Agilent 4396B Network/Spectrum/Impedance Analyzer

PERFORMANCE TEST MANUAL

SERIAL NUMBERS

This manual applies directly to instruments with serial number prefix JP1KE, or firmware revision 1.01 and below. For additional important information about serial numbers, read "Serial Number" in Appendix A.

Agilent Technologies

Agilent Part No. 04396-90130
Printed in Japan March 2000

Third Edition

Notice

The information contained in this document is subject to change without notice.

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Manual Printing History

March 1997 .... First Edition (part number: 04396-90120)

July 1997 .... Second Edition (part number: 04396-90130)

March 2000 .... Third Edition (part number: 04396-90130)

Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific *WARNINGS* elsewhere in this manual may impair the protection provided by the equipment. In addition it violates safety standards of design, manufacture, and intended use of the instrument.

The Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

Note 4396B comply with INSTALLATION CATEGORY II and POLLUTION DEGREE 2 in IEC1010-1. 4396B are INDOOR USE product.

Note LEDs in 4396B are Class 1 in accordance with IEC825-1.
CLASS 1 LED PRODUCT

Ground The Instrument

To avoid electric shock hazard, the instrument chassis and cabinet must be connected to a safety earth ground by the supplied power cable with earth blade.

DO NOT Operate In An Explosive Atmosphere

Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Keep Away From Live Circuits

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT Service Or Adjust Alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT Substitute Parts Or Modify Instrument

Because of the danger of introducing additional hazards, do not install substitute parts or perform unauthorized modifications to the instrument. Return the instrument to a Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

Dangerous Procedure Warnings

Warnings , such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

Warning **Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting this instrument.**

Certification

Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institution's calibration facility, or to the calibration facilities of other International Standards Organization members.

Warranty

This Agilent Technologies instrument product is warranted against defects in material and workmanship for a period of one year from the date of shipment, except that in the case of certain components listed in *General Information* of this manual, the warranty shall be for the specified period. During the warranty period, Agilent Technologies will, at its option, either repair or replace products that prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Agilent Technologies. Buyer shall prepay shipping charges to Agilent Technologies and Agilent Technologies shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Agilent Technologies from another country.

Agilent Technologies warrants that its software and firmware designated by Agilent Technologies for use with an instrument will execute its programming instruction when property installed on that instrument. Agilent Technologies does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

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The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside the environmental specifications for the product, or improper site preparation or maintenance.

No other warranty is expressed or implied. Agilent Technologies specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

Exclusive Remedies

The remedies provided herein are buyer's sole and exclusive remedies. Agilent Technologies shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products.

For any assistance, contact your nearest Agilent Technologies Sales and Service Office. Addresses are provided at the back of this manual.

Safety Symbols

General definitions of safety symbols used on equipment or in manuals are listed below.

Instruction manual symbol: the product is marked with this symbol when it is necessary for the user to refer to the instruction manual.

Alternating current.

Direct current.

On (Supply).

Off (Supply).

In position of push-button switch.

Out position of push-button switch.

Frame (or chassis) terminal. A connection to the frame (chassis) of the equipment which normally include all exposed metal structures.

High voltage terminals : terminals fed from internal or external sources by voltages which may exceed 1000 volts.

Warning

This **Warning** sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.

Caution

This **Caution** sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

Note

Note denotes important information. It calls attention to a procedure, practice, condition or the like, which is essential to highlight.

Affixed to product containing static sensitive devices use anti-static handling procedures to prevent electrostatic discharge damage to component.

Documentation Map

The following manuals are available for the analyzer.

Task Reference (Agilent Part Number 04396-90030)

Task Reference helps you to learn how to use the analyzer. This manual provide simple step-by-step instruction, without concepts.

User's Guide (Agilent Part Number 04396-90031)

The User's Guide walks you through system setup and initial power-on, shows how to make basic measurements, explains commonly used features, and typical application measurement examples. After you receive your analyzer, begin with this manual.

Function Reference (Agilent Part Number 04396-90052)

Function Reference describes all function accessed from the front panel keys and softkeys, and provides information on options and accessories available, specifications, system performance, and some topics about the analyzer's features.

Programming Guide (Agilent Part Number 04396-90043)

The Programming Guide shows how to make basic program to control the analyzer by a controller by GPIB.

GPIB Command Reference (Agilent Part Number 04396-90044)

GPIB Command Reference provides a summary of all available GPIB command, and information on status reporting structure and trigger system correspond to SCPI.

HP instrument BASIC Users Handbook (Agilent Part Number E2083-90000)

The HP instrument BASIC Users Handbook introduces you to the HP instrument BASIC programming language, provide some helpful hints on getting the most use from it, and provide a general programming reference. It is divided into three books, *HP instrument BASIC Programming Techniques* , *HP instrument BASIC Interface Techniques* , and *HP instrument BASIC Language Reference*.

Performance Test Manual (Agilent Part Number 04396-90130)

The Performance Test Manual explains how to verify conformance to published specifications.

Service Manual (Option 0BW only), (Agilent Part Number 04396-90121)

The Service Manual explains how to adjust, troubleshoot, and repair the instrument. This manual is option 0BW only.

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1

General Information

INTRODUCTION

This chapter provides an overview of the manual and 4396B Network/Spectrum/Impedance Analyzer (analyzer) performance tests. In addition, this chapter describes the analyzer calibration cycle, calculation sheets and performance test record, and test equipment required in test procedures of this manual.

ABOUT THIS MANUAL

This manual contains the performance test procedures for the analyzer. These performance tests are used to verify that the analyzer's performance meets its specifications.

Manual Organization

This manual contains the following chapters:

Chapter 1. General Information

Chapter 1 describes this manual, the analyzer's performance tests, calculation sheet and performance test record, and lists the test equipment required for the preventive maintenance and the performance tests.

Chapter 2. Performance Tests

Chapter 2 provides all the performance test procedures.

Chapter 3. Calculation Sheet

Chapter 3 provides a calculation sheet for those performance tests that require additional calculations to determine the final test result.

Chapter 4. Performance Test Record

Chapter 4 provides a performance test record. The record sheets for all test results are provided.

The manual also contains **Appendix A, Manual Changes.**

PERFORMANCE TESTS

The analyzer's performance tests consist of the 24 tests listed in Table 1-1. These tests verify that the analyzer's performance meets the guaranteed specifications. See the *Function Reference* for the specifications.

The analyzer's performance is categorized into two groups; performance in the network analyzer mode and performance in the spectrum analyzer mode. The third column in Table 1-1 indicates to which group the listed performance test belongs.

All tests can be performed without access to the interior of the instrument. The performance tests can be used to perform incoming inspection, and to verify that the analyzer meets performance specifications after repair.

Table 1-1. Performance Tests

Test Number	Test Name	Category[1]
1	Frequency Accuracy Test	NA
2	Source Level Accuracy/Flatness Test	NA
3	Non-sweep Linearity Test	NA
4	Power Sweep Linearity Test	NA
5	Harmonics/Non-harmonic Test	NA
6	Receiver Noise Level Test	NA
7	Input Crosstalk Test	NA
8	Input Impedance Test	NA
9	Absolute Amplitude Accuracy Test	NA
10	Magnitude Ratio/Phase Dynamic Accuracy Test	NA
11	Magnitude Ratio/Phase Frequency Response Test	NA
12	Calibrator Amplitude Accuracy Test	SA
13	Displayed Average Noise Level Test	SA
14	Amplitude Fidelity Test	SA
15	Input Attenuator Switching Uncertainty Test	SA
16	Resolution Bandwidth Accuracy/Selectivity Test	SA
17	Resolution Bandwidth Switching Uncertainty Test	SA
18	IF Gain Switching Uncertainty Test	SA
19	Noise Sidebands Test	SA
10	Frequency Response Test	SA
21	Second Harmonic Distortion Test	SA
22	Third Order Intermodulation Distortion Test	SA
23	Other Spurious Test	SA
24	Residual Response Test	SA

1 : NA: Network Analyzer Mode, SA: Spectrum Analyzer Mode

The test numbers in Table 1-1 are numbered according to the recommended sequence of performing tests. When performing more than one performance test, perform them in the order listed in Table 1-1. The first test failed indicates the problem you should troubleshoot first.

If the performance tests indicate that the analyzer is not operating within the specified limits, check the test setup. If the test setup is correct, see the *Adjustments and Correction Constants* chapter or the *Troubleshooting* chapter in the *4396B Service Manual* for corrective action.

Note Allow the analyzer to warm up for at least 30 minutes before you execute any of the performance tests.

Perform all performance tests in an ambient temperature of 23 ± 5°C.

CALIBRATION CYCLE

The analyzer requires periodic performance verification to remain in calibration. The frequency of performance verification depends on the operating and environmental conditions under which the analyzer is used. Verify the analyzer's performance at least once a year using the performance tests contained in this manual.

CALCULATION SHEET AND PERFORMANCE TEST RECORD

The Calculation Sheet and Performance Test Record tables are provided in Chapter 3 and Chapter 4.

Calculation Sheet

Use the calculation sheet as an aid for recording raw measurement data and calculating the performance test results. Calculation sheet entries are provided only for performance tests in which calculations are required to obtain the test results.

Performance Test Record

The performance test record lists all test points, acceptable test limits, and measurement uncertainties (if applicable). The measurement uncertainty shows how accurately the analyzer's specifications are measured and depends on the test equipment used. The listed measurement uncertainties are valid only when the recommended equipment is used.

How to Use

The following procedure is recommended when using the calculation sheet and the performance test record:

1. Make extra copies of the calculation sheet and the performance test record.
2. Follow the performance test procedure and record the measured data in the specified column in the calculation sheet. For tests where no calculation sheet entry spaces are provided, record the measured values directly in the performance test record.
3. Calculate the test result using the appropriate equation given in the calculation sheet. Record the test results in the TEST RESULT column in the calculation sheet.
4. When appropriate, copy the test results from the calculation sheet to the performance test record.
5. Keep the performance test record for tracking gradual changes in test results over long periods of time.

RECOMMENDED TEST EQUIPMENT

Table 1-2 lists the equipment required for performance testing the analyzer. Other equipment may be substituted if the equipment meets or exceeds the critical specifications given in Table 1-2.

Table 1-2. Recommended Test Equipment

Equipment	Critical Specifications	Recommended Model/ Agilent Part Number	Qty
Frequency Counter	Frequency Range: 1 GHz, Time Base Error: $\leq \pm 1.9\times10^{-7}$/year	5343A Opt. 001[1]	1
Frequency Standard[2]	Frequency: 10 MHz, Time Base Error: $\leq \pm 1\times10^{-10}$/year	5061B	1
Spectrum Analyzer	Frequency Range: 100 kHz to 4 GHz	8566A/B	1
Network Analyzer	Frequency Range: 300 kHz to 1.8 GHz	8753A/B/C	1
Power Meter	No substitute	436A Opt. 022, 437B, or 438A	1
Power Sensor	Frequency Range : 20 MHz to 1.8 GHz, Power: −20 dBm to +5 dBm	8482A	1
Power Sensor	Frequency Range : 50 MHz to 1.8 GHz, Power: −60 dBm to −20 dBm	8481D	1
Function Genarator	Frequency Range : 10 Hz to 10 kHz, Level Accuracy: ±0.2 dB, Return loss: > 20 dB	3325A	1
Signal Generator	Frequency Range : 100 kHz to 1.82 GHz, SSB Phase Noise at 1 kHz offset: < −110 dBc/Hz, SSB Phase Noise at 10 kHz offset: < −119 dBc/Hz, Harmonics: < −30 dBc	8663A or 8642B	2
Step Attenuator[3]	Attenuation Range : 0 dB to 70 dB, Step: 10 dB, VSWR: ≤ 1.02	8496A/G Option 001 and H60[4]	1
Step Attenuator[3]	Attenuation Range: 0 dB to 10 dB, Step: 1 dB, VSWR: ≤ 1.02	8494A/G Option 001 and H60[5]	1
Attenuator/Switch Driver	No substitute	11713A[6]	1
50Ω Type-N Calibration Kit	No substitute	85032B	1
T/R Test Set	Frequency Range: 300 kHz to 1.8 GHz, Directivity: ≥ 40 dB	85044A	1
50 MHz Low Pass Filter	Rejection at 75 MHz: ≥ 60 dB	PN 0955-0306	1
Termination	50Ω termination, type-N(m)	909C Opt 012 or part of 85032B[7]	3

1 Option 001 (optional time base) is not required, when a frequency standard in Table 1-2 is available.

2 Required for testing an analyzer equipped with Option 1D5 (High Stability Frequency Reference).

3 Calibration values at 50 MHz are required in the tests. See the *Calibration Data Required for Step Attenuators* later in this chapter.

4 An 8496A/G step attenuator with required low VSWR (≤ 1.02) can be purchased by specifying option H60.

5 An 8494A/G step attenuator with required low VSWR (≤ 1.02) can be purchased by specifying option H60.

6 Required when an 8494G or 8496G step attenuator is used in the tests.

7 The 85032B includes a type-N(m) 50 Ω termination.

Table 1-2. Recommended Test Equipment (continued)

Equipment	Critical Specifications	Recommended Model/ Agilent Part Number	Qty
6 dB Fixed Attenuation	50 Ω, N(m)-N(f)	8491A Opt 006	2
6 dB Fixed Attenuation	50 Ω, N(m)-N(f), VSWR $\leq$ 1.015	8491A Opt 006 & Opt H60[1]	2
Two-way Power Splitter	Frequency Range: 100 kHz to 1.8 GHz, Output Tracking: $\leq$ 0.15 dB	11667A	1
Cables	N(m)-N(m) cable, 50 Ω	11500B or part of 11851B[2]	4
	RF cable kit	11851B	1
	BNC(m)-BNC(m) cable, 61 cm, 50 Ω	PN 8120-1839	1
	BNC(m)-BNC(m) cable, 122 cm, 50 Ω	PN 8120-1840	2
Adapters	BNC(f)-BNC(f) adapter, 50 Ω	PN 1250-0080	1
	BNC(f)-SMA(f) adapter, 50 Ω	PN 1250-0562	1
	Tee BNC(m)-(f)-(f) adapter, 50 Ω	PN 1250-0781	1
	N(m)-N(m) adapter, 50 Ω	PN 1250-1475	1
	N(m)-BNC(f) adapter, 50 Ω	PN 1250-1476	1
	N(f)-BNC(m) adapter, 50 Ω	PN 1250-1477	1
	APC 3.5(m)-APC 3.5(f) adapter, 50 Ω	PN 1250-1866	1
	APC 7-N(f) adapter, 50 Ω	11524A or part of 85032B[3]	1

1 An 8491A Opt. 006 fixed attenuator with required low VSWR ($\leq$ 1.015) can be purchased by specifying Opt. H60.

2 The 11851B includes three N(m)-N(m) cables of 61 cm and a N(m)-N(m) cable of 88 cm.

3 The 85032B includes two APC 7-N(f) adapters.

Calibration Data Required for Step Attenuator

The six performance tests listed below measure the analyzer's performance against a known standard (the attenuation values at a frequency 50 MHz of the 8496A/G and 8494A/G step attenuators).

3. Non-Sweep Power Linearity Test
4. Power Sweep Linearity Test
10. Magnitude Ratio/Phase Dynamic Accuracy Test
14. Amplitude Fidelity Test
15. Input Attenuator Switching Uncertainty Test
18. IF Gain Switching Uncertainty Test

These tests require the calibrated values of the attenuators listed in Table 1-3 and Table 1-4. The attenuation values (referenced to 0 dB setting) are required in the calculation sheet. The attenuation values used in the tests are listed in each calculation sheet.

Table 1-3. Calibration Data Required for 8496A/G

Frequency	Attenuation	Uncertainty
50 MHz	10 dB	$\leq$ 0.0060 dB
	20 dB	$\leq$ 0.0060 dB
	30 dB	$\leq$ 0.0066 dB
	40 dB	$\leq$ 0.0090 dB
	50 dB	$\leq$ 0.0165 dB
	60 dB	$\leq$ 0.0197 dB
	70 dB	$\leq$ 0.0272 dB

Table 1-4. Calibration Data Required for 8494A/G

Frequency	Attenuation	Uncertainty
50 MHz	2 dB	$\leq$ 0.007 dB
	4 dB	$\leq$ 0.007 dB
	6 dB	$\leq$ 0.007 dB
	8 dB	$\leq$ 0.007 dB
	10 dB	$\leq$ 0.007 dB

The calibration uncertainty is the primary source of measurement error in performance tests. The measurement uncertainties listed in the performance test record of Chapter 4 are valid only when the uncertainty of the step attenuation data satisfies that given in the third column of Table 1-3 and Table 1-4.

The calibration of step attenuators, 8496A/G and 8494A/G, are available at Agilent Technologies. For information about the calibration and the available uncertainties, contact your nearest Agilent Technologies service center.

Note

The 8496G programmable step attenuator has four attenuation segments, 10 dB segment, 20 dB segment, and two 40 dB segments. Each attenuation from 10 dB to 70 dB is obtained by combining these segments. The attenuations from 40 dB to 70 dB depend on the 40 dB segment that is used.

When setting the step attenuator for the calibration, specify one of the 40 dB segments for attenuations from 40 dB to 70 dB. Then use the specified segment in the tests.

Note

The 8494G programmable step attenuator has four attenuation segments, 1 dB segment, 2 dB segment, and two 4 dB segments. Each attenuation is obtained by combining these segments. The attenuations of 4 dB and 6 dB depend on the 4 dB segment that is used.

When setting the step attenuator for the calibration, specify one of the 4 dB segment for attenuations of 4 dB and 6 dB. Then use the specified segment in the tests.

2

Performance Tests

INTRODUCTION

This chapter contains the performance test procedures. The test procedures listed in Table 1-1 are described sequentially in the following pages.

The test name indicates the tested performance and to which performance group the tested performance belongs to. *NA* indicates the performance test belongs to the network analyzer mode performance group. *SA* indicates the performance test belongs to the spectrum analyzer mode performance group.

Each procedure consists of the following parts:

Description:	describes the test procedure.
Specification:	describes the performance verified in the test.
Test Equipment:	describes test equipment required in the test.
Procedure:	describes the test procedure step by step.

Note

Allow the analyzer to warm up for at least 30 minutes before you execute any of the performance tests.

Perform all performance tests in an ambient temperature of 23 ± 5°C.

Note

Before performing any tests, make extra copies of the calculation sheet in Chapter 3 and the performance test record in Chapter 4. These are required in the test procedure. For an explanation of how to use these records, see the *CALCULATION SHEET AND PERFORMANCE TEST RECORD* in Chapter 1.

1. FREQUENCY ACCURACY TEST (NA)

Description

This test uses a frequency counter to measure the actual frequency of the 4396B RF OUT signal when it is tuned to 1 GHz. This test checks the frequency accuracy of the internal frequency reference (or the high stability frequency reference for Option 1D5).

Specification

Frequency reference accuracy
@23±5°C, referenced to 23°C .... <±5.5 ppm/year
Precision frequency reference accuracy (option 1D5)
@0°C to 55°C, referenced to 23°C .... <±0.13 ppm/year

Test Equipment

For testing a standard 4396B (not equipped with Opt. 1D5)

Frequency Counter .... 5343A Opt. 001[1]
BNC(m)-BNC(m) cable, 61 cm .... PN 8120-1839
APC 3.5(m)-APC 3.5(f) adapter[2] .... PN 1250-1866
N(m)-BNC(f) adapter .... PN 1250-1476
BNC(f)-SMA(f) adapter .... PN 1250-0562

For testing an 4396B equipped with Opt. 1D5

Frequency Counter 5343A
Frequency Standard .... 5061B [3]
BNC(m)-BNC(m) cable, 61 cm .... PN 8120-1839
BNC(m)-BNC(m) cable, 122 cm .... PN 8120-1840
APC 3.5(m)-APC 3.5(f) adapter[2] .... PN 1250-1866
BNC(f)-SMA(f) adapter .... PN 1250-0562

1: Option 001 Time Base is not required, when any 10 MHz frequency standard with time base error < ±1.9 x 10^{-7}/year is available as an external frequency reference for the frequency counter.

2: This adapter is used to protect the 5343A's APC 3.5(m) input connector, sometimes called "connector saver." In the test setup, the BNC(m)-SMA(f) adapter is connected to the 5343A's APC 3.5(m) input connector through this adapter. For more information on microwave connectors and connector care, see *MICROWAVE CONNECTOR CARE* (PN 08510-90064).

3: The 5061B can be replaced with any 10 MHz frequency standard with time base error of < ± 1 x 10^{-10}/year.

Procedure

1. Connect the test equipment as shown in Figure 2-1.

   For testing a standard 4396B (not equipped with Option 1D5), do not connect any cable to the EXT REF input connector in the 4396B rear panel.

   For testing an 4396B equipped with Option 1D5, connect a BNC(m)-BNC(m) cable between the EXT REF input connector and the REF OVEN connector on the 4396B rear panel. Then connect the frequency standard's 10 MHz connector to the frequency counter's EXT FREQ STD connector as shown in Figure 2-1.

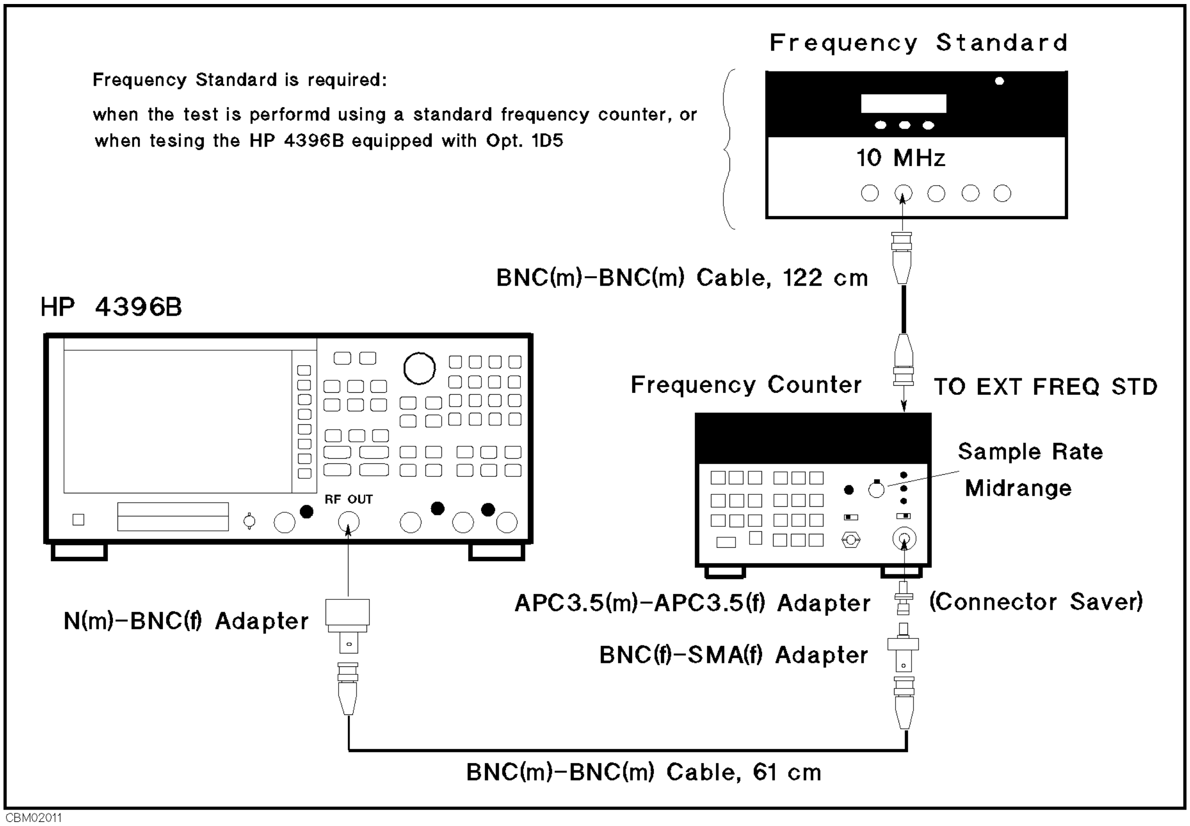

Figure 2-1. Frequency Accuracy Test Setup

Note

An APC 3.5(m)-APC 3.5(f) adapter is used between the BNC(f)-SMA(f) adapter and the 5343A's APC 3.5(m) input connector to protect the 5343A's APC 3.5(m) input connector. In Figure 2-1, the SMA connector of the BNC(f)-SMA(f) adapter is mated with the APC 3.5 connector of the different type.

2. Initialize the frequency counter. Then set the controls as follows:

Controls	Settings
Sample Rate	Midrange
Range Switch	500 MHz-26.5 MHz
INT/EXT Switch (rear panel)	Internal or External (when the frequency standard is connected)

3. Press (Meas), ANALYZER TYPE, NETWORK ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	Key Strokes
Center Frequency: 1 GHz	(Center), (1), (G/n)
Frequency Span: ZERO	(Span), ZERO SPAN

4. Wait for the frequency counter reading to settle.

5. Record the frequency counter reading to 1 Hz resolution in the performance test record ("Test Result" column).

2. SOURCE LEVEL ACCURACY/FLATNESS TEST (NA)

Description

This test uses a power meter and a power sensor to measure the actual power level of the RF OUT signal at several frequencies from 100 kHz to 1.8 GHz when the signal amplitude is set to 0 dBm. The level accuracy is checked at a frequency 50 MHz. The level flatness is calculated as power deviation from the power reading taken at 50 MHz.

Specification

Level accuracy
@23±5°C, 50 MHz, 0 dBm output .... <±0.5 dB
Flatness
@23±5°C, relative to 50 MHz, 0 dBm output .... ±1.0 dB

Test Equipment

Power Meter .... 436A Opt. 022, 437B, or 438A
Power Sensor 8482A

Procedure

1. Connect the power sensor to the power meter. Calibrate the power meter for the power sensor.
2. Connect the test equipment as shown in Figure 2-2.

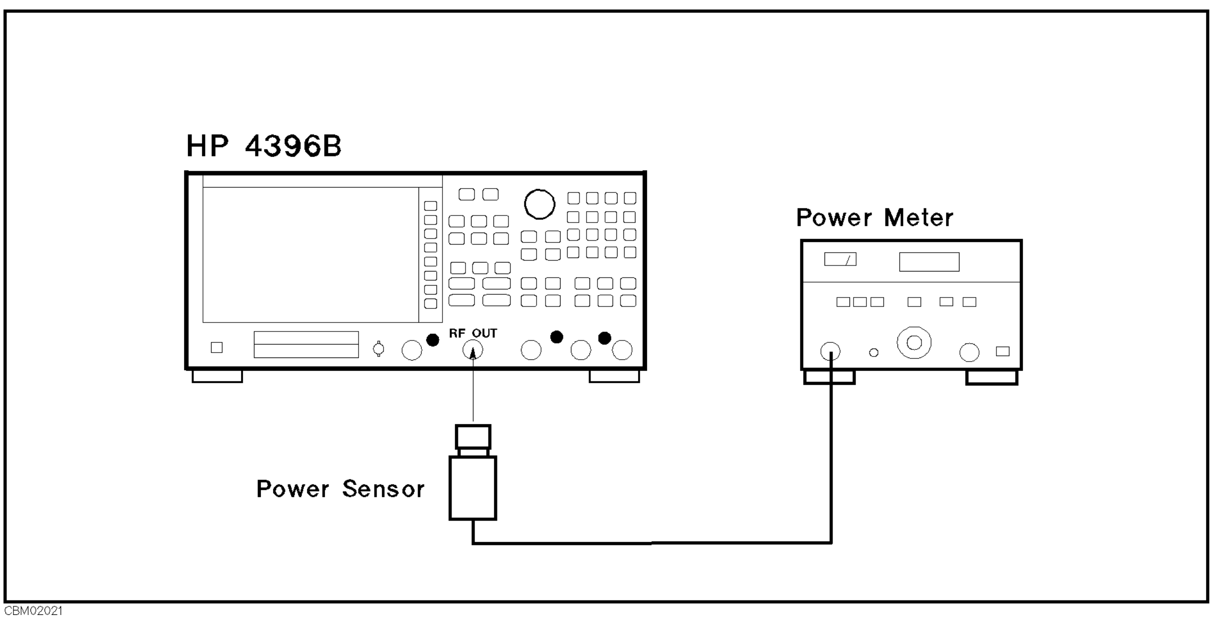

Figure 2-2. Source Level Accuracy/Flatness Test Setup

3. Press (Meas), ANALYZER TYPE, NETWORK ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	Key Strokes
Center Frequency: 50 MHz	(Center), (5), (0). (M/μ)
Frequency Span: 0 Hz	(Span), ZERO SPAN
IF BW: 1 kHz	(Bw/Avg), IF BW, (1), (k/m)

The source power now is set to 0 dBm (preset value).

4. **Source Level Accuracy Test**

   a. Wait for the power meter reading to settle.
   b. Record the power meter reading in the performance test record ("Test Result" column for the level accuracy test).

5. **Source Level Flatness Test**

   a. Record the test result of the level accuracy test in the calculation sheet ("Power Meter Reading [ref]" column for the level flatness test).
   b. Press (Center), (1), (0), (0), (k/m) to change the 4396B center frequency to the first flatness test frequency 100 kHz listed in Table 2-1. Table 2-1 lists flatness test frequencies.

Table 2-1. Source Level Flatness Test Settings

4396B Center Frequency
100 kHz
1 MHz
10 MHz
100 MHz
400 MHz
700 MHz
1 GHz
1.3 GHz
1.6 GHz
1.8 GHz

   c. Wait for the power meter reading to settle. Then record the reading in the calculation sheet ("Power Meter Reading" column).
   d. Change the 4396B center frequency in accordance with Table 2-1 and repeat step 5-c for each frequency.
   e. Calculate test results using the equation given in the calculation sheet. Record the test results in the performance test record.

3. NON-SWEEP POWER LINEARITY TEST (NA)

Description

This test uses a power meter and a high sensitivity power sensor to measure the actual power of the 4396B RF OUT signal at several power settings and then calculates the power linearity. The power linearity is referenced to a power level of 0 dBm.

In this test, the input power to the power sensor is maintained between −60 dBm and −30 dBm using the step attenuator. This reduces measurement uncertainty caused by the power sensor's non-linearity and noise. The actual power of the RF OUT signal is calculated by adding the attenuation used and the power meter reading. Therefore, this test requires the calibrated attenuation values of the step attenuator at 50 MHz.

Specification

Level linearity

Output Power	Linearity[1]
-20 dBm $\leq$ power $\leq$ $+20$ dBm	± 0.7 dB
-40 dBm $\leq$ power $<$ -20 dBm	± 1.0 dB
-60 dBm $\leq$ power $<$ -40 dBm	± 1.5 dB

1 : @23±5°C, relative to 0 dBm output

Test Equipment

Power Meter .... 436A Opt. 022, 437B, or 438A
Power Sensor 8481D
N(m)-N(m) cable, 61 cm .... 11500B or part of 11851B
Step Attenuator[1], 10 dB Step ...., VSWR $\leq$ 1.02 8496A/G Option 001 and H60
Attenuator driver[2] 11713A

1: Calibration values for attenuation settings of 10 dB to 50 dB at 50 MHz are required.

2: Required when using a programmable step attenuator 8496G.

Procedure

1. Record the step attenuator 50 MHz calibration values in the calculation sheet ("Calibration Value" column).
2. Connect the power sensor to the power meter, and calibrate the power meter for the power sensor.
3. Set the step attenuator to 50 dB before connecting the test equipment. This protects the power sensor from excess input.
4. Connect the test equipment as shown in Figure 2-3.

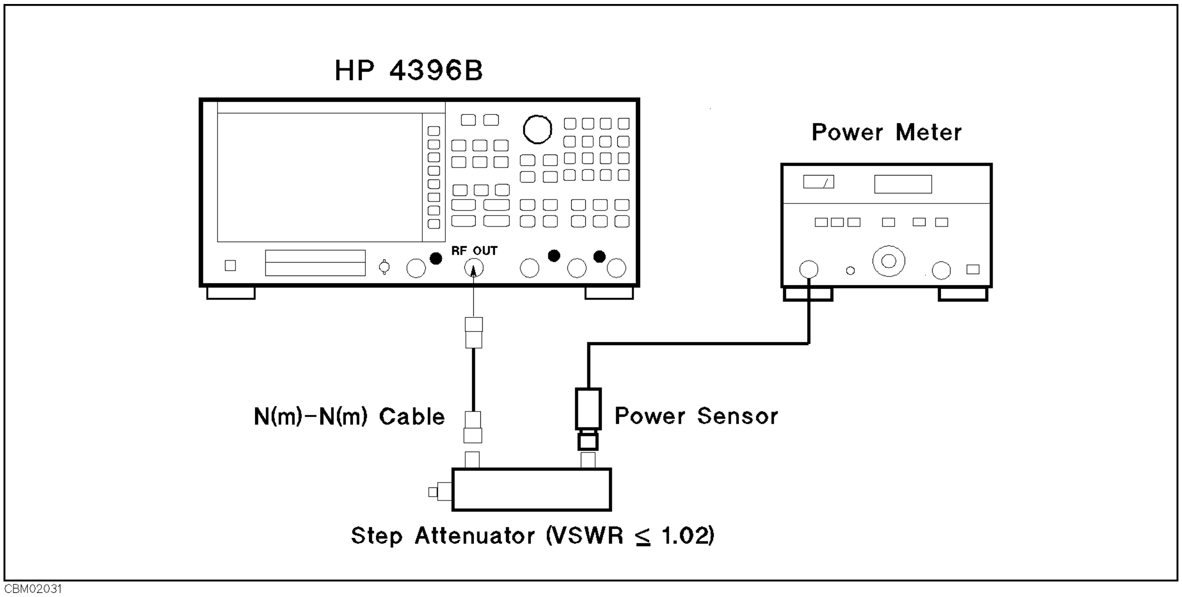

Figure 2-3. Non-sweep Power Linearity Test Setup

5. Press (Meas), ANALYZER TYPE, NETWORK ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	Key Strokes
Center Frequency: 50 MHz	(Center), (5), (0), (M/μ)
Frequency Span: 0 Hz	(Span), ZERO SPAN

6. Press (Source), POWER, (0), (x1) to set the source power to the first test setting (0 dBm) listed in Table 2-2.
7. Set the step attenuator to the first setting (30 dB) listed in the second column of Table 2-2.
8. Wait for the power meter reading to settle.
9. Record the power meter reading in the calculation sheet. Use "Power Meter Reading" column of the calculation sheet for the reference (0 dBm).

Table 2-2. Non-Sweep Power Linearity Test Settings

4396B Source Power	Step Attenuator
0 dBm	30 dB
+20 dBm	50 dB
+10 dBm	40 dB
−10 dBm	20 dB
−20 dBm	10 dB
−30 dBm	10 dB
−40 dBm	10 dB
−50 dBm	10 dB
−60 dBm	0 dB

10. Change the source power setting and the step attenuator setting in accordance with Table 2-2. Record the power meter reading in the calculation sheet. Use “Power Meter Reading” column of the calculation sheet for the non-sweep power linearity test.
11. Calculate the test results using the equations given in the calculation sheet. Record the test results in the performance test record.

4. POWER SWEEP LINEARITY TEST (NA)

Description

This test sets the 4396B to the power sweep mode and then makes a power sweep from −10 dBm to +20 dBm in 5 dB steps. Using a power meter and a high sensitivity power sensor, the actual power of the 4396B RF OUT signal at each sweep point is measured. Then the power sweep linearity for a sweep span ≤ +20 dB is calculated. The power linearity is specified as values relative to the stop power. Therefore, the power linearity for stop powers from −5 dBm to 20 dBm is calculated using each measured power as a stop power.

This test uses a step attenuator to maintain the power sensor input level ≤ −30 dBm. This reduces the measurement uncertainty caused by the power sensor's linearity error. The actual power of the RF OUT signal is calculated by adding the attenuation used and the power meter reading. Therefore, this test requires the calibrated attenuation values of the step attenuator at 50 MHz.

Specification

Sweep range .... 20 dB
Sweep linearity
@23±5°C, 50 MHz, relative to stop power .... ±0.5 dB

Test Equipment

Power Meter .... 436A Opt. 022, 437B, or 438A
Power Sensor 8481D
Step Attenuator[1], 10 dB Step , VSWR ≤ 1.02 .... 8496A/G Option 001 and H60
Attenuator driver[2] 11713A
N(m)-N(m) cable, 61 cm .... 11500B or part of 11851B

1: Calibration values for attenuation settings of 40 dB and 50 dB at 50 MHz are required.

2: Required when using a programmable step attenuator 8496G.

Procedure

1. Record the step attenuator 50 MHz calibration values in the calculation sheet ("Calibration Value" column).
2. Connect the power sensor to the power meter. Then calibrate the power meter for the power sensor.
3. Set the step attenuator to 40 dB before connecting the test equipment. This protects the power sensor from excess input.
4. Connect the test equipment as shown in Figure 2-4.

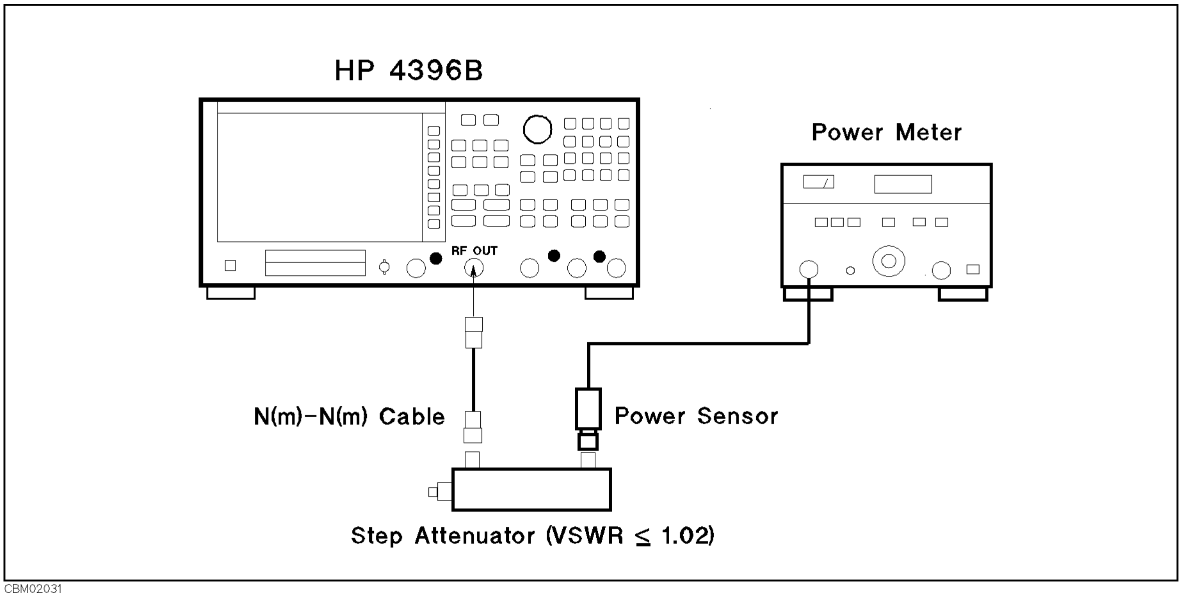

Figure 2-4. Power Sweep Linearity Test Setup

5. Press (Meas), ANALYZER TYPE, NETWORK ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	Key Strokes
Sweep Type: POWER SWEEP	(Sweep), SWEEP TYPE MENU, POWER SWEEP
CW Frequency: 50 MHz	(Source), CW FREQ, (5), (0), (M/μ)
Start Power: −10 dBm	(Start), (-), (1), (0), (x1)
Stop Power: +20 dBm	(Stop), (2), (0), (x1)
Number of Points: 7	(Sweep), NUMBER of POINTS, (7), (x1)
Manual Trigger	(Trigger), TRIGGER: [FREE RUN], MANUAL
Trigger Event: ON POINT	(Trigger), TRIGGER:[MANUAL], TRIG EVENT [ON SWEEP] (Then the softkey label changes to TRIG EVENT [ON POINT])

6. Press (Trigger), SINGLE, TRIGGER:[MANUAL] to start a power sweep and to set the 4396B power to the first sweep point of −10 dBm listed in Table 2-3. Table 2-3 lists test settings. Verify that the step attenuator is set to 40 dB.

Table 2-3. Power Sweep Linearity Test Settings

4396B Source Power	Step Attenuator
−10 dBm	40 dB
−5 dBm	40 dB
0 dBm	40 dB
+5 dBm	40 dB
+10 dBm	40 dB
+15 dBm	50 dB
+20 dBm	50 dB

7. Wait for the power meter reading to settle.
8. Record the power meter reading in the calculation sheet ("Power Meter Reading" column).
9. Repeat the following steps until a power sweep completed.
   a. Press MANUAL to set the source power to the next measurement point listed in Table 2-3. The sweep indicator moves to the last measurement point on the sweep. (The sweep indicator indicates the last measurement point on the sweep, not the current point.)
   b. Change the step attenuator setting to the next setting in the second column of Table 2-3.
   c. Wait for the power meter reading to settle.
   d. Record the power meter reading in the calculation sheet.
10. Calculate the test results using the equation given in the calculation sheet. Record the test results in the performance test record.

5. HARMONICS/NON-HARMONIC SPURIOUS TEST (NA)

Description

This test sets the 4396B RF OUT signal power to +15 dBm and uses a spectrum analyzer to measure the RF OUT signal's second harmonic and non-harmonic spurious at several frequencies. The RF OUT signal frequency is set to values where harmonics and non-harmonic spurious are most likely to be observed.

Specification

Spectral Purity Characteristics

Harmonics

@+15 dBm output .... <−30 dBc

Non-harmonics spurious

@+15 dBm output .... <−30 dBc

Test Equipment

Spectrum Analyzer 8566A/B
N(m)-N(m) cable, 61 cm .... 11500B or part of 11851B
BNC(m)-BNC(m) cable, 122 cm .... PN 8120-1840

Procedure

1. Connect the test equipment as shown in Figure 2-5.

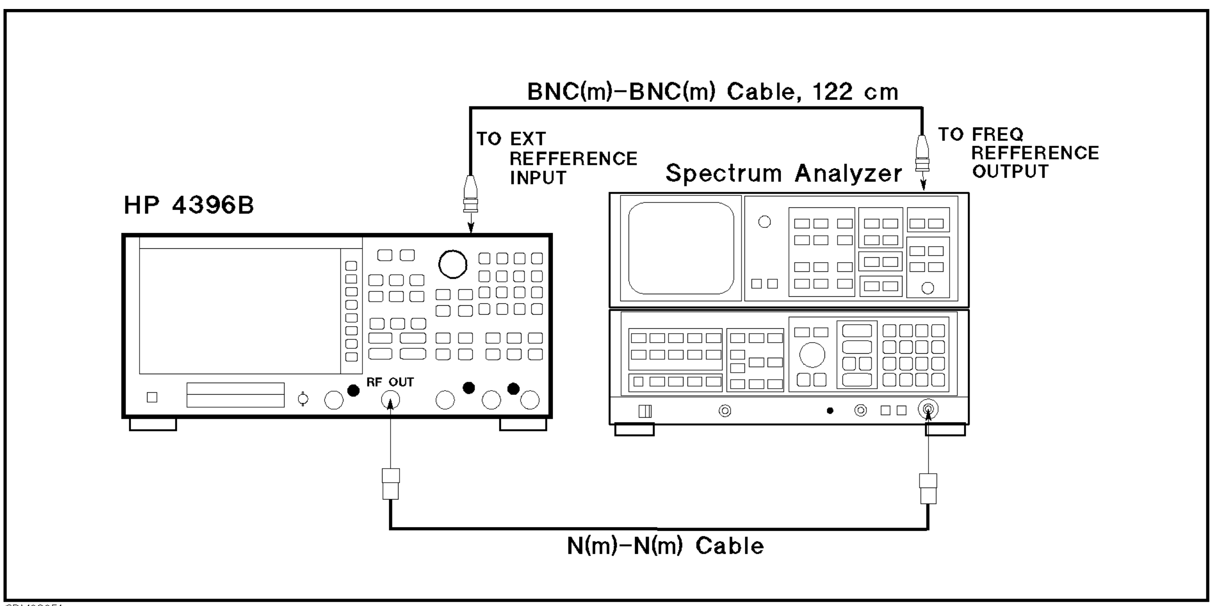

Figure 2-5. Harmonics Test Setup

Note Connect the spectrum analyzer's 10 MHz frequency reference output to the 4396B EXT REF Input on the rear panel as shown in Figure 2-5. With this configuration, both the spectrum analyzer and the 4396B are phase locked to the same reference frequency to eliminate frequency offset errors.

2. Initialize the spectrum analyzer. When an 8566B is used, perform the FREQ ZERO calibration in accordance with the spectrum analyzer manual.

3. On the spectrum analyzer, set the controls as follows:

Controls	**Settings**
Frequency Span	100 kHz
Reference Level	+20 dBm
Input Attenuator	50 dB

4. Press (Meas), ANALYZER TYPE, NETWORK ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	**Key Strokes**
Frequency Span: 0 Hz	(Span), ZERO SPAN
Source Power: +15 dBm	(Source), POWER, (1), (5), (x1)
IF BW: 1 kHz	(Bw/Avg), IF BW, (1), (k/m)

5. **—Harmonics Test—**

a. On the 4396B, press (Center), (1), (0), (0), (k/m) to set the center frequency to the first center frequency listed in the first column of Table 2-4. Table 2-4 lists test frequencies.

Table 2-4. Harmonics Test Settings

4396B Center Frequency	Second Harmonic Frequency
100 kHz	200 kHz
500 MHz	1 GHz
1.8 GHz	3.6 GHz

b. On the spectrum analyzer, perform the following steps to measure the second harmonic level of the first test frequency 100 kHz.

i. Press (CENTER FREQUENCY), (1), (0), (0), (kHz) to set the center frequency to the same value as the 4396B center frequency.
ii. Press (SINGLE) to make a sweep. Wait for the completion of the sweep.
iii. Press (PEAK SEARCH), (Δ) to move the marker to the peak of the fundamental signal and to place the delta maker reference at the peak.
iv. Press (CENTER FREQUENCY), (2), (0), (0), (kHz) to change the center frequency to the second harmonics frequency listed in the second column of Table 2-4.
v. Press (SINGLE) to make a sweep. Wait for the completion of the sweep.
vi. Press (PEAK SEARCH) to move the marker to the peak of the second harmonic.
vii. Record the delta marker reading in the performance test record ("Test Result" column).

c. On the 4396B, press (Center), (5), (0), (0), (M/μ) to set the center frequency to the second test frequency 500 MHz.

d. On the spectrum analyzer, perform the following steps to measure the second harmonic level.

i. Press (CENTER FREQUENCY), (5), (0), (0), (MHz).
ii. Press (SINGLE) to make a sweep. Wait for the completion of the sweep.
iii. Press (PEAK SEARCH), (NORMAL), (Δ).
iv. Press (CENTER FREQUENCY), (1), (GHz).
v. Press (SINGLE) to make a sweep. Wait for the completion of the sweep.

vi. Press (PEAK SEARCH).
vii. Record the delta marker reading in the performance test record ("Test Result" column).

e. On the 4396B, press (Center), (1), (.), (8), (G/n) to set the center frequency to the third test frequency 1.8 GHz.

f. On the spectrum analyzer, perform the following steps to measure the second harmonic level.

i. Press (CENTER FREQUENCY), (1), (.), (8), (GHz).
ii. Press (SINGLE) to make a sweep. Wait for the completion of the sweep.
iii. Press (PEAK SEARCH), (NORMAL), (Δ).
iv. Press (CENTER FREQUENCY), (3), (.), (6), (GHz).
v. Press (SINGLE) to make a sweep. Wait for the completion of the sweep.
vi. Press (PEAK SEARCH).
vii. Record the delta marker reading in the performance test record ("Test Result" column).

6. **—Non-Harmonic Spurious Test—**

a. On the 4396B, press (Center), (5), (0), (0), (M/μ) to set the center frequency to the first center frequency 500 MHz listed in the first column of Table 2-5. Table 2-5 lists test frequencies.

Table 2-5. Non-Harmonic Spurious Test Settings

4396B Center Frequency	Non-Harmonic Spurious Frequency
500 MHz	478.58 MHz
	521.42 MHz
	1558.58 MHz
1800 MHz	258.58 MHz
	1778.58 MHz
	1821.42 MHz
	2058.58 MHz
	3858.58 MHz

b. On the spectrum analyzer, perform the following steps to measure the non-harmonic spurious level of the first test frequency 500 MHz.

i. Press (CENTER FREQUENCY), (5), (0), (0), (MHz) to set the center frequency to the same value as the 4396B center frequency.
ii. Press (SINGLE) to make a sweep. Wait for the completion of the sweep.
iii. Press (PEAK SEARCH), (NORMAL), (Δ) to move the marker to the peak of the fundamental signal and to place the delta maker reference at the peak.
iv. Press (CENTER FREQUENCY), (4), (7), (8), (.), (5), (8), (MHz) to change the center frequency to the first non-harmonics spurious frequency listed in the second column of Table 2-5.
v. Press (SINGLE) to make a sweep. Wait for the completion of the sweep.
vi. Press (PEAK SEARCH) to move the marker to the peak of the non-harmonic spurious.
vii. Record the delta marker reading in the performance test record ("Test Result" column).
viii. Press (CENTER FREQUENCY), (5), (2), (1), (.), (4), (2), (MHz) to change the center frequency to the next non-harmonic spurious frequency.
ix. Press (SINGLE) to make a sweep. Wait for the completion of the sweep.

x. Press PEAK SEARCH.
xi. Record the delta marker reading in the performance test record (“Test Result” column).
xii. Press CENTER FREQUENCY, 1, 5, 5, 8, ., 5, 8, MHz to change the center frequency to the next non-harmonic spurious frequency.
xiii. Press SINGLE to make a sweep. Wait for the completion of the sweep.
xiv. Press PEAK SEARCH.
xv. Record the delta marker reading in the performance test record (“Test Result” column).

c. On the 4396B, press Center, 1, ., 8, G/n to set the center frequency to the second center frequency 1.8 GHz in the first column of Table 2-5.

d. On the spectrum analyzer, perform the following steps to measure the non-harmonic spurious level of the test frequency 1.8 GHz.

i. Press CENTER FREQUENCY, 1, ., 8, G/n.
ii. Press SINGLE to make a sweep. Wait for the completion of the sweep.
iii. Press PEAK SEARCH, NORMAL, Δ.
iv. Press CENTER FREQUENCY, 2, 5, 8, ., 5, 8, MHz.
v. Press SINGLE to make a sweep. Wait for the completion of the sweep.
vi. Press PEAK SEARCH.
vii. Record the delta marker reading in the performance test record (“Test Result” column).
viii. Press CENTER FREQUENCY, 1, 7, 7, 8, ., 5, 8, MHz.
ix. Press SINGLE to make a sweep. Wait for the completion of the sweep.
x. Press PEAK SEARCH.
xi. Record the delta marker reading in the performance test record (“Test Result” column).
xii. Press CENTER FREQUENCY, 1, 8, 2, 1, ., 4, 2, MHz.
xiii. Press SINGLE to make a sweep. Wait for the completion of the sweep.
xiv. Press PEAK SEARCH.
xv. Record the delta marker reading in the performance test record (“Test Result” column).
xvi. Press CENTER FREQUENCY, 2, 0, 5, 8, ., 5, 8, MHz.
xvii. Press SINGLE to make a sweep. Wait for the completion of the sweep.
xviii. Press PEAK SEARCH.
xix. Record the delta marker reading in the performance test record (“Test Result” column).
xx. Press CENTER FREQUENCY, 3, 8, 5, 8, ., 5, 8, MHz.
xxi. Press SINGLE to make a sweep. Wait for the completion of the sweep.
xxii. Press PEAK SEARCH.
xxiii. Record the delta marker reading in the performance test record (“Test Result” column).

6. RECEIVER NOISE LEVEL TEST (NA)

Description

This test measures the 4396B receiver noise levels (noise floor) in the network analyzer mode at IF BW 10 Hz and 40 kHz. This measures the noise level using the marker statistics function (mean) when the inputs are terminated.

In this test, the noise level (trace mean value) is measured in linear format [Unit]. Then the measured values are converted to log magnitude format [dBm]. This is done to avoid skewing the data with the marker statistics function.

The receiver noise level at IF BW 10 Hz is measured using IF BW 1 kHz. The measured values are converted (−20 dB) to the value of the IF BW 10 Hz. The noise sources depend mainly on the used signal path within the analyzer. The signal path for IF BW 1 kHz is the same as that for the IF BW 10 Hz. A digital filter technique is used at both IF BW settings. Therefore, the receiver noise level at 10 Hz can be calculated mathematically from the noise level at IF BW 1 kHz. The measurement using IF BW 1 kHz reduces the measurement time. The signal path for IF BW 40 kHz is different from that for IF BW ≤ 3 kHz. Therefore, the receiver noise level at IF BW 40 kHz is tested.

Specification

Noise level

Frequency	Input	Noise Level @IFBW = 10 Hz	Noise Level @IFBW = 40 kHz[1]
100 k ≤ freq. < 10 MHz	R	<−85 dBm	<−50 dBm
100 k ≤ freq. < 10 MHz	A, B	<−110 dBm	<−75 dBm
10 MHz ≤ freq.	R	<[−100 + 3f] dBm[2]	<[−65 + 3f] dBm[2]
10 MHz ≤ freq.	A, B	<[−125 + 3f] dBm[2]	<[−90 + 3f] dBm[2]

1 : Frequency range at IFBW 40 kHz is from 1 MHz to 1.8 GHz.

2 : f is measurement frequency (GHz).

Test Equipment

50Ω termination, type-N(m) (three required) .... 909C Opt 012 or part of 85032B

Procedure

1. Connect the test equipment as shown in Figure 2-6.

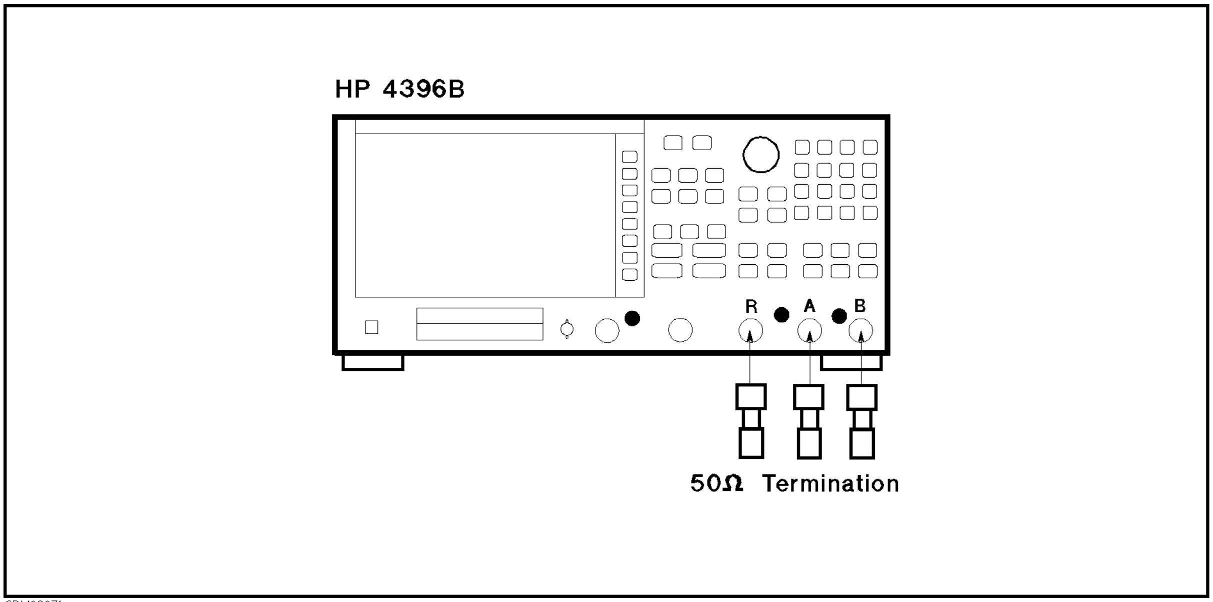

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Figure 2-6. Receiver Noise Level Test Setup

2. Press (Meas), ANALYZER TYPE, NETWORK ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	Key Strokes
Input: R	(Meas), R
Format: LINEAR	(Format), LIN MAG
Scale/Division: 1 mU	(Scale Ref), SCALE/DIV, (1), (k/m)
Input: A	(Meas), A
Format: LINEAR	(Format), LIN MAG
Scale/Division: 1 mU	(Scale Ref), SCALE/DIV, (1), (k/m)
Input: B	(Meas), B
Format: LINEAR	(Format), LIN MAG
Scale/Division: 1 mU	(Scale Ref), SCALE/DIV, (1), (k/m)
RF OUT Power: OFF	(Source), RF OUT ON off (Then the softkey label changes to RF OUT on OFF.)
Frequency Span: 0 Hz	(Span), ZERO SPAN
Number of Points: 801	(Sweep), NUMBER of POINTS (8), (0), (1), (x1)
Statistics: ON	(Utility), STATISTICS on OFF (Then the softkey label changes to STATISTICS ON off.)

3. Press (Bw/Avg), IF BW, (1), (k/m) to set the 4396B IF BW to 1 kHz.

4. Press (Center), (1), (0), (0), (k/m) to set the 4396B center frequency to the first center frequency 100 kHz listed in Table 2-6. Table 2-6 lists test frequencies for the receiver noise level test at IF BW 10 Hz.

Table 2-6. Receiver Noise Test Settings

4396B Center Frequency
100 kHz
1 MHz
10 MHz
100 MHz
500 MHz
1.0 GHz
1.4 GHz
1.8 GHz

5. Perform the following steps to measure the receiver noise level.
   a. Press (Meas), R to set the 4396B input to R input.
   b. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
   c. Record the 4396B trace mean value [Unit] in the calculation sheet ("Trace Mean [Unit]" column). The trace mean value is displayed as a marker statistic (mean) in the upper right-hand corner of the display.
   d. Press (Meas), A to set the 4396B to A input.
   e. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
   f. Record the 4396B trace mean value [Unit] in the calculation sheet ("Trace Mean [Unit]" column).
   g. Press (Meas), B to set the 4396B input to B input.
   h. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
   i. Record the 4396B trace mean value [Unit] in the calculation sheet ("Trace Mean [Unit]" column).
6. Change the 4396B center frequency in accordance with Table 2-6, and repeat step 5 for each setting.
7. Press (Bw/Avg), IF BW, (4), (0), (k/m) to set the 4396B IF BW to 40 kHz.
8. Press (Center), (1), (M/μ) to set the 4396B center frequency to the first center frequency 1 MHz listed in Table 2-7. Table 2-7 lists test frequencies for the receiver noise level test at IF BW 40 kHz.

Table 2-7. Receiver Noise Test Settings 2

4396B Center Frequency
1 MHz
10 MHz
100 MHz
500 MHz
1.0 GHz
1.4 GHz
1.8 GHz

9. Repeat step 5 to measure the receiver noise level.

10. Change the 4396B center frequency in accordance with Table 2-6, and repeat step 5 for each setting.
11. Convert the unit of the test results from [Unit] to [dBm] using the equation given in the calculation sheet. Record the test results [dBm] in the performance test record.

7. INPUT CROSSTALK TEST (NA)

Description

This test measures the crosstalk (signal leakage interference) between two inputs of the 4396B R, A, and B inputs when RF OUT signal is supplied to one input and the other is terminated.

Specification

Input crosstalk

@≥300 kHz

A to/from B .... <−100 dB

R to A, B .... <−120 dB

A, B to R .... <−80 dB

Test Equipment

N(m)-N(m) cable, 61 cm .... 11500B or part of 11851B

50Ω termination, type-N(m) (two required) .... 909C Opt 012 or part of 85032B

Procedure

1. Press (Meas), ANALYZER TYPE, NETWORK ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	Key Strokes
Dual Channel: ON	(Display), DUAL CHAN on OFF (Then the softkey label changes to DUAL CHAN ON off.)
Start Frequency: 300 kHz	(Start), (3), (0), (0), (k/m)

2. **—R into A Crosstalk and R into B Crosstalk—**

   a. Connect the test equipment as shown in Figure 2-7.

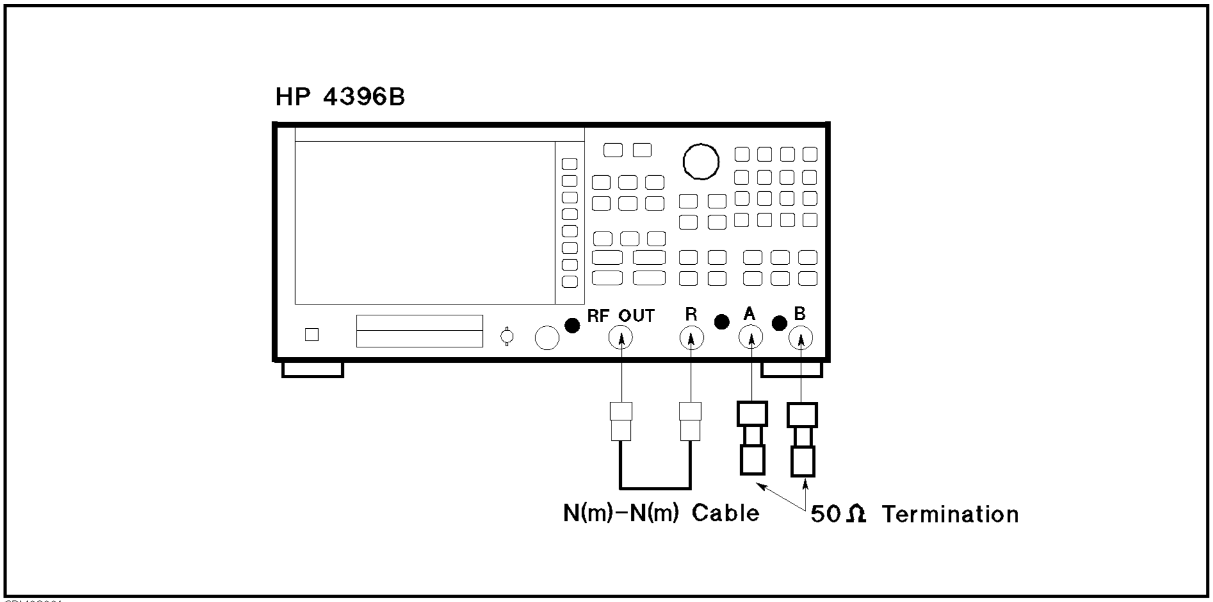

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Figure 2-7. Input Crosstalk Test Setup 1

b. Set the 4396B controls as follows:

Control Settings	**Key Strokes**
Active Channel: CH 1	(Ch 1)
Input: A/R	(Meas), A/R
Reference Value: −100 dB	(Scale Ref), REFERENCE VALUE, (-), (1), (0), (0), (x1)
Active Channel: CH 2	(Ch 2)
Input: B/R	(Meas), B/R
Reference Value: −100 dB	(Scale Ref), REFERENCE VALUE, (-), (1), (0), (0), (x1)
Source Power: +20 dBm	(Source), POWER, (2), (0), (x1)
IF BW: 10 Hz	(Bw/Avg), IF BW, (1), (0), (x1)

c. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

d. Press (Ch 1), (Search), MAX to move the channel 1 marker to the maximum point on the trace (A/R).

e. Record the marker reading in the performance test record ("Test Result" column for R into A crosstalk).

f. Press (Ch 2), (Search), MAX to move the channel 2 marker to the maximum point on the trace (B/R).

g. Record the marker reading in the performance test record ("Test Result" column for R into B crosstalk).

3. **—A into R Crosstalk and A into B Crosstalk—**

a. Press (Source), POWER, (-), (5), (x1) to set the source power to −5 dBm.

b. Connect the test equipment as shown in Figure 2-8.

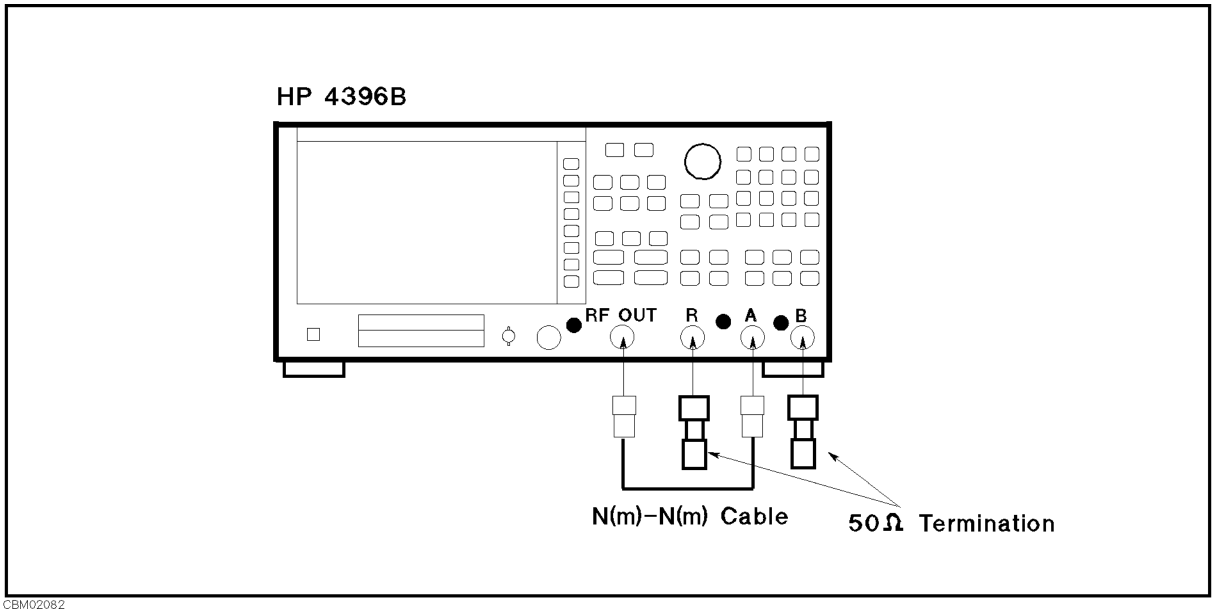

Figure 2-8. Input Crosstalk Test Setup 2

c. Change the 4396B controls as follows:

Control Settings	Key Strokes
Active Channel: CH 1	(Ch 1)
Input: A	(Meas), A
Active Channel: CH 2	(Ch 2)
Input: A	(Meas), A
IF BW: 1 kHz	(Bw/Avg), IF BW, (1), (k/m)

d. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

e. Set the 4396B controls as follows:

Control Settings	Key Strokes
Active Channel: CH 1	(Ch 1)
Data→Memory	(Display), DATA→MEMORY (A beep indicates that the trace is stored.)
Data Math: DATA−MEM	(Display), DATA MATH [DATA], DATA−MEM
Reference Value: −100 dB	(Scale Ref), REFERENCE VALUE, (-), (1), (0), (0), (x1)
Input: R	(Meas), R
Active Channel: CH 2	(Ch 2)
Data→Memory	(Display), DATA→MEMORY (A beep indicates that the trace is stored.)
Data Math: DATA−MEM	(Display), DATA MATH [DATA], DATA−MEM
Reference Value: −100 dB	(Scale Ref), REFERENCE VALUE, (-), (1), (0), (0), (x1)

Input: B	(Meas), B
IF BW: 10 Hz	(Bw/Avg), IF BW, (1), (0), (x1)

f. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

g. Press (Ch 1), (Search), MAX to move the channel 1 marker to the maximum point on the trace (R/Memory).

h. Record the marker reading in the performance test record ("Test Result" column for A into R crosstalk).

i. Press (Ch 2), (Search), MAX to move the channel 2 marker to the maximum point on the trace (B/Memory).

j. Record the marker reading in the performance test record ("Test Result" column for A into B crosstalk).

4. **—B into R Crosstalk and B into A Crosstalk—**

a. Connect the test equipment as shown in Figure 2-9.

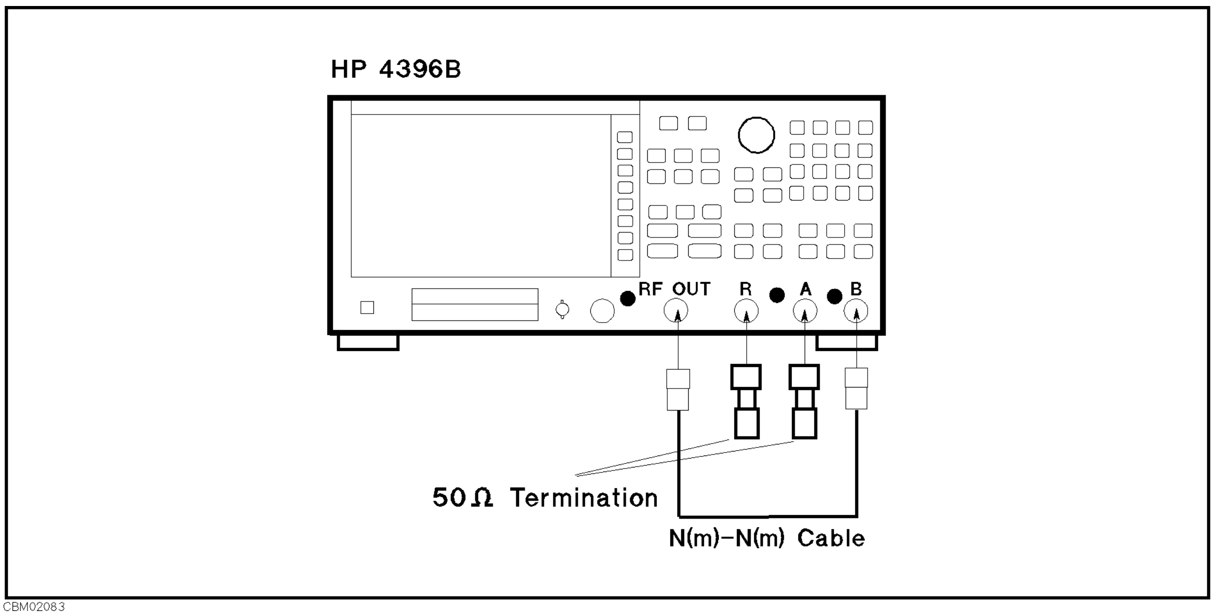

Figure 2-9. Input Crosstalk Test Setup 3

b. Change the 4396B controls as follows:

Control Settings	**Key Strokes**
Active Channel: CH 1	(Ch 1)
Input: B	(Meas), B
Data Math: DATA	(Display), DATA MATH [D−M], DATA MATH: DATA
Active Channel: CH 2	(Ch 2)
Input: B	(Meas), B
Data Math: DATA	(Display), DATA MATH [D−M], DATA MATH: DATA
IF BW: 1 kHz	(Bw/Avg), IF BW, (1), (k/m)

c. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

d. Set the 4396B controls as follows:

Control Settings	**Key Strokes**
Active Channel: CH 1	(Ch 1)
Data→Memory	(Display), DATA→MEMORY (A beep indicates that the trace is stored.)
Data Math: DATA−MEM	(Display), DATA MATH [DATA] , DATA−MEM
Reference Value: −100 dB	(Scale Ref), REFERENCE VALUE , (-), (1), (0), (x1)
Input: R	(Meas), R
Active Channel: CH 2	(Ch 2)
Data→Memory	(Display), DATA→MEMORY (A beep indicates that the trace is stored.)
Data Math: DATA−MEM	(Display), DATA MATH [DATA] , DATA−MEM
Reference Value: −100 dB	(Scale Ref), REFERENCE VALUE , (-), (1), (0), (x1)
Input: A	(Meas), A
IF BW: 10 Hz	(Bw/Avg), IF BW , (1), (0), (x1)

e. Press (Trigger), SINGLE to make a sweep. Wait for completion of the sweep.

f. Press (Ch 1), (Search), MAX to move the channel 1 marker to the maximum point on the trace (R/Memory).

g. Record the marker reading in the performance test record ("Test Result" column for B into R crosstalk).

h. Press (Ch 2), (Search), MAX to move the channel 2 marker to the maximum point (A/Memory).

i. Record the marker reading in the performance test record ("Test result" column for B into A crosstalk).

8. INPUT IMPEDANCE TEST (NA)

Description

This test uses a network analyzer and a T/R test set to measure the return losses of the 4396B R, A, and B inputs. One-port full calibration is performed to measured the return loss accurately.

The 4396B has no capability for making an A/B measurement. The 4396B can measure the return loss of the B (or A) input using A/R (or B/R) measurement capability of the 4396B. However, it cannot measure the R input's return loss. Therefore, a network analyzer is used in this test.

Specification

Return loss
@frequency $\geq$ 500 kHz .... >20 dB

Test Equipment

Network Analyzer 8753A/B/C
T/R Test Set 85044A
50Ω Type-N Calibration Kit .... 85032B[1]
APC 7-N(f) adapter .... 11524A or part of 85032B
N(m)-N(m) cable, 61 cm (four required) .... 11500B or part of 11851B

1: This calibration kit includes several terminations and adapters. This test requires the OPEN(f), SHORT(f), LOAD(f) in the calibration kit 85032B.

Procedure

1. Connect the test equipment as shown in Figure 2-10. Don't connect anything to the end of the test port cable.

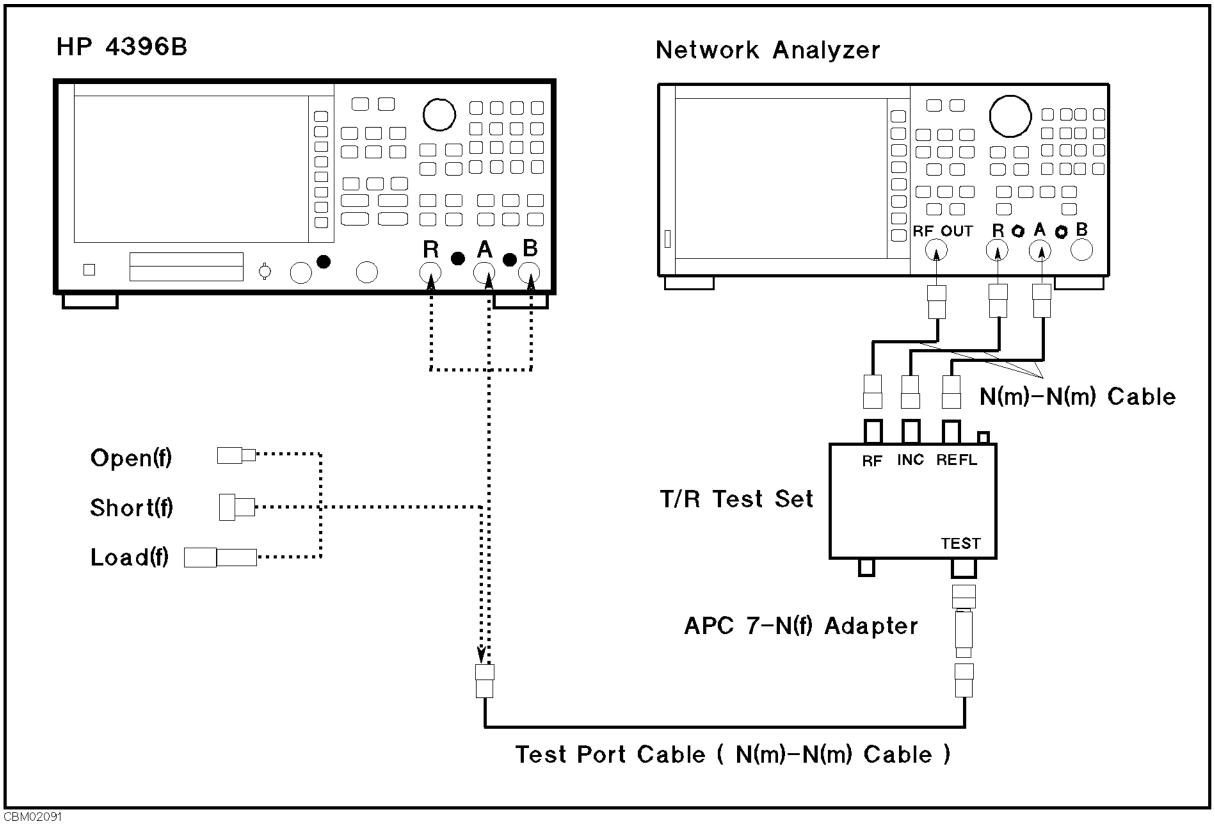

Figure 2-10. Impedance Test Setup

2. Press (Meas), ANALYZER TYPE, NETWORK ANALYZER, (Preset) to initialize the 4396B.
3. On the network analyzer, perform the following steps to set the network analyzer controls to measure the return loss.
   a. Press (Preset) to initialize the network analyzer.
   b. Press (MENU), POWER, (-), (1), (x1).
   c. Press (START), (5), (0), (0), (k/m).
   d. Press (STOP), (1), (.), (8), (G/n).
   e. Press (CAL), CAL KIT [7mm], N 50Ω, RETURN, CALIBRATION MENU, S11 1-PORT to initiate a calibration.
   f. Connect a type N(f) open to the end of the test port cable.
   g. Press (S11):OPENS, OPEN (M). Wait until a beep sounds. Then press DONE:OPENS.
   h. Remove the open from the test port cable and connect a type N(f) short to the test port cable.
   i. Press SHORTS, SHORT (M). Wait until a beep sounds. Then press DONE:SHORTS.
   j. Remove the short from the test port cable and connect a type N(f) 50 Ω load to the test port cable.
   k. Press LOAD. Wait until a beep sounds.
   l. Press DONE:1-PORT CAL to complete the calibration sequence.
   m. Remove the type N(f) 50 Ω load from the test port cable
4. Connect the test port cable to the 4396B R input.

5. On the network analyzer, press (MENU), TRIGGER MENU, SINGLE to make a sweep. Wait for the completion of the sweep.
6. On the network analyzer, press (MKR FCTN), MKR SEARCH [OFF], MAX to move the marker to the maximum point on the trace.
7. Record the network analyzer's marker reading (with an opposite sign) in the performance test record ("Test Result" column).
8. Remove the test port cable from the 4396B R input and connect it to the A input.
9. On the network analyzer, press (MENU), TRIGGER MENU, SINGLE to make a sweep. Wait for the completion of the sweep.
10. On the network analyzer, press (MKR FCTN), MKR SEARCH [OFF], MAX to move the marker to the maximum point on the trace.
11. Record the network analyzer's marker reading (with an opposite sign) in the performance test record ("Test Result" column).
12. Remove the test port cable from the 4396B A input and connect it to the B input.
13. On the network analyzer, press (MENU), TRIGGER MENU, SINGLE to make a sweep. Wait for the completion of the sweep.
14. On the network analyzer, press (MKR FCTN), MKR SEARCH [OFF], MAX to move the marker to the maximum point on the trace.
15. Record the network analyzer's marker reading (with an opposite sign) in the performance test record ("Test Result" column).

9. ABSOLUTE AMPLITUDE ACCURACY TEST (NA)

Description

This test measures a test signal amplitude using the 4396B absolute amplitude measurement function in the network analyzer mode and using a power meter and a power sensor. Then it compares the 4396B reading with the reading of the power meter. The accuracy of the absolute amplitude measurement is verified over the entire frequency range.

In this test, the 4396B RF OUT signal is used as the test signal. The RF OUT signal is divided through a two-way power splitter and applied to an 4396B input and the power sensor input.

Specification

Absolute amplitude accuracy (R, A, B)

@−20 dBm input, 23±5°C .... <±1.5 dB

Test Equipment

Power Meter .... 436A Opt. 022, 437B, or 438A
Power Sensor 8482A
Two-way Power Splitter 11667A
N(m)-N(m) cable, 61 cm .... 11500B or part of 11851B
N(m)-N(m) adapter .... PN 1250-1475

Procedure

1. Connect the power sensor to the power meter. Calibrate the power meter for the power sensor.
2. Connect the test equipment as shown in Figure 2-11.

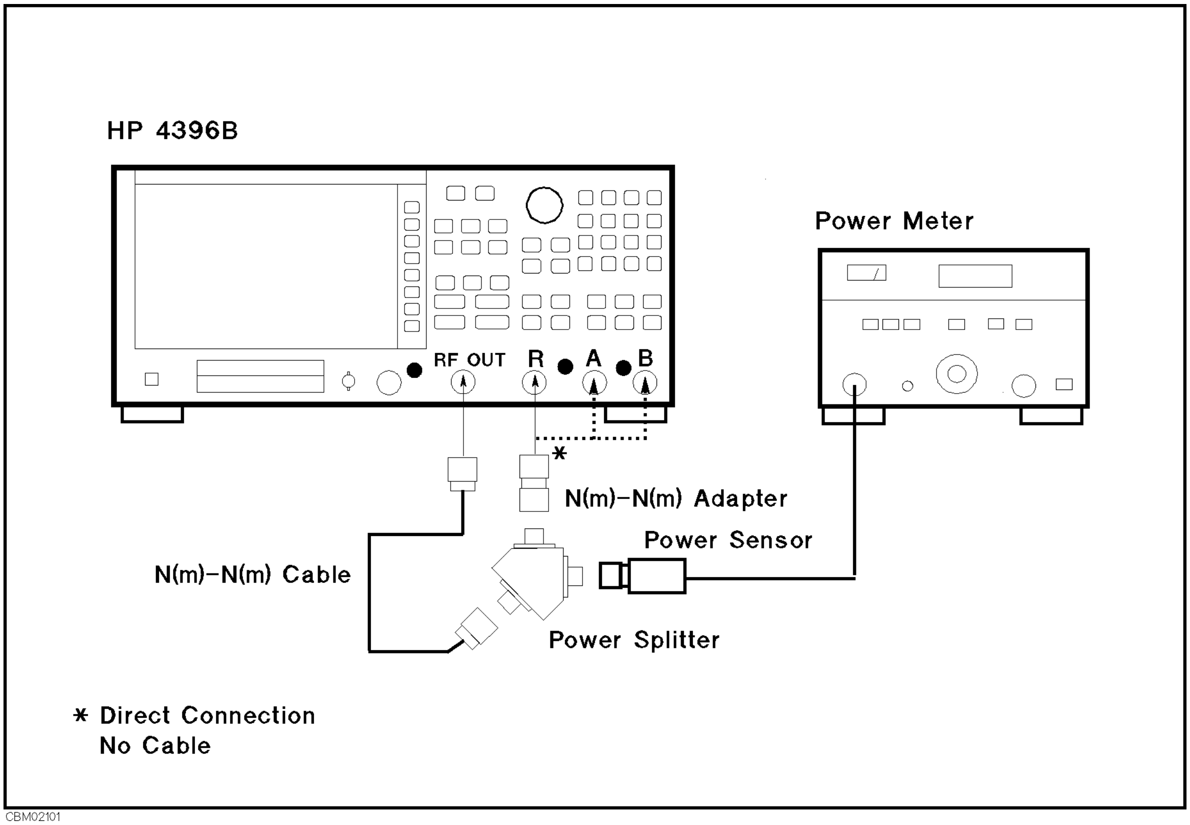

Figure 2-11. Absolute Amplitude Accuracy Test Setup

3. Press (Meas), ANALYZER TYPE, NETWORK ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	Key Strokes
Source Power: −14 dBm	(Source), POWER, (-), (1), (4), (x1)
IF BW: 100 Hz	(Bw/Avg), IF BW, (1), (0), (0), (x1)
Number of Points: 11	(Sweep), NUMBER of POINTS, (1), (1), (x1)
Frequency Span: 0 Hz	(Span), ZERO SPAN
Statistics: ON	(Utility), STATISTICS on OFF (Then the softkey label changes to STATISTICS ON off.)

4. Press (Meas), R to set the 4396B to the R input.

5. Perform the following steps to test the absolute amplitude accuracy at the R input.

   a. Press (Center), (1), (0), (0), (k/m) to set the 4396B center frequency to the first test frequency 100 kHz listed in Table 2-8. Table 2-8 lists test frequencies.

Table 2-8. Absolute Amplitude Accuracy Test Settings

4396B Center Frequency
100 kHz
1 MHz
10 MHz
50 MHz
100 MHz
1 GHz
1.79 GHz
1.8 GHz

b. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

c. Record the trace mean value and the power meter reading in the calculation sheet ("4396B Reading" column and "Power Meter Reading" column, respectively). The trace mean value is displayed as a marker statistic (mean) in the upper right-hand corner of the display.

d. Change the 4396B center frequency in accordance with Table 2-8, and repeat steps 5-b and 5-c for each center frequency.

6. Remove the power splitter from the R input, and connect it directly to the A input.
7. Press (Meas), A to set the 4396B to the A input.
8. Repeat step 5 to test the absolute amplitude accuracy at the 4396B A input.
9. Remove the power splitter from the A input, and connect it directly to the B input.
10. Press (Meas), B to set the 4396B to the B input.
11. Repeat step 5 to test the absolute amplitude accuracy at the B input.
12. Calculate the test results using the equation given in the calculation sheet. Record the test results in the performance test record.

10. MAGNITUDE RATIO/PHASE DYNAMIC ACCURACY TEST (NA)

Description

Dynamic accuracy is a measure of how well a receiver measures the magnitude and phase components of a signal as that signal varies in amplitude over a specified dynamic range.

To measure the dynamic accuracy, this test applies a fixed level signal of −35 dBm to the 4396B R input (reference input). At the same time, it applies a signal that varies from −5 dBm (full scale input level) to −105 dBm to one of the 4396B's A or B inputs (test input). It then measures the magnitude ratio from +30 dB to −70 dB and the phase of the signals.

The signal amplitude at the test input is varied by inserting known attenuation values. The measured magnitude ratio values are then compared to the inserted attenuation's calibrated values.

The phase dynamic accuracy is measured at 3 MHz (where the phase error contribution by the individual attenuator segments is small when compared to the test limits).

In this test, a step attenuator with its VSWR $\leq$ 1.02 and two 6 dB fixed attenuators with a VSWR $\leq$ 1.015 are used. Using these attenuators reduces the measurement uncertainties caused by mismatch error. When they are used, the measurement uncertainties listed in the performance test record are valid.

Specification

Magnitude ratio/phase dynamic accuracy (A/R, B/R)

Input Level (relative to full scale input level)[1]	Magnitude Ratio Dynamic Accuracy[2]	Phase Dynamic Accuracy[1]
0 dB	<±0.3 dB	<±3 deg
−10 dB	<±0.05 dB	<±0.6 deg
−20 dB	<±0.05 dB	<±0.3 deg
−30 dB	<±0.05 dB	<±0.3 deg
−40 dB	<±0.05 dB	<±0.3 deg
−50 dB	<±0.05 dB	<±0.3 deg
−60 dB	<±0.05 dB	<±0.3 deg
−70 dB	<±0.05 dB	<±0.3 deg
−80 dB	<±0.1 dB	<±0.7 deg
−90 dB	<±0.3 dB	<±2 deg
−100 dB	<±1.0 dB	<±7 deg

1 : full scale input level = −5 dBm

2 : @23±5°C, IFBW = 10 Hz, R input = −35 dBm, Reference power level=−35 dBm

Test Equipment

Two-way Power Splitter	11667A
Step Attenuator[1], 10 dB Step, VSWR $\leq$ 1.02	8496A/G Option 001 and H60
Attenuator driver[2]	11713A
6 dB Fixed Attenuation (two required)	8491A Opt 006
6 dB Fixed Attenuation, VSWR $\leq$ 1.015 (two required)	8491A Opt 006 & Opt H60
N(m)-N(m) cable, 61 cm (three required)	11500B or part of 11851B
N(m)-N(m) adapter	PN 1250-1475

1: Calibration values for attenuation settings of 10 dB to 70 dB at 50 MHz are required.

2: Required when using a programmable step attenuator 8496G.

Procedure

1. Record the step attenuator 50 MHz calibration values in the calculation sheet ("Calibration Value" column).
2. Press (Meas), ANALYZER TYPE, NETWORK ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	**Key Strokes**
Dual Channel: ON	(Display), DUAL CHAN on OFF (Then the softkey label changes to DUAL CHAN ON off.)
Marker: DISCRETE	(Marker), MKR [CONT] (Then the softkey label changes to MKR [DISCRETE].)
Start Frequency: 3 MHz	(Start), (3), (M/μ)
Stop Frequency: 50 MHz	(Stop), (5), (0), (M/μ)
IF BW: 10 Hz	(Bw/Avg), IF BW, (1), (0), (x1)
Number of Points: 2	(Sweep), NUMBER of POINTS, (2), (x1)
Calibration Kit: Type–N, 50 Ω	(Cal), CAL KIT [7mm], N 50Ω

3. **—A/R Dynamic Accuracy Test (Magnitude Ratio at 50 MHz and Phase at 3 MHz)—**
   a. Connect the test equipment as shown in Figure 2-12.

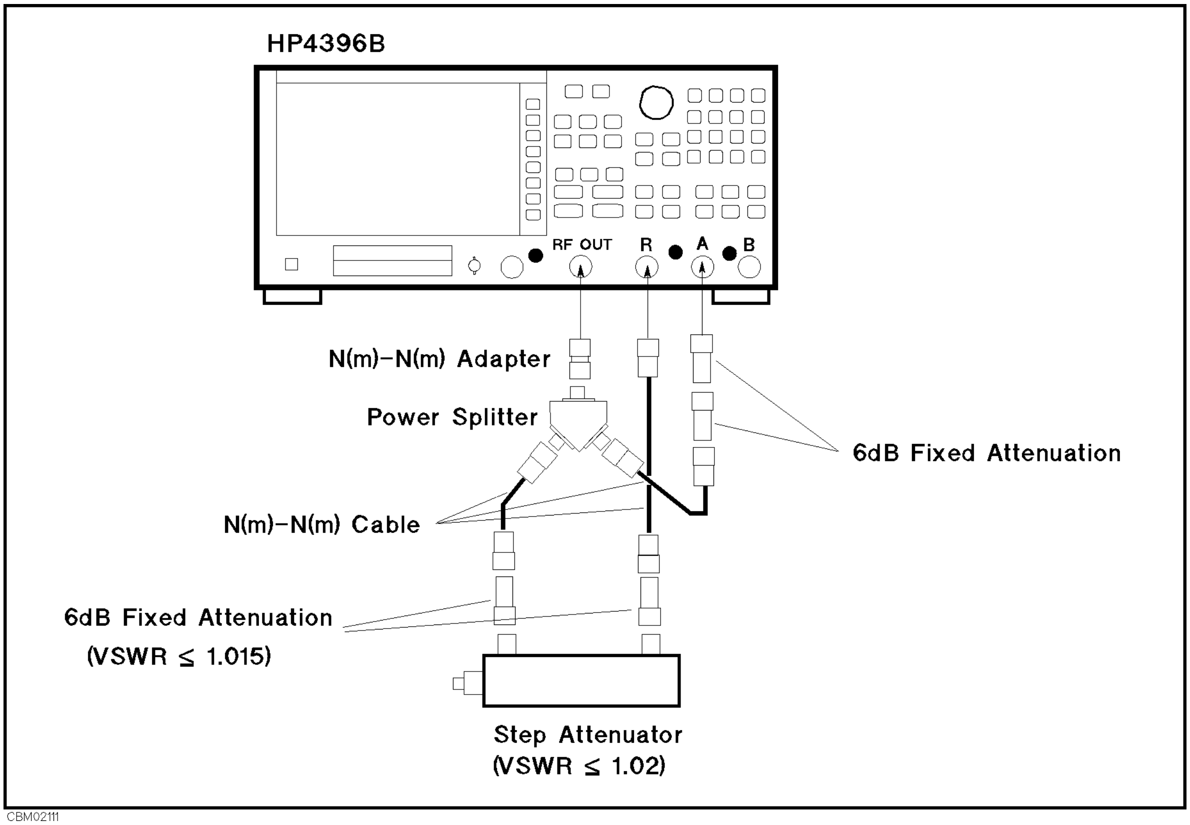

Figure 2-12. A/R Magnitude Ratio/Phase Dynamic Accuracy Test Setup 1

b. On the 4396B, set the controls as follows:

Control Settings	Key Strokes
Source Power: −17 dBm	(Source), POWER, (-), (1), (7), (x1)
Active Channel: CH 1	(Ch 1)
Input: A/R	(Meas), A/R
Format: LOG MAG	(Format), LOG MAG
Average Factor: 5	(Bw/Avg), AVERAGE FACTOR, (5), (x1)
Averaging: ON	(Bw/Avg), AVERAGE on OFF (Then the softkey label changes to AVERAGE ON off.)
Active Channel: CH 2	(Ch 2)
Input: A/R	(Meas), A/R
Format: PHASE	(Format), PHASE
Average Factor: 5	(Bw/Avg), AVERAGE FACTOR, (5), (x1)
Averaging: ON	AVERAGE on OFF (Then the softkey label changes to AVERAGE ON off.)

c. Set the step attenuator to 0 dB.

d. Press (Cal), CALIBRATION MENU, RESPONSE, THRU to perform the response (THRU) calibration. Wait for the completion of the sweep. Then press DONE:RESPONSE.

e. Set the step attenuator to the first setting 30 dB in the second column of Table 2-9.

Table 2-9. A/R Dynamic Accuracy Test Settings 1

4396B Input Level	Step Attenuator	4396B Source Power
0 dB	30 dB	+13 dBm
−10 dB	20 dB	+3 dBm
−20 dB	10 dB	−7 dBm

f. On the 4396B, press (Source), POWER, (1), (3), (x1) to set the source power to the first setting in the third columns of Table 2-9.

g. Perform the following steps to measure the dynamic accuracy.

i. Press (Trigger), NUMBER OF GROUPS, (5), (x1) to make a sweep. Wait for the completion of the sweep.
ii. Press (Marker), (⇑) to move the channel 1 marker to 50 MHz.
iii. Record the channel 1 marker reading in the calculation sheet for the magnitude ratio dynamic accuracy. Use the 4396B reading column corresponding to the input level in the first column of Table 2-9.
iv. Press (⇓) to move the channel 2 marker to 3 MHz.
v. Record the channel 2 marker reading directly in the performance test record. Use the test result column of the phase measurement corresponding to the input level in the first column of Table 2-9.

h. Change the step attenuator setting and 4396B power setting in accordance with the second and third columns of Table 2-9, and perform step 3-g for each setting.

i. Change the cable connection as shown in Figure 2-13.

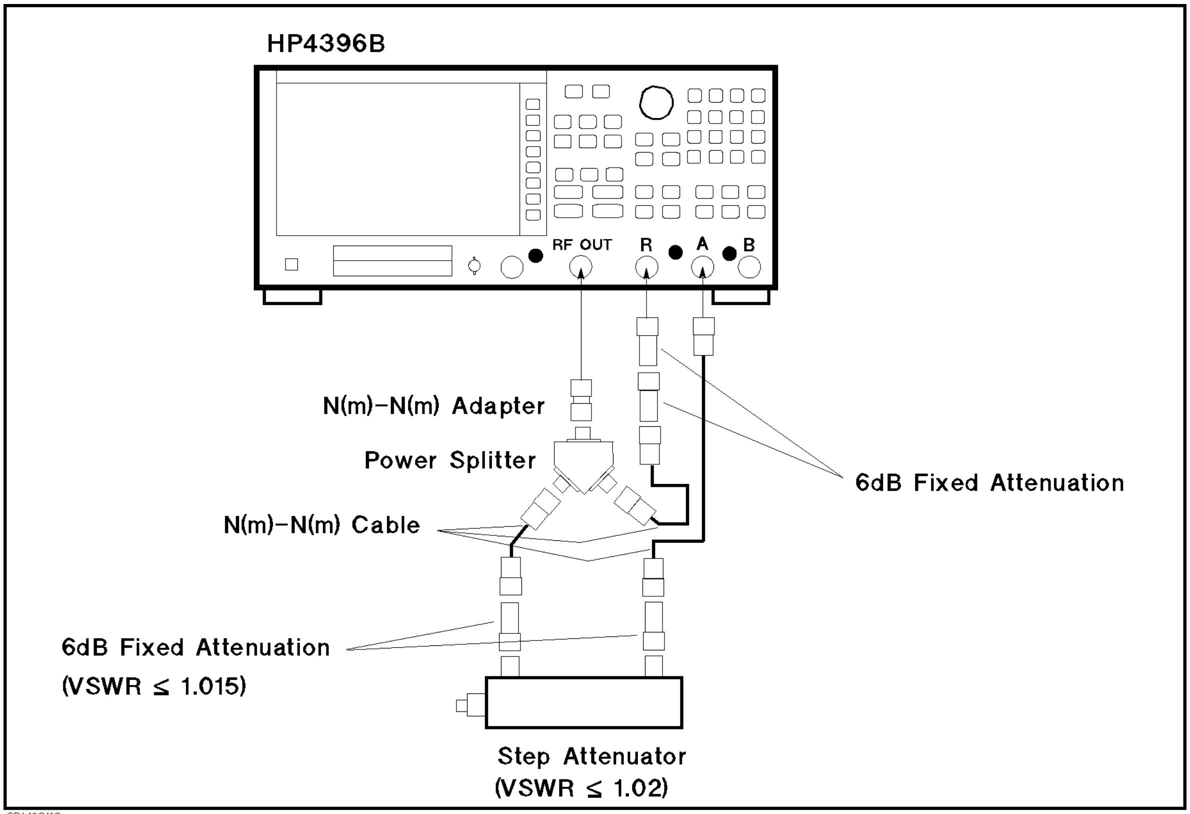

Figure 2-13. A/R Magnitude Ratio/Phase Dynamic Accuracy Test Setup 2

j. On the 4396B, set the controls as follows:

Control Settings	**Key Strokes**
Source Power: −17 dBm	(Source), POWER, (-), (1), (7), (x1)
Active Channel: CH 1	(Ch 1)
Average Factor: 10	(Bw/Avg), AVERAGE FACTOR, (1), (0), (x1)
Active Channel: CH 2	(Ch 2)
Average Factor: 10	(Bw/Avg), AVERAGE FACTOR, (1), (0), (x1)

k. Set the step attenuator to 0 dB.

l. Press (Cal), CALIBRATION MENU, RESPONSE, THRU to perform the response (THRU) calibration. Wait for the completion of the sweep. Then press DONE:RESPONSE.

m. Set the step attenuator to the first setting 10 dB in the second column of Table 2-10.

Table 2-10. A/R Dynamic Accuracy Test Settings 2

4396B Input Level	Step Attenuator
−40 dB	10 dB
−50 dB	20 dB
−60 dB	30 dB
−70 dB	40 dB
−80 dB	50 dB
−90 dB	60 dB
−100 dB	70 dB

n. Perform the following steps to measure the dynamic accuracy.

  i. Press (Trigger), NUMBER OF GROUPS, (1), (0), (x1) to make a sweep. Wait for the completion of the sweep.
  ii. Press (Marker), (⇧) to move the channel 1 marker to 50 MHz.
  iii. Record the channel 1 marker reading in the calculation sheet for the magnitude ratio dynamic accuracy. Use the 4396B reading column corresponding to the input level in the first column of Table 2-10.
  iv. Press (⇩) to move the channel 2 marker to 3 MHz.
  v. Record the channel 2 marker reading directly in the performance test record. Use the test result column of the phase measurement corresponding to the input level in the first column of Table 2-10.

o. Change the step attenuator setting in accordance with the second column of Table 2-10, and perform step 3-n for each setting.

4. **—B/R Dynamic Accuracy Test (Magnitude Ratio at 50 MHz and Phase at 3 MHz)—**

  a. Connect the test equipment as shown in Figure 2-14.

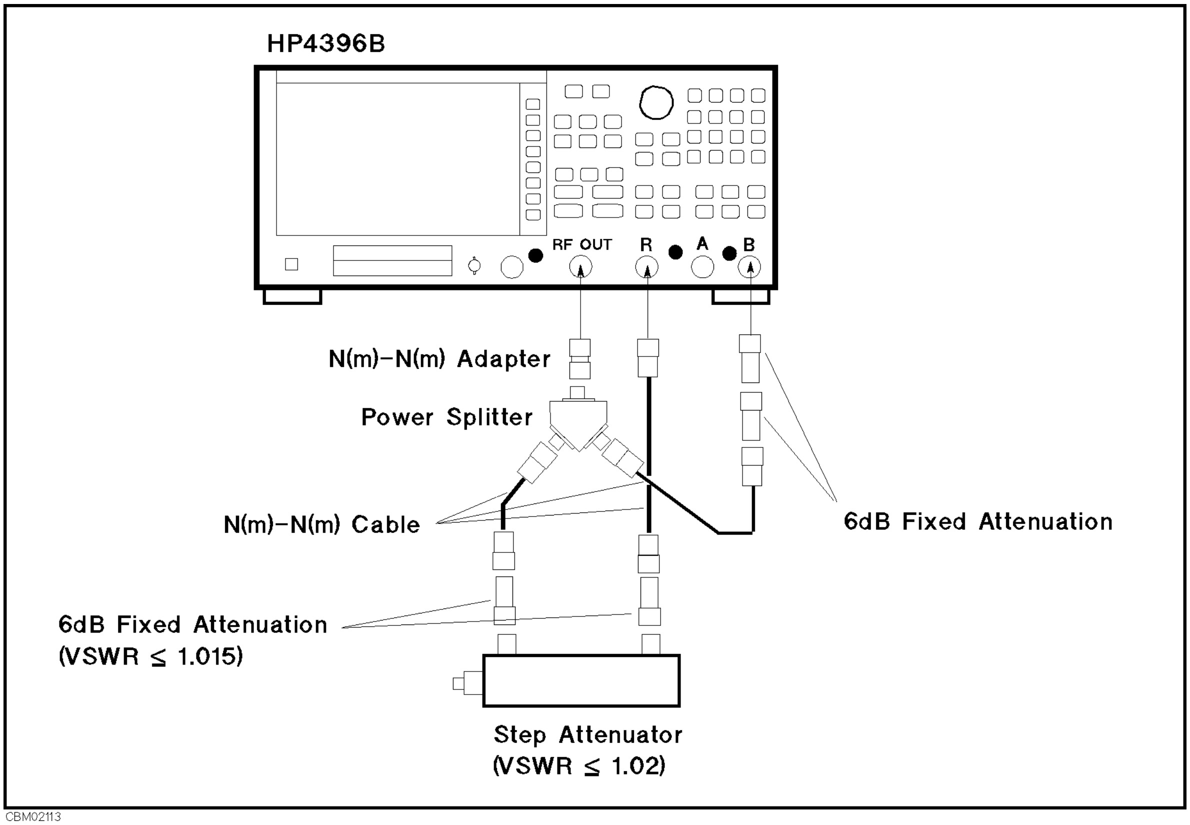

Figure 2-14. B/R Magnitude Ratio/Phase Dynamic Accuracy Test Setup 1

b. On the 4396B, set the controls as follows:

Control Settings	Key Strokes
Active Channel: CH 1	(Ch 1)
Input: B/R	(Meas), B/R
Format: LOG MAG	(Format), LOG MAG
Average Factor: 5	(Bw/Avg), AVERAGE FACTOR, (5), (x1)
Active Channel: CH 2	(Ch 2)
Input: B/R	(Meas), B/R
Format: PHASE	(Format), PHASE
Average Factor: 5	(Bw/Avg), AVERAGE FACTOR, (5), (x1)
Source Power: −17 dBm	(Source), POWER, (-), (1), (7), (x1)

c. Set the step attenuator to 0 dB.

d. Press (Cal), CALIBRATION MENU, RESPONSE, THRU to perform the response (THRU) calibration. Wait for the completion of the sweep. Then press DONE:RESPONSE.

e. Set the step attenuator to the first setting 30 dB in the second column of Table 2-11.

Table 2-11. B/R Dynamic Accuracy Test Settings 1

4396B Input Level	Step Attenuator	4396B Source Power
0 dB	30 dB	+13 dBm
−10 dB	20 dB	+3 dBm
−20 dB	10 dB	−7 dBm

f. On the 4396B, press (Source), POWER, (1), (3), (x1) to set the source power to the first setting +13 dBm in the third columns of Table 2-11.

g. Perform the following steps to measure the dynamic accuracy.

   i. Press (Trigger), NUMBER OF GROUPS, (5), (x1) to make a sweep. Wait for the completion of the sweep.
   ii. Press (Marker), (⇧) to move the channel 1 marker to 50 MHz.
   iii. Record the channel 1 marker reading in the calculation sheet for the magnitude ratio dynamic accuracy. Use the 4396B reading column corresponding to the input level in the first column of Table 2-11.
   iv. Press (⇩) to move the channel 2 marker to 3 MHz.
   v. Record the channel 2 marker reading directly in the performance test record. Use the test result column of the phase measurement corresponding to the input level in the first column of Table 2-11.

h. Change the step attenuator setting and 4396B power setting in accordance with the second and third columns of Table 2-11, and perform step 4-g for each setting.

i. Change the cable connection as shown in Figure 2-15.

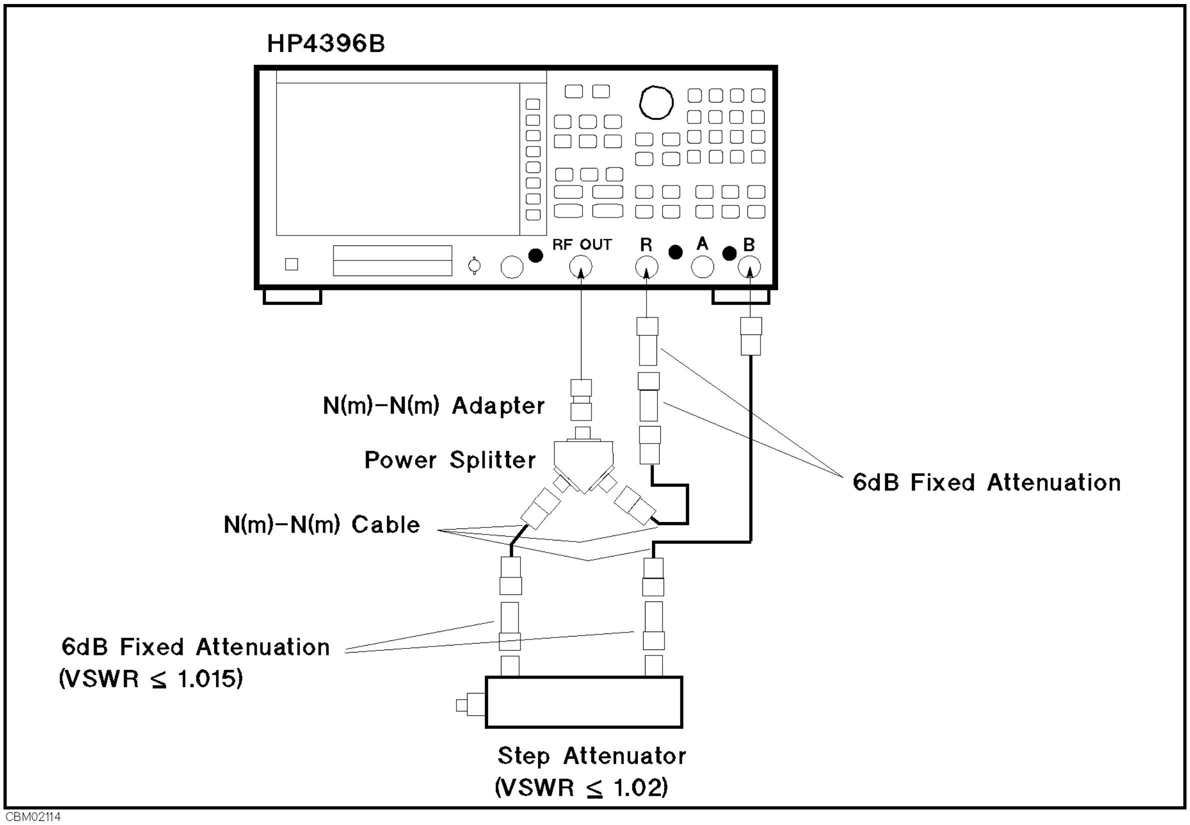

Figure 2-15. B/R Magnitude Ratio/Phase Dynamic Accuracy Test Setup 2

j. On the 4396B, set the controls as follows:

Control Settings	**Key Strokes**
Source Power: −17 dBm	(Source), POWER, (-), (1), (7), (x1)
Active Channel: CH 1	(Ch 1)
Average Factor: 10	(Bw/Avg), AVERAGE FACTOR, (1), (0), (x1)
Active Channel: CH 2	(Ch 2)
Average Factor: 10	(Bw/Avg), AVERAGE FACTOR, (1), (0), (x1)

k. Set the step attenuator to 0 dB.

l. Press (Cal), CALIBRATION MENU, RESPONSE, THRU to perform the response (THRU) calibration. Wait for the completion of the sweep. Then press DONE:RESPONSE.

m. Set the step attenuator to the first setting 10 dB in the second column of Table 2-12.

Table 2-12. B/R Dynamic Accuracy Test Settings 2

4396B Input Level	**Step Attenuator**
−40 dB	10 dB
−50 dB	20 dB
−60 dB	30 dB
−70 dB	40 dB
−80 dB	50 dB
−90 dB	60 dB
−100 dB	70 dB

n. Perform the following steps to measure the dynamic accuracy.

   i. Press (Trigger), NUMBER OF GROUPS, (1), (0), (x1) to make a sweep. Wait for the completion of the sweep.
   ii. Press (Marker), (⇑) to move the channel 1 marker to 50 MHz.
   iii. Record the channel 1 marker reading in the calculation sheet for the magnitude ratio dynamic accuracy. Use the 4396B reading column corresponding to the input level in the first column of Table 2-12.
   iv. Press (⇓) to move the channel 2 marker to 3 MHz.
   v. Record the channel 2 marker reading directly in the performance test record. Use the test result column of the phase measurement corresponding to the input level in the first column of Table 2-12.

o. Change the step attenuator setting in accordance with the second column of Table 2-12, and perform step 4-n for each setting.

5. Calculate the test results for the magnitude ratio dynamic accuracy test using the equations given in the calculation sheet. Record the test results in the performance test record.

11. MAGNITUDE RATIO/PHASE FREQUENCY RESPONSE TEST (NA)

Description

This test applies the RF OUT signal to the 4396B R input and either the A or B input through a power splitter. It then measures the magnitude ratio and phase of the A/R and B/R measurements. The magnitude ratio frequency response is measured as the deviation from the ideal magnitude ratio value of 0 dB. The phase frequency response is measured as the deviation from linear phase.

In this test, the frequency response is measured at two frequency ranges, from 100 kHz to 1 MHz and from 1 MHz to 1.8 GHz. This is done to measure the frequency response at a low frequency range using a linear frequency sweep mode. The frequency response at each frequency range is measured twice while reversing the connections of the power splitter's two output ports. The connections are reversed to remove the frequency tracking between the two signal paths (from the power splitter output port to the 4396B input port) from measured values. The frequency response without the tracking is calculated using equations provided in the calculation sheet.

Specification

Magnitude ratio accuracy (A/R, B/R)
@−20 dBm input, IF BW ≤ 3 kHz, 23±5°C
@100 k ≤ frequency < 1 MHz .... <±1 dB
@frequency ≥ 1 MHz .... <±0.5 dB
Phase frequency response (Deviation from Linear Phase) (A/R, B/R)
@−20 dBm input, IF BW ≤ 3 kHz, 23±5°C
100 k ≤ frequency < 1 MHz .... < ±6 deg
frequency ≥ 1 MHz .... < ±3 deg

Test Equipment

Two-way Power Splitter 11667A
RF cable kit .... 11851B[1]
N(m)-N(m) adapter .... PN 1250-1475

1: Includes three 61 cm N(m)-N(m) cables phase matched. Use two N(m)-N(m) phase matched cables in this test.

Procedure

1. Press (Meas), ANALYZER TYPE, NETWORK ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	Key Strokes
Active Channel: CH 2	(Ch 2)
Statistics: ON	(Utility), STATISTICS on OFF (Then the softkey label changes to STATISTICS ON off.)
Dual Channel: ON	(Display), DUAL CHAN on OFF (Then the softkey label changes to DUAL CHAN ON off.)
Source Power: −14 dBm	(Source), POWER, (-), (1), (4), (x1)

IF BW: 100 Hz	(Bw/Avg), IF BW, (1), (0), (0), (x1)

2. **—A/R Magnitude Ratio/Phase Frequency Response Test—**

a. Connect the test equipment as shown in setup 1 of Figure 2-16.

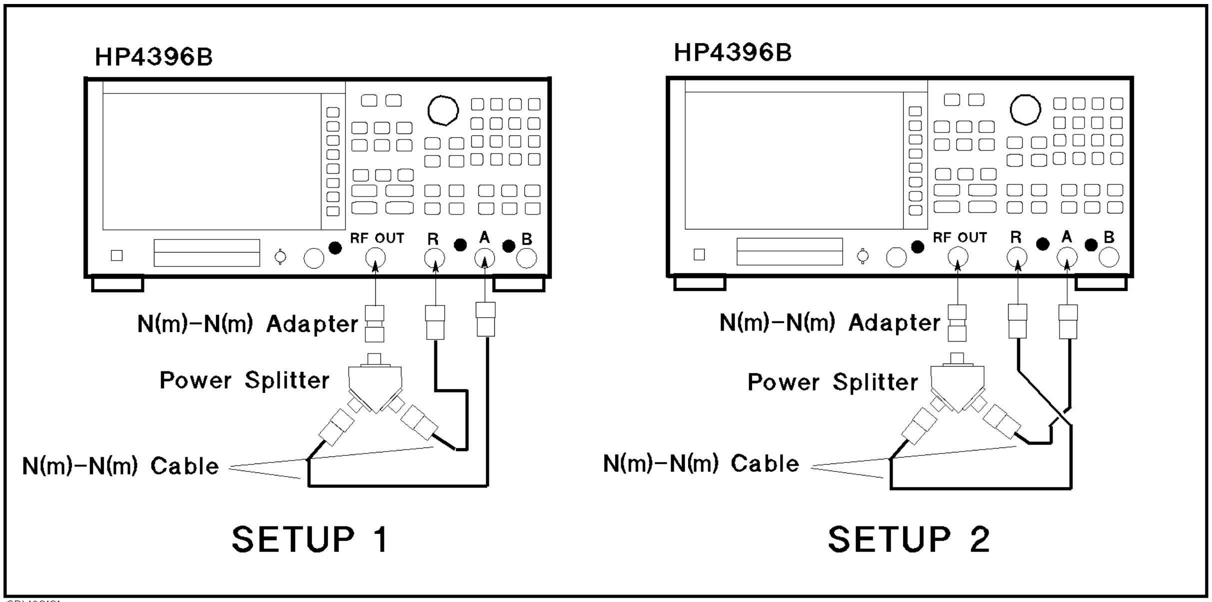

Figure 2-16. A/R Magnitude Ratio/Phase Frequency Response Test Setup

b. Set the 4396B controls as follows:

Control Settings	**Key Strokes**
Active Channel: CH 1	(Ch 1)
Input: A/R	(Meas), A/R
Format: LOG MAG	(Format), LOG MAG
Active Channel: CH 2	(Ch 2)
Input: A/R	(Meas), A/R
Format: PHASE	(Format), PHASE
Start Frequency: 100 kHz	(Start), (1), (0), (0), (k/m)
Stop Frequency: 1 MHz	(Stop), (1), (M/μ)
Number of Points: 50	(Sweep), NUMBER of POINTS, (5), (0), (x1)

c. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

d. Set the 4396B controls as follows:

Control Settings	**Key Strokes**
Active Channel: CH 1	(Ch 1)
Data→Memory	(Display), DATA→MEMORY (A beep indicates that the trace is stored.)
Active Channel: CH 2	(Ch 2)
Data→Memory	(Display), DATA→MEMORY (A beep indicates that the trace is stored.)

e. Reverse the cable connections of the 4396B A and R inputs as shown in setup 2 of Figure 2-16.

f. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

g. Set the 4396B controls as follows:

Control Settings	Key Strokes
Active Channel: CH 1	(Ch 1)
Data Math: G*(DATA+MEM)	(Display), DATA MATH [DATA], DATA+MEM, GAIN, (.), (5), (x1)
Auto Scale	(Scale Ref), AUTO SCALE
Active Channel: CH 2	(Ch 2)
Data Math: G*(DATA+MEM)	(Display), DATA MATH [DATA], DATA+MEM, GAIN, (.), (5), (x1)
Auto Scale	(Scale Ref), AUTO SCALE

h. Press (Ch 1), (Search), MAX and (Search), MIN to move the channel 1 marker to the maximum and minimum points on the trace. Compare the absolute values at the maximum and minimum points.

i. Record the larger value in the performance test record ("Test Result" column for A/R magnitude ratio of the frequency range 100 kHz to 1 MHz).

j. Press (Ch 2), (Scale Ref), ELECTRICAL DELAY MENU, ELECTRICAL DELAY. Then press (⇧) or (⇩) and turn the RPG knob to vary the electrical delay until the trace is in the most horizontal position.

k. Press PHASE OFFSET and enter the trace mean value using numeric keys. The trace mean value is displayed as a marker statistic (mean) in the upper right-hand corner of the display.

l. Press (Search), MAX and (Search), MIN to move the channel 2 marker to the maximum and minimum points on the trace. Compare the absolute values at the maximum and minimum points.

m. Record the larger value in the performance test record ("Test Result" column for A/R phase of the frequency range 100 kHz to 1 MHz).

n. Set the 4396B controls as follows:

Control Settings	Key Strokes
Active Channel: CH 1	(Ch 1)
Data Math: DATA	(Display), DATA MATH [G*(D+M)], DATA MATH: DATA, DEFAULT GAIN & OFS
Active Channel: CH 2	(Ch 2)
Data Math: DATA	(Display), DATA MATH [G*(D+M)], DATA MATH: DATA, DEFAULT GAIN & OFS
Electrical Delay: 0 sec	(Scale Ref), ELECTRICAL DELAY MENU, ELECTRICAL DELAY, (0), (x1)
Phase Offset: 0°	PHASE OFFSET, (0), (x1)

o. Connect the test equipment as shown in setup 1 of Figure 2-16.

p. Set the 4396B controls as follows:

Control Settings	**Key Strokes**
Start Frequency: 1 MHz	(Start), (1), (M/μ)
Stop Frequency: 1.8 GHz	(Stop), (1), (.), (8), (G/n)
Number of Points: 201	(Sweep), NUMBER of POINTS, (2), (0), (1), (x1)

q. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

r. Set the 4396B controls as follows:

Control Settings	**Key Strokes**
Active Channel: CH 1	(Ch 1)
Data→Memory	(Display), DATA→MEMORY (A beep indicates that the trace is stored.)
Active Channel: CH 2	(Ch 2)
Data→Memory	(Display), DATA→MEMORY (A beep indicates that the trace is stored.)

s. Reverse the cable connections of the 4396B A and R inputs as shown in setup 2 of Figure 2-16.

t. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

u. Set the 4396B controls as follows:

Control Settings	**Key Strokes**
Active Channel: CH 1	(Ch 1)
Data Math: G*(DATA+MEM)	(Display), DATA MATH [DATA], DATA+MEM, GAIN, (.), (5), (x1)
Auto Scale	(Scale Ref), AUTO SCALE
Active Channel: CH 2	(Ch 2)
Data Math: G*(DATA+MEM)	(Display), DATA MATH [DATA], DATA+MEM, GAIN, (.), (5), (x1)
Auto Scale	(Scale Ref), AUTO SCALE

v. Press (Ch 1), (Search), MAX and (Search), MIN to move the channel 1 marker to the maximum and minimum points on the trace. Compare the absolute values at the maximum and minimum points.

w. Record the larger value in the performance test record ("Test Result" column for A/R magnitude ratio of the frequency range 1 MHz to 1.8 GHz).

x. Press (Ch 2), (Scale Ref), ELECTRICAL DELAY MENU, ELECTRICAL DELAY. Then press (⇧) or (⇩) and turn the RPG knob to vary the electrical delay until the trace is in the most horizontal position.

y. Press PHASE OFFSET and enter the trace mean value using numeric keys. The trace mean value is displayed as a marker statistic (mean) in the upper right-hand corner of the display.

z. Press (Search), MAX and (Search), MIN to move the channel 2 marker to the maximum and minimum points on the trace. Compare the absolute values at the maximum and minimum points.

aa. Record the larger value in the performance test record ("Test Result" column for A/R phase of the frequency range 1 MHz to 1.8 GHz).

bb. Set the 4396B controls as follows:

Control Settings	Key Strokes
Active Channel: CH 1	(Ch 1)
Data Math: DATA	(Display), DATA MATH [G*(D+M)], DATA MATH: DATA, DEFAULT GAIN & OFS
Active Channel: CH 2	(Ch 2)
Data Math: DATA	(Display), DATA MATH [G*(D+M)], DATA MATH: DATA, DEFAULT GAIN & OFS
Electrical Delay: 0 sec	(Scale Ref), ELECTRICAL DELAY MENU, ELECTRICAL DELAY, (0), (x1)
Phase Offset: 0°	PHASE OFFSET, (0), (x1)

3. **—B/R Magnitude Ratio/Phase Frequency Response Test—**

   a. Connect the test equipment as shown in setup 1 of Figure 2-17.

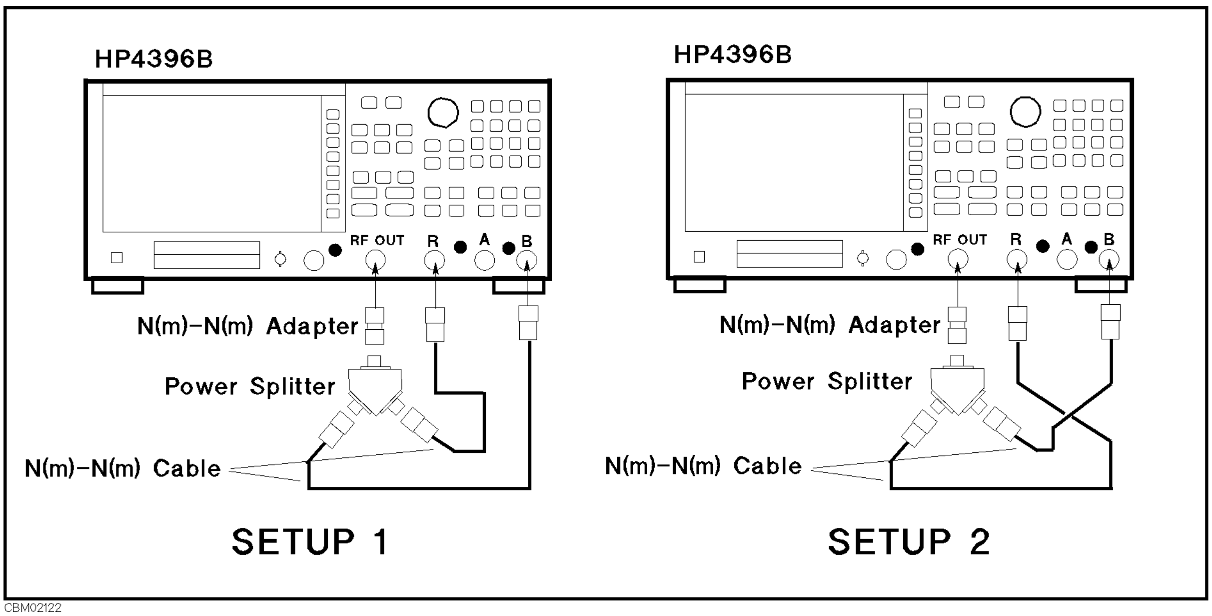

Figure 2-17. B/R Magnitude Ratio/Phase Frequency Response Test Setup

   b. Set the 4396B controls as follows:

Control Settings	Key Strokes
Active Channel: CH 1	(Ch 1)
Input: B/R	(Meas), B/R
Format: LOG MAG	(Format), LOG MAG
Active Channel: CH 2	(Ch 2)
Input: B/R	(Meas), B/R
Format: PHASE	(Format), PHASE
Start Frequency: 100 kHz	(Start), (1), (0), (0), (k/m)
Stop Frequency: 1 MHz	(Stop), (1), (M/μ)
Number of Points: 50	(Sweep), NUMBER of POINTS, (5), (0), (x1)

c. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

d. Set the 4396B controls as follows:

Control Settings	Key Strokes
Active Channel: CH 1	(Ch 1)
Data→Memory	(Display), DATA→MEMORY (A beep indicates that the trace is stored.)
Active Channel: CH 2	(Ch 2)
Data→Memory	(Display), DATA→MEMORY (A beep indicates that the trace is stored.)

e. Reverse the cable connections of the 4396B B and R inputs as shown in setup 2 of Figure 2-17.

f. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

g. Set the 4396B controls as follows:

Control Settings	Key Strokes
Active Channel: CH 1	(Ch 1)
Data Math: G*(DATA+MEM)	(Display), DATA MATH [DATA] , DATA+MEM, GAIN, (.), (5), (x1)
Auto Scale	(Scale Ref), AUTO SCALE
Active Channel: CH 2	(Ch 2)
Data Math: G*(DATA+MEM)	(Display), DATA MATH [DATA] , DATA+MEM, GAIN, (.), (5), (x1)
Auto Scale	(Scale Ref), AUTO SCALE

h. Press (Ch 1), (Search), MAX and (Search), MIN to move the channel 1 marker to the maximum and minimum points on the trace. Compare the absolute values at the maximum and minimum points.

i. Record the larger value in the performance test record ("Test Result" column for B/R magnitude ratio of the frequency range 100 kHz to 1 MHz).

j. Press (Ch 2), (Scale Ref), ELECTRICAL DELAY MENU , ELECTRICAL DELAY . Then press (⇧) or (⇩) and turn the RPG knob to vary the electrical delay until the trace is in the most horizontal position.

k. Press PHASE OFFSET and enter the trace mean value using numeric keys. The trace mean value is displayed as a marker statistic (mean) in the upper right-hand corner of the display.

l. Press (Search), MAX and (Search), MIN to move the channel 2 marker to the maximum and minimum points on the trace. Compare the absolute values at the maximum and minimum points.

m. Record the larger value in the performance test record ("Test Result" column for B/R phase of the frequency range 100 kHz to 1 MHz).

n. Set the 4396B controls as follows:

Control Settings	Key Strokes
Active Channel: CH 1	Ch 1
Data Math: DATA	Display, DATA MATH [G*(D+M)] , DATA MATH: DATA , DEFAULT GAIN & OFS
Active Channel: CH 2	Ch 2
Data Math: DATA	Display, DATA MATH [G*(D+M)] , DATA MATH: DATA , DEFAULT GAIN & OFS
Electrical Delay: 0 sec	Scale Ref, ELECTRICAL DELAY MENU , ELECTRICAL DELAY , 0, x1
Phase Offset: 0°	PHASE OFFSET , 0, x1

o. Connect the test equipment as shown in setup 1 of Figure 2-17.

p. Set the 4396B controls as follows:

Control Settings	Key Strokes
Start Frequency: 1 MHz	Start, 1, M/μ
Stop Frequency: 1.8 GHz	Stop, 1, ., 8, G/n
Number of Points: 201	Sweep, NUMBER of POINTS , 2, 0, 1, x1

q. Press Trigger, SINGLE to make a sweep. Wait for the completion of the sweep.

r. Set the 4396B controls as follows:

Control Settings	Key Strokes
Active Channel: CH 1	Ch 1
Data→Memory	Display, DATA→MEMORY (A beep indicates that the trace is stored.)
Active Channel: CH 2	Ch 2
Data→Memory	Display, DATA→MEMORY (A beep indicates that the trace is stored.)

s. Reverse the cable connections of the 4396B B and R inputs as shown in setup 2 of Figure 2-16.

t. Press Trigger, SINGLE to make a sweep. Wait for the completion of the sweep.

u. Set the 4396B controls as follows:

Control Settings	Key Strokes
Active Channel: CH 1	Ch 1
Data Math: G*(DATA+MEM)	Display, DATA MATH [DATA] , DATA+MEM , GAIN , ., 5, x1
Auto Scale	Scale Ref, AUTO SCALE
Active Channel: CH 2	Ch 2
Data Math: G*(DATA+MEM)	Display, DATA MATH [DATA] , DATA+MEM , GAIN , ., 5, x1
Auto Scale	Scale Ref, AUTO SCALE

v. Press Ch 1, Search, MAX and Search, MIN to move the channel 1 marker to the maximum and minimum points on the trace. Compare the absolute values at the maximum and minimum points.

w. Record the larger value in the performance test record ("Test Result" column for B/R magnitude ratio of the frequency range 1 MHz to 1.8 GHz).

x. Press (Ch 2), (Scale Ref), ELECTRICAL DELAY MENU, ELECTRICAL DELAY. Then press (⇧) or (⇩) and turn the RPG knob to vary the electrical delay until the trace is in the most horizontal position.

y. Press PHASE OFFSET and enter the trace mean value using numeric keys. The trace mean value is displayed as a marker statistic (mean) in the upper right-hand corner of the display.

z. Press (Search), MAX and (Search), MIN to move the channel 2 marker to the maximum and minimum points on the trace. Compare the absolute values at the maximum and minimum points.

aa. Record the larger value in the performance test record ("Test Result" column for B/R phase of the frequency range 1 MHz to 1.8 GHz).

12. CALIBRATOR AMPLITUDE ACCURACY TEST (SA)

Description

This test uses a power meter and power sensor to measure the actual signal amplitude at 4396B CAL OUT connector and checks that the level accuracy meets the specification.

Specification

Calibrator accuracy (−20 dBm 20MHz) .... <±0.4 dB

Test Equipment

Power Meter .... 436A Opt. 022, 437B, or 438A
Power Sensor 8482A
N(f)-BNC(m) adapter .... PN 1250-1477

Procedure

1. Connect the power sensor to the power meter. Calibrate the power meter for the power sensor.
2. Connect the test equipment as shown in Figure 2-18.

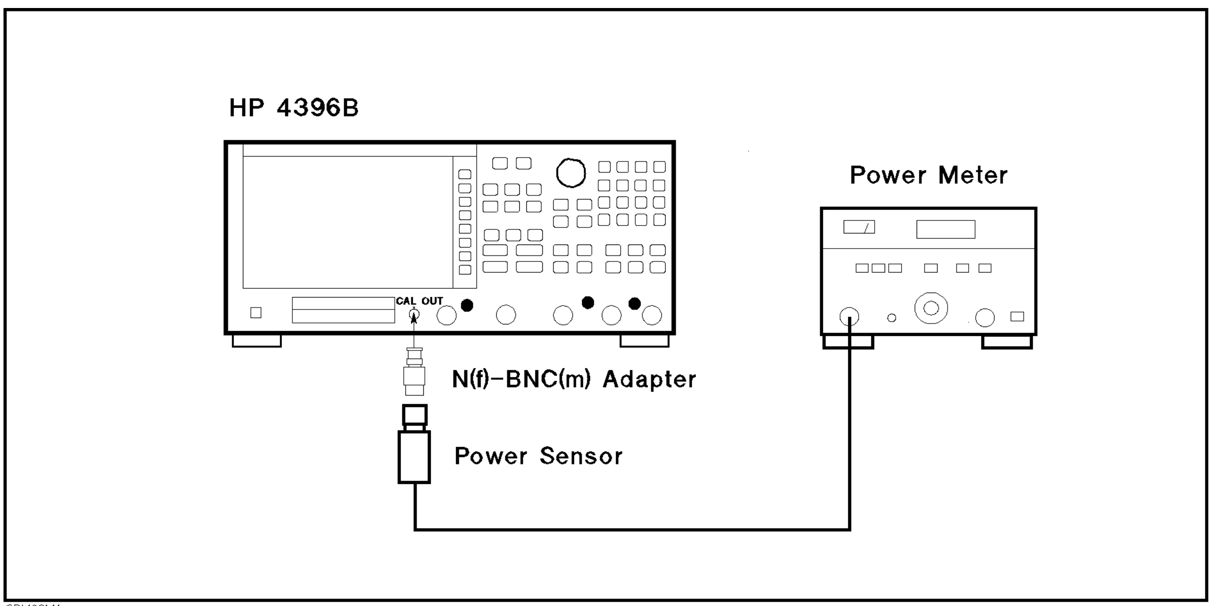

Figure 2-18. Calibrator Amplitude Accuracy Test Setup

3. Wait for the power meter reading to settle. Then record the power meter reading in the performance test record ("Test Result" column).

13. DISPLAYED AVERAGE NOISE LEVEL TEST (SA)

Description

This test uses the 4396B marker statistics function to measure the displayed average noise level in the 4396B spectrum analyzer mode when the 4396B S input is terminated.

In this test, the noise level (trace mean value) is measured in linear format [Watt]. Then the measured values are converted to log magnitude format [dBm]. This is done to avoid skewing the data with the marker statistics function.

Specification

Displayed average noise level
@frequency$\geq$10 MHz, ref. level $\leq$ −40 dBm, att.=0 dB . . . . <[−150+ 3*f(GHz)*] dBm/Hz
@10 kHz $\leq$ frequency <10 MHz, ref. level $\leq$ −40 dBm, att.=0 dB . . . . <−125 dBm/Hz

Test Equipment

50Ω termination, type-N(m) . . . . 909C Opt 012 or part of 85032B

Procedure

1. Connect the test equipment as shown in Figure 2-19.

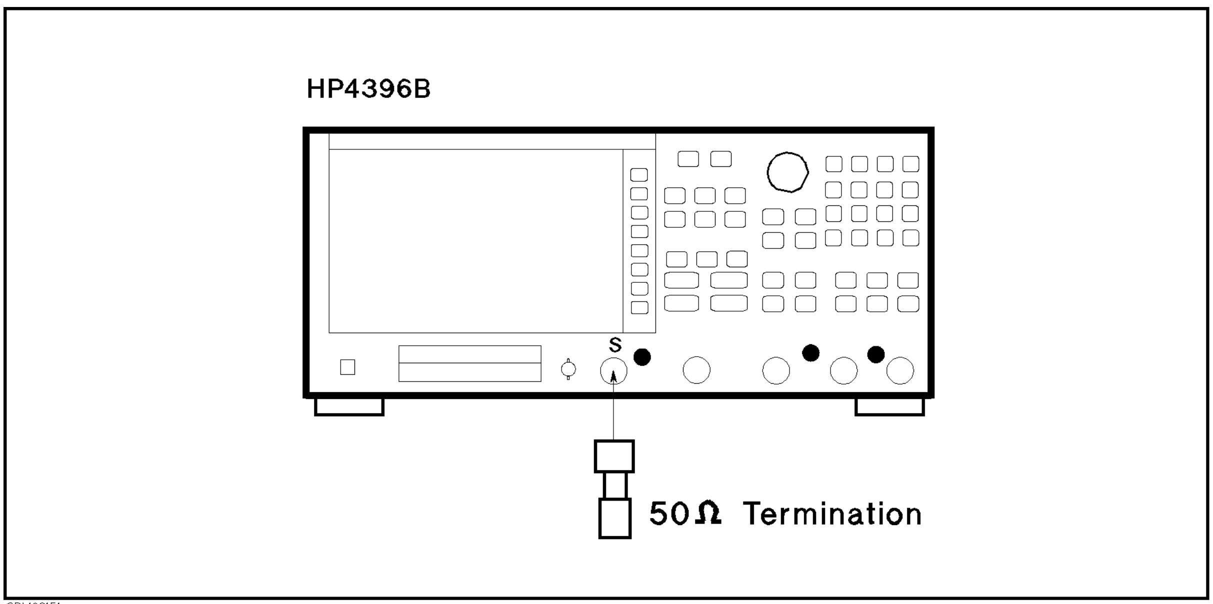

Figure 2-19. Average Noise Level Test Setup

2. Press (Meas), ANALYZER TYPE , SPECTRUM ANALYZER , (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	**Key Strokes**
Reference Value: −40 dBm	(Scale Ref), REFERENCE VALUE (-), (4), (0), (x1)
Input Att.: 0 dB	(Scale Ref), ATTEN , (0), (x1)

Unit: WATT	(Format), WATT
Statistics: ON	(Utility), STATISTICS on OFF (Then the softkey label changes to STATISTICS ON off .)

3. Set the controls as follows. (This sets the center frequency, frequency span, and RBW to the first settings listed in Table 2-13).

Control Settings	Key Strokes
Center Frequency: 10 kHz	(Center), (1), (0), (k/m)
RBW: 10 Hz	(Bw/Avg), RES BW , (1), (0), (x1)
Frequency Span: 100 Hz	(Span), (1), (0), (0), (x1)

Table 2-13. Displayed Average Noise Level Test Settings

4396B		
Center Frequency	**RBW**	**Frequency Span**
10 kHz	10 Hz	100 Hz
100 kHz	10 kHz	1 Hz
1 MHz	10 kHz	1 Hz
10 MHz	10 kHz	1 Hz
100 MHz	10 kHz	1 Hz
500 MHz	10 kHz	1 Hz
1.0 GHz	10 kHz	1 Hz
1.4 GHz	10 kHz	1 Hz
1.8 GHz	10 kHz	1 Hz

4. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
5. Record the 4396B trace mean value [Unit] in the calculation sheet ("Trace Mean [Unit]" column). The trace mean value is displayed as a marker statistic (mean) in the upper right-hand corner of the display.
6. Change the center frequency, frequency span, and RBW settings in accordance with Table 2-13. Then repeat steps 4 and 5 for each setting.
7. Convert the unit of the test results from [Watt] to [dBm] using the equation given in the calculation sheet. Record the test results [dBm] in the performance test record.

14. AMPLITUDE FIDELITY TEST (SA)

Description

This test checks the 4396B amplitude fidelity at RBWs of 10 kHz and 1 MHz. A 50 MHz CW signal is applied to the 4396B S input through a step attenuator. The signal amplitude is varied by inserting known attenuation values. Each signal amplitude [dB] is measured to a reference value at the attenuator setting of 0 dB. Then the measured values are compared with to the inserted attenuation's calibrated values.

The amplitude fidelity performance at RBWs $\leq$ 3 kHz are not tested in this test. The error sources at RBW $\leq$ 3 kHz are exactly same as those of the magnitude ratio dynamic accuracy in the 4396B network analyzer mode. Because the dynamic accuracy is tested in the *Magnitude Ratio/Phase Dynamic Accuracy Test*, the fidelity test at the RBW $\leq$ 3 kHz is omitted.

The amplitude fidelity performance at low signal levels are not tested in this test. That is, the fidelity is not checked at signal levels ≤ -60 dB (from the reference level) at an RBW of 10 kHz and at signal levels ≤ -50 dB (from the reference level) at an RBW of 1 MHz. These tests are not necessary because the fidelity performance at these levels are theoretically determined by the fidelity at higher signal levels and the fidelity at an RBW of $\leq$ 3 kHz.

Two 6 dB fixed attenuators with a VSWR of $\leq$ 1.015 are connected to the signal generator output connector and the 4396B S input, respectively. These fixed attenuators are used to reduce the measurement uncertainties caused by mismatch error. When they are used, the measurement uncertainties listed in the performance test record are valid.

Specification

Amplitude fidelity
Log scale

Range	Amplitude Fidelity[1]		
(dB from Ref. Level)	@1 Hz $\leq$ RBW $\leq$ 3 kHz	@10 kHz $\leq$ RBW $\leq$ 300 kHz	@1 MHz $\leq$ RBW $\leq$ 3 MHz
0 dB $\geq$ range ≥ -30 dB	±0.05 dB	±0.3 dB	±1.0 dB
-30 dB > range ≥ -40 dB	±0.07 dB	±0.3 dB	±1.0 dB
-40 dB > range ≥ -50 dB	±0.12 dB	±0.4 dB	±1.2 dB
-50 dB > range ≥ -60 dB	±0.4 dB	±0.7 dB	±1.4 dB
-60 dB > range ≥ -70 dB	±1.2 dB	±1.5 dB	±2.2 dB
-70 dB > range ≥ -80 dB	±4 dB	±4.3 dB	–

1 : @23±5°C, -10 dBm $\geq$ [*ref. level* $-$ *input att*] ≥ -50 dBm except for gain compression

Test Equipment

Signal Generator .... 8663A or 8642B
Step Attenuator[1], 10 dB step, VSWR $\leq$ 1.02 .... 8496A/G Option 001 and H60
Attenuator Driver[2] 11713A
N(m)-N(m) cable, 61 cm (two required) .... 11500B or part of 11851B
BNC(m)-BNC(m) cable, 122 cm .... PN 8120-1840
6 dB Fixed Attenuation (two required) .... 8491A Opt 006 & Opt H60

1: Calibration values for attenuation settings of 10 dB to 60 dB at 50 MHz are required.

2: Required when using a programmable step attenuator 8496G.

Procedure

1. Record the step attenuator 50 MHz calibration values in the calculation sheet ("Calibration Value" column).
2. Initialize the signal generator. Then set the controls as follows:

Controls	Settings
Frequency	50 MHz
Amplitude	+2 dBm

3. Connect the test equipment as shown in Figure 2-20.

Note

Connect the signal generator's 10 MHz frequency reference output to the 4396B EXT REF Input on the rear panel as shown in Figure 2-20. With this configuration, both the signal generator and the 4396B are phase locked to the same reference frequency to obtain a stable measurement.

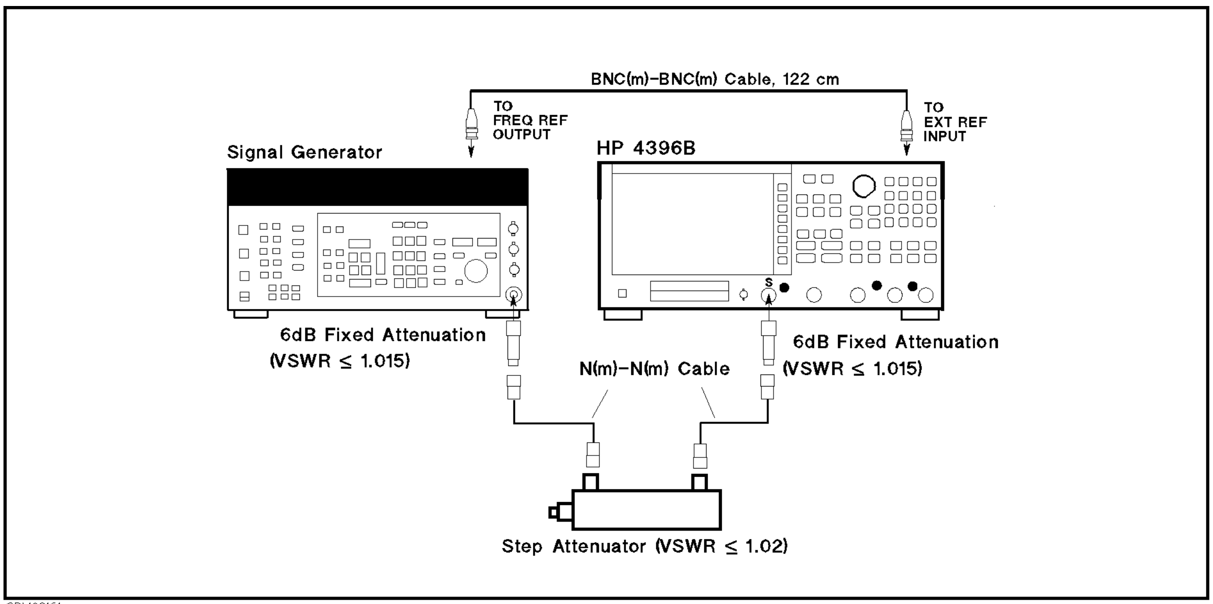

Figure 2-20. Amplitude Fidelity Test Setup

4. Press (Meas), ANALYZER TYPE, SPECTRUM ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	Key Strokes
Center Frequency: 50 MHz	(Center), (5), (0), (M/μ)
Reference Level: −10 dBm	(Scale Ref), REFERENCE VALUE, (-), (1), (0), (x1)
Input Att.: 10 dB	(Scale Ref), ATTEN, (1), (0), (x1)

5. Set the 4396B controls as follows to measure the amplitude fidelity at RBW 10 kHz.

Control Settings	Key Strokes
Frequency Span: 1 MHz	(Span), (1), (M/μ)
RBW: 10 kHz	(Bw/Avg), RES BW, (1), (0), (k/m)
VBW: 300 Hz	(Bw/Avg), VIDEO BW, (3), (0), (0), (x1)

6. Set the step attenuator to 0 dB.
7. On the 4396B, press (Search), MAX to move the marker to the peak of the carrier.
8. On the signal generator, adjust the amplitude until the 4396B marker reads −10 dB ±0.1 dB.
9. On the 4396B, press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
10. Press (Search), MAX , (Marker), ΔMODE MENU , FIXED ΔMKR to place the delta reference marker on the peak of the carrier (reference level of the amplitude fidelity).
11. Set the step attenuator to the first setting 10 dB in the second column of Table 2-14.

Table 2-14. Amplitude Fidelity Test Settings 1

dB from Reference Level	Step Attenuator
−10 dB	10 dB
−20 dB	20 dB
−30 dB	30 dB
−40 dB	40 dB
−50 dB	50 dB
−60 dB	60 dB

12. Perform the following steps to measure the amplitude fidelity.
    a. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
    b. Press (Search), MAX .
    c. Record the delta marker reading in the calculation sheet for the amplitude fidelity at an RBW of 10 kHz. Use the "4396B Reading" column corresponding to the dB from the reference level in the first column of Table 2-14.
13. Change the step attenuator setting in accordance with the second column of Table 2-14. Then perform step 12 for each setting.
14. Set the 4396B controls as follows to measure the amplitude fidelity at RBW 1 MHz.

Control Settings	**Key Strokes**
Frequency Span: 50 MHz	(Span), (5), (0), (M/μ)
RBW: 1 MHz	(Bw/Avg), RES BW , (1), (M/μ)
VBW: 30 kHz	(Bw/Avg), VIDEO BW , (3), (0), (k/m)
Trigger: CONTINUOUS	(Trigger), CONTINUOUS

15. Set the step attenuator to 0 dB.
16. On the 4396B, press (Marker), ΔMODE MENU , ΔMODE OFF , (Search), MAX to move the marker to the peak of the carrier.
17. On the signal generator, adjust the amplitude until the 4396B marker reads −10 dB ±0.1 dB.
18. On the 4396B, press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
19. Press (Search), MAX , (Marker), ΔMODE MENU , FIXED ΔMKR to place the delta reference marker on the peak of the carrier (reference level of the amplitude fidelity).

20. Set the step attenuator to the first setting 10 dB in the second column of Table 2-15.

Table 2-15. Amplitude Fidelity Test Settings 2

dB from Reference Level	Step Attenuator
−10 dB	10 dB
−20 dB	20 dB
−30 dB	30 dB
−40 dB	40 dB
−50 dB	50 dB

21. Perform the following steps to measure the amplitude fidelity.
    a. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
    b. Press (Search), MAX .
    c. Record the delta marker reading in the calculation sheet for the amplitude fidelity at an RBW of 1 MHz. Use the "4396B Reading" column corresponding to the dB from reference level in the first column of Table 2-15.
22. Change the step attenuator setting in accordance with the second column of Table 2-15. Then perform step 21 for each setting.
23. Calculate the test results using the equations given in the calculation sheet. Record the test results in the performance test record.

15. INPUT ATTENUATOR SWITCHING UNCERTAINTY TEST (SA)

Description

This test measures the 4396B input attenuator switching uncertainty over the entire range from 10 dB to 60 dB. The switching uncertainty is referenced to the 10 dB attenuator setting.

In this test, a 50 MHz CW signal is applied to the 4396B S input through a step attenuator. The signal amplitude is measured at each 4396B input attenuator setting. At each measurement, the other measurement conditions are kept constant to measure the switching uncertainty exclusively. The applied signal level is controlled using the step attenuator so as to keep the signal level input to the first mixer (the internal circuit stage following the input attenuator) constant. For example, the step attenuator is decreased by 10 dB, when the 4396B input attenuator is increased by 10 dB. The 4396B reference level is set to the value of the input attenuator setting − 50 dB. This keeps the 4396B internal IF gain constant.

Two 6 dB fixed attenuators with a VSWR of $\leq$ 1.015 are connected to the signal generator output connector and the 4396B S input, respectively. These fixed attenuators are used to reduce the measurement uncertainties caused by mismatch error. When they are used, the measurement uncertainties listed in the performance test record are valid.

Specification

A input attenuator switching uncertainty

@20 dB to 40 dB, referenced to 10 dB ....<±1.0 dB
@50 dB to 60 dB, referenced to 10 dB ....<±1.5 dB

Test Equipment

Signal Generator .... 8663A or 8642B
Step Attenuator[1], 10 dB step, VSWR $\leq$ 1.02 .... 8496A/G Option 001 and H60
Attenuator driver[2] 11713A
N(m)-N(m) cable, 61 cm (two required) .... 11500B or part of 11851B
BNC(m)-BNC(m) cable, 122 cm .... PN 8120-1840
6 dB Fixed Attenuation (two required) .... 8491A Opt 006 & Opt H60

1: Calibration values for attenuation settings of 10 dB to 50 dB at 50 MHz are required.

2: Required when using a programmable step attenuator 8496G.

Procedure

1. Record the step attenuator 50 MHz calibration values in the calculation sheet ("Calibration Value" column).
2. Set the step attenuator to 50 dB.
3. On the signal generator, initialize the signal generator. Then set the controls as follows:

Controls	Settings
Frequency	50 MHz
Amplitude	+12 dBm

4. Connect the test equipment as shown in Figure 2-21.

Note Connect the signal generator's 10 MHz frequency reference output to the 4396B EXT REF Input on the rear panel as shown in Figure 2-21. With this configuration, both the signal generator and the 4396B are phase locked to the same reference frequency to obtain a stable measurement.

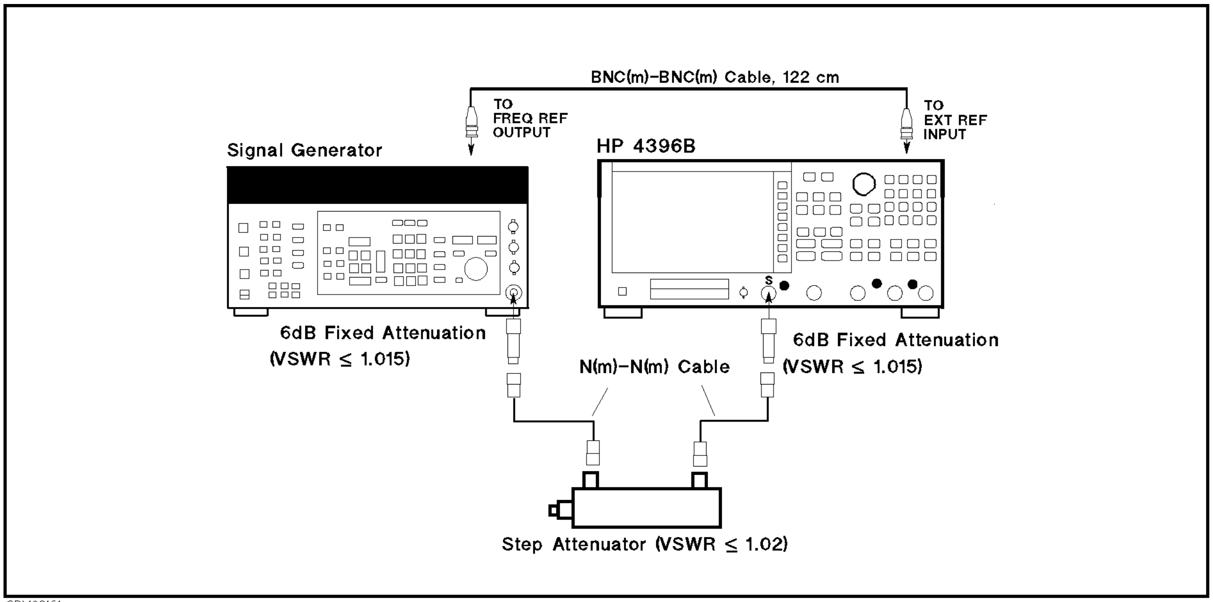

Figure 2-21. Input Attenuator Accuracy Test Setup

5. Press (Meas), ANALYZER TYPE, SPECTRUM ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	**Key Strokes**
Center Frequency: 50 MHz	(Center), (5), (0), (M/μ)
Frequency Span: 10 kHz	(Span), (1), (0), (k/m)
RBW: 1 kHz	(Bw/Avg), RES BW, (1), (k/m)
Scale/Division: 5 dB/Div	(Scale Ref), SCALE/DIV, (5), (x1)

6. Press (Scale Ref), REFERENCE VALUE, (-), (4), (0), (x1), (Scale Ref), ATTEN, (1), (0), (x1), to set the 4396B controls to the reference setting for the test.

7. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

8. Press (Search), MAX, (Marker), ΔMODE MENU, FIXED ΔMKR to place the delta reference marker on the peak of the carrier.

9. Set the 4396B controls as follows. This sets the input attenuator and reference level to the first settings listed in Table 2-16.

Control Settings	**Key Strokes**
Input Att.: 20 dB	(Scale Ref), ATTEN, (2), (0), (x1)
Reference Level: −30 dBm	(Scale Ref), REFERENCE VALUE, (-), (3), (0), (x1)

Table 2-16. Input Attenuator Switching Uncertainty Test Settings

4396B		Step Attenuator
Input Attenuator	Reference Level	
20 dB	−30 dBm	40 dB
30 dB	−20 dBm	30 dB
40 dB	−10 dBm	20 dB
50 dB	0 dBm	10 dB
60 dB	+10 dBm	0 dB

10. Set the step attenuator to the first setting (40 dB) listed in the third column of Table 2-16.
11. Perform the following steps to measure the input attenuator switching uncertainty.
    a. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
    b. Press (Search), MAX .
    c. Record the delta marker reading in the calculation sheet ("4396B Reading" column).
12. Change the 4396B input attenuator setting, the reference level setting, and the step attenuator setting in accordance with Table 2-16. Repeat step 11 for each setting.
13. Calculate the test results using the equation given in the calculation sheet. Record the test results in the performance test record.

16. RESOLUTION BANDWIDTH ACCURACY/SELECTIVITY TEST (SA)

Description

This test measures the 3 dB/60 dB bandwidth and calculates the selectivity at resolution bandwidth (RBW) settings $\geq$ 10 kHz and checks the performance meets the specification.

The bandwidth accuracy and selectivity for resolution bandwidth settings $\leq$ 3 kHz are not tested because the 4396B uses a digital filter technique on RBW settings $\leq$ 3 kHz. Therefore, the bandwidth accuracy and selectivity can be calculated mathematically. The calculated uncertainty is within the specification.

Specification

Resolution bandwidth (RBW)
Accuracy
@RBW $\geq$10 kHz .... $<\pm 20\%$
@RBW $\leq$ 3 kHz .... $<\pm 10\%$
Selectivity (60 dB BW / 3 dB BW)
@RBW $\geq$10 kHz .... <10
@RBW $\leq$ 3 kHz .... <3

Test Equipment

Signal Generator .... 8663A or 8642B
N(m)-N(m) cable, 61 cm .... 11500B or part of 11851B
BNC(m)-BNC(m) cable, 122 cm .... PN 8120-1840

Procedure

1. Connect the test equipment as shown in Figure 2-22.

Note Connect the signal generator's 10 MHz frequency reference output to the 4396B EXT REF Input on the rear panel as shown in Figure 2-22. With this configuration, both the signal generator and the 4396B are phase locked to the same reference frequency to obtain a stable measurement.

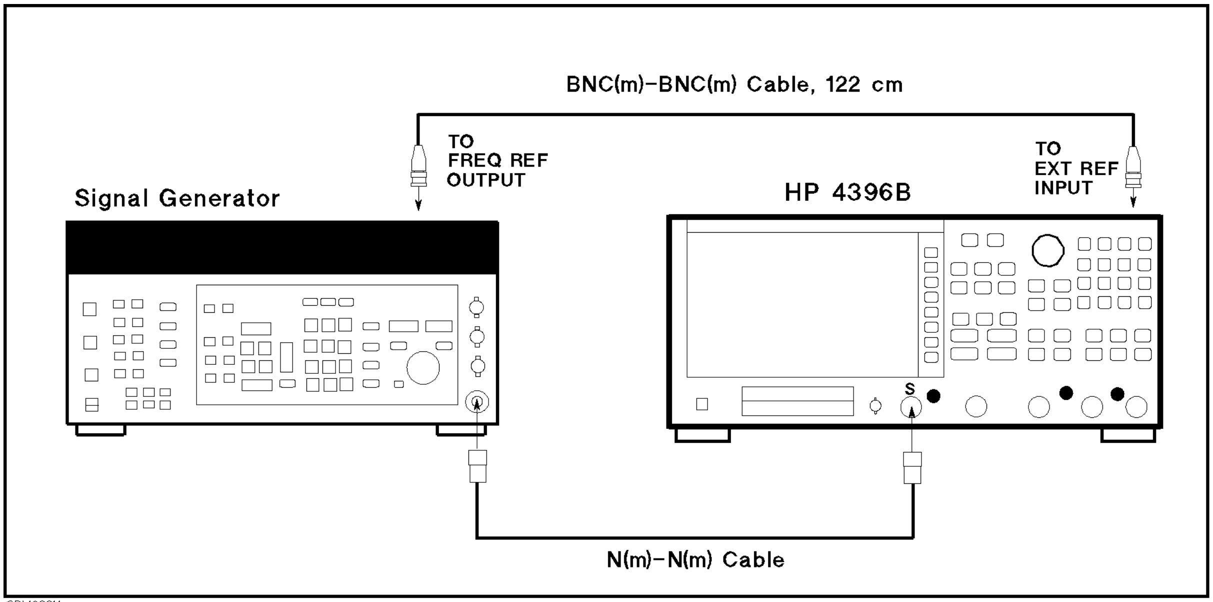

Figure 2-22. RBW Accuracy and Selectivity Test Setup

2. Initialize the signal generator. Then set the controls as follows:

Controls	**Settings**
Frequency	20 MHz
Amplitude	−20 dBm

3. Press (Meas), ANALYZER TYPE, SPECTRUM ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	**Key Strokes**
Center Frequency: 20 MHz	(Center), (2), (0), (M/μ)
Reference Level: −15 dBm	(Scale Ref), REFERENCE VALUE, (-), (1), (5), (x1)

4. **—Resolution Bandwidth Accuracy Test—**

   a. Press (Scale Ref), SCALE/DIV, (1), (x1) to set the scale appropriately.

   b. Set the 4396B controls as follows. This sets the RBW and frequency span to the first settings listed in Table 2-17.

Control Settings	**Key Strokes**
RBW: 10 kHz	(Bw/Avg), RES BW, (1), (0), (k/m)
Frequency Span: 30 kHz	(Span), (3), (0), (k/m)

Table 2-17. RBW Accuracy Test Settings

4396B	
RBW	**Frequency Span**
10 kHz	30 kHz
30 kHz	90 kHz
100 kHz	300 kHz
300 kHz	900 kHz
1 MHz	3 MHz
3 MHz	9 MHz

c. Perform the following steps to measure the RBW accuracy:

i. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

ii. Press (Search), MAX, (Marker), ΔMODE MENU, FIXED ΔMKR to place the delta marker reference at the peak of the carrier.

iii. Rotate the RPG knob to move the delta marker to lower frequency points until the delta marker reads −3 dB ± 0.1 dB.

iv. Press (Marker), ΔMODE MENU, FIXED ΔMKR to place the delta marker reference at the lower 3 dB frequency.

v. Rotate the RPG knob to move the delta marker to higher frequency points beyond the peak of the signal until the delta marker reads 0 dB ± 0.1 dB.

vi. Record the delta marker frequency reading in the performance test record ("Test Result" column for the resolution bandwidth accuracy).

d. Change the 4396B RBW and frequency span settings in accordance with Table 2-17, and repeat step 4-c for each setting.

5. **—Resolution Bandwidth Selectivity Test—**

a. Copy the test results of the RBW accuracy to the calculation sheet ("3dB Bandwidth" column for the RBW selectivity).

b. Set the 4396B controls as follows.

Control Settings	**Key Strokes**
Scale/Division: 10 dB/Div	(Scale Ref), SCALE/DIV, (1), (0), (x1)
VBW: 10 kHz	(Bw/Avg), VIDEO BW, (1), (0), (k/m)

c. Set the 4396B controls as follows. This sets the RBW, span, and input attenuator settings to the first settings listed in Table 2-18.

Control Settings	**Key Strokes**
RBW: 10 kHz	(Bw/Avg), RES BW, (1), (0), (k/m)
Frequency Span: 200 kHz	(Span), (2), (0), (0), (k/m)
Input Att.: 10 dB	(Scale Ref), ATTEN, (1), (0), (x1)

Table 2-18. RBW Selectivity Test Settings

4396B		
RBW	**Frequency Span**	**Input Attenuator**
10 kHz	200 kHz	10 dB
30 kHz	600 kHz	10 dB
100 kHz	2 MHz	10 dB
300 kHz	6 MHz	10 dB
1 MHz	20 MHz	0 dB
3 MHz	30 MHz	0 dB

d. Perform the following steps to measure the RBW selectivity.

i. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

ii. Press (Search), MAX, (Marker), ΔMODE MENU, FIXED ΔMKR to place the delta marker reference at the peak of the carrier.

iii. Rotate the RPG knob to move the delta marker to lower frequency points until the delta marker reads between −60 dB and −60.8 dB.

iv. Press (Marker), ΔMODE MENU, FIXED ΔMKR to place the delta marker reference at the lower 60 dB frequency.

v. Rotate the RPG knob to move the delta marker to higher frequency points beyond the peak frequency until the delta marker reads between 0 dB and −0.8 dB.

vi. Record the delta marker frequency in the calculation sheet ("60 dB Bandwidth" column for the RBW selectivity).

e. Change the RBW, the frequency span, and the input attenuator in accordance with Table 2-18. Repeat step 5-d for each setting.

f. Calculate the test results for the RBW selectivity using the equation given in the calculation sheet. Record the test results in the performance test record.

17. RESOLUTION BANDWIDTH SWITCHING UNCERTAINTY TEST (SA)

Description

This test measures the 4396B spectrum amplitude measurement uncertainty caused by switching the resolution bandwidth (RBW) setting. The uncertainty is tested for switching the RBW from 3 kHz to each RBW $\geq$ 10 kHz.

The uncertainty of switching the RBW between any two RBWs $\leq$ 3 kHz is not tested. This is because the 4396B uses a digital filter technique on RBW settings $\leq$ 3 kHz. Therefore, the uncertainty can be calculated mathematically. The calculated uncertainty is within the specification.

Specification

RBW switching uncertainty

@SPAN<100 $\times$ RBW for RBW$\geq$10 kHz, 23$\pm$5°C, referenced to 10 kHz RBW ...... <$\pm$0.5 dB

Test Equipment

BNC(m)-BNC(m) cable, 61 cm .... PN 8120-1839
N(m)-BNC(f) adapter .... PN 1250-1476

Procedure

1. Connect the test equipment as shown in Figure 2-23.

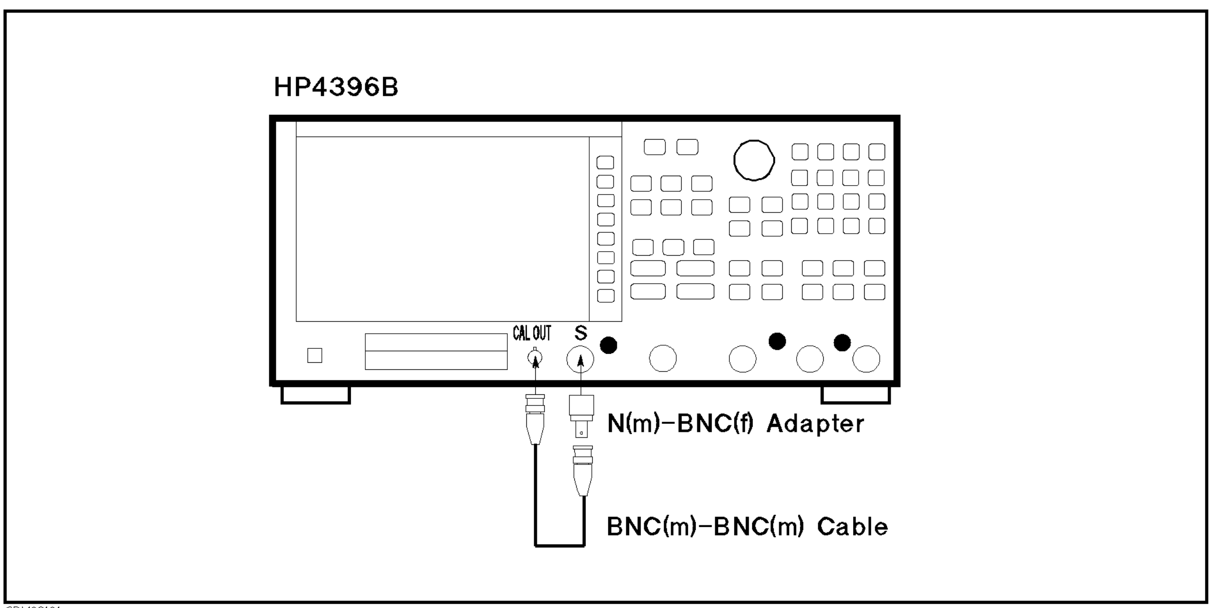

Figure 2-23. RBW Switching Uncertainty Test Setup

2. Press (Meas), ANALYZER TYPE, SPECTRUM ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	Key Strokes
Center Frequency: 20 MHz	(Center), (2), (0), (M/μ)
Reference Level: −18 dBm	(Scale Ref), REFERENCE VALUE, (-), (1), (8), (x1)
Scale/Division: 1 dB/Div	(Scale Ref), SCALE/DIV, (1), (x1)

3. Set the 4396B controls as follows. This sets the 4396B RBW to the reference 10 kHz of the RBW switching uncertainty test.

Control Settings	Key Strokes
RBW: 10 kHz	(Bw/Avg), RES BW, (1), (0), (k/m)
Frequency Span: 100 kHz	(Span), (1), (0), (0), (k/m)

4. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

5. Press (Search), MAX, (Marker), ΔMODE MENU, FIXED ΔMKR to place the delta marker reference at the peak of the carrier.

6. Set the 4396B controls as follows. This sets the RBW and the frequency span to the first settings listed in Table 2-19.

Control Settings	Key Strokes
RBW: 3 kHz	(Bw/Avg), RES BW, (3), (k/m)
Frequency Span: 30 kHz	(Span), (3), (0), (k/m)

Table 2-19. RBW Switching Uncertainty Test Settings

4396B	
RBW	**Frequency Span**
3 kHz	30 kHz
30 kHz	300 kHz
100 kHz	1 MHz
300 kHz	3 MHz
1 MHz	10 MHz
3 MHz	30 MHz

7. Perform the following steps to measure the RBW switching uncertainty:
   a. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
   b. Press (Search), MAX to move the delta marker to the peak of the carrier.
   c. Record the delta marker reading in the performance test record ("Test Result" column).

8. Change the 4396B RBW and frequency span in accordance with Table 2-19. Repeat step 7 for each setting.

18. IF GAIN SWITCHING UNCERTAINTY TEST (SA)

Description

The IF gain is the total gain of the internal path of the IF signal within the 4396B. The 4396B has twelve IF gain settings from 0 dB to 40 dB. The IF gain is automatically set to the setting determined by the selected reference level and input attenuator settings.

This test measures the 4396B spectrum amplitude measurement uncertainty caused by changing the IF gain settings over the entire range. The switching uncertainty is referenced to the IF gain setting at a reference level of −10 dBm and an input attenuator setting of 10 dB.

