ADVANTEST

ADVANTEST CORPORATION

R3969/R3970

Multi-port Test Adapter

Operation Manual

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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

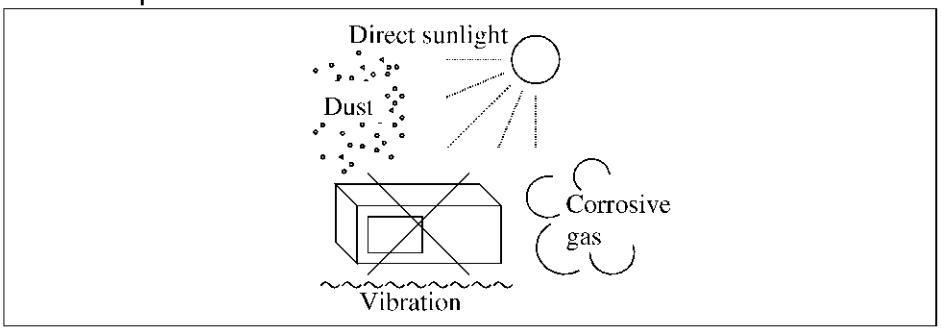


Figure-1 Environmental Conditions

- Operating position

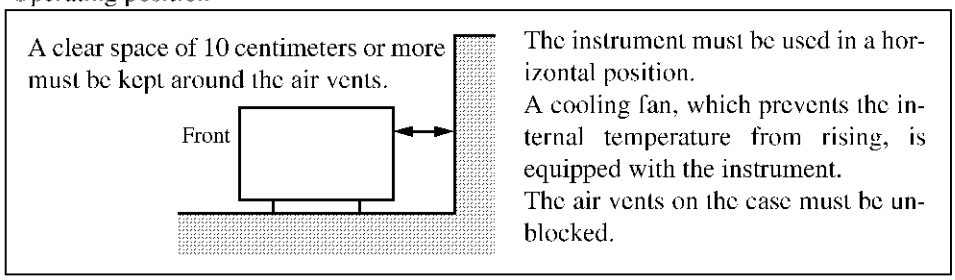


Figure-2 Operating Position

- Storage position

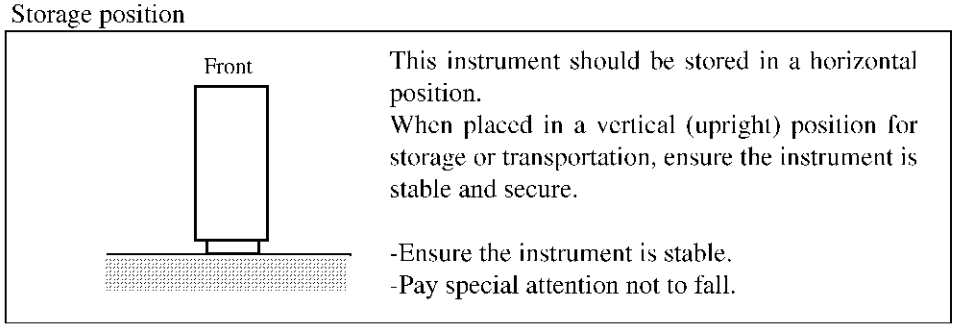


Figure-3 Storage Position

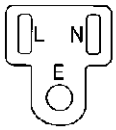
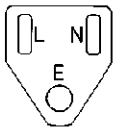
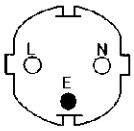
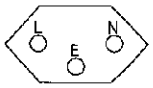
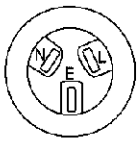
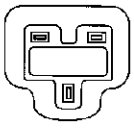
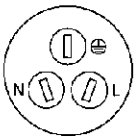
- The classification of the transient over-voltage, which exists typically in the main power supply, and the pollution degree is defined by IEC61010-1 and described below.

  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

Certificate of Conformity

CE

This is to certify, that

Multi-port Test Adaptor

R3969/R3970 Series

instrument, type, designation

complies with the provisions of the EMC Directive 89/336/EEC (All of these factors are revised by 91/263/EEC,92/31/EEC,93/68/EEC) in accordance with EN61326
and Low Voltage Directive 73/23/EEC (All of these factors are revised by 93/68/EEC) in accordance with EN61010.

ADVANTEST Corp.

Tokyo, Japan

ROHDE&SCHWARZ

Engineering and Sales GmbH
Munich, Germany

3969/3970.01

PREFACE

! Use this instrument with the RF Component Analyzer/Network Analyzer, which is also produced by Advantest and is compliant with the UL mark.

- This manual describes the following test adapters:

  Multi-port Test Adapter: R3969 OPT12 (8 GHz, 12-PORT type)
  R3969 OPT15 (8 GHz, 15-PORT type with isolation measurement function)
  R3969 OPT16 (8 GHz, 16-PORT type)
  R3969 OPT17 (8 GHz, 12-PORT type with isolation measurement function)
  R3970 OPT12 (20 GHz, 12-PORT type)
  R3970 OPT15 (20 GHz, 15-PORT type with isolation measurement function)
  R3970 OPT16 (20 GHz, 16-PORT type)
  R3970 OPT17 (20 GHz, 12-PORT type with isolation measurement function)

- Multi-port test adapters and available instruments are described below:

  R3969 OPT12: 3-PORT or 4-PORT type of the R3860A, R3768, or R3770
  R3969 OPT15,16,17: 4-PORT type of the R3860A, R3768, or R3770
  R3970 OPT12: 3-PORT or 4-PORT type of the R3860A (20 GHz type) or R3770
  R3970 OPT15,16,17: 4-PORT type of the R3860A (20 GHz type) or R3770

  The standard accessories cannot be used to connect the R3969 to the R3860A (20 GHz type) or R3770. Use other accessories to connect them.

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LIST OF TABLES

1. INTRODUCTION

This chapter describes the product overview, accessories, operating environment, cleaning, storage, and transportation.

1.1 Product Overview

The R3969 or R3970 (this instrument) is a multi-port test adapter that can measure the transmission and reflection characteristics (S-parameter measurement) easily without changing connections of the multi-port device by connecting to R3860A, R3770, or R3768 RF Component Analyzer

1.2 Accessories

Standard accessories, which are included in this instrument, are listed in Table 1-1 to Table 1-4. If any accessory is damaged or missing, contact Advantest or a sales representative. Quote the model name of the accessory when ordering.

Table 1-1 List of Standard Accessories(R3969 OPT12)

Name	Model name	Quantity
Semi-rigid cable (For PORT 1)	DCP-FF00580X01-1	4
Semi-rigid cable (For PORT 2)		
Semi-rigid cable (For PORT 3)		
Spare semi-rigid cable		
N-SMA adapter	JCF-AA001JX36-1	4
Control cable	DCP-RR00475X01-1	1
Operation manual	ER3969/3970	1

Table 1-2 List of Standard Accessories(R3969 OPT15, 16, 17)

Name	Model name	Quantity
Semi-rigid cable (For PORT 1)	DCP-FF00580X01-1	4
Semi-rigid cable (For PORT 2)		
Semi-rigid cable (For PORT 3)		
Semi-rigid cable (For PORT 4)		
N-SMA adapter	JCF-AA001JX36-1	4
Control cable	DCP-RR00475X01-1	1
Operation manual	ER3969/3970	1

Table 1-3 List of Standard Accessories(R3970 OPT12)

Name	Model name	Quantity
Semi-rigid cable (For PORT 1)	DCP-FF00650X01-1	4
Semi-rigid cable (For PORT 2)		
Semi-rigid cable (For PORT 3)		
Spare semi-rigid cable		
Control cable	DCP-RR00475X01-1	1
Operation manual	ER3969/3970	1

Table 1-4 List of Standard Accessories(R3970 OPT15, 16, 17)

Name	Model name	Quantity
Semi-rigid cable (For PORT 1)	DCP-FF00650X01-1	4
Semi-rigid cable (For PORT 2)		
Semi-rigid cable (For PORT 3)		
Semi-rigid cable (For PORT 4)		
Control cable	DCP-RR00475X01-1	1
Operation manual	ER3969/3970	1

1.3 Operating Environment

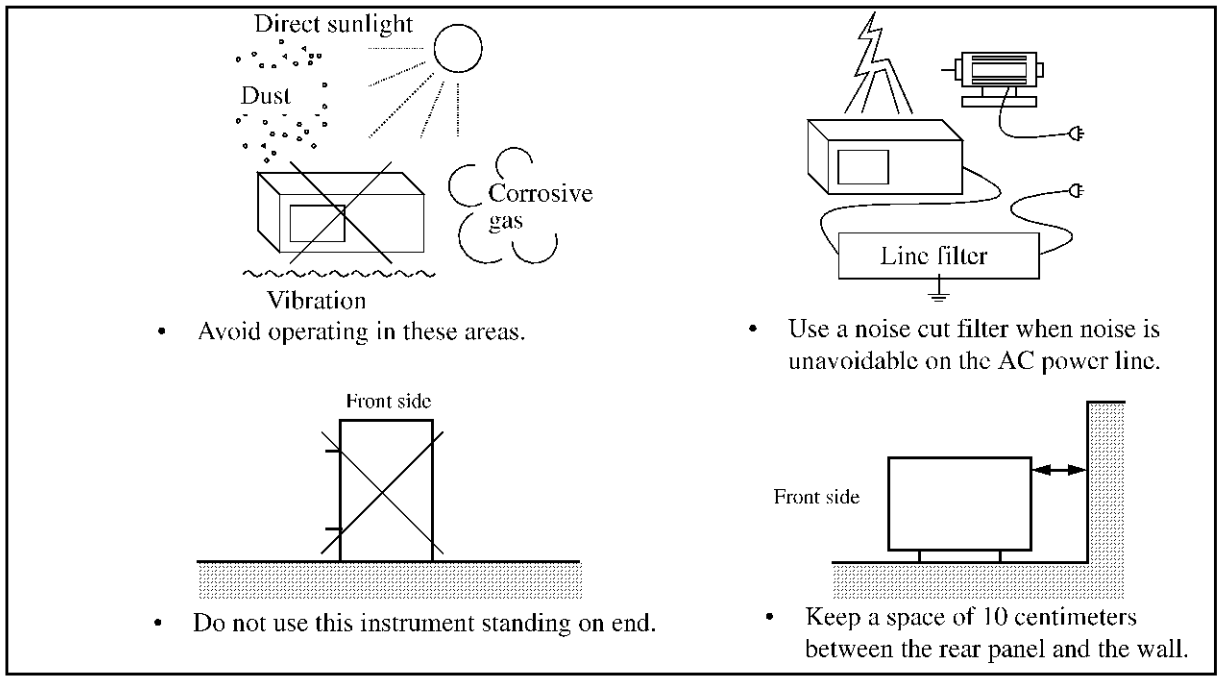
This section describes the environmental conditions necessary to use this instrument.

1.3.1 Environmental Conditions

Install this instrument in an environment in which the following conditions are satisfied.

- Ambient temperature: +5 °C to +40 °C (Operating temperature range: When FDD is used.)
  0 °C to +50 °C (Operating temperature range: When FDD is not used.)
  -20 °C to +60 °C (Storage temperature range)
- Relative humidity: 80 percent or less with no condensation
- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- A low noise area

  Although this instrument has been designed to withstand a certain amount of noise from the AC power line, it should be used in a low noise area. Use a noise cut filter if ambient noise is unavoidable.



- Avoid operating in these areas.
- Use a noise cut filter when noise is unavoidable on the AC power line.
- Do not use this instrument standing on end.
- Keep a space of 10 centimeters between the rear panel and the wall.

Figure 1-1 Operating Environment

1.4 Precautions when using this Instrument

1. Before starting the measurement

   Before turning on the power of the R3860A, R3770, or R3768, connect the control cable to the rear panel of the R3860A, R3770, or R3768 and the rear panel of this instrument. (See Chapter 3. "CONNECTING TO THE R3860A, R3770, OR R3768")

2. Do not use this instrument standing on end. You may be hurt if this instrument falls down.

3. Removing the case

   The case of this instrument should only be opened by Advantest service engineers. This instrument contains high-voltage and high temperature parts.

4. If a fault occurs

   If any smoke, smell, or noise emanates from this instrument, turn off the POWER switch, remove the power cable from the outlet, and contact Advantest. A contact address and telephone number is provided at the end of this manual.

5. Electromagnetic interference

   This instrument may cause electromagnetic interference and affect television and radio. If this instrument's power is turned off and any electromagnetic interference that may be present is reduced, then this instrument has caused the interference.

   Electromagnetic interference from this instrument may be prevented by the following precautions.

   - Changing the direction of the antenna of the television or radio.
   - Placing this instrument on the other side of the television or radio.
   - Placing this instrument away from the television or radio.
   - Using a different power source for the television or radio, and this instrument.

6. Protecting against electrostatic discharge

   To prevent semiconductors from being damaged by electrostatic discharge (ESD), the precautions shown below should be taken. We recommend combining two or more countermeasures to prevent damage from ESD.

   (Static electricity can be generated easily by the movement of a person or the friction against insulation.)

   Precaution example

   Human Body: Use a wrist strap (See Figure 1-2).

   Work floor: Install a conductive mat, use conductive shoes, and connect to earth. (See Figure 1-3)

   Workbench: Install a conductive mat and connect to earth. (See Figure 1-4)

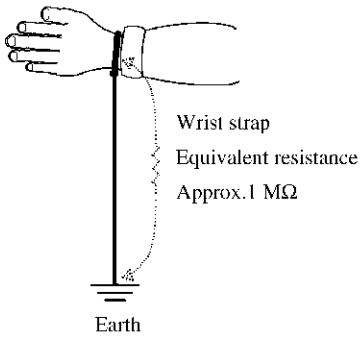


Figure 1-2 Precautions against Static Electricity from the Human Body

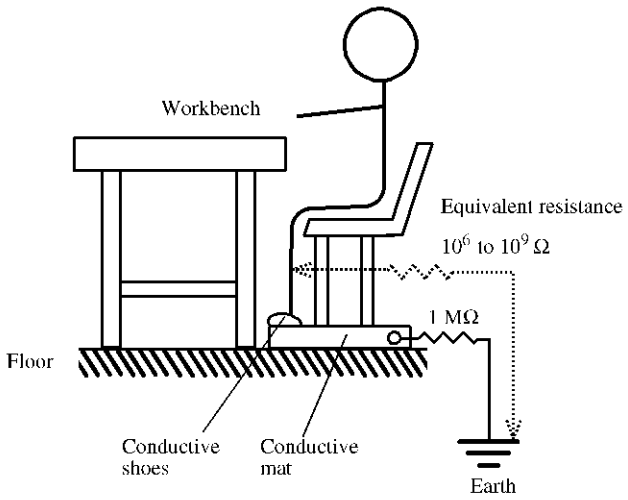


Figure 1-3 Precautions against Static Electricity from the Work Floor

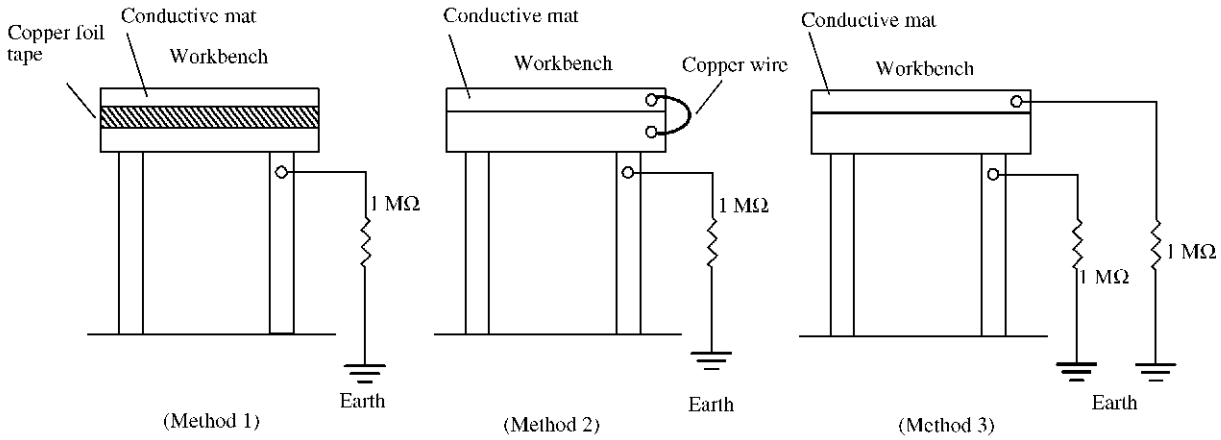


Figure 1-4 Countermeasures for Static Electricity from the Workbench

1.5 Cleaning, Storage, and Transportation of this Instrument

1.5.1 Cleaning

Use a soft or damp cloth to clean this instrument. Be careful of the following:

- Do not allow water inside the instrument or lint on the instrument.
- Do not use an organic solvent such as benzene or acetone for cleaning because it degrades the plastic.

1.5.2 Storage

Store this instrument at a temperature in the range of -20 °C to +60 °C. If you do not use this instrument for 90 days or more, store it in an appropriate moisture-proof bag with desiccant. Store this instrument in an area away from dust and direct sunlight.

1.5.3 Transportation

When transporting this instrument, use the packing materials used for the shipping of this instrument. If other materials must be used, pack the instrument according to the following procedure.

1. The inner dimensions of the carton case must be at least 15 cm larger than the physical size of this instrument to accommodate cushioning material.
2. Cover this instrument with a protective sheet.
3. Place the cushioning material inside the carton case and cover all sides of this instrument with cushioning material.
4. Seal the carton case with an industrial stapler or shipping tape.

When sending this instrument to Advantest or a sales representative, attach a tag that indicates the following information.

- Your company name and address
- Name of the person in charge
- Serial number (on the rear panel)
- What work to request.

1.6 Warm-up

After this instrument reaches room temperature, turn on the POWER switch and warm up for 30 minutes or more.

1.7 Calibration

Calibration should be performed at our factory site.

For more information on calibration of this instrument, contact Advantest or a sales representative.

Recommended calibration period	One year

1.8 Product Disposal and Recycle

This product should be disposed of according to the regulations and laws that are established by your country and municipality.

When treating this product, separately collect components according to this chapter to prevent the spread of substances, which may be harmful to humans, and to protect the global environment.

Components, which must be separately collected, are shown in the following table.

The treatment of this product should comply with the relevant laws of your country and waste-disposal regulations of your company.

Name	Component	Location	Quantity in maximum configuration	Remarks
Mercury	-	-	1	
Battery	-	-	1	
Printed circuit boards	BLJ-**, BLN-**	Inside the instrument	2	
Plastic containing halogenated flame retardants	-	-	-	
CRT	-	-	-	
LCD	-	-	-	
External electric cables	DCP-**	Accessories	5	Semi-rigid cable Control cable
Arsenic compound semiconductors	-	-	-	

2. PANEL DESCRIPTION

2.1 Front Panel

2.1.1 R3969/R3970 OPT12

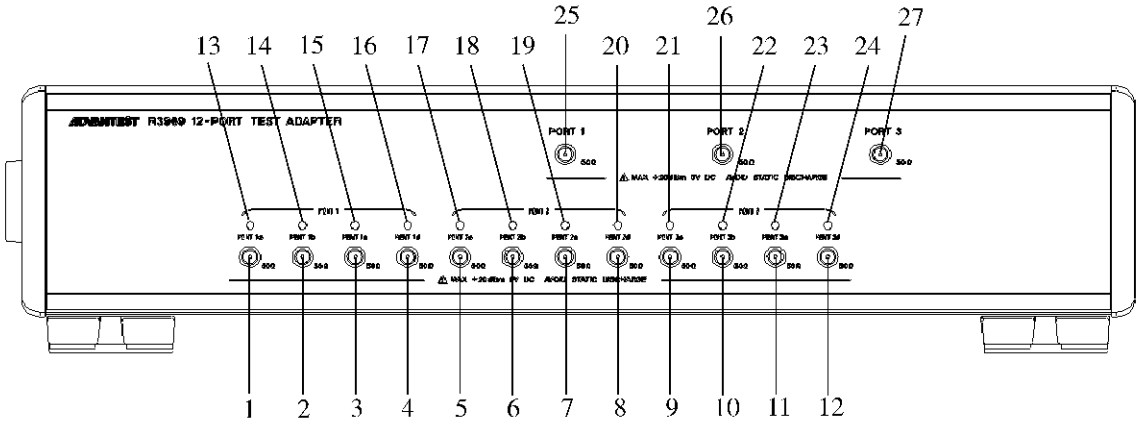


Figure 2-1 Front Panel of the R3969 and the R3970 OPT12

Table 2-1 Front Panel Description of the R3969 and the R3970 OPT12 (1 of 2)

No.	Name	Description
1	PORT 1a Connector	This is used when the transmission and reflection characteristics are measured at PORT 1a.
2	PORT 1b Connector	This is used when the transmission and reflection characteristics are measured at PORT 1b.
3	PORT 1c Connector	This is used when the transmission and reflection characteristics are measured at PORT 1c.
4	PORT 1d Connector	This is used when the transmission and reflection characteristics are measured at PORT 1d.
5	PORT 2a Connector	This is used when the transmission and reflection characteristics are measured at PORT 2a.
6	PORT 2b Connector	This is used when the transmission and reflection characteristics are measured at PORT 2b.
7	PORT 2c Connector	This is used when the transmission and reflection characteristics are measured at PORT 2c.
8	PORT 2d Connector	This is used when the transmission and reflection characteristics are measured at PORT 2d.

Table 2-1 Front Panel Description of the R3969 and the R3970 OPT12 (2 of 2)

No.	Name	Description
9	PORT 3a Connector	This is used when the transmission and reflection characteristics are measured at PORT 3a.
10	PORT 3b Connector	This is used when the transmission and reflection characteristics are measured at PORT 3b.
11	PORT 3c Connector	This is used when the transmission and reflection characteristics are measured at PORT 3c.
12	PORT 3d Connector	This is used when the transmission and reflection characteristics are measured at PORT 3d.
13	PORT 1a LED	Lights when PORT 1a is connected to the power supply of the R3860A, R3770, or R3768.
14	PORT 1b LED	Lights when PORT 1b is connected to the power supply of the R3860A, R3770, or R3768.
15	PORT 1c LED	Lights when PORT 1c is connected to the power supply of the R3860A, R3770, or R3768.
16	PORT 1d LED	Lights when PORT 1d is connected to the power supply of the R3860A, R3770, or R3768.
17	PORT 2a LED	Lights when PORT 2a is connected to the power supply of the R3860A, R3770, or R3768.
18	PORT 2b LED	Lights when PORT 2b is connected to the power supply of the R3860A, R3770, or R3768.
19	PORT 2c LED	Lights when PORT 2c is connected to the power supply of the R3860A, R3770, or R3768.
20	PORT 2d LED	Lights when PORT 2d is connected to the power supply of the R3860A, R3770, or R3768.
21	PORT 3a LED	Lights when PORT 3a is connected to the power supply of the R3860A, R3770, or R3768.
22	PORT 3b LED	Lights when PORT 3b is connected to the power supply of the R3860A, R3770, or R3768.
23	PORT 3c LED	Lights when PORT 3c is connected to the power supply of the R3860A, R3770, or R3768.
24	PORT 3d LED	Lights when PORT 3d is connected to the power supply of the R3860A, R3770, or R3768.
25	PORT 1 Connector	This is connected to TEST PORT 1 of the R3860A, R3770, or R3768.
26	PORT 2 Connector	This is connected to TEST PORT 2 of the R3860A, R3770, or R3768.
27	PORT 3 Connector	This is connected to TEST PORT 3 of the R3860A, R3770, or R3768.

2.1.2 R3969/R3970 OPT15

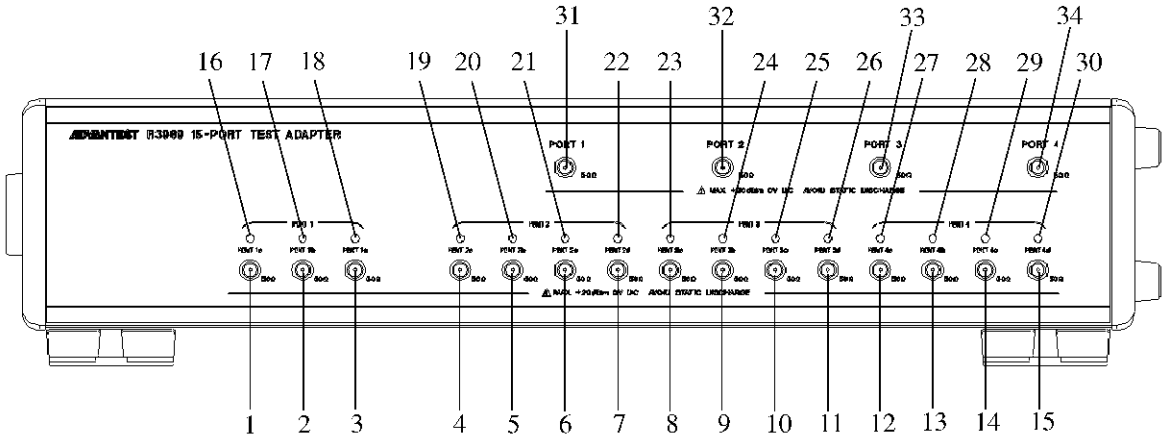


Figure 2-2 Front Panel of the R3969 and the R3970 OPT15

Table 2-2 Front Panel Description of the R3969 and the R3970 OPT15 (1 of 3)

No.	Name	Description
1	PORT 1a Connector	This is used when the transmission and reflection characteristics are measured at PORT 1a.
2	PORT 1b Connector	This is used when the transmission and reflection characteristics are measured at PORT 1b.
3	PORT 1c Connector	This is used when the transmission and reflection characteristics are measured at PORT 1c.
4	PORT 2a Connector	This is used when the transmission and reflection characteristics are measured at PORT 2a.
5	PORT 2b Connector	This is used when the transmission and reflection characteristics are measured at PORT 2b.
6	PORT 2c Connector	This is used when the transmission and reflection characteristics are measured at PORT 2c.
7	PORT 2d Connector	This is used when the transmission and reflection characteristics are measured at PORT 2d.
8	PORT 3a Connector	This is used when the transmission and reflection characteristics are measured at PORT 3a.
9	PORT 3b Connector	This is used when the transmission and reflection characteristics are measured at PORT 3b.
10	PORT 3c Connector	This is used when the transmission and reflection characteristics are measured at PORT 3c.
11	PORT 3d Connector	This is used when the transmission and reflection characteristics are measured at PORT 3d.

2.1.2 R3969/R3970 OPT15

Table 2-2 Front Panel Description of the R3969 and the R3970 OPT15 (2 of 3)

No.	Name	Description
12	PORT 4a Connector	This is used when the transmission and reflection characteristics are measured at PORT 4a.
13	PORT 4b Connector	This is used when the transmission and reflection characteristics are measured at PORT 4b.
14	PORT 4c Connector	This is used when the transmission and reflection characteristics are measured at PORT 4c.
15	PORT 4d Connector	This is used when the transmission and reflection characteristics are measured at PORT 4d.
16	PORT 1a LED	Lights when PORT 1a is connected to the power supply of the R3860A, R3770, or R3768.
17	PORT 1b LED	Lights when PORT 1b is connected to the power supply of the R3860A, R3770, or R3768.
18	PORT 1c LED	Lights when PORT 1c is connected to the power supply of the R3860A, R3770, or R3768.
19	PORT 2a LED	Lights when PORT 2a is connected to the power supply of the R3860A, R3770, or R3768.
20	PORT 2b LED	Lights when PORT 2b is connected to the power supply of the R3860A, R3770, or R3768.
21	PORT 2c LED	Lights when PORT 2c is connected to the power supply of the R3860A, R3770, or R3768.
22	PORT 2d LED	Lights when PORT 2d is connected to the power supply of the R3860A, R3770, or R3768.
23	PORT 3a LED	Lights when PORT 3a is connected to the power supply of the R3860A, R3770, or R3768.
24	PORT 3b LED	Lights when PORT 3b is connected to the power supply of the R3860A, R3770, or R3768.
25	PORT 3c LED	Lights when PORT 3c is connected to the power supply of the R3860A, R3770, or R3768.
26	PORT 3d LED	Lights when PORT 3d is connected to the power supply of the R3860A, R3770, or R3768.
27	PORT 4a LED	Lights when PORT 4a is connected to the power supply of the R3860A, R3770, or R3768.
28	PORT 4b LED	Lights when PORT 4b is connected to the power supply of the R3860A, R3770, or R3768.
29	PORT 4c LED	Lights when PORT 4c is connected to the power supply of the R3860A, R3770, or R3768.
30	PORT 4d LED	Lights when PORT 4d is connected to the power supply of the R3860A, R3770, or R3768.
31	PORT 1 Connector	This is connected to TEST PORT 1 of the R3860A, R3770, or R3768.

Table 2-2 Front Panel Description of the R3969 and the R3970 OPT15 (3 of 3)

No.	Name	Description
32	PORT 2 Connector	This is connected to TEST PORT 2 of the R3860A, R3770, or R3768.
33	PORT 3 Connector	This is connected to TEST PORT 3 of the R3860A, R3770, or R3768.
34	PORT 4 Connector	This is connected to TEST PORT 4 of the R3860A, R3770, or R3768.

2.1.3 R3969/R3970 OPT16

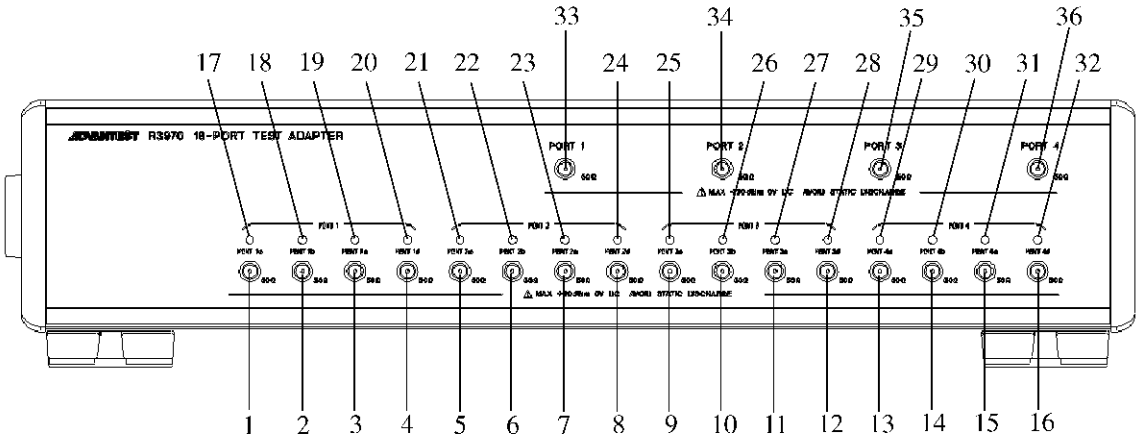


Figure 2-3 Front Panel of the R3969 and the R3970 OPT16

Table 2-3 Front Panel Description of the R3969 and the R3970 OPT16 (1 of 3)

No.	Name	Description
1	PORT 1a Connector	This is used when the transmission and reflection characteristics are measured at PORT 1a.
2	PORT 1b Connector	This is used when the transmission and reflection characteristics are measured at PORT 1b.
3	PORT 1c Connector	This is used when the transmission and reflection characteristics are measured at PORT 1c.
4	PORT 1d Connector	This is used when the transmission and reflection characteristics are measured at PORT 1d.
5	PORT 2a Connector	This is used when the transmission and reflection characteristics are measured at PORT 2a.

Table 2-3 Front Panel Description of the R3969 and the R3970 OPT16 (2 of 3)

No.	Name	Description
6	PORT 2b Connector	This is used when the transmission and reflection characteristics are measured at PORT 2b.
7	PORT 2c Connector	This is used when the transmission and reflection characteristics are measured at PORT 2c.
8	PORT 2d Connector	This is used when the transmission and reflection characteristics are measured at PORT 2d.
9	PORT 3a Connector	This is used when the transmission and reflection characteristics are measured at PORT 3a.
10	PORT 3b Connector	This is used when the transmission and reflection characteristics are measured at PORT 3b.
11	PORT 3c Connector	This is used when the transmission and reflection characteristics are measured at PORT 3c.
12	PORT 3d Connector	This is used when the transmission and reflection characteristics are measured at PORT 3d.
13	PORT 4a Connector	This is used when the transmission and reflection characteristics are measured at PORT 4a.
14	PORT 4b Connector	This is used when the transmission and reflection characteristics are measured at PORT 4b.
15	PORT 4c Connector	This is used when the transmission and reflection characteristics are measured at PORT 4c.
16	PORT 4d Connector	This is used when the transmission and reflection characteristics are measured at PORT 4d.
17	PORT 1a LED	Lights when PORT 1a is connected to the power supply of the R3860A, R3770, or R3768.
18	PORT 1b LED	Lights when PORT 1b is connected to the power supply of the R3860A, R3770, or R3768.
19	PORT 1c LED	Lights when PORT 1c is connected to the power supply of the R3860A, R3770, or R3768.
20	PORT 1d LED	Lights when PORT 1d is connected to the power supply of the R3860A, R3770, or R3768.
21	PORT 2a LED	Lights when PORT 2a is connected to the power supply of the R3860A, R3770, or R3768.
22	PORT 2b LED	Lights when PORT 2b is connected to the power supply of the R3860A, R3770, or R3768.
23	PORT 2c LED	Lights when PORT 2c is connected to the power supply of the R3860A, R3770, or R3768.
24	PORT 2d LED	Lights when PORT 2d is connected to the power supply of the R3860A, R3770, or R3768.
25	PORT 3a LED	Lights when PORT 3a is connected to the power supply of the R3860A, R3770, or R3768.

Table 2-3 Front Panel Description of the R3969 and the R3970 OPT16 (3 of 3)

No.	Name	Description
26	PORT 3b LED	Lights when PORT 3b is connected to the power supply of the R3860A, R3770, or R3768.
27	PORT 3c LED	Lights when PORT 3c is connected to the power supply of the R3860A, R3770, or R3768.
28	PORT 3d LED	Lights when PORT 3d is connected to the power supply of the R3860A, R3770, or R3768.
29	PORT 4a LED	Lights when PORT 4a is connected to the power supply of the R3860A, R3770, or R3768.
30	PORT 4bLED	Lights when PORT 4b is connected to the power supply of the R3860A, R3770, or R3768.
31	PORT 4c LED	Lights when PORT 4c is connected to the power supply of the R3860A, R3770, or R3768.
32	PORT 4d LED	Lights when PORT 4d is connected to the power supply of the R3860A, R3770, or R3768.
33	PORT 1 Connector	This is connected to TEST PORT 1 of the R3860A, R3770, or R3768.
34	PORT 2 Connector	This is connected to TEST PORT 2 of the R3860A, R3770, or R3768.
35	PORT 3 Connector	This is connected to TEST PORT 3 of the R3860A, R3770, or R3768.
36	PORT 4 Connector	This is connected to TEST PORT 4 of the R3860A, R3770, or R3768.

2.1.4 R3969/R3970 OPT17

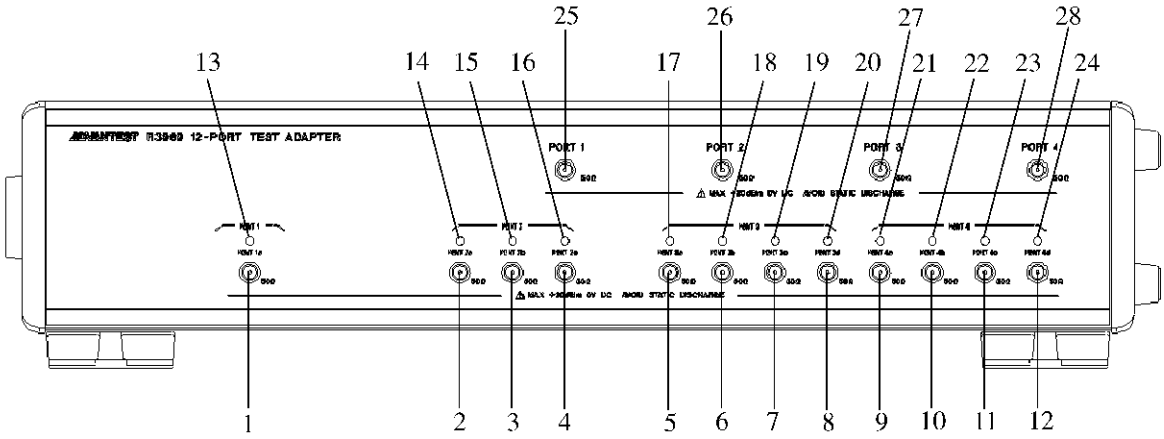


Figure 2-4 Front Panel of the R3969 and the R3970 OPT17

Table 2-4 Front Panel Description of the R3969 and the R3970 OPT17 (1 of 2)

No.	Name	Description
1	PORT 1a Connector	This is used when the transmission and reflection characteristics are measured at PORT 1a.
2	PORT 2a Connector	This is used when the transmission and reflection characteristics are measured at PORT 2a.
3	PORT 2b Connector	This is used when the transmission and reflection characteristics are measured at PORT 2b.
4	PORT 2c Connector	This is used when the transmission and reflection characteristics are measured at PORT 2c.
5	PORT 3a Connector	This is used when the transmission and reflection characteristics are measured at PORT 3a.
6	PORT 3b Connector	This is used when the transmission and reflection characteristics are measured at PORT 3b.
7	PORT 3c Connector	This is used when the transmission and reflection characteristics are measured at PORT 3c.
8	PORT 3d Connector	This is used when the transmission and reflection characteristics are measured at PORT 3d.
9	PORT 4a Connector	This is used when the transmission and reflection characteristics are measured at PORT 4a.
10	PORT 4b Connector	This is used when the transmission and reflection characteristics are measured at PORT 4b.
11	PORT 4c Connector	This is used when the transmission and reflection characteristics are measured at PORT 4c.

Table 2-4 Front Panel Description of the R3969 and the R3970 OPT17 (2 of 2)

No.	Name	Description
12	PORT 4d Connector	This is used when the transmission and reflection characteristics are measured at PORT 4d.
13	PORT 1a LED	Lights when PORT 1a is connected to the power supply of the R3860A, R3770, or R3768.
14	PORT 2a LED	Lights when PORT 2a is connected to the power supply of the R3860A, R3770, or R3768.
15	PORT 2b LED	Lights when PORT 2b is connected to the power supply of the R3860A, R3770, or R3768.
16	PORT 2c LED	Lights when PORT 2c is connected to the power supply of the R3860A, R3770, or R3768.
17	PORT 3a LED	Lights when PORT 3a is connected to the power supply of the R3860A, R3770, or R3768.
18	PORT 3b LED	Lights when PORT 3b is connected to the power supply of the R3860A, R3770, or R3768.
19	PORT 3c LED	Lights when PORT 3c is connected to the power supply of the R3860A, R3770, or R3768.
20	PORT 3d LED	Lights when PORT 3d is connected to the power supply of the R3860A, R3770, or R3768.
21	PORT 4a LED	Lights when PORT 4a is connected to the power supply of the R3860A, R3770, or R3768.
22	PORT 4b LED	Lights when PORT 4b is connected to the power supply of the R3860A, R3770, or R3768.
23	PORT 4c LED	Lights when PORT 4c is connected to the power supply of the R3860A, R3770, or R3768.
24	PORT 4d LED	Lights when PORT 4d is connected to the power supply of the R3860A, R3770, or R3768.
25	PORT 1 Connector	This is connected to TEST PORT 1 of the R3860A, R3770, or R3768.
26	PORT 2 Connector	This is connected to TEST PORT 2 of the R3860A, R3770, or R3768.
27	PORT 3 Connector	This is connected to TEST PORT 3 of the R3860A, R3770, or R3768.
28	PORT 4 Connector	This is connected to TEST PORT 4 of the R3860A, R3770, or R3768.

2.2 Rear Panel

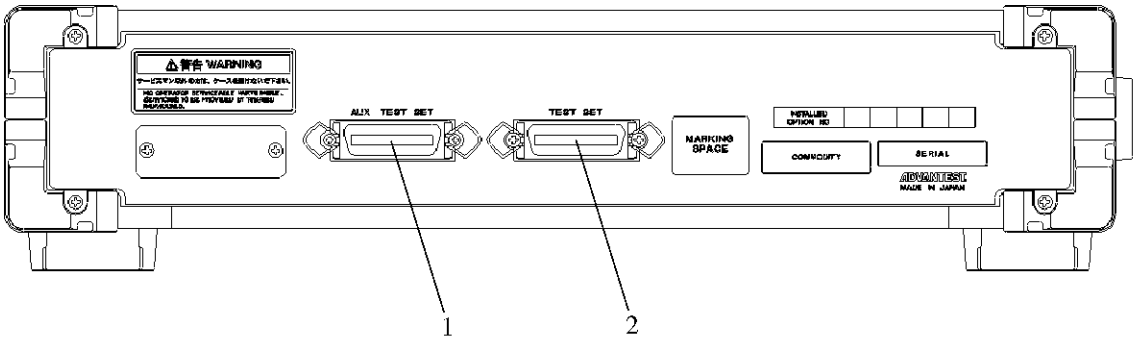


Figure 2-5 Rear Panel of the R3969 and R3970

Table 2-5 Rear Panel Description

No.	Name	Description
1	AUX TESTSET Connector	This is used when two or more test sets are used.
2	TEST SET Connector	This is connected to the connector for the test set connection of the R3860A, R3770, or R3768.

3. CONNECTING TO THE R3860A, R3770, OR R3768

This chapter describes how to connect this instrument to the R3860A, R3770, or R3768.

3.1 Front Panel Connections

3.1.1 Connecting the R3969 OPT12 to the R3860A (8 GHz) or R3768

R3969 OPT12 (This instrument)	R3860A(8 GHz)/R3768	Cable	Coaxial adapter
PORT 1	TEST PORT 1	DCP-FF00580X01-1	JCF-AA001JX36-1
PORT 2	TEST PORT 2	DCP-FF00580X01-1	
PORT 3	TEST PORT 3	DCP-FF00580X01-1	

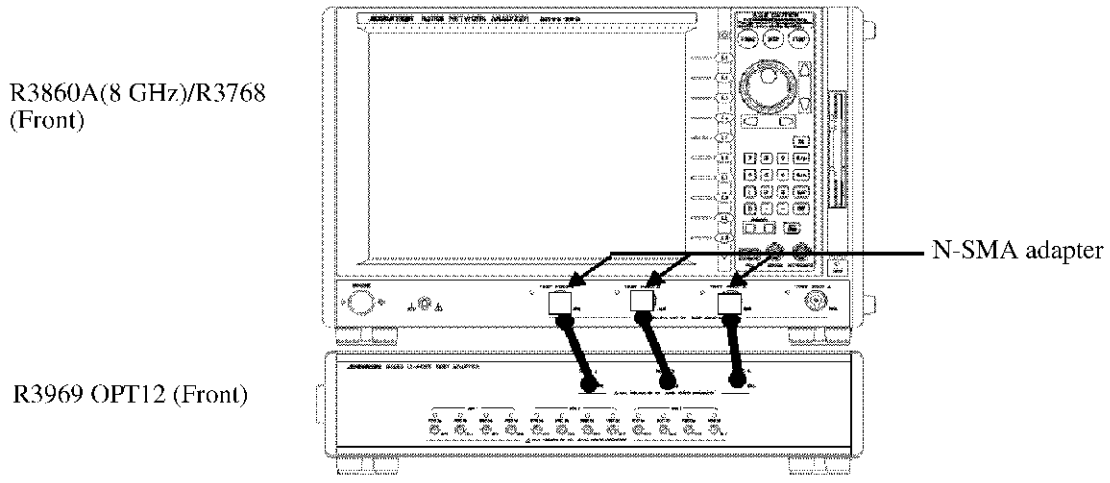


Figure 3-1 Front Panel Connections (R3969 OPT12)

3.1.2 Connecting the R3970 OPT12 to the R3860A (20 GHz) or R3770

R3970 OPT12 (This instrument)	R3860A(20 GHz)/R3770	Cable
PORT 1	TEST PORT 1	DCP-FF00650X01-1
PORT 2	TEST PORT 2	DCP-FF00650X01-1
PORT 3	TEST PORT 3	DCP-FF00650X01-1

R3860A(20 GHz)/R3770 (Front)

R3970 OPT12 (Front)

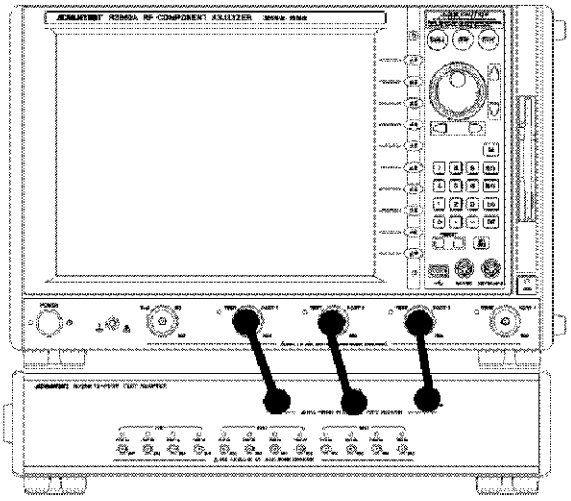


Figure 3-2 Front Panel Connections (R3970 OPT12)

3.1.3 Connecting the R3969 OPT15 to the R3860A (8 GHz) or R3768

R3969 OPT15 (This instrument)	R3860A(8 GHz)/R3768	Cable	Coaxial adapter
PORT 1	TEST PORT 1	DCP-FF00580X01-1	JCF-AA001JX36-1
PORT 2	TEST PORT 2	DCP-FF00580X01-1	
PORT 3	TEST PORT 3	DCP-FF00580X01-1	
PORT 4	TEST PORT 4	DCP-FF00580X01-1	

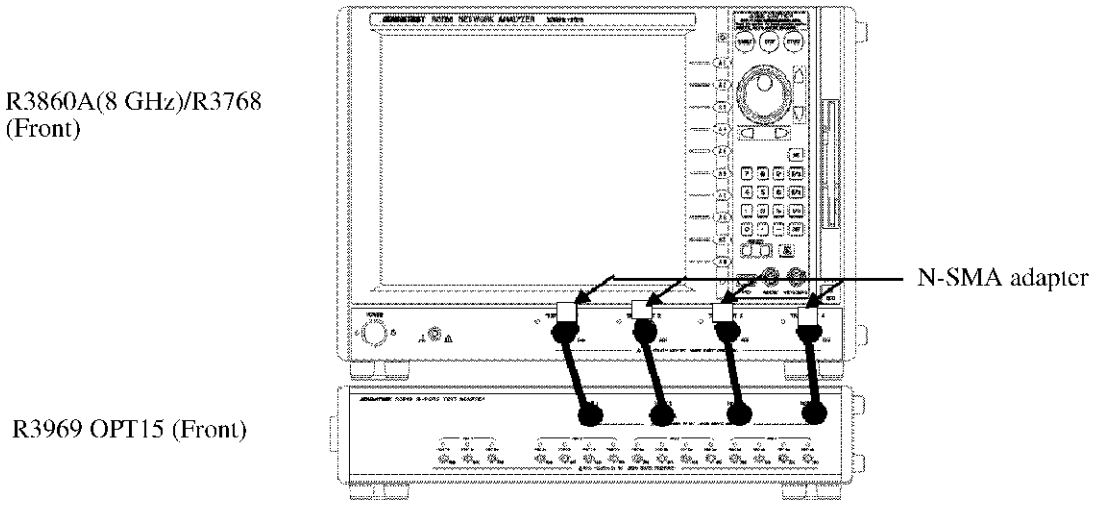


Figure 3-3 Front Panel Connections(R3969 OPT15)

3.1.4 Connecting the R3970 OPT15 to the R3860A (20 GHz) or R3770

R3970 OPT15 (This instrument)	R3860A (20 GHz)/R3770	Cable
PORT 1	TEST PORT 1	DCP-FF00650X01-1
PORT 2	TEST PORT 2	DCP-FF00650X01-1
PORT 3	TEST PORT 3	DCP-FF00650X01-1
PORT 4	TEST PORT 4	DCP-FF00650X01-1

R3860A(20 GHz)/R3770 (Front)

R3970 OPT15 (Front)

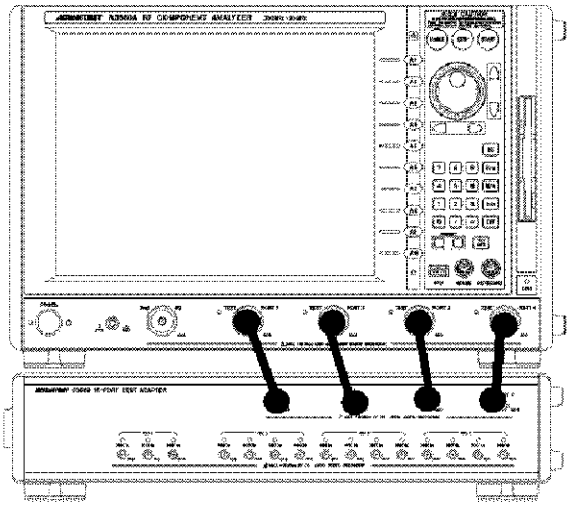


Figure 3-4 Front Panel Connections (R3970 OPT15)

3.1.5 Connecting the R3969 OPT16 to the R3860A (8 GHz) or R3768

R3969 OPT16 (This instrument)	R3860A(8 GHz)/R3768	Cable	Coaxial adapter
PORT 1	TEST PORT 1	DCP-FF00580X01-1	JCF-AA001JX36-1
PORT 2	TEST PORT 2	DCP-FF00580X01-1	
PORT 3	TEST PORT 3	DCP-FF00580X01-1	
PORT 4	TEST PORT 4	DCP-FF00580X01-1	

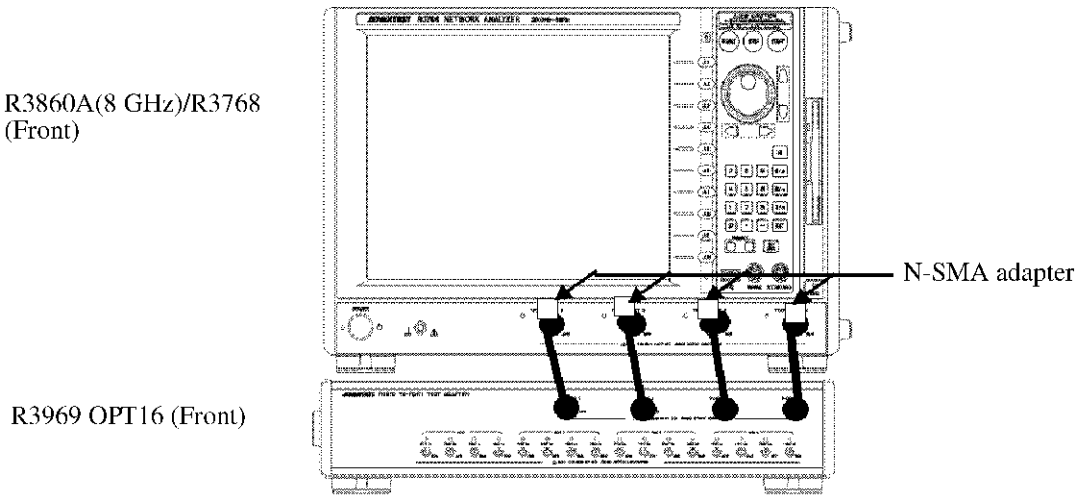


Figure 3-5 Front Panel Connections(R3969 OPT16)

3.1.6 Connecting the R3970 OPT16 to the R3860A (20 GHz) or R3770

R3970 OPT16 (This instrument)	R3860A (20 GHz)/R3770	Cable
PORT 1	TEST PORT 1	DCP-FF00650X01-1
PORT 2	TEST PORT 2	DCP-FF00650X01-1
PORT 3	TEST PORT 3	DCP-FF00650X01-1
PORT 4	TEST PORT 4	DCP-FF00650X01-1

R3860A(20 GHz)/R3770 (Front)

R3970 OPT16 (Front)

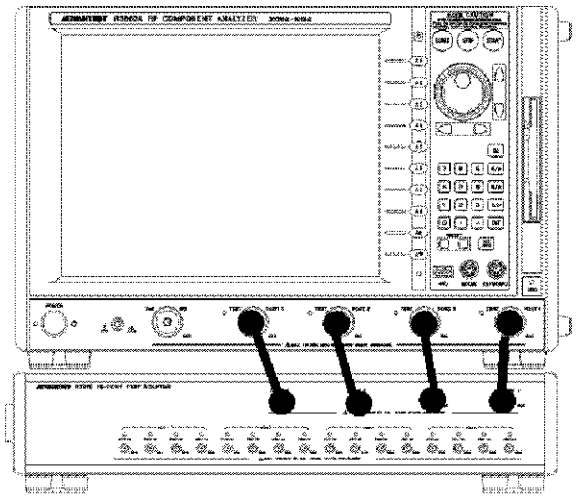


Figure 3-6 Front Panel Connections(R3970 OPT16)

3.1.7 Connecting the R3969 OPT17 to the R3860A (8 GHz) or R3768

R3969 OPT17 (This instrument)	R3860A(8 GHz)/R3768	Cable	Coaxial adapter
PORT 1	TEST PORT 1	DCP-FF00580X01-1	JCF-AA001JX36-1
PORT 2	TEST PORT 2	DCP-FF00580X01-1	
PORT 3	TEST PORT 3	DCP-FF00580X01-1	
PORT 4	TEST PORT 4	DCP-FF00580X01-1	

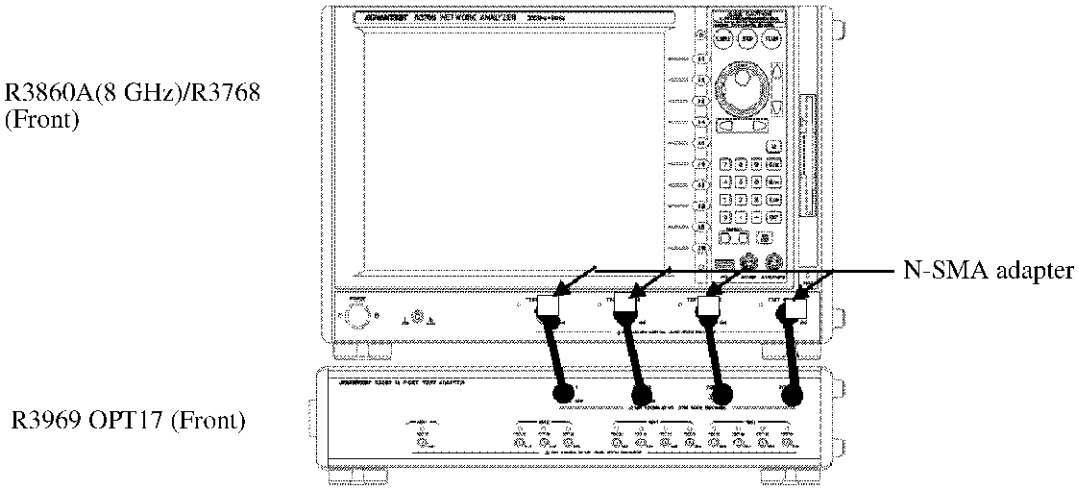


Figure 3-7 Front Panel Connections(R3969 OPT17)

3.1.8 Connecting the R3970 OPT17 to the R3860A (20 GHz) or R3770

R3970 OPT17 (This instrument)	R3860A (20 GHz)/R3770	Cable
PORT 1	TEST PORT 1	DCP-FF00650X01-1
PORT 2	TEST PORT 2	DCP-FF00650X01-1
PORT 3	TEST PORT 3	DCP-FF00650X01-1
PORT 4	TEST PORT 4	DCP-FF00650X01-1

R3860A(20 GHz)/R3770 (Front)

R3970 OPT17 (Front)

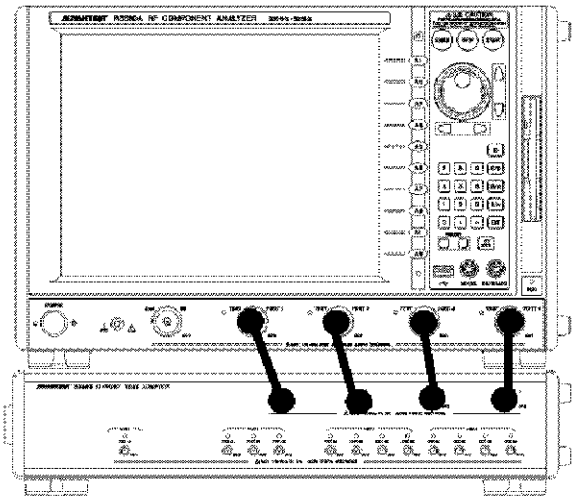


Figure 3-8 Front Panel Connections(R3970 OPT17)

3.2 Rear Panel Connections

Connect as shown below by using the attached control cable.

R3969/R3970 OPT12/15/16/17 (This instrument)	R3860A/R3770/R3768	Cable
TEST SET	TEST SET	DCP-RR00475X01-1

CAUTION: ***Before connecting this instrument to the R3860A, R3770, or R3768, turn off the power of both instruments.***

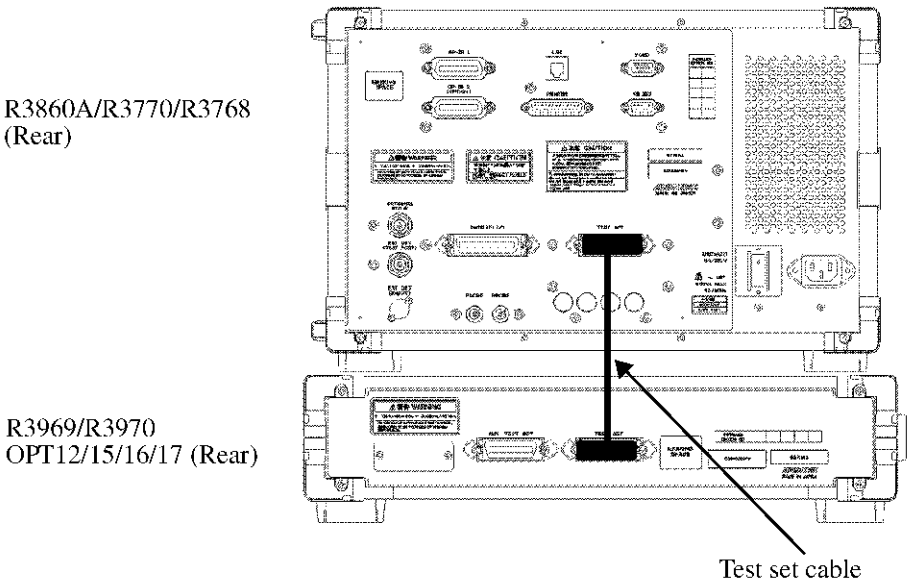


Figure 3-9 Rear Panel Connections

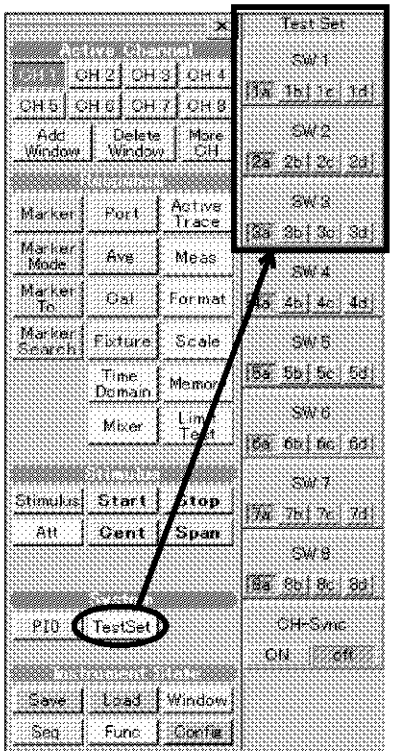
4. HOW TO OPERATE THE R3969 AND R3970

4.1 R3969/R3970 OPT12

This section describes how to set the path of the R3969 OPT12 or R3970 OPT12, which is shown in Table 4-1, by using the SW1, SW2, and SW3 on the R3860A, R3768, or the R3770 Network Analyzer operation panel shown below.

Table 4-1 Path Selection of the Test Set (OPT12)

Test port \ Switch	SW1	SW2	SW3
PORT 1 → PORT 1a	1a		
PORT 1 → PORT 1b	1b		
PORT 1 → PORT 1c	1c		
PORT 1 → PORT 1d	1d		
PORT 2 → PORT 2a		2a	
PORT 2 → PORT 2b		2b	
PORT 2 → PORT 2c		2c	
PORT 2 → PORT 2d		2d	
PORT 3 → PORT 3a			3a
PORT 3 → PORT 3b			3b
PORT 3 → PORT 3c			3c
PORT 3 → PORT 3d			3d



Network Analyzer Operation Panel

Set the ***SW1*** to ***1a*** for the path from PORT 1 to PORT 1a.
Set the ***SW1*** to ***1b*** for the path from PORT 1 to PORT 1b.
Set the ***SW1*** to ***1c*** for the path from PORT 1 to PORT 1c.
Set the ***SW1*** to ***1d*** for the path from PORT 1 to PORT 1d.

Set the ***SW2*** to ***2a*** for the path from PORT 2 to PORT 2a.
Set the ***SW2*** to ***2b*** for the path from PORT 2 to PORT 2b.
Set the ***SW2*** to ***2c*** for the path from PORT 2 to PORT 2c.
Set the ***SW2*** to ***2d*** for the path from PORT 2 to PORT 2d.

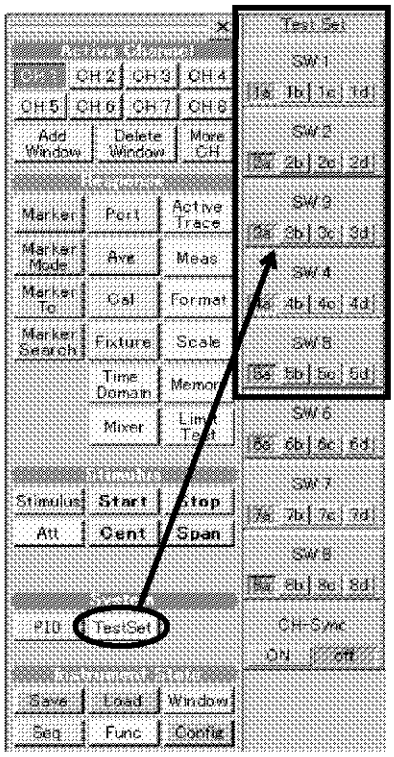
Set the ***SW3*** to ***3a*** for the path from PORT 3 to PORT 3a.
Set the ***SW3*** to ***3b*** for the path from PORT 3 to PORT 3b.
Set the ***SW3*** to ***3c*** for the path from PORT 3 to PORT 3c.
Set the ***SW3*** to ***3d*** for the path from PORT 3 to PORT 3d.

4.2 R3969/R3970 OPT15

This section describes how to set the path of the R3969 OPT15 or R3970 OPT15, which is shown in Table 4-2, by using the SW1, SW2, SW3, SW4, and SW5 on the R3860A, R3768, or the R3770 Network Analyzer operation panel shown below.

Table 4-2 Path Selection of the Test Set (OPT15)

Test port \ Switch	SW1	SW2	SW3	SW4	SW5
PORT 1 → PORT 1a	1a				
PORT 1 → PORT 1b	1b				
PORT 1 → PORT 1c	1c				
PORT 1 → PORT 2a	1d				5a
PORT 2 → PORT 2a		2a			5b
PORT 2 → PORT 2b		2b			
PORT 2 → PORT 2c		2c			
PORT 2 → PORT 2d		2d			
PORT 3 → PORT 3a			3a		
PORT 3 → PORT 3b			3b		
PORT 3 → PORT 3c			3c		
PORT 3 → PORT 3d			3d		
PORT 4 → PORT 4a				4a	
PORT 4 → PORT 4b				4b	
PORT 4 → PORT 4c				4c	
PORT 4 → PORT 4d				4d	



Network Analyzer Operation Panel

Set the ***SW1*** to ***1a*** for the path from PORT 1 to PORT 1a.
Set the ***SW1*** to ***1b*** for the path from PORT 1 to PORT 1b.
Set the ***SW1*** to ***1c*** for the path from PORT 1 to PORT 1c.
Set the ***SW1*** to ***1d*** and the ***SW5*** to ***5a*** for the path from PORT 1 to PORT 2a.

Set the ***SW2*** to ***2a*** and the ***SW5*** to ***5b*** for the path from PORT 2 to PORT 2a.
Set the ***SW2*** to ***2b*** for the path from PORT 2 to PORT 2b.
Set the ***SW2*** to ***2c*** for the path from PORT 2 to PORT 2c.
Set the ***SW2*** to ***2d*** for the path from PORT 2 to PORT 2d.

Set the ***SW3*** to ***3a*** for the path from PORT 3 to PORT 3a.
Set the ***SW3*** to ***3b*** for the path from PORT 3 to PORT 3b.
Set the ***SW3*** to ***3c*** for the path from PORT 3 to PORT 3c.
Set the ***SW3*** to ***3d*** for the path from PORT 3 to PORT 3d.

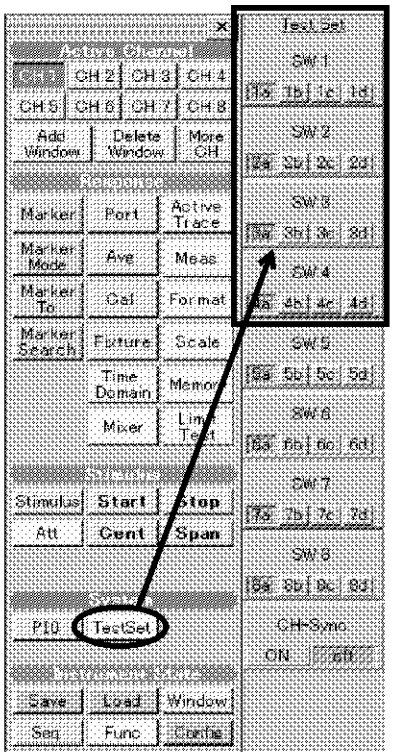
Set the ***SW4*** to ***4a*** for the path from PORT 4 to PORT 4a.
Set the ***SW4*** to ***4b*** for the path from PORT 4 to PORT 4b.
Set the ***SW4*** to ***4c*** for the path from PORT 4 to PORT 4c.
Set the ***SW4*** to ***4d*** for the path from PORT 4 to PORT 4d.

4.3 R3969/R3970 OPT16

This section describes how to set the path of the R3969 OPT16 or R3970 OPT16, which is shown in Table 4-3, by using the SW1, SW2, SW3, and SW4 on the R3860A, R3768, or the R3770 Network Analyzer operation panel shown below.

Table 4-3 Path Selection of the Test Set (OPT16)

Test port \ Switch	SW1	SW2	SW3	SW4
PORT 1 → PORT 1a	1a			
PORT 1 → PORT 1b	1b			
PORT 1 → PORT 1c	1c			
PORT 1 → PORT 1d	1d			
PORT 2 → PORT 2a		2a		
PORT 2 → PORT 2b		2b		
PORT 2 → PORT 2c		2c		
PORT 2 → PORT 2d		2d		
PORT 3 → PORT 3a			3a	
PORT 3 → PORT 3b			3b	
PORT 3 → PORT 3c			3c	
PORT 3 → PORT 3d			3d	
PORT 4 → PORT 4a				4a
PORT 4 → PORT 4b				4b
PORT 4 → PORT 4c				4c
PORT 4 → PORT 4d				4d



Network Analyzer Operation Panel

Set the ***SW1*** to ***1a*** for the path from PORT 1 to PORT 1a.
Set the ***SW1*** to ***1b*** for the path from PORT 1 to PORT 1b.
Set the ***SW1*** to ***1c*** for the path from PORT 1 to PORT 1c.
Set the ***SW1*** to ***1d*** for the path from PORT 1 to PORT 1d.

Set the ***SW2*** to ***2a*** for the path from PORT 2 to PORT 2a.
Set the ***SW2*** to ***2b*** for the path from PORT 2 to PORT 2b.
Set the ***SW2*** to ***2c*** for the path from PORT 2 to PORT 2c.
Set the ***SW2*** to ***2d*** for the path from PORT 2 to PORT 2d.

Set the ***SW3*** to ***3a*** for the path from PORT 3 to PORT 3a.
Set the ***SW3*** to ***3b*** for the path from PORT 3 to PORT 3b.
Set the ***SW3*** to ***3c*** for the path from PORT 3 to PORT 3c.
Set the ***SW3*** to ***3d*** for the path from PORT 3 to PORT 3d.

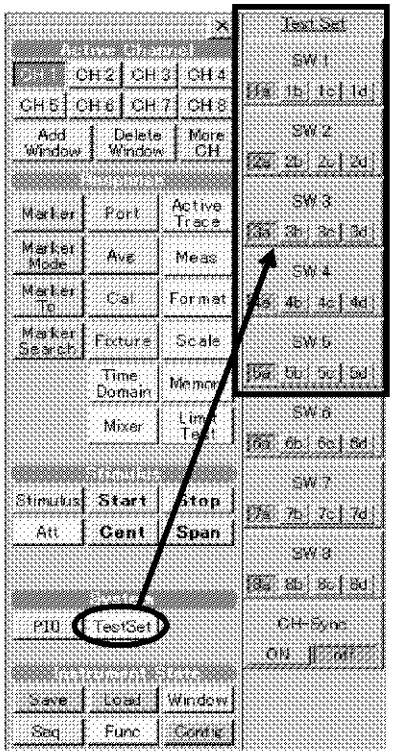
Set the ***SW4*** to ***4a*** for the path from PORT 4 to PORT 4a.
Set the ***SW4*** to ***4b*** for the path from PORT 4 to PORT 4b.
Set the ***SW4*** to ***4c*** for the path from PORT 4 to PORT 4c.
Set the ***SW4*** to ***4d*** for the path from PORT 4 to PORT 4d.

4.4 R3969/R3970 OPT17

This section describes how to set the path of the R3969 OPT17 or R3970 OPT17, which is shown in Table 4-4, by using the SW1, SW2, SW3, SW4, and SW5 on the R3860A, R3768, or the R3770 Network Analyzer operation panel shown below.

Table 4-4 Path Selection of the Test Set (OPT17)

Test port \ Switch	SW1	SW2	SW3	SW4	SW5
PORT 1 → PORT 1a	1a				
PORT 1 → PORT 2a	1d				5b
PORT 2 → PORT 2a		2a			5a
PORT 2 → PORT 2b		2b			
PORT 2 → PORT 2c		2c			
PORT 3 → PORT 3a			3a		
PORT 3 → PORT 3b			3b		
PORT 3 → PORT 3c			3c		
PORT 3 → PORT 3d			3d		
PORT 4 → PORT 4a				4a	
PORT 4 → PORT 4b				4b	
PORT 4 → PORT 4c				4c	
PORT 4 → PORT 4d				4d	



Network Analyzer Operation Panel

Set the ***SW1*** to ***1a*** for the path from PORT 1 to PORT 1a.
Set the ***SW1*** to ***1d*** and the ***SW5*** to ***5b*** for the path from PORT 1 to PORT 2a.

Set the ***SW2*** to ***2a*** and the ***SW5*** to ***5a*** for the path from PORT 2 to PORT 2a.
Set the ***SW2*** to ***2b*** for the path from PORT 2 to PORT 2b.
Set the ***SW2*** to ***2c*** for the path from PORT 2 to PORT 2c.

Set the ***SW3*** to ***3a*** for the path from PORT 3 to PORT 3a.
Set the ***SW3*** to ***3b*** for the path from PORT 3 to PORT 3b.
Set the ***SW3*** to ***3c*** for the path from PORT 3 to PORT 3c.
Set the ***SW3*** to ***3d*** for the path from PORT 3 to PORT 3d.

Set the ***SW4*** to ***4a*** for the path from PORT 4 to PORT 4a.
Set the ***SW4*** to ***4b*** for the path from PORT 4 to PORT 4b.
Set the ***SW4*** to ***4c*** for the path from PORT 4 to PORT 4c.
Set the ***SW4*** to ***4d*** for the path from PORT 4 to PORT 4d.

5. MEASUREMENT

5.1 Overview

CAUTION: ***Use the 50 Ω calibration kit and cables in this instrument. Before performing the calibration, set the appropriate type of calibration kit and connectors (either Female or Male) according to the type of connectors on this instrument.***

The S-parameter is selected by using the **MEAS** key and the measuring path is selected by using the keys in the MULTI PORT menu. The combinations of S-parameter and measuring path are listed in Table 5-1 to Table 5-4.

- R3969/R3970 OPT12

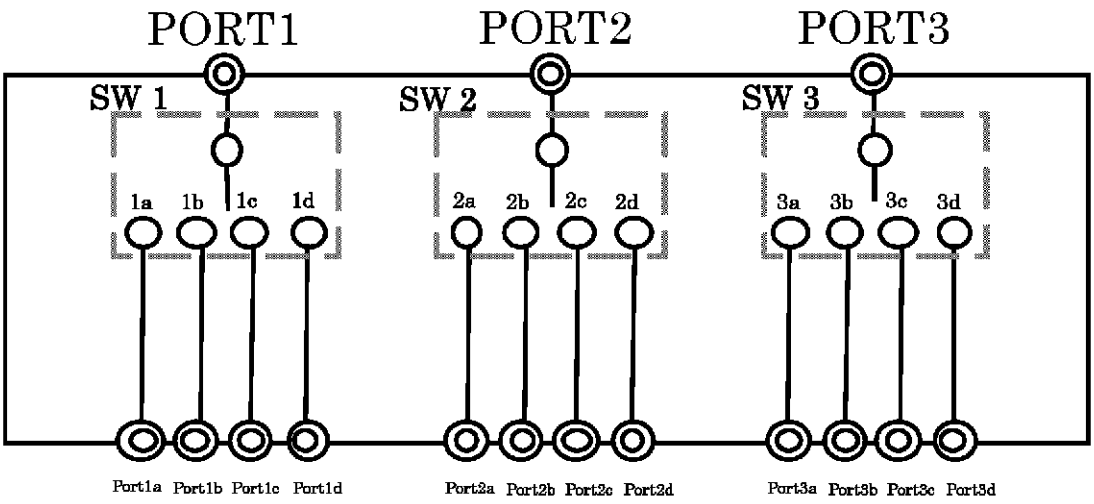


Table 5-1 Combination of S-parameter and Measuring Path (OPT12)

Meas	Measuring path
S11	PORT 1a,1b,1c,1d (Reflection characteristics)
S12	PORT (2a,2b,2c,2d) to PORT (1a,1b,1c,1d) (Transmission characteristics)
S13	PORT (3a,3b,3c,3d) to PORT (1a,1b,1c,1d) (Transmission characteristics)
S21	PORT (1a,1b,1c,1d) to PORT (2a,2b,2c,2d) (Transmission characteristics)
S22	PORT (2a,2b,2c,2d) (Reflection characteristics)
S23	PORT (3a,3b,3c,3d) to PORT (2a,2b,2c,2d) (Transmission characteristics)
S31	PORT (1a,1b,1c,1d) to PORT (3a,3b,3c,3d) (Transmission characteristics)
S32	PORT (2a,2b,2c,2d) to PORT (3a,3b,3c,3d) (Transmission characteristics)
S33	PORT (3a,3b,3c,3d) (Reflection characteristics)

- R3969/R3970 OPT15

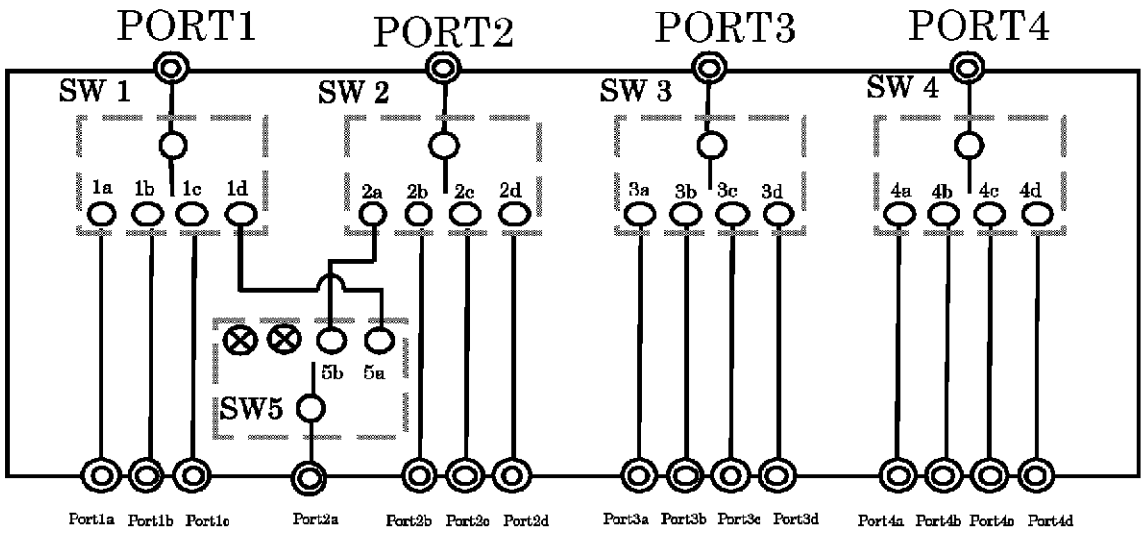


Table 5-2 Combination of S-parameter and Measuring Path (OPT15)

Meas	Measuring path
S11	PORT (1a,1b,1c,2a) (Reflection characteristics)
S12	PORT (2a,2b,2c,2d) to PORT (1a,1b,1c,2a) (Transmission characteristics)
S13	PORT (3a,3b,3c,3d) to PORT (1a,1b,1c,2a) (Transmission characteristics)
S14	PORT (4a,4b,4c,4d) to PORT (1a,1b,1c,2a) (Transmission characteristics)
S21	PORT (1a,1b,1c,2a) to PORT (2a,2b,2c,2d) (Transmission characteristics)
S22	PORT (2a,2b,2c,2d) (Reflection characteristics)
S23	PORT (3a,3b,3c,3d) to PORT (2a,2b,2c,2d) (Transmission characteristics)
S24	PORT (4a,4b,4c,4d) to PORT (2a,2b,2c,2d) (Transmission characteristics)
S31	PORT (1a,1b,1c,2a) to PORT (3a,3b,3c,3d) (Transmission characteristics)
S32	PORT (2a,2b,2c,2d) to PORT (3a,3b,3c,3d) (Transmission characteristics)
S33	PORT (3a,3b,3c,3d) (Reflection characteristics)
S34	PORT (4a,4b,4c,4d) to PORT (3a,3b,3c,3d) (Transmission characteristics)
S41	PORT (1a,1b,1c,2a) to PORT (4a,4b,4c,4d) (Transmission characteristics)
S42	PORT (2a,2b,2c,2d) to PORT (4a,4b,4c,4d) (Transmission characteristics)
S43	PORT (3a,3b,3c,3d) to PORT (4a,4b,4c,4d) (Transmission characteristics)
S44	PORT (4a,4b,4c,4d) (Reflection characteristics)

- R3969/R3970 OPT16

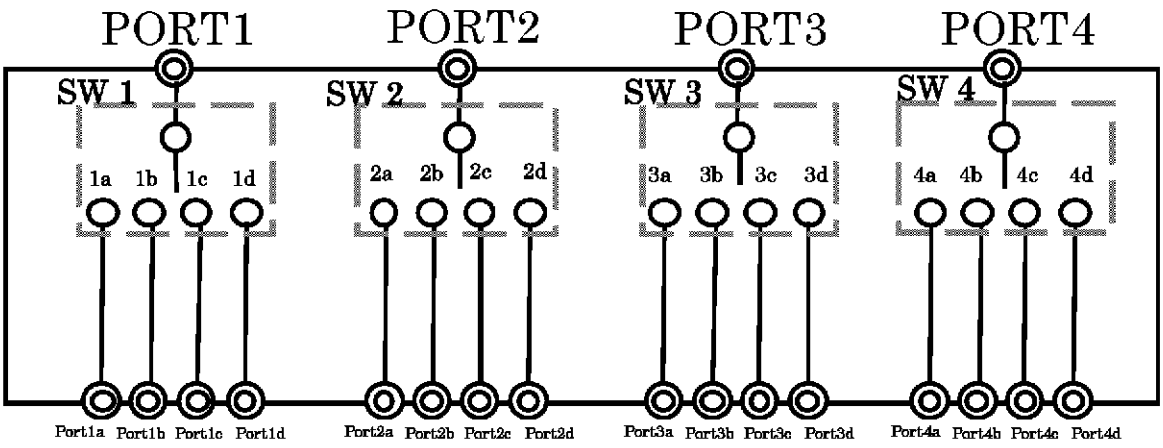


Table 5-3 Combination of S-parameter and Measuring Path (OPT16)

Meas	Measuring path
S11	PORT 1a,1b,1c,1d (Reflection characteristics)
S12	PORT (2a,2b,2c,2d) to PORT (1a,1b,1c,1d) (Transmission characteristics)
S13	PORT (3a,3b,3c,3d) to PORT (1a,1b,1c,1d) (Transmission characteristics)
S14	PORT (4a,4b,4c,4d) to PORT (1a,1b,1c,1d) (Transmission characteristics)
S21	PORT (1a,1b,1c,1d) to PORT (2a,2b,2c,2d) (Transmission characteristics)
S22	PORT (2a,2b,2c,2d) (Reflection characteristics)
S23	PORT (3a,3b,3c,3d) to PORT (2a,2b,2c,2d) (Transmission characteristics)
S24	PORT (4a,4b,4c,4d) to PORT (2a,2b,2c,2d) (Transmission characteristics)
S31	PORT (1a,1b,1c,1d) to PORT (3a,3b,3c,3d) (Transmission characteristics)
S32	PORT (2a,2b,2c,2d) to PORT (3a,3b,3c,3d) (Transmission characteristics)
S33	PORT (3a,3b,3c,3d) (Reflection characteristics)
S34	PORT (4a,4b,4c,4d) to PORT (3a,3b,3c,3d) (Transmission characteristics)
S41	PORT (1a,1b,1c,1d) to PORT (4a,4b,4c,4d) (Transmission characteristics)
S42	PORT (2a,2b,2c,2d) to PORT (4a,4b,4c,4d) (Transmission characteristics)
S43	PORT (3a,3b,3c,3d) to PORT (4a,4b,4c,4d) (Transmission characteristics)
S44	PORT (4a,4b,4c,4d) (Reflection characteristics)

- R3969/R3970 OPT17

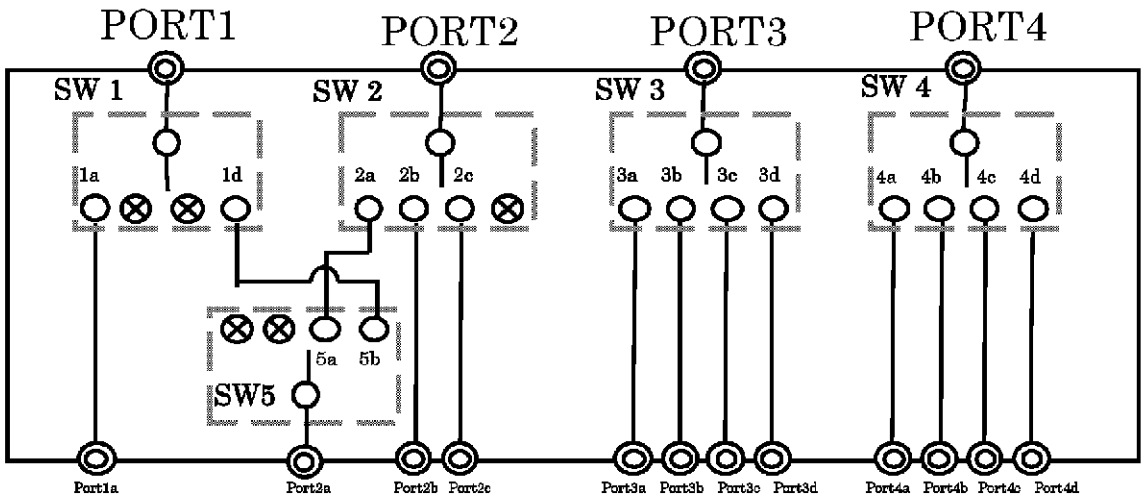


Table 5-4 Combination of S-parameter and Measuring Path (OPT17)

Meas	Measuring path
S11	PORT 1a,2a (Reflection characteristics)
S12	PORT (2a,2b,2c) to PORT (1a,2a) (Transmission characteristics)
S13	PORT (3a,3b,3c,3d) to PORT (1a,2a) (Transmission characteristics)
S14	PORT (4a,4b,4c,4d) to PORT (1a,2a) (Transmission characteristics)
S21	PORT (1a,2a) to PORT (2a,2b,2c) (Transmission characteristics)
S22	PORT (2a,2b,2c) (Reflection characteristics)
S23	PORT (3a,3b,3c,3d) to PORT (2a,2b,2c) (Transmission characteristics)
S24	PORT (4a,4b,4c,4d) to PORT (2a,2b,2c) (Transmission characteristics)
S31	PORT (1a,2a) to PORT (3a,3b,3c,3d) (Transmission characteristics)
S32	PORT (2a,2b,2c) to PORT (3a,3b,3c,3d) (Transmission characteristics)
S33	PORT (3a,3b,3c,3d) (Reflection characteristics)
S34	PORT (4a,4b,4c,4d) to PORT (3a,3b,3c,3d) (Transmission characteristics)
S41	PORT (1a,2a) to PORT (4a,4b,4c,4d) (Transmission characteristics)
S42	PORT (2a,2b,2c) to PORT (4a,4b,4c,4d) (Transmission characteristics)
S43	PORT (3a,3b,3c,3d) to PORT (4a,4b,4c,4d) (Transmission characteristics)
S44	PORT (4a,4b,4c,4d) (Reflection characteristics)

5.2 Measurement Example

This section describes an example measurement of the quad type filter module by using the R3969 OPT12 (8 GHz).

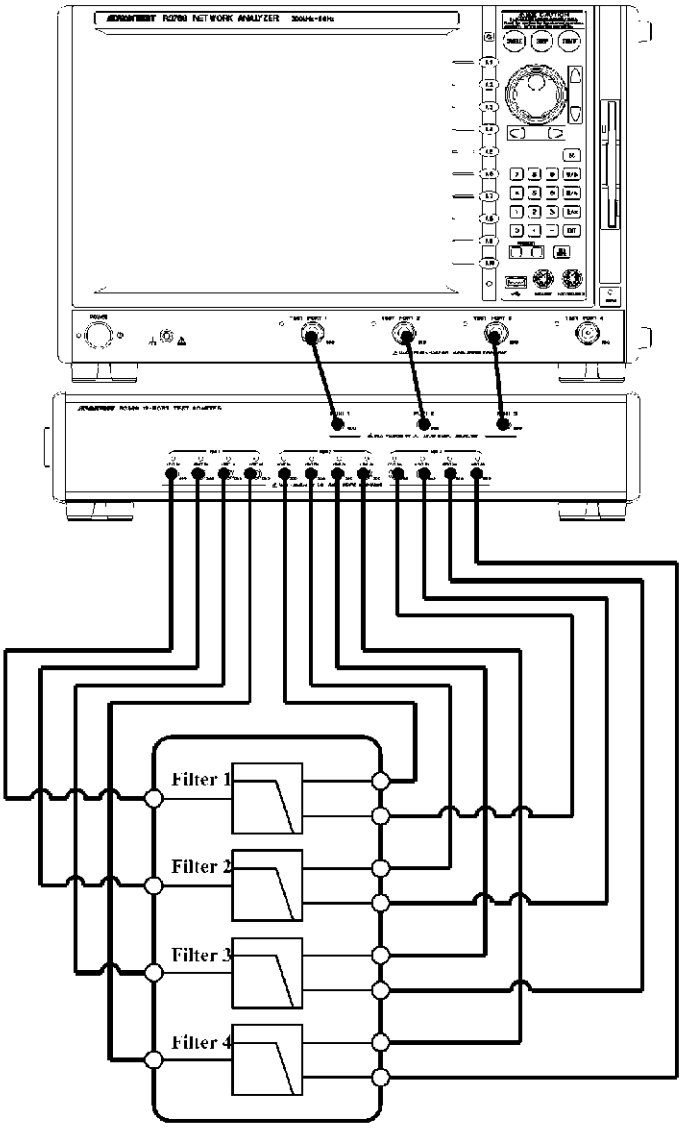


Figure 5-1 Setting up the Measurement System (OPT 12)

1. Connect this instrument to the front panel of the R3860A, R3770, or R3768. (See Section 3.1)
2. Connect this instrument to the rear panel of the R3860A, R3770, or R3768. (See Section 3.2)

3. Measure the Filter 1 characteristics in CH1 by using PORTs 1a, 2a, and 3a of this instrument.
4. Measure the Filter 2 characteristics in CH2 by using PORTs 1b, 2b, and 3b of this instrument.
5. Measure the Filter 3 characteristics in CH3 by using PORTs 1c, 2c, and 3c of this instrument.
6. Measure the Filter 4 characteristics in CH4 by using PORTs 1d, 2d, and 3d of this instrument.

CAUTION: ***The measurement conditions depend on the filter to be measured.***

Setting the measurement conditions of CH1 (Filter for JDC)

7. Initializes the settings of the R3860A, R3770, or R3768.
   Main menu:Config → ***Preset***
8. To measure the Filter 1 characteristics in CH1 by using Ports 1a, 2a, and 3a, set as follows:
   Tool menu: Port → ***P123***
   Start Frequency → **1** → **G/p**
   Stop Frequency → **1** → **.** → **6** → **G/p**
   Stimulus → **Meas Point** → **2** → **0** → **1** → **Enter**
   Avg → ***IF RBW*** → ***100kHz***
   Tool menu: Meas → ***S21***
   Tool menu: Test Set → ***1a*** → ***2a*** → ***3a***

Setting the measurement conditions of CH2 (Filter for GSM)

9. To measure the Filter 2 characteristics in CH2 by using Ports 1b, 2b, and 3b, set as follows:
   Tool menu: Active Channel → ***CH2*** → ***Add Window***
   Tool menu: Port → ***P123***
   Start Frequency → **8** → **0** → **0** → **M/n**
   Stop Frequency → **1** → **G/p**
   Stimulus → ***Meas Point*** → **2** → **0** → **1** → **Enter**
   Avg → ***IF RBW*** → ***100kHz***
   Tool menu: Meas → ***S21***
   Tool menu: Test Set → ***1b*** → ***2b*** → ***3b***

Setting the measurement conditions of CH3 (Filter for PDC)

10. To measure the Filter 3 characteristics in CH3 by using Ports 1c, 2c, and 3c, set as follows:

    Tool menu: Active Channel → CH3 → Add Window

    Tool menu: Port → P123

    ***Start Frequency* → 1 → . → 3 → G/p**

    ***Stop Frequency* → 1 → . → 6 → G/p**

    ***Stimulus* → *Meas Point* → 2 → 0 → 1 → Enter**

    Avg* → *IF RBW* → *100kHz

    Tool menu: Meas → S21

    Tool menu: Test Set → 1c → 2c → 3c

Setting the measurement conditions of CH4 (Filter for PDC 2)

11. To measure the Filter 4 characteristics in CH4 by using Ports 1d, 2d, and 3d, set as follows:

    Tool menu: Active Channel → CH4 → Add Window

    Tool menu: Port → P123

    ***Start Frequency* → 6 → 0 → 0 → M/n**

    ***Stop Frequency* → 9 → 0 → 0 → M/n**

    ***Stimulus* → *Meas Point* → 2 → 0 → 1 → Enter**

    Avg* → *IF RBW* → *100kHz

    Tool menu: Meas → S21

    Tool menu: Test Set → 1d → 2d → 3d

Calibration of CH1

12. Perform the 3-port full calibration at Ports 1a, 2a, and 3a.

    Connect the R17052A Automatic Calibration Kit to Ports 1a, 2a, and 3a of this instrument.

    Tool menu: Cal → Auto Cal

    Confirm the message "Auto Cal: Completed" is displayed.

Calibration of CH2

13. Perform the 3-port full calibration at Ports 1b, 2b, and 3b.

    Connect the R17052A Automatic Calibration Kit to Ports 1b, 2b, and 3b of this instrument.

    Tool menu: Cal → Auto Cal

    Confirm the message "Auto Cal: Completed" is displayed.

Calibration of CH3

14. Perform the 3-port full calibration at Ports 1c, 2c, and 3c.

    Connect the R17052A Automatic Calibration Kit to Ports 1c, 2c, and 3c of this instrument.

    Tool menu: Cal → Auto Cal

    Confirm the message "Auto Cal: Completed" is displayed.

Calibration of CH4

15. Perform the 3-port full calibration at Ports 1d, 2d, and 3d.

    Connect the R17052A Automatic Calibration Kit to Ports 1d, 2d, and 3d of this instrument.

    Tool menu: Cal → Auto Cal

    Confirm the message "Auto Cal: Completed" is displayed.

16. Set the software fixture.

    Set as follows in CH1, CH2, CH3, and CH4 separately.

    Tool menu: Fixture → Soft Fixture → ON

    Software Balun function: Fixture → Balance Meas → Balun → ON

Checking the measurement results

17. After completing the setting until the step 16, connect this instrument to the device as shown in Figure 5-1.

    The measurement values can be checked by using the marker function of the R3860A, R3770, or R3768.

    The measurement results are displayed on the screen.

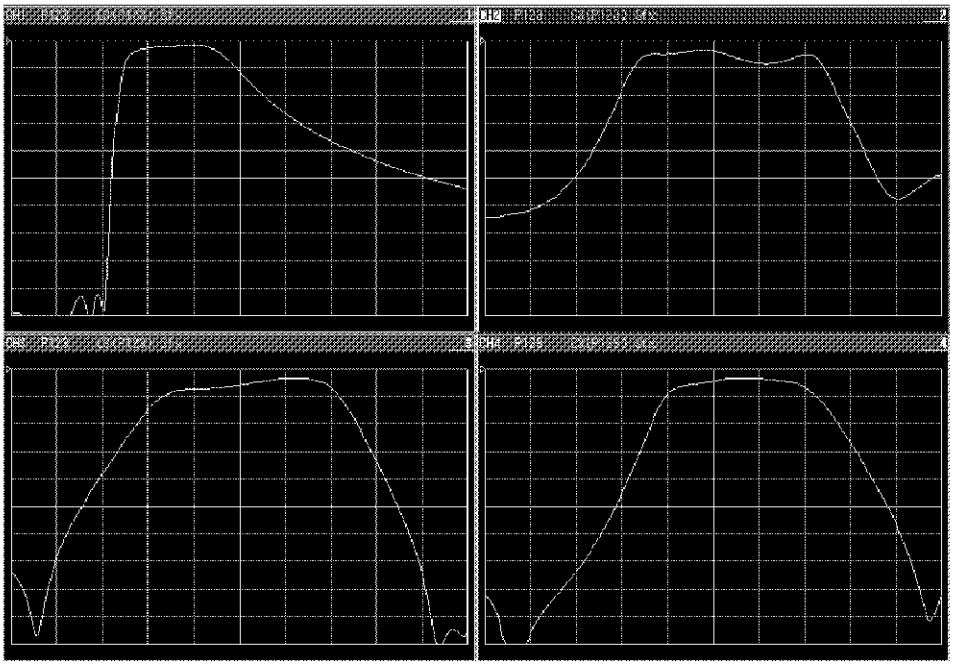


Figure 5-2 Display Example of the Measurement Results

6. OPERATION DESCRIPTION

6.1 R3969/R3970 OPT12

6.1.1 Block Diagram

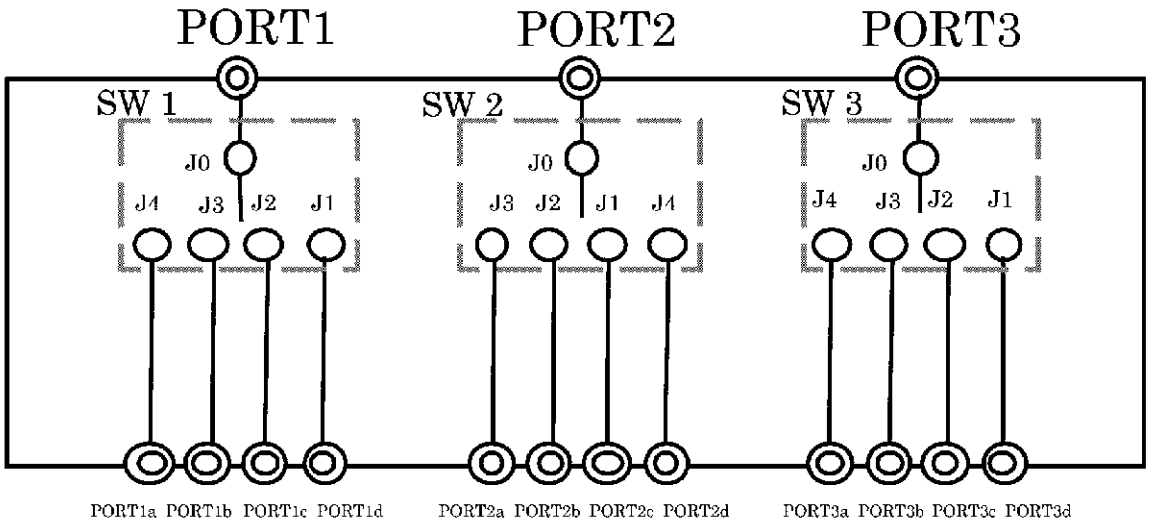


Figure 6-1 Block Diagram of the R3969 and the R3970 OPT12

6.1.2 Reflection Characteristics

According to the following paths, signals output from the R3860A, R3770, or R3768 are input to each port of this instrument and reflection characteristics are analyzed.

1. S11

<PORT 1a>
SW1(J0 → J4) → DUT → SW1(J4 → J0)
<PORT 1b>
SW1(J0 → J3) → DUT → SW1(J3 → J0)
<PORT 1c>
SW1(J0 → J2) → DUT → SW1(J2 → J0)
<PORT 1d>
SW1(J0 → J1) → DUT → SW1(J1 → J0)

2. S22

<PORT 2a>
SW2(J0 → J3) → DUT → SW2(J3 → J0)
<PORT 2b>
SW2(J0 → J2) → DUT → SW2(J2 → J0)
<PORT 2c>
SW2(J0 → J1) → DUT → SW2(J1 → J0)
<PORT 2d>
SW2(J0 → J4) → DUT → SW2(J4 → J0)

3. S33

<PORT 3a>
SW3(J0 → J4) → DUT → SW3(J4 → J0)
<PORT 3b>
SW3(J0 → J3) → DUT → SW3(J3 → J0)
<PORT 3c>
SW3(J0 → J2) → DUT → SW3(J2 → J0)
<PORT 3d>
SW3(J0 → J1) → DUT → SW3(J1 → J0)

6.1.3 Transmission Characteristics

According to the following paths, signals output from the R3860A, R3770, or R3768 are input to each port of this instrument and transmission characteristics are analyzed.

1. S21

<PORT 1 ~ PORT 1a ~ DUT ~ PORT 2a ~ PORT 2>
SW1(J0 → J4) → DUT → SW2(J3 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 2b ~ PORT 2>
SW1(J0 → J4) → DUT → SW2(J2 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 2c ~ PORT 2>
SW1(J0 → J4) → DUT → SW2(J1 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 2d ~ PORT 2>
SW1(J0 → J4) → DUT → SW2(J4 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 2a ~ PORT 2>
SW1(J0 → J3) → DUT → SW2(J3 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 2b ~ PORT 2>
SW1(J0 → J3) → DUT → SW2(J2 → J0)

<PORT 1 ~ PORT 1b ~ DUT ~ PORT 2c ~ PORT 2>
SW1(J0 → J3) → DUT → SW2(J1 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 2d ~ PORT 2>
SW1(J0 → J3) → DUT → SW2(J4 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 2a ~ PORT 2>
SW1(J0 → J2) → DUT → SW2(J3 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 2b ~ PORT 2>
SW1(J0 → J2) → DUT → SW2(J2 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 2c ~ PORT 2>
SW1(J0 → J2) → DUT → SW2(J1 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 2d ~ PORT 2>
SW1(J0 → J2) → DUT → SW2(J4 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 2a ~ PORT 2>
SW1(J0 → J1) → DUT → SW2(J3 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 2b ~ PORT 2>
SW1(J0 → J1) → DUT → SW2(J2 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 2c ~ PORT 2>
SW1(J0 → J1) → DUT → SW2(J1 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 2d ~ PORT 2>
SW1(J0 → J1) → DUT → SW2(J4 → J0)

2. S12

<PORT 2 ~ PORT 2a ~ DUT ~ PORT 1a ~ PORT 1>
SW2(J0 → J3) → DUT → SW1(J4 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 1b ~ PORT 1>
SW2(J0 → J3) → DUT → SW1(J3 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 1c ~ PORT 1>
SW2(J0 → J3) → DUT → SW1(J2 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 1d ~ PORT 1>
SW2(J0 → J3) → DUT → SW1(J1 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 1a ~ PORT 1>
SW2(J0 → J2) → DUT → SW1(J4 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 1b ~ PORT 1>
SW2(J0 → J2) → DUT → SW1(J3 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 1c ~ PORT 1>
SW2(J0 → J2) → DUT → SW1(J2 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 1d ~ PORT 1>
SW2(J0 → J2) → DUT → SW1(J1 → J0)

<PORT 2 ~ PORT 2c ~ DUT ~ PORT 1a ~ PORT 1>
SW2(J0 → J1) → DUT → SW1(J4 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 1b ~ PORT 1>
SW2(J0 → J1) → DUT → SW1(J3 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 1c ~ PORT 1>
SW2(J0 → J1) → DUT → SW1(J2 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 1d ~ PORT 1>
SW2(J0 → J1) → DUT → SW1(J1 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 1a ~ PORT 1>
SW2(J0 → J4) → DUT → SW1(J4 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 1b ~ PORT 1>
SW2(J0 → J4) → DUT → SW1(J3 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 1c ~ PORT 1>
SW2(J0 → J4) → DUT → SW1(J2 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 1d ~ PORT 1>
SW2(J0 → J4) → DUT → SW1(J1 → J0)

3. S31

<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3a ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J4 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3b ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J3 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3c ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J2 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3d ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J1 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 3a ~ PORT 3>
SW1(J0 → J3) → DUT → SW3(J4 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 3b ~ PORT 3>
SW1(J0 → J3) → DUT → SW3(J3 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 3c ~ PORT 3>
SW1(J0 → J3) → DUT → SW3(J2 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 3d ~ PORT 3>
SW1(J0 → J3) → DUT → SW3(J1 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 3a ~ PORT 3>
SW1(J0 → J2) → DUT → SW3(J4 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 3b ~ PORT 3>
SW1(J0 → J2) → DUT → SW3(J3 → J0)

<PORT 1 ~ PORT 1c ~ DUT ~ PORT 3c ~ PORT 3>
SW1(J0 → J2) → DUT → SW3(J2 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 3d ~ PORT 3>
SW1(J0 → J2) → DUT → SW3(J1 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 3a ~ PORT 3>
SW1(J0 → J1) → DUT → SW3(J4 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 3b ~ PORT 3>
SW1(J0 → J1) → DUT → SW3(J3 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 3c ~ PORT 3>
SW1(J0 → J1) → DUT → SW3(J2 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 3d ~ PORT 3>
SW1(J0 → J1) → DUT → SW3(J1 → J0)

4. S13

<PORT 3 ~ PORT 3a ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J4) → DUT → SW1(J4 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 1b ~ PORT 1>
SW3(J0 → J4) → DUT → SW1(J3 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 1c ~ PORT 1>
SW3(J0 → J4) → DUT → SW1(J2 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 1d ~ PORT 1>
SW3(J0 → J4) → DUT → SW1(J1 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J3) → DUT → SW1(J4 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 1b ~ PORT 1>
SW3(J0 → J3) → DUT → SW1(J3 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 1c ~ PORT 1>
SW3(J0 → J3) → DUT → SW1(J2 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 1d ~ PORT 1>
SW3(J0 → J3) → DUT → SW1(J1 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J2) → DUT → SW1(J4 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 1b ~ PORT 1>
SW3(J0 → J2) → DUT → SW1(J3 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 1c ~ PORT 1>
SW3(J0 → J2) → DUT → SW1(J2 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 1d ~ PORT 1>
SW3(J0 → J2) → DUT → SW1(J1 → J0)

<PORT 3 ~ PORT 3d ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J1) → DUT → SW1(J4 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 1b ~ PORT 1>
SW3(J0 → J1) → DUT → SW1(J3 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 1c ~ PORT 1>
SW3(J0 → J1) → DUT → SW1(J2 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 1d ~ PORT 1>
SW3(J0 → J1) → DUT → SW1(J1 → J0)

5. S32

<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3a ~ PORT 3>
SW2(J0 → J3) → DUT → SW3(J4 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3b ~ PORT 3>
SW2(J0 → J3) → DUT → SW3(J3 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3c ~ PORT 3>
SW2(J0 → J3) → DUT → SW3(J2 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3d ~ PORT 3>
SW2(J0 → J3) → DUT → SW3(J1 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3a ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J4 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3b ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J3 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3c ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J2 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3d ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J1 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3a ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J4 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3b ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J3 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3c ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J2 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3d ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J1 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 3a ~ PORT 3>
SW2(J0 → J4) → DUT → SW3(J4 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 3b ~ PORT 3>
SW2(J0 → J4) → DUT → SW3(J3 → J0)

<PORT 2 ~ PORT 2d ~ DUT ~ PORT 3c ~ PORT 3>
SW2(J0 → J4) → DUT → SW3(J2 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 3d ~ PORT 3>
SW2(J0 → J4) → DUT → SW3(J1 → J0)

6. S23

<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J4) → DUT → SW2(J3 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J4) → DUT → SW2(J2 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J4) → DUT → SW2(J1 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2d ~ PORT 2>
SW3(J0 → J4) → DUT → SW2(J4 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J3) → DUT → SW2(J3 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J3) → DUT → SW2(J2 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J3) → DUT → SW2(J1 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2d ~ PORT 2>
SW3(J0 → J3) → DUT → SW2(J4 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J2) → DUT → SW2(J3 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J2) → DUT → SW2(J2 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J2) → DUT → SW2(J1 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2d ~ PORT 2>
SW3(J0 → J2) → DUT → SW2(J4 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J1) → DUT → SW2(J3 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J1) → DUT → SW2(J2 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J1) → DUT → SW2(J1 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2d ~ PORT 2>
SW3(J0 → J1) → DUT → SW2(J4 → J0)

6.2 R3969/R3970 OPT15

6.2.1 Block Diagram

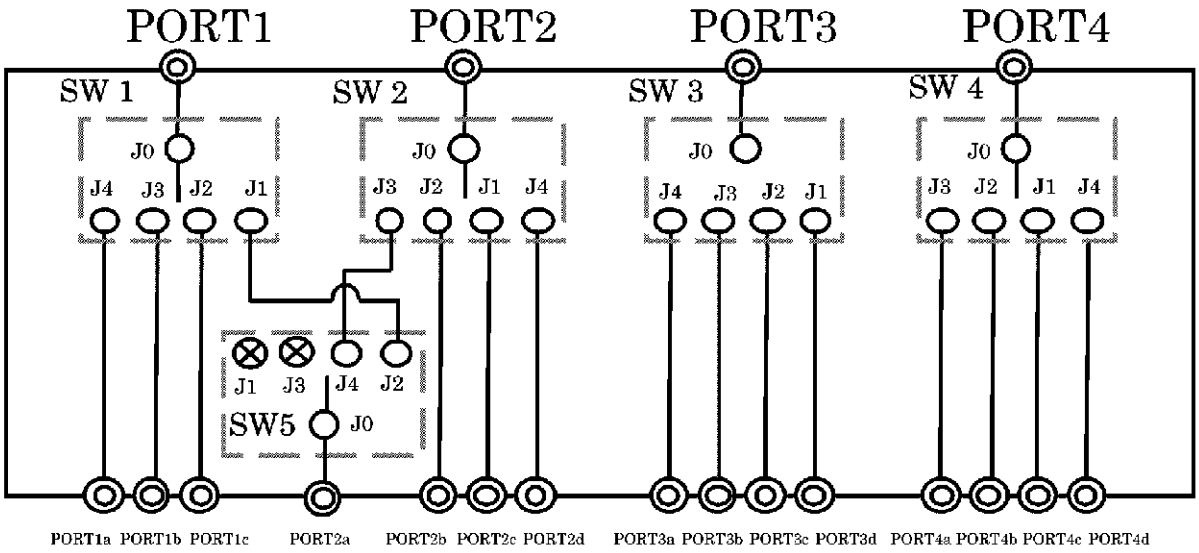


Figure 6-2 Block Diagram of the R3969 and the R3970 OPT15

6.2.2 Reflection Characteristics

According to the following paths, signals output from the R3860A, R3770, or R3768 are input to each port of this instrument and reflection characteristics are analyzed.

1. S11

<PORT 1a>
SW1(J0 → J4) → DUT → SW1(J4 → J0)
<PORT 1b>
SW1(J0 → J3) → DUT → SW1(J3 → J0)
<PORT 1c>
SW1(J0 → J2) → DUT → SW1(J2 → J0)
<PORT 2a>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW5(J0 → J2) → SW1(J1 → J0)

2. S22

<PORT 2a>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 2b>
SW2(J0 → J2) → DUT → SW2(J2 → J0)
<PORT 2c>
SW2(J0 → J1) → DUT → SW2(J1 → J0)
<PORT 2d>
SW2(J0 → J4) → DUT → SW2(J4 → J0)

3. S33

<PORT 3a>
SW3(J0 → J4) → DUT → SW3(J4 → J0)
<PORT 3b>
SW3(J0 → J3) → DUT → SW3(J3 → J0)
<PORT 3c>
SW3(J0 → J2) → DUT → SW3(J2 → J0)
<PORT 3d>
SW3(J0 → J1) → DUT → SW3(J1 → J0)

4. S44

<PORT 4a>
SW4(J0 → J3) → DUT → SW4(J3 → J0)
<PORT 4b>
SW4(J0 → J2) → DUT → SW4(J2 → J0)
<PORT 4c>
SW4(J0 → J1) → DUT → SW4(J1 → J0)
<PORT 4d>
SW4(J0 → J4) → DUT → SW4(J4 → J0)

6.2.3 Transmission Characteristics

According to the following paths, signals output from the R3860A, R3770, or R3768 are input to each port of this instrument and transmission characteristics are analyzed.

1. S21

<PORT 1 ~ PORT 1a ~ DUT ~ PORT 2a ~ PORT 2>
SW1(J0 → J4) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 2b ~ PORT 2>
SW1(J0 → J4) → DUT → SW2(J2 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 2c ~ PORT 2>
SW1(J0 → J4) → DUT → SW2(J1 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 2d ~ PORT 2>
SW1(J0 → J4) → DUT → SW2(J4 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 2a ~ PORT 2>
SW1(J0 → J3) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 2b ~ PORT 2>
SW1(J0 → J3) → DUT → SW2(J2 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 2c ~ PORT 2>
SW1(J0 → J3) → DUT → SW2(J1 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 2d ~ PORT 2>
SW1(J0 → J3) → DUT → SW2(J4 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 2a ~ PORT 2>
SW1(J0 → J2) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 2b ~ PORT 2>
SW1(J0 → J2) → DUT → SW2(J2 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 2c ~ PORT 2>
SW1(J0 → J2) → DUT → SW2(J1 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 2d ~ PORT 2>
SW1(J0 → J2) → DUT → SW2(J4 → J0)

2. S12

<PORT 2 ~ PORT 2a ~ DUT ~ PORT 1a ~ PORT 1>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW1(J4 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 1b ~ PORT 1>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW1(J3 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 1c ~ PORT 1>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW1(J2 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 1a ~ PORT 1>
SW2(J0 → J2) → DUT → SW1(J4 → J0)

<PORT 2 ~ PORT 2b ~ DUT ~ PORT 1b ~ PORT 1>
SW2(J0 → J2) → DUT → SW1(J3 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 1c ~ PORT 1>
SW2(J0 → J2) → DUT → SW1(J2 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 2a ~ PORT 1>
SW2(J0 → J2) → DUT → SW5(J0 → J2) → SW1(J1 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 1a ~ PORT 1>
SW2(J0 → J1) → DUT → SW1(J4 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 1b ~ PORT 1>
SW2(J0 → J1) → DUT → SW1(J3 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 1c ~ PORT 1>
SW2(J0 → J1) → DUT → SW1(J2 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 2a ~ PORT 1>
SW2(J0 → J1) → DUT → SW5(J0 → J2) → SW1(J1 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 1a ~ PORT 1>
SW2(J0 → J4) → DUT → SW1(J4 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 1b ~ PORT 1>
SW2(J0 → J4) → DUT → SW1(J3 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 1c ~ PORT 1>
SW2(J0 → J4) → DUT → SW1(J2 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 2a ~ PORT 1>
SW2(J0 → J4) → DUT → SW5(J0 → J2) → SW1(J1 → J0)

3. S31

<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3a ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J4 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3b ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J3 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3c ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J2 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3d ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J1 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 3a ~ PORT 3>
SW1(J0 → J3) → DUT → SW3(J4 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 3b ~ PORT 3>
SW1(J0 → J3) → DUT → SW3(J3 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 3c ~ PORT 3>
SW1(J0 → J3) → DUT → SW3(J2 → J0)

<PORT 1 ~ PORT 1b ~ DUT ~ PORT 3d ~ PORT 3>
SW1(J0 → J3) → DUT → SW3(J1 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 3a ~ PORT 3>
SW1(J0 → J2) → DUT → SW3(J4 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 3b ~ PORT 3>
SW1(J0 → J2) → DUT → SW3(J3 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 3c ~ PORT 3>
SW1(J0 → J2) → DUT → SW3(J2 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 3d ~ PORT 3>
SW1(J0 → J2) → DUT → SW3(J1 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 3a ~ PORT 3>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW3(J4 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 3b ~ PORT 3>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW3(J3 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 3c ~ PORT 3>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW3(J2 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 3d ~ PORT 3>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW3(J1 → J0)

4. S13

<PORT 3 ~ PORT 3a ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J4) → DUT → SW1(J4 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 1b ~ PORT 1>
SW3(J0 → J4) → DUT → SW1(J3 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 1c ~ PORT 1>
SW3(J0 → J4) → DUT → SW1(J2 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2a ~ PORT 1>
SW3(J0 → J4) → DUT → SW5(J0 → J2) → SW1(J1 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J3) → DUT → SW1(J4 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 1b ~ PORT 1>
SW3(J0 → J3) → DUT → SW1(J3 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 1c ~ PORT 1>
SW3(J0 → J3) → DUT → SW1(J2 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2a ~ PORT 1>
SW3(J0 → J3) → DUT → SW5(J0 → J2) → SW1(J1 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J2) → DUT → SW1(J4 → J0)

<PORT 3 ~ PORT 3c ~ DUT ~ PORT 1b ~ PORT 1>
SW3(J0 → J2) → DUT → SW1(J3 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 1c ~ PORT 1>
SW3(J0 → J2) → DUT → SW1(J2 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2a ~ PORT 1>
SW3(J0 → J2) → DUT → SW5(J0 → J2) → SW1(J1 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J1) → DUT → SW1(J4 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 1b ~ PORT 1>
SW3(J0 → J1) → DUT → SW1(J3 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 1c ~ PORT 1>
SW3(J0 → J1) → DUT → SW1(J2 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2a ~ PORT 1>
SW3(J0 → J1) → DUT → SW5(J0 → J2) → SW1(J1 → J0)

5. S41

<PORT 1 ~ PORT 1a ~ DUT ~ PORT 4a ~ PORT 4>
SW1(J0 → J4) → DUT → SW4(J3 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 4b ~ PORT 4>
SW1(J0 → J4) → DUT → SW4(J2 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 4c ~ PORT 4>
SW1(J0 → J4) → DUT → SW4(J1 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 4d ~ PORT 4>
SW1(J0 → J4) → DUT → SW4(J4 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 4a ~ PORT 4>
SW1(J0 → J3) → DUT → SW4(J3 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 4b ~ PORT 4>
SW1(J0 → J3) → DUT → SW4(J2 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 4c ~ PORT 4>
SW1(J0 → J3) → DUT → SW4(J1 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 4d ~ PORT 4>
SW1(J0 → J3) → DUT → SW4(J4 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 4a ~ PORT 4>
SW1(J0 → J2) → DUT → SW4(J3 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 4b ~ PORT 4>
SW1(J0 → J2) → DUT → SW4(J2 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 4c ~ PORT 4>
SW1(J0 → J2) → DUT → SW4(J1 → J0)

<PORT 1 ~ PORT 1c ~ DUT ~ PORT 4d ~ PORT 4>
SW1(J0 → J2) → DUT → SW4(J4 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 4a ~ PORT 4>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW4(J3 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 4b ~ PORT 4>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW4(J2 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 4c ~ PORT 4>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW4(J1 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 4d ~ PORT 4>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW4(J4 → J0)

6. S14

<PORT 4 ~ PORT 4a ~ DUT ~ PORT 1a ~ PORT 1>
SW4(J0 → J3) → DUT → SW1(J4 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 1b ~ PORT 1>
SW4(J0 → J3) → DUT → SW1(J3 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 1c ~ PORT 1>
SW4(J0 → J3) → DUT → SW1(J2 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 2a ~ PORT 1>
SW4(J0 → J3) → DUT → SW5(J0 → J2) → SW1(J1 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 1a ~ PORT 1>
SW4(J0 → J2) → DUT → SW1(J4 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 1b ~ PORT 1>
SW4(J0 → J2) → DUT → SW1(J3 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 1c ~ PORT 1>
SW4(J0 → J2) → DUT → SW1(J2 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 2a ~ PORT 1>
SW4(J0 → J2) → DUT → SW5(J0 → J2) → SW1(J1 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 1a ~ PORT 1>
SW4(J0 → J1) → DUT → SW1(J4 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 1b ~ PORT 1>
SW4(J0 → J1) → DUT → SW1(J3 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 1c ~ PORT 1>
SW4(J0 → J1) → DUT → SW1(J2 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 2a ~ PORT 1>
SW4(J0 → J1) → DUT → SW5(J0 → J2) → SW1(J1 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 1a ~ PORT 1>
SW4(J0 → J4) → DUT → SW1(J4 → J0)

<PORT 4 ~ PORT 4d ~ DUT ~ PORT 1b ~ PORT 1>
SW4(J0 → J4) → DUT → SW1(J3 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 1c ~ PORT 1>
SW4(J0 → J4) → DUT → SW1(J2 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 2a ~ PORT 1>
SW4(J0 → J4) → DUT → SW5(J0 → J2) → SW1(J1 → J0)

7. S32

<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3a ~ PORT 3>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW3(J4 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3b ~ PORT 3>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW3(J3 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3c ~ PORT 3>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW3(J2 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3d ~ PORT 3>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW3(J1 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3a ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J4 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3b ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J3 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3c ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J2 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3d ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J1 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3a ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J4 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3b ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J3 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3c ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J2 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3d ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J1 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 3a ~ PORT 3>
SW2(J0 → J4) → DUT → SW3(J4 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 3b ~ PORT 3>
SW2(J0 → J4) → DUT → SW3(J3 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 3c ~ PORT 3>
SW2(J0 → J4) → DUT → SW3(J2 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 3d ~ PORT 3>
SW2(J0 → J4) → DUT → SW3(J1 → J0)

8. S23

<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J4) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J4) → DUT → SW2(J2 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J4) → DUT → SW2(J1 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2d ~ PORT 2>
SW3(J0 → J4) → DUT → SW2(J4 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J3) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J3) → DUT → SW2(J2 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J3) → DUT → SW2(J1 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2d ~ PORT 2>
SW3(J0 → J3) → DUT → SW2(J4 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J2) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J2) → DUT → SW2(J2 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J2) → DUT → SW2(J1 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2d ~ PORT 2>
SW3(J0 → J2) → DUT → SW2(J4 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J1) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J1) → DUT → SW2(J2 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J1) → DUT → SW2(J1 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2d ~ PORT 2>
SW3(J0 → J1) → DUT → SW2(J4 → J0)

9. S42

<PORT 2 ~ PORT 2a ~ DUT ~ PORT 4a ~ PORT 4>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW4(J3 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 4b ~ PORT 4>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW4(J2 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 4c ~ PORT 4>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW4(J1 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 4d ~ PORT 4>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW4(J4 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 4a ~ PORT 4>
SW2(J0 → J2) → DUT → SW4(J3 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 4b ~ PORT 4>
SW2(J0 → J2) → DUT → SW4(J2 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 4c ~ PORT 4>
SW2(J0 → J2) → DUT → SW4(J1 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 4d ~ PORT 4>
SW2(J0 → J2) → DUT → SW4(J4 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 4a ~ PORT 4>
SW2(J0 → J1) → DUT → SW4(J3 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 4b ~ PORT 4>
SW2(J0 → J1) → DUT → SW4(J2 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 4c ~ PORT 4>
SW2(J0 → J1) → DUT → SW4(J1 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 4d ~ PORT 4>
SW2(J0 → J1) → DUT → SW4(J4 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 4a ~ PORT 4>
SW2(J0 → J4) → DUT → SW4(J3 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 4b ~ PORT 4>
SW2(J0 → J4) → DUT → SW4(J2 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 4c ~ PORT 4>
SW2(J0 → J4) → DUT → SW4(J1 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 4d ~ PORT 4>
SW2(J0 → J4) → DUT → SW4(J4 → J0)

10. S24

<PORT 4 ~ PORT 4a ~ DUT ~ PORT 2a ~ PORT 2>
SW4(J0 → J3) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 2b ~ PORT 2>
SW4(J0 → J3) → DUT → SW2(J2 → J0)

<PORT 4 ~ PORT 4a ~ DUT ~ PORT 2c ~ PORT 2>
SW4(J0 → J3) → DUT → SW2(J1 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 2d ~ PORT 2>
SW4(J0 → J3) → DUT → SW2(J4 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 2a ~ PORT 2>
SW4(J0 → J2) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 2b ~ PORT 2>
SW4(J0 → J2) → DUT → SW2(J2 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 2c ~ PORT 2>
SW4(J0 → J2) → DUT → SW2(J1 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 2d ~ PORT 2>
SW4(J0 → J2) → DUT → SW2(J4 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 2a ~ PORT 2>
SW4(J0 → J1) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 2b ~ PORT 2>
SW4(J0 → J1) → DUT → SW2(J2 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 2c ~ PORT 2>
SW4(J0 → J1) → DUT → SW2(J1 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 2d ~ PORT 2>
SW4(J0 → J1) → DUT → SW2(J4 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 2a ~ PORT 2>
SW4(J0 → J4) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 2b ~ PORT 2>
SW4(J0 → J4) → DUT → SW2(J2 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 2c ~ PORT 2>
SW4(J0 → J4) → DUT → SW2(J1 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 2d ~ PORT 2>
SW4(J0 → J4) → DUT → SW2(J4 → J0)

11. S43

<PORT 3 ~ PORT 3a ~ DUT ~ PORT 4a ~ PORT 4>
SW3(J0 → J4) → DUT → SW4(J3 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 4b ~ PORT 4>
SW3(J0 → J4) → DUT → SW4(J2 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 4c ~ PORT 4>
SW3(J0 → J4) → DUT → SW4(J1 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 4d ~ PORT 4>
SW3(J0 → J4) → DUT → SW4(J4 → J0)

<PORT 3 ~ PORT 3b ~ DUT ~ PORT 4a ~ PORT 4>
SW3(J0 → J3) → DUT → SW4(J3 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 4b ~ PORT 4>
SW3(J0 → J3) → DUT → SW4(J2 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 4c ~ PORT 4>
SW3(J0 → J3) → DUT → SW4(J1 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 4d ~ PORT 4>
SW3(J0 → J3) → DUT → SW4(J4 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 4a ~ PORT 4>
SW3(J0 → J2) → DUT → SW4(J3 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 4b ~ PORT 4>
SW3(J0 → J2) → DUT → SW4(J2 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 4c ~ PORT 4>
SW3(J0 → J2) → DUT → SW4(J1 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 4d ~ PORT 4>
SW3(J0 → J2) → DUT → SW4(J4 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 4a ~ PORT 4>
SW3(J0 → J1) → DUT → SW4(J3 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 4b ~ PORT 4>
SW3(J0 → J1) → DUT → SW4(J2 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 4c ~ PORT 4>
SW3(J0 → J1) → DUT → SW4(J1 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 4d ~ PORT 4>
SW3(J0 → J1) → DUT → SW4(J4 → J0)

12. S34

<PORT 4 ~ PORT 4a ~ DUT ~ PORT 3a ~ PORT 3>
SW4(J0 → J3) → DUT → SW3(J4 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 3b ~ PORT 3>
SW4(J0 → J3) → DUT → SW3(J3 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 3c ~ PORT 3>
SW4(J0 → J3) → DUT → SW3(J2 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 3d ~ PORT 3>
SW4(J0 → J3) → DUT → SW3(J1 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 3a ~ PORT 3>
SW4(J0 → J2) → DUT → SW3(J4 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 3b ~ PORT 3>
SW4(J0 → J2) → DUT → SW3(J3 → J0)

<PORT 4 ~ PORT 4b ~ DUT ~ PORT 3c ~ PORT 3>
SW4(J0 → J2) → DUT → SW3(J2 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 3d ~ PORT 3>
SW4(J0 → J2) → DUT → SW3(J1 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 3a ~ PORT 3>
SW4(J0 → J1) → DUT → SW3(J4 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 3b ~ PORT 3>
SW4(J0 → J1) → DUT → SW3(J3 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 3c ~ PORT 3>
SW4(J0 → J1) → DUT → SW3(J2 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 3d ~ PORT 3>
SW4(J0 → J1) → DUT → SW3(J1 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 3a ~ PORT 3>
SW4(J0 → J4) → DUT → SW3(J4 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 3b ~ PORT 3>
SW4(J0 → J4) → DUT → SW3(J3 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 3c ~ PORT 3>
SW4(J0 → J4) → DUT → SW3(J2 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 3d ~ PORT 3>
SW4(J0 → J4) → DUT → SW3(J1 → J0)

6.3 R3969/R3970 OPT16

6.3.1 Block Diagram

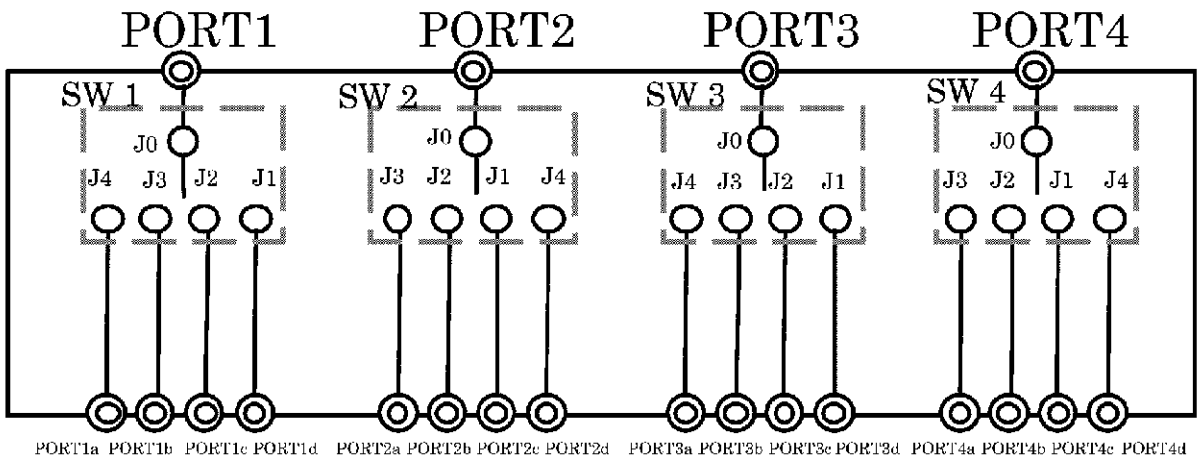


Figure 6-3 Block Diagram of the R3969 and the R3970 OPT16

6.3.2 Reflection Characteristics

According to the following paths, signals output from the R3860A, R3770, or R3768 are input to each port of this instrument and reflection characteristics are analyzed.

1. S11

<PORT 1a>
SW1(J0 → J4) → DUT → SW1(J4 → J0)
<PORT 1b>
SW1(J0 → J3) → DUT → SW1(J3 → J0)
<PORT 1c>
SW1(J0 → J2) → DUT → SW1(J2 → J0)
<PORT 1d>
SW1(J0 → J1) → DUT → SW1(J1 → J0)

2. S22

<PORT 2a>
SW2(J0 → J3) → DUT → SW2(J3 → J0)
<PORT 2b>
SW2(J0 → J2) → DUT → SW2(J2 → J0)

<PORT 2c>
SW2(J0 → J1) → DUT → SW2(J1 → J0)
<PORT 2d>
SW2(J0 → J4) → DUT → SW2(J4 → J0)

3. S33

<PORT 3a>
SW3(J0 → J4) → DUT → SW3(J4 → J0)
<PORT 3b>
SW3(J0 → J3) → DUT → SW3(J3 → J0)
<PORT 3c>
SW3(J0 → J2) → DUT → SW3(J2 → J0)
<PORT 3d>
SW3(J0 → J1) → DUT → SW3(J1 → J0)

4. S44

<PORT 4a>
SW4(J0 → J3) → DUT → SW4(J3 → J0)
<PORT 4b>
SW4(J0 → J2) → DUT → SW4(J2 → J0)
<PORT 4c>
SW4(J0 → J1) → DUT → SW4(J1 → J0)
<PORT 4d>
SW4(J0 → J4) → DUT → SW4(J4 → J0)

6.3.3 Transmission Characteristics

According to the following paths, signals output from the R3860A, R3770, or R3768 are input to each port of this instrument and transmission characteristics are analyzed.

1. S21

<PORT 1 ~ PORT 1a ~ DUT ~ PORT 2a ~ PORT 2>
SW1(J0 → J4) → DUT → SW2(J3 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 2b ~ PORT 2>
SW1(J0 → J4) → DUT → SW2(J2 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 2c ~ PORT 2>
SW1(J0 → J4) → DUT → SW2(J1 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 2d ~ PORT 2>
SW1(J0 → J4) → DUT → SW2(J4 → J0)

<PORT 1 ~ PORT 1b ~ DUT ~ PORT 2a ~ PORT 2>
SW1(J0 → J3) → DUT → SW2(J3 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 2b ~ PORT 2>
SW1(J0 → J3) → DUT → SW2(J2 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 2c ~ PORT 2>
SW1(J0 → J3) → DUT → SW2(J1 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 2d ~ PORT 2>
SW1(J0 → J3) → DUT → SW2(J4 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 2a ~ PORT 2>
SW1(J0 → J2) → DUT → SW2(J3 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 2b ~ PORT 2>
SW1(J0 → J2) → DUT → SW2(J2 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 2c ~ PORT 2>
SW1(J0 → J2) → DUT → SW2(J1 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 2d ~ PORT 2>
SW1(J0 → J2) → DUT → SW2(J4 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 2a ~ PORT 2>
SW1(J0 → J1) → DUT → SW2(J3 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 2b ~ PORT 2>
SW1(J0 → J1) → DUT → SW2(J2 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 2c ~ PORT 2>
SW1(J0 → J1) → DUT → SW2(J1 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 2d ~ PORT 2>
SW1(J0 → J1) → DUT → SW2(J4 → J0)

2. S12

<PORT 2 ~ PORT 2a ~ DUT ~ PORT 1a ~ PORT 1>
SW2(J0 → J3) → DUT → SW1(J4 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 1b ~ PORT 1>
SW2(J0 → J3) → DUT → SW1(J3 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 1c ~ PORT 1>
SW2(J0 → J3) → DUT → SW1(J2 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 1d ~ PORT 1>
SW2(J0 → J3) → DUT → SW1(J1 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 1a ~ PORT 1>
SW2(J0 → J2) → DUT → SW1(J4 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 1b ~ PORT 1>
SW2(J0 → J2) → DUT → SW1(J3 → J0)

<PORT 2 ~ PORT 2b ~ DUT ~ PORT 1c ~ PORT 1>
SW2(J0 → J2) → DUT → SW1(J2 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 1d ~ PORT 1>
SW2(J0 → J2) → DUT → SW1(J1 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 1a ~ PORT 1>
SW2(J0 → J1) → DUT → SW1(J4 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 1b ~ PORT 1>
SW2(J0 → J1) → DUT → SW1(J3 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 1c ~ PORT 1>
SW2(J0 → J1) → DUT → SW1(J2 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 1d ~ PORT 1>
SW2(J0 → J1) → DUT → SW1(J1 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 1a ~ PORT 1>
SW2(J0 → J4) → DUT → SW1(J4 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 1b ~ PORT 1>
SW2(J0 → J4) → DUT → SW1(J3 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 1c ~ PORT 1>
SW2(J0 → J4) → DUT → SW1(J2 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 1d ~ PORT 1>
SW2(J0 → J4) → DUT → SW1(J1 → J0)

3. S31

<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3a ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J4 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3b ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J3 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3c ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J2 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3d ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J1 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 3a ~ PORT 3>
SW1(J0 → J3) → DUT → SW3(J4 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 3b ~ PORT 3>
SW1(J0 → J3) → DUT → SW3(J3 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 3c ~ PORT 3>
SW1(J0 → J3) → DUT → SW3(J2 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 3d ~ PORT 3>
SW1(J0 → J3) → DUT → SW3(J1 → J0)

<PORT 1 ~ PORT 1c ~ DUT ~ PORT 3a ~ PORT 3>
SW1(J0 → J2) → DUT → SW3(J4 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 3b ~ PORT 3>
SW1(J0 → J2) → DUT → SW3(J3 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 3c ~ PORT 3>
SW1(J0 → J2) → DUT → SW3(J2 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 3d ~ PORT 3>
SW1(J0 → J2) → DUT → SW3(J1 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 3a ~ PORT 3>
SW1(J0 → J1) → DUT → SW3(J4 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 3b ~ PORT 3>
SW1(J0 → J1) → DUT → SW3(J3 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 3c ~ PORT 3>
SW1(J0 → J1) → DUT → SW3(J2 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 3d ~ PORT 3>
SW1(J0 → J1) → DUT → SW3(J1 → J0)

4. S13

<PORT 3 ~ PORT 3a ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J4) → DUT → SW1(J4 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 1b ~ PORT 1>
SW3(J0 → J4) → DUT → SW1(J3 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 1c ~ PORT 1>
SW3(J0 → J4) → DUT → SW1(J2 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 1d ~ PORT 1>
SW3(J0 → J4) → DUT → SW(J1 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J3) → DUT → SW1(J4 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 1b ~ PORT 1>
SW3(J0 → J3) → DUT → SW1(J3 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 1c ~ PORT 1>
SW3(J0 → J3) → DUT → SW1(J2 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 1d ~ PORT 1>
SW3(J0 → J3) → DUT → SW1(J1 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J2) → DUT → SW1(J4 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 1b ~ PORT 1>
SW3(J0 → J2) → DUT → SW1(J3 → J0)

<PORT 3 ~ PORT 3c ~ DUT ~ PORT 1c ~ PORT 1>
SW3(J0 → J2) → DUT → SW1(J2 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 1d ~ PORT 1>
SW3(J0 → J2) → DUT → SW1(J1 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J1) → DUT → SW1(J4 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 1b ~ PORT 1>
SW3(J0 → J1) → DUT → SW1(J3 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 1c ~ PORT 1>
SW3(J0 → J1) → DUT → SW1(J2 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 1d ~ PORT 1>
SW3(J0 → J1) → DUT → SW1(J1 → J0)

5. S41

<PORT 1 ~ PORT 1a ~ DUT ~ PORT 4a ~ PORT 4>
SW1(J0 → J4) → DUT → SW4(J3 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 4b ~ PORT 4>
SW1(J0 → J4) → DUT → SW4(J2 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 4c ~ PORT 4>
SW1(J0 → J4) → DUT → SW4(J1 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 4d ~ PORT 4>
SW1(J0 → J4) → DUT → SW4(J4 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 4a ~ PORT 4>
SW1(J0 → J3) → DUT → SW4(J3 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 4b ~ PORT 4>
SW1(J0 → J3) → DUT → SW4(J2 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 4c ~ PORT 4>
SW1(J0 → J3) → DUT → SW4(J1 → J0)
<PORT 1 ~ PORT 1b ~ DUT ~ PORT 4d ~ PORT 4>
SW1(J0 → J3) → DUT → SW4(J4 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 4a ~ PORT 4>
SW1(J0 → J2) → DUT → SW4(J3 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 4b ~ PORT 4>
SW1(J0 → J2) → DUT → SW4(J2 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 4c ~ PORT 4>
SW1(J0 → J2) → DUT → SW4(J1 → J0)
<PORT 1 ~ PORT 1c ~ DUT ~ PORT 4d ~ PORT 4>
SW1(J0 → J2) → DUT → SW4(J4 → J0)

<PORT 1 ~ PORT 1d ~ DUT ~ PORT 4a ~ PORT 4>
SW1(J0 → J1) → DUT → SW4(J3 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 4b ~ PORT 4>
SW1(J0 → J1) → DUT → SW4(J2 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 4c ~ PORT 4>
SW1(J0 → J1) → DUT → SW4(J1 → J0)
<PORT 1 ~ PORT 1d ~ DUT ~ PORT 4d ~ PORT 4>
SW1(J0 → J1) → DUT → SW4(J4 → J0)

6. S14

<PORT 4 ~ PORT 4a ~ DUT ~ PORT 1a ~ PORT 1>
SW4(J0 → J3) → DUT → SW1(J4 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 1b ~ PORT 1>
SW4(J0 → J3) → DUT → SW1(J3 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 1c ~ PORT 1>
SW4(J0 → J3) → DUT → SW1(J2 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 1d ~ PORT 1>
SW4(J0 → J3) → DUT → SW1(J1 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 1a ~ PORT 1>
SW4(J0 → J2) → DUT → SW1(J4 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 1b ~ PORT 1>
SW4(J0 → J2) → DUT → SