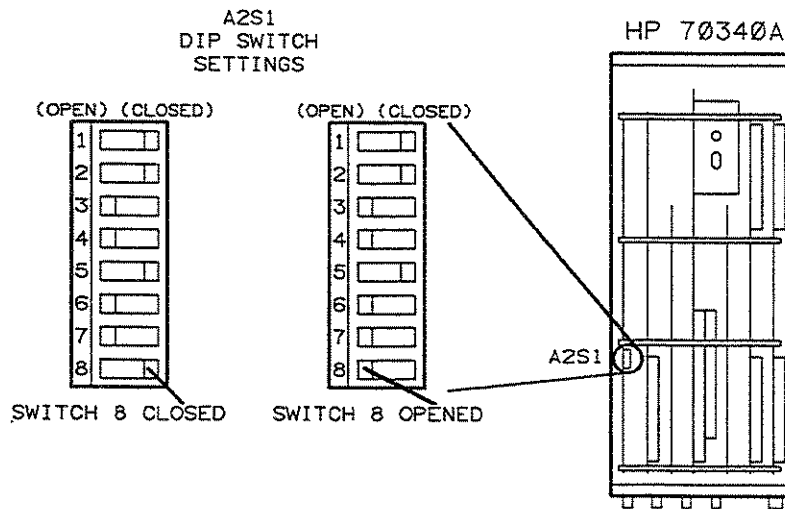


Figure 3-2. DIP Switch, S1, Settings

System Requirements and Setup

Hardware

The automated adjustments require an HP 9000 series 200/300 computer with at least 4 megabytes of RAM, a disk drive, and an HP-IB interface. They also require a HP-IB compatible printer. The software disks provided are in the 3.5 inch format. There are a total of three double-sided disks included with the calibration kit.

Operating System

These procedures were developed to run on BASIC version 5.1. However, they may be run on earlier versions of BASIC. Refer to the BASIC user's documentation for instructions on loading the operating system and binaries.

Software

The automated adjustments are contained on three double-sided disks. All disks are required in order to run the procedures.

It is suggested that you make working copies of the master disks.

Running the Software

CAUTION

This software uses RAM volumes for fast access of data files. These volumes may also be used by other programs containing data that will be erased by this program. Be certain that the computer does not contain important data in any memory volumes before you run this program.

NOTE

The computer containing this program must be the only controller on the bus. If more than one controller is present, the software will not run properly.

1. Copy the software from the master disks to working disks.
2. Set the default mass storage to the disk drive which will contain the automated adjustment software using the BASIC "MASS STORAGE IS" command.

Refer to the BASIC Language Reference for more information on setting the default mass storage.

3. Select a Display device using the PRINTER IS statement.

Specific instructions are shown on the display device that you are using. A hard copy of adjustment outputs is sent to the hard copy printer with the address selected in the "USER_FILE" program that follows.

NOTE

There are various ways to enter data or commands when you are within *this* program. **ENTER**, **CONTINUE**, **RETURN**, and **EXECUTE** are all interchangeable. For consistency, the **ENTER** key is used throughout this book.

To Edit the User_File (70340A or 70341A)

The user file has been set up to allow storage of user-supplied information such as instrument HP-IB addresses and calibration factors. These values are entered once and only need to be updated if they are changed.

1. Insert Disk 1 into the default drive.
2. Type LOAD "USER_FILE"
3. Press **ENTER**.
4. Type EDIT
5. Press **ENTER**.
6. To enter user parameters:
 - a. Scroll through the file until you read:

```
Dut=xxx THIS IS THE HP-IB ADDRESS OF THE DEVICE UNDER TEST
```



```
HP 7034X OR 837XX
```

where the default value of xxx is 719
 - b. Type in the HP-IB Address if it differs from the value of xxx.

For the HP 70340A, the Signal Generator HP-IB address can be viewed using the **DISPLAY** key and the **Address Map** function. Refer to "To Set the HP-IB Address" in the *HP 70340A User's Guide* for more information.
 - c. Press **ENTER** in order to enter the data into the program.
 - d. Continue to scroll through the program until you read the following heading:

```
Prnt=yyy THIS IS THE ADDRESS OF THE HARD COPY PRINTER
```

where the default value of yyy is 701
 - e. Type in the address of the hardcopy printer if it differs from the value of yyy.
 - f. Continue to scroll through the program in order to modify any of the following parameters:

Power Meter HP-IB Address, default Pm = 713

Automated Adjustment Procedures

Running the Software

Measuring Receiver HP-IB Address, default Meas_rec = 716

Spectrum Analyzer HP-IB Address, default Spec_a = 718

Voltage Source HP-IB Address, default Source = 709

RF Signal Generator HP-IB Address, default Rf_gen = 725

Sampling Oscilloscope, default scope = 708

HIGH FREQUENCY POWER SENSOR CALIBRATION DATA:

Number (maximum=40) of Sensor Cal Factor Frequencies, default N_freqs = 20

Sensor Cal Factor Frequencies in GHz, default Freq:
.05,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20

Sensor Cal Factors corresponding to
Frequencies entered, default Fact:
99.5,98.2,97.6,97.6,97,97,96.2,95.8,95.8,95.2,95.2,94.8,95,94.8,
94,93.2,93.5,93,92.6,91.4

LOW FREQUENCY POWER SENSOR CALIBRATION DATA (HP
70340A Low Band Calibrations Only):

Number (maximum=40) of Sensor Cal Factor Frequencies, default
N_lo = 5

Sensor Cal Factor Frequencies in MHz, default Freq_lo:
10,30,100,300,1000

Sensor Cal Factors corresponding to Frequencies entered, default
Fact_lo: 99.2,98.7,98.2,97.7,97.2

- g. Type in the appropriate parameter information according to the prompts and then press **(ENTER)** for each parameter.
7. Purge the old and store the new "USER.FILE" when you are finished entering user parameters into the file.

HP 70340A Vernier Calibration

This calibration is necessary after replacing the ALC Assembly (A10), Output Module (A8A1), Coupler/Detector, SLPFA (A8A2), RF Output connector, semi-rigid cables between Output Module (A8A1) and RF Output connector, or Step Attenuator (A8AT1). Calibration is also necessary when calibration data is lost or when the instrument fails the Vernier Level Accuracy test.

Required Equipment

HP 70001-60013 Extender Module (HP 70340A only)
HP 8485A Sensor
HP 437B Power Meter
HP-IB Printer

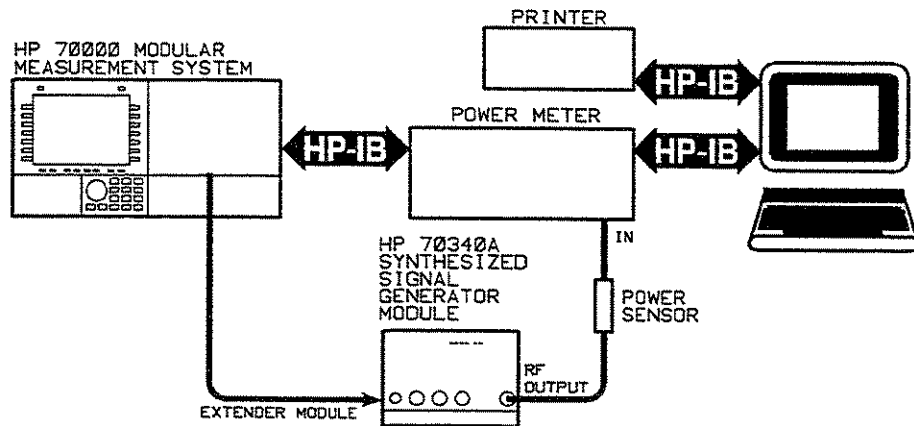


Figure 3-3. Vernier Calibration Equipment Setup

To run the procedure

1. Zero and calibrate the power meter and sensor.

Be certain that the appropriate calibration factor information is loaded in to USER_FILE on Disk 1 prior to running this procedure.

2. Set up the equipment as shown in Figure 3-3.
3. Insert Disk 3 into the default drive.
4. Type LOAD "VERN_CAL"
5. Press **ENTER**.
6. Press **RUN** to start the automated adjustment.
7. Follow the computer instructions.

Refer to Figure 3-2 for DIP switch, S1, location and positions.

Typically, the program will run through 3 iterations before successfully converging.

8. If the program does not converge (finish running) after about 5 minutes, press **STOP**, rezero and calibrate the power meter, and then press **RUN** to rerun the procedure.
9. If the program still does not converge, there is a hardware problem with the instrument. Refer to the troubleshooting procedures in the *Service Guide*.

CAUTION

Be certain to open PG(8) of the DIP switch, S1, when you finish running this procedure. If the switch remains closed, you risk the loss of all calibration data. Refer to Figure 3-2.

If the Procedure Fails

- Verify the equipment setup and instrument settings.

- Zero and calibrate the power meter and sensor and then rerun this procedure.

If the program still does not converge, refer to the *Service Guide*.

HP 70340A Frequency Calibration 1

Perform this calibration after replacing the Output Module (A8A1), SLPFA (A8A2), ALC Assembly (A10), Step Attenuator (A8AT1), RF Output connector, or semi-rigid cables between the Output Module (A8A1) and the RF Output connector. Calibration is also necessary when calibration data is lost or when the instrument fails the Vernier Level Accuracy and Flatness test.

Required Equipment

- HP 70001-60013 Extender Module (HP 70340A only)
- HP 8485A Sensor
- HP 437B Power Meter
- HP-IB Printer

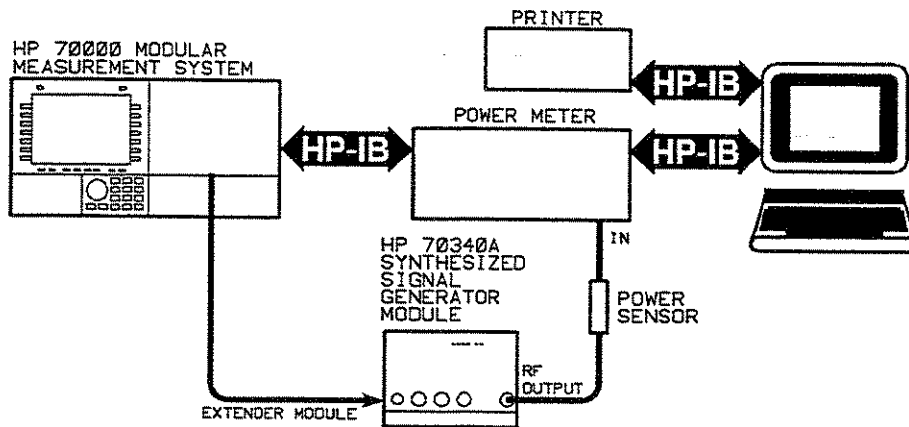


Figure 3-4. Frequency Calibration Equipment Setup

To run the procedure

1. Zero and calibrate the power meter and sensor.

Be certain that the appropriate calibration factor information is loaded in to USER_FILE on Disk 1 prior to running this procedure.

2. Set up the equipment as shown in Figure 3-4.
3. Insert Disk 3 into the default drive.
4. Type LOAD "FREQ_CAL"
5. Press **ENTER**.
6. Press **RUN** to start the automated adjustment.
7. Follow the computer instructions.

Refer to Figure 3-2 for DIP switch, S1, location and positions.

Upon completion, the program prints out a graph of the instrument's Frequency response.

If the plot is not within the specified limits, the instrument can not be accurately calibrated and a repair is required.

CAUTION

Be certain to open PG(8) of the DIP switch, S1, when you finish running this procedure. If the switch remains closed, you risk the loss of all calibration data. Refer to Figure 3-2.

HP 70340A Frequency Calibration 2

This procedure applies only to instruments with Option 1E1.

Perform this calibration after replacing the Step Attenuator (A8AT1) or when calibration data is lost. Calibration should also be attempted if the instrument fails the Low Level Accuracy performance test.

Required Equipment

HP 70001-60013 Extender Module

HP 8485A Sensor

HP 437B Power Meter

HP-IB Printer

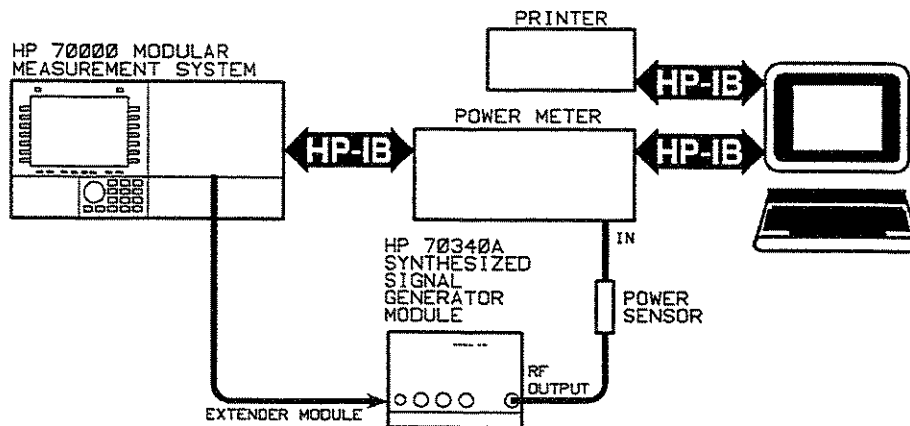


Figure 3-5. Frequency Calibration 2 Equipment Setup

To run the procedure

1. Zero and calibrate the power meter and sensor.

Be certain that the appropriate calibration factor information is loaded in to USER_FILE on Disk 1 prior to running this procedure.

2. Set up the equipment as shown in Figure 3-5.
3. Insert Disk 3 into the default drive.
4. Type LOAD "FREQ_CAL2"
5. Press **ENTER**.
6. Press **RUN** to start the automated adjustment.
7. Follow the computer instructions.

Refer to Figure 3-2 for DIP switch, S1, location and positions.

Upon completion, the program prints out a graph of the instrument's Frequency response.

If the plot is not within the specified limits, the instrument can not be accurately calibrated and a repair is required.

CAUTION

Be certain to open PG(8) of the DIP switch, S1, when you finish running this procedure. If the switch remains closed, you risk the loss of all calibration data. Refer to Figure 3-2.

HP 70340A Attenuator Calibration

This calibration applies only to an instrument with Option 1E1.

Perform this calibration after replacing the Step Attenuator (A8AT1) or when calibration data is lost. Calibration should also be attempted if the instrument fails the Low Level Accuracy performance test.

NOTE

This procedure takes about 4 hours to perform.

