ADVANTEST CORPORATION

R3477 Series
Performance Test Guide

MANUAL NUMBER FOE-8440196B01

Applicable Model
R3477

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Safety Summary

To ensure thorough understanding of all functions and to ensure efficient use of this instrument, please read the manual carefully before using. Note that Advantest bears absolutely no responsibility for the result of operations caused due to incorrect or inappropriate use of this instrument.

If the equipment is used in a manner not specified by Advantest, the protection provided by the equipment may be impaired.

- **Warning Labels**

Warning labels are applied to Advantest products in locations where specific dangers exist. Pay careful attention to these labels during handling. Do not remove or tear these labels. If you have any questions regarding warning labels, please ask your nearest Advantest dealer. Our address and phone number are listed at the end of this manual.

Symbols of those warning labels are shown below together with their meaning.

DANGER: Indicates an imminently hazardous situation which will result in death or serious personal injury.

WARNING: Indicates a potentially hazardous situation which will result in death or serious personal injury.

CAUTION: Indicates a potentially hazardous situation which will result in personal injury or a damage to property including the product.

- **Basic Precautions**

Please observe the following precautions to prevent fire, burn, electric shock, and personal injury.

- Use a power cable rated for the voltage in question. Be sure however to use a power cable conforming to safety standards of your nation when using a product overseas.
- When inserting the plug into the electrical outlet, first turn the power switch OFF and then insert the plug as far as it will go.
- When removing the plug from the electrical outlet, first turn the power switch OFF and then pull it out by gripping the plug. Do not pull on the power cable itself. Make sure your hands are dry at this time.
- Before turning on the power, be sure to check that the supply voltage matches the voltage requirements of the instrument.
- Connect the power cable to a power outlet that is connected to a protected ground terminal. Grounding will be defeated if you use an extension cord which does not include a protected ground terminal.
- Be sure to use fuses rated for the voltage in question.
- Do not use this instrument with the case open.
- Do not place anything on the product and do not apply excessive pressure to the product. Also, do not place flower pots or other containers containing liquid such as chemicals near this

product.

- When the product has ventilation outlets, do not stick or drop metal or easily flammable objects into the ventilation outlets.
- When using the product on a cart, fix it with belts to avoid its drop.
- When connecting the product to peripheral equipment, turn the power off.

- **Caution Symbols Used Within this Manual**

Symbols indicating items requiring caution which are used in this manual are shown below together with their meaning.

DANGER: Indicates an item where there is a danger of serious personal injury (death or serious injury).

WARNING: Indicates an item relating to personal safety or health.

CAUTION: Indicates an item relating to possible damage to the product or instrument or relating to a restriction on operation.

- **Safety Marks on the Product**

The following safety marks can be found on Advantest products.

: ATTENTION - Refer to manual.

: Protective ground (earth) terminal.

: DANGER - High voltage.

: CAUTION - Risk of electric shock.

- **Replacing Parts with Limited Life**

The following parts used in the instrument are main parts with limited life.
Replace the parts listed below before their expected lifespan has expired to maintain the performance and function of the instrument.
Note that the estimated lifespan for the parts listed below may be shortened by factors such as the environment where the instrument is stored or used, and how often the instrument is used.
The parts inside are not user-replaceable. For a part replacement, please contact the Advantest sales office for servicing.

Each product may use parts with limited life.
For more information, refer to the section in this document where the parts with limited life are described.

Main Parts with Limited Life

Part name	Life
Unit power supply	5 years
Fan motor	5 years
Electrolytic capacitor	5 years
LCD display	6 years
LCD backlight	2.5 years
Floppy disk drive	5 years
Memory backup battery	5 years

- **Hard Disk Mounted Products**

The operational warnings are listed below.

- Do not move, shock and vibrate the product while the power is turned on.
  Reading or writing data in the hard disk unit is performed with the memory disk turning at a high speed. It is a very delicate process.

- Store and operate the products under the following environmental conditions.
  An area with no sudden temperature changes.
  An area away from shock or vibrations.
  An area free from moisture, dirt, or dust.
  An area away from magnets or an instrument which generates a magnetic field.

- Make back-ups of important data.
  The data stored in the disk may become damaged if the product is mishandled. The hard disc has a limited life span which depends on the operational conditions. Note that there is no guarantee for any loss of data.

- **Precautions when Disposing of this Instrument**

When disposing of harmful substances, be sure dispose of them properly with abiding by the state-provided law.

Harmful substances: (1) PCB (polycarbon biphenyl)
(2) Mercury
(3) Ni-Cd (nickel cadmium)
(4) Other
Items possessing cyan, organic phosphorous and hexadic chromium and items which may leak cadmium or arsenic (excluding lead in solder).

Example: fluorescent tubes, batteries

Environmental Conditions

This instrument should be only be used in an area which satisfies the following conditions:

- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- Altitude of up to 2000 m

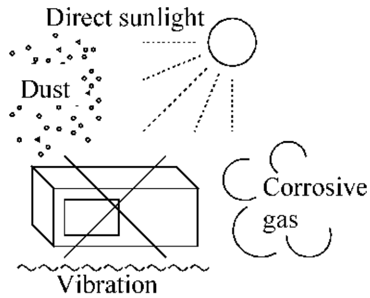
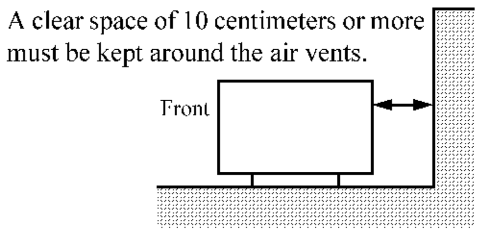


Figure-1 Environmental Conditions

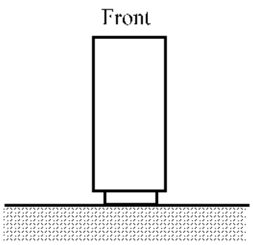
- Operating position



⚠The instrument must be used in a horizontal position.
A cooling fan, which prevents the internal temperature from rising, is equipped with the instrument.
The air vents on the case must be unblocked.

Figure-2 Operating Position

- Storage position



This instrument should be stored in a horizontal position.
When placed in a vertical (upright) position for storage or transportation, ensure the instrument is stable and secure.

⚠ Do not operate in this position.

-Ensure the instrument is stable.
-Pay special attention not to fall.

Figure-3 Storage Position

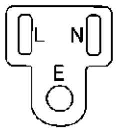
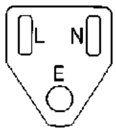
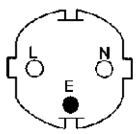
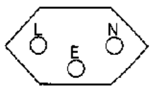
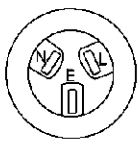
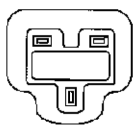
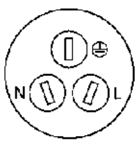
- The classification of the transient over-voltage, which exists typically in the main power supply, and the pollution degree is defined by IEC61010-1 and described below.

  Impulse withstand voltage (over-voltage) category II defined by IEC60364-4-443

  Pollution Degree 2

Types of Power Cable

Replace any references to the power cable type, according to the following table, with the appropriate power cable type for your country.

Plug configuration	Standards	Rating, color and length	Model number (Option number)
	PSE: Japan Electrical Appliance and Material Safety Law	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
	UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
	CEE: Europe DEMKO: Denmark NEMKO: Norway VDE: Germany KEMA: The Netherlands CEBEC: Belgium OVE: Austria FIMKO: Finland SEMKO: Sweden	250 V at 6 A Gray 2 m (6 ft)	Straight: A01404 (Option 96) Angled: A01414
	SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
	SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: ---------
	BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417
	CCC:China	250 V at 10 A Black 2 m (6 ft)	Straight: A114009 (Option 94) Angled: A114109

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LIST OF TABLES

1. INTRODUCTION

This chapter describes the contents of this manual to help the user get the most out of the manual.

1.1 About this Manual

This manual is a performance test guide for the R3477 series signal analyzer.

The manual describes the procedure which is used to check whether the R3477 series signal analyzer performs according to its specifications.

This manual does not contain detailed descriptions of the operating methods and functions of the R3477 series signal analyzer. For information on the operating methods and functions, refer to the user's guide.

Contents of each chapter are as follows:

Chapter 1. INTRODUCTION	Describes the manual, instruments and information required to calibrate this instrument to help the user get the most out of the manual.
Chapter 2. PERFORMANCE VERIFICATION	Describes the performance test items and performance test procedures of this instrument. Performance test record sheets are provided in this chapter.
Chapter 3. SPECIFICATIONS	Describes the specifications of this instrument.

1.2 Required Instruments

Table 2-2 shows the instruments, which are required for the performance verification of this instrument.

The instruments, which are required in all tests, are listed. Instruments which are required for individual tests are also listed in each test. If the user's instruments meet the specifications described in Table 2-2, the instruments can be used instead of the recommended models.

1.3 Calibration Period

It is recommended that the performance is verified once a year to check whether the signal analyzer meets its specifications.

1.4 Performance Verification Record Sheets

The performance verification record sheets are provided at the end of Chapter 2 for users to record values, which are measured in each performance verification test.

The performance verification record sheets feature the test specifications and acceptable values.

Copy the sheets, enter all the test results, and keep the sheets as calibration test records.

These records can be used to trace gradual changes of the test results if using the instruments over a long period of time.

1.5 Conventions of Notation Used in This Document

In this document, hard keys, touch-screen buttons and menus are represented by the following symbols:

Hard keys
"Hard keys" are hardware keys which are on the panel.

Sample	Indicates a hard key labeled "Sample." Example: **FREQ**, **LEVEL**

Touch-screen system menus

[Sample]	Indicates a touch-screen menu, tab, button or dialog box that is labeled "Sample" and that is selected or executed when touched. Example: **[Normal]** tab, **[Option]** button

Touch-screen soft menu bar

Sample	Indicates a touch-screen soft menu bar labeled "Sample." Example: **Center** key, **Ref Level** key

Sequential key operation

FREQ, **Center**	Indicates that you need to touch the **FREQ** key and then touch the **Center** key.

Toggle key operation

ΔMarker On/Off (On)	Indicates that you need to touch the **ΔMarker On/Off** key to turn on the ΔMarker.

1.6 Trademarks and Registered Trademarks

- Microsoft® and Windows® are trademarks or registered trademarks of Microsoft Corporation in the United States and other countries.
- Other product and company names referenced herein are trademarks or registered trademarks of their respective owners.

1.7 Other Manuals Related to This Instrument

The following manuals are available for this instrument:

- User's Guide (Part Code: {ER3477-U}, English)

  This manual describes, in addition to how to use the R3477 series Signal Analyzer, the following information: setup, basic operations, applied measurements, function descriptions, controlling by remote, specifications, and maintenance.

- Performance Test Guide (Part Code: {ER3477-T}, This manual)

  This manual describes information, which is required to check the performance of the R3477 series Signal Analyzer, such as performance test procedures and specifications.

2. PERFORMANCE VERIFICATION

2.1 Overview

2.1.1 Before Starting

This chapter describes the performance verification procedure in order of the items listed in Table 2-1.

Table 2-1 Performance Verification List

Test No.	Test item	Applicable model
2.2.1	Frequency Reference Stability	
2.2.2	Calibration Signal Output Accuracy	
2.2.3	Marker Frequency Counter Accuracy	
2.2.4	Frequency Reading Accuracy	
2.2.5	Residual FM	
2.2.6	Frequency Span Accuracy	
2.2.7	Signal Purity	
2.2.8	Resolution Bandwidth Accuracy and Selectivity	
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2.2.14	1 dB Gain Compression	
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2.2.20	TG Output Level Accuracy	OPT79
2.2.21	TG Vernier Accuracy	OPT79

2.1.2 Required Instruments

Table 2-2 shows a list of required instruments.

Instruments, which are required in all tests, are listed.

Instruments which are required for individual tests are also listed in each test.

If the user's instruments meet the specifications described in the table, these instruments can be used instead of the recommended models.

1. Test environment and conditions

   Conduct performance verification under the following conditions:

   - 20°C to 30°C environment, after turning on the power and warming-up for 30 minutes or more
   - After automatic calibration has been performed.

2. Required measurement instruments

   Table 2-2 shows the list of instruments which are required in all tests.

   Instruments which are required for individual tests are also listed in each test.

   If the user's instruments meet the specifications described in the table, these instruments can be used instead of the recommended models.

3. Performance verification period

   It is recommended that the performance is verified once a year to check whether the signal analyzer meets its specifications.

4. Performance verification sheets

   Performance verification sheets are provided at the end of this chapter for a user to record values, which are measured in each performance verification test.

   When conducting performance verification, it is recommended that copies of the sheets are used for the test results, and the sheets are kept as test records.

5. Notation used in the performance verification procedure

   Notation of operations described in this chapter is as follows:

   - Continuous operations, when described, are separated by commas.
   - Notation used when switching settings such as On/Off or Auto/Man is described in the following examples:

     Example 1: To set Preamp to On: **Preamp** (On)

     Example 2: To set RBW to Man: **RBW** (Man)

Table 2-2 Required Instruments List (1 of 2)

Instrument	Specification	Recommended Model	Qty.
Frequency Standard	Output Frequency: 10 MHz Stability: 5×10^{-12} / day Output Impedance: 50 Ω Output Level: 1 V_{P-P} or more	R3031A ADVANTEST	1
Frequency Counter	Input Frequency: 10 MHz Frequency Error: 1E-4 Hz	53132A Agilent	1
Signal Generator	Frequency Range: 10 MHz to 20 GHz Output Level: -50 dBm to +10 dBm Stability: 1×10^{-6} / year	SMP02 + B11 + B15 Rohde & Schwarz	2
Signal Generator	Frequency Range: 10 MHz to 2.5 GHz Output Level: -20 dBm to +10 dBm Residual SSB Phase noise 1 kHz offset < -115 dBc/Hz 10 kHz offset < -124 dBc/Hz 100 kHz offset< -130 dBc/Hz	8665B Option004 Agilent	1
Signal Generator	Frequency Range: 5 kHz to 1.5 GHz Output Level: -20 dBm to +10 dBm Pulse period: 40 µs to 45 s Pulse width: 20 µs to 1 s	SMT02 + B1 + B3 + B4 Rohde & Schwarz	1
Power Meter	Compatible with NRV series Power sensors dB relative mode Resolution 0.01 dB Reference Accuracy 0.9%	NRVS Rohde & Schwarz	1
Power Sensor	Frequency Range: 50 MHz to 18 GHz Input Level: 1 µW to 100 mW Maximum SWR: 1.2 (18 GHz)	NRV-Z51 Rohde & Schwarz	1
Power Splitter	Frequency Range: 10 MHz to 26.5 GHz Insertion Loss: 6 dB (nominal)	1579 Weinschel	1
Power Divider	Frequency Range: 5 MHz to 1000 MHz Isolation: Greater than 18 dB	PDML-20A-500 Merrimac	1
Power Divider	Frequency Range: 0.5 GHz to 18 GHz Isolation: Greater than 18 dB	4426-2 Narda	1
10 dB Attenuator	Impedance: 50 Ω Attenuation: 10 dB Connector: SMA(m)-SMA(f)	DEE-000477-1 ADVANTEST	1
3 dB Attenuator	Impedance: 50 Ω Attenuation: 3 dB Connector: SMA(m)-SMA(f)	DEE-000685-1 ADVANTEST	2

Table 2-2 Required Instruments List (2 of 2)

Instrument	Specification	Recommended Model	Qty.
RF Cable	Impedance: 50 Ω Connector: SMA(m)-SMA(m) Length: Approx. 0.7 m	A01002 ADVANTEST	3
RF Cable	Impedance: 50 Ω Connector: BNC(m)-BNC(m) Length: Approx. 0.3 m	A01037-0300 ADVANTEST	1
RF Cable	Impedance: 50 Ω Connector: BNC(m)-BNC(m) Length: Approx. 1.5 m	A01037-1500 ADVANTEST	3
Terminator	Impedance: 50 Ω	HRM-601A (02) HIROSE	1
Low pass filter	Insertion loss @1.5 GHz: 2 dB or less Rejection @3 GHz: 30 dB or more Connector: SMA(f)	F-80 series RLC ELECTRONICS, INC.	1
Adapter	Connector: N(m)-SMA(f)	HRM-554S HIROSE	2
Adapter	Connector: BNC-JA-JJJ	302-0024-6 HIROSE	1
Adapter	Connector: N(f)-BNC(f)	NJ-BNCJ HIROSE	1
Adapter	Connector: N(f)-SMA(f)	HRM-552S HIROSE	1
Adapter	Connector: SMA(m)-SMA(m)	HRM-502 (09) HIROSE	3
Adapter	Connector: N(m)-BNC(f)	JUG-201A/U(03) HIROSE	2

2.2 Performance Verification Procedure

This section describes the performance verification procedure in order of the items listed in Table 2-1.

2.2.1 Frequency Reference Stability

[Overview]

This section describes how to check the frequency stability of the 10 MHz frequency reference oscillator (frequency reference error and aging rate).

The reference stability is the frequency stability after the power is turned on and 24 hours have passed at an ambient temperature of 25°C.

[Procedure]

1. Measures the output signal frequency of 10 MHz REF OUT by using the frequency counter.
2. After 24 hours, measure the output signal frequency again.
3. Obtain the aging rate per 24 hours (one day) from the difference between the two measurement results.

Use an external frequency reference source as the frequency reference source of the frequency counter.
For the OPTION 23, perform only step 1.

[Specifications]

- Internal source

  Aging rate: $\pm 5 \times 10^{-8}$ / day, $\pm 5 \times 10^{-7}$ / year

  Temperature stability: $\pm 1 \times 10^{-7}$ (0°C to 50°C)

  Warm-up (Nominal): $\pm 5 \times 10^{-7}$ / 1 minute

- OPTION21 High stability source

  Aging rate: $\pm 5 \times 10^{-9}$ / day, $\pm 8 \times 10^{-8}$ / year

  Temperature stability: $\pm 5 \times 10^{-8}$ (0°C to 50°C)

  Warm-up (Nominal): $\pm 5 \times 10^{-8}$ / 10 minutes

- OPTION22 High stability source

  Aging rate: $\pm 3 \times 10^{-10}$ / day, $\pm 2 \times 10^{-8}$ / year

  Temperature stability: $\pm 5 \times 10^{-9}$ (0°C to 50°C)

  Warm-up (Nominal): $\pm 1 \times 10^{-8}$ / 30 minutes
  $\pm 5 \times 10^{-9}$ / 60 minutes

- OPTION23 High stability source

  Frequency accuracy: $\pm 5 \times 10^{-9}$

  Aging rate: $\pm 1 \times 10^{-10}$ / month

  Temperature stability: $\pm 1 \times 10^{-9}$ (0°C to 40°C)

  Warm-up (Nominal): $\pm 1 \times 10^{-9}$ / 15 minutes

[Required instruments]

Instrument	Quantity	Recommended model
Frequency source	1	R3031A
Frequency counter	1	53132A
RF cable BNC(m)-BNC(m)	2	A01037-1500

[Connection diagram]

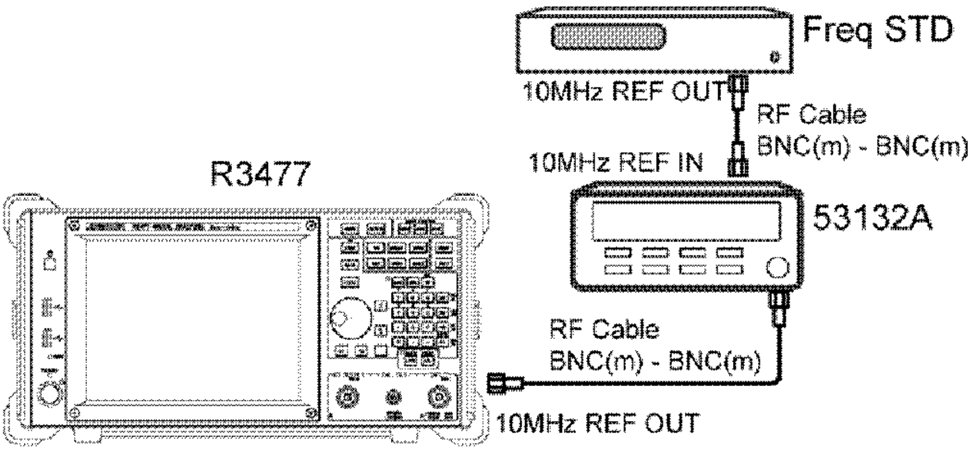

Figure 2-1 Frequency Stability Test Connection Diagram

[Test procedure]

1. Connect the instruments as shown in Figure 2-1.
2. Specify the frequency counter setting as follows:
   Reference frequency signal: External
3. Turn on the power of this instrument.
4. Preset this instrument.
   Operation: **SHIFT** and **LCL**(PRESET)
5. Run this instrument for 24 hours.

Checking the frequency reference error

6. After 24 hours, read the frequency displayed in the frequency counter, substitute the value into the formula shown below to obtain the frequency reference error, and then enter the value into the performance verification sheet.

   Formula:

   Frequency reference error = (measured value in step 6 - 10 MHz) / 10 MHz

7. For the OPTION 23, ensure that the data entered in step 6 is within the specified range.

For the OPTION 23, steps 8 and later are not required.

Measuring the aging rate

8. After performing step 6 and 24 hours have passed, obtain the frequency reference error in the same manner as described in step 6, and enter the value into the performance verification sheet.

9. Substitute the value measured in step 6 and step 8 into the formula shown below to obtain the aging rate, then enter the aging rate into the performance verification sheet, and ensure that the value is within the specified range.

   Formula: Aging rate = measured value in step 8 - measured value in step 6

2.2.2 Calibration Signal Output Accuracy

[Overview]

This section describes how to check whether the amplitude accuracy of the calibration signal of this instrument is within -10 dBm ± 0.2 dB.

[Specifications]

-10 dBm ± 0.2 dB

[Required instruments]

Instrument	Quantity	Recommended model
Power meter	1	NRVS
Power sensor	1	NRV-Z51
RF cable BNC(m)-BNC(m)	1	A01037-0300
Adapter N(f)-BNC(f)	1	HRM-552S

[Connection diagram]

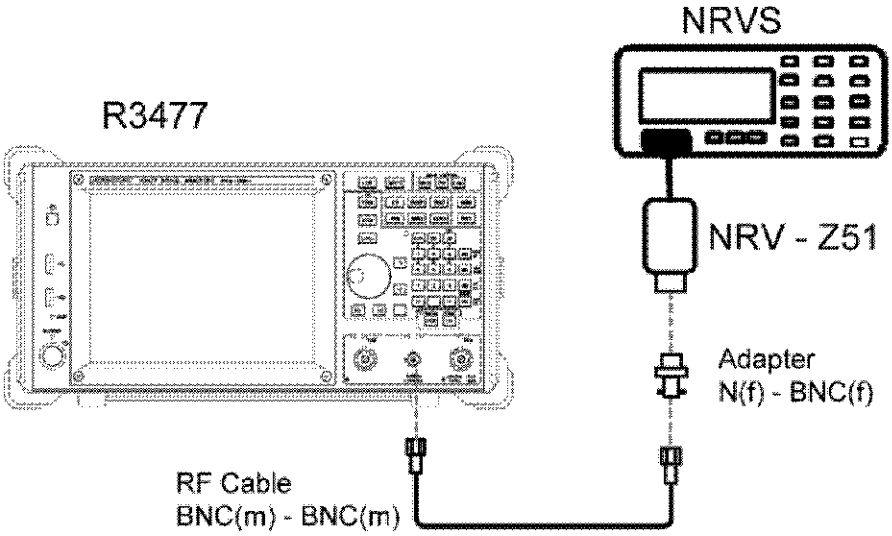

Figure 2-2 Calibration Signal Output Accuracy Test Diagram

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-2.

Measurement condition setting

2. Adjust point 0 of the power sensor and power meter and perform calibration.
3. Set the power meter to the dBm display.
4. Set the calibration frequency of the power meter to 50 MHz.
5. Set the CAL signal output of this instrument to ON.

   Operation: **MENU**, **Cal**, and **Cal Signal On/Off** (On)

Measuring the output level

6. Connect the power sensor as shown in the Figure 2-2.
7. Read the value on the power meter and then enter the value into the performance verification sheet.
8. Ensure that the value entered in step 7 is within the specified range.

2.2.3 Marker Frequency Counter Accuracy

[Overview]

This section describes how to read the frequency of this instrument and measure the marker frequency counter accuracy by inputting a signal of known frequency from the external signal generator.

When using a frequency that exceeds 3.3 GHz, the frequency must be tuned to the peak frequency of the pre-selector.

[Specifications]

Marker Frequency Counter Accuracy (S/N > 50 dB)
= ± (Marker frequency × frequency reference error + 3 Hz × N)

[Required instruments]

Instrument	Quantity	Recommended model
Signal generator	1	SMP02
RF cable BNC(m)-BNC(m)	1	A01037-1500
RF cable SMA(m)-SMA(m)	1	A01002
Adapter N(m)-SMA(f)	1	HRM-554S

[Connection diagram]

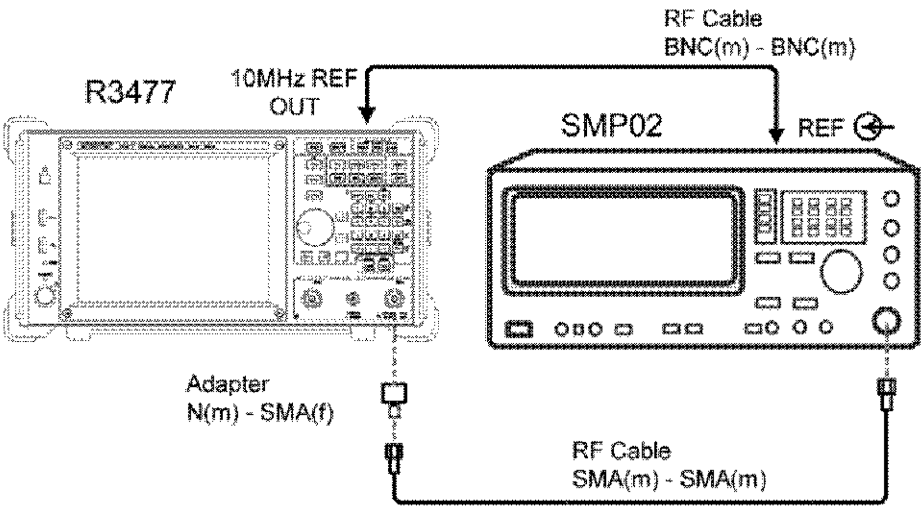

Figure 2-3 Marker Frequency Counter Accuracy Test

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-3.

Initialization

2. Preset this instrument.
   Operation: **SHIFT** and **LCL** (PRESET)

Setting the signal generator

3. Specify the signal generator setting as follows:

Output frequency:	2 GHz
Output level:	-10 dBm
Reference frequency signal:	External

Setting this instrument

4. Set the center frequency to 2 GHz.
   Operation: **FREQ**, **Center**, **2**, and **GHz**
5. Set the frequency span to 200 MHz.
   Operation: **SPAN**, **2**, **0**, **0**, and **MHz**
6. Set the counter function to ON.
   Operation: **FUNC**, **Meas**, and **Counter**
7. Search for the peak.
   Operation: **SRCH**

Measuring the marker frequency counter accuracy

8. Enter the reading frequency of the counter into the performance verification sheet.
9. Ensure that the data entered in step 8 is within the specified range.
10. Turn off the counter function.
    Operation: **FUNC**, **Meas**, **Counter**, and **Counter Off**

Measuring the accuracy at other frequency points

11. Repeat steps 3 to 10 by using the non-2 GHz frequencies described in Table 2-3. Note that when using a center frequency that exceeds 5 GHz, tune the pre-selector by following the operation below after setting the frequency span in step 5.
    How to tune the pre-selector: **FREQ**, **Presel Tune**, and **Auto Tune**

Table 2-3 Set Frequency List

Center frequency of this instrument	Output frequency of the signal generator
2 GHz	2 GHz
5 GHz	5 GHz
11 GHz	11 GHz

2.2.4 Frequency Reading Accuracy

[Overview]

This section describes how to check the frequency reading accuracy by inputting a signal of known frequency from the signal generator.

[Specifications]

Frequency reading accuracy = ± (Marker frequency × frequency reference error + frequency span × frequency span accuracy + resolution bandwidth × 0.1 + 3 Hz × N)

[Required instruments]

Instrument	Quantity	Recommended model
Signal generator	1	SMP02
RF cable BNC(m)-BNC(m)	1	A01037-1500
RF cable SMA(m)-SMA(m)	1	A01002
Adapter N(m)-SMA(f)	1	HRM-554S

[Connection diagram]

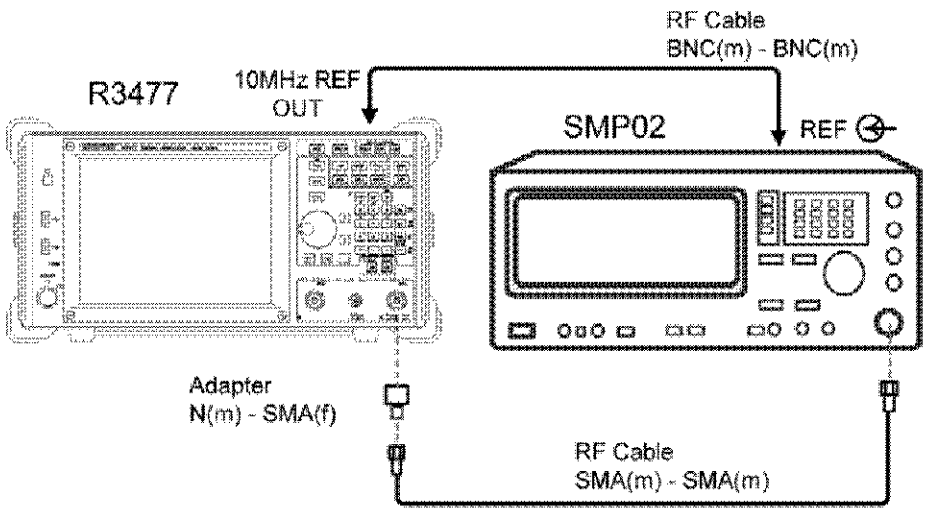

Figure 2-4 Frequency Reading Accuracy Test

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-4.

Initialization

2. Preset this instrument.
   Operation: SHIFT and LCL (PRESET)

Setting the signal generator

3. Specify the signal generator setting as follows:

   Output frequency: 2 GHz
   Output level: -10 dBm
   Reference frequency signal: External

Setting this instrument

4. Set the center frequency to 2 GHz.
   Operation: FREQ, **Center**, 2, and GHz
5. Set the frequency span to 1 MHz.
   Operation: SPAN, 1, and MHz
6. Set the resolution bandwidth to 10 kHz.
   Operation: BW, **RBW** (Man), 1, 0, and kHz
7. Search for the peak.
   Operation: SRCH
8. Read the value of the marker frequency and then enter the value into the performance verification sheet.
9. Ensure that the data entered in step 8 is within the specified range.
10. Repeat steps 3 to 9 according to the settings described in Table 2-4. Note that if the set frequency exceeds 3.3 G, tune the pre-selector by following the operation below before performing step 7.
    How to tune the pre-selector: FREQ, **Presel Tune**, and **Auto Tune**

Table 2-4 Set Frequency List

Center frequency of this instrument	Frequency span of this instrument	Resolution bandwidth of this instrument	Output frequency of the signal generator
2 GHz	1 MHz	10 kHz	2 GHz
2 GHz	10 MHz	100 kHz	2 GHz
2 GHz	50 MHz	300 kHz	2 GHz
2 GHz	100 MHz	1 MHz	2 GHz
2 GHz	1 GHz	3 MHz	2 GHz
5 GHz	1 MHz	10 kHz	5 GHz
5 GHz	10 MHz	100 kHz	5 GHz
5 GHz	50 MHz	300 kHz	5 GHz
5 GHz	100 MHz	1 MHz	5 GHz
5 GHz	1 GHz	3 MHz	5 GHz
11 GHz	1 MHz	10 kHz	11 GHz
11 GHz	10 MHz	100 kHz	11 GHz
11 GHz	50 MHz	300 kHz	11 GHz
11 GHz	100 MHz	1 MHz	11 GHz
11 GHz	1 GHz	3 MHz	11 GHz

2.2.5 Residual FM

[Overview]

This section describes how to check the instability over a short period of time.

A stabilized signal is input and then the signal is measured by performing slope detection in the 0-span mode.

Residual FM can be obtained by multiplying the IF filter slope (Hz/dB) by the amplitude change of the measured signal.

[Specifications]

(When OPT23 is excluded installed.)

$\leq (3\ \text{Hz} \times \text{N})_{\text{p-p}}/100\ \text{ms}$

(When OPT23 is installed.)

$\leq (12\ \text{Hz} \times \text{Measurement frequency} / 10^9)_{\text{p-p}}/100\ \text{ms}$

[Required instruments]

Instrument	Quantity	Recommended model
Frequency standard	1	R3031A
Signal generator	1	8665B Option004
RF cable BNC(m)-BNC(m)	1	A01037-1500
RF cable SMA(m)-SMA(m)	1	A01002
Adapter N(m)-SMA(f)	2	HRM-554S

[Connection diagram]

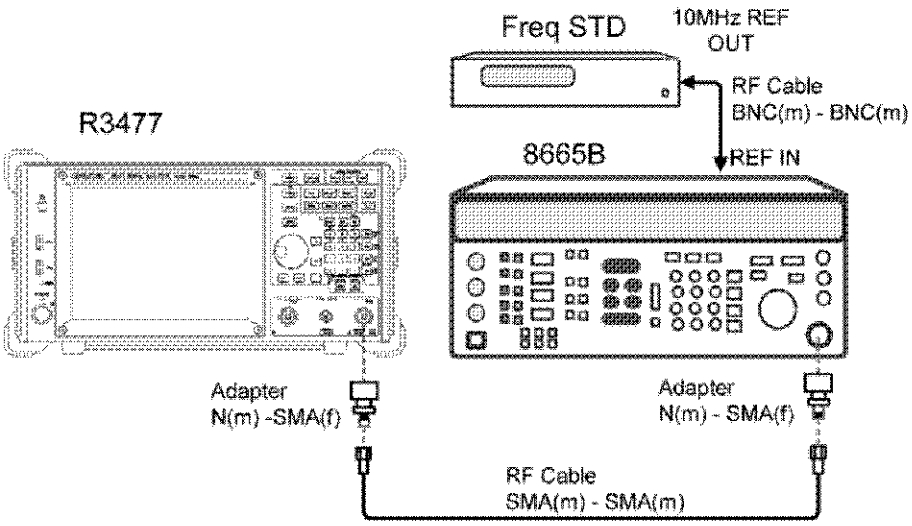

Figure 2-5 Residual FM Test

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-5.

Setting the signal generator

2. Specify the signal generator setting as follows:
   Output frequency: 2.99 GHz
   Output level: -10 dBm
   Reference frequency signal: External

Initialization

3. Preset this instrument.
   Operation: **SHIFT** and **LCL**(PRESET)

Measuring the IF filter slope

4. Set the center frequency to 2.99 GHz.
   Operation: **FREQ**, **Center**, **2**, **.**, **9**, **9**, and **GHz**
5. Set the frequency span to 100 kHz.
   Operation: **SPAN**, **1**, **0**, **0**, and **kHz**
6. Search for the peak.
   Operation: **SRCH**
7. Set the Signal Track to ON.
   Operation: **MKR** and **Signal Track** (On)
8. Set the frequency span to 5 kHz.
   Operation: **SPAN**, **5**, and **kHz**
9. (When OPT23 is excluded installed.)
   Set the RBW to 30 Hz.
   Operation: **BW**, **RBW** (Man), **3**, **0**, and **Hz**
   (When OPT23 is installed.)
   Set the RBW to 100 Hz.
   Operation: **BW**, **RBW** (Man), **1**, **0**, **0**, and **Hz**
10. Set the frequency span to 200 Hz.
    Operation: **SPAN**, **2**, **0**, **0**, and **Hz**
11. Set the Signal Track to OFF.
    Operation: **MKR** and **Signal Track** (Off)

12. Set the Ref LEVEL to -5 dBm.
    Operation: **LEVEL**, **5**, and **MHz** (-dBm)
13. Sets the scale to 1 dB/div.
    Operation: **LEVEL**, **dB/div**, **1**, and **GHz** (dB)
14. Perform Peak→Ref.
    Operation: **MKR→** and **Peak→Ref**
15. Set the trace mode to Average and set the averaging count to 40.
    Operation: **TRACE**, **Average**, **4**, **0**, and **Hz** (ENTER)
16. Perform a single sweep.
    Operation: **SINGLE**
17. Search for the peak.
    Operation: **SRCH**
18. Set ΔMarker to ON.
    Operation: **MKR** and **Delta Marker**
19. Lower the marker frequency by using the rotary encoder or the ▲ ▼ keys to set the ΔMarker reading value to -3 ±0.1 dB.
20. Set Fixed ΔMarker to ON.
    Operation: **Fixed ΔMarker** (On)
21. Lower the marker frequency by using the rotary encoder or the ▲ ▼ keys to set the marker reading value to -6 ±0.1 dB.
22. Obtain Slope from the ΔMarker reading value by using the formula shown below and enter the value into the performance verification sheet.
    Formula: Slope = ΔMarker frequency reading value/ ΔMarker level reading value

Measuring the residual FM deviation

23. Set the marker to OFF.
    Operation: **MKR** and **Marker All Off**
24. Set the trace mode to Write.
    Operation: **TRACE** and **Write**
25. Set the REPEAT sweep.
    Operation: **START**
26. Set Zero Span.
    Operation: **SPAN** and **Zero Span**
27. Set the sweep time to 100 msec.
    Operation: **SWEEP**, **Sweep Time** (Man), **1**, **0**, **0**, and **kHz** (ms)
28. Set the VBW to 1 kHz.
    Operation: **BW**, **VBW** (Man), **1**, and **kHz**

29. Lower the center frequency gradually by using the rotary encoder or the ▲ ▼ keys to set the waveform to a point which is 5 divisions lower than the reference level.

    Operation: **FREQ**, **Center** and (rotary encoder or the ▲ ▼ keys)

30. Perform the SINGLE sweep.

    Operation: **SINGLE**

31. Search for the peak.

    Operation: **SRCH**

32. Set ΔMarker to ON.

    Operation: **MKR** and **Delta Marker**

33. Search for the minimum peak.

    Operation: **SRCH** and **Min Peak**

34. Enter the marker level reading value ΔLEVEL into the performance verification sheet.

Calculating the residual FM

35. Substitute the Slope value obtained in step 22 and the ΔLEVEL value measured in step 34 into the formula shown below to obtain the residual FM, then enter the value into the performance verification sheet.

    Formula: Residual FM [Hz] = Slope [Hz / dB] × ΔLevel [dB]

36. Ensure that the result obtained in step 35 is smaller than the value described in the specifications.

2.2.6 Frequency Span Accuracy

[Overview]

This section describes how to check the span accuracy by inputting signals, which are at the frequencies shown on the 1st and 9th divisions from the left of the screen, from the signal generator, and reading the frequency difference between these two frequencies by using the marker.

[Specifications]

< ± 1% × Frequency span

[Required instruments]

Instrument	Quantity	Recommended model
Signal generator	1	SMP02
RF cable BNC(m)-BNC(m)	1	A01037-1500
RF cable SMA(m)-SMA(m)	1	A01002
Adapter N(m)-SMA(f)	1	HRM-554S

[Connection diagram]

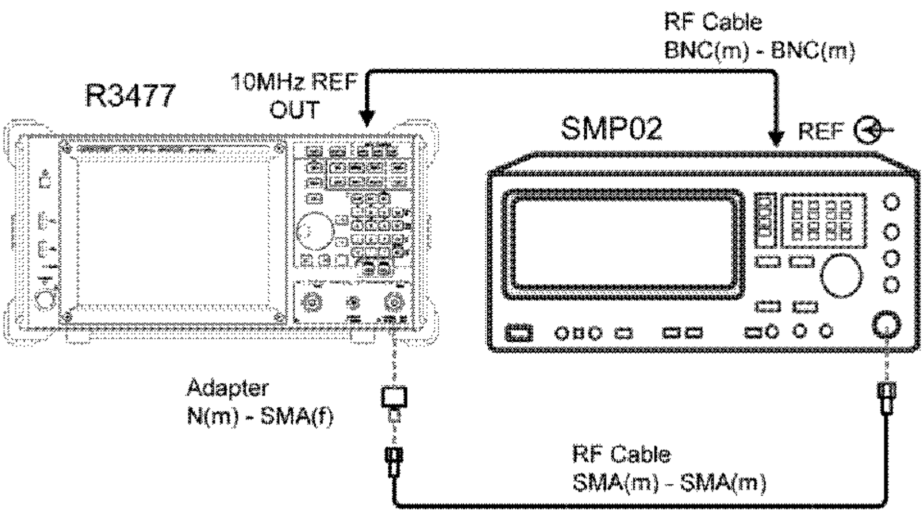

Figure 2-6 Frequency Span Accuracy Test

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-6.

Initialization

2. Preset this instrument.
   Operation: **SHIFT** and **LCL** (PRESET)

Setting the signal generator

3. Specify the signal generator setting as follows:
   Output level: -10 dBm
   Reference frequency signal: External

Setting this instrument

4. Set the center frequency of this instrument to 2 GHz.
   Operation: **FREQ**, **Center**, **2**, and **GHz**
5. Set the frequency span to 1 MHz.
   Operation: **SPAN**, **1**, and **MHz**
6. Set Measuring Window to ON.
   Operation: **FUNC**, **Display**, **Meas Window**, and **Window** (On)
7. Set Window Position to 2 GHz.
   Operation: **Window Position**, **2**, and **GHz**
8. Set Window Width to 900 kHz.
   Operation: **Window Width**, **9**, **0**, **0**, and **kHz**
9. Set the output frequency of the signal generator to 1.9996 GHz.
10. Set SINGLE to perform a single sweep.
    Operation: **SINGLE**
11. Search for the peak.
    Operation: **SRCH**
12. Set ΔMarker to ON.
    Operation: **MKR** and **Delta Marker**
13. Set the output frequency of the signal generator to 2.0004 GHz.
14. Set SINGLE to perform a single sweep.
    Operation: **SINGLE**

15. Search for the peak.
    Operation: **SRCH**
16. Read the marker frequency and then enter the value into the performance verification sheet.
17. Ensure that the value entered in step 16 is within the specified range.
18. Repeat steps 4 to 17 by using the set frequencies described in Table 2-5.

Table 2-5 Instrument Settings in the Frequency Span Accuracy Measurement

Setting of this instrument				Signal generator setting	
Center frequency [Hz]	Frequency Span [Hz]	Window Center [Hz]	Window Width [Hz]	Setting in step 9 [Hz]	Setting in step 13 [Hz]
2 G	1 M	2 G	900 k	1.9996 G	2.0004 G
2 G	10 M	2 G	9 M	1.996 G	2.004 G
2 G	100 M	2 G	90 M	1.96 G	2.04 G
2 G	1 G	2 G	900 M	1.6 G	2.4 G
6.75 G	10 G	6.75 G	9 G	2.75 G	10.75 G
6.75 G	13.5 G	6.75 G	12.15 G	1.35 G	12.15 G

2.2.7 Signal Purity

[Overview]

This section describes how to measure the signal purity of 10 kHz, 100 kHz, and 1 MHz offset signals at a center frequency of 1 GHz.