In this test, a 50 MHz CW signal is applied to the 4396B S input through two step attenuators: a 1 dB step and a 10 dB step attenuator. The signal amplitude is measured at several 4396B reference level settings (where the IF gain is varied over the entire range). At each measurement, the internal measurement settings (other than the IF gain) are kept constant to measure the switching uncertainty exclusively.

To do this, the input attenuator setting is fixed to 10 dB. The applied signal level is controlled using the step attenuators so as to keep the signal level input to the A/D converter (internal circuit following the IF signal path) constant. For example, when the reference level is decreased by 2 dB (while the IF gain setting is increased by 2 dB), the measured signal level is decreased by 2 dB through the two step attenuators whose total attenuation is increased by 2 dB.

Two 6 dB fixed attenuators with a VSWR of ≤ 1.015 are connected to the signal generator output connector and the 4396B S input, respectively. These fixed attenuators are used to reduce the measurement uncertainties caused by mismatch error. When they are used, the measurement uncertainties listed in the performance test record are valid.

Specification

IF gain switching uncertainty

@ input att. fixed, referenced to −20 dBm [*ref. level − input att*] .... <±0.3 dB

Test Equipment

Signal Generator .... 8663A or 8642B
Step Attenuator[1], 10 dB step, VSWR ≤ 1.02 .... 8496A/G Option 001 and H60
Step Attenuator[2], 1 dB step, VSWR ≤ 1.02 .... 8494A/G Option 001 and H60
Attenuator driver[3] 11713A
6 dB Fixed Attenuation .... 8491A Opt 006 & Opt H60
N(m)-N(m) cable, 61 cm (three required) .... 11500B or part of 11851B
BNC(m)-BNC(m) cable, 122 cm .... PN 8120-1840

1: Calibration values for attenuation settings of 10 dB to 50 dB at 50 MHz are required.

2: Calibration values for attenuation settings of 2 dB, 4 dB, 6 dB, 8 dB, and 10 dB at 50 MHz are required.

3: Required when using a programmable step attenuator of the 8494G and the 8496G.

Procedure

1. Record the 50 MHz calibration values of the 1 dB step attenuator and the 10 dB step attenuator in the calculation sheet ("Calibration Value" column).
2. Set the 1 dB step attenuator to 10 dB. Set the 10 dB step attenuator to 10 dB.
3. Initialize the signal generator. Then set the controls as follows:

Controls	Settings
Frequency	50 MHz
Amplitude	+6 dBm

4. Connect the test equipment as shown in Figure 2-24.

Note Connect the signal generator's 10 MHz frequency reference output to the 4396B EXT REF Input on the rear panel as shown in Figure 2-24. With this configuration, both the signal generator and the 4396B are phase locked to the same reference frequency to obtain a stable measurement.

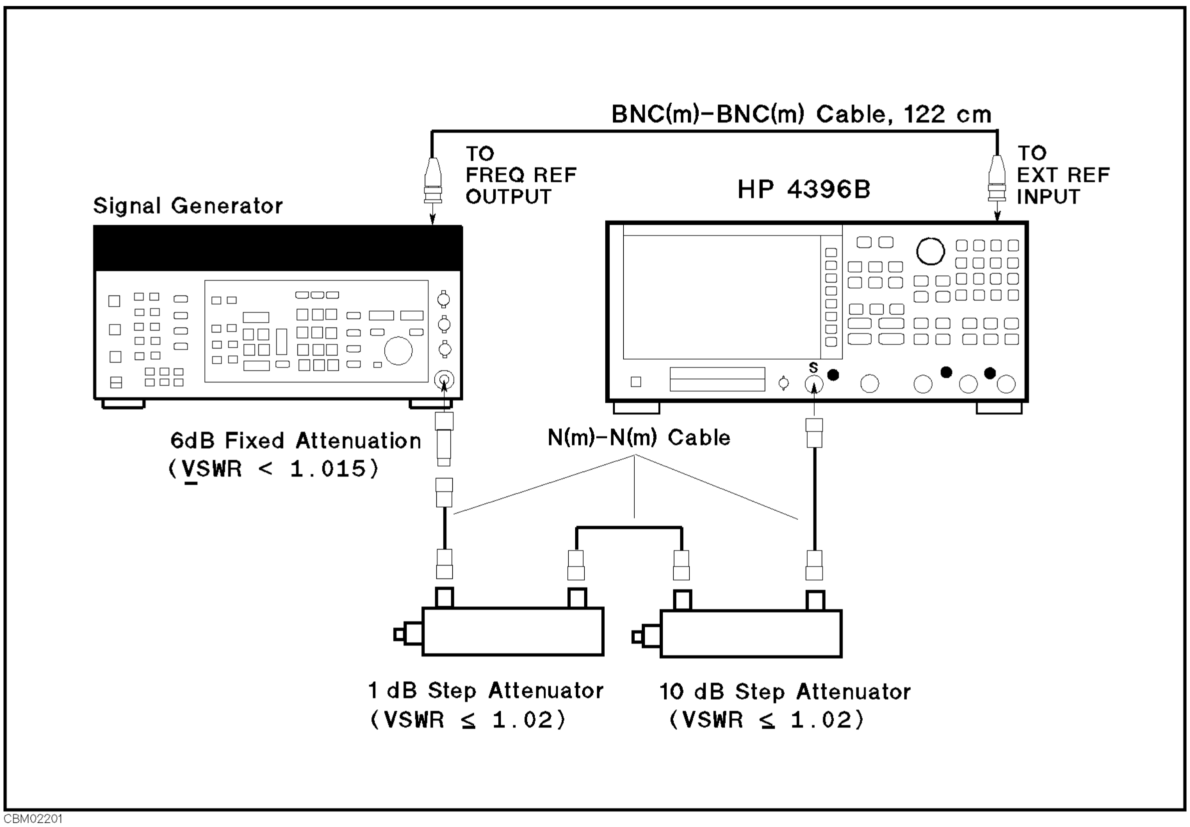

Figure 2-24. IF Gain Switching Uncertainty Test Setup

5. Press Meas, ANALYZER TYPE, SPECTRUM ANALYZER, Preset to initialize the 4396B. Then set the controls as follows:

Control Settings	Key Strokes
Center Frequency: 50 MHz	Center, 5, 0, M/μ
Frequency Span: 3 kHz	Span, 3, k/m
RBW: 300 Hz	Bw/Avg, RES BW, 3, 0, 0, x1
Reference Level: −10 dBm	Scale Ref, REFERENCE VALUE, -, 1, 0, x1
Scale/Division: 5 dB/Div	Scale Ref, SCALE/DIV, 5, x1
Input Att.: MANUAL, 10 dB	Scale Ref, ATTEN AUTO man (Then the softkey label changes to ATTEN auto MAN), ATTEN, 1, 0, x1

6. Press Trigger, SINGLE to make a sweep. Wait for the completion of the sweep.

7. Press Search, MAX, Marker, ΔMODE MENU, FIXED ΔMKR to place the delta marker reference at the peak of the carrier.

8. Press Scale Ref, REFERENCE VALUE, 0, x1 to set the 4396B reference level to the first setting listed in the first column of Table 2-20.

Table 2-20. IF Gain Switching Uncertainty Test Settings

4396B Reference Level	1 dB Step Attenuator	10 dB Step Attenuator
0 dB	0 dB	10 dB
−2 dB	2 dB	10 dB
−4 dB	4 dB	10 dB
−6 dB	6 dB	10 dB
−8 dB	8 dB	10 dB
−12 dB	2 dB	20 dB
−14 dB	4 dB	20 dB
−16 dB	6 dB	20 dB
−18 dB	8 dB	20 dB
−20 dB	10 dB	20 dB
−30 dB	10 dB	30 dB
−40 dB	10 dB	40 dB

9. Set the 1 dB step attenuator to the first setting 0 dB listed in the second column of Table 2-20.

10. Set the 10 dB step attenuator to the first setting 10 dB listed in the third column of Table 2-20.

11. Perform the following steps to measure the IF gain switching uncertainty.

    a. Press Trigger, SINGLE to make a sweep. Wait for the completion of the sweep.

    b. Press Search, MAX to move the marker to the peak of the carrier.

    c. Record the delta marker reading in the calculation sheet (“4396B Reading” column).

12. Change the 4396B reference level, the 1 dB step attenuator, and the 10 dB step attenuator settings in accordance with Table 2-20. Repeat step 11 for each setting.

13. Calculate the test results using the equation given in the calculation sheet. Record the test results in the performance test record.

19. NOISE SIDEBANDS TEST (SA)

Description

This test applies 39 MHz, 10 MHz, 100 MHz, and 1.8 GHz CW frequency signals to the 4396B S input. Then this measures noise sidebands at offsets ±1 kHz, ±10 kHz, and ±1 MHz from each carrier using a 4396B NOISE FORM function. Using the noise form function and the delta marker mode, the noise sidebands level is displayed directly in [dBc/Hz].

In this test, the noise sidebands at the 1 kHz offset from the carrier is measured at a 39 MHz CW frequency signal. The noise sidebands around the 1 kHz offset from the carrier are mainly determined by the phase noise caused by the fraction N oscillator. The frequency range around 39 MHz is one of the frequencies where the phase noise of the 1 kHz offset is most likely to be high. Therefore the noise sidebands at the offset 1 kHz is measured only at the 39 MHz CW frequency signal.

Specification

Noise sidebands

Offset from Carrier	Noise Sidebands[1]
≥1 kHz	<−95 dBc/Hz
≥10 kHz	<−105 dBc/Hz
≥1 MHz	<−110 dBc/Hz

1 : Center frequency ≤1 GHz. Add [20log(*frequency(GHz)*)] for frequency > 1 GHz.

Test Equipment

Signal Generator .... 8663A or 8642B
N(m)-N(m) cable, 61 cm .... 11500B or part of 11851B
BNC(m)-BNC(m) cable, 122 cm .... PN 8120-1840

Procedure

1. Initialize the signal generator. Then set the amplitude to 0 dBm.
2. Connect the test equipment as shown in Figure 2-25.

Note

Connect the signal generator's 10 MHz frequency reference output to the 4396B EXT REF Input on the rear panel as shown in Figure 2-25. With this configuration, both the signal generator and the 4396B are phase locked to the same reference frequency to obtain a stable measurement.

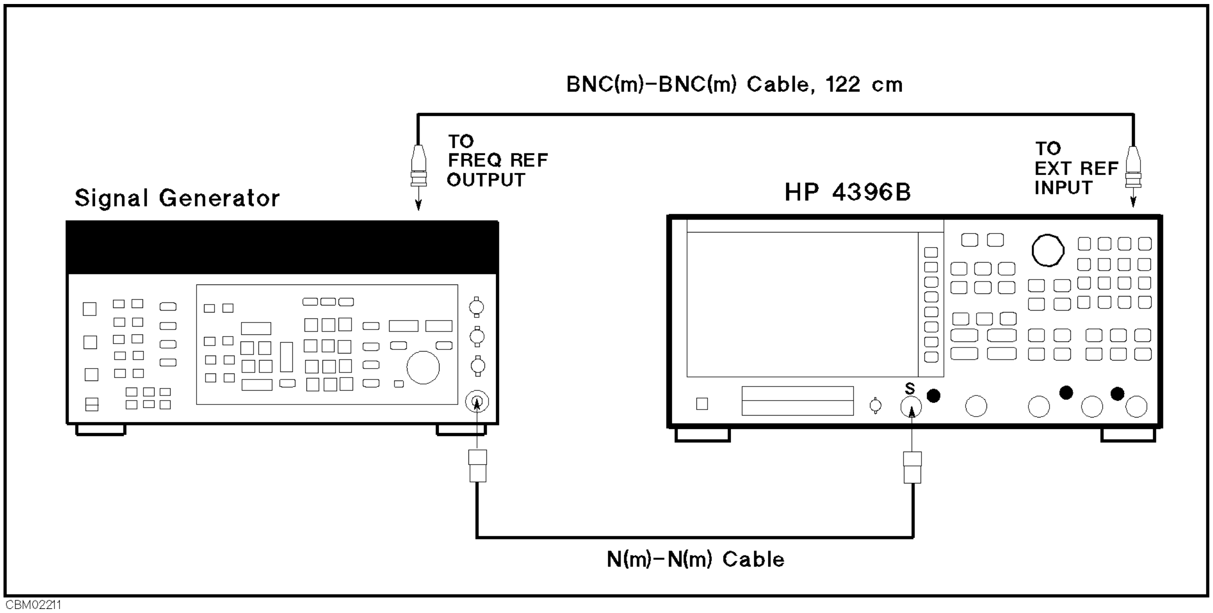

Figure 2-25. Noise Sidebands Test Setup

3. Press (Meas), ANALYZER TYPE, SPECTRUM ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	**Key Strokes**
Reference Level: 0 dBm	(Scale Ref), REFERENCE VALUE, (0), (x1)
Noise Form: ON	(Utility), NOISE FORM on OFF (Then the softkey label changes to NOISE FORM ON off.)

4. On the signal generator, set the frequency to the first carrier frequency 39 MHz in Table 2-21.

Table 2-21. Noise Sideband Test Settings

Signal Generator Carrier Frequency	4396B				Offset from Carrier
	Center Frequency	RBW	VBW	Frequency Span	
39 MHz	39 MHz	100 Hz	3 Hz	2.5 kHz	±1 kHz
10 MHz	10 MHz	1 kHz	10 Hz	25 kHz	±10 kHz
				2.5 MHz	±1 MHz
100 MHz	100 MHz	1 kHz	10 Hz	25 kHz	±10 kHz
				2.5 MHz	±1 MHz
1 GHz	1 GHz	1 kHz	10 Hz	25 kHz	±10 kHz
				2.5 MHz	±1 MHz
1.8 GHz	1.8 GHz	1 kHz	10 Hz	25 kHz	±10 kHz
				2.5 MHz	±1 MHz

5. On the 4396B, set the controls as follows (the first setting in Table 2-21).

Control Settings	**Key Strokes**
Center Frequency: 39 MHz	(Center), (3), (9), (M/μ)
RBW: 100 Hz	(Bw/Avg), RES BW, (1), (0), (0), (x1)
VBW: 3 Hz	(Bw/Avg), VIDEO BW, (3), (x1)
Frequency Span: 2.5 kHz	(Span), (2), (.), (5), (k/m)

6. Perform the following steps to measure the noise sideband level at ±1 kHz offset from the 39 MHz carrier.
   a. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
   b. Press (Search), MAX, (Marker), ΔMODE MENU, ΔMKR to place the delta marker reference at the peak of the carrier.
   c. Press (-), (1), (k/m) to move the delta marker to an offset of −1 kHz from the carrier.
   d. Record the marker reading in the performance test record.
   e. Press (1), (k/m) to move the delta marker to an offset of +1 kHz from the carrier.
   f. Record the delta marker reading in the performance test record.
7. On the signal generator, set the frequency to the second center frequency 10 MHz in Table 2-21.
8. On the 4396B, set the controls as follows (the second setting listed in Table 2-21):

Control Settings	**Key Strokes**
Center Frequency: 10 MHz	(Center), (1), (0), (M/μ)
RBW: 1 kHz	(Bw/Avg), RES BW, (1), (k/m)
VBW: 10 Hz	(Bw/Avg), VIDEO BW, (1), (0), (x1)

9. Perform the following steps to measure the noise sideband level at ±10 kHz and ±1 MHz offsets from the carrier of 10 MHz.
   a. Press (Span), (2), (5), (k/m) to set the frequency span to 25 kHz.
   b. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
   c. Press (Search), MAX, (Marker), ΔMODE MENU, ΔMKR to place the delta marker reference at the peak of the carrier.
   d. Press (-), (1), (0), (k/m) to move the delta marker at the offset −10 kHz from the carrier.
   e. Record the marker reading in the performance test record.
   f. Press (1), (0), (k/m) to move the delta marker at the offset +10 kHz from the carrier.
   g. Record the delta marker reading in the performance test record.
   h. Press (Span), (2), (.), (5), (M/μ) to set the frequency span to 2.5 MHz.
   i. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
   j. Press (Search), MAX, (Marker), ΔMODE MENU, ΔMKR to place the delta marker reference at the peak of the carrier.
   k. Press (-), (1), (M/μ) to move the delta marker at the offset −1 MHz from the carrier.
   l. Record the marker reading in the performance test record.
   m. Press (1), (M/μ) to move the delta marker at the offset +1 MHz from the carrier.
   n. Record the delta marker reading in the performance test record.
10. On the signal generator, set the frequency to the next center frequency 100 MHz in Table 2-21.
11. On the 4396B, press (Center), (1), (0), (0), (M/μ) to set the center frequency to 100 MHz.
12. Repeat step 9 to measure the noise sideband level at ±10 kHz and ±1 MHz offsets from the carrier of 100 MHz.

13. On the signal generator, set the frequency to the next center frequency 1 GHz in Table 2-21.
14. On the 4396B, press (Center), (1), (G/n) to set the center frequency to 1 GHz.
15. Repeat step 9 to measure the noise sideband level at ±10 kHz and ±1 MHz offsets from the carrier of 1 GHz.
16. On the signal generator, set the frequency to the next center frequency 1.8 GHz in Table 2-21.
17. On the 4396B, press (Center), (1), (.), (8), (G/n) to set the center frequency to 1.8 GHz.
18. Repeat step 9 to measure the noise sideband level at ±10 kHz and ±1 MHz offsets from the carrier of 1.8 GHz.

20. FREQUENCY RESPONSE TEST (SA)

Description

This test measures the amplitude measurement accuracy of the 4396B spectrum measurement over the entire frequency range. The frequency response is calculated as the accuracy deviation from the absolute amplitude accuracy at a frequency of 20 MHz.

At frequency ranges $\geq$ 100 kHz, this test applies a CW signal to the 4396B S input and power meter through a power splitter. The signal level is measured by doing a 4396B spectrum measurement using a power meter and a power sensor. Then the 4396B reading is compared with the reading of the power meter to obtain the absolute amplitude accuracy. These tests are performed twice while reversing connections of the power splitter's two output ports. This is done to remove the frequency tracking between two output ports of the power splitter.

At low frequencies (< 100 kHz), this test measures the CW signal level of the function generator using the 4396B spectrum measurement. The function generator's output level is used as the measurement standard.

Specification

Frequency response

@23±5°C, att.= 10 dB, referenced to level at 20 MHz

10 MHz $\leq$ frequency $\leq$ 1.8 GHz ....<±0.5 dB

2 Hz $\leq$ frequency < 10 MHz ....<±1.5 dB

Test Equipment

Power Meter	436A Opt. 022, 437B, or 438A
Power Sensor	8482A
Signal Generator	8663A or 8642B
Function Genarator	3325A
Two-way Power Splitter	11667A
N(m)-N(m) cable, 61 cm	11500B or part of 11851B
BNC(m)-BNC(m) cable, 61 cm	PN 8120-1839
BNC(m)-BNC(m) cable, 122 cm	PN 8120-1840
N(m)-N(m) adapter	PN 1250-1475
N(m)-BNC(f) adapter	PN 1250-1476

Procedure

1. Connect the power sensor to the power meter. Calibrate the power meter for the power sensor.
2. Connect the test equipment as shown in Figure 2-26.

Note Connect the signal generator's 10 MHz frequency reference output to the 4396B EXT REF Input on the rear panel as shown in Figure 2-26. With this configuration, both the signal generator and the 4396B are phase locked to the same reference frequency to obtain a stable measurement.

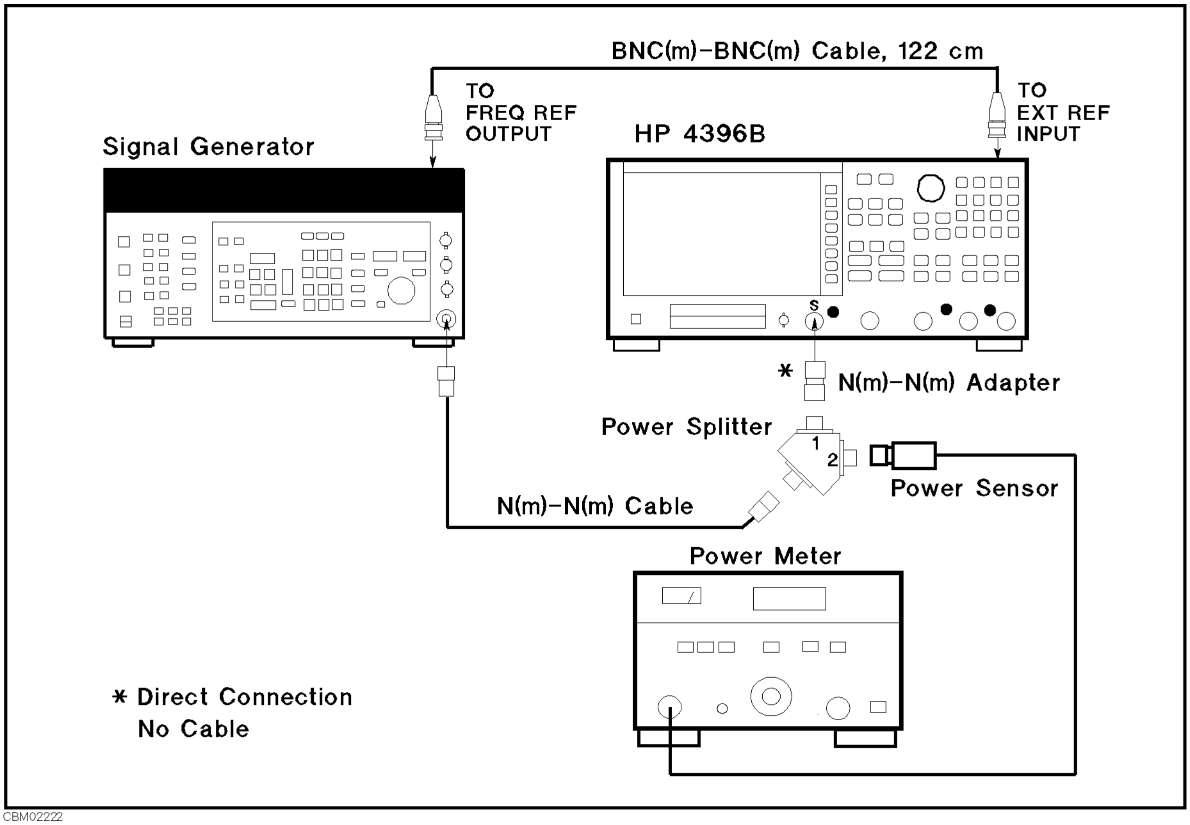

Figure 2-26. Frequency Response Test Setup 1

3. Initialize the signal generator. Then set the amplitude to −4 dBm.
4. Press (Meas), ANALYZER TYPE, SPECTRUM ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	Key Strokes
Frequency Span: 1 kHz	(Span), (1), (k/m)
RBW: 100 Hz	(Bw/Avg), RES BW, (1), (0), (0), (x1)
Reference Level: −8 dBm	(Scale Ref), REFERENCE VALUE, (-), (8), (x1)
Scale/Division: 1 dB/Div	(Scale Ref), SCALE/DIV, (1), (x1)
Input Att.: 10 dB	(Scale Ref), ATTEN, (1), (0), (x1)

5. On the signal generator, set the frequency to the first frequency 20 MHz in the first column of Table 2-22. Table 2-22 lists the test settings at frequencies ≥ 100 kHz.

Table 2-22. Frequency Response Test Settings 1

Signal Generator Frequency	4396B Center Frequency
20 MHz	20 MHz
100 kHz	100 kHz
1 MHz	1 MHz
6 MHz	6 MHz
10 MHz	10 MHz
50 MHz	50 MHz
100 MHz	100 MHz
1 GHz	1 GHz
1.79 GHz	1.79 GHz
1.8 GHz	1.8 GHz

6. On the 4396B, press (Center), (2), (0), (M/μ) to set the center frequency to the first setting 20 MHz in Table 2-22.
7. Perform the following steps to measure the frequency response.
   a. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
   b. Press (Search), MAX to place the marker at the peak of the carrier.
   c. Record the 4396B marker reading and power meter reading in the "4396B Reading 1" and "Power Meter Reading 1" columns of the calculation sheet for the 20 MHz reference.
8. Change the signal generator frequency and the 4396B center frequency in accordance with Table 2-22. Then repeat step 7 for each setting. Record the 4396B marker reading and power meter reading in the "4396B Reading 1" and "Power Meter Reading 1" columns of the calculation sheet for frequencies $\geq$ 100 kHz.
9. Reverse the power splitter output connections as shown in Figure 2-27.

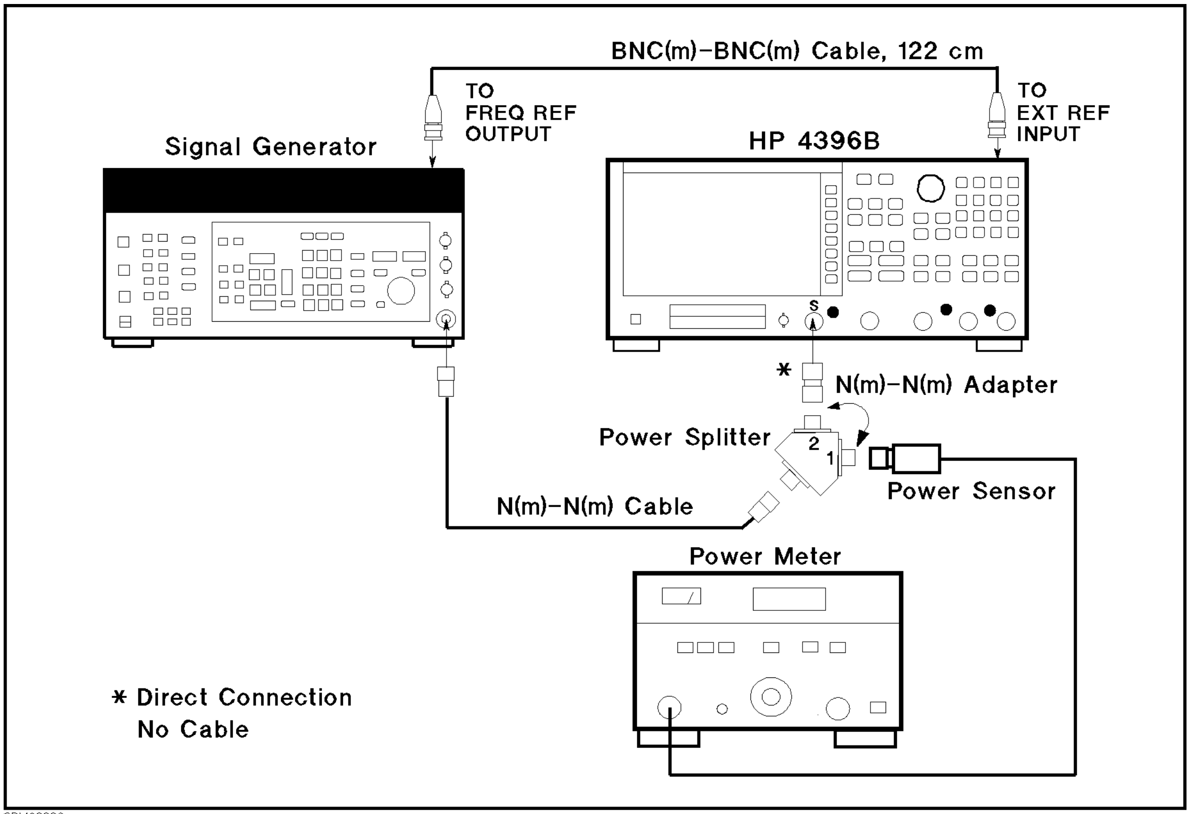

Figure 2-27. Frequency Response Test Setup 2

10. Repeat steps 5 through 8 to remove the power splitter tracking characteristic. Record the 4396B marker reading and power meter reading in the in "4396B Reading 2" and "Power Meter Reading 2" columns of the calculation sheet.
11. Change the test equipment setup as shown in Figure 2-28.

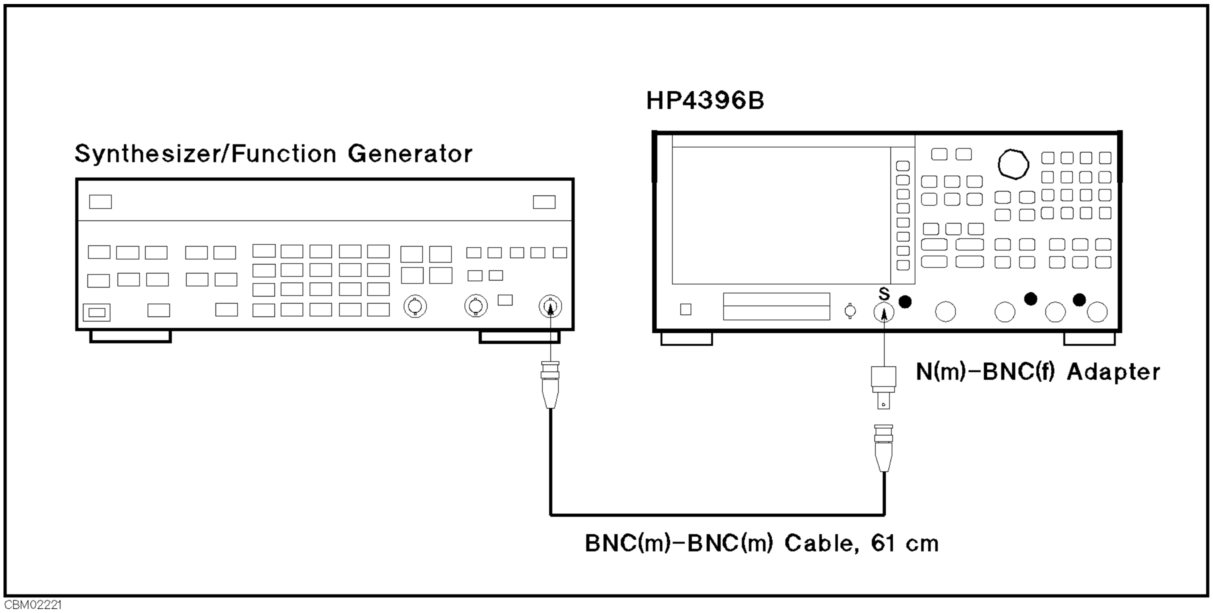

Figure 2-28. Frequency Response Test Setup 3

12. Initialize the function generator. Then set the amplitude to −10 dBm.
13. On the 4396B, press (Bw/Avg), RES BW, (1), (x1) to set the RBW to 1 Hz.
14. On the function generator, set the frequency to the first test frequency (10 Hz) in the first column of Table 2-23. Table 2-23 lists the test settings at frequencies < 100 kHz.

Table 2-23. Frequency Response Test Settings 1

Function Generator Frequency	4396B	
	Center Frequency	Frequency Span
10 Hz	10 Hz	10 Hz
100 Hz	100 Hz	100 Hz
1 kHz	1 kHz	200 Hz
10 kHz	10 kHz	200 Hz

15. On the 4396B, set the controls as follows (the first setting in Table 2-23):

Control Settings	Key Strokes
Center Frequency: 10 Hz	(Center), (1), (0), (x1)
Frequency Span: 10 Hz	(Span), (1), (0), (x1)

16. Perform the following steps to measure the frequency response at frequencies < 100 kHz.
    a. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
    b. Press (Search), MAX to place the marker at the peak of the carrier.
    c. Record the marker reading in the calculation sheet for frequencies < 100 kHz.
17. Change the function generator frequency, 4396B center frequency, and span frequency in accordance with Table 2-23. Repeat step 16 for each setting:
18. Calculate the test results using the equation given in the calculation sheet. Record the test results in the performance test record.

21. SECOND HARMONIC DISTORTION TEST (SA)

Description

This test measures the second harmonics level generated within the 4396B at a frequency of 40 MHz in the 4396B spectrum analyzer mode.

This test applies a 40 MHz CW frequency signal to the 4396B S input through a 50 MHz low pass filter (LPF). The LPF removes the second harmonics included in the applied signal. This ensures that the harmonics read by the 4396B are internally generated and not coming from the external signal source.

Specification

Second harmonic distortion

@≥10 MHz, −35 dBm mixer input .... <−70 dBc
@<10 MHz, −35 dBm mixer input .... <−60 dBc

Test Equipment

Signal Generator .... 8663A or 8642B
Power Meter .... 436A Opt. 022, 437B, or 438A
Power Sensor 8482A
50 MHz Low Pass Filter .... PN 0955-0306
Two-way Power Splitter 11667A
BNC(m)-BNC(m) cable, 61 cm (two required) .... PN 8120-1839
BNC(m)-BNC(m) cable, 122 cm .... PN 8120-1839
BNC(f)-BNC(f) adapter .... BNC(f)-BNC(f) adapter
N(m)-N(m) adapter .... PN 1250-1475
N(m)-BNC(f) adapter (two required) .... PN 1250-1476

Procedure

1. Initialize the signal generator. Then set the signal generator controls as follows:

Controls	**Settings**
Frequency	40 MHz
Amplitude	−19 dBm

2. Connect the test equipment as shown in Figure 2-29.

Note

Connect the signal generator's 10 MHz frequency reference output to the 4396B EXT REF Input on the rear panel as shown in Figure 2-29. With this configuration, both the signal generator and the 4396B are phase locked to the same reference frequency to obtain a stable measurement.

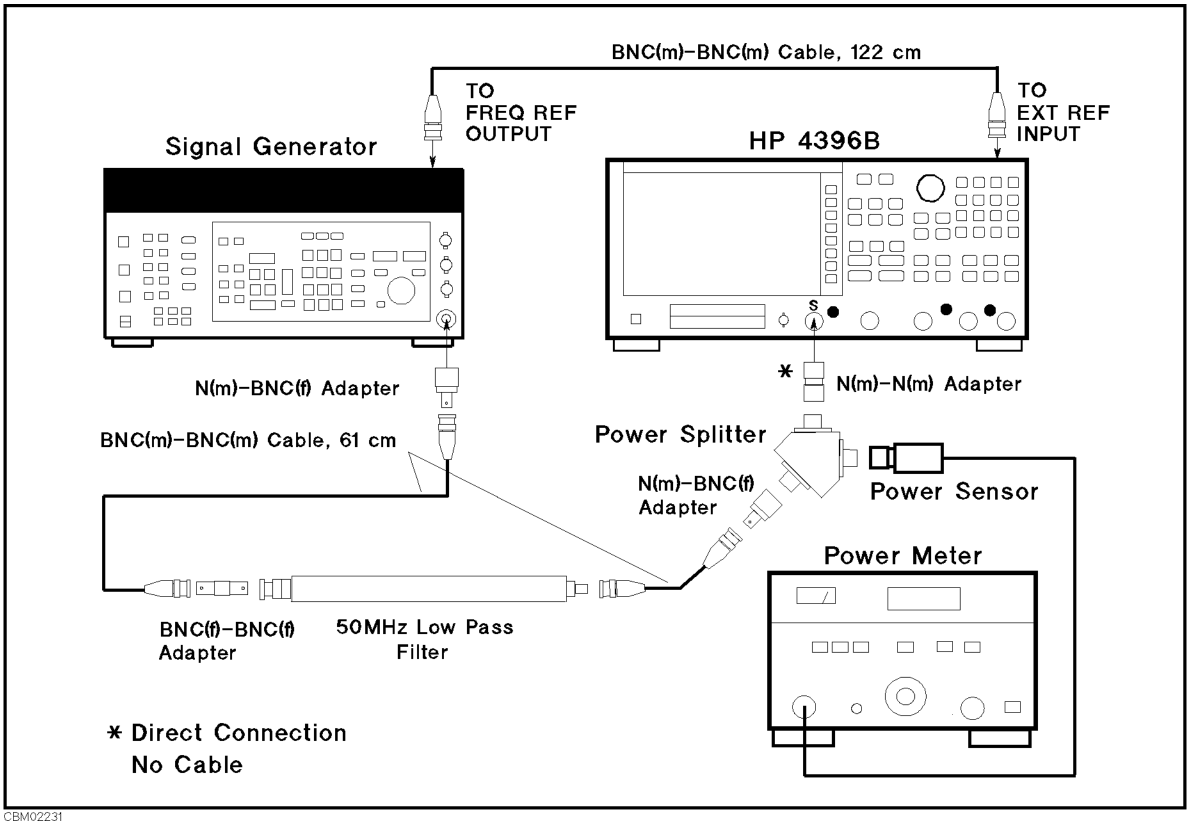

Figure 2-29. Second Harmonics Distortion Test Setup

3. Press (Meas), ANALYZER TYPE, SPECTRUM ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	Key Strokes
Center Frequency: 40 MHz	(Center), (4), (0), (M/μ)
Frequency Span: 10 kHz	(Span), (1), (0), (k/m)
RBW: 100 Hz	(Bw/Avg), RES BW, (1), (0), (0), (x1)
VBW: 10 Hz	(Bw/Avg), VIDEO BW, (1), (0), (x1)
Reference Level: −24 dBm	(Scale Ref), REFERENCE VALUE, (-), (2), (4), (x1)
Input Att.: 10 dB	(Scale Ref), ATTEN, (1), (0), (x1)

4. On the signal generator, adjust the amplitude until the power meter reads −25 ± 0.1 dBm.
5. On the 4396B, press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
6. Press (Search), MAX, (Marker), ΔMODE MENU, FIXED ΔMKR to place the delta marker reference at the peak of the carrier.
7. Press (Center), (8), (0), (M/μ) to set the 4396B center frequency to 80 MHz.
8. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
9. Press (Search), MAX to move the delta marker to the peak of the second harmonic distortion. Record the delta marker reading in the performance test record ("Test Result" column).

22. THIRD ORDER INTERMODULATION DISTORTION TEST (SA)

Description

This test measures the spurious level generated by the 4396B's third order intermodulation distortion at four frequencies; 1 MHz, 10 MHz, 500 MHz, and 1.8 GHz.

In this test, two signals are combined in the directional bridge and applied to the 4396B's S input. A T/R test set is used as the directional bridge. The frequency of one signal is separated from the other with 20 kHz. This test measures the level of the spurious products that appear at a 20 kHz offset from the signals. The power level of the two signals is adjusted to −20 dBm. Therefore, each signal at the specified power level of −30 dBm is applied to the input mixer through the 4396B's 10 dB input attenuator.

Specification

Third order inter-modulation distortion

@each input mixer level of two tones = −30 dBm, separation $\geq$ 20 kHz

@$\geq$10 MHz	<-75 dBc
@$<$10 MHz	<-65 dBc

Test Equipment

Signal Generator (two required)	8663A or 8642B
Power Meter	436A Opt. 022, 437B, or 438A
Power Sensor	8482A
Two-way Power Splitter	11667A
T/R Test Set	85044A
50Ω termination, type-N(m)	909C Opt 012 or part of 85032B
N(m)-N(m) cable, 61 cm (three required)	11500B or part of 11851B
BNC(m)-BNC(m) cable, 122 cm (two required)	PN 8120-1840
N(m)-N(m) adapter	PN 1250-1475
APC 7-N(f) adapter	11524A or part of 85032B
Tee BNC(m)-(f)-(f) adapter	PN 1250-0781

Procedure

1. Connect the test equipment as shown in Figure 2-30.

Note

Connect the signal generator's 10 MHz frequency reference output to the 4396B EXT REF Input on the rear panel as shown in Figure 2-30. With this configuration, both the signal generator and the 4396B are phase locked to the same reference frequency to obtain a stable measurement.

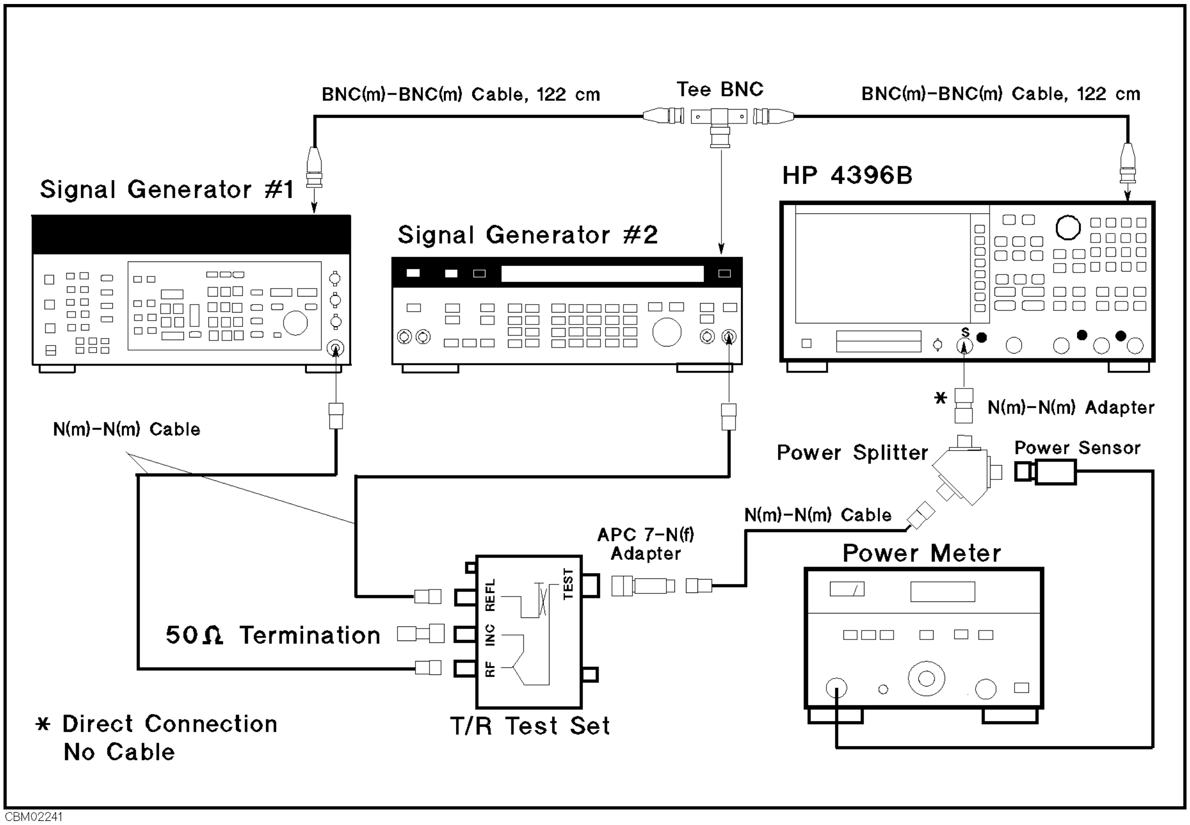

Figure 2-30. Third Order Intermodulation Distortion Test Setup

2. Initialize both signal generators. Then set their controls as follows:

Controls	Settings
Modulation	OFF
Amplitude	−14 dBm
RF Signal	OFF

3. Press (Meas), ANALYZER TYPE, SPECTRUM ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	Key Strokes
Frequency Span: 100 kHz	(Span), (1), (0), (0), (k/m)
RBW: 30 Hz	(Bw/Avg), RES BW, (3), (0), (x1)
VBW: 10 Hz	(Bw/Avg), VIDEO BW, (1), (0), (x1)
Reference Level: −14 dBm	(Scale Ref), REFERENCE VALUE, (-), (1), (4), (x1)
Input Att.: 10 dB	(Scale Ref), ATTEN, (1), (0), (x1)

4. On the 4396B, press (Center), (1), (.), (0), (1), (M/μ) to set the center frequency to the first center frequency 1.01 MHz in Table 2-24.

Table 2-24. Third Order Intermodulation Test Settings

4396B Center Frequency	Signal Generator 1 Frequency	Signal Generator 2 Frequency
1.01 MHz	1 MHz	1.02 MHz
10.01 MHz	10 MHz	10.02 MHz
500.01 MHz	500 MHz	500.02 MHz
1800.01 MHz	1800 MHz	1800.02 MHz

5. On signal generator 1, set the frequency to 1 MHz (the first frequency of signal generator 1 in Table 2-24).
6. On signal generator 2, set the frequency to 1.02 MHz (the first frequency of signal generator 2 in Table 2-24.
7. On signal generators 1 and 2, perform the following steps to adjust each generator's signal amplitude to −20 dBm.
   a. On signal generator 1, turn the RF signal on and adjust the amplitude until the power meter reads −20 dBm ± 0.5 dB.
   b. On signal generator 1, turn the RF signal off.
   c. On signal generator 2, turn the RF signal on and adjust the amplitude until the power meter reads −20 dBm ± 0.5 dB.
   d. On signal generator 1, turn the RF signal on.
8. On the 4396B, perform the following steps to measure the third order intermodulation distortion product.
   a. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
   b. Press (Marker), (1), (M/μ) to move the marker to peak of the signal generator 1's signal.
   c. Press (Marker), ΔMODE MENU, FIXED ΔMKR to place the delta marker reference at the peak of one carrier.
   d. Press (Marker), (-), (2), (0), (k/m) to move the marker to the third order intermodulation distortion products at the lower frequency.
   e. Record the marker reading in the calculation sheet ("Lower Frequency" column).
   f. Press (Marker), (4), (0), (k/m) to move the marker to the third order intermodulation distortion product at the upper frequency.
   g. Record the marker reading in the calculation sheet ("Upper Frequency" column).
   h. Press (Marker), ΔMODE MENU, ΔMODE OFF.
9. Change the 4396B center frequency and the frequencies of signal generators 1 and 2 in accordance with Table 2-24. Repeat steps 7 and 8 for each setting.
10. Compare the two marker readings at the lower and upper frequencies in the calculation sheet. Record the larger value in the performance test record ("Test Result" column).

23. OTHER SPURIOUS (SA)

Description

This test measures the level of spurious signals generated by causes other than the second harmonic distortion and the third order intermodulation distortion.

This test applies several CW frequency signals to the 4396B S input and then measures the spurious signal level at a frequency range where the spurious signal is most likely to be observed.

Specification

Other spurious

@−30 dBm mixer input, offset ≥ 1 kHz .... <−70 dBc

Test Equipment

Signal Generator .... 8663A or 8642B
N(m)-N(m) cable, 61 cm .... 11500B or part of 11851B
BNC(m)-BNC(m) cable, 122 cm .... PN 8120-1840

Procedure

1. Connect the test equipment as shown in Figure 2-31.

Note

Connect the signal generator's 10 MHz frequency reference output to the 4396B EXT REF Input on the rear panel as shown in Figure 2-31. With this configuration, both the signal generator and the 4396B are phase locked to the same reference frequency to obtain a stable measurement.

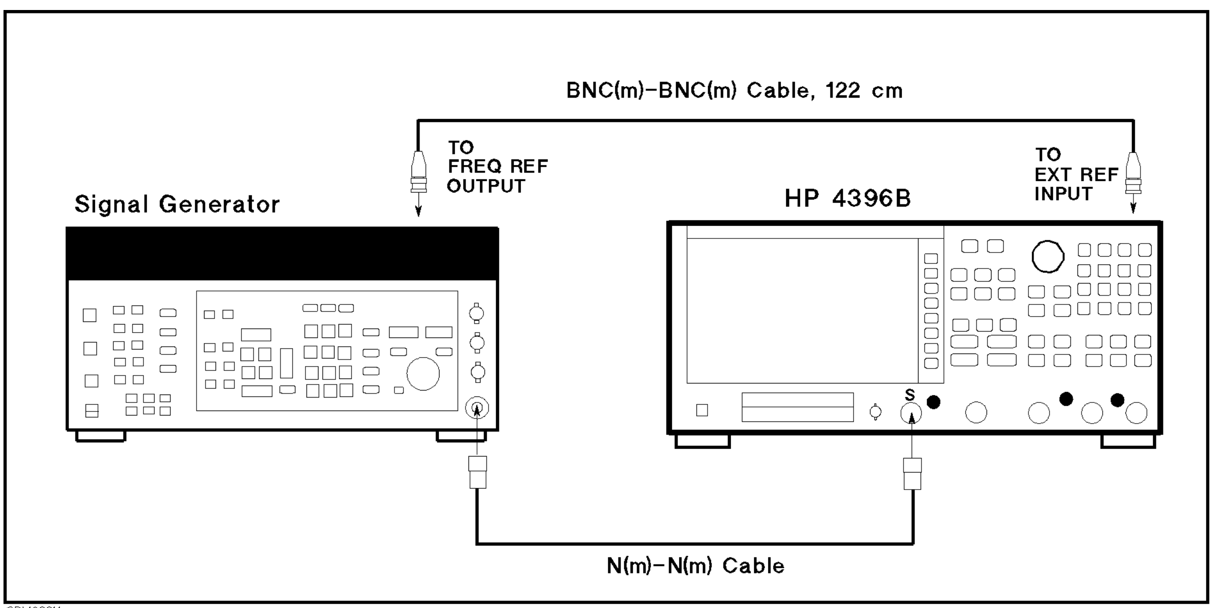

Figure 2-31. Other Spurious Test Setup

2. Press (Meas), ANALYZER TYPE, SPECTRUM ANALYZER, (Preset) to initialize the 4396B.

3. Initialize the signal generator. Then set the controls as follows.

Controls	**Settings**
Amplitude	−20 dBm

4. On the signal generator, set the frequency to 23.92375 MHz (the first column of Table 2-25).

Table 2-25. Other Spurious Test Settings

Signal Generator Frequency	4396B				
	Center Frequency	Frequency Span	RBW	VBW	Spurious Frequency
23.92375 MHz	23.92075 MHz	5.99 kHz	30 Hz	10 Hz	23.92075 MHz
99.9985 MHz	100 MHz	9.99 kHz	100 Hz	10 Hz	100.0045 MHz
99.9924 MHz	100 MHz	9.99 kHz	100 Hz	10 Hz	100.0048 MHz
100 MHz	110.71 MHz	9.99 kHz	100 Hz	10 Hz	110.71 MHz
100 MHz	142.84 MHz	9.99 kHz	100 Hz	10 Hz	142.84 MHz
1155.786429 MHz	1155.6734286 MHz	9.99 kHz	100 Hz	30 Hz	1155.6734286 MHz
1723.92375 MHz	1723.92075 MHz	5.99 kHz	30 Hz	10 Hz	1723.92075 MHz

5. On the 4396B, perform the following steps to measure the spurious level. In each step, the carrier level is measured first. Then the spurious level is measured.

   a. Set the controls as follows to measure the carries level:

Control Settings	**Key Strokes**
Center Frequency: 23.92375 MHz	(Center), (2), (3), (.), (9), (2), (3), (7), (5), (M/μ)
Frequency Span: 1 MHz	(Span), (1), (M/μ)
RBW: 3 kHz	(Bw/Avg), RES BW, (3), (k/m)

   The center frequency is set to the frequency of the signal generator.

   b. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

   c. Press (Search), MAX, (Marker), ΔMODE MENU, FIXED ΔMKR to place the delta marker reference at the peak of the carrier.

   d. Set the following controls to the settings listed in Table 2-25 (from the second to the fifth columns):

Control Settings	**Key Strokes**
Center Frequency: 23.92075 MHz	(Center), (2), (3), (.), (9), (2), (0), (7), (5), (M/μ)
Frequency Span: 5.99 kHz	(Span), (5), (.), (9), (9), (k/m)
RBW: 30 Hz	(Bw/Avg), RES BW, (3), (0), (x1)
VBW: 10 Hz	(Bw/Avg), VIDEO BW, (1), (0), (x1)

   e. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

   f. Press (Marker), ΔMODE MENU, ΔMKR SWP PARAM, (2), (3), (.), (9), (2), (0), (7), (5), (M/μ) to move the delta reference marker to the spurious frequency in the sixth column of Table 2-25.

   g. Press (Marker), (0), (x1), to move the delta marker to the spurious frequency.

   h. Record the 4396B marker reading in the performance test record ("Test Result" column).

6. Repeat steps 4 and 5 for each setting in Table 2-25.

7. On the signal generator, set the controls as follows:

Controls	Settings
Frequency	1.8 GHz
Amplitude	0 dBm

8. On the 4396B, perform the following steps to measure the carrier level.

   a. Set the controls as follows.

Control Settings	Key Strokes
Center Frequency: 1.8 GHz	(Center), (1), (.), (8), (G/n)
Frequency Span: 1 MHz	(Span), (1), (M/μ)
RBW: 3 kHz	(Bw/Avg), RES BW, (3), (k/m)

   b. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

   c. Press (Search), MAX, (Marker), ΔMODE MENU, FIXED ΔMKR to place the delta marker reference at the peak of the carrier.

9. On the 4396B, set the following controls to the first settings in Table 2-26:

Control Settings	Key Strokes
Center Frequency: 1.749 GHz	(Center), (1), (.), (7), (4), (9), (G/n)
Frequency Span: 98 MHz	(Span), (9), (8), (M/μ)
RBW: 30 kHz	(Bw/Avg), RES BW, (3), (0), (k/m)
VBW: 10 kHz	(Bw/Avg), VIDEO BW, (1), (0), (k/m)

Table 2-26. Other Spurious Test Settings 2

4396B			
Center Frequency	**Frequency Span**	**RBW**	**VBW**
1749 MHz	98 MHz	30 kHz	10 kHz
1798.995 MHz	1.99 MHz	1 kHz	100 Hz
1799.9945 MHz	9 kHz	30 Hz	3 Hz

10. Perform the following steps to measure the spurious level.

    a. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.

    b. Press (Search), MAX to move the delta marker to the maximum spurious product on the trace.

    c. Record the delta marker reading in the performance test record ("Test Result" column).

11. Change the 4396B controls (center frequency, frequency span, RBW and VBW) in accordance with Table 2-26. Then repeat step 10 for each setting.

24. RESIDUAL RESPONSE TEST (SA)

Description

This test connects a 50 Ω terminator to the 4396B's S input and measures the 4396B residual response at several frequencies where the response is most likely to be observed.

The residual response is any internally generated by mixing the harmonics of the first/second local phase-lock-loop oscillators and the related reference signal.

Specification

Residual response

@≥3 MHz, 0 dB attenuator .... <−100 dBm
@1 kHz ≤ frequency < 3 MHz, 0 dB attenuator .... <−90 dBm

Test Equipment

50Ω termination, type-N(m) .... 909C Opt 012 or part of 85032B

Procedure

1. Connect the test equipment as shown in Figure 2-32.

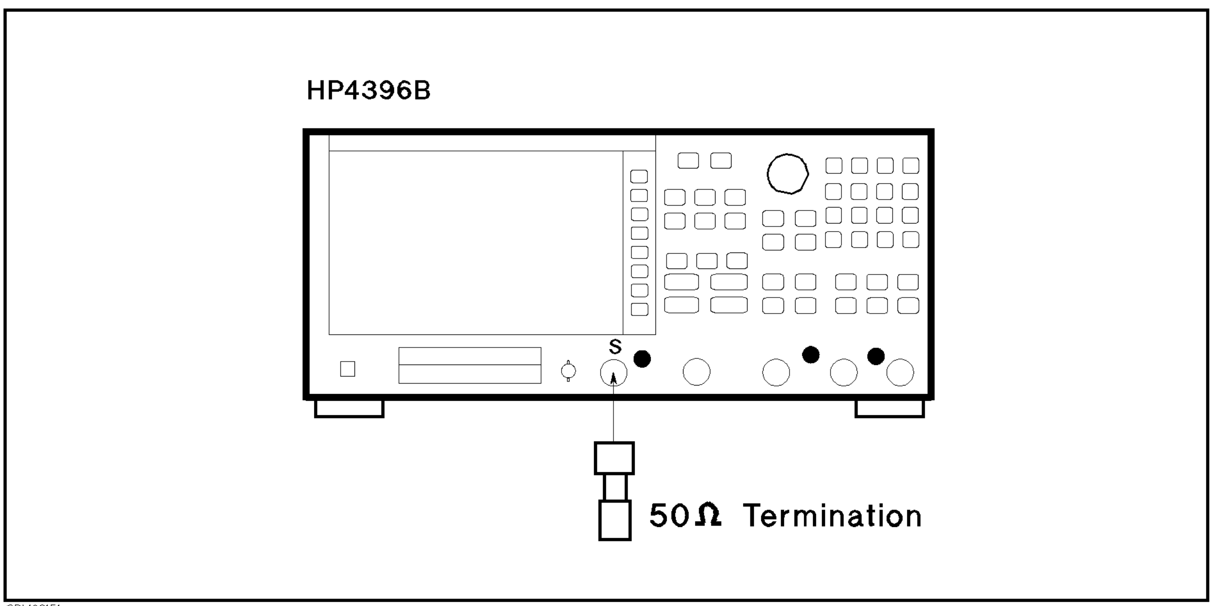

Figure 2-32. Residual Response Test Setup

2. Press (Meas), ANALYZER TYPE, SPECTRUM ANALYZER, (Preset) to initialize the 4396B. Then set the controls as follows:

Control Settings	Key Strokes
Frequency Span: 6 kHz	(Span), (6), (k/m)
RBW: 30 Hz	(Bw/Avg), RES BW, (3), (0), (x1)
Reference Level: −40 dBm	(Scale Ref), REFERENCE VALUE, (-), (4), (0), (x1)
Input Att.: 0 dB;	(Scale Ref), ATTEN, (0), (x1)

3. Set the center frequency to the first frequency 10.71 MHz in Table 2-27.

Table 2-27. Residual Response Test Settings

4396B Center Frequency
10.71 MHz
17.24 MHz
40 MHz
42.84 MHz
630 MHz
686.19333333333 MHz
1064.99 MHz
1352.9683333333 MHz
1387.278 MHz
1586.775 MHz

4. Perform the following steps to measure the residual response at a frequency 10.71 MHz.
   a. Press (Trigger), SINGLE to make a sweep. Wait for the completion of the sweep.
   b. Press (Search), MAX to move the marker to the maximum point on the trace.
   c. Record the marker reading in the performance test record "Test Result" column).
5. Change the 4396B center frequency in accordance with Table 2-27. Repeat step 4 for each setting.

3

Calculation Sheet

INTRODUCTION

This chapter contains calculation sheets for each performance test that requires additional calculations to determine the final test result.

Use the calculation sheet in this chapter as an aid for recording raw measurement data and calculating the performance test results.

Calculation sheet entries are provided only for performance tests in which calculations are required to obtain the test results.

2. SOURCE LEVEL FLATNESS TEST

Frequency	Power Meter Reading [ref[1]]
50 MHz	______ dBm

1 : is the power meter reading of the source level accuracy test.

Frequency	Power Meter Reading [a]	Test Result [a−ref]
100 kHz	______ dBm	______ dB
1 MHz	______ dBm	______ dB
10 MHz	______ dBm	______ dB
100 MHz	______ dBm	______ dB
400 MHz	______ dBm	______ dB
700 MHz	______ dBm	______ dB
1 GHz	______ dBm	______ dB
1.3 GHz	______ dBm	______ dB
1.6 GHz	______ dBm	______ dB
1.8 GHz	______ dBm	______ dB

3. NON SWEEP POWER LINEARITY TEST

Step Attenuator Calibration Value at 50 MHz

Attenuation	Calibration Value[1]
10 dB	**a1** = ____________ dB
20 dB	**a2** = ____________ dB
30 dB	**a3** = ____________ dB
40 dB	**a4** = ____________ dB
50 dB	**a5** = ____________ dB

1 : Incremental attenuation referenced to 0 dB setting.

Reference (0 dBm)

4396B Source Power	Power Meter Reading [b]	Reference [ref]
0 dBm	____________ dBm	**b + a3 =** ____________ dBm

Non Sweep Power Linearity

4396B Source Power	Power Meter Reading [b]	Test Result
20 dBm	____________ dBm	**b + a5 − ref − 20 =** ____________ dB
10 dBm	____________ dBm	**b + a4 − ref − 10 =** ____________ dB
−10 dBm	____________ dBm	**b + a2 − ref + 10 =** ____________ dB
−20 dBm	____________ dBm	**b + a1 − ref + 20 =** ____________ dB
−30 dBm	____________ dBm	**b + a1 − ref + 30 =** ____________ dB
−40 dBm	____________ dBm	**b + a1 − ref + 40 =** ____________ dB
−50 dBm	____________ dBm	**b + a1 − ref + 50 =** ____________ dB
−60 dBm	____________ dBm	**b − ref + 60 =** ____________ dB

Note

Calculate **ref** in the calculation sheet for the reference (0 dBm) first. Then calculate test results using the equation and the value of **ref**.

4. POWER SWEEP LINEARITY TEST

Step Attenuator Calibration Value at 50 MHz

Attenuation	Calibration Value[1]	[a5-a4][2]
40 dB	**a4** = ____________ dB	____________ dB
50 dB	**a5** = ____________ dB	

1 : Incremental attenuation referenced to 0 dB setting.

2 : **a5-a4** appears in equations to calculate the power sweep linearity. Use this value as **a5-a4** of each equation.

4396B Source Power	Power Meter Reading
−10 dBm	**b1** = ____________ dBm
−5 dBm	**b2** = ____________ dBm
0 dBm	**b3** = ____________ dBm
5 dBm	**b4** = ____________ dBm
10 dBm	**b5** = ____________ dBm
15 dBm	**b6** = ____________ dBm
20 dBm	**b7** = ____________ dBm

Stop Power	Source Power	Test Result
20 dBm	15 dBm	**b7−b6−5** = ____________ dB
	10 dBm	**b7−b5+(a5−a4)−10** = ____________ dB
	5 dBm	**b7−b4+(a5−a4)−15** = ____________ dB
	0 dBm	**b7−b3+(a5−a4)−20** = ____________ dB
15 dBm	10 dBm	**b6−b5+(a5−a4)−5** = ____________ dB
	5 dBm	**b6−b4+(a5−a4)−10** = ____________ dB
	0 dBm	**b6−b3+(a5−a4)−15** = ____________ dB
	−5 dBm	**b6−b2+(a5−a4)−20** = ____________ dB
10 dBm	5 dBm	**b5−b4−5** = ____________ dB
	0 dBm	**b5−b3−10** = ____________ dB
	−5 dBm	**b5−b2−15** = ____________ dB
	−10 dBm	**b5−b1−20** = ____________ dB
5 dBm	0 dBm	**b4−b3−5** = ____________ dB
	−5 dBm	**b4−b2−10** = ____________ dB
	−10 dBm	**b4−b1−15** = ____________ dB
0 dBm	−5 dBm	**b3−b2−5** = ____________ dB
	−10 dBm	**b3−b1−10** = ____________ dB
−5 dBm	−10 dBm	**b2−b1−5** = ____________ dB

6. RECEIVER NOISE LEVEL TEST

At IF BW 10 Hz

Frequency	Input	Trace Mean [a]	Test Result [$20\times\log(a) - 20\ dB^1$]
100 kHz	R	______ Unit	______ dBm
	A	______ Unit	______ dBm
	B	______ Unit	______ dBm
1 MHz	R	______ Unit	______ dBm
	A	______ Unit	______ dBm
	B	______ Unit	______ dBm
10 MHz	R	______ Unit	______ dBm
	A	______ Unit	______ dBm
	B	______ Unit	______ dBm
100 MHz	R	______ Unit	______ dBm
	A	______ Unit	______ dBm
	B	______ Unit	______ dBm
500 MHz	R	______ Unit	______ dBm
	A	______ Unit	______ dBm
	B	______ Unit	______ dBm
1 GHz	R	______ Unit	______ dBm
	A	______ Unit	______ dBm
	B	______ Unit	______ dBm
1.4 GHz	R	______ Unit	______ dBm
	A	______ Unit	______ dBm
	B	______ Unit	______ dBm
1.8 GHz	R	______ Unit	______ dBm
	A	______ Unit	______ dBm
	B	______ Unit	______ dBm

1 : 10×LOG(RBW 1kHz/RBW 10 Hz)

At IF BW 40 kHz

Frequency	Input	Trace Mean [a]		Test Result [20×log(a)]	
1 MHz	R	______	Unit	______	dBm
	A	______	Unit	______	dBm
	B	______	Unit	______	dBm
10 MHz	R	______	Unit	______	dBm
	A	______	Unit	______	dBm
	B	______	Unit	______	dBm
100 MHz	R	______	Unit	______	dBm
	A	______	Unit	______	dBm
	B	______	Unit	______	dBm
500 MHz	R	______	Unit	______	dBm
	A	______	Unit	______	dBm
	B	______	Unit	______	dBm
1 GHz	R	______	Unit	______	dBm
	A	______	Unit	______	dBm
	B	______	Unit	______	dBm
1.4 GHz	R	______	Unit	______	dBm
	A	______	Unit	______	dBm
	B	______	Unit	______	dBm
1.8 GHz	R	______	Unit	______	dBm
	A	______	Unit	______	dBm
	B	______	Unit	______	dBm

9. ABSOLUTE AMPLITUDE ACCURACY TEST

R input

Frequency	4396B Reading [a]	Power Meter Reading [b]	Test Result [a−b]
100 kHz	______ dBm	______ dBm	______ dB
1 MHz	______ dBm	______ dBm	______ dB
10 MHz	______ dBm	______ dBm	______ dB
50 MHz	______ dBm	______ dBm	______ dB
100 MHz	______ dBm	______ dBm	______ dB
1 GHz	______ dBm	______ dBm	______ dB
1.79 GHz	______ dBm	______ dBm	______ dB
1.8 GHz	______ dBm	______ dBm	______ dB

A input

Frequency	4396B Reading [a]	Power Meter Reading [b]	Test Result [a−b]
100 kHz	______ dBm	______ dBm	______ dB
1 MHz	______ dBm	______ dBm	______ dB
10 MHz	______ dBm	______ dBm	______ dB
50 MHz	______ dBm	______ dBm	______ dB
100 MHz	______ dBm	______ dBm	______ dB
1 GHz	______ dBm	______ dBm	______ dB
1.79 GHz	______ dBm	______ dBm	______ dB
1.8 GHz	______ dBm	______ dBm	______ dB

B input

Frequency	4396B Reading [a]	Power Meter Reading [b]	Test Result [a−b]
100 kHz	______ dBm	______ dBm	______ dB
1 MHz	______ dBm	______ dBm	______ dB
10 MHz	______ dBm	______ dBm	______ dB
50 MHz	______ dBm	______ dBm	______ dB
100 MHz	______ dBm	______ dBm	______ dB
1 GHz	______ dBm	______ dBm	______ dB
1.79 GHz	______ dBm	______ dBm	______ dB
1.8 GHz	______ dBm	______ dBm	______ dB

10. MAGNITUDE RATIO/PHASE DYNAMIC ACCURACY TEST

Step Attenuator Calibration Value at 50 MHz

Attenuationg	Calibration Value[1]	
10 dB	**a1** = ____________	dB
20 dB	**a2** = ____________	dB
30 dB	**a3** = ____________	dB
40 dB	**a4** = ____________	dB
50 dB	**a5** = ____________	dB
60 dB	**a6** = ____________	dB
70 dB	**a7** = ____________	dB

1 : Incremental attenuation referenced to 0 dB setting.

A/R Measurement

Input Level	4396B Reading [b]		Test Result	
0 dB	____________	dB	**b−a3** = ____________	dB
−10 dB	____________	dB	**b−a2** = ____________	dB
−20 dB	____________	dB	**b−a1** = ____________	dB
−40 dB	____________	dB	**b+a1** = ____________	dB
−50 dB	____________	dB	**b+a2** = ____________	dB
−60 dB	____________	dB	**b+a3** = ____________	dB
−70 dB	____________	dB	**b+a4** = ____________	dB
−80 dB	____________	dB	**b+a5** = ____________	dB
−90 dB	____________	dB	**b+a6** = ____________	dB
−100 dB	____________	dB	**b+a7** = ____________	dB

B/R Measurement

Input Level	4396B Reading [b]		Test Result	
0 dB	____________	dB	**b−a3** = ____________	dB
−10 dB	____________	dB	**b−a2** = ____________	dB
−20 dB	____________	dB	**b−a1** = ____________	dB
−40 dB	____________	dB	**b+a1** = ____________	dB
−50 dB	____________	dB	**b+a2** = ____________	dB
−60 dB	____________	dB	**b+a3** = ____________	dB
−70 dB	____________	dB	**b+a4** = ____________	dB
−80 dB	____________	dB	**b+a5** = ____________	dB
−90 dB	____________	dB	**b+a6** = ____________	dB
−100 dB	____________	dB	**b+a7** = ____________	dB

13. DISPLAYED AVERAGE NOISE LEVEL TEST

Center Frequency	Trace Mean [a]		Test Result			
10 kHz	____________	Watt	**10×log(a/0.001)−10dB**[1]	=	____________	dBm/Hz
100 kHz	____________	Watt	**10×log(a/0.001)−40dB**[2]	=	____________	dBm/Hz
1 MHz	____________	Watt	**10×log(a/0.001)−40dB**[2]	=	____________	dBm/Hz
10 MHz	____________	Watt	**10×log(a/0.001)−40dB**[2]	=	____________	dBm/Hz
100 MHz	____________	Watt	**10×log(a/0.001)−40dB**[2]	=	____________	dBm/Hz
500 MHz	____________	Watt	**10×log(a/0.001)−40dB**[2]	=	____________	dBm/Hz
1 GHz	____________	Watt	**10×log(a/0.001)−40dB**[2]	=	____________	dBm/Hz
1.4 GHz	____________	Watt	**10×log(a/0.001)−40dB**[2]	=	____________	dBm/Hz
1.8 GHz	____________	Watt	**10×log(a/0.001)−40dB**[2]	=	____________	dBm/Hz

1 : 10×LOG(RBW10 Hz /RBW 1 Hz)

2 : 10×LOG(RBW10 kHz /RBW 1 Hz)

14. AMPLITUDE FIDELITY

Step Attenuator Calibration Value at 50 MHz

Attenuation	Calibration Value[1]
10 dB	**a1** = __________ dB
20 dB	**a2** = __________ dB
30 dB	**a3** = __________ dB
40 dB	**a4** = __________ dB
50 dB	**a5** = __________ dB
60 dB	**a6** = __________ dB

1 : Incremental attenuation referenced to 0 dB setting.

At RBW 10 kHz

dB from Reference Level	4396B Reading [b]	Test Result
−10 dB	__________ dB	**b+a1** = __________
−20 dB	__________ dB	**b+a2** = __________
−30 dB	__________ dB	**b+a3** = __________
−40 dB	__________ dB	**b+a4** = __________
−50 dB	__________ dB	**b+a5** = __________
−60 dB	__________ dB	**b+a6** = __________

At RBW 1 MHz

dB from Reference Level	4396B Reading [b]	Test Result
−10 dB	__________ dB	**b+a1** = __________
−20 dB	__________ dB	**b+a2** = __________
−30 dB	__________ dB	**b+a3** = __________
−40 dB	__________ dB	**b+a4** = __________
−50 dB	__________ dB	**b+a5** = __________

15. INPUT ATTENUATOR SWITCHING UNCERTAINTY TEST

Step Attenuator Calibration Value at 50 MHz

Attenuation	Calibration Value[1]	
10 dB	**a1** = ___________	dB
20 dB	**a2** = ___________	dB
30 dB	**a3** = ___________	dB
40 dB	**a4** = ___________	dB
50 dB	**a5** = ___________	dB

1 : Incremental attenuation referenced to 0 dB setting.

Input Attenuator Switching Uncertainty

4396B Input Attenuation	4396B Reading [b]		Test Result	
20 dB	___________	dB	**b−a5+a4** =	___________
30 dB	___________	dB	**b−a5+a3** =	___________
40 dB	___________	dB	**b−a5+a2** =	___________
50 dB	___________	dB	**b−a5+a1** =	___________
60 dB	___________	dB	**b−a5** =	___________

16. RESOLUTION BANDWIDTH ACCURACY/SELECTIVITY TEST

RBW Selectivity

RBW	3 dB Bandwidth [a]	60 dB Bandwidth [b]	Test Result [b/a]
10 kHz	____________ kHz	____________ kHz	____________
30 kHz	____________ kHz	____________ kHz	____________
100 kHz	____________ kHz	____________ kHz	____________
300 kHz	____________ kHz	____________ kHz	____________
1 MHz	____________ MHz	____________ MHz	____________
3 MHz	____________ MHz	____________ MHz	____________

18. IF GAIN SWITCHING UNCERTAINTY TEST

10 dB Step Attenuator Calibration Value at 50 MHz

Attenuation	Calibration Value[1]
10 dB	**a1** = ________ dB
20 dB	**a2** = ________ dB
30 dB	**a3** = ________ dB
40 dB	**a4** = ________ dB
50 dB	**a5** = ________ dB

1 : Incremental attenuation referenced to 0 dB setting.

1 dB Step Attenuator Calibration Value at 50 MHz

Attenuation	Calibration Value[1]
2 dB	**b2** = ________ dB
4 dB	**b4** = ________ dB
6 dB	**b6** = ________ dB
8 dB	**b8** = ________ dB
10 dB	**b10** = ________ dB

1 : Incremental attenuation referenced to 0 dB setting.

IF Gain Switching Uncertainty

4396B Reference Level	4396B Reading [c]	Test Result
0 dBm	________ dB	**c−b10** = ________ dB
−2 dBm	________ dB	**c+b2−b10** = ________ dB
−4 dBm	________ dB	**c+b4−b10** = ________ dB
−6 dBm	________ dB	**c+b6−b10** = ________ dB
−8 dBm	________ dB	**c+b8−b10** = ________ dB
−12 dBm	________ dB	**c+a2+b2−a1−b10** = ________ dB
−14 dBm	________ dB	**c+a2+b4−a1−b10** = ________ dB
−16 dBm	________ dB	**c+a2+b6−a1−b10** = ________ dB
−18 dBm	________ dB	**c+a2+b8−a1−b10** = ________ dB
−20 dBm	________ dB	**c+a2−a1** = ________ dB
−30 dBm	________ dB	**c+a3−a1** = ________ dB
−40 dBm	________ dB	**c+a4−a1** = ________ dB

20. FREQUENCY RESPONSE TEST

Note Calculate **ref** first in the table for the reference at 20 MHz. Then calculate test results using the equation and the value of **ref**.

Reference at 20 MHz

4396B Frequency	4396B Reading 1 [r1]	Power Meter Reading 1 [r2]	4396B Reading 2 [r3]	Power Meter Reading 2 [r4]	Reference [ref] [(r1−r2+r3−r4)/2]
20 MHz	________ dBm	________ dBm	________ dBm	________ dBm	___________ dB

At Frequencies ≥ 100 kHz

4396B Frequency	4396B Reading 1 [a1]	Power Meter Reading 1 [b1]	4396B Reading 2 [a2]	Power Meter Reading 2 [b2]	Reference [(a1−b1+a2−b2)/2−ref]
100 kHz	________ dBm	________ dBm	________ dBm	________ dBm	___________ dB
1 MHz	________ dBm	________ dBm	________ dBm	________ dBm	___________ dB
6 MHz	________ dBm	________ dBm	________ dBm	________ dBm	___________ dB
10 MHz	________ dBm	________ dBm	________ dBm	________ dBm	___________ dB
50 MHz	________ dBm	________ dBm	________ dBm	________ dBm	___________ dB
100 MHz	________ dBm	________ dBm	________ dBm	________ dBm	___________ dB
1 GHz	________ dBm	________ dBm	________ dBm	________ dBm	___________ dB
1.79 GHz	________ dBm	________ dBm	________ dBm	________ dBm	___________ dB
1.8 GHz	________ dBm	________ dBm	________ dBm	________ dBm	___________ dB

At Frequencies < 100 kHz

Frequency	4396B Reading [c]	Test Result [c+10 dBm[1]−ref]
10 Hz	___________ dBm	___________ dB
100 Hz	___________ dBm	___________ dB
1 kHz	___________ dBm	___________ dB
10 kHz	___________ dBm	___________ dB

1 : is −(−10 dBm). −10 dBm is the output level of the function generator.

22. THIRD ORDER INTERMODULATION DISTORTION TEST

Frequency	4396B Marker Reading		Test Result
	Lower Frequency	Upper Frequency	
	[a]	[b]	[larger of a and b]
1 MHz	________ dBc	________ dBc	________ dBc
10 MHz	________ dBc	________ dBc	________ dBc
500 MHz	________ dBc	________ dBc	________ dBc
1.8 GHz	________ dBc	________ dBc	________ dBc

4

Performance Test Record

Agilent 4396B NETWORK/SPECTRUM ANALYZER

Date:	____________________
Temperature:	____________________
Humidity:	____________________
Serial No.:	____________________
Tested by:	____________________

1. FREQUENCY ACCURACY TEST

without Option 1D5

Frequency	Minimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
1 GHz	999.9945 MHz	____________	1000.0055 MHz	±191 Hz

with Option 1D5

Frequency	Minimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
1 GHz	999.99987 MHz	____________	1000.00013 MHz	±1.1 Hz

2. SOURCE LEVEL ACCURACY/FLATNESS TEST

Level Accuracy

Minimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
−0.5 dBm	__________	0.5 dBm	±0.050 dB

Level Flatness

Frequency	Minimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
100 kHz	−1 dB	__________	1 dB	±0.16 dB
1 MHz	−1 dB	__________	1 dB	±0.08 dB
10 MHz	−1 dB	__________	1 dB	±0.07 dB
100 MHz	−1 dB	__________	1 dB	±0.08 dB
400 MHz	−1 dB	__________	1 dB	±0.11 dB
700 MHz	−1 dB	__________	1 dB	±0.11 dB
1 GHz	−1 dB	__________	1 dB	±0.11 dB
1.3 GHz	−1 dB	__________	1 dB	±0.11 dB
1.6 GHz	−1 dB	__________	1 dB	±0.11 dB
1.8 GHz	−1 dB	__________	1 dB	±0.11 dB

3. NON SWEEP POWER LINEARITY TEST

4396B Power Setting	Minimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
20 dBm	−0.7 dB	__________	0.7 dB	±0.043 dB
10 dBm	−0.7 dB	__________	0.7 dB	±0.040 dB
−10 dBm	−0.7 dB	__________	0.7 dB	±0.039 dB
−20 dBm	−0.7 dB	__________	0.7 dB	±0.039 dB
−30 dBm	−1.0 dB	__________	1.0 dB	±0.039 dB
−40 dBm	−1.0 dB	__________	1.0 dB	±0.041 dB
−50 dBm	−1.5 dB	__________	1.5 dB	±0.133 dB
−60 dBm	−1.5 dB	__________	1.5 dB	±0.139 dB

4. POWER SWEEP LINEARITY TEST

STOP Power	Source Power	Minimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
20 dBm	15 dBm	−0.5 dB	___________	0.5 dB	±0.055 dB
	10 dBm	−0.5 dB	___________	0.5 dB	±0.043 dB
	5 dBm	−0.5 dB	___________	0.5 dB	±0.052 dB
	0 dBm	−0.5 dB	___________	0.5 dB	±0.043 dB
15 dBm	10 dBm	−0.5 dB	___________	0.5 dB	±0.052 dB
	5 dBm	−0.5 dB	___________	0.5 dB	±0.060 dB
	0 dBm	−0.5 dB	___________	0.5 dB	±0.052 dB
	−5 dBm	−0.5 dB	___________	0.5 dB	±0.060 dB
10 dBm	5 dBm	−0.5 dB	___________	0.5 dB	±0.050 dB
	0 dBm	−0.5 dB	___________	0.5 dB	±0.040 dB
	−5 dBm	−0.5 dB	___________	0.5 dB	±0.050 dB
	−10 dBm	−0.5 dB	___________	0.5 dB	±0.042 dB
5 dBm	0 dBm	−0.5 dB	___________	0.5 dB	±0.050 dB
	−5 dBm	−0.5 dB	___________	0.5 dB	±0.058 dB
	−10 dBm	−0.5 dB	___________	0.5 dB	±0.051 dB
0 dBm	−5 dBm	−0.5 dB	___________	0.5 dB	±0.050 dB
	−10 dBm	−0.5 dB	___________	0.5 dB	±0.042 dB
−5 dBm	−10 dBm	−0.5 dB	___________	0.5 dB	±0.052 dB

5. HARMONICS/NON-HARMONIC SPURIOUS TEST

Harmonics

Frequency	Harmonics Frequency	Test Result	Test Limit	Measurement Uncertainty
100 kHz	200 kHz	________ dBc	< −30 dBc	±1.72 dB
500 MHz	1 GHz	________ dBc	< −30 dBc	±1.73 dB
1.8 GHz	3.6 GHz	________ dBc	< −30 dBc	±1.73 dB

Non-Harmonic Spurious

Frequency	Non-Harmonic Frequency	Test Result	Test Limit	Measurement Uncertainty
500 MHz	478.58 MHz	________	< −30 dBc	±1.73 dB
	521.42 MHz	________	< −30 dBc	±1.73 dB
	1558.58 MHz	________	< −30 dBc	±1.73 dB
1.8 GHz	258.58 MHz	________	< −30 dBc	±1.73 dB
	1778.58 MHz	________	< −30 dBc	±1.73 dB
	1821.42 MHz	________	< −30 dBc	±1.73 dB
	2058.58 MHz	________	< −30 dBc	±1.73 dB
	3858.58 MHz	________	< −30 dBc	±1.73 dB

6. RECEIVER NOISE LEVEL TEST

At IF BW 10 Hz

Frequency	Input	Test Result	Test Limit
100 kHz	R	___________	< −85 dBm
	A	___________	< −110 dBm
	B	___________	< −110 dBm
1 MHz	R	___________	< −85 dBm
	A	___________	< −110 dBm
	B	___________	< −110 dBm
10 MHz	R	___________	< −99.97 dBm
	A	___________	< −124.97 dBm
	B	___________	< −124.97 dBm
100 MHz	R	___________	< −99.7 dBm
	A	___________	< −124.7 dBm
	B	___________	< −124.7 dBm
500 MHz	R	___________	< −98.5 dBm
	A	___________	< −123.5 dBm
	B	___________	< −123.5 dBm
1 GHz	R	___________	< −97 dBm
	A	___________	< −122 dBm
	B	___________	< −122 dBm
1.4 GHz	R	___________	< −95.8 dBm
	A	___________	< −120.8 dBm
	B	___________	< −120.8 dBm
1.8 GHz	R	___________	< −94.6 dBm
	A	___________	< −119.6 dBm
	B	___________	< −119.6 dBm

At IF BW 40 kHz

Frequency	Input	Test Result	Test Limit
1 MHz	R	___________	< −50 dBm
	A	___________	< −75 dBm
	B	___________	< −75 dBm
10 MHz	R	___________	< −64.97 dBm
	A	___________	< −89.97 dBm
	B	___________	< −89.97 dBm
100 MHz	R	___________	< −64.7 dBm
	A	___________	< −89.7 dBm
	B	___________	< −89.7 dBm
500 MHz	R	___________	< −63.5 dBm
	A	___________	< −88.5 dBm
	B	___________	< −88.5 dBm
1 GHz	R	___________	< −62 dBm
	A	___________	< −87 dBm
	B	___________	< −87 dBm
1.4 GHz	R	___________	< −60.8 dBm
	A	___________	< −85.8 dBm
	B	___________	< −85.8 dBm
1.8 GHz	R	___________	< −59.6 dBm
	A	___________	< −84.6 dBm
	B	___________	< −84.6 dBm

7. INPUT CROSSTALK TEST

Measurement	Test Result	Test Limit
R into A Crosstalk	____________	< -120 dB
R into B Crosstalk	____________	< -120 dB
A into R Crosstalk	____________	< -80 dB
A into B Crosstalk	____________	< -100 dB
B into R Crosstalk	____________	< -80 dB
B into A Crosstalk	____________	< -100 dB

8. INPUT IMPEDANCE TEST

Measurement	Test Result	Test Limit	Measurement Uncertainty
R Return Loss	____________	> 20 dB	± 1.2 dB
A Return Loss	____________	> 20 dB	± 1.2 dB
B Return Loss	____________	> 20 dB	± 1.2 dB

9. ABSOLUTE AMPLITUDE ACCURACY TEST

Input R

Frequency	Mimimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
100 kHz	−1.5 dB	________	1.5 dB	±0.22 dB
1 MHz	−1.5 dB	________	1.5 dB	±0.18 dB
10 MHz	−1.5 dB	________	1.5 dB	±0.17 dB
50 MHz	−1.5 dB	________	1.5 dB	±0.17 dB
100 MHz	−1.5 dB	________	1.5 dB	±0.18 dB
1 GHz	−1.5 dB	________	1.5 dB	±0.18 dB
1.79 GHz	−1.5 dB	________	1.5 dB	±0.18 dB
1.8 GHz	−1.5 dB	________	1.5 dB	±0.18 dB

Input A

Frequency	Mimimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
100 kHz	−1.5 dB	________	1.5 dB	±0.22 dB
1 MHz	−1.5 dB	________	1.5 dB	±0.18 dB
10 MHz	−1.5 dB	________	1.5 dB	±0.17 dB
50 MHz	−1.5 dB	________	1.5 dB	±0.17 dB
100 MHz	−1.5 dB	________	1.5 dB	±0.18 dB
1 GHz	−1.5 dB	________	1.5 dB	±0.18 dB
1.79 GHz	−1.5 dB	________	1.5 dB	±0.18 dB
1.8 GHz	−1.5 dB	________	1.5 dB	±0.18 dB

Input B

Frequency	Mimimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
100 kHz	−1.5 dB	________	1.5 dB	±0.22 dB
1 MHz	−1.5 dB	________	1.5 dB	±0.18 dB
10 MHz	−1.5 dB	________	1.5 dB	±0.17 dB
50 MHz	−1.5 dB	________	1.5 dB	±0.17 dB
100 MHz	−1.5 dB	________	1.5 dB	±0.18 dB
1 GHz	−1.5 dB	________	1.5 dB	±0.18 dB
1.79 GHz	−1.5 dB	________	1.5 dB	±0.18 dB
1.8 GHz	−1.5 dB	________	1.5 dB	±0.18 dB

10. MAGNITUDE RATIO/PHASE DYNAMIC ACCURACY TEST

A/R Measurement

Input Level	Measurement	Minimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
0 dB	Magnitude Ratio	−0.30 dB	________	0.30 dB	±0.0094 dB
	Phase	−3.0°	________	3.0°	±0.043°
−10 dB	Magnitude Ratio	−0.05 dB	________	0.05 dB	±0.0090 dB
	Phase	−0.6°	________	0.6°	±0.043°
−20 dB	Magnitude Ratio	−0.05 dB	________	0.05 dB	±0.0091 dB
	Phase	−0.3°	________	0.3°	±0.043°
−40 dB	Magnitude Ratio	−0.05 dB	________	0.05 dB	±0.0091 dB
	Phase	−0.3°	________	0.3°	±0.043°
−50 dB	Magnitude Ratio	−0.05 dB	________	0.05 dB	±0.0090 dB
	Phase	−0.3°	________	0.3°	±0.043°
−60 dB	Magnitude Ratio	−0.05 dB	________	0.05 dB	±0.0094 dB
	Phase	−0.3°	________	0.3°	±0.043°
−70 dB	Magnitude Ratio	−0.05 dB	________	0.05 dB	±0.0112 dB
	Phase	−0.3°	________	0.3°	±0.043°
−80 dB	Magnitude Ratio	−0.10 dB	________	0.10 dB	±0.0178 dB
	Phase	−0.7°	________	0.7°	±0.043°
−90 dB	Magnitude Ratio	−0.30 dB	________	0.30 dB	±0.0208 dB
	Phase	−2.0°	________	2.0°	±0.043°
−100 dB	Magnitude Ratio	−1.00 dB	________	1.00 dB	±0.0280 dB
	Phase	−7.0°	________	7.0°	±0.043°

B/R Measurement

Input Level	Measurement	Minimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
0 dB	Magnitude Ratio	−0.30 dB	________	0.30 dB	±0.0094 dB
	Phase	−3.0°	________	3.0°	±0.043°
−10 dB	Magnitude Ratio	−0.05 dB	________	0.05 dB	±0.0090 dB
	Phase	−0.6°	________	0.6°	±0.043°
−20 dB	Magnitude Ratio	−0.05 dB	________	0.05 dB	±0.0091 dB
	Phase	−0.3°	________	0.3°	±0.043°
−40 dB	Magnitude Ratio	−0.05 dB	________	0.05 dB	±0.0091 dB
	Phase	−0.3°	________	0.3°	±0.043°
−50 dB	Magnitude Ratio	−0.05 dB	________	0.05 dB	±0.0090 dB
	Phase	−0.3°	________	0.3°	±0.043°
−60 dB	Magnitude Ratio	−0.05 dB	________	0.05 dB	±0.0094 dB
	Phase	−0.3°	________	0.3°	±0.043°
−70 dB	Magnitude Ratio	−0.05 dB	________	0.05 dB	±0.0112 dB
	Phase	−0.3°	________	0.3°	±0.043°
−80 dB	Magnitude Ratio	−0.10 dB	________	0.10 dB	±0.0178 dB
	Phase	−0.7°	________	0.7°	±0.043°
−90 dB	Magnitude Ratio	−0.30 dB	________	0.30 dB	±0.0208 dB
	Phase	−2.0°	________	2.0°	±0.043°
−100 dB	Magnitude Ratio	−1.00 dB	________	1.00 dB	±0.0280 dB
	Phase	−7.0°	________	7.0°	±0.043°

11. MAGNITUDE RATIO/PHASE FREQUENCY RESPONSE TEST

A/R Measurement

Frequency	Measurement	Minimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
100 kHz to 1 MHz	Magnitude Ratio	−1 dB	________	1 dB	±0.105 dB
	Phase	−6°	________	6°	±0.69°
1 MHz to 1.8 GHz	Magnitude Ratio	−0.5 dB	________	0.5 dB	±0.042 dB
	Phase	−3°	________	3°	±0.29°

B/R Measurement

Frequency	Measurement	Minimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
100 kHz to 1 MHz	Magnitude Ratio	−1 dB	________	1 dB	±0.105 dB
	Phase	−6°	________	6°	±0.69°
1 MHz to 1.8 GHz	Magnitude Ratio	−0.5 dB	________	0.5 dB	±0.042 dB
	Phase	−3°	________	3°	±0.29°

12. CALIBRATOR AMPLITUDE ACCURACY TEST

Minimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
−19.6 dBm	________	−20.4 dBm	±0.082 dB

13. DISPLAYED AVERAGE NOISE LEVEL TEST

Frequency	Test Result	Test Limit
10 kHz	________	< −125 dBm/Hz
100 kHz	________	< −125 dBm/Hz
1 MHz	________	< −125 dBm/Hz
10 MHz	________	< −149.97 dBm/Hz
100 MHz	________	< −149.7 dBm/Hz
500 MHz	________	< −148.5 dBm/Hz
1 GHz	________	< −147 dBm/Hz
1.4 GHz	________	< −145.8 dBm/Hz
1.8 GHz	________	< −144.6 dBm/Hz

14. AMPLITUDE FIDELITY TEST

At RBW 10 kHz

dB from Reference Level	Minimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
−10 dB	−0.3 dB	________	0.3 dB	±0.021 dB
−20 dB	−0.3 dB	________	0.3 dB	±0.021 dB
−30 dB	−0.3 dB	________	0.3 dB	±0.021 dB
−40 dB	−0.3 dB	________	0.3 dB	±0.022 dB
−50 dB	−0.4 dB	________	0.4 dB	±0.026 dB
−60 dB	−0.7 dB	________	0.7 dB	±0.028 dB

At RBW 1 MHz

dB from Reference Level	Minimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
−10 dB	−1 dB	________	1 dB	±0.021 dB
−20 dB	−1 dB	________	1 dB	±0.021 dB
−30 dB	−1 dB	________	1 dB	±0.021 dB
−40 dB	−1 dB	________	1 dB	±0.022 dB
−50 dB	−1.2 dB	________	1.2 dB	±0.026 dB

15. INPUT ATTENUATOR SWITCHING UNCERTAINTY TEST

Input Attenuation	Minimum Limit	Test Result	Maximum Limit	Measurement Uncertainty
20 dB	−1 dB	________	1 dB	±0.024 dB
30 dB	−1 dB	________	1 dB	±0.023 dB
40 dB	−1 dB	________	1 dB	±0.023 dB
50 dB	−1.5 dB	________	1.5 dB	±0.024 dB
60 dB	−1.5 dB	________	1.5 dB	±0.033 dB

16. RESOLUTION BANDWIDTH ACCURACY/SELECTIVITY TEST

Bandwidth Accuracy

RBW	Minimum Limit	Test Result	Maximum Limit
10 kHz	8 kHz	________ kHz	12 kHz
30 kHz	24 kHz	________ kHz	36 kHz
100 kHz	80 kHz	________ kHz	120 kHz
300 kHz	240 kHz	________ kHz	360 kHz
1 MHz	0.8 MHz	________ MHz	1.2 MHz
3 MHz	2.4 MHz	________ MHz	3.6 MHz

Selectivity

RBW	Test Result	Test Limit
10 kHz	________	< 10
30 kHz	________	< 10
100 kHz	________	< 10
300 kHz	________	< 10
1 MHz	________	< 10
3 MHz	________	< 10

17. RESOLUTION BANDWIDTH SWITCHING UNCERTAINTY TEST

RBW	Minimum Limit	Test Result	Maximum Limit
3 kHz	−0.5 dB	___________	0.5 dB
30 kHz	−0.5 dB	___________	0.5 dB
100 kHz	−0.5 dB	___________	0.5 dB
300 kHz	−0.5 dB	___________	0.5 dB
1 MHz	−0.5 dB	___________	0.5 dB
3 MHz	−0.5 dB	___________	0.5 dB

18. IF GAIN SWITCHING UNCERTAINTY TEST

Reference Level	Minimum Limit	Test Result	Maximum Limit	Measuement Uncertainty
0 dBm	−0.3 dB	___________	0.3 dB	±0.032 dB
−2 dBm	−0.3 dB	___________	0.3 dB	±0.030 dB
−4 dBm	−0.3 dB	___________	0.3 dB	±0.028 dB
−6 dBm	−0.3 dB	___________	0.3 dB	±0.027 dB
−8 dBm	−0.3 dB	___________	0.3 dB	±0.027 dB
−12 dBm	−0.3 dB	___________	0.3 dB	±0.028 dB
−14 dBm	−0.3 dB	___________	0.3 dB	±0.027 dB
−16 dBm	−0.3 dB	___________	0.3 dB	±0.026 dB
−18 dBm	−0.3 dB	___________	0.3 dB	±0.026 dB
−20 dBm	−0.3 dB	___________	0.3 dB	±0.026 dB
−30 dBm	−0.3 dB	___________	0.3 dB	±0.027 dB
−40 dBm	−0.3 dB	___________	0.3 dB	±0.030 dB

19. NOISE SIDEBANDS TEST

Frequency	Offset from Carrier	Test Result	Test Limit	Measurement Uncertainty
39 MHz	−1 kHz	________	< −95 dBc/Hz	±0.44 dB
	1 kHz	________	< −95 dBc/Hz	±0.44 dB
10 MHz	−10 kHz	________	< −105 dBc/Hz	±1.30 dB
	10 kHz	________	< −105 dBc/Hz	±1.30 dB
	−1 MHz	________	< −110 dBc/Hz	±1.30 dB
	1 MHz	________	< −110 dBc/Hz	±1.30 dB
100 MHz	−10 kHz	________	< −105 dBc/Hz	±1.30 dB
	10 kHz	________	< −105 dBc/Hz	±1.30 dB
	−1 MHz	________	< −110 dBc/Hz	±1.30 dB
	1 MHz	________	< −110 dBc/Hz	±1.30 dB
1 GHz	−10 kHz	________	< −105 dBc/Hz	±1.30 dB
	10 kHz	________	< −105 dBc/Hz	±1.30 dB
	−1 MHz	________	< −110 dBc/Hz	±1.30 dB
	1 MHz	________	< −110 dBc/Hz	±1.30 dB
1.8 GHz	−10 kHz	________	< −99.9 dBc/Hz	±0.44 dB
	10 kHz	________	< −99.9 dBc/Hz	±0.44 dB
	−1 MHz	________	< −104.9 dBc/Hz	±1.30 dB
	1 MHz	________	< −104.9 dBc/Hz	±1.30 dB

20. FREQUENCY RESPONSE TEST

Frequency	Minimum Limit	Test Result	Test Limit	Measurement Uncertainty
10 Hz	−1.5 dB	________	1.5 dB	±0.21 dB
100 Hz	−1.5 dB	________	1.5 dB	±0.21 dB
1 kHz	−1.5 dB	________	1.5 dB	±0.21 dB
10 kHz	−1.5 dB	________	1.5 dB	±0.21 dB
100 kHz	−1.5 dB	________	1.5 dB	±0.102 dB
1 MHz	−1.5 dB	________	1.5 dB	±0.089 dB
6 MHz	−1.5 dB	________	1.5 dB	±0.090 dB
10 MHz	−0.5 dB	________	0.5 dB	±0.090 dB
50 MHz	−0.5 dB	________	0.5 dB	±0.093 dB
100 MHz	−0.5 dB	________	0.5 dB	±0.107 dB
1 GHz	−0.5 dB	________	0.5 dB	±0.101 dB
1.79 GHz	−0.5 dB	________	0.5 dB	±0.101 dB
1.8 GHz	−0.5 dB	________	0.5 dB	±0.101 dB

21. SECOND HARMONIC DISTORTION TEST

Test Result	Test Limit	Measurement Uncertainty
________	< −70 dBc	±1.47 dB

22. THIRD ORDER INTERMODULATION DISTORTION TEST

Frequency	Test Result	Test Limit	Measurement Uncertainty
1 MHz	________	< −65 dBc	±0.7 dB
10 MHz	________	< −75 dBc	±3.7 dB
500 MHz	________	< −75 dBc	±3.7 dB
1.8 GHz	________	< −75 dBc	±3.8 dB

23. OTHER SPURIOUS TEST

Spurious Frequency	Test Result	Test Limit	Measurement Uncertainty
23.92075 MHz	________	< −70 dBc	±0.40 dB
100.0045 MHz	________	< −70 dBc	±0.40 dB
100.0048 MHz	________	< −70 dBc	±0.40 dB
110.71 MHz	________	< −70 dBc	±0.40 dB
142.84 MHz	________	< −70 dBc	±0.40 dB
1155.6734286 MHz	________	< −70 dBc	±0.40 dB
1723.92075 MHz	________	< −70 dBc	±0.40 dB
1749 MHz	________	< −70 dBc	±0.61 dB
1798.995 MHz	________	< −70 dBc	±0.40 dB
1799.9945 MHz	________	< −70 dBc	±0.40 dB

24. RESIDUAL RESPONSE TEST

Frequency	Test Result	Test Limit
10.71 MHz	________	< −100 dBm
17.24 MHz	________	< −100 dBm
40 MHz	________	< −100 dBm
42.84 MHz	________	< −100 dBm
630 MHz	________	< −100 dBm
686.19333333333 MHz	________	< −100 dBm
1064.99 MHz	________	< −100 dBm
1352.9683333333 MHz	________	< −100 dBm
1387.278 MHz	________	< −100 dBm
1586.775 MHz	________	< −100 dBm

A

Manual Changes

Introduction

This appendix contains the information required to adapt this manual to earlier versions or configurations of the 4396B than the current printing date of this manual. The information in this manual applies directly to the 4396B serial number prefix listed on the title page of this manual.

Manual Changes

To adapt this manual to your 4396B, see Table A-1 and Table A-2, and make all the manual changes listed opposite your instrument's serial number and firmware version.

Instruments manufactured after the printing of this manual may be different from those documented in this manual. Later instrument versions will be documented in a manual changes supplement that will accompany the manual shipped with that instrument. If your instrument's serial number or ROM version is not listed on the title page of this manual, in Table A-1, or Table A-2, make changes according to the *yellow MANUAL CHANGES* supplement.

In additions to information on changes, the supplement may contain information for correcting errors (Errata) in the manual. To keep this manual as current and accurate as possible, Agilent Technologies recommends that you periodically request the latest *MANUAL CHANGES* supplement.

For information concerning serial number prefixes not listed on the title page or in the *MANUAL CHANGE* supplement, contact the nearest Agilent Technologies office.

To confirm the firmware version, turn ON the power for the 4396B or execute `*IDN?` on the external controller.

Table A-1. Manual Changes by Serial Number

Serial Prefix or Number	Make Manual Changes

Table A-2. Manual Changes by ROM Version

Version	Make Manual Changes

Serial Number

Agilent Technologies uses a two-part, ten-character serial number that is stamped on the serial number plate (see Figure A-1) attached to the rear panel. The first five characters are the serial prefix and the last five digits are the suffix.

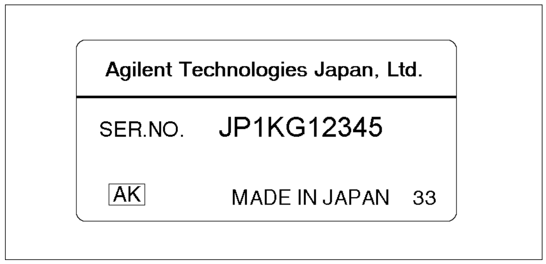

Figure A-1. Serial Number Plate