Recommended Equipment

HP 70001-60013 Extender Module (HP 70340A only)
HP 71210C Spectrum Analyzer
HP 8902A Measuring Receiver
HP 8493C Option 010 10 dB Attenuator

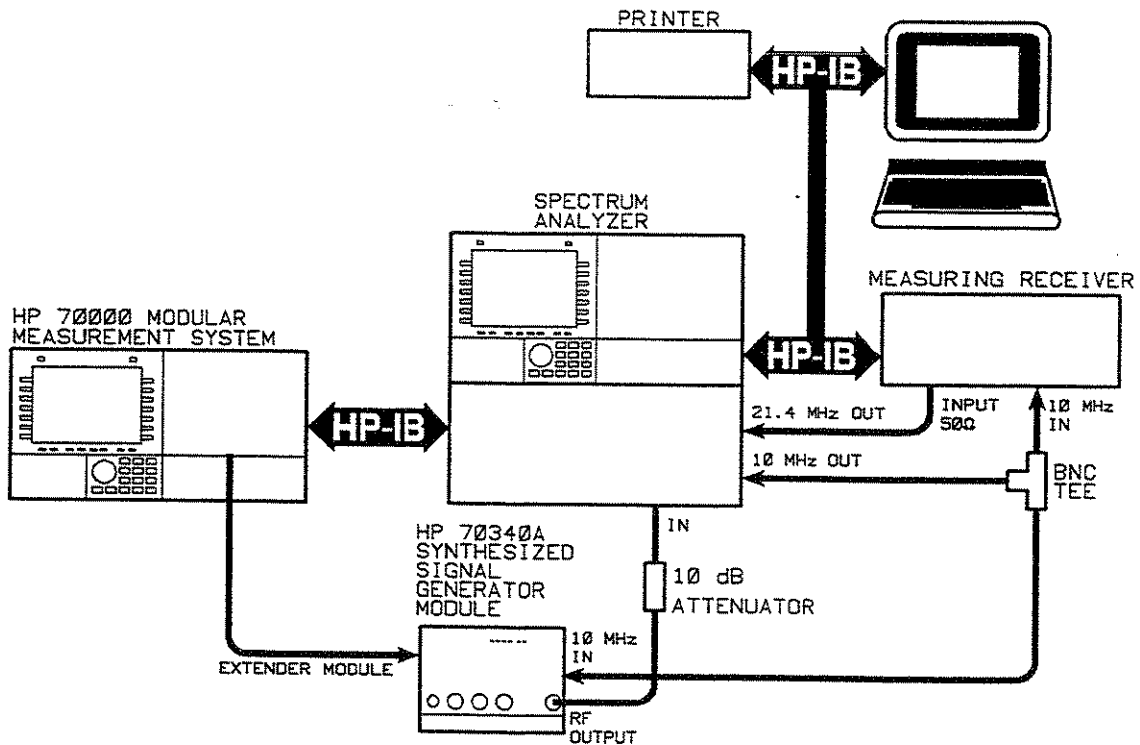


Figure 3-6. Attenuator Calibration Equipment Setup

Notes

1. It is recommended that you use a rigid or high quality semi-rigid cable that is less than 2 feet long for this procedure. At 18 GHz, the maximum allowable loss of the cable (connecting Signal Generator RF Output to spectrum analyzer RF Input) is 5 dB.
2. For maximum accuracy, connect the 10 dB attenuator directly to the spectrum analyzer input.

To run the procedure

1. Set up the equipment as shown in Figure 3-6.
2. Insert Disk 3 into the default drive.
3. Type LOAD "ATTEN_CAL"
4. Press **ENTER**.
5. Press **RUN** to start the automated adjustment.
6. Follow the computer instructions.

NOTE

When the routine starts gathering data, the process takes about 3.5 hours. During this time, the program can run unattended. Once the routine is complete, however, follow the rest of the computer instructions in order to complete the calibration.

Refer to Figure 3-2 for DIP switch, S1, location and positions.

CAUTION

Be certain to open PG(8) of the DIP switch, S1, when you finish running this procedure. If the switch remains closed, you risk the loss of all calibration data. Refer to Figure 3-2.

If the Test Fails

- Verify the equipment setup and instrument settings.
- Refer to the troubleshooting section of the *Service Guide*.

HP 70340A AM Linearity Calibration

Perform this calibration if AM calibration data is lost or after you replace the Pulse and AM Driver Assembly (A5), the SLPFA (A8A2), or the Output Module (A8A1).

NOTE

The AM Linearity calibration *must* be run before the AM Gain calibration.

Required Equipment

HP 70001-60013 Extender Module (HP 70340A only)
HP-IB Printer
HP 70210C Spectrum Analyzer
HP 3245A Pulse/Function Generator

Automated Adjustment Procedures
HP 70340A AM Linearity Calibration

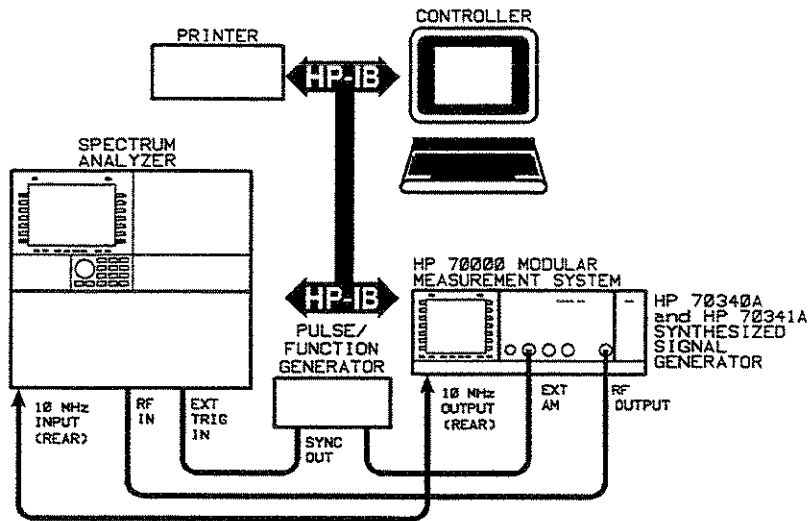


Figure 3-7. AM Linearity Calibration Equipment Setup

To run the procedure

1. Set up the equipment as shown in Figure 3-7.
2. Insert Disk 4 into the default drive.
3. Type LOAD "AM_LIN"
4. Press **ENTER**.
5. Press **RUN** to start the automated adjustment.
6. Follow the computer instructions.

NOTE

When the routine starts gathering data, the process takes about 2 hours. During this time, the program can run unattended.

Upon completion, the program prints out a table of each calibration DAC's value for a given output frequency. If both DAC values are within the acceptable range, the frequency is labeled "Pass." If all DAC values are *not* within acceptable limits, the instrument can not be accurately calibrated, and a repair is required.

If the Procedure Fails

- Verify the equipment setup and instrument settings.
- Refer to the troubleshooting section of the *Service Guide*.

HP 70340A AM Gain Calibration

Perform this calibration if AM calibration data is lost or after you replace the Pulse and AM Driver Assembly (A5), the SLPFA (A8A2), or the Output Module (A8A1).

NOTE

The AM Linearity calibration *must* be run before the AM Gain calibration.

Required Equipment

HP 70001-60013 Extender Module (HP 70340A only)
HP-IB Printer
HP 70210C Spectrum Analyzer
HP 3245A Pulse/Function Generator

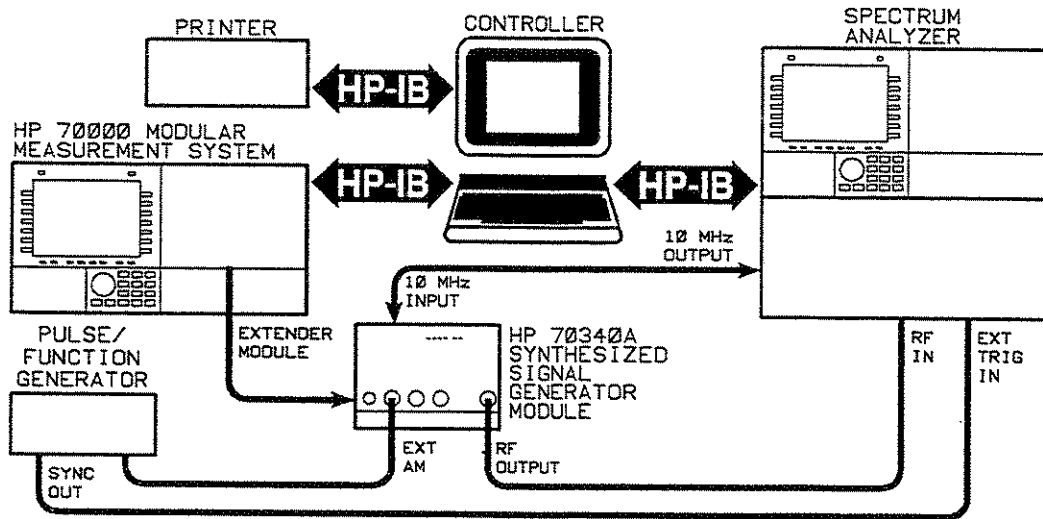


Figure 3-8. AM Gain Calibration Equipment Setup

To run the procedure

1. Set up the equipment as shown in Figure 3-8.
2. Insert Disk 4 into the default drive.
3. Type LOAD "AM_GAIN"
4. Press **ENTER**.
5. Press **RUN** to start the automated adjustment.
6. Follow the computer instructions.

Automated Adjustment Procedures
HP 70340A AM Gain Calibration

NOTE

When the routine starts gathering data, the process takes about 40 minutes. During this time, the program can run unattended.

Upon completion, the program prints out a graph of the instrument's AM Gain Correction.

If the plot is not within the specified limits, the instrument can not be accurately calibrated and a repair is required.

If the Procedure Fails

- Verify the equipment setup and instrument settings.
- Refer to the *Service Guide*.

Vernier Low Band (0.01 to 1 GHz) Calibration (HP 70340A Only)

This calibration is necessary after replacing the Coupler/Detector, ALC Assembly (A10), Output Module (A8A1), SLPFA (A8A2), RF Output connector, semi-rigid cables between Output Module (A8A1) and RF Output connector, or Step Attenuator (A8AT1). Calibration is also necessary when calibration data is lost or when the instrument fails any of the HP 70341A Level Accuracy performance tests.

Required Equipment

HP 70001-60013 Extender Module (HP 70340A only)
HP 8482A Power Sensor
HP 437B Power Meter
HP-IB Printer
HP 8663A or HP 8662A RF Source¹
HP 11742A Blocking Capacitor
In-Line Resistor²

¹The HP 8662A is an acceptable RF source only if its RF output power level is greater than +16 dBm from 0.01 to 1 GHz. This level of performance is beyond the specified performance of the HP 8662A.

²If the HP 8663A is used as the RF source, the in-line resistor value is 1 k Ω . If the HP 8662A is used, the value for the resistor is 1.62 k Ω .

Automated Adjustment Procedures

Vernier Low Band (0.01 to 1 GHz) Calibration (HP 70340A Only)

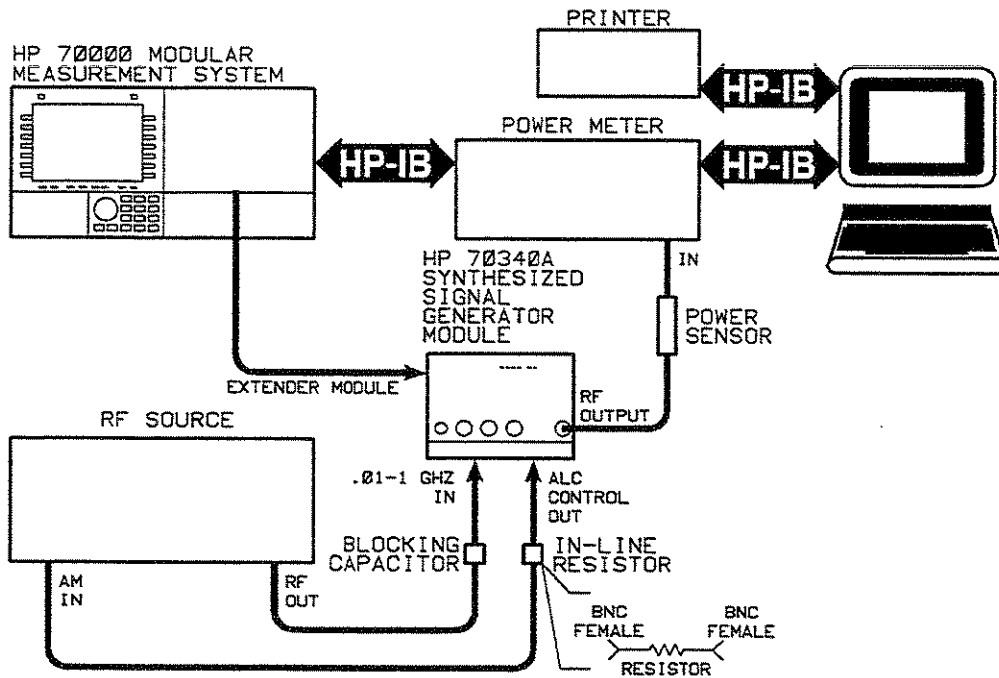


Figure 3-9. Low Band Vernier Calibration Equipment Setup

To run the procedure

1. Zero and calibrate the power meter and sensor.

Be certain that the appropriate calibration factor information is loaded in to `USER_FILE` on Disk 1 prior to running this procedure.

2. Set up the equipment as shown in Figure 3-9.
3. Insert Disk 5 into the default drive.
4. Type `LOAD "VERN_CAL_L"`
5. Press **ENTER**.

6. Press **RUN** to start the automated adjustment.
7. Follow the computer instructions.
Refer to Figure 3-2 for DIP switch, S1, location and positions.
Typically, the program will run through 3 iterations before successfully converging.
8. If the program does not converge (finish running) after about 5 minutes, press **STOP**, rezero and calibrate the power meter, and then press **RUN** to rerun the procedure.
9. If the program still does not converge, there is a hardware problem with the instrument. Refer to the troubleshooting procedures in the *Service Guide*.

CAUTION

Be certain to open PG(8) of the DIP switch, S1, when you finish running this procedure. If the switch remains closed, you risk the loss of all calibration data. Refer to Figure 3-2.

If the Procedure Fails

- Verify the equipment setup and instrument settings.
- Zero and calibrate the power meter and sensor and then rerun this procedure.

If the program still does not converge, refer to the *Service Guide*.

Frequency 1 Low Band (0.01 to 1 GHz) Calibration (HP 70340A Only)

This calibration is necessary after replacing the Coupler/Detector, ALC Assembly (A10), Output Module (A8A1), SLPFA (A8A2), RF Output connector, semi-rigid cables between Output Module (A8A1) and RF Output connector, or Step Attenuator (A8AT1). Calibration is also necessary when calibration data is lost or when the instrument fails any of the HP 70341A Level Accuracy performance tests.

Required Equipment

HP 70001-60013 Extender Module (HP 70340A only)
HP 8482A Power Sensor
HP 437B Power Meter
HP-IB Printer
HP 8663A or HP 8662A RF Source¹
HP 11742A Blocking Capacitor
In-Line Resistor²

¹The HP 8662A is an acceptable RF source only if its RF output power level is greater than +16 dBm from 0.01 to 1 GHz. This level of performance is beyond the specified performance of the HP 8662A.

²If the HP 8663A is used as the RF source, the in-line resistor value is 1 k Ω . If the HP 8662A is used, the value for the resistor is 1.62 k Ω .

Automated Adjustment Procedures
Frequency 1 Low Band (0.01 to 1 GHz)
Calibration (HP 70340A Only)

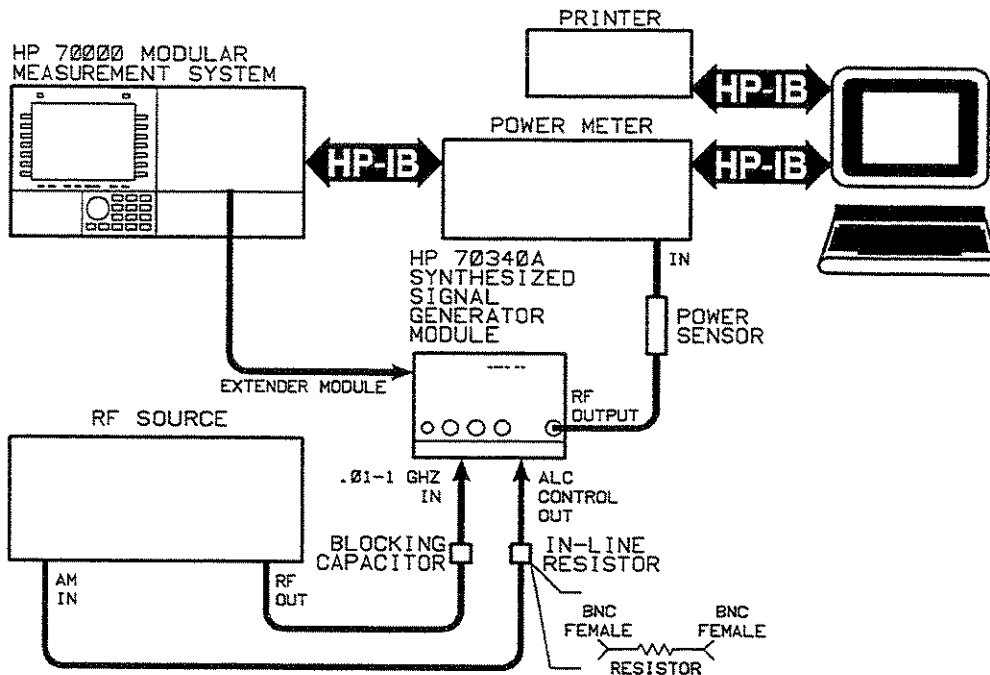


Figure 3-10. Lo Band Frequency Calibration Equipment Setup

To run the procedure

1. Zero and calibrate the power meter and sensor.

Be certain that the appropriate calibration factor information is loaded in to USER_FILE on Disk 1 prior to running this procedure.

2. Set up the equipment as shown in Figure 3-10.
3. Insert Disk 5 into the default drive.
4. Type LOAD "FREQ_CAL.L"
5. Press **ENTER**.

Automated Adjustment Procedures
Frequency 1 Low Band (0.01 to 1 GHz)
Calibration (HP 70340A Only)

6. Press **RUN** to start the automated adjustment.
7. Follow the computer instructions.

Refer to Figure 3-2 for DIP switch, S1, location and positions.

Upon completion, the program prints out a graph of the instrument's Frequency response.

If the plot is not within the specified limits, the instrument can not be accurately calibrated and a repair is required.

CAUTION

Be certain to open PG(8) of the DIP switch, S1, when you finish running this procedure. If the switch remains closed, you risk the loss of all calibration data. Refer to Figure 3-2.

Frequency 2 Low Band (0.01 to 1 GHz) Calibration (HP 70340A Only)

This procedure applies only to instruments with Option 1E1.

This calibration is necessary after replacing the Coupler/Detector, ALC Assembly (A10), Output Module (A8A1), SLPFA (A8A2), RF Output connector, semi-rigid cables between Output Module (A8A1) and RF Output connector, or Step Attenuator (A8AT1). Calibration is also necessary when calibration data is lost or when the instrument fails any of the HP 70341A Level Accuracy performance tests.

Required Equipment

HP 70001-60013 Extender Module (HP 70340A only)
HP 8482A Power Sensor
HP 437B Power Meter
HP-IB Printer
HP 8663A or HP 8662A RF Source¹
HP 11742A Blocking Capacitor
In-Line Resistor²

¹The HP 8662A is an acceptable RF source only if its RF output power level is greater than +16 dBm from 0.01 to 1 GHz. This level of performance is beyond the specified performance of the HP 8662A.

²If the HP 8663A is used as the RF source, the in-line resistor value is 1 k Ω . If the HP 8662A is used, the value for the resistor is 1.62 k Ω .

Automated Adjustment Procedures
Frequency 2 Low Band (0.01 to 1 GHz)
Calibration (HP 70340A Only)

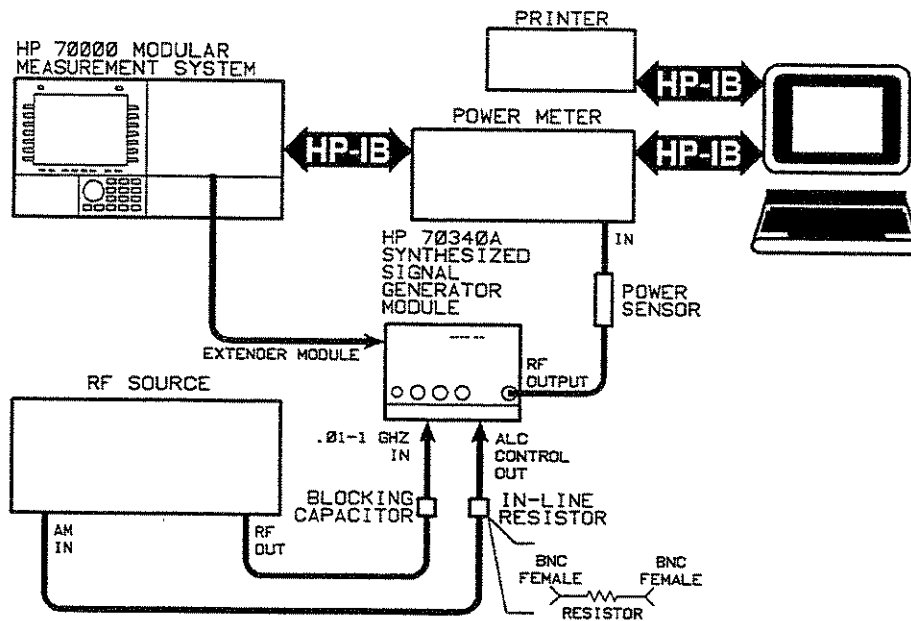


Figure 3-11. Lo Band Frequency Calibration 2 Equipment Setup

To run the procedure

1. Zero and calibrate the power meter and sensor.

Be certain that the appropriate calibration factor information is loaded in to USER_FILE on Disk 1 prior to running this procedure.

2. Set up the equipment as shown in Figure 3-11.
3. Insert Disk 5 into the default drive.
4. Type LOAD "FREQ_CL2_L"
5. Press **ENTER**.

Automated Adjustment Procedures
Frequency 2 Low Band (0.01 to 1 GHz)
Calibration (HP 70340A Only)

6. Press **(RUN)** to start the automated adjustment.
7. Follow the computer instructions.

Refer to Figure 3-2 for DIP switch, S1, location and positions.

Upon completion, the program prints out a graph of the instrument's Frequency response.

If the plot is not within the specified limits, the instrument can not be accurately calibrated and a repair is required.

CAUTION

Be certain to open PG(8) of the DIP switch, S1, when you finish running this procedure. If the switch remains closed, you risk the loss of all calibration data. Refer to Figure 3-2.

Attenuator Low Band (0.01 to 1 GHz) Calibration (HP 70340A Only)

This calibration applies only to an instrument with Option 1E1.

This calibration is necessary after replacing the Coupler/Detector, ALC Assembly (A10), Output Module (A8A1), SLPFA (A8A2), RF Output connector, semi-rigid cables between Output Module (A8A1) and RF Output connector, or Step Attenuator (A8AT1). Calibration is also necessary when calibration data is lost or when the instrument fails any of the HP 70341A Level Accuracy performance tests.

Recommended Equipment

HP 70001-60013 Extender Module (HP 70340A only)
HP 8482A Power Sensor
HP 437B Power Meter
HP-IB Printer
HP 8663A or HP 8662A RF Source¹
HP 11742A Blocking Capacitor
In-Line Resistor²
HP 8493C Option 010 10 dB Attenuator
HP 71210C Spectrum Analyzer
HP 8902A Measuring Receiver

¹The HP 8662A is an acceptable RF source only if its RF output power level is greater than +16 dBm from 0.01 to 1 GHz. This level of performance is beyond the specified performance of the HP 8662A.

²If the HP 8663A is used as the RF source, the in-line resistor value is 1 k Ω . If the HP 8662A is used, the value for the resistor is 1.62 k Ω .

Automated Adjustment Procedures
Attenuator Low Band (0.01 to 1 GHz) Calibration (HP 70340A Only)

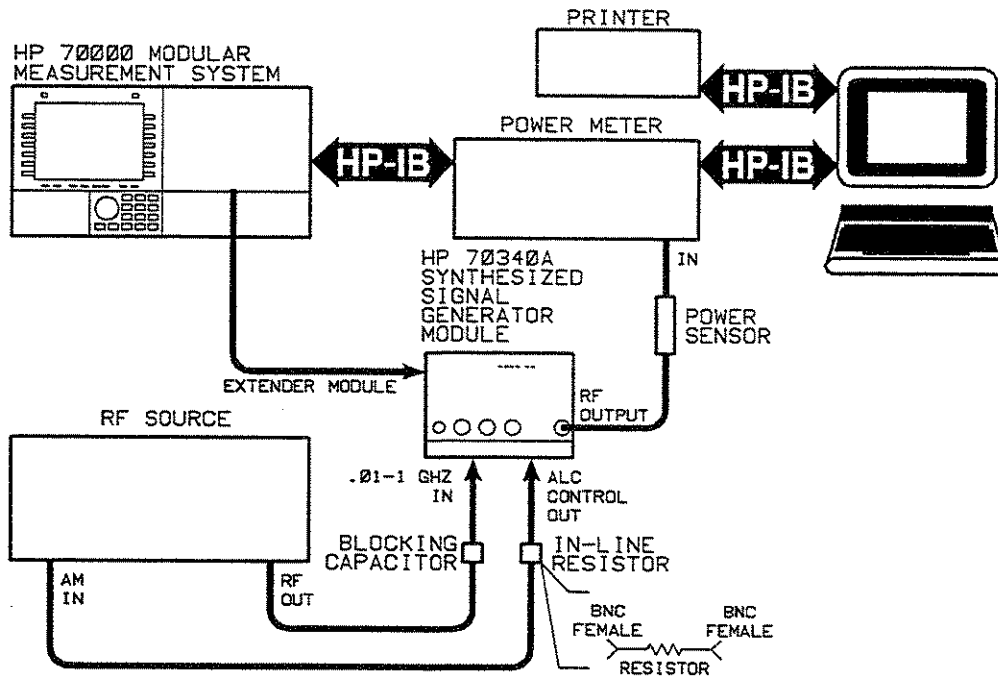


Figure 3-12. Attenuator Low Band Calibration Equipment Setup - Part 1

To run the procedure

1. Set up the equipment as shown in Figure 3-12.
2. Insert Disk 5 into the default drive.
3. Type LOAD "ATTN_CAL_L"
4. Press **ENTER**.
5. Press **RUN** to start the automated adjustment.
6. Follow the computer instructions.

Automated Adjustment Procedures

Attenuator Low Band (0.01 to 1 GHz) Calibration (HP 70340A Only)

Notes

- a. When instructed by the computer to disconnect the power meter and connect the spectrum analyzer and measuring receiver, refer to Figure 3-13.
- b. For maximum accuracy, connect the 10 dB attenuator directly to the spectrum analyzer input.
- c. It is recommended that you use a rigid or high quality semi-rigid cable for the connection from the Signal Generator output to the 10 dB attenuator at the spectrum analyzer input.

Automated Adjustment Procedures
Attenuator Low Band (0.01 to 1 GHz) Calibration (HP 70340A Only)

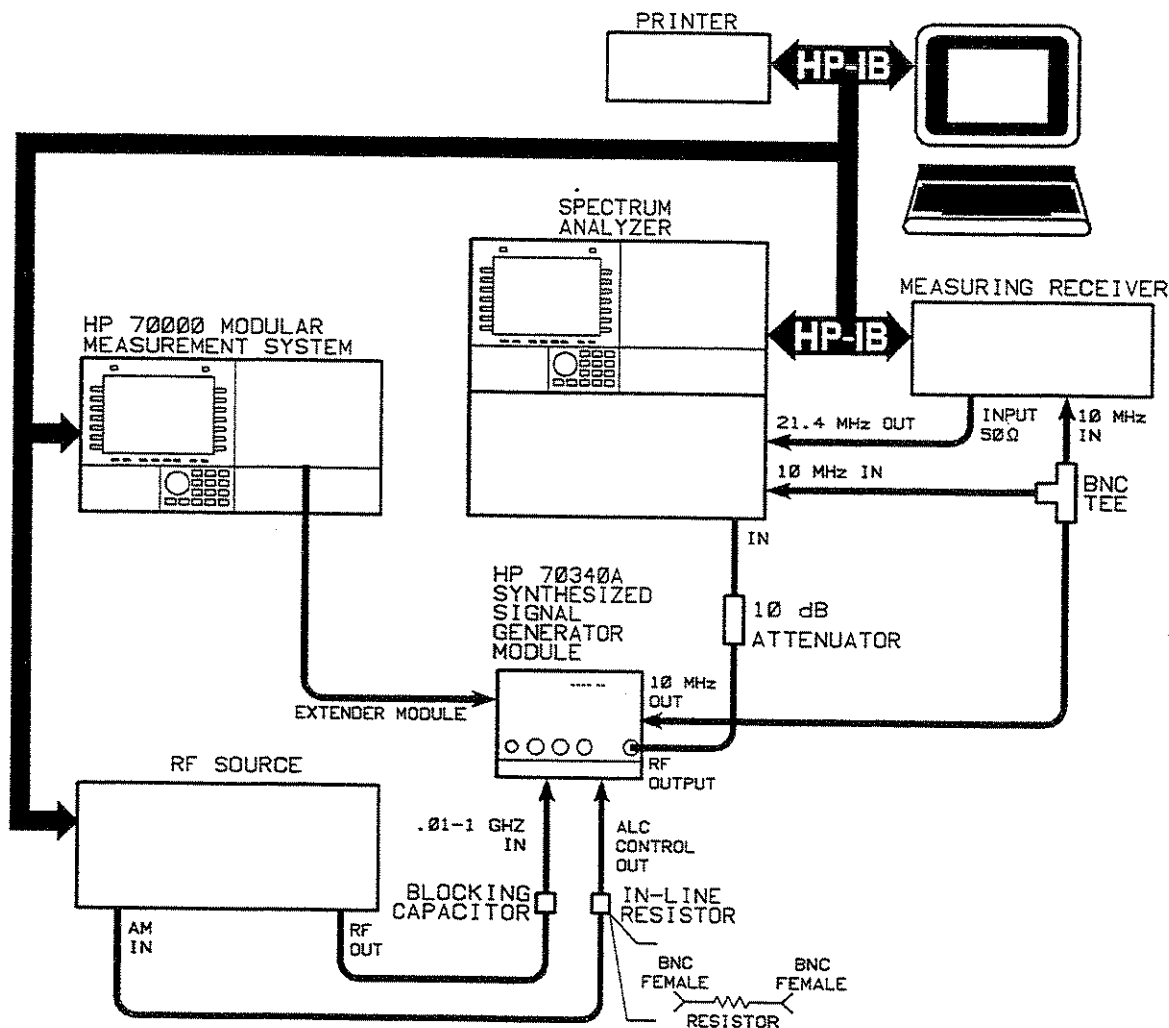


Figure 3-13. Attenuator Low Band Calibration Equipment Setup - Part 2

Refer to Figure 3-2 for DIP switch, S1, location and positions.

CAUTION

Be certain to open PG(8) of the DIP switch, S1, when you finish running this procedure. If the switch remains closed, you risk the loss of all calibration data. Refer to Figure 3-2.

If the Test Fails

- Verify the equipment setup and instrument settings.
- Refer to the troubleshooting section of the *Service Guide*.

0.01 - 1 GHz AM Calibration

This calibration applies to the HP 70341A only. Perform this calibration if AM calibration data is lost, or after you replace the Pulse and AM Driver Assembly.

Required Equipment

HP-IB Printer
HP 70210C Spectrum Analyzer
HP 3245A Pulse/Function Generator

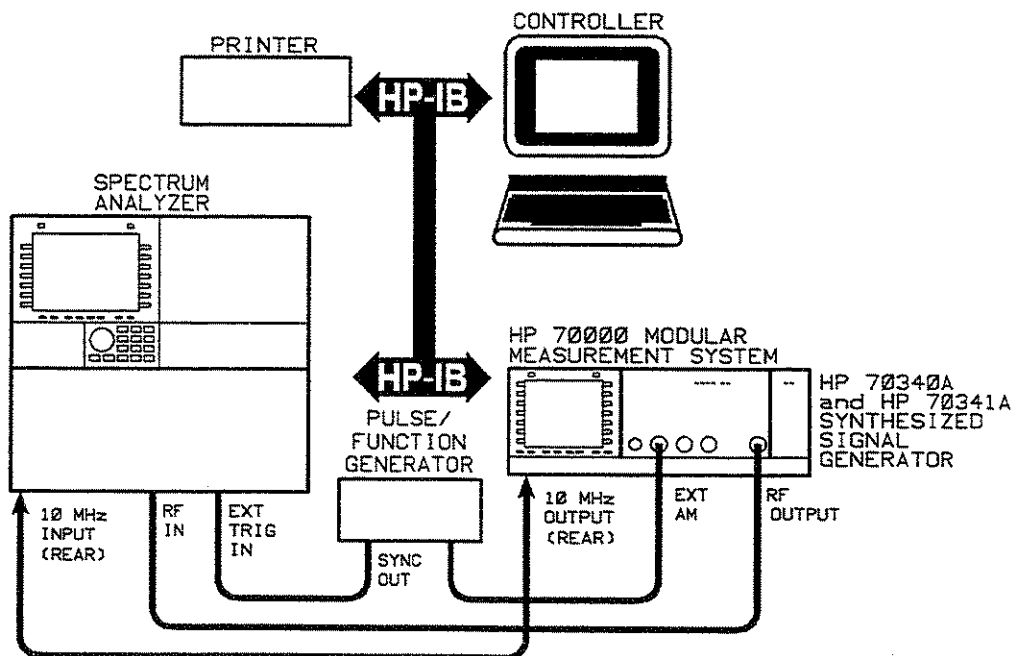


Figure 3-14. 0.01 to 1 GHz AM Calibration Equipment Setup

To run the procedure

1. Set up the equipment as shown in 3-14.
2. Insert Disk 4 into the default drive.
3. Type LOAD "LOW_AM"
4. Press **ENTER**.
5. Press **RUN** to start the automated adjustment.
6. Follow the computer instructions.

NOTE

When the routine starts gathering data, the process takes about 5 minutes. During this time, the program can run unattended.

Upon completion, the program prints out a graph of the instrument's 0.01 to 1 GHz AM Gain Correction.

If the plot is not within the specified limits, the instrument can not be accurately calibrated and a repair is required.

If the Procedure Fails

- Verify the equipment setup and instrument settings.
- Refer to the *Service Guide*.

0.01 - 1 GHz Pulse Calibration

This calibration applies to the HP 70341A only. Perform this calibration if AM calibration data is lost, or after you replace the Pulse and AM Driver Assembly (A5).

Required Equipment

HP-IB Printer
HP 8130A Pulse Generator
HP 54121T (HP 54120B and HP 54121A) 20 GHz Digitizing Oscilloscope

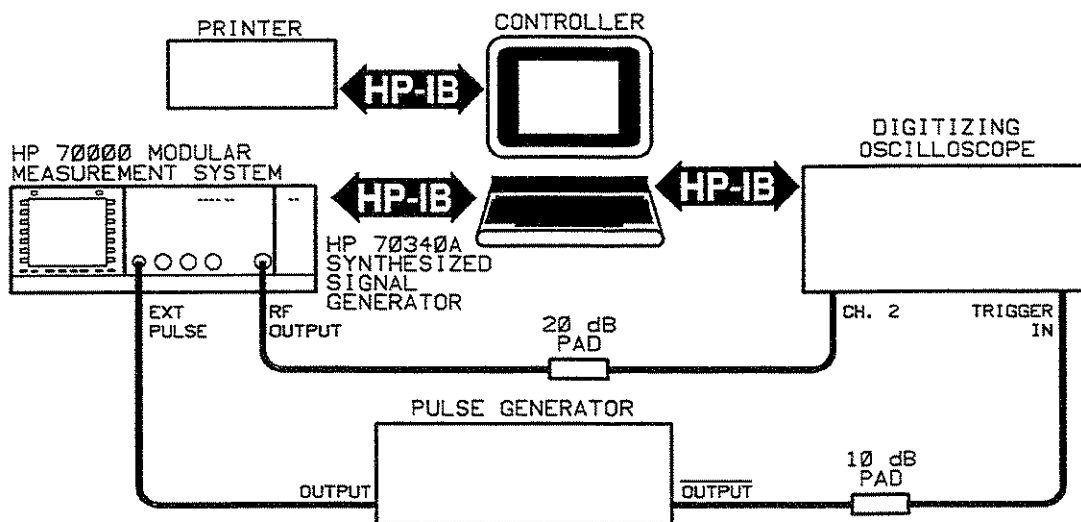


Figure 3-15. 0.01 to 1 GHz Pulse Calibration Equipment Setup

To run the procedure

1. Set up the equipment as shown in 3-15.
2. Insert Disk 4 into the default drive.
3. Type LOAD "PULSE"
4. Press **ENTER**.
5. Press **RUN** to start the automated adjustment.
6. Follow the computer instructions.

NOTE

When the routine starts gathering data, the process takes about 15 minutes to run.

Upon completion, the program prints out 3 correction factors and the calibration status (pass or fail) is stated. If the corrections are not within limits, the instrument cannot be accurately calibrated and a repair is required.

If the Procedure Fails

- Verify the equipment setup and instrument settings.
- Refer to the *Service Guide*.

4

Test Records

Test Records

This chapter contains test records for each of the Signal Generators covered in this book. The test records are as follows:

HP 70340A Test Record

HP 70341A Test Record

Make a copy of the appropriate test record, and use it as a record and worksheet when you run the Performance Tests.

HP 70340A Test Record

Hewlett-Packard Company
HP 70340A Synthesized Signal Generator
Serial Number _____

Tested By _____

Date _____

Test Records
HP 70340A Test Record

Test	Minimum	Actual	Maximum
SELF TEST		pass/fail	
FREQUENCY RANGE AND RESOLUTION			
1.000 000 000 GHz			
without Option 1E8	999 999 900 Hz	_____	1 000 000 100 Hz
with Option 1E8	999 999 999 Hz	_____	1 000 000 001 Hz
One Step Resolution			
without Option 1E8	1 000 000 900 Hz	_____	1 000 001 100 Hz
with Option 1E8	1 000 000 000 Hz	_____	1 000 000 002 Hz
20.000 000 000 GHz			
without Option 1E8	19 999 999 900 Hz	_____	20 000 000 100 Hz
with Option 1E8	19 999 999 999 Hz	_____	20 000 000 001 Hz
EXTERNAL ALC			
Does the signal remain leveled?		yes/no	
MAXIMUM LEVELED POWER			
For the following frequencies, is Unleveled Indicator off, and does power meter read: $\geq +11$ dBm [+10 dBm with Option 1E1]?			
1.0 GHz		yes/no	
1.64 GHz		yes/no	
2.74 GHz		yes/no	
4.79 GHz		yes/no	
5.99 GHz		yes/no	
7.99 GHz		yes/no	
9.99 GHz		yes/no	
10.00 GHz		yes/no	
12.79 GHz		yes/no	
13.99 GHz		yes/no	
17.99 GHz		yes/no	

Test Records
HP 70340A Test Record

Test	Minimum	Actual	Maximum
For the following frequencies, is Unleveled Indicator off, and does power meter read: $\geq +10$ dBm (+8 dBm with Option 1E1)?			
19.00 GHz		yes/no	
19.20 GHz		yes/no	
19.30 GHz		yes/no	
19.40 GHz		yes/no	
19.50 GHz		yes/no	
19.60 GHz		yes/no	
19.70 GHz		yes/no	
19.80 GHz		yes/no	
19.90 GHz		yes/no	
20.00 GHz		yes/no	
VERNIER LEVEL ACCURACY			
1.033 GHz			
+8 dBm	+7.0 dBm	_____	+9 dBm
+6 dBm	+5.0 dBm	_____	+7. dBm
-3.9 dBm	-4.9 dBm	_____	-2.9 dBm
5.225 GHz			
+8 dBm	+7.0 dBm	_____	+9 dBm
+6 dBm	+5.0 dBm	_____	+7. dBm
-3.9 dBm	-4.9 dBm	_____	-2.9 dBm
9.487 GHz			
+8 dBm	+7.0 dBm	_____	+9 dBm
+6 dBm	+5.0 dBm	_____	+7. dBm
-3.9 dBm	-4.9 dBm	_____	-2.9 dBm
13.75 GHz			
+8 dBm	+7.0 dBm	_____	+9 dBm
+6 dBm	+5.0 dBm	_____	+7. dBm
-3.9 dBm	-4.9 dBm	_____	-2.9 dBm
18.00 GHz			
+8 dBm	+7.0 dBm	_____	+9 dBm
+6 dBm	+5.0 dBm	_____	+7. dBm
-3.9 dBm	-4.9 dBm	_____	-2.9 dBm

Test Records
 HP 70340A Test Record

Test	Minimum	Actual	Maximum
20.00 GHz (Option 1E9 only)			
+8 dBm	+7.0 dBm	_____	+9 dBm
+6 dBm	+5.0 dBm	_____	+7. dBm
-3.9 dBm	-4.9 dBm	_____	-2.9 dBm
FLATNESS		_____	1 dB
LOW LEVEL ACCURACY and FLATNESS			
Power Meter Readings at 1.033 GHz			
-24 dBm	-26 dBm	_____ (dBm)	-22 dBm
-14 dBm	-16 dBm	_____ (dBm)	-12 dBm
-4 dBm	-5 dBm	_____ (dBm)	-3 dBm
+5 dBm = ABS@1.033GHz	+4 dBm	_____ (dBm)	+6 dBm
Measuring Receiver Relative Readings at 1.033 GHz			
-34 dBm setting = REL@-34dBm = _____			
-44 dBm setting = REL@-44dBm = _____			
-54 dBm setting = REL@-54dBm = _____			
-64 dBm setting = REL@-64dBm = _____			
-74 dBm setting = REL@-74dBm = _____			
-84 dBm setting = REL@-84dBm = _____			
-90 dBm setting = REL@-90dBm = _____			
Calculated Actual Power Levels at 1.033 GHz			
ABS@1.033GHz + REL@-34dBm = ACT@-34dBm	-36 dBm	_____ (dBm)	-32 dBm
ABS@1.033GHz + REL@-44dBm = ACT@-44dBm	-46 dBm	_____ (dBm)	-42 dBm
ABS@1.033GHz + REL@-54dBm = ACT@-54dBm	-56 dBm	_____ (dBm)	-52 dBm
ABS@1.033GHz + REL@-64dBm = ACT@-64dBm	-66 dBm	_____ (dBm)	-62 dBm
ABS@1.033GHz + REL@-74dBm = ACT@-74dBm	-76 dBm	_____ (dBm)	-72 dBm
ABS@1.033GHz + REL@-84dBm = ACT@-84dBm	-86 dBm	_____ (dBm)	-82 dBm
ABS@1.033GHz + REL@-90dBm = ACT@-90dBm	-92 dBm	_____ (dBm)	-88 dBm

Test Records
HP 70340A Test Record

Test	Minimum	Actual	Maximum
5.225 GHz			
Power Meter Readings			
-14 dBm	-16 dBm	_____ (dBm)	-12 dBm
+5 dBm = ABS@5.225GHz	+4 dBm	_____ (dBm)	+6 dBm
Measuring Receiver Relative Readings			
-90 dBm setting = REL@-90dBm = _____			
Calculated Actual Power Level			
ABS@5.225 GHz + REL@-90dBm = ACT@-90dBm			
	-92 dBm	_____ (dBm)	-88 dBm
9.487 GHz			
Power Meter Readings			
-14 dBm	-16 dBm	_____ (dBm)	-12 dBm
+5 dBm = ABS@9.487GHz	+4 dBm	_____ (dBm)	+6 dBm
Measuring Receiver Relative Reading			
-90 dBm setting = REL@-90dBm = _____			
Calculated Actual Power Level			
ABS@9.487GHz + REL@-90dBm = ACT@-90dBm			
	-92 dBm	_____ (dBm)	-88 dBm
13.75 GHz			
Power Meter Readings			
-14 dBm	-16 dBm	_____ (dBm)	-12 dBm
+5 dBm = ABS@13.75GHz	+4 dBm	_____ (dBm)	+6 dBm
Measuring Receiver Relative Reading			
-90 dBm setting = REL@-90dBm = _____			
Calculated Actual Power Level			
ABS@13.75GHz + REL@-90dBm = ACT@-90dBm			
	-92 dBm	_____ (dBm)	-88 dBm

Test Records
HP 70340A Test Record

Test	Minimum	Actual	Maximum
Power Meter Readings at 18 GHz			
-24 dBm	-26 dBm	_____ (dBm)	-22 dBm
-14 dBm	-16 dBm	_____ (dBm)	-12 dBm
-4 dBm	-5 dBm	_____ (dBm)	-3 dBm
+5 dBm = ABS@18GHz	+4 dBm	_____ (dBm)	+6 dBm
Measuring Receiver Relative Readings at 18 GHz			
-34 dBm setting = REL@-34dBm = _____			
-44 dBm setting = REL@-44dBm = _____			
-54 dBm setting = REL@-54dBm = _____			
-64 dBm setting = REL@-64dBm = _____			
-74 dBm setting = REL@-74dBm = _____			
-84 dBm setting = REL@-84dBm = _____			
-90 dBm setting = REL@-90dBm = _____			
Calculated Actual Power Levels at 18 GHz			
ABS@18GHz + REL@-34dBm = ACT@-34dBm	-36 dBm	_____ (dBm)	-32 dBm
ABS@18GHz + REL@-44dBm = ACT@-44dBm	-46 dBm	_____ (dBm)	-42 dBm
ABS@18GHz + REL@-54dBm = ACT@-54dBm	-56 dBm	_____ (dBm)	-52 dBm
ABS@18GHz + REL@-64dBm = ACT@-64dBm	-66 dBm	_____ (dBm)	-62 dBm
ABS@18GHz + REL@-74dBm = ACT@-74dBm	-76 dBm	_____ (dBm)	-72 dBm
ABS@18GHz + REL@-84dBm = ACT@-84dBm	-86 dBm	_____ (dBm)	-82 dBm
ABS@18GHz + REL@-90dBm = ACT@-90dBm	-92 dBm	_____ (dBm)	-88 dBm
Flatness Power Meter Readings			
-14 dBm at 1.033 GHz = _____ (dBm)			
-14 dBm at 5.225 GHz = _____ (dBm)			
-14 dBm at 9.487 GHz = _____ (dBm)			
-14 dBm at 13.75 GHz = _____ (dBm)			
-14 dBm at 18.00 GHz = _____ (dBm)			

Test	Minimum	Actual	Maximum
Flatness Calculated Actual Power Levels			
1.033GHz ACT@-90dBm = _____			
5.225GHz ACT@-90dBm = _____			
9.487GHz ACT@-90dBm = _____			
13.75GHz ACT@-90dBm = _____			
18.00GHz ACT@-90dBm = _____			
Flatness Calculated			
for -14 dBm			
Minimum Power Meter Reading = _____(dBm)			
Maximum Power Meter Reading = _____(dBm)			
Maximum Reading - Minimum Reading		_____ dB	1 dB
for -90 dBm			
Minimum Calculated Actual Power = _____(dBm)			
Maximum Calculated Actual Power = _____(dBm)			
Maximum Power - Minimum Power		_____ (dB)	1 dB
HARMONICS			
Carrier Level of -3.9 dBm			
2nd Harmonic (2.0 GHz)		yes/no	-55 dBc
2nd Harmonic (3.30 GHz)		yes/no	-55 dBc
2nd Harmonic (5.50 GHz)		yes/no	-55 dBc
2nd Harmonic (9.6 GHz)		yes/no	-55 dBc
2nd Harmonic (16.0 GHz)		yes/no	-55 dBc
2nd Harmonic (19.8 GHz)		yes/no	-55 dBc
2nd Harmonic (20.0 GHz)		yes/no	-55 dBc
Carrier Level of +6 dBm			
2nd Harmonic (2.0 GHz)		yes/no	-55 dBc
2nd Harmonic (3.30 GHz)		yes/no	-55 dBc
2nd Harmonic (5.50 GHz)		yes/no	-55 dBc
2nd Harmonic (9.6 GHz)		yes/no	-55 dBc
2nd Harmonic (16.0 GHz)		yes/no	-55 dBc
2nd Harmonic (19.8 GHz)		yes/no	-55 dBc
2nd Harmonic (20.0 GHz)		yes/no	-55 dBc

Test Records
HP 70340A Test Record

Test	Minimum	Actual	Maximum
SINGLE-SIDEBAND PHASE NOISE			
@ 2 GHz			
Vb (for dynamic signal analyzer) = _____ dBm			
@ 100 Hz Offset			
10logBW = _____ dB			
Vs (Measured Level @ 100 Hz Offset) = _____			
Constants = -46.00 dB			
Calculated Phase Noise (@ 100 Hz Offset) =			
Vs - Vb - 10logBW -46 dB		_____ dBc/Hz	-66 dBc/Hz
@ 1 kHz Offset			
Vs (Measured Level @ 1 kHz Offset) = _____			
Constants = -46.00 dB			
Calculated Phase Noise (@ 1 kHz Offset) =			
Vs - Vb - 10logBW -46 dB		_____ dBc/Hz	-74 dBc/Hz
@ 10 khz Offset			
Vs (Measured Level @ 10 khz Offset) = _____			
Constants = -46.00 dB			
Calculated Phase Noise (@ 10 khz Offset) =			
Vs - Vb - 10logBW -46 dB		_____ dBc/Hz	-91 dBc/Hz
@ 100 khz Offset			
Vb (for spectrum analyzer) = _____ dBm			
10logBW = _____ dB			
Constants = -43.50 dB			
Vs (Measured Level @ 100 kHz Offset) = _____			
Calculated Phase Noise (@ 100 kHz Offset) =			
Vs - Vb - 10logBW - 43.50 dB		_____ dBc/Hz	-107 dBc/Hz

Test	Minimum	Actual	Maximum
<p>@ 10 GHz</p> <p>Vb (for dynamic signal analyzer) = _____ dBm</p> <p>@ 100 Hz Offset</p> <p>Vs (Measured Level @ 100 Hz Offset) = _____</p> <p>Constants = -46.00 dB</p> <p>Calculated Phase Noise (@ 100 Hz Offset) = _____</p> <p>Vs - Vb - 10logBW -46 dB</p> <p>@ 1 kHz Offset</p> <p>Vs (Measured Level @ 1 kHz Offset) = _____</p> <p>Constants = -46.00 dB</p> <p>Calculated Phase Noise (@ 1 kHz Offset) = _____</p> <p>Vs - Vb - 10logBW -46 dB</p> <p>@ 10 khz Offset</p> <p>Vs (Measured Level @ 10 khz Offset) = _____</p> <p>Constants = -46.00 dB</p> <p>Calculated Phase Noise (@ 10 khz Offset) = _____</p> <p>Vs - Vb - 10logBW -46 dB</p> <p>@ 100 kHz Offset</p> <p>Vb (for spectrum analyzer) = _____ dBm</p> <p>Constants = -43.50 dB</p> <p>Vs (Measured Level @ 100 kHz Offset) = _____</p> <p>Calculated Phase Noise (@ 100 kHz Offset) = _____</p> <p>Vs - Vb - 10logBW - 43.50 dB</p>		<p>_____ dBc/Hz</p> <p>_____ dBc/Hz</p> <p>_____ dBc/Hz</p> <p>_____ dBc/Hz</p>	<p>-69 dBc/Hz</p> <p>-75 dBc/Hz</p> <p>-79 dBc/Hz</p> <p>-101 dBc/Hz</p>

Test Records
HP 70340A Test Record

Test	Minimum	Actual	Maximum
@ 18 GHz Vb (for dynamic signal analyzer) = _____dBm @ 100 Hz Offset Vs (Measured Level @ 100 Hz Offset) = _____ Constants = -46.00 dB Calculated Phase Noise (@ 100 Hz Offset)= Vs - Vb - 10logBW -46 dB		_____dBc/Hz	-63 dBc/Hz
@ 1 kHz Offset Vs (Measured Level @ 1 kHz Offset) = _____ Constants = -46.00 dB Calculated Phase Noise (@ 1 kHz Offset)= Vs - Vb - 10logBW -46 dB		_____dBc/Hz	-70 dBc/Hz
@ 10 khz Offset Vs (Measured Level @ 10 khz Offset) = _____ Constants = -46.00 dB Calculated Phase Noise (@ 10 khz Offset)= Vs - Vb - 10logBW -46 dB		_____dBc/Hz	-73 dBc/Hz
@ 100 kHz Offset Vb (for spectrum analyzer) = _____dBm Constants = -43.50 dB Vs (Measured Level @ 100 kHz Offset) = _____ Calculated Phase Noise (@ 100 kHz Offset) = Vs - Vb - 10logBW - 43.50 dB		_____dBc/Hz	-99 dBc/Hz

Test	Minimum	Actual	Maximum
<p>NON-HARMONIC SPURS 3 - 30 kHz</p> <p>@17005.111 MHz Vb (from "To Calibrate the System") = _____ dBm Total Correction Factor = -Vb - 46.00 dB = _____dB</p> <p>for 3 kHz to 8 kHz Span Vs (Measured Level) = _____ dBm Calculated Spurious Level = Total Correction Factor + Vs Noise ____ or Offset Frequency _____dBm</p> <p>for 8 kHz to 13 kHz Span Vs (Measured Level) = _____ dBm Calculated Spurious Level = Total Correction Factor + Vs</p> <p>for 13 kHz to 23 kHz Span Vs (Measured Level) = _____ dBm Calculated Spurious Level = Total Correction Factor + Vs Noise ____ or Offset Frequency _____dBm</p> <p>for 23 kHz to 33 kHz Span Vs (Measured Level) = _____ dBm Calculated Spurious Level = Total Correction Factor + Vs Noise ____ or Offset Frequency _____dBm</p> <p>@17501.777 MHz Vb (from "To Calibrate the System") = _____ dBm Total Correction Factor = -Vb - 46.00 dB = _____dB</p> <p>for 3 kHz to 8 kHz Span Vs (Measured Level) = _____ dBm Calculated Spurious Level = Total Correction Factor + Vs Noise ____ or Offset Frequency _____dBm</p> <p>for 8 kHz to 13 kHz Span Vs (Measured Level) = _____ dBm Calculated Spurious Level = Total Correction Factor + Vs</p>		<p>_____dBc</p> <p>_____dBc</p> <p>_____dBc</p> <p>_____dBc</p> <p>_____dBc</p> <p>_____dBc</p> <p>_____dBc</p> <p>_____dBc</p>	<p>-60 dBc</p> <p>-60 dBc</p> <p>-60 dBc</p> <p>-60 dBc</p> <p>-60 dBc</p> <p>-60 dBc</p> <p>-60 dBc</p> <p>-60 dBc</p>

Test Records
HP 70340A Test Record

Test	Minimum	Actual	Maximum
for 13 kHz to 23 kHz Span Vs (Measured Level) = _____ dBm Calculated Spurious Level = Total Correction Factor + Vs Noise ____ or Offset Frequency _____ dBm for 23 kHz to 33 kHz Span Vs (Measured Level) = _____ dBm Calculated Spurious Level = Total Correction Factor + Vs Noise ____ or Offset Frequency _____ dBm		_____ dBc _____ dBc	-60 dBc -60 dBc
NON-HARMONIC SPURS >30 kHz Is the spurious level no greater than -60 dBc for the following frequencies and spans? @17005.111 MHz @17501.777 MHz @19801.511 MHz		yes/no yes/no yes/no	
PULSE ON/OFF RATIO 1 GHz 20 GHz		yes/no yes/no	-80 dBc -80 dBc
PULSE RISE/FALLTIME 1-20 GHz Risetime Falltime		_____ (ns) _____ (ns)	10 ns 10 ns
PULSE WIDTH Pulse Width (@ 1 GHz)		_____ (ns)	25 ns

Test	Minimum	Actual	Maximum
<p>FM DEVIATION</p> <p>2 GHz Does spectrum fill 8 center graticules symmetrically?</p> <p>10 GHz Does spectrum fill 8 center graticules symmetrically?</p> <p>1 GHz Does spectrum fill 8 center graticules symmetrically?</p>		<p>yes/no</p> <p>yes/no</p> <p>yes/no</p>	
<p>FM RATE AND FLATNESS</p> <p>6 GHz CW Frequency</p> <p>@100 kHz First 1st Sideband Null $f_{100kHz} = \text{_____ kHz}$ $V_{100kHz} = \text{_____ mV}$</p> <p>@100 kHz Fourth 1st Sideband Null $f_{100kHz} = \text{_____ kHz}$ $V_{100kHz} = \text{_____ mV}$</p> <p>@1 kHz First 1st Sideband Null $f_x = \text{_____ kHz}$ $V_x = \text{_____ mV}$</p> <p>@5 kHz Sixth 1st Sideband Null $f_x = \text{_____ kHz}$ $V_x = \text{_____ mV}$</p> <p>@1 MHz First 1st Sideband Null $f_x = \text{_____ kHz}$ $V_x = \text{_____ mV}$</p> <p>Relative FM Response @1kHz = $20\log(V_x/V_{100kHz}) - 20\log(f_x/f_{100kHz}) = \text{_____}$</p> <p>Relative FM Response @5kHz = $20\log(V_x/V_{100kHz}) - 20\log(f_x/f_{100kHz}) = \text{_____}$</p> <p>Relative FM Response @1MHz = $20\log(V_x/V_{100kHz}) - 20\log(f_x/f_{100kHz}) = \text{_____}$</p> <p>Calculated FM Flatness for 6 GHz CW Frequency =</p>		<p>_____</p>	<p>4 dB</p>

Test Records
HP 70340A Test Record

Test	Minimum	Actual	Maximum
<p>18 GHz CW Frequency</p> <p>@100 kHz First 1st Sideband Null f100kHz = _____ kHz V100kHz = _____ mV</p> <p>@100 kHz Fourth 1st Sideband Null f100kHz = _____ kHz V100kHz = _____ mV</p> <p>@1 kHz First 1st Sideband Null fx = _____ kHz Vx = _____ mV</p> <p>@5 kHz Sixth 1st Sideband Null fx = _____ kHz Vx = _____ mV</p> <p>@1 MHz First 1st Sideband Null fx = _____ kHz Vx = _____ mV</p> <p>Relative FM Response @1kHz = $20\log(Vx/V100kHz) - 20\log(fx/f100kHz) = \underline{\hspace{2cm}}$</p> <p>Relative FM Response @5kHz = $20\log(Vx/V100kHz) - 20\log(fx/f100kHz) = \underline{\hspace{2cm}}$</p> <p>Relative FM Response @1MHz = $20\log(Vx/V100kHz) - 20\log(fx/f100kHz) = \underline{\hspace{2cm}}$</p> <p>Calculated FM Flatness for 18 GHz CW Frequency =</p>		<p>_____</p>	<p>4 dB</p>
<p>MINIMUM AM DEPTH</p>	<p>60 dBc</p>	<p>yes/no</p>	

HP 70341A Test Record

Hewlett-Packard Company
HP 70341A Synthesized Signal Generator

Tested By _____

Serial Number _____

Date _____

Test Records
HP 70341A Test Record

Test	Minimum	Actual	Maximum
SELF TEST		pass/fail	
FREQUENCY RANGE AND RESOLUTION			
010 000 000 Hz			
without Option 1E8	9 999 900 Hz	_____	010 000 100 Hz
with Option 1E8	9 999 999 Hz	_____	010 000 001 Hz
One Step Resolution			
without Option 1E8	010 000 900 Hz	_____	010 001 100 Hz
with Option 1E8	010 000 000 Hz	_____	010 000 002 Hz
0.999 999 000 GHz			
without Option 1E8	999 998 900 Hz	_____	999 999 100
with Option 1E8	999 999 998 Hz	_____	1 000 000 000 Hz
MAXIMUM LEVELED POWER			
For the following frequencies, is Uneveled Indicator off, and does power meter read: $\geq +13$ dBm?			
10 MHz		yes/no	
11.2 MHz		yes/no	
11.3 MHz		yes/no	
15.9MHz		yes/no	
16 MHz		yes/no	
22.5 MHz		yes/no	
22.6 MHz		yes/no	
31.9 MHz		yes/no	
32 MHz		yes/no	
45.3MHz		yes/no	
45.4 MHz		yes/no	
63.9 MHz		yes/no	
64 MHz		yes/no	
90.4 MHz		yes/no	
90.5 MHz		yes/no	
127.9 MHz		yes/no	
128 MHz		yes/no	

Test Records
HP 70341A Test Record

Test	Minimum	Actual	Maximum
130.9 MHz		yes/no	
181 MHz		yes/no	
255.9 MHz		yes/no	
256 MHz		yes/no	
361.9 MHz		yes/no	
362 MHz		yes/no	
499.9 MHz		yes/no	
500 MHz		yes/no	
699.9 MHz		yes/no	
700 MHz		yes/no	
999 MHz		yes/no	
VERNIER LEVEL ACCURACY			
10.1 MHz			
+8 dBm	+6.7 dBm	_____	+9.3 dBm
+6 dBm	+4.7 dBm	_____	+7.3 dBm
-3.9 dBm	-4.6 dBm	_____	-2.6 dBm
18.192 MHz			
+8 dBm	+6.7 dBm	_____	+9.3 dBm
+6 dBm	+4.7 dBm	_____	+7.3 dBm
-3.9 dBm	-4.6 dBm	_____	-2.6 dBm
329.488 MHz			
+8 dBm	+7.0 dBm	_____	+9 dBm
+6 dBm	+5.0 dBm	_____	+7. dBm
-3.9 dBm	-4.9 dBm	_____	-2.9 dBm
657.168 MHz			
+8 dBm	+7.0 dBm	_____	+9 dBm
+6 dBm	+5.0 dBm	_____	+7. dBm
-3.9 dBm	-4.9 dBm	_____	-2.9 dBm
984.848 MHz			
+8 dBm	+7.0 dBm	_____	+9 dBm
+6 dBm	+5.0 dBm	_____	+7. dBm
-3.9 dBm	-4.9 dBm	_____	-2.9 dBm
FLATNESS 0.01 - 1 GHz			
+8 dBm		_____	< 1 dB
+6 dBm		_____	< 1 dB
-3.9 dBm		_____	< 1 dB

Test Records
HP 70341A Test Record

Test	Minimum	Actual	Maximum
LOW LEVEL ACCURACY and FLATNESS			
Power Meter Readings at 42.768 MHz			
-24 dBm	-26.3 dBm	_____ (dBm)	-21.7 dBm
-14 dBm	-16.3 dBm	_____ (dBm)	-11.7 dBm
-4 dBm	-5 dBm	_____ (dBm)	-3 dBm
+5 dBm = ABS@42.768MHz	+4 dBm	_____ (dBm)	+6 dBm
Measuring Receiver Relative Readings at 42.768 MHz			
-34 dBm setting = REL@-34dBm = _____			
-44 dBm setting = REL@-44dBm = _____			
-54 dBm setting = REL@-54dBm = _____			
-64 dBm setting = REL@-64dBm = _____			
-74 dBm setting = REL@-74dBm = _____			
-84 dBm setting = REL@-84dBm = _____			
-90 dBm setting = REL@-90dBm = _____			
Calculated Actual Power Levels at 42.768 MHz			
ABS@42.768MHz + REL@-34dBm = ACT@-34dBm	-36.3 dBm	_____ (dBm)	-31.7 dBm
ABS@42.768MHz + REL@-44dBm = ACT@-44dBm	-46.3 dBm	_____ (dBm)	-41.7 dBm
ABS@42.768MHz + REL@-54dBm = ACT@-54dBm	-56.3 dBm	_____ (dBm)	-51.7 dBm
ABS@42.768MHz + REL@-64dBm = ACT@-64dBm	-66.3 dBm	_____ (dBm)	-61.7 dBm
ABS@42.768MHz + REL@-74dBm = ACT@-74dBm	-76.3 dBm	_____ (dBm)	-71.7 dBm
ABS@42.768MHz + REL@-84dBm = ACT@-84dBm	-86.3 dBm	_____ (dBm)	-81.7 dBm
ABS@42.768MHz + REL@-90dBm = ACT@-90dBm	-92.3 dBm	_____ (dBm)	-87.7 dBm
304.912 MHz			
Power Meter Readings			
-14 dBm	-16 dBm	_____ (dBm)	-12 dBm
+5 dBm = ABS@304.912MHz	+4 dBm	_____ (dBm)	+6 dBm
Measuring Receiver Relative Readings			
-90 dBm setting = REL@-90dBm = _____			
Calculated Actual Power Levels			
ABS@304.912MHz + REL@-90dBm = ACT@-90dBm	-92.0 dBm	_____ (dBm)	-88.0 dBm

Test Records
HP 70341A Test Record

Test	Minimum	Actual	Maximum
632.592 MHz			
Power Meter Readings			
-14 dBm	-16 dBm	_____ (dBm)	-12 dBm
+5 dBm = ABS@632.592MHz	+4 dBm	_____ (dBm)	+6 dBm
Measuring Receiver Relative Readings			
-90 dBm setting = REL@-90dBm = _____			
Calculated Actual Power Levels			
ABS@632.592MHz + REL@-90dBm = ACT@-90dBm	-92.0 dBm	_____ (dBm)	-88.0 dBm
Power Meter Readings at 960.272 MHz			
-24 dBm	-26 dBm	_____ (dBm)	-22 dBm
-14 dBm	-16 dBm	_____ (dBm)	-12 dBm
-4 dBm	-5 dBm	_____ (dBm)	-3 dBm
+5 dBm = ABS@960.272MHz	+4 dBm	_____ (dBm)	+6 dBm
Measuring Receiver Relative Readings at 960.272 MHz			
-34 dBm setting = REL@-34dBm = _____			
-44 dBm setting = REL@-44dBm = _____			
-54 dBm setting = REL@-54dBm = _____			
-64 dBm setting = REL@-64dBm = _____			
-74 dBm setting = REL@-74dBm = _____			
-84 dBm setting = REL@-84dBm = _____			
-90 dBm setting = REL@-90dBm = _____			
Calculated Actual Power Levels at 960.272 MHz			
ABS@960.272MHz + REL@-34dBm = ACT@-34dBm	-36 dBm	_____ (dBm)	-32 dBm
ABS@960.272MHz + REL@-44dBm = ACT@-44dBm	-46 dBm	_____ (dBm)	-42 dBm
ABS@960.272MHz + REL@-54dBm = ACT@-54dBm	-56 dBm	_____ (dBm)	-52 dBm
ABS@960.272MHz + REL@-64dBm = ACT@-64dBm	-66 dBm	_____ (dBm)	-62 dBm
ABS@960.272MHz + REL@-74dBm = ACT@-74dBm	-76 dBm	_____ (dBm)	-72 dBm
ABS@960.272MHz + REL@-84dBm = ACT@-84dBm	-86 dBm	_____ (dBm)	-82 dBm
ABS@960.272MHz + REL@-90dBm = ACT@-90dBm	-92 dBm	_____ (dBm)	-88 dBm

Test Records
 HP 70341A Test Record

Test	Minimum	Actual	Maximum
Flatness Power Meter Readings 10 MHz to 1 GHz -14 dBm at 42.768 MHz = _____(dBm) -14 dBm at 304.912 MHz = _____(dBm) -14 dBm at 632.592 MHz = _____(dBm) -14 dBm at 960.272 MHz = _____(dBm)			
Flatness Calculated Actual Power Levels 10 MHz to 1 GHz 42.768MHz ACT@-90dBm = _____(dBm) 304.912 MHz ACT@-90dBm = _____(dBm) 632.592MHz ACT@-90dBm = _____(dBm) 960.272MHz ACT@-90dBm = _____(dBm)			
Flatness Calculated 10 MHz to 1 GHz for -14 dBm Maximum Power Meter Reading = _____(dBm) Minimum Power Meter Reading = _____(dBm) Maximum Reading - Minimum Reading _____(dB)			1 dB
for -90 dBm Maximum Calculated Actual Power = _____(dBm) Minimum Calculated Actual Power = _____(dBm) Maximum Power - Minimum Power _____(dB)			1 dB

Test Records
HP 70341A Test Record

Test	Minimum	Actual	Maximum
HARMONICS			
Carrier Level of -3.9 dBm			
2nd Harmonic (20.0 MHz)		yes/no	-55 dBc
2nd Harmonic (22.6 MHz)		yes/no	-55 dBc
2nd Harmonic (32.0 MHz)		yes/no	-55 dBc
2nd Harmonic (45.2 MHz)		yes/no	-55 dBc
2nd Harmonic (64 MHz)		yes/no	-55 dBc
2nd Harmonic (91.0 MHz)		yes/no	-55 dBc
2nd Harmonic (128.0 MHz)		yes/no	-55 dBc
2nd Harmonic (181.0 MHz)		yes/no	-55 dBc
2nd Harmonic (256.0 MHz)		yes/no	-55 dBc
2nd Harmonic (362.0 MHz)		yes/no	-55 dBc
2nd Harmonic (512.0 MHz)		yes/no	-55 dBc
2nd Harmonic (724.0 MHz)		yes/no	-55 dBc
2nd Harmonic (1.0 GHz)		yes/no	-55 dBc
2nd Harmonic (1.4 GHz)		yes/no	-55 dBc
Carrier Level of +6.0 dBm			
2nd Harmonic (20.0 MHz)		yes/no	-55 dBc
2nd Harmonic (22.6 MHz)		yes/no	-55 dBc
2nd Harmonic (32.0 MHz)		yes/no	-55 dBc
2nd Harmonic (45.2 MHz)		yes/no	-55 dBc
2nd Harmonic (64 MHz)		yes/no	-55 dBc
2nd Harmonic (91.0 MHz)		yes/no	-55 dBc
2nd Harmonic (128.0 MHz)		yes/no	-55 dBc
2nd Harmonic (181.0 MHz)		yes/no	-55 dBc
2nd Harmonic (256.0 MHz)		yes/no	-55 dBc
2nd Harmonic (362.0 MHz)		yes/no	-55 dBc
2nd Harmonic (512.0 MHz)		yes/no	-55 dBc
2nd Harmonic (724.0 MHz)		yes/no	-55 dBc
2nd Harmonic (1.0 GHz)		yes/no	-55 dBc
2nd Harmonic (1.4 GHz)		yes/no	-55 dBc

Test Records
HP 70341A Test Record

Test	Minimum	Actual	Maximum
<p>SINGLE-SIDEBAND PHASE NOISE @ 500 MHz Vb (for dynamic signal analyzer) = _____dBm</p> <p>@ 100 Hz Offset Vs (Measured Level @ 100 Hz Offset) = _____ Constants = -46.00 dB Calculated Phase Noise (@ 100 Hz Offset) = Vs - Vb - 10logBW -46 dB</p> <p>@ 1 kHz Offset Vs (Measured Level @ 1 kHz Offset) = _____ Constants = -46.00 dB Calculated Phase Noise (@ 1 kHz Offset) = Vs - Vb - 10logBW -46 dB</p> <p>@ 10 khz Offset Vs (Measured Level @ 10 khz Offset) = _____ Constants = -46.00 dB Calculated Phase Noise (@ 10 khz Offset) = Vs - Vb - 10logBW -46 dB</p> <p>@ 100 kHz Offset Vb (for spectrum analyzer) = _____dBm Constants = -43.50 dB Vs (Measured Level @ 100 kHz Offset) = _____ Calculated Phase Noise (@ 100 kHz Offset) = Vs - Vb - 10logBW - 43.50 dB</p>		<p>_____dBc/Hz</p> <p>_____dBc/Hz</p> <p>_____dBc/Hz</p> <p>_____dBc/Hz</p>	<p>-70 dBc/Hz</p> <p>-86 dBc/Hz</p> <p>-103 dBc/Hz</p> <p>-119 dBc/Hz</p>

Test	Minimum	Actual	Maximum
NON-HARMONIC SPURS > 30 kHz			
Is the spurious level no greater than -60 dBc for the following frequencies and spans?			
@10 MHz		yes/no	
@8.74 MHz		yes/no	
@11.26 MHz		yes/no	
@63 MHz		yes/no	
@61.74 MHz		yes/no	
@64.26 MHz		yes/no	
@499 MHz		yes/no	
@497.74 MHz		yes/no	
@500.26 MHz		yes/no	
@500 MHz		yes/no	
@498.74 MHz		yes/no	
@501.74 MHz		yes/no	
@999 MHz		yes/no	
@997.74 MHz		yes/no	
@1000.26 MHz		yes/no	

Test Records
 HP 70341A Test Record

Test	Minimum	Actual	Maximum
PULSE ON/OFF RATIO			
10 MHz		yes/no	-80 dBc
50 MHz		yes/no	-80 dBc
300 MHz		yes/no	-80 dBc
600 MHz		yes/no	-80 dBc
999 MHz		yes/no	-80 dBc
PULSE RISE/FALLTIME			
10-25 MHz			
Risetime		_____ (ns)	500 ns
Falltime		_____ (ns)	500 ns
25-64 MHz			
Risetime		_____ (ns)	350 ns
Falltime		_____ (ns)	350 ns
64-128 MHz			
Risetime		_____ (ns)	50 ns
Falltime		_____ (ns)	50 ns
128-500 MHz			
Risetime		_____ (ns)	35 ns
Falltime		_____ (ns)	35 ns
500-1000 MHz			
Risetime		_____ (ns)	20 ns
Falltime		_____ (ns)	20 ns
PULSE WIDTH			
Pulse Width (0.01 to 0.064 GHz)		_____ (μs)	1 μs
Pulse Width (0.064 to 0.5 GHz)		_____ (ns)	100 ns
Pulse Width (0.5 to 1 GHz)		_____ (ns)	25 ns
MINIMUM AM DEPTH			
0.01 - 1 GHz	60 dBc	yes/no	

Specifications

Specifications

Specifications- HP 70340A/41A

This chapter contains the specifications, supplemental characteristics, and electrical options for both the HP 70340A and the HP 70340A/41A. Refer to the *HP 70340A/41A User's Guide* for mechanical, documentation, and warranty options for the HP 70340A. Refer to the "Options" entry in this chapter for mechanical, documentation, and warranty options for the HP 70341A.

Specifications describe the instruments warranted performance over the 0° to 55° temperature range unless otherwise noted. Supplemental characteristics, *indicated by italics*, are intended to provide information useful in estimating instrument capability in your application by describing typical, but not warranted, performance.

Frequency

Range: HP 70340A Modular Signal Generator, 1.0 to 20.0 GHz
HP 70341A Frequency Extension Module, 10 MHz to 1 GHz
HP 70341A can only be used in combination with the HP 70340A.
Resolution: 1 kHz (1 Hz with Option 1E8)
Stability (with external high stability timebase):

Aging Rate: same as external reference.
Temperature Effects: same as external reference.

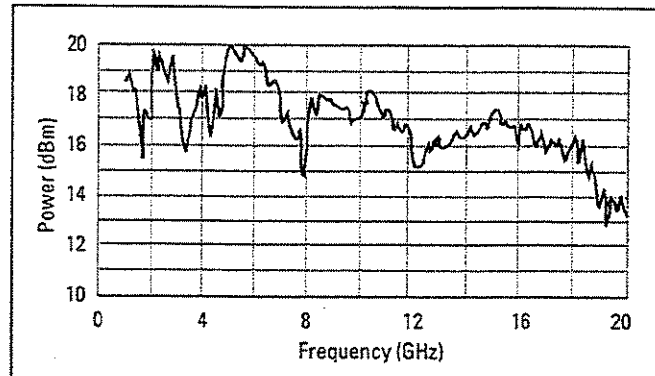
Stability (without external high stability timebase):

Aging Rate: $<1.0 \times 10^{-8}$ /day after 72-hours at $25^\circ\text{C} \pm 10^\circ\text{C}$
Temperature Effects: $<5 \times 10^{-6}$ over 0 to 55°C , referenced to 25°C
Frequency Switching Time: < 50 ms to within 1 kHz, 1 - 20 GHz.
 <100 ms to within 1 kHz, 10 MHz - 1 GHz.

RF Output

Maximum Leveled Output Power:

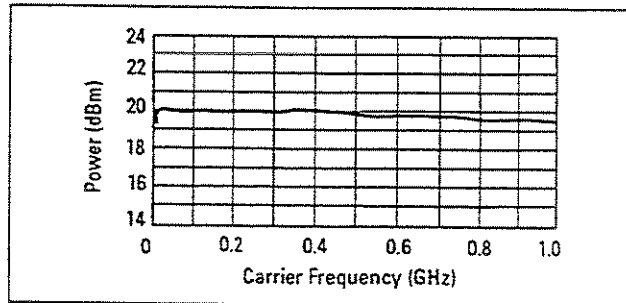
Frequency	Standard	with Option 1E1
0.01—1 GHz	+13 dBm	+13 dBm
1—18 GHz	+11 dBm	+10 dBm
18—20 GHz	+10 dBm	+8 dBm



Typical maximum available output power from 1 to 20 GHz, at 25°C with output step attenuator (Option 1E1) installed.

Specifications

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Typical maximum available output power from 0.01 to 1 GHz at 25°C.

Display Resolution: 0.01 dB

Minimum Levelled Output Power (without Option 1E1): -4 dBm

Minimum Levelled Output Power (with Option 1E1): -90 dBm

Accuracy: (-4 dBm to specified maximum levelled output power)

10 MHz to 50 MHz: ± 1.3 dB

50 MHz to 20 GHz: ± 1.0 dB

Accuracy: (over all specified temperatures and power levels)

10 MHz to 50 MHz: ± 2.3 dB

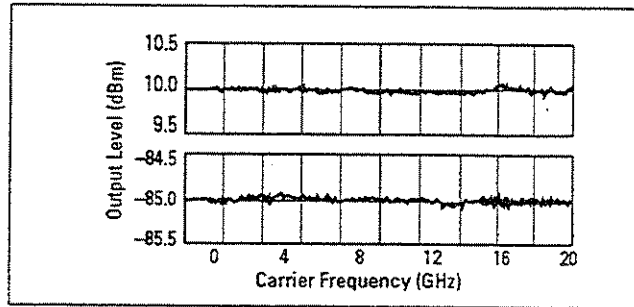
50 MHz to 20 GHz: ± 2.0 dB

The use of Type-N RF connectors above 18.0 GHz degrades specification typically by 0.2 dB.

Flatness: ± 0.5 dB. The use of Type-N RF connectors above 18.0 GHz degrades specification typically by 0.2 dB.

Level Switching Time: < 15 ms (without step attenuator range change. Attenuator range changes occur at -4 dBm, -14 dBm, -24 dBm, etc.)

Output SWR: $< 2.0 : 1$ nominal



Typical output level accuracy and flatness at +10 and -85 dBm

Spectral Purity

SSB Phase Noise (dBc/Hz):

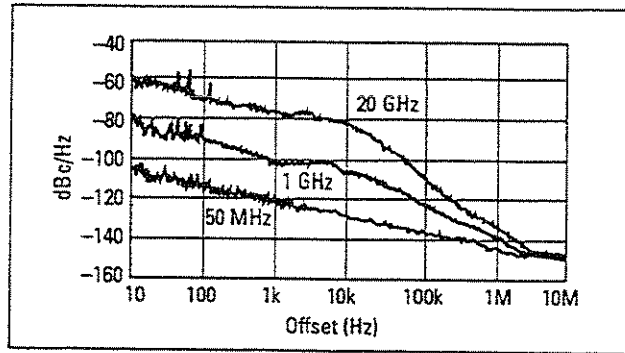
Offsets

Carrier Freq.	100 Hz	1 kHz	10 kHz	100 kHz
500 MHz	-70	-86	-103	-119
2 GHz	-66	-74	-91	-107
10 GHz	-69	-75	-79	-101
18 GHz	-63	-70	-73	-99

Phase noise decreases 6 dB/octave below 500 MHz and reaches a floor of <-140 dBc/Hz.

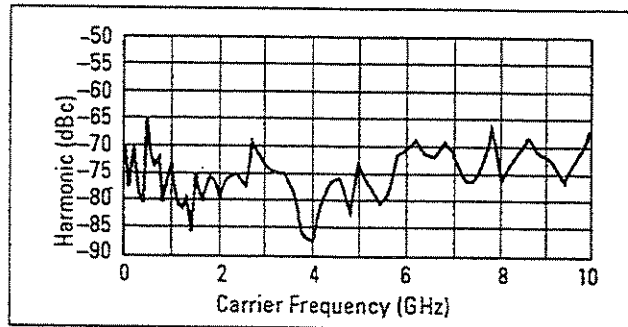
Specifications

HP 70341A Test Record



Typical single-sideband phase noise at 50 MHz, 1 GHz and 20 GHz, 25°C, CW mode. Offsets less than 100 Hz require use of external high stability timebase.

Harmonics: < -55 dBc at output levels $< +6$ dBm, 0.01 to 20 GHz



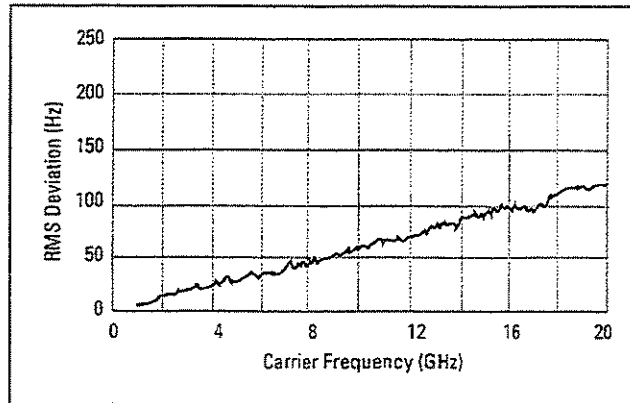
Typical 2nd harmonic levels measured at output power of +6 dBm

Non-Harmonic Spurious (≥ 3 kHz): < -60 dBc (includes power supply and frequency synthesis spurious).

Non-Harmonic Spurious (< 3 kHz): < -50 dBc

Sub-Harmonics: None

Residual FM:



Typical residual FM measured in 50 Hz - 15 kHz bandwidth, CW mode.

At 1 GHz, <15 Hz in 50 Hz - 15 kHz bandwidth.

Residual FM decreases 6 dB per octave below 1 GHz.

AM Noise Floor: (at 0 dBm and offsets greater than 5 MHz from carrier)

<-150 dBm/Hz, 1 - 20 GHz.

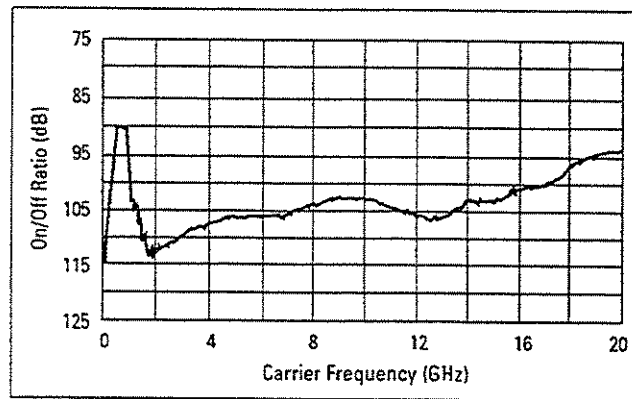
<-140 dBm/Hz, 0.01 - 1 GHz.

Modulation

CARRIER FREQUENCY	<25 MHz	25 - <64 MHz	64 - <128 MHz	128 - <500 MHz	500 - <1000 MHz	1 - 20 GHz
Minimum Pulse Width	<1 μ s		<100 ns		<25 ns <i>Typically <10 ns</i>	
Rise/Fall Time	<500 ns	<350 ns	<50 ns	<35 ns	<20 ns	<10 ns
Video Feedthrough	<2 mV peak-to-peak at 0 dBm					<20 mV peak-to-peak at 0 dBm
Pulse Width Compression	± 150 ns		± 15 ns		± 5 ns	
Pulse Delay (Video out to RF out)	<1 μ s		<200 ns		<125 ns	<100 ns

Pulse Modulation

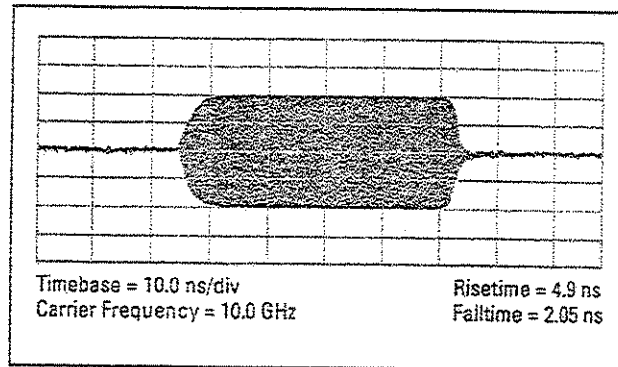
On/Off Ratio: > 80 dB



Typical pulse modulation on/off ratio at +8 dBm

Maximum Pulse Repetition Frequency: > 3 MHz
Minimum Pulse Duty Cycle: No restrictions on duty cycle.
Pulse Level Accuracy (relative to CW): ± 1.0 dB
Pulse Overshoot: < 10%
Input Impedance: 50 Ω nominal; TTL drive levels

Maximum Leveled Output Power in Pulse Mode (relative to CW):
-0.5 dB



Typical pulse modulation envelope illustrates the fast rise and fall times, excellent flatness and pulse fidelity of the HP 70340A

Internal Pulse Source (Option 1E2)

Pulse Source Modes: Free-run, triggered with delay, doublet and gated.
Triggered with delay, doublet and gated require external trigger source.

Pulse Repetition Frequency: 3 Hz to >3 MHz

Pulse Repetition Interval (PRI): 300 ns to 419 ms

Pulse Width (T_w): 25 ns to 419 ms

Variable Pulse Delay (free-run mode, T_d): ± 419 ms from sync pulse to video modulation

Variable Pulse Delay (triggered with delay & doublet modes, T_d):

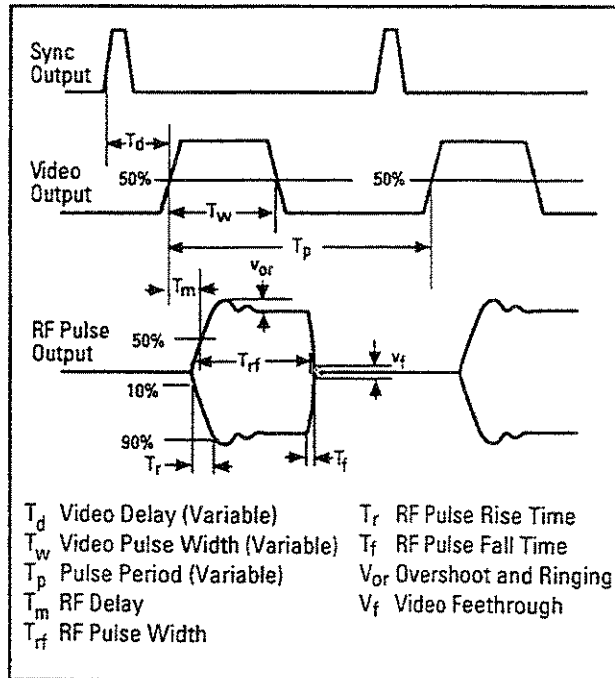
225 ns to 419 ms with ± 25 ns jitter

Pulse Width/Delay/PRI Resolution: 25 ns

Pulse Delay (Video to RF, T_m): Nominally, <20 ns, 1 to 20 GHz

All pulse modulation specifications and supplemental characteristics apply during use of internal pulse source.

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Frequency Modulation

Rates: 1 kHz to 1 MHz
 Flatness: ± 2 dB

CARRIER FREQUENCY		256 - <500 MHz	500 MHz - <1 GHz	1 - 2 GHz	2 - 20 GHz
Maximum Deviation ¹		1.25 MHz peak	2.5 MHz peak	5 MHz peak	10 MHz peak
Modulation Index		>37	>75	>150	>300
CARRIER FREQUENCY	10 - 16 MHz	16 - 64 MHz	64 MHz - 256 MHz	256 MHz - 1 GHz	1 - 20 GHz
FM Sensitivity	40 kHz/V	80 kHz/V	320 kHz/V	1.25 kHz/V	5 MHz/V
FM Sensitivity Accuracy	$\pm 25\%$ at 100 kHz				
Incidental AM	<5%				
FM Input Impedance	600 Ω nominal				
Harmonic Distortion	<1% (1 MHz peak deviation @ 100 kHz rate)				

¹ Maximum deviation decreases by a factor of 2 for each octave below 256 MHz

Logarithmic Amplitude Modulation (Scan Modulation)

Maximum Depth: > 60 dB

Sensitivity: -10 dB/V; (0 to +6V for 0 to -60 dBc)

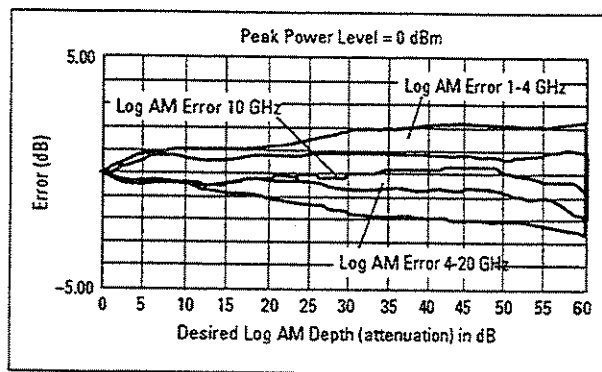
Step Response (50 dB change in level):

	<1 GHz	1 - 20 GHz
rise time	<10 μ s	<5 μ s
fall time	<20 μ s	<5 μ s

Input Impedance: 5000 Ω nominal

Maximum Leveled Output Power in Log AM Mode (relative to CW):

<1 GHz	1 - 4 GHz	>4 GHz
+0 dB	-4.5 dB	-1.0 dB



Typical log AM error (deviation from desired depth) at 25°C for carrier frequencies between 1.0 and 20 GHz

Specifications

HP 70341A Test Record

Simultaneous Modulations

Full AM bandwidth and depth is available at any pulse rate or width. FM is completely independent of AM and pulse modulation.

General

Programming

The HP 70340A and HP 70341A are fully compatible with the Standard Commands for Programmable Instruments (SCPI). SCPI programming complies with IEEE 488.2-1987. Optional CIL programming compatibility is available. Please consult your HP sales representative for details.

Environmental

Operating Temperature Range: 0° to 55° C

EMC: Meets or exceeds EN 55011/CISPR 11/1990, Class A and Mil-Std-461C Part 2 RE02, CE03, CS02, RS03.

Physical Dimensions

Net Weight: HP 70340A, < 9 kg (20 lb).

HP 70341A, < 2.5 kg (5 lbs).

Shipping: HP 70340A, < 15 kg (30 lb)

HP 70341A, < 6 kg (12 lbs).

Size: HP 70340A, 4/8 MMS module width.

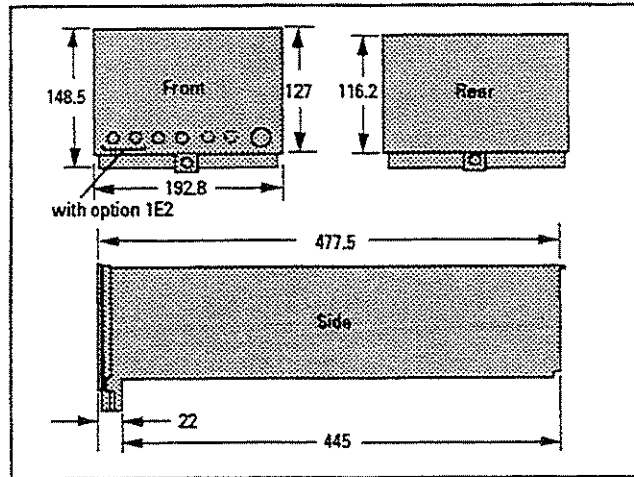
148.5 mm H × 192.8 mm W × 477.5 mm D.

HP 70341A, 1/8 MMS module width.

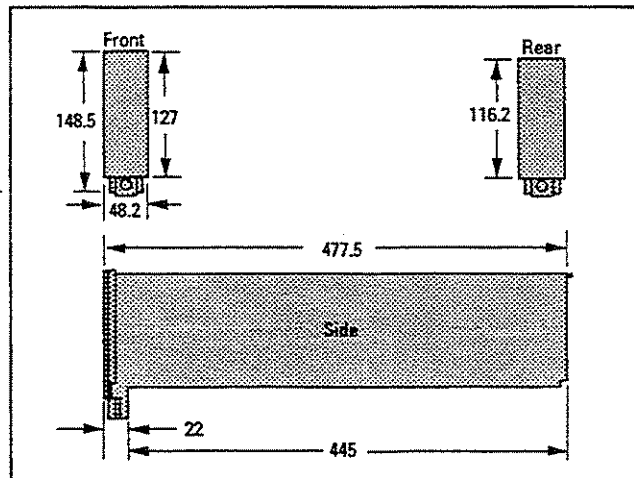
148 mm H × 48.2 mm W × 477.5 mm D.

Power Consumption: HP 70340A, < 80 Watts.

HP 70341A, <30 Watts.



HP 70340A Dimensions



HP 70341A Dimensions

Rear Panel Connectors

HP 70340A

0.5-1 GHz OUTPUT:

SMA connector outputs a 0.5 to 1.0 GHz signal for driving the HP 70341A Frequency Extension module. The HP 70341A combined with the HP 70340A extends the Signal Generator RF Output frequency range down to 0.01 GHz.

0.01-1 GHz INPUT:

SMA connector accepts the HP 70341A 0.01-1 GHz output signal. The HP 70341A signal is output step attenuated in the HP 70340A with the 0.01 to 1.0 GHz output available at the front panel RF Output connector of the HP 70340A.

10 MHz INPUT:

SMB connector accepts a 10 MHz \pm 100 Hz, 0 to +10 dBm, external reference signal for operation from an external high stability timebase. Nominal input impedance is 50 Ω .

10 MHz OUTPUT:

SMB connector outputs the 10 MHz external reference signal, nominally +3 dBm, for use as an external reference signal.

EXTERNAL ALC OUTPUT:

SMB connector outputs external ALC drive signal (from the front panel EXT ALC input connector) to the frequency extension module.

ALC CONTROL OUTPUT:

SMB connector supplies a -10 to +10 V signal as a reference for leveling the .01 to 1.0 GHz output signal of the HP 70341A.

0.5V/GHz OUTPUT:

SMB connector supplies a voltage proportional to output frequency for use with mm-wave frequency multipliers, including the HP 835XX Series.

AM OUTPUT:

SMB connector outputs AM drive signals (from the front panel EXT PULSE input connector) to the frequency extension module.

PULSE OUTPUT:

2 SMB connectors output pulse modulation drive signals (from the front panel EXT PULSE input connector) to the frequency extension modules.

HP 70341A

0.5-1 GHz INPUT:

SMA connector accepts a 0.5 to 1.0 GHz signal from the HP 70340A that drives the HP 70341A Frequency Extension module.

0.01-1 GHz OUTPUT:

SMA connector outputs a 0.01-1 GHz signal which extends the HP 70340A frequency range down to 0.01 GHz. The HP 70341A signal is output step attenuated in the HP 70340A with the 0.01 to 1.0 GHz output available at the front panel RF Output connector of the HP 70340A.

ALC CTRL:

SMB connector accepts a -10 to $+10$ V signal as a reference for leveling the .01 to 1.0 GHz output signal.

AM INPUT:

SMB connector accepts AM drive signals from the HP 70340A rear panel AM OUTPUT connector.

PULSE INPUT:

SMB connector accepts pulse modulation drive signal from the HP 70340A rear panel PULSE OUTPUT connector).

Options

There are several electrical, mechanical, warranty, and documentation options available for the HP 70340A.

Electrical Options: There are three electrical options available for the Signal Generator. These options are as follows:

Option 1E1 - Add Output Step Attenuator

If option 1E1 is ordered, an internal step attenuator is included before the RF OUTPUT connector. The step attenuator has a range of 0 to 90 dB in 10 dB steps. The correct amount of attenuation is selected automatically by the Signal Generator dependent on the output power level selected. If this option is installed, you can select whether or not the step attenuator will

Specifications

HP 70341A Test Record

automatically switch. This function is useful during certain applications, such as when external automatic level control is used.

Option 1E2 - Internal Pulse Modulation Generator

If Option 1E2 is installed, the instrument includes an internal pulse source with four different pulse modes. With Option 1E2, the six pulse modulation modes available are: external, inverted external, free-run internal, gated, triggered with delay, and pulse doublet. Pulse rise and fall times are typically < 5 ns, minimum leveled pulse width is < 25 ns, and on/off ratio is > 80 dB.

Option 1E8 - 1 Hz Frequency Resolution

Consult your HP sales representative for details on availability and retrofit information.

Option 1E9 - 3.5 mm RF Output Connector

If option 1E9 is ordered, the RF OUTPUT connector is a male APC-3.5 precision connector in place of the standard female type-N connector.

Recommended Test
Equipment

Recommended Test Equipment

This chapter contains a table of equipment that is necessary for operator's checks or incoming inspection, performance tests, adjustments, and troubleshooting.

Recommended Test Equipment Table

The Instrument column of the table contains the generic instrument name. The Critical Specification column contains the specifications which the instrument must meet or exceed. The Recommended Model column contains the suggested instrument model. The Use column contains codes which denote where the equipment is used (P = Performance Tests, A = Adjustments, O = Operator's Check's- upon installation or after repair, T = Troubleshooting).

Recommended Test Equipment
Recommended Test Equipment Table

Recommended Test Equipment

Instrument	Critical Specifications	Recommended Model	Use
Spectrum Analyzer ^{1,2}	Frequency Range: 10 MHz to 20 GHz 21.4 MHz Output 17 dB Max Loss btw RF In and 21.4 MHz Out	HP 71210C	P,A
Spectrum Analyzer	Frequency Range: 10 MHz to 20 GHz Minimum Resolution Bandwidth: 1 kHz	HP 71210C/HP 8566B	P,O,T
Frequency Counter	Frequency: 10 MHz \pm 1 Hz	HP 5334B	A
Microwave Frequency Counter	Signal Generator's Frequency Range	HP 5343A Option 001	P,O,A,T
Voltmeter	Range: -50 to +50Vdc Input Impedence: \geq 10M Ω	HP 3456A	P,O,A,T
Function Generator	Frequency Range: DC to 10 MHz Square/ Sinewave Outputs Level Range: 0 to 10 V Maximum Transition Time: 7 ns Minimum Pulse Width: 25 ns	HP 8116A	O,P,T
Pulse/Function Generator ²	Accuracy: 20 mV	HP 3245A	A
Power Meter ²	Power Range: 1 μ W to 100 mW Accuracy: \pm 0.02 dB	HP 437B	P,O,A
Power Sensor	Frequency Range: 50 MHz to 20 GHz SWR < 1.25 Power Range: 1 μ W to 100 mW	HP 8485A	O ³ ,P ³ ,A
Power Sensor	Frequency Range: 10 MHz to 18 GHz Power Range: 1 μ W to 100 mW SWR < 1.28	HP 8481A	O,P,T
Power Sensor	Frequency Range: 10 MHz to 1 GHz SWR < 1.10 Power Range: 1.0 μ W to 100 mW	HP 8482A	A
Adapter	Type N(m) to APC 3.5mm(f); no substitute	HP 1250-1744	P

1 required for Option 1E1 (add step attenuator) Low Level Accuracy Performance Test and Adjustment, only

2 the programming language for this equipment must be compatible with the language used in the automated adjustment procedures

3 required for Option 1E9 (3.5mm RF Output connector, only)

Recommended Test Equipment
Recommended Test Equipment Table

Recommended Test Equipment (continued)

Instrument	Critical Specifications	Recommended Model	Use
Step Attenuator	0 to 11 dB	HP 8494B	P
Measuring Receiver ¹	Tuned Frequency: 21.4 MHz Power Range: 0 to -127 dBm Relative Power Accuracy: ± 0.5 dB	HP 8902A	O,P,T,A
Carrier Noise Test Set	no substitute	HP 11729C	P
Dynamic Signal Analyzer	Center Frequency Range: 100 Hz to 10 kHz Frequency Span: 200 Hz to 33 kHz Start Frequency: 3 kHz	HP 3561A	P
Digitizing Oscilloscope	General Purpose	HP 54100D	T,P,A
Digitizing Oscilloscope ²	Frequency Range: dc to 20 GHz Risetime: 17.5 ps max Time Interval Accuracy: 10 ps max	HP 54121T	P,A
Frequency Standard	Frequency: 10 MHz Aging Rate: $< 1.5 \times 10^{-10}$ /day	HP 5061B	P,A
6 dB BNC Attenuator	BNC(m) to BNC(f)	Texscan FP-50	P
10 dB Attenuator	APC 3.5mm(m) to APC 3.5mm(f)	HP 8493C Opt 010	P,A
20 dB Attenuator	APC 3.5mm(m) to APC 3.5mm(f)	HP 8493C Opt 020	P
20 dB BNC Attenuator	BNC(m) to BNC(f)	Texscan FP-50	P
Reference Oscillator	Frequency Range: 80 MHz to 720 MHz Power Output: 0 dBm to -40 dBm	HP 8662A Opt 003	P
Controller	HP BASIC 5.1 HP-IB capability	HP SERIES 300	A
Printer	HP-IB Capability		A

1 the programming language for this equipment must be compatible with the language used in the automated adjustment procedures

2 the programming language for this equipment must be compatible with the language used in the automated tests

Recommended Test Equipment
Recommended Test Equipment Table

Recommended Test Equipment (continued)

Instrument	Critical Specifications	Recommended Model	Use
Pulse Generator	Transition < 1 ns Variable delay Inverse output 100 μ s PRI w = 50 μ s	HP 8130A	A
RF Source ¹	Frequency Range: 0.01 to 1 GHz Power Out: + 16 dBm External ALC and AM	HP 8663A or HP 8662A	PA
Extender Module ²	no substitute	HP 11742A	A
Blocking Capacitor ²	no substitute	HP 11742A	A
In-Line Resistor ²	1 k Ω ³ BNC(m) to BNC(f)		A

¹ the programming language for this equipment must be compatible with the language used in the automated tests

² HP 70340A only

³ 1.62 k Ω if the HP 8662A is used as the RF Source

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