[Specifications]

Offset 10 kHz: < -99 dBc/Hz

Offset 100 kHz: < -111 dBc/Hz

Offset 1 MHz: < -133 dBc/Hz

[Required instruments]

Instrument	Quantity	Recommended model
Signal generator	1	8665B Option004
RF cable BNC(m)-BNC(m)	1	A01037-1500
RF cable SMA(m)-SMA(m)	1	A01002
Adapter N(m)-SMA(f)	2	HRM-554S

[Connection diagram]

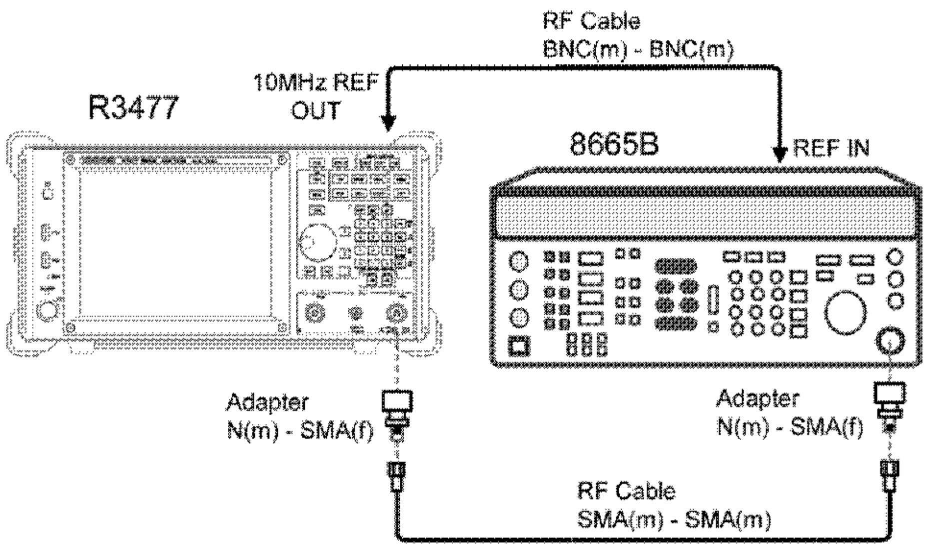

Figure 2-7 Signal Purity Test

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-7.

Initialization

2. Preset this instrument.
   Operation: **SHIFT** and **LCL** (PRESET)

Setting the signal generator

3. Specify the signal generator setting as follows:
   Output frequency: 1 GHz
   Output level: -5 dBm
   Reference frequency signal: External

Setting this instrument

4. Set the center frequency to 1 GHz.
   Operation: **FREQ**, **Center**, **1**, and **GHz**
5. Set the frequency span to 25 kHz.
   Operation: **SPAN**, **2**, **5**, and **kHz**

Measuring the signal purity

6. Search for the peak.
   Operation: **SRCH**
7. Perform Peak→REF.
   Operation: **MKR→** and **Peak→Ref**
8. Search for the peak.
   Operation: **SRCH**
9. Set the Noise/Hz measurement mode.
   Operation: **FUNC**, **Meas**, and **Noise/Hz**
10. Set the Noise/x Hz to 1 Hz.
    Operation: **Noise/x Hz**, **1**, and **Hz**
11. Set the dBc/Hz mode.
    Operation: **dBc/Hz**

12. Set the offset value to 10 kHz.
Operation: [1], [0], and [kHz]

13. Lower the reference level 20 dB.
Operation: [LEVEL], Ref Level, ▼, and ▼

14. Set the trace mode to Average and set the averaging count to 20.
Operation: [TRACE], Average, [2], [0], and [Hz](ENTER)

15. After averaging is complete, enter the marker Noise/Hz reading value into the performance verification sheet.

16. Set the trace mode to Write.
Operation: [TRACE] and Write

17. Set the REF LEVEL to 0 dBm.
Operation: [LEVEL], [0], and [GHz](+dBm)

18. Set the marker to OFF.
Operation: [MKR] and Marker All Off

19. Repeat steps 5 to 18 according to the settings in the table shown below.

Offset	Frequency span
10 kHz	25 kHz
100 kHz	250 kHz
1 MHz	2.5 MHz

2.2.8 Resolution Bandwidth Accuracy and Selectivity

[Overview]

This section describes how to check the 3-dB bandwidth accuracy of the RBW and the selectivity.

The selectivity is determined by the ratio between the 3-dB attenuation width of the RBW and 60-dB attenuation width.

[Specifications]

Accuracy: ± 3% 1 Hz to 300 kHz

± 7% 1 MHz and 3 MHz

±20% 10 MHz

Selectivity: 6 : 1 (60 dB : 3 dB)

[Required instruments]

Instrument	Quantity	Recommended model
Signal generator	1	SMP02
RF cable BNC(m)-BNC(m)	1	A01037-1500
RF cable SMA(m)-SMA(m)	1	A01002
Adapter N(m)-SMA(f)	1	HRM-554S

[Connection diagram]

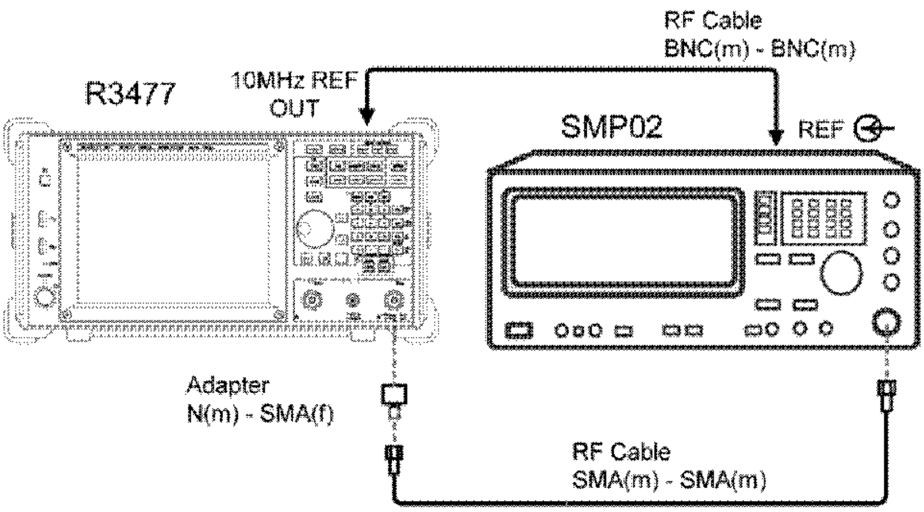

Figure 2-8 Resolution Bandwidth Accuracy and Selectivity Test

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-8.

Initialization

2. Preset this instrument.
   Operation: **SHIFT** and **LCL** (PRESET)

Measuring the 3 dB attenuation width

3. Specify the signal generator setting as follows:

Output frequency:	100 MHz
Output level:	0 dBm
Reference frequency signal:	External

4. Set the center frequency of this instrument to 100 MHz.
   Operation: **FREQ**, **Center**, **1**, **0**, **0**, and **MHz**
5. Set the display scale to 1 dB/div.
   Operation: **LEVEL**, **dB/div**, **1**, and **GHz** (dB)
6. Set the Ref LEVEL to 0 dBm.
   Operation: **LEVEL**, **0**, and **GHz** (+dBm)
7. Set the Trace Detector mode to SAMPLE.
   Operation: **TRACE**, **Trace Detector**, and **Sample**
8. Set the video bandwidth to 1 kHz.
   Operation: **BW**, **VBW** (Man), **1**, and **kHz**
9. Set the resolution bandwidth to 10 MHz.
   Operation: **BW**, **RBW** (Man), **1**, **0**, and **MHz**
10. Set the frequency span to 20 MHz.
    Operation: **SPAN**, **2**, **0**, and **MHz**
11. Set the sweep time to 50 msec.
    Operation: **SWEEP**, **Sweep Time** (Man), **5**, **0**, and **kHz** (ms)
12. Set SINGLE to perform a single sweep.
    Operation: **SINGLE**
13. Set the X dB down mode to 3 dB.
    Operation: **FUNC**, **Meas**, **X dB Down**, **X dB Down Level**, **3**, and **GHz** (dB)

14. Set Peak X dB Down.
    Operation: **Peak X dB Down**

15. Set Cont Down to ON.
    Operation: **Cont Down** (On)

16. Perform a single sweep.
    Operation: **SINGLE**

17. Read the marker display frequency and ensure that the value is within the specified range.

18. Repeat steps 8 to 17 by using the resolution bandwidth set values described in the table shown below.

19. Set the marker display to OFF.
    Operation: **MKR** and **Marker All Off**

Measuring the 60 dB attenuation width

20. Set the display scale to 10 dB/div.
    Operation: **LEVEL**, **dB/div**, **1**, **0**, and **GHz**(dB)

21. Set the resolution bandwidth to 10 MHz.
    Operation: **BW**, **RBW** (Man), **1**, **0**, and **MHz**

22. Set the frequency span to 100 MHz.
    Operation: **SPAN**, **1**, **0**, **0**, and **MHz**

23. Set SINGLE to perform a single sweep.
    Operation: **SINGLE**

24. Search for the peak.
    Operation: **SRCH**

25. Set the X dB down mode to 60 dB.
    Operation: **FUNC**, **Meas**, **X dB Down**, **X dB Down Level**, **6**, **0**, and **GHz**(dB)

26. Set Peak x dB down.
    Operation: **Peak X dB Down**

27. Set Cont down to ON.
    Operation: **Cont Down** (On)

28. Set SINGLE to perform a single sweep.
    Operation: **SINGLE**

29. Read the marker display frequency and substitute the value into the formula shown below to obtain the selectivity.

    Formula: Selectivity = (60 dB attenuation width / 3 dB attenuation width) : 1

30. Repeat steps 21 to 29 by using the resolution bandwidth set values described in Table 2-6.

Table 2-6 Resolution Bandwidth Set Values

Resolution bandwidth setting	3 dB width measurement Frequency span	60 dB width measurement Frequency span	Sweep time
10 MHz	20 MHz	100 MHz	50 msec
3 MHz	5 MHz	30 MHz	50 msec
1 MHz	2 MHz	10 MHz	50 msec
300 kHz	500 kHz	3 MHz	50 msec
100 kHz	200 kHz	1 MHz	50 msec
30 kHz	50 kHz	300 kHz	50 msec
10 kHz	20 kHz	100 kHz	50 msec
3 kHz	5 kHz	30 kHz	50 msec
1 kHz	2 kHz	10 kHz	50 msec
300 Hz	500 Hz	3 kHz	500 msec
100 Hz	200 Hz	1 kHz	1 sec
30 Hz	50 Hz	300 Hz	10 sec
10 Hz	20 Hz	100 Hz	10 sec
3 Hz	20 Hz	30 Hz	20 sec
1 Hz	20 Hz	20 Hz	150 sec

2.2.9 Sweep Time Accuracy

[Overview]

This section describes how to check the sweep time accuracy by displaying the square wave with the TIME DOMAIN.

[Specifications]

Sweep time accuracy: 2% of the set sweep time

[Required instruments]

Instrument	Quantity	Recommended model
Signal generator	1	SMT02
RF cable SMA(m)-SMA(m)	1	A01002
Adapter N(m)-SMA(f)	2	HRM-554S

[Connection diagram]

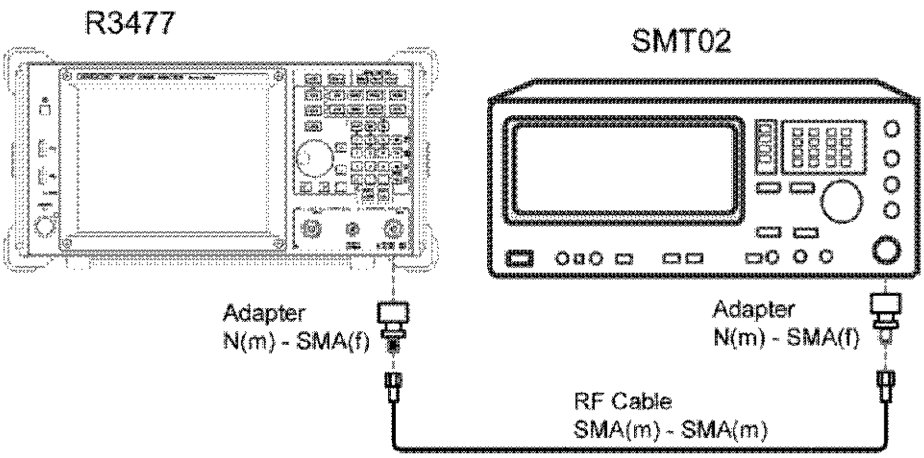

Figure 2-9 Sweep Time Accuracy Test

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-9.

Initialization

2. Preset this instrument.
   Operation: SHIFT and LCL (PRESET)

Setting the signal generator

3. Specify the signal generator setting as follows:

Output frequency:	30 MHz
Output level:	0 dBm
Pulse:	ON
Pulse cycle:	90 μsec
Pulse width:	40 μsec

Setting this instrument

4. Set the center frequency to 30 MHz.
   Operation: FREQ, Center, 3, 0, and MHz
5. Set the frequency span to 0 MHz.
   Operation: SPAN and Zero Span
6. Set the Ref LEVEL to 0 dBm.
   Operation: LEVEL, 0, and GHz (+dBm)
7. Set the resolution bandwidth to 3 MHz.
   Operation: BW, RBW (Man), 3, and MHz
8. Set the video bandwidth to 3 MHz.
   Operation: BW, VBW (Man), 3, and MHz
9. Set the sweep time to 100 μsec.
   Operation: SWEEP, Sweep Time (Man), 1, 0, 0, and Hz (μs)

Measuring the sweep time accuracy

10. Set the trigger mode to VIDEO.
    Operation: SWEEP, Trigger Source, and Video

11. Adjust the trigger level by using the rotary encoder or the ▲ ▼ keys to perform sweeps.
    Operation: Rotary encoder or the ▲ ▼ keys
12. Set Trigger Delay and set delay time to 85 μsec.
    Operation: **SWEEP**, **Trigger Delay**, **8**, **5**, and **Hz**(μs)
13. Set the marker to the first rising edge.
    Operation: **MKR** and rotary encoder or the ▲ ▼ keys
14. Set the ΔMarker to the second rising edge and measure the time interval between the first rising edge and second rising edge.
    Operation: **MKR**, **Delta Marker** and rotary encoder or the ▲ ▼ keys
15. Ensure that the value entered in step 14 is within the specified range.
16. Repeat steps 2 to 15 by using the sweep time described in Table 2-7.

Table 2-7 Sweep Time Accuracy Set Value

Sweep time of this instrument	Pulse cycle of the signal generator	Pulse width of the signal generator	Delay time of this instrument
100 μsec	90 μsec	40 μsec	85 μsec
1 msec	900 μsec	400 μsec	850 μsec
10 msec	9 msec	4 msec	8.5 msec
100 msec	90 msec	40 msec	85 msec
1 sec	900 msec	400 msec	850 msec

2.2.10 Frequency Response

[Overview]

This section describes how to measure the frequency response when the Preamplifier is set to OFF or ON.

[Specifications]

Spectrum analysis mode

Preamplifier OFF

50 MHz to 2.5 GHz ±0.4 dB

9 kHz to 3.3 GHz ±1.0 dB

3.3 GHz to 7.5 GHz ±1.5 dB

7.5 GHz to 13.5 GHz ±2.0 dB

Preamplifier ON

50 MHz to 2.5 GHz ±1.0 dB

100 kHz to 3.3 GHz ±2.0 dB

[Required instruments]

Instrument	Quantity	Recommended model
Signal generator	1	SMP02
Power meter	1	NRVS
Power sensor	1	NRV-Z51
Power splitter	1	1579
RF cable BNC(m)-BNC(m)	1	A01037-1500
RF cable SMA(m)-SMA(m)	1	A01002
Adapter N(m)-SMA(f)	1	HRM-554S
Adapter N(f)-SMA(f)	1	HRM-552S
Adapter SMA(m)-SMA(m)	2	HRM-502 (09)
3 dB attenuator	2	DEE-000685-1

[Connection diagram]

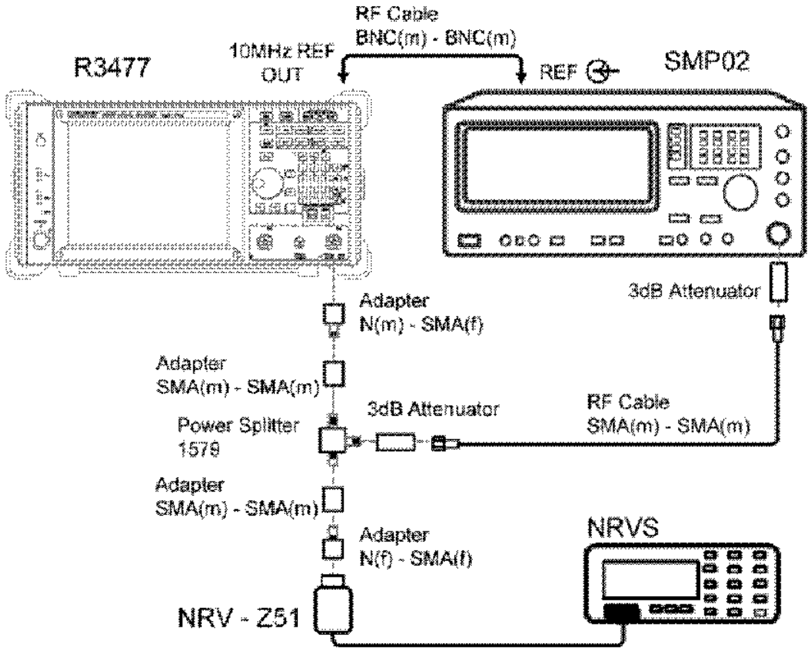

Figure 2-10 Frequency Response Test

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-10.

Initializing the power meter

2. Adjust point 0 of the power sensor and power meter and perform the calibration.
3. Set the power meter to the dBm display.

Initialization

4. Preset this instrument.
   Operation: **SHIFT** and **LCL** (PRESET)

Setting the signal generator

5. Specify the signal generator setting as follows:

Output frequency:	50 MHz
Output level:	-10 dBm
Reference frequency input:	External

Setting this instrument

6. Set the center frequency to 50 MHz.
   Operation: FREQ, Center, 5, 0, and MHz
7. Set the frequency span to 40 MHz.
   Operation: SPAN, 4, 0, and MHz
8. Set the resolution bandwidth to 3 MHz.
   Operation: BW, RBW (Man), 3, and MHz
9. Set the video bandwidth to 1 kHz.
   Operation: BW, VBW (Man), 1, and kHz
10. Set the input attenuator to 10 dB.
    Operation: LEVEL, ATT (Man), 1, 0, and GHz(dB)
11. Set the display scale to 1 dB/div.
    Operation: LEVEL, dB/div, 1, and GHz(dB)
12. Set the Ref LEVEL to -5 dBm.
    Operation: LEVEL, 5, and MHz(-dBm)
13. Set the continuous peak search to ON.
    Operation: SRCH, Cont Peak (On)

Acquiring the frequency response reference level

14. Set the calibration frequency of the power meter to 50 MHz.
15. Adjust the output level of the signal generator to set the marker display level to -10 dBm ± 0.09 dBm.
16. Set the power meter to the relative value display.

Setting in the 9 kHz to 3.3 GHz frequency range

17. Set the output frequency of the signal generator to 100 MHz.
18. Set the center frequency of this instrument to 100 MHz.
    Operation: FREQ, Center, 1, 0, 0, and MHz
19. Set the step size of the center frequency to 100 MHz.
    Operation: CF Step Size (Man), 1, 0, 0, and MHz.

20. Set the calibration frequency of the power meter to 100 MHz.
21. Adjust the output level of the signal generator to set the marker display level to -10 dBm ±0.09 dBm.
22. Change the sign of the value displayed on the power meter and enter the value into the performance verification sheet.
23. Ensure that the value acquired in step 22 is within the specified range.
24. Repeat steps 17 to 23 up to the 3.2 GHz center frequency in 100 MHz increments.

Setting in the 3.3 GHz to 7.5 GHz frequency range

25. Set the output frequency of the signal generator to 3.3 GHz.
26. Set the center frequency of this instrument to 3.3 GHz.
    Operation: **FREQ**, **Center**, **3**, **.**, **3**, and **GHz**
27. Set the calibration frequency of the power meter to 3.3 GHz.
28. Tune the pre-selector.
    Operation: **FREQ**, **Presel Tune**, and **Auto Tune**
29. Adjust the output level of the signal generator to set the marker display level to -10 dBm ±0.09 dBm.
30. Change the sign of the value displayed on the power meter and enter the value into the performance verification sheet.
31. Ensure that the value acquired in step 30 is within the specified range.
32. Repeat steps 25 to 31 up to the 7.5 GHz center frequency in 100 MHz increment.

Setting in the 7.5 GHz to 13.5 GHz frequency range

33. Set the output frequency of the signal generator to 7.6 GHz.
34. Set the center frequency of this instrument to 7.6 GHz.
    Operation: **FREQ**, **Center**, **7**, **.**, **6**, and **GHz**
35. Set the step size of the center frequency to 200 MHz.
    Operation: **CF Step Size** **(Man)**, **2**, **0**, **0**, and **MHz**
36. Set the calibration frequency of the power meter to 7.6 GHz.
37. Tune the pre-selector.
    Operation: **FREQ**, **Presel Tune**, and **Auto Tune**
38. Adjust the output level of the signal generator to set the marker display level to -10 dBm ±0.09 dBm.
39. Change the sign of the value displayed on the power meter and enter the value into the performance verification sheet.
40. Ensure that the value acquired in step 39 is within the specified range.

41. Repeat steps 33 to 40 up to the 13.4 GHz center frequency in 200 MHz increment.

Frequency response when the Preamplifier is set to ON
Initializing the power meter

42. Adjust point 0 of the power sensor and power meter and perform the calibration.
43. Set the power meter to the dBm display.

Initialization

44. Preset this instrument.
    Operation: **SHIFT** and **LCL** (PRESET)

Setting the signal generator

45. Specify the signal generator setting as follows:

Output frequency:	50 MHz
Output level:	-20 dBm
Reference frequency input:	External

Setting this instrument

46. Set the center frequency to 50 MHz.
    Operation: **FREQ**, **Center**, **5**, **0**, and **MHz**
47. Set the step size of the center frequency to 100 MHz.
    Operation: **CF Step Size** (Man), **1**, **0**, **0**, and **MHz**
48. Set the frequency span to 40 MHz.
    Operation: **SPAN**, **4**, **0**, and **MHz**
49. Set the resolution bandwidth to 3 MHz.
    Operation: **BW**, **RBW** (Man), **3**, and **MHz**
50. Set the video bandwidth to 1 kHz.
    Operation: **BW**, **VBW** (Man), **1**, and **kHz**
51. Set the input attenuator to 10 dB.
    Operation: **LEVEL**, **ATT** (Man), **1**, **0**, and **GHz** (dB)
52. Set the display scale to 1 dB/div.
    Operation: **LEVEL**, **dB/div**, **1**, and **GHz** (dB)
53. Set the preamplifier to ON.
    Operation: **LEVEL** and **Preamp** (On)

54. Set the Ref LEVEL to -15 dBm.
    Operation: **LEVEL**, **1**, **5**, and **MHz** (-dBm)

55. Set the continuous peak search to ON.
    Operation: **SRCH** and **Cont Peak** (On)

Acquiring the frequency response reference level

56. Set the calibration frequency of the power meter to 50 MHz.

57. Adjust the output level of the signal generator so that the marker display level is set to -20 dBm ±0.09 dBm.

58. Set the power meter to the relative value display.

Setting in the 100 kHz to 3.3 GHz frequency range

59. Set the output frequency of the signal generator to 100 MHz.

60. Set the center frequency of this instrument to 100 MHz.
    Operation: **FREQ**, **Center**, **1**, **0**, **0**, and **MHz**

61. Set the calibration frequency of the power meter to 100 MHz.

62. Adjust the output level of the signal generator to set the marker display level to -20 dBm ±0.09 dBm.

63. Change the sign of the value displayed on the power meter and enter the value into the performance verification sheet.

64. Ensure that the value acquired in step 63 is within the specified range.

65. Repeat steps 59 to 64 up to the 3.2 GHz center frequency in 100 MHz increment.

2.2.11 Attenuator Switching Accuracy

[Overview]

This section describes how to measure the level error when the input attenuator of this instrument is switched.

[Specifications]

9 kHz to 8 GHz: < ±1.2 dB (5 dB to 50 dB)
< ±1.8 dB (55 dB to 75 dB)

8 GHz to 13.5 GHz: < ±1.4 dB (5 dB to 50 dB)
< ±2.3 dB (55 dB to 75 dB)

[Required instruments]

Instrument	Quantity	Recommended model
Signal generator	1	SMP02
RF cable BNC(m)-BNC(m)	1	A01037-1500
RF cable SMA(m)-SMA(m)	1	A01002
Adapter N(m)-SMA(f)	1	HRM-554S
3 dB attenuator	2	DEE-000685-1

[Connection diagram]

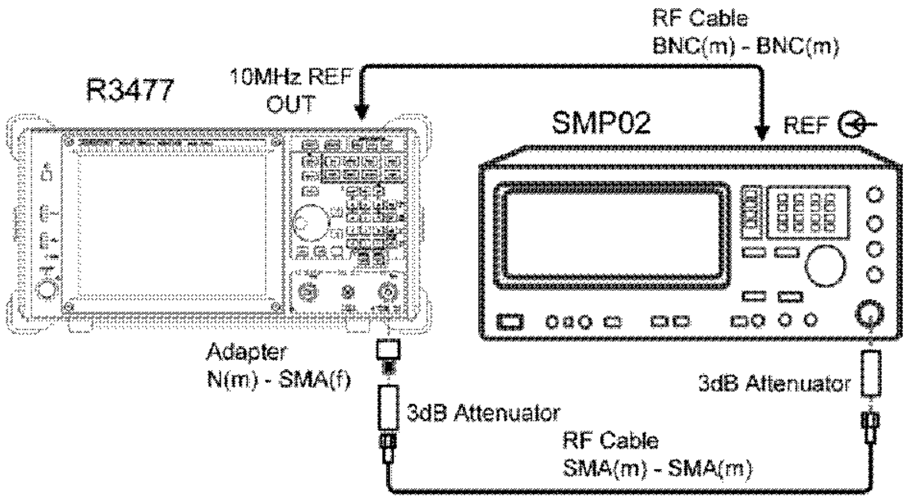

Figure 2-11 Attenuator Switching Accuracy Test

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-11.

Initialization

2. Preset this instrument.
   Operation: SHIFT and LCL (PRESET)

Setting the signal generator

3. Specify the signal generator setting as follows:
   Output frequency: 1 GHz
   Output level: -9 dBm
   Reference frequency signal: External

Setting this instrument

4. Set the center frequency to 1 GHz.
   Operation: FREQ, Center, 1, and GHz
5. Set the frequency span to 1 kHz.
   Operation: SPAN, 1, and kHz
6. Set the resolution bandwidth to 300 Hz.
   Operation: BW, RBW (Man), 3, 0, 0, and Hz
7. Set the Ref LEVEL to -10 dBm.
   Operation: LEVEL, 1, 0, and MHz (-dBm)
8. Set the display scale to 1 dB/div.
   Operation: LEVEL, dB/div, 1, and GHz (dB)
9. Set the sweep time to 200 msec.
   Operation: SWEEP, Sweep Time (Man), 2, 0, 0, and kHz (ms)
10. Set Min ATT of the input attenuator to OFF.
    Operation: LEVEL and Min ATT (Off)
11. Set the input attenuator to 10 dB.
    Operation: LEVEL, ATT (Man), 1, 0, and GHz (dB)
12. Set the Display Line to -15 dBm.
    Operation: FUNC, Display, Display Line (On), 1, 5, and MHz (-dBm)

13. Set the reference of the marker reading level to the display line.
    Operation: MKR, **Reference Object**, and **[Disp Line]**

14. Closes the dialog box.
    Operation: **Close**

15. Set the continuous peak search to ON.
    Operation: SRCH and **Cont Peak** (On)

16. Adjust the output level of the signal generator to set the marker level to 0 dB ±0.01 dB.

Measuring the switching error

17. Set ATT to 5 dB.
    Operation: LEVEL, **ATT** (Man), 5, and GHz (dB)

18. Read the marker level and change the sign of the value, and enter the value into the performance verification sheet.

19. Ensure that the value is within the specified range.

20. Repeat steps 17 to 19 by using the ATT values from 15 dB to 75 dB in 5 dB increments.

21. Repeat steps 3 to 20 by using each frequency described in Table 2-8.

Table 2-8 Center frequency Setting List

Center frequency	Signal generator Set frequency
1 GHz	1 GHz
5 GHz	5 GHz
10 GHz	10 GHz

2.2.12 Resolution Bandwidth Switching Error

[Overview]

This section describes how to check the switching error in the resolution bandwidth.

Based on the amplitude at a resolution bandwidth of 300 kHz, the switching error from 1 kHz to 10 MHz is measured by using steps 1 and 3.

[Specifications]

Switching error ±0.05 dB (1 Hz to 3 MHz)
±0.3 dB (10 MHz)

[Required instruments]

Instrument	Quantity	Recommended model
Signal generator	1	SMP02
RF cable BNC(m)-BNC(m)	1	A01037-1500
RF cable SMA(m)-SMA(m)	1	A01002
Adapter N(m)-SMA(f)	1	HRM-554S

[Connection diagram]

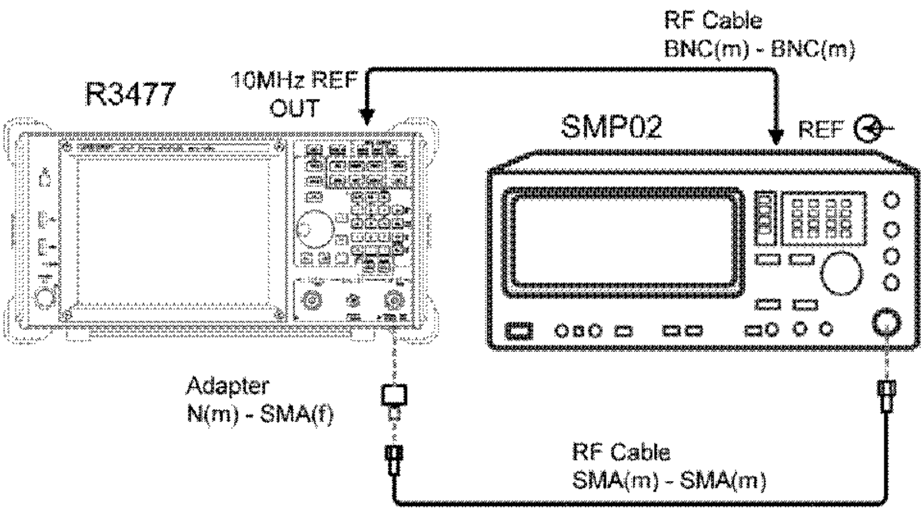

Figure 2-12 Resolution Bandwidth Switching Error Test

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-12.

Initialization

2. Preset this instrument.
   Operation: SHIFT and LCL (PRESET)

Setting the signal generator

3. Specify the signal generator setting as follows:
   Output frequency: 100 MHz
   Output level: -5 dBm
   Reference frequency signal: External

Setting this instrument

4. Set the center frequency to 100 MHz.
   Operation: FREQ, Center, 1, 0, 0, and MHz
5. Set the display scale to 1 dB/div.
   Operation: LEVEL, dB/div, 1, and GHz (dB)
6. Set the Ref LEVEL to 0 dBm.
   Operation: LEVEL, 0, and GHz (+dBm)
7. Set the Trace Detector mode to Average (RMS).
   Operation: TRACE, Trace Detector, and Average

Setting the switching error reference level

8. Set the resolution bandwidth to 300 kHz.
   Operation: BW, RBW (Man), 3, 0, 0, and kHz
9. Set the frequency span to 500 kHz.
   Operation: SPAN, 5, 0, 0, and kHz
10. Set SINGLE to perform a single sweep.
    Operation: SINGLE
11. Search for the peak.
    Operation: SRCH

12. Set Fixed ΔMarker to ON.
    Operation: **MKR**, **Delta Marker**, and **Fixed ΔMarker** (On)

Measuring the switching error

13. Set the resolution bandwidth to 10 MHz.
    Operation: **BW**, **1**, **0**, and **MHz**
14. Set the frequency span to 20 MHz.
    Operation: **SPAN**, **2**, **0**, **MHz**
15. Perform a single sweep.
    Operation: **SINGLE**
16. Search for the peak.
    Operation: **SRCH**
17. Read the marker display level and ensure that the value is within the specified range.
18. Repeat steps 13 to 17 by using each RBW described in Table 2-9.

Table 2-9 RBW Setting List

RBW setting [Hz]	Frequency span [Hz]
10 M	20 M
3 M	5 M
1 M	2 M
1000 k	200 k
30 k	50 k
10 k	20 k
3 k	5 k
1 k	2 k

2.2.13 Displayed Average Noise Level

[Overview]

This section describes how to measure the displayed average noise level of the signal analyzer.

Measurement is performed under the following conditions: the input terminal is terminated, the input attenuator: 0 dB, RBW: normalized to 1 Hz, detector: sample, averaging: 20 times or more, and average type: video.

[Specifications]

Spectrum analysis mode

- Preamplifier Off
  - 10 kHz: < -125 dBm
  - 100 kHz: < -135 dBm
  - 1 MHz: < -145 dBm
  - 10 MHz to 1 GHz: < -156 dBm
  - 1 GHz to 2 GHz: < -154 dBm
  - 2 GHz to 2.5 GHz: < -152 dBm
  - 2.5 GHz to 3 GHz: < -150 dBm
  - 3 GHz to 3.3 GHz: < -148 dBm
  - 3.3 GHz to 7.5 GHz: < -146 dBm
  - 7.5 GHz to 13.5 GHz: < -146 dBm
- Preamplifier On
  - 100 kHz: < -140 dBm
  - 1 MHz: < -150 dBm
  - 10 MHz to 1 GHz: < -162 dBm
  - 1 GHz to 2.5 GHz: < -160 dBm
  - 2.5 GHz to 3 GHz: < -158 dBm
  - 3 GHz to 3.3 GHz: < -156 dBm

[Required instruments]

Instrument	Quantity	Recommended model
Adapter N(m)-SMA(f)	1	HRM-554S
50 Ω terminator	1	HRM-601A(02)

[Connection diagram]

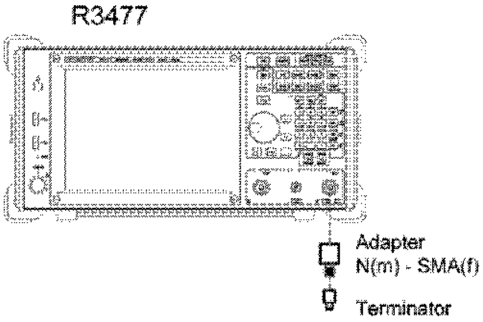

Figure 2-13 Displayed Average Noise Level Test

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-13.

Setting and measurement method (10 kHz to 1 MHz)

2. Preset this instrument.
   Operation: **SHIFT** and **LCL** (PRESET)
3. Set the frequency span to 0 Hz.
   Operation: **SPAN** and **Zero Span**
4. Set the resolution bandwidth to 1 kHz.
   Operation: **BW**, **RBW** (Man), **1**, and **kHz**
5. Set the video bandwidth to 1 Hz.
   Operation: **BW**, **VBW** (Man), **1**, and **Hz**
6. Set the Trace Detector mode to SAMPLE.
   Operation: **TRACE**, **Trace Detector**, and **Sample**
7. Set the average type to Video.
   Operation: **TRACE**, **Average Type**, and **Video**
8. Set Min ATT of the input attenuator to OFF.
   Operation: **LEVEL** and **Min ATT** (Off)
9. Set the input attenuator to 0 dB.
   Operation: **LEVEL**, **ATT** (Man), **0**, and **GHz** (dB)
10. Set the Ref LEVEL to -90 dBm.
    Operation: **LEVEL**, **9**, **0**, and **MHz** (-dBm)
11. Set the sweep time to 200 msec.
    Operation: **SWEEP**, **Sweep Time** (Man), **2**, **0**, **0**, and **kHz** (ms)

12. Sets the averaging count to 50.
    Operation: TRACE, **Average**, 5, 0, and Hz(ENTER)
13. Set the center frequency to 10 kHz.
    Operation: FREQ, **Center**, 1, 0, and kHz
14. After the averaging count reaches 50, read the marker level.
    Operation: MKR
15. Substitute the value that was read in step 14 into the formula, which is shown below, to normalize it to RBW 1 Hz and enter the normalized value into the performance verification sheet.

    Formula: Normalized value = Marker level - 30 dB
16. Repeat steps 13 to 15 by using each frequency up to 1 MHz described in Table 2-10.
17. Set the preamplifier to ON.
    Operation: LEVEL, **Preamp** (On)
18. Repeat steps 13 to 15 by using 100 kHz and 1 MHz center frequencies.

Table 2-10 Center Frequency Setting List

Preamplifier	Frequency
Off	10 kHz
	100 kHz
	1 MHz
On	100 kHz
	1 MHz

Setting and measurement method (10 MHz or higher)

19. Preset this instrument.
    Operation: SHIFT and LCL(PRESET)
20. Set the Start frequency to 10 MHz.
    Operation: FREQ, **Start**, 1, 0, and MHz
21. Set the Stop frequency to 1 GHz.
    Operation: **Stop**, 1, and GHz
22. Set the resolution bandwidth to 1 MHz.
    Operation: BW, **RBW** (Man), 1, and MHz
23. Set the video bandwidth to 1 kHz.
    Operation: BW, **VBW** (Man), 1, and kHz
24. Set the Trace Detector mode to SAMPLE.
    Operation: TRACE, **Trace Detector**, and **Sample**

25. Set Min ATT of the input attenuator to OFF.
    Operation: **LEVEL** and **Min ATT** (Off)
26. Set the input attenuator to 0 dB.
    Operation: **LEVEL**, **ATT** (Man), **0**, and **GHz** (dB)
27. Set the Ref LEVEL to -50 dBm.
    Operation: **LEVEL**, **5**, **0**, and **MHz** (-dBm)
28. Perform a single sweep.
    Operation: **SINGLE**
29. Perform Peak→CF.
    Operation: **MKR→** and **Peak→CF**
30. Set the frequency span to 100 MHz.
    Operation: **SPAN**, **1**, **0**, **0**, and **MHz**
31. Set the resolution bandwidth to 100 kHz.
    Operation: **BW**, **1**, **0**, **0**, and **kHz**
32. Set the video bandwidth to 300 Hz.
    Operation: **BW**, **VBW** (Man), **3**, **0**, **0**, and **Hz**
33. Perform a single sweep.
    Operation: **SINGLE**
34. Perform PEAK→CF.
    Operation: **MKR→** and **Peak→CF**
35. Set the sweep time to 200 msec.
    Operation: **SWEEP**, **Sweep Time** (Man), **2**, **0**, **0**, and **kHz** (ms)
36. Set the frequency span to 0 Hz.
    Operation: **SPAN** and **Zero Span**
37. Set the resolution bandwidth to 1 kHz.
    Operation: **BW**, **1**, and **kHz**
38. Set the video bandwidth to 1 Hz.
    Operation: **BW**, **VBW** (Man), **1**, and **Hz**
39. Set the Ref LEVEL to -90 dBm.
    Operation: **LEVEL**, **9**, **0**, and **MHz** (-dBm)
40. Perform the continuous sweep.
    Operation: **START**
41. Perform the averaging by setting the averaging count to 50.
    Operation: **TRACE**, **Average**, **5**, **0**, and **Hz** (ENTER)
42. After averaging is complete, search for the peak.
    Operation: **SRCH**

43. Read the marker frequency and level.
44. Substitute the value that was read in step 43 into the formula, which is shown below, to normalize it to RBW 1 Hz and enter the normalized value into the performance verification sheet.

    Formula: Normalized value = Marker level -30 dB
45. Repeat steps 20 to 44 by using each frequency range described in Table 2-11 when the preamplifier is set to OFF.
46. Repeat steps 20 to 27.
47. Set the preamplifier to ON.
    Operation: **LEVEL** and **Preamp** (On)
48. Repeat steps 28 to 44.
49. Repeat steps 46 to 48 by using each frequency range described in Table 2-11 when the preamplifier is set to ON.

Table 2-11 Frequency Range Setting List

Preamplifier	Frequency	Start freq	Stop freq
Off	10 MHz to 1 GHz	10 MHz	1 GHz
	1 GHz to 2 GHz	1 GHz	2 GHz
	2 GHz to 2.5 GHz	2 GHz	2.5 GHz
	2.5 GHz to 3 GHz	2.5 GHz	3 GHz
	3 GHz to 3.3 GHz	3 GHz	3.3 GHz
	3.3 GHz to 7.5 GHz	3.3 GHz	7.5 GHz
	7.5 GHz to 13.5 GHz	7.5 GHz	13.5 GHz
On	10 MHz to 1 GHz	10 MHz	1 GHz
	1 GHz to 2.5 GHz	1 GHz	2.5 GHz
	2.5 GHz to 3 GHz	2.5 GHz	3 GHz
	3 GHz to 3.3 GHz	3 GHz	3.3 GHz

2.2.14 1 dB Gain Compression

[Overview]

This section describes how to check the gain compression.

The gain compression is measured by using two signal generators to synthesize two signals with a 1 MHz difference, and inputting the signal into this instrument.

One of the signals is fixed at -30 dBm, and the other signal level is increased until the fixed signal level decreases by 1 dB. The input level to this instrument at this point is the gain compression level.

[Specifications]

Separation of the two signals: Resolution bandwidth × 15, 50 kHz min

50 MHz to 200 MHz:> +2 dBm
200 MHz to 3.3 GHz:> +6 dBm
3.3 GHz to 7.5 GHz:> -5 dBm
7.5 GHz to 13.5 GHz:> -3 dBm

[Required instruments]

Instrument	Quantity	Recommended model
Signal generator 1	1	SMP02
Signal generator 2	1	SMP02
Power meter	1	NRVS
Power sensor	1	NRV-Z51
Power divider	1	PDML-20A-500
Power divider	1	4426-2
RF cable BNC(m)-BNC(m)	3	A01037-1500
RF cable SMA(m)-SMA(m)	3	A01002
Adapter BNC-TA-JJJ	1	302-0024-6
Adapter N(m)-SMA(f)	1	HRM-554S
Adapter N(f)-SMA(f)	1	HRM-552S

[Connection diagram]

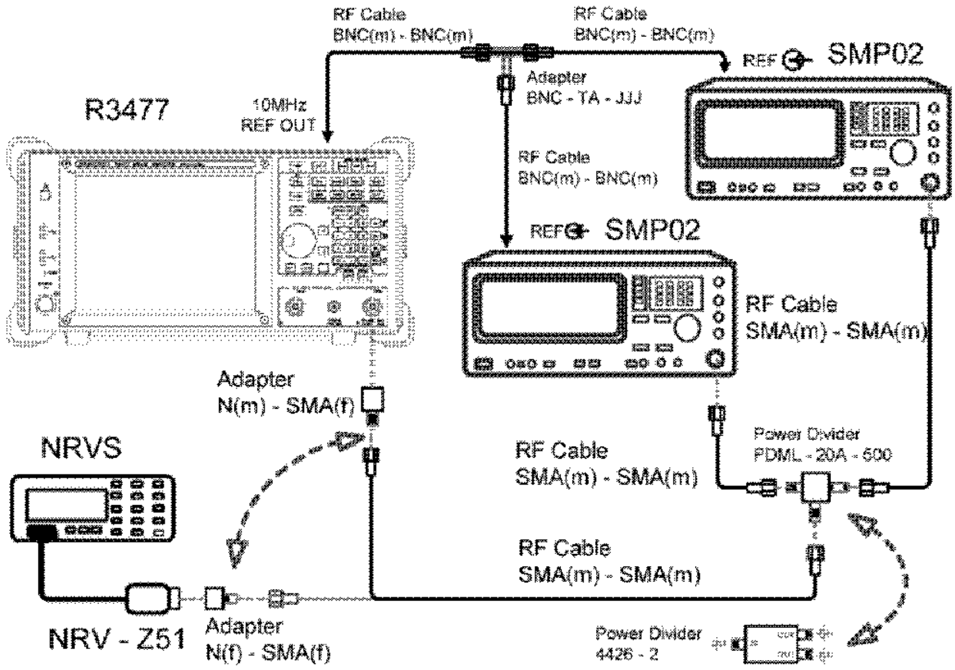

Figure 2-14 1 dB Gain Compression Test

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-14.

Initializing the power meter

2. Adjust point 0 of the power sensor and power meter and perform the calibration.
3. Set the power meter to the dBm display.
4. Set the calibration frequency of the power meter to 100 MHz.

Initialization

5. Preset this instrument.
   Operation: **SHIFT** and **LCL** (PRESET)

Setting signal generator 1

6. Specify the signal generator 1 setting as follows:
   Output frequency: 100 MHz
   Output level: -10 dBm

Setting signal generator 2

7. Specify the signal generator 2 setting as follows:
   Output frequency: 101 MHz
   Output level: -10 dBm

Setting this instrument

8. Set the center frequency to 100.5 MHz.
   Operation: **FREQ**, **Center**, **1**, **0**, **0**, **.**, **5**, and **MHz**
9. Set the frequency span to 2 MHz.
   Operation: **SPAN**, **2**, and **MHz**
10. Set the Ref LEVEL to -30 dBm.
    Operation: **LEVEL**, **3**, **0**, and **MHz**(-dBm)
11. Set Min ATT of the input attenuator to OFF.
    Operation: **LEVEL** and **Min ATT** (Off)
12. Set the input attenuator to 0 dB.
    Operation: **LEVEL**, **ATT** (Man), **0**, and **GHz**(dB)
13. Set the display scale to 1 dB/div.
    Operation: **LEVEL**, **dB/div**, **1**, and **GHz**(dB)

Measuring the 1 dB gain compression

14. Set the output of signal generator 2 to OFF.
15. Search for the peak.
    Operation: **SRCH**
16. Set the continuous peak search to ON.
    Operation: **SRCH** and **Cont Peak** (On)
17. Adjust the output level of signal generator 1 to set the marker display level to -30 dBm ± 0.1 dBm.
18. Set the continuous peak search to OFF.
    Operation: **SRCH** and **Cont Peak** (Off)
19. Set Fixed ΔMarker to ON.
    Operation: **MKR**, **Delta Marker**, and **Fixed ΔMarker** (On)

20. Set the output of signal generator 2 to ON.
21. Adjust the output level of signal generator 2 to set the ΔMarker display level to -1 dB ± 0.1 dB.
22. Set the output of signal generator 1 to OFF.
23. Remove the cable, which is connected to the RF input and connect it to the power sensor.
24. Enter the value on the power meter into the performance verification sheet.
25. Ensure that the entered level is within the specified range.
26. Repeat steps 4 to 25 by using 2.2 GHz described in the table shown below.

Signal generator 1	Signal generator 2	Center frequency	Power meter
100 MHz	101 MHz	100.5 MHz	100 MHz
2.2 GHz	2.201 GHz	2.2005 GHz	2.2 GHz

Setting the power meter

27. Set the calibration frequency of the power meter to 5 GHz.

Initialization

28. Preset this instrument.
    Operation: **SHIFT** and **LCL** (PRESET)

Setting signal generator 1

29. Specify the signal generator 1 setting as follows:
    Output frequency: 5 GHz
    Output level: -35 dBm

Setting signal generator 2

30. Specify the signal generator 2 setting as follows:
    Output frequency: 5.001 GHz
    Output level: -10 dBm

Setting this instrument

31. Set the center frequency to 5.0005 GHz.
    Operation: **FREQ**, **Center**, **5**, **.**, **0**, **0**, **0**, **5**, and **GHz**
32. Set the frequency span to 2 MHz.

Operation: SPAN, 2, and MHz

33. Set the Ref LEVEL to -30 dBm.
Operation: LEVEL, 3, 0, and MHz(-dBm)

34. Set MinATT of the input attenuator to OFF.
Operation: LEVEL and Min ATT (Off)

35. Set the input attenuator to 0 dB.
Operation: LEVEL, ATT (Man), 0, and GHz (dB)

36. Set the display scale to 1 dB/div.
Operation: LEVEL, dB/div, 1, and GHz (dB)

Tuning the pre-selector

37. Set the output of signal generator 2 to OFF.

38. Tune the pre-selector.
Operation: FREQ, Presel Tune, and Auto Tune

Measuring the 1 dB gain compression

39. Search for the peak.
Operation: SRCH

40. Set the continuous peak search to ON.
Operation: SRCH and Cont Peak (On)

41. Adjust the output level of signal generator 1 to set the marker display level to -30 dBm ±0.1 dBm.

42. Set the continuous peak search to OFF.
Operation: SRCH and Cont Peak (Off)

43. Set Fixed ΔMarker to ON.
Operation: MKR, Delta Marker, and Fixed ΔMarker (On)

44. Set the output of signal generator 2 to ON.

45. Adjust the output level of signal generator 2 to set the ΔMarker display level to -1 dB ±0.1 dB.

46. Set the output of signal generator 1 to OFF.

47. Remove the cable, which is connected to the RF input and connect it to the power sensor.

48. Enter the value on the power meter into the performance verification sheet.

49. Ensure that the entered level is within the specified range.

50. Repeat steps 27 to 49 by using 7 GHz and 10 GHz described in the table shown below.

Signal generator 1	Signal generator 2	Center frequency	Power meter
5 GHz	5.001 GHz	5.0005 GHz	5 GHz
7 GHz	7.001 GHz	7.0005 GHz	7 GHz
10 GHz	10.001 GHz	10.0005 GHz	10 GHz

2.2.15 2nd Order Harmonic Distortion

[Overview]

This section describes how to check the 2nd order harmonic distortion, which occurs in this instrument, by inputting a distorted signal.

The 2nd order harmonic distortion is measured by inputting a signal from the signal generator into this instrument through the low pass filter.

The low pass filter is used to restrain the 2nd order harmonic distortion.

[Specifications]

2nd order harmonic distortion: ≤ -60 dBc (50 MHz to 1.65 GHz, mixer input level -20 dBm)
≤ -100 dBc (> 1.65 GHz, mixed input level -10 dBm)

[Required instruments]

Instrument	Quantity	Recommended model
Signal generator	1	SMP02
Power meter	1	NRVS
Power sensor	1	NRV-Z51
Power splitter	1	1579
Low pass filter	1	
RF cable BNC(m)-BNC(m)	1	A01037-1500
RF cable SMA(m)-SMA(m)	1	A01002
Adapter N(m)-SMA(f)	1	HRM-554S
Adapter N(f)-SMA(f)	1	HRM-552S
Adapter SMA(m)-SMA(m)	3	HRM-502 (09)

[Connection diagram]

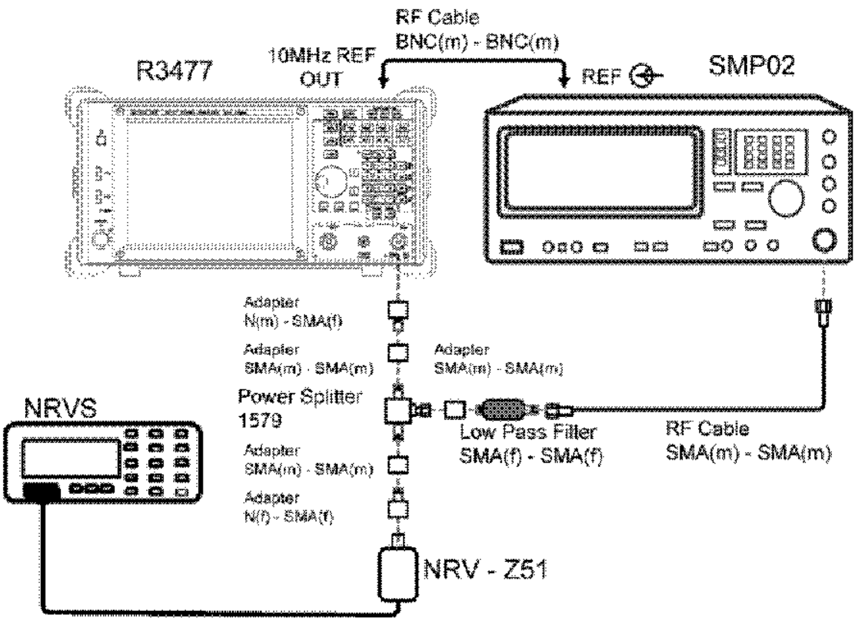

Figure 2-15 2nd Order Harmonic Distortion Test (with the Filter)

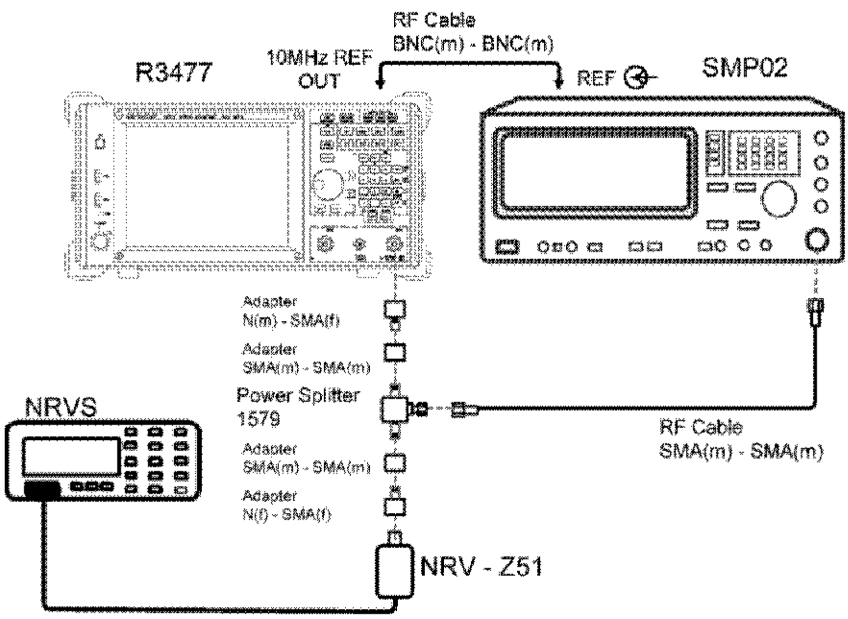

Figure 2-16 2nd Order Harmonic Distortion Test (without the Filter)

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-15.

Initializing the power meter

2. Adjust point 0 of the power sensor and power meter and perform the calibration.
3. Set the power meter to the dBm display.
4. Set the calibration frequency of the power meter to 1.5 GHz.

Initialization

5. Preset this instrument.
   Operation: **SHIFT** and **LCL** (PRESET)

Setting the signal generator

6. Specify the signal generator setting as follows:
   Output frequency: 1.5 GHz
   Output level: -10 dBm
   Reference frequency signal: External

Setting this instrument

7. Set the center frequency to 1.5 GHz.
   Operation: **FREQ**, **Center**, **1**, **.**, **5**, and **GHz**
8. Set the frequency span to 10 kHz.
   Operation: **SPAN**, **1**, **0**, and **kHz**
9. Set the input attenuator to 10 dB.
   Operation: **LEVEL**, **ATT** (Man), **1**, **0**, and **GHz** (dB)
10. Set the Ref LEVEL to -10 dBm.
    Operation: **LEVEL**, **1**, **0**, and **MHz** (-dBm)
11. Set the video bandwidth to 30 Hz.
    Operation: **BW**, **VBW** (Man), **3**, **0**, and **Hz**
12. Adjust the output level of the signal generator to set the power meter display level to -10 dBm ±0.09 dBm.
13. Set SINGLE to perform a single sweep.
    Operation: **SINGLE**

14. Search for the peak.
    Operation: **SRCH**

15. Set Fixed ΔMarker to ON.
    Operation: **MKR**, **Delta Marker**, and **Fixed ΔMarker** (On)

16. Set the center frequency of this instrument to 3 GHz.
    Operation: **FREQ**, **Center**, **3**, and **GHz**

17. Set SINGLE to perform a single sweep.
    Operation: **SINGLE**

18. Search for the peak.
    Operation: **SRCH**

19. Read the ΔMarker value and ensure that the value is within the specified range.

20. Perform the continuous sweep.
    Operation: **START**

21. Set the marker to OFF.
    Operation: **MKR** and **Marker All Off**

Changing the connection of the instruments

22. Change the connection of the instruments as shown in Figure 2-16.

Setting the signal generator

23. Specify the signal generator setting as follows:

Output frequency:	3.8 GHz
Output level:	-10 dBm

Setting this instrument

24. Set the center frequency to 3.8 GHz.
    Operation: **FREQ**, **Center**, **3**, **.**, **8**, and **GHz**

25. Set the frequency span to 500 kHz.
    Operation: **SPAN**, **5**, **0**, **0**, and **kHz**

26. Tune the pre-selector.
    Operation: **FREQ**, **Presel Tune**, and **Auto Tune**

27. After the pre-selector is tuned, specify the signal generator setting as follows:

Output frequency:	1.9 GHz
Output level:	0 dBm

28. Set the calibration frequency of the power meter to 1.9 GHz.

29. Adjust the output level of the signal generator to set the power meter display level

to 0 dBm ±0.09 dBm.

30. Set the center frequency to 1.9 GHz.
    Operation: [FREQ], **Center**, [1], [.], [9], and [GHz]
31. Set the frequency span to 1 kHz.
    Operation: [SPAN], [1], and [kHz]
32. Search for the peak.
    Operation: [SRCH]
33. Set Fixed ΔMarker to ON.
    Operation: [MKR], **Delta Marker**, and **Fixed ΔMarker** (On)
34. Set the center frequency to 3.8 GHz.
    Operation: [FREQ], **Center**, [3], [.], [8], and [GHz]
35. Set the Ref LEVEL to -40 dBm.
    Operation: [LEVEL], [4], [0], and [MHz](-dBm)
36. Perform the averaging by setting the averaging count to 20.
    Operation: [TRACE], **Average**, [2], [0], and [Hz](ENTER)
37. Search for the peak.
    Operation: [SRCH]
38. Read the ΔMarker value and ensure that the value is within the specified range.

2.2.16 Third Order Intermodulation Distortion

[Overview]

This section describes how to check the third order intermodulation distortion by measuring the third order distortion, which occurs when two signals are input.

[Specifications]

TOI (Mixer input level: -10 dBm, separation of the two signals: Resolution bandwidth × 15: 25 kHz min)

10 MHz to 200 MHz:	> +12 dBm
200 MHz to 500 MHz:	> +16 dBm
500 MHz to 1 GHz:	> +20 dBm
1 GHz to 2 GHz:	> +21 dBm
2 GHz to 3.3 GHz:	> +22 dBm
3.3 GHz to 7.5 GHz:	> +5 dBm
7.5 GHz to 13.5 GHz:	> +8 dBm

[Required instruments]

Instrument	Quantity	Recommended model
Signal generator 1	1	SMP02
Signal generator 2	1	SMP02
Power meter	1	NRVS
Power sensor	1	NRV-Z51
Power divider	1	PDML-20A-500
Power divider	1	4426-2
RF cable BNC(m)-BNC(m)	3	A01037-1500
RF cable SMA(m)-SMA(m)	3	A01002
Adapter N(m)-SMA(f)	1	HRM-554S
Adapter N(f)-SMA(f)	1	HRM-552S

[Connection diagram]

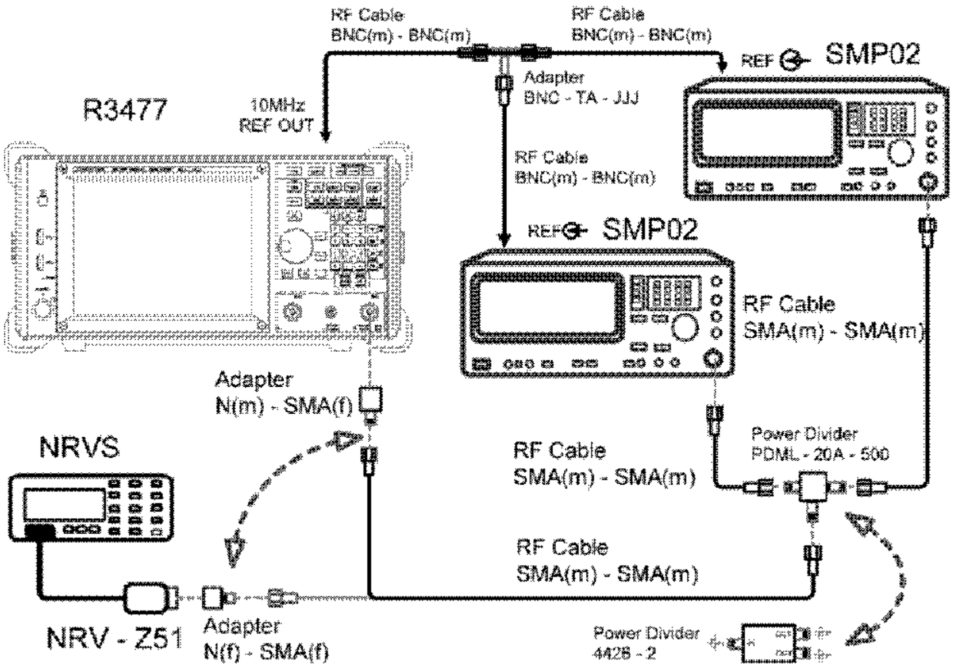

Figure 2-17 Third Order Intermodulation Distortion Test

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-17.

Initializing the power meter

2. Adjust point 0 of the power sensor and power meter and perform the calibration.
3. Set the power meter to the dBm display.

Initialization

4. Preset this instrument.
   Operation: **SHIFT** and **LCL** (PRESET)

Setting signal generator 1

5. Specify the signal generator 1 setting as follows:
   Output frequency: 99.9875 MHz
   Output level: 0 dBm

Setting signal generator 2

6. Specify the signal generator 2 setting as follows:
   Output frequency: 100.0125 MHz
   Output level: 0 dBm

Setting this instrument

7. Set the center frequency to 100 MHz.
   Operation: **FREQ**, **Center**, **1**, **0**, **0**, and **MHz**
8. Set the frequency span to 100 kHz.
   Operation: **SPAN**, **1**, **0**, **0**, and **kHz**
9. Set the Ref LEVEL to 0 dBm.
   Operation: **LEVEL**, **0**, and **GHz** (+dBm)
10. Set the resolution bandwidth to 1 kHz.
    Operation: **BW**, **RBW** (Man), **1**, and **kHz**
11. Set ADC Dither to ON.
    Operation: **BW** and **ADC Dither** (On)
12. Set the video bandwidth to 10 Hz.
    Operation: **BW**, **VBW** (Man), **1**, **0**, and **Hz**
13. Set the input attenuator to 10 dB.
    Operation: **LEVEL**, **ATT** (Man), **1**, **0**, and **GHz** (dB)

Adjusting the output level of signal generator 1 and 2

14. Set the calibration frequency of the power meter to 100 MHz.
15. Connect the power sensor to the RF cable.
16. Set the output of signal generator 2 to OFF.
17. Adjust the output level of signal generator 1 to set the power meter display level to 0 dBm ±0.1 dBm.
18. Set the output of signal generator 1 to OFF and the output of signal generator 2 to ON.
19. Adjust the output level of signal generator 2 to set the power meter display level to 0 dBm ±0.1 dBm.
20. Set the output of signal generator 1 to ON.
21. Remove the cable, which is connected to the power sensor and connect it to the RF input.

Measuring the third order intermodulation distortion

22. Perform the SINGLE sweep.
    Operation: **SINGLE**

23. Perform Peak→Ref.
    Operation: **MKR→** and **Peak→Ref**

24. Perform a single sweep.
    Operation: **SINGLE**

25. Search for the peak.
    Operation: **SRCH**

26. Set the ΔMarker to ON.
    Operation: **MKR** and **Delta Marker**

27. Move the marker to the right third-order distortion peak to read the marker level.

28. Move the marker to the left third-order distortion peak to read the marker level.

29. The value, which is greater than the other, is the 2-signal 3rd order harmonic distortion when -10 dBm is input.

30. Repeat step 5 to step 29 by using the frequencies described in the table shown below.

Signal generator 1	Signal generator 2	Center frequency	Power meter
99.9875 MHz	100.0125 MHz	100 MHz	100 MHz
299.9875 MHz	300.0125 MHz	300 MHz	300 MHz
799.9875 MHz	800.0125 MHz	800 MHz	800 MHz
1499.9875 MHz	1500.0125 MHz	1.5 GHz	1.5 GHz
2199.9875 MHz	2200.0125 MHz	2.2 GHz	2.2 GHz

31. Substitute the absolute value of the 2-signal 3rd order harmonic distortion, which is obtained from the measurement, to the formula below to obtain the TOI.

    Formula: TOI [dBm] = - 10 dBm + (the absolute value of the 2-signal 3rd order harmonic distortion) / 2

Initialization

32. Preset this instrument.
    Operation: **SHIFT** and **LCL** (PRESET)

Setting signal generator 1

33. Specify the signal generator 1 setting as follows:

    Output frequency: 4999.9875 MHz

    Output level: 0 dBm

Setting signal generator 2

34. Specify the signal generator 2 setting as follows:

Output frequency:	5000.0125 MHz
Output level:	0 dBm

Setting this instrument

35. Set the center frequency to 5 GHz.
    Operation: [FREQ], Center, [5], and [GHz]
36. Set the frequency span to 100 kHz.
    Operation: [SPAN], [1], [0], [0], and [kHz]
37. Set the Ref LEVEL to 0 dBm.
    Operation: [LEVEL], [0], and [GHz](+dBm)
38. Set the resolution bandwidth to 1 kHz.
    Operation: [BW], RBW (Man), [1], and [kHz]
39. Set ADC Dither to ON.
    Operation: [BW] and ADC Dither (On)
40. Set the video bandwidth to 10 Hz.
    Operation: [BW], VBW (Man), [1], [0], and [Hz]
41. Set the input attenuator to 10 dB.
    Operation: [LEVEL], ATT (Man), [1], [0], and [GHz](dB)

Adjusting the output level of signal generators 1 and 2

42. Set the calibration frequency of the power meter to 5 GHz.
43. Remove the RF cable, which is connected to this instrument, and connect it to the power sensor.
44. Set the output of signal generator 2 to OFF.
45. Adjust the output level of signal generator 1 to set the power meter display level to 0 dBm ±0.1 dBm.
46. Set the output of signal generator 1 to OFF and the output of signal generator 2 to ON.
47. Adjust the output level of signal generator 2 to set the power meter display level to 0 dBm ±0.1 dBm.
48. Set the output of signal generator 1 to ON.
49. Remove the cable, which is connected to the power sensor, and connect it to the RF input of this instrument.

Tuning the pre-selector

50. Set the output of signal generator 2 to OFF.
51. Tune the pre-selector.
    Operation: **FREQ**, **Presel Tune**, and **Auto Tune**
52. After the pre-selector is tuned, set the output of signal generator 2 to ON.

Measuring the third order intermodulation distortion

53. Perform the SINGLE sweep.
    Operation: **SINGLE**
54. Perform Peak→Ref.
    Operation: **MKR→** and **Peak→Ref**
55. Perform a single sweep.
    Operation: **SINGLE**
56. After the sweep is complete, search for the peak.
    Operation: **SRCH**
57. Set ΔMarker to ON.
    Operation: **MKR** and **Delta Marker**
58. Move the marker to the right third-order distortion peak to read the marker level.
59. Move the marker to the left third-order distortion peak to read the marker level.
60. The value, which is greater than the other, is the 2-signal 3rd order harmonic distortion when -10 dBm is input.
61. Repeat steps 33 to 60 by using the frequencies described in the table shown below.

Signal generator 1	Signal generator 2	Center frequency	Power meter
4999.9875 MHz	5000.0125 MHz	5 GHz	5 GHz
6999.9875 MHz	7000.0125 MHz	7 GHz	7 GHz
9999.9875 MHz	10000.0125 MHz	10 GHz	10 GHz

62. Substitute the absolute value of the 2-signal 3rd order harmonic distortion, which is obtained from the measurement, to the formula below to obtain the TOI.

    Formula: TOI [dBm] = -10 dBm + (the absolute value of the 2-signal 3rd order harmonic distortion) / 2

2.2.17 Image/Multiple/Out-of-band Responses

[Overview]

This section describes how to check the image, multiple, and out-of band responses.

[Specifications]

10 MHz to 13.5 GHz: < -70 dBc

[Required instruments]

Instrument	Quantity	Recommended model
Signal generator	1	SMP02
Power meter	1	NRVS
Power sensor	1	NRV-Z51
Power splitter	1	1579
RF cable BNC(m)-BNC(m)	1	A01037-1500
RF cable SMA(m)-SMA(m)	1	A01002
Adapter N(m)-SMA(f)	1	HRM-554S
Adapter N(f)-SMA(f)	1	HRM-552S
Adapter SMA(m)-SMA(m)	2	HRM-502 (09)

[Connection diagram]

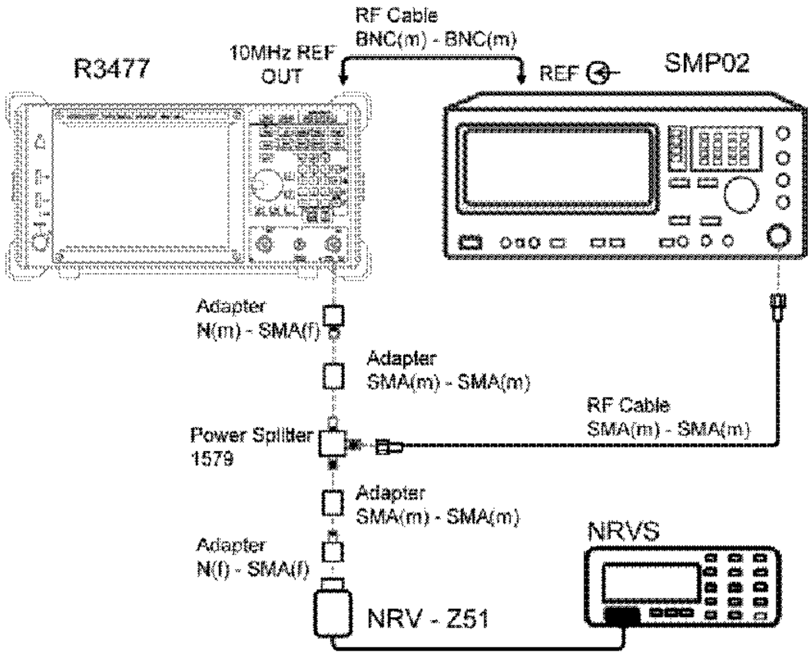

Figure 2-18 Image, Multiple, and Out-of Band Responses Test

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-18.

Initializing the power meter

2. Adjust point 0 of the power sensor and power meter and perform the calibration.
3. Set the power meter to the dBm display.

Initialization

4. Preset this instrument.
   Operation: **SHIFT** and **LCL** (PRESET)

Setting the signal generator

5. Specify the signal generator setting as follows:
   Output level: 0 dBm
   Reference frequency signal: External

Setting this instrument

6. Set the frequency span to 5 MHz.
   Operation: **SPAN**, **5**, and **MHz**
7. Set the resolution bandwidth to 100 kHz.
   Operation: **BW**, **RBW** (Man), **1**, **0**, **0**, and **kHz**
8. Set the video bandwidth to 1 kHz.
   Operation: **BW**, **VBW** (Man), **1**, and **kHz**

Image, multiple, and out-of band responses test

9. Set the output frequency of the signal generator to 2 GHz.
10. Set the center frequency of this instrument to 2 GHz.
    Operation: **FREQ**, **Center**, **2**, and **GHz**
11. Set the calibration frequency of the power meter to 2 GHz.
12. Adjust the output level of the signal generator to set the power meter reading to 0 dBm ±0.1 dBm.

13. Set SINGLE to perform a single sweep.
    Operation: **SINGLE**
14. Search for the peak.
    Operation: **SRCH**
15. Set Fixed ΔMarker to ON.
    Operation: **MKR**, **Delta Marker**, and **Fixed ΔMarker** (On)
16. Perform the continuous sweep.
    Operation: **START**
17. Set the output frequency of the signal generator to 1.9572 GHz.
18. Set the calibration frequency of the power meter to 1.96 GHz.
19. Adjust the output level of the signal generator to set the power meter reading to 0 dBm ±0.1 dBm.
20. Set SINGLE to perform a single sweep.
    Operation: **SINGLE**
21. Search for the peak.
    Operation: **SRCH**
22. Read the delta marker reading value and ensure that the value is within the specified range.
23. Perform steps 9 to 22 by using the frequencies described in the table shown below. If the center frequency is set to 3.3 GHz or higher, tune the pre-selector after performing step 10.

Center frequency in steps 9, 10, and 11 [GHz]	SMP04 output frequency in step 17 [GHz]	NRVS calibration frequency in step 18 [GHz]
2	1.9572	1.96
2	1.1572	1.16
2	10.8628	10.86
2	8.4314	8.43
5.5	6.3428	6.34
5.5	11.4214	11.42
12	12.8428	12.84
12	5.7893	5.79

2.2.18 Residual Response

[Overview]

This section describes how to measure the residual response when the Preamplifier is set to OFF or ON.

[Specifications]

Preamplifier OFF

< -100 dBm (1 MHz to 3.3 GHz)

< -90 dBm (3.3 GHz to 13.5 GHz)

Preamplifier ON

< -100 dBm (1 MHz to 3.3 GHz)

[Required instruments]

Instrument	Quantity	Recommended model
Adapter N(m)-SMA(f)	1	HRM-554S
50 Ω terminator	1	HRM-601A (02)

[Connection diagram]

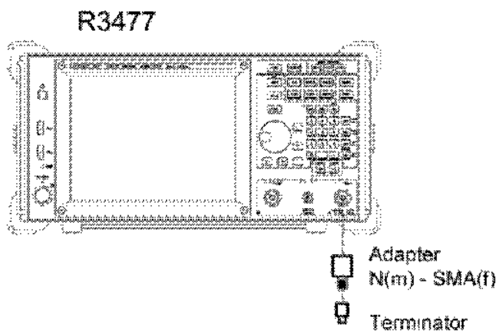

Figure 2-19 Residual Response Test

[Test procedure]

Connecting the instruments

1. Connect the instruments as shown in Figure 2-19.

Initialization

2. Preset this instrument.
   Operation: [SHIFT] and [LCL](PRESET)

Measuring the residual response in the 1 MHz to 3.3 GHz frequency range

3. Set the center frequency to 2 MHz.
   Operation: [FREQ], **Center**, [2], and [MHz]
4. Set the frequency span to 2 MHz.
   Operation: [SPAN], [2], and [MHz]
5. Set the CF step size to 1.9 MHz.
   Operation: [FREQ], **CF Step Size**, [1], [.], [9], and [MHz]
6. Set the resolution bandwidth to 3 kHz.
   Operation: [BW], **RBW** (Man), [3], and [kHz]
7. Set the video bandwidth to 300 Hz.
   Operation: [BW], **VBW** (Man), [3], [0], [0], and [Hz]
8. Set MinATT of the input attenuator to OFF.
   Operation: [LEVEL] and **Min ATT** (Off)
9. Set the input attenuator to 0 dB.
   Operation: [LEVEL], **ATT** (Man), [0], and [GHz](dB)
10. Set the Ref LEVEL to -50 dBm.
    Operation: [LEVEL], [5], [0], and [MHz](-dBm)
11. Set the Display Line to -101 dBm (the specification value -1 dB).
    Operation: [FUNC], **Display**, **Display Line** (On), [1], [0], [1], and [MHz](-dBm)
12. Set the marker reference to the display line.
    Operation: [MKR], **Reference Object**, and **[Disp Line]**
13. Close the dialog box.
    Operation: **Close**
14. Perform a single sweep.
    Operation: [SINGLE]

    The noise level must be at least 3 dB lower than the display line. If the noise level is close to the display line, narrow the frequency span and resolution bandwidth to reduce the noise level.

    If the frequency span is narrowed, set the CF step size to approximately 95% of the frequency span. If the setting is changed, perform a single sweep.

    Operation: [SINGLE]
15. Search for the peak.
    Operation: [SRCH]

16. Read the marker frequency and level.

17. If the marker level is set to 0 dB or higher, perform a single sweep, and then perform a peak search and measure the frequency and level.

18. If the marker frequencies and levels in step 17 and step 16 are equivalent, a residual response may exist. Check the residual response by following steps 19 to 28. If the level is lower than 0 dB, follow the procedure from step 29.

19. Save the current setting by using the Save function.
    Operation: Click on [MENU], **File** from the menu bar and then select **Save Data**

20. Perform MKR→CF.
    Operation: [MKR→], **MKR→CF**

21. Set the resolution bandwidth to 1 kHz.
    Operation: [BW], [1], and [kHz]

22. Set the video bandwidth to 10 Hz.
    Operation: [BW], **VBW** (Man), [1], [0], and [Hz]

23. Set the frequency span to 50 kHz.
    Operation: [SPAN], [5], [0], and [kHz]

24. Set the marker reference object to No Reference.
    Operation: [MKR], **Reference Object**, and **[No Reference]**

25. Close the dialog box.
    Operation: **Close**

26. Set SINGLE to perform a single sweep.
    Operation: [SINGLE]

27. Search for the peak, and then enter the frequency and level into the performance verification sheet.
    Operation: [SRCH]

28. Ensure that the level entered in step 27 is within the specified range.

29. Use the Recall function to return the setting to the one saved in step 19.
    Operation: [MENU], **File** and **Load Data**

30. Increase the center frequency 1.9 MHz and repeat steps 14 to 18.
    Operation: [FREQ], **Center**, and ▲

31. Repeat step 30 until the center frequency reaches 3.299 GHz or higher.

Measuring the residual response in the 1 MHz to 3.3 GHz frequency range, and when the Preamplifier is set to ON

32. Set the center frequency to 2 MHz.
    Operation: [FREQ], **Center**, [2], and [MHz]

33. Set the preamplifier to ON.
    Operation: [LEVEL] and **Preamp** (On)

34. Set the Display Line to -101 dBm.
    Operation: [FUNC], **Display**, **Display Line** (On), [1], [0], [1], and [MHz](-dBm)

35. Perform the measurement in the same manner as in steps 14 to 18.

36. Increase the center frequency 1.9 MHz and repeat step 35.
    Operation: [FREQ], **Center**, and ▲

37. Repeat step 36 until the center frequency reaches 3.299 GHz or higher.

Measuring the residual response in the 3.3 GHz to 13.5 GHz frequency range

38. Set the center frequency to 3.325 GHz.
    Operation: [FREQ], **Center**, [3], [.], [3], [2], [5], and [GHz]

39. Set the frequency span to 50 MHz.
    Operation: [SPAN], [5], [0], and [MHz]

40. Set the resolution bandwidth to 30 kHz.
    Operation: [BW], [3], [0], and [kHz]

41. Set the video bandwidth to 1 kHz.
    Operation: [BW], **VBW** (Man), [1], and [kHz]

42. Set the preamplifier to OFF.
    Operation: [LEVEL], **Preamp** (Off)

43. Set the CF step size to 47.5 MHz.
    Operation: [FREQ], **CF Step Size**, [4], [7], [.], [5], and [MHz]

44. Set the Display Line to -91 dBm.
    Operation: [FUNC], **Display**, **Display Line** (On), [9], [1], and [MHz](-dBm)

45. Perform the measurement in the same manner as in steps 14 to 18.

46. Increase the center frequency 47.5 MHz and repeat step 45.
    Operation: [FREQ], **Center** and ▲

47. Repeat step 46 until the center frequency reaches 13.475 GHz or higher.

2.2.19 TG Output Level Flatness

[Overview]

This section describes how to measure the output level of the tracking generator when the output frequency of the tracking generator changes.

[Specifications]

(at 100 kHz to 3.3 GHz, -10 dBm is output, by relative value)

±3 dB

[Required instruments]

Instrument	Quantity	Recommended model
Power meter	1	NRVS
Power sensor	1	NRV-Z51

[Connection diagram]

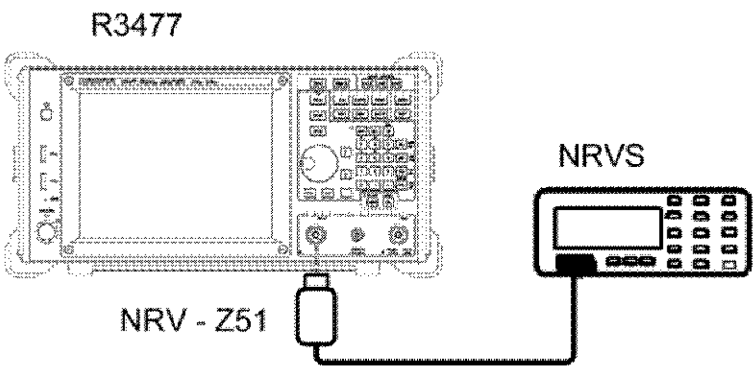

Figure 2-20 TG Output Level Flatness Test

[Test procedure]

Initializing the power meter

1. Adjust point 0 of the power sensor and power meter and perform calibration.
2. Set the power meter to the dBm display.

Connecting the instruments

3. Connect the instruments as shown in Figure 2-20.

Initialization

4. Preset this instrument.
   Operation: **SHIFT** and **LCL**(PRESET)

Setting this instrument

5. Set the output level of the tracking generator to -10 dBm.
   Operation: **FUNC**, **TG**, **Output Level**, **1**, **0**, and **MHz**(-dBm)
6. Set the frequency span to 0 Hz.
   Operation: **SPAN**, **0**, and **Hz**
7. Set the center frequency to 0 Hz.
   Operation: **FREQ**, **Center**, **0**, and **Hz**
8. Set the step size of the center frequency to 300 MHz.
   Operation: **CF Step Size** (Man), **3**, **0**, **0**, and **MHz**

Measuring the output level flatness

9. Increase the center frequency by 300 MHz.
   Operation: **FREQ**, **Center** and ▲
10. Set the calibration frequency of the power meter to the same as the center frequency of this instrument.
11. Enter the value on the power meter into the performance verification sheet.
12. Repeat steps 9 to 11 until the center frequency reaches 3.3 GHz.

Calculating the maximum deviation

13. Obtain the maximum deviation by subtracting the minimum value from the maximum value on the performance verification sheet and ensure that the value is within the specified range.

2.2.20 TG Output Level Accuracy

[Overview]

This section describes how to measure the output level of the tracking generator at a frequency of 50 MHz and an output level of -10 dBm.

Perform the test after executing Level Cal for the tracking generator.

[Specifications]

(at 50 MHz, -10 dBm is output)

±1 dB

[Required instruments]

Instrument	Quantity	Recommended model
Power meter	1	NRVS
Power sensor	1	NRV-Z51
RF cable BNC(m)-BNC(m)	1	A01037-0300
RF cable N(m)-BNC(f)	2	JUG-201A/U

[Connection diagram]

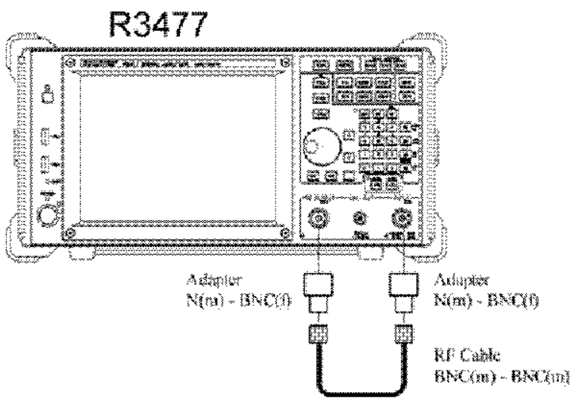

Figure 2-21 Connection when TG Level Cal is Executed

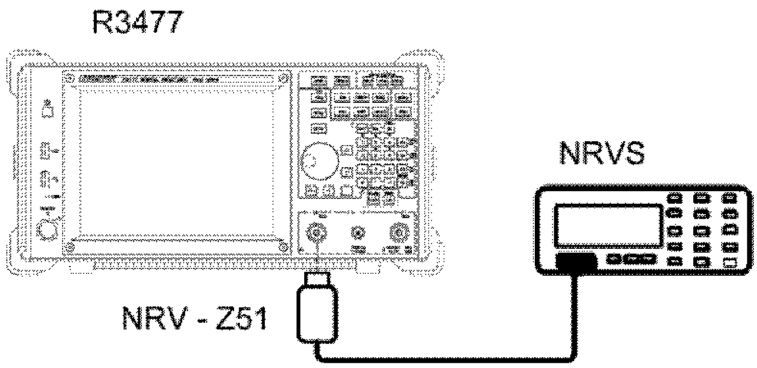

Figure 2-22 TG Output Level Accuracy Test

[Test procedure]

Executing Level Cal

1. Connect the instrument as shown in Figure 2-21.
2. Execute Level Cal for the tracking generator.
   Operation: **FUNC**, **TG**, **TG Cal**, and **Level Cal**

Initializing the power meter

3. Adjust point 0 of the power sensor and power meter and perform calibration.
4. Set the power meter to the dBm display.

Connecting the instruments

5. Connect the instruments as shown in Figure 2-22.

Initialization

6. Preset this instrument.
   Operation: **SHIFT** and **LCL**(PRESET)

Setting of this instrument

7. Set the output level of the tracking generator to -10 dBm.
   Operation: **FUNC**, **TG**, **Output Level**, **1**, **0**, and **MHz**(-dBm)
8. Set the frequency span to 0 Hz.
   Operation: **SPAN**, **0**, and **Hz**

9. Set the center frequency to 50 MHz.
   Operation: FREQ, Center, 5, 0, and MHz

Measuring the output level accuracy

10. Set the calibration frequency of the power meter to 50 MHz.
11. Enter the value on the power meter into the performance verification sheet, and then ensure that the value is within the specified range.

2.2.21 TG Vernier Accuracy

[Overview]

This section describes how to measure the output level variation when the output level is set from -10 dBm to 0 dBm.

Perform the test after executing Level Cal for the tracking generator.

[Specifications]

(at 50 MHz, -10 dBm to 0 dBm is output)

±0.5 dB/1 dB

[Required instruments]

Instrument	Quantity	Recommended model
Power meter	1	NRVS
Power sensor	1	NRV-Z51

[Connection diagram]

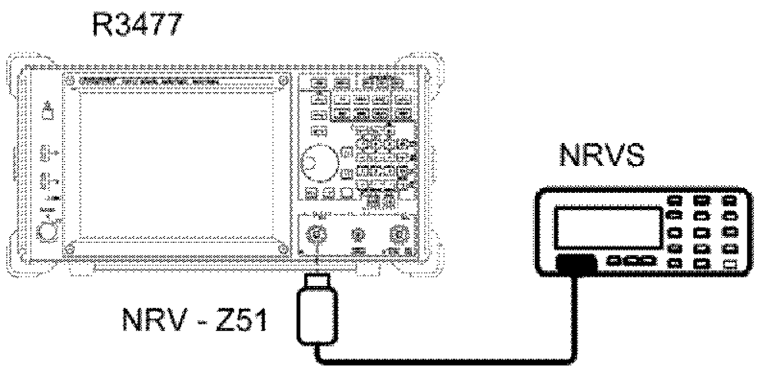

Figure 2-23 TG Vernier Accuracy Test

[Test procedure]

Executing Level Cal

1. Connect the instruments as shown in Figure 2-21.
2. Execute Level Cal for the tracking generator.
   Operation: **FUNC**, **TG**, **TG Cal**, and **Level Cal**

Initializing the power meter

3. Adjust point 0 of the power sensor and power meter and perform calibration.

4. Set the power meter to the dBm display.
5. Set the calibration frequency of the power meter to 50 MHz.

Connecting the instruments

6. Connect the instruments as shown in Figure 2-23.

Initialization

7. Preset this instrument.
   Operation: **SHIFT** and **LCL** (PRESET)

Setting of this instrument

8. Set the frequency span to 0 Hz.
   Operation: **SPAN**, **0**, and **Hz**
9. Set the center frequency to 50 MHz.
   Operation: **FREQ**, **Center**, **5**, **0**, and **MHz**
10. Set the output level of the tracking generator to -10 dBm.
    Operation: **FUNC**, **TG**, **Output Level**, **1**, **0**, and **MHz** (-dBm)

Measuring the vernier accuracy

11. Enter the value on the power meter into the performance verification sheet.
12. Increase the TG output level by 1 dB.
    Operation: ▲
13. Enter the value on the power meter into the performance verification sheet.

Calculating the vernier accuracy

14. Obtain the vernier accuracy from the power meter display value before the output level was increased and the value after the output level was increased by using the formula shown below, enter the value into the performance verification sheet, and ensure that the value is within the specified range.

    Formula:
    Vernier accuracy = Power meter display value after the output level was increased - Power meter display value before the output level was increased -1
15. Repeat steps 12 to 14 until the TG output level is 0 dBm.

2.3 Performance Verification Record Sheets

2.3.1 Frequency Reference Stability

Internal frequency reference source

Item	Specification (Min.) [Hz]	Measured value [Hz]	Specification (Max.) [Hz]	Pass / Fail
Frequency reference error				
Reference error measurement after 24 hours				
Aging rate	-5×10^{-8}		$+5 \times 10^{-8}$	

OPTION21

Item	Specification (Min.) [Hz]	Measured value [Hz]	Specification (Max.) [Hz]	Pass / Fail
Frequency reference error				
Reference error measurement after 24 hours				
Aging rate	-5×10^{-9}		$+5 \times 10^{-9}$	

OPTION22

Item	Specification (Min.) [Hz]	Measured value [Hz]	Specification (Max.) [Hz]	Pass / Fail
Frequency reference error				
Reference error measurement after 24 hours				
Aging rate	-3×10^{-10}		$+3 \times 10^{-10}$	

OPTION23

Item	Specification (Min.) [Hz]	Measured value [Hz]	Specification (Max.) [Hz]	Pass / Fail
Frequency reference error	-5×10^{-9}		$+5 \times 10^{-9}$	

2.3.2 Calibration Signal Output Accuracy

Setting [dBm]	Specification (Min.) [dBm]	Measured value [dBm]	Specification (Max.) [dBm]	Pass / Fail
-10	-10.20		-9.80	

2.3.3 Marker Frequency Counter Accuracy

Set frequency [GHz]	Specification (Min.) [GHz]	Measured value [GHz]	Specification (Max.) [GHz]	Pass / Fail
2	1.99999999700		2.00000000300	
5	4.99999999700		5.00000000300	
11	10.99999999400		11.00000000600	

2.3.4 Frequency Reading Accuracy

Set frequency [GHz]	Frequency span [MHz]	Specification (Min.) [GHz]	Measured value [GHz]	Specification (Max.) [GHz]	Pass / Fail
2	1	1.999989		2.000011	
2	10	1.99989		2.00011	
2	50	1.99947		2.00053	
2	100	1.9989		2.0011	
2	1000	1.990		2.010	
5	1	4.999989		5.000011	
5	10	4.99989		5.00011	
5	50	4.99947		5.00053	
5	100	4.9989		5.0011	
5	1000	4.990		5.010	
11	1	10.999989		11.000011	
11	10	10.99989		11.00011	
11	50	10.99947		11.00053	
11	100	10.9989		11.0011	
11	1000	10.990		11.010	

2.3.5 Residual FM

When OPT23 is excluded installed.

Slope	ΔLEVEL	Residual FM	Specification	Pass / Fail
			≤ 3 Hz	

When OPT23 is installed.

Slope	ΔLEVEL	Residual FM	Specification	Pass / Fail
			≤ 35.88 Hz	

2.3.6 Frequency Span Accuracy

Set frequency [Hz]	Frequency span [Hz]	Specification (Min.) [Hz]	Measured value Δf [Hz]	Specification (Max.) [Hz]	Pass / Fail
2 G	1 M	792 k		808 k	
2 G	10 M	7.92 M		8.08 M	
2 G	100 M	79.2 M		80.8 M	
2 G	1 G	792 M		808 M	
6.75 G	10 G	7.92 G		8.08 G	
6.75 G	13.5 G	10.692 G		10.908 G	

2.3.7 Signal Purity

Offset frequency	Measured value	Specification	Pass / Fail
10 kHz		< -99 dBc/Hz	
100 kHz		< -111 dBc/Hz	
1 MHz		< -133 dBc/Hz	

2.3.8 Resolution Bandwidth Accuracy

Accuracy

RBW setting [Hz]	Frequency span [Hz]	Specification (min) [Hz]	Measured value [Hz]	Specification (max) [Hz]	Pass / Fail
10 M	20 M	8.0 M		12.0 M	
3 M	5 M	2.79 M		3.21 M	
1 M	2 M	930 k		1.07 M	
300 k	500 k	291 k		309 k	
100 k	200 k	97 k		103 k	
30 k	50 k	29.1 k		30.9 k	
10 k	20 k	9.7 k		10.3 k	
3 k	5 k	2.91 k		3.09 k	
1 k	2 k	970		1.03 k	
300	500	291		309	
100	200	97		103	
30	50	29.1		30.9	
10	20	9.7		10.3	
3	20	2.91		3.09	
1	20	0.97		1.03	

Selectivity

RBW setting [Hz]	Frequency span [Hz]	Measured value (60 dB : 3 dB)	Specification (max)	Pass / Fail
10 M	100 M	: 1	6 : 1	
3 M	30 M	: 1	6 : 1	
1 M	10 M	: 1	6 : 1	
300 k	3 M	: 1	6 : 1	
100 k	1 M	: 1	6 : 1	
30 k	300 k	: 1	6 : 1	
10 k	100 k	: 1	6 : 1	
3 k	30 k	: 1	6 : 1	
1 k	10 k	: 1	6 : 1	
300	3 k	: 1	6 : 1	
100	1 k	: 1	6 : 1	
30	300	: 1	6 : 1	
10	100	: 1	6 : 1	
3	30	: 1	6 : 1	
1	20	: 1	6 : 1	

2.3.9 Sweep Time Accuracy

Sweep time	Specification (Min.)	Measured value	Specification (Max.)	Pass / Fail
100 μsec	88.2 μsec		91.8 μsec	
1 msec	882 μsec		918 μsec	
10 msec	8.82 msec		9.18 msec	
100 msec	88.2 msec		91.8 msec	
1 sec	882 msec		918 msec	

2.3.10 Frequency Response

Frequency response (up to 3.2 GHz)

Preamplifier	Frequency [MHz]	Specification (Min.) [dB]	Measured value [dB]	Specification (Max.) [dB]	Pass / Fail
Off	100	-0.4		0.4	
	200	-0.4		0.4	
	300	-0.4		0.4	
	400	-0.4		0.4	
	500	-0.4		0.4	
	600	-0.4		0.4	
	700	-0.4		0.4	
	800	-0.4		0.4	
	900	-0.4		0.4	
	1,000	-0.4		0.4	
	1,100	-0.4		0.4	
	1,200	-0.4		0.4	
	1,300	-0.4		0.4	
	1,400	-0.4		0.4	
	1,500	-0.4		0.4	
	1,600	-0.4		0.4	
	1,700	-0.4		0.4	
	1,800	-0.4		0.4	
	1,900	-0.4		0.4	
	2,000	-0.4		0.4	
	2,100	-0.4		0.4	
	2,200	-0.4		0.4	
	2,300	-0.4		0.4	
	2,400	-0.4		0.4	
	2,500	-0.4		0.4	
	2,600	-1.0		+1.0	
	2,700	-1.0		+1.0	
	2,800	-1.0		+1.0	
	2,900	-1.0		+1.0	
	3,000	-1.0		+1.0	
	3,100	-1.0		+1.0	
	3,200	-1.0		+1.0	

Frequency response (3.3 GHz to 7.5 GHz) (1 of 2)

Preamplifier	Frequency [MHz]	Specification (Min.)	Measured value	Specification (Max.)	Pass / Fail
Off	3,300	-1.5		+1.5	
	3,400	-1.5		+1.5	
	3,500	-1.5		+1.5	
	3,600	-1.5		+1.5	
	3,700	-1.5		+1.5	
	3,800	-1.5		+1.5	
	3,900	-1.5		+1.5	
	4,000	-1.5		+1.5	
	4,100	-1.5		+1.5	
	4,200	-1.5		+1.5	
	4,300	-1.5		+1.5	
	4,400	-1.5		+1.5	
	4,500	-1.5		+1.5	
	4,600	-1.5		+1.5	
	4,700	-1.5		+1.5	
	4,800	-1.5		+1.5	
	4,900	-1.5		+1.5	
	5,000	-1.5		+1.5	
	5,100	-1.5		+1.5	
	5,200	-1.5		+1.5	
	5,300	-1.5		+1.5	
	5,400	-1.5		+1.5	
	5,500	-1.5		+1.5	
	5,600	-1.5		+1.5	
	5,700	-1.5		+1.5	
	5,800	-1.5		+1.5	
	5,900	-1.5		+1.5	
	6,000	-1.5		+1.5	
	6,100	-1.5		+1.5	
	6,200	-1.5		+1.5	
	6,300	-1.5		+1.5	
	6,400	-1.5		+1.5	
	6,500	-1.5		+1.5	
	6,600	-1.5		+1.5	
	6,700	-1.5		+1.5	
	6,800	-1.5		+1.5	
	6,900	-1.5		+1.5	

Frequency response (3.3 GHz to 7.5 GHz) (2 of 2)

Preamplifier	Frequency [MHz]	Specification (Min.)	Measured value	Specification (Max.)	Pass / Fail
Off	7,000	-1.5		+1.5	
	7,100	-1.5		+1.5	
	7,200	-1.5		+1.5	
	7,300	-1.5		+1.5	
	7,400	-1.5		+1.5	
	7,500	-1.5		+1.5	

Frequency response (7.6 GHz to 13.4 GHz)

Preamplifier	Frequency [MHz]	Specification (Min.)	Measured value	Specification (Max.)	Pass / Fail
Off	7,600	-2.0		+2.0	
	7,800	-2.0		+2.0	
	8,000	-2.0		+2.0	
	8,200	-2.0		+2.0	
	8,400	-2.0		+2.0	
	8,600	-2.0		+2.0	
	8,800	-2.0		+2.0	
	9,000	-2.0		+2.0	
	9,200	-2.0		+2.0	
	9,400	-2.0		+2.0	
	9,600	-2.0		+2.0	
	9,800	-2.0		+2.0	
	10,000	-2.0		+2.0	
	10,200	-2.0		+2.0	
	10,400	-2.0		+2.0	
	10,600	-2.0		+2.0	
	10,800	-2.0		+2.0	
	11,000	-2.0		+2.0	
	11,200	-2.0		+2.0	
	11,400	-2.0		+2.0	
	11,600	-2.0		+2.0	
	11,800	-2.0		+2.0	
	12,000	-2.0		+2.0	
	12,200	-2.0		+2.0	
	12,400	-2.0		+2.0	
	12,600	-2.0		+2.0	
	12,800	-2.0		+2.0	
	13,000	-2.0		+2.0	
	13,200	-2.0		+2.0	
	13,400	-2.0		+2.0	

Frequency response (The preamplifier is set to ON.)

Preamplifier	Frequency [MHz]	Specification (Min.) [dB]	Measured value [dB]	Specification (Max.) [dB]	Pass / Fail
On	100	-1.0		+1.0	
	200	-1.0		+1.0	
	300	-1.0		+1.0	
	400	-1.0		+1.0	
	500	-1.0		+1.0	
	600	-1.0		+1.0	
	700	-1.0		+1.0	
	800	-1.0		+1.0	
	900	-1.0		+1.0	
	1,000	-1.0		+1.0	
	1,100	-1.0		+1.0	
	1,200	-1.0		+1.0	
	1,300	-1.0		+1.0	
	1,400	-1.0		+1.0	
	1,500	-1.0		+1.0	
	1,600	-1.0		+1.0	
	1,700	-1.0		+1.0	
	1,800	-1.0		+1.0	
	1,900	-1.0		+1.0	
	2,000	-1.0		+1.0	
	2,100	-1.0		+1.0	
	2,200	-1.0		+1.0	
	2,300	-1.0		+1.0	
	2,400	-1.0		+1.0	
	2,500	-1.0		+1.0	
	2,600	-2.0		+2.0	
	2,700	-2.0		+2.0	
	2,800	-2.0		+2.0	
	2,900	-2.0		+2.0	
	3,000	-2.0		+2.0	
	3,100	-2.0		+2.0	
	3,200	-2.0		+2.0	

2.3.11 Attenuator Switching Accuracy

Frequency: 1 GHz

Input attenuator setting value	Switching Error Specification (Min.)	Switching Error Measured value	Switching Error Specification (Max.)	Pass / Fail
5 dB	-1.2 dB		+1.2 dB	
15 dB	-1.2 dB		+1.2 dB	
20 dB	-1.2 dB		+1.2 dB	
25 dB	-1.2 dB		+1.2 dB	
30 dB	-1.2 dB		+1.2 dB	
35 dB	-1.2 dB		+1.2 dB	
40 dB	-1.2 dB		+1.2 dB	
45 dB	-1.2 dB		+1.2 dB	
50 dB	-1.2 dB		+1.2 dB	
55 dB	-1.8 dB		+1.8 dB	
60 dB	-1.8 dB		+1.8 dB	
65 dB	-1.8 dB		+1.8 dB	
70 dB	-1.8 dB		+1.8 dB	
75 dB	-1.8 dB		+1.8 dB	

Frequency: 5 GHz

Input attenuator setting value	Switching Error Specification (Min.)	Switching Error Measured value	Switching Error Specification (Max.)	Pass / Fail
5 dB	-1.2 dB		+1.2 dB	
15 dB	-1.2 dB		+1.2 dB	
20 dB	-1.2 dB		+1.2 dB	
25 dB	-1.2 dB		+1.2 dB	
30 dB	-1.2 dB		+1.2 dB	
35 dB	-1.2 dB		+1.2 dB	
40 dB	-1.2 dB		+1.2 dB	
45 dB	-1.2 dB		+1.2 dB	
50 dB	-1.2 dB		+1.2 dB	
55 dB	-1.8 dB		+1.8 dB	
60 dB	-1.8 dB		+1.8 dB	
65 dB	-1.8 dB		+1.8 dB	
70 dB	-1.8 dB		+1.8 dB	
75 dB	-1.8 dB		+1.8 dB	

Frequency: 10 GHz

Input attenuator setting value	Switching Error Specification (Min.)	Switching Error Measured value	Switching Error Specification (Max.)	Pass / Fail
5 dB	-1.4 dB		+1.4 dB	
15 dB	-1.4 dB		+1.4 dB	
20 dB	-1.4 dB		+1.4 dB	
25 dB	-1.4 dB		+1.4 dB	
30 dB	-1.4 dB		+1.4 dB	
35 dB	-1.4 dB		+1.4 dB	
40 dB	-1.4 dB		+1.4 dB	
45 dB	-1.4 dB		+1.4 dB	
50 dB	-1.4 dB		+1.4 dB	
55 dB	-2.3 dB		+2.3 dB	
60 dB	-2.3 dB		+2.3 dB	
65 dB	-2.3 dB		+2.3 dB	
70 dB	-2.3 dB		+2.3 dB	
75 dB	-2.3 dB		+2.3 dB	

2.3.12 Resolution Bandwidth Switching Error

RBW setting [Hz]	Frequency span [Hz]	Specification (min) [dB]	Measured value [dB]	Specification (max) [dB]	Pass / Fail
10 M	20 M	-0.3		+0.3	
3 M	5 M	-0.05		+0.05	
1 M	2 M	-0.05		+0.05	
100 k	200 k	-0.05		+0.05	
30 k	50 k	-0.05		+0.05	
10 k	20 k	-0.05		+0.05	
3 k	5 k	-0.05		+0.05	
1 k	2 k	-0.05		+0.05	

2.3.13 Displayed Average Noise Level

Preamplifier	Frequency [Hz]	Measurement Frequency	Measurement value level	Specification	Pass / Fail
Off	10 k			< -125 dBm	
	100 k			< -135 dBm	
	1 M			< -145 dBm	
	10 M - 1 G			< -156 dBm	
	1 G - 2 G			< -154 dBm	
	2 G - 2.5 G			< -152 dBm	
	2.5 G - 3 G			< -150 dBm	
	3 G - 3.3 G			< -148 dBm	
	3.3 G - 7.5 G			< -146 dBm	
	7.5 G - 13.5 G			< -146 dBm	
On	100 k			< -140 dBm	
	1 M			< -150 dBm	
	10 M - 1 G			< -162 dBm	
	1 G - 2.5 G			< -160 dBm	
	2.5 G - 3 G			< -158 dBm	
	3 G - 3.3 G			< -156 dBm	

2.3.14 1 dB Gain Compression

Center frequency	Measurement value	Specification	Pass / Fail
100.5 MHz		> +2 dBm	
2.2005 GHz		> +6 dBm	
5.0005 GHz		> -5 dBm	
7.0005 GHz		> -5 dBm	
10.0005 GHz		> -3 dBm	

2.3.15 2nd Order Harmonic Distortion

Fundamental frequency	Harmonic frequency	Measurement value	Specification	Pass / Fail
1.5 GHz	3.0 GHz		< -60 dBc	
1.9 GHz	3.8 GHz		< -100 dBc	

2.3.16 Third Order Intermodulation Distortion

Center frequency [MHz]	2-signal 3rd order harmonic distortion [dBc]	TOI [dBm]	Specification [dBm]	Pass / Fail
100			+12	
300			+16	
800			+20	
1,500			+21	
2,200			+22	
5,000			+5	
7,000			+5	
10,000			+8	

2.3.17 Image/Multiple/Out-of-band Responses

Center frequency [GHz]	Signal generator Output frequency [GHz]	Measurement value [dBc]	Specification [dBc]	Pass / Fail
2	1.9572		< -70	
2	1.1572		< -70	
2	10.8628		< -70	
2	8.4314		< -70	
5.5	6.3428		< -70	
5.5	11.4214		< -70	
12	12.8428		< -70	
12	5.7893		< -70	

2.3.18 Residual Response

Frequency range	Preamplifier	Measurement value	Specification	Pass / Fail
1 MHz to 3.3 GHz	Off		< -100 dBm	
3.3 GHz to 13.5 GHz	Off		< -90 dBm	
1 MHz to 3.3 GHz	On		< -100 dBm	

2.3.19 TG Output Level Flatness

Set frequency [MHz]	Measured value output voltage [dB]
300	
600	
900	
1200	
1500	
1800	
2100	
2400	
2700	
3000	
3300	

Maximum deviation [dB]	Specification (Max.) [dB]	Pass / Fail
	6	

2.3.20 TG Output Level Accuracy

Setting [dBm]	Specification (Min.) [dBm]	Measured value [dBm]	Specification (Max.) [dBm]	Pass / Fail
-10	-11		-9	

2.3.21 TG Vernier Accuracy

Setting [dBm]	Measured value [dBm]	Vernier accuracy			Pass / Fail
		Specification (Min.) [dB]	Measured value [dB]	Specification (Max.) [dB]	
-10					
-9		-0.5		+0.5	
-8		-0.5		+0.5	
-7		-0.5		+0.5	
-6		-0.5		+0.5	
-5		-0.5		+0.5	
-4		-0.5		+0.5	
-3		-0.5		+0.5	
-2		-0.5		+0.5	
-1		-0.5		+0.5	
0		-0.5		+0.5	

3. SPECIFICATIONS

This chapter describes the specifications of this instrument.

The performance of this instrument is guaranteed under the following conditions unless otherwise specified.

- The specified calibration period must be adhered to.
- After turning on the power and warming-up for 5 minutes or more under the specified environmental conditions.
- After automatic calibration has been performed.

Reference data is provided to help you use the product efficiently, but it will not guarantee the performance of this instrument. The data is described by using the following notation.

Specifications (spec.): Indicates the specifications within which the performance of the product can be guaranteed. Includes variations in the performance of each product, uncertainty in calibrations, and changes in performance due to the environment.

Typical value (typ.): Indicates the average performance of the product. Excludes variations in the performance of each product, uncertainty in measurements, and changes in performance due to the environment.

Nominal value (nom.): Indicates the general performance of the product and does not refer to the guaranteed performance.

3.1 R3477 Performance Specifications

3.1.1 Frequency

<table>
<tr><th>Description</th><th>Specifications</th></tr>
<tr><td>Frequency range
Spectrun analysis mode

Modulation analysis mode
(When the modulation analysis option is set)

Built-in preamp
(Only in band 0)</td><td>
9 kHz to 13.5 GHz
<table>
<tr><th>Frequency Range</th><th>Frequency Band</th><th>Harmonic Mixing mode (N)</th></tr>
<tr><td>9 kHz to 3.3 GHz</td><td>0</td><td>1-</td></tr>
<tr><td>3.2 GHz to 7.5 GHz</td><td>1</td><td>1-</td></tr>
<tr><td>7.4 GHz to 13.5 GHz</td><td>2</td><td>2-</td></tr>
<tr><td colspan="3">The built-in YIG tuned pre-selector is used in bands 1 and 2.</td></tr>
</table>

20 MHz to 3.3 GHz
<table>
<tr><th>Frequency Range</th><th>Frequency Band</th><th>Harmonic Mixing mode (N)</th></tr>
<tr><td>20 MHz to 3.3 GHz</td><td>0</td><td>1-</td></tr>
</table>

100 kHz to 3.3 GHz Gain 20 dB (Typ.)</td></tr>
<tr><td>Input coupling</td><td>DC</td></tr>
<tr><td>Internal frequency reference stability
Aging rate
Temperature stability

Warm-up (nom.)</td><td>
$\pm 5 \times 10^{-8}$/ day, $\pm 5 \times 10^{-7}$/ year
$\pm 1 \times 10^{-7}$ (Temperature range: 0 to 50 °C, Relative to the frequency at 25 °C)
$\pm 5 \times 10^{-7}$/minute</td></tr>
<tr><td>Marker frequency counter
Accuracy
Resolution</td><td>(S/N > 50 dB)
± (Marker frequency × Frequency reference error + Residual FM)
0.01 Hz</td></tr>
<tr><td>Frequency reading accuracy</td><td>(Resolution bandwidth 1 Hz to 3 MHz)
± (Frequency reading × Frequency reference error + span × span accuracy + resolution bandwidth × 0.1 + residual FM)</td></tr>
<tr><td>Frequency stability
Residual FM</td><td>
(When the internal frequency reference is used and OPT23 is excluded installed.)
$\leq (3\ Hz \times N)_{P\text{-}P}$/100 ms
(When the internal frequency reference is used and OPT23 is installed.)
$\leq (12\ Hz \times \text{Measurement frequency}/ 10^{9})_{P\text{-}P}$/100 ms</td></tr>
<tr><td>Frequency span
Range
Accuracy</td><td>
20 Hz to 13.5 GHz, 0 Hz (Zero span)
± 1% (200 Hz ≤ Span)
± 1 × N% (20 Hz ≤ Span < 200 Hz)</td></tr>
</table>

<table>
<tr><th>Description</th><th>Specifications</th></tr>
<tr><td>Signal purity
(IF Shift Normal, When the internal frequency reference is used.)</td><td>At 1 GHz input
<table>
<tr><th>Offset</th><th>20°C to 30°C</th><th>0°C to 50°C</th></tr>
<tr><td>1 kHz</td><td>< -91 dBc/Hz
-95 dBc/Hz (Typ.)</td><td>< -90 dBc/Hz</td></tr>
<tr><td>10 kHz</td><td>< -99 dBc/Hz
-102 dBc/Hz (Typ.)</td><td>< -98 dBc/Hz</td></tr>
<tr><td>100 kHz</td><td>< -111 dBc/Hz
-115 dBc/Hz (Typ.)</td><td>< -110 dBc/Hz</td></tr>
<tr><td>1 MHz</td><td>< -133 dBc/Hz
-137 dBc/Hz (Typ.)</td><td>< -132 dBc/Hz</td></tr>
<tr><td>5 MHz</td><td></td><td>-150 dBc/Hz (nom.)</td></tr>
</table></td></tr>
<tr><td>Resolution bandwidth (RBW)
Range
Accuracy

Selectivity (60 dB/ 3 dB)</td><td>
1 Hz to 10 MHz (1, 3, sequence)
± 3% : Resolution bandwidth 1 Hz to 300 kHz
± 7% : Resolution bandwidth 1 MHz to 3 MHz
± 20% : Resolution bandwidth 10 MHz
< 6:1 (5:1, typ.)</td></tr>
<tr><td>Video bandwidth (VBW)
Range</td><td>
1 Hz to 10 MHz (1, 3, sequence)</td></tr>
</table>

3.1.2 Sweep

Description	Specifications
Sweep Sweep time setting range Zero span Span> 0 Hz Sweep time accuracy	 1 μs to 6000 s 2 ms to 2000 s ± 2%
Sweep mode	Continuous, Single
Trigger function Trigger source Trigger delay setting range (Zero span) Resolution	 Free Run, Video, IF External 1 (TTL level), External 2 (0 to 5 V, resolution: 20 mV) -(Sweep Time) to 1 s 100 ns

3.1.3 Amplitude

Description	Specifications
Amplitude measurement range Preamp off Preamp on	 +30 dBm to displayed average noise level +30 dBm to displayed average noise level (Only in band 0)
Maximum safe input level Average continuous power Preamp off Preamp on DC voltage	 +30 dBm (Input attenuator ≥ 10 dB) +13 dBm (Input attenuator ≥ 10 dB) 0 V (Do not apply a DC voltage to the signal.)
Input attenuator range	0 to 75 dB, 5 dB step
Display range Log scale Linear scale	10 div. fixed 0.1 dB to 1 dB/div., 0.1 dB steps 1 dB to 20 dB/div., 1 dB steps 10%/div. of the reference level
Scale Unit	dBm, dBmV, dBμV, dBμVemf, dBpW, W, V
Reference level setting range Preamp off Log scale Linear scale Preamp on Log scale Linear scale	 -170 dBm to +60 dBm, 0.01 dB steps 707.1 pV to 223.6 V, approx. 1% steps -170 dBm to +30 dBm, 0.01 dB steps 707.1 pV to 7.071 V, approx. 1% steps
Trace	A maximum of 4
Detector mode	Normal, Positive Peak, Negative Peak, Sample, Average (RMS, Video, Voltage)

3.1.4 Amplitude Accuracy

<table>
<tr><th>Description</th><th>Specifications</th></tr>
<tr><td>Calibration signal accuracy (50 MHz)
Amplitude
Accuracy</td><td>
-10 dBm
± 0.2 dB (20°C to 30°C), ± 0.3 dB (0°C to 50°C)</td></tr>
<tr><td>FRequency response
Spectrum analysis mode
Preamp off

Preamp on</td><td>(After performing the automatic calibration, Measured relative to the level at 50 MHz, Input attenuator: 10 dB, IF Shift Normal, After tuning the pre-selector peak)
<table>
<tr><th rowspan="2">Frequency</th><th colspan="2">Temperature range</th><th rowspan="2">In-band flatness</th></tr>
<tr><th>20°C to 30°C</th><th>0°C to 50°C</th></tr>
<tr><td>50 MHz to 2.5 GHz
(Input filter OFF)</td><td>< ±0.4 dB</td><td>< ±0.9 dB</td><td>-</td></tr>
<tr><td>9 kHz to 3.3 GHz</td><td>< ±1.0 dB</td><td>< ±1.5 dB</td><td>-</td></tr>
<tr><td>3.3 GHz to 7.5 GHz</td><td>< ±1.5 dB</td><td>< ±3.5 dB</td><td>< ±1.5 dB</td></tr>
<tr><td>7.5 GHz to 13.5 GHz</td><td>< ±2.0 dB</td><td>< ±4.0 dB</td><td>< ±2.0 dB</td></tr>
</table>
<table>
<tr><th rowspan="2">Frequency</th><th colspan="2">Temperature range</th></tr>
<tr><th>20°C to 30°C</th><th>0°C to 50°C</th></tr>
<tr><td>50 MHz to 2.5 GHz</td><td>< ±1.0 dB</td><td>< ±1.5 dB</td></tr>
<tr><td>100 kHz to 3.3 GHz</td><td>< ±2.0 dB</td><td>< ±2.5 dB</td></tr>
</table></td></tr>
<tr><td>Input attenuator switching error</td><td>(Attenuator: 10 dB reference)
<table>
<tr><th>Frequency range</th><th>Switching error</th></tr>
<tr><td>9 kHz to 8 GHz</td><td>< ±1.2 dB (5 dB to 50 dB)
< ±1.8 dB (55 dB to 75 dB)</td></tr>
<tr><td>8 GHz to 13.5 GHz</td><td>< ±1.4 dB (5 dB to 50 dB)
< ±2.3 dB (55 dB to 75 dB)</td></tr>
</table></td></tr>
<tr><td>Scale display error</td><td>(Relative to the mixer input level of -20 dBm, Mixer input level: -10 dBm to -50 dBm, temperature range 20°C to 30°C)
< ±0.13 dB</td></tr>
<tr><td>Resolution bandwidth switching uncertainty</td><td>(Relative to the resolution bandwidth of 300 kHz, after autocalibration, 10 dB/div. or less)
< ±0.05 dB (1 Hz to 3 MHz)
< ±0.3 dB (10 MHz)</td></tr>
<tr><td>Total level accuracy</td><td>(After performing the automatic calibration, Signal level: -10 dBm to -50 dBm, Preamp Off, Input attenuator: 10dB, RBW: 300 kHz, Temperature 20°C to 30°C)
< ± (0.2 dB + frequency response + scale display error)</td></tr>
</table>

3.1.5 Dynamic Range

<table>
<tr><th>Description</th><th>Specifications</th></tr>
<tr><td>Displayed average noise level

Spectrum analysis mode
Preamp off</td><td>(Input connector is terminated, Input attenuator: 0 dB, RBW is normalized to 1 Hz, VBW: 1 Hz, Detector: Sample, Averaging: 20 times or more, Average type: Video, Temperature range: 20 to 30 °C) (2 dB is added to the specification in the temperature range of 0 to -50°C.)
<table>
<tr><th>Frequency</th><th>Specification</th><th>Typical value</th></tr>
<tr><td>10 kHz</td><td>< -125 dBm</td><td>-133 dBm</td></tr>
<tr><td>100 kHz</td><td>< -135 dBm</td><td>-143 dBm</td></tr>
<tr><td>1 MHz</td><td>< -145 dBm</td><td>-153 dBm</td></tr>
<tr><td>10 MHz to 1 GHz</td><td>< -156 dBm</td><td>-158 dBm</td></tr>
<tr><td>1 GHz to 2 GHz</td><td>< -154 dBm</td><td>-156 dBm</td></tr>
<tr><td>2 GHz to 2.5 GHz</td><td>< -152 dBm</td><td>-154 dBm</td></tr>
<tr><td>2.5 GHz to 3 GHz</td><td>< -150 dBm</td><td>-152 dBm</td></tr>
<tr><td>3 GHz to 3.3 GHz</td><td>< -148 dBm</td><td>-150 dBm</td></tr>
<tr><td>3.3 GHz to 7.5 GHz</td><td>< -146 dBm</td><td>-149 dBm</td></tr>
<tr><td>7.5 GHz to 13.5 GHz</td><td>< -146 dBm</td><td>-149 dBm</td></tr>
</table></td></tr>
<tr><td>Preamp on</td><td>
<table>
<tr><th>Frequency</th><th>Specification</th><th>Typical value</th></tr>
<tr><td>100 kHz</td><td>< -140 dBm</td><td>-155 dBm</td></tr>
<tr><td>1 MHz</td><td>< -150 dBm</td><td>-160 dBm</td></tr>
<tr><td>10 MHz to 1 GHz</td><td>< -162 dBm</td><td>-168 dBm</td></tr>
<tr><td>1 GHz to 2.5 GHz</td><td>< -160 dBm</td><td>-166 dBm</td></tr>
<tr><td>2.5 GHz to 3 GHz</td><td>< -158 dBm</td><td>-164 dBm</td></tr>
<tr><td>3 GHz to 3.3 GHz</td><td>< -156 dBm</td><td>-162 dBm</td></tr>
</table></td></tr>
<tr><td>1 dB Gain compression (Two-tone signal)</td><td>(Separation: RBW × 15, 50 kHz min.)
<table>
<tr><th>Input frequency</th><th>Specification</th><th>Typical value</th></tr>
<tr><td>50 MHz to 200 MHz</td><td>> +2 dBm</td><td>+5 dBm</td></tr>
<tr><td>200 MHz to 3.3 GHz</td><td>> +6 dBm</td><td>+9 dBm</td></tr>
<tr><td>3.3 GHz to 7.5 GHz</td><td>> -5 dBm</td><td>-2 dBm</td></tr>
<tr><td>7.5 GHz to 13.5 GHz</td><td>> -3 dBm</td><td>+0 dBm</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Description</th><th>Specifications</th></tr>
<tr><td>Second harmonic distortion</td><td>
<table>
<tr><th>Input frequency</th><th>Specification (SHI)</th><th>Mixer level</th></tr>
<tr><td>50 MHz to 1.65 GHz</td><td>< -60 dBc (+40 dBm)</td><td>-20 dBm</td></tr>
<tr><td>720 MHz to 958 MHz
(Input filter ON)</td><td>< -100 dBc (+90 dBm)</td><td>-10 dBm</td></tr>
<tr><td>> 1.65 GHz</td><td>< -100 dBc (+90 dBm)</td><td>-10 dBm</td></tr>
</table>
</td></tr>
<tr><td>Third order intermodulation distortion (TOI)</td><td>(Mixer level: -10 dBm, separation: RBW×15, 25 kHz min)
<table>
<tr><th>Input frequency</th><th>Specification</th><th>Typical value</th></tr>
<tr><td>10 MHz to 200 MHz</td><td>> +12 dBm</td><td>+16 dBm</td></tr>
<tr><td>200 MHz to 500 MHz</td><td>> +16 dBm</td><td>+20 dBm</td></tr>
<tr><td>500 MHz to 1 GHz</td><td>> +20 dBm</td><td>+24 dBm</td></tr>
<tr><td>1 GHz to 2 GHz</td><td>> +21 dBm</td><td>+25 dBm</td></tr>
<tr><td>2 GHz to 3.3 GHz</td><td>> +22 dBm</td><td>+26 dBm</td></tr>
<tr><td>3.3 GHz to 7.5 GHz</td><td>> +5 dBm</td><td>+10 dBm</td></tr>
<tr><td>7.5 GHz to 13.5 GHz</td><td>> +8 dBm</td><td>+12 dBm</td></tr>
</table>
</td></tr>
<tr><td>Image responses, Multiple responses, and Out-of-band responses</td><td>(Spectrum analysis mode)
<table>
<tr><th>Frequency</th><th>Specification</th></tr>
<tr><td>10 MHz to 13.5 GHz</td><td>< -70 dBc</td></tr>
</table>
</td></tr>
<tr><td>Residual responses</td><td>(Spectrum analysis mode, No signal input, Input termination, Input attenuator: 0 dB)
<table>
<tr><th></th><th>Frequency</th><th>Specification</th></tr>
<tr><td>Preamp On</td><td>1 MHz to 3.3 GHz</td><td>< -100 dBm</td></tr>
<tr><td rowspan="2">Preamp Off</td><td>1 MHz to 3.3 GHz</td><td>< -100 dBm</td></tr>
<tr><td>3.3 GHz to 13.5 GHz</td><td>< - 90 dBm</td></tr>
</table>
</td></tr>
</table>

3.1.6 Input and Output

Description	Specifications
RF Input Connector Impedance VSWR	 Type-N (f) on the front panel 50 Ω (nom.) Input attenuator ≥ 10 dB, In the set frequency < 1.5:1 (9 kHz ≤ f ≤ 3.3 GHz) (nom.) < 2.0:1 (3.3 GHz < f GHz) (nom.)
Calibration signal output Connector Impedance Frequency	 BNC (f) on the front panel 50 Ω (nom.) 50 MHz
Probe power supply Connector Output voltage and current	 4-pin connector, Rear panel ± 15 V, 150 mA (nom.)
External trigger input 1 Connector Impedance Trigger level	 SMA (f) on the rear panel 10 kΩ (nom.), DC coupling TTL level
External trigger input 2 Connector Impedance Trigger level	 SMA (f) on the rear panel 10 kΩ (nom.), DC coupling 0 V to 5 V
Trigger output Connector Amplitude	 SMA (f) on the rear panel TTL level
Frequency reference input Connector Impedance Frequency Amplitude	 BNC (f) on the rear panel 50 Ω (nom.) 10 MHz 0 dBm to ± 5 dB
10 MHz Frequency reference output Connector Impedance Frequency Amplitude	 BNC (f) on the rear panel 50 Ω (nom.) 10 MHz 0 dBm to ± 5 dB
421.4 MHz IF Output Connector Impedance Frequency Amplitude	 BNC (f) on the rear panel 50 Ω (nom.) 421.4 MHz Mixer input level -7 dB (Typical value at 50 MHz)

Description	Specifications
I/O	
USB	Front panel
GPIB	IEEE-488.2 compatible, Rear panel
LAN	10Base-T, protocol used: TCP/IP, Rear panel
External display signal	15-pin D-SUB connector (VGA), Rear panel

3.1.7 General Specifications

Description	Specifications
Operation Environment	Ambient temperature: 0°C to +50°C Relative humidity: 80% or less (no condensation)
Storage environmental range	Ambient temperature: -20°C to +60°C Relative humidity: 80% or less (no condensation)
AC Power Supply Input	AC100 V to 120 V, 50 Hz/60 Hz AC220 V to 240 V, 50 Hz/60 Hz (Automatically switches the input voltage between 100 V AC and 220 V AC.)
Power Consumption	360 VA or less Approx. 250 VA (without option)
Dimensions	Approximately 365 mm (W) × 177 mm (H) × 417 mm (D) (Including the handle and feet)
Weight	Approximately 18 kg or less (without option)

3.1.8 Options

- OPTION 21 High Stability Frequency Reference

Description	Specifications
Reference Frequency Stability Aging Rate Temperature drift Warm-up drift (nom.)	 $\pm 5 \times 10^{-9}$/ day, $\pm 8 \times 10^{-8}$/ year $\pm 5 \times 10^{-8}$ (0 to +50°C, frequency at 25°C used as the reference) $\pm 5 \times 10^{-8}$ / 10 min
External frequency reference input Frequency range Frequency setting resolution	 5 MHz to 20 MHz 1 Hz

- OPTION 22 High Stability Frequency Reference

Description	Specifications
Reference Frequency Stability Aging Rate Temperature drift Warm-up drift (nom.)	 $\pm 3 \times 10^{-10}$/ day, $\pm 2 \times 10^{-8}$/ year $\pm 5 \times 10^{-9}$ (0 to +50°C, frequency at 25°C used as the reference) $\pm 1 \times 10^{-8}$/ 30 min } (frequency at 25°C, 24 hours after power $\pm 5 \times 10^{-9}$/ 60 min } on used as reference)
External frequency reference input Frequency range Frequency setting resolution	 5 MHz to 20 MHz 1 Hz

- OPTION 23 High Stability Frequency Reference

Description	Specifications
Reference Frequency Stability Frequency accuracy Aging Rate Temperature drift Warm-up drift (nom.)	 $\pm 5 \times 10^{-9}$ $\pm 1 \times 10^{-10}$/ month $\pm 1 \times 10^{-9}$ (0 to +40°C, frequency at 25°C used as the reference) $\pm 1 \times 10^{-9}$ / 15 min
External frequency reference input Frequency range Frequency setting resolution	 5 MHz to 20 MHz 1 Hz

- OPTION 71 6 GHz Wide-band Converter

Description	Specifications
Frequency range	3.3 GHz to 6 GHz
Modulation analysis bandwidth	25 MHz

- OPTION 79 Tracking Generator

Description	Specifications
Output frequency	100 kHz to 3.3 GHz
Output level Setting range Setting resolution Output level flatness Output level accuracy Vernier accuracy	 -10 dBm to 0 dBm 0.1 dB < ±3 dB (100 kHz to 3.3 GHz, Relative value) < ±1 dB (50 MHz, -10 dBm, 25°C ± 10°C) < 0.5 dB/1 dB
Output spurious Harmonics Non-harmonics	 < -15 dBc (When 0 dBm is output) < -25 dBc (When 0 dBm is output)
TG Leakage	INPUT and TG OUTPUT are terminated, Input attenuator: 0 dB < -100 dBm (100 kHz ≤ f ≤ 3.3 GHz)
TG output Impedance (nom.) VSWR (When 10 dBm is output, nom.)	 50 Ω (nom.) < 2.0:1 (100 kHz ≤ f ≤ 3.0 GHz) < 3.0:1 (3.0 GHz < f ≤ 3.3 GHz)

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   (b) any improper or inadequate handling, carriage or storage of the Product by the Purchaser or any third party (other than Advantest or its agents);

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Advantest's maintenance agreement provides the Purchaser on-site and off-site maintenance, parts, maintenance machinery, regular inspections, and telephone support and will last a maximum of ten years from the date the delivery of the Product. For specific details of the services provided under the maintenance agreement, please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest 's sales representatives.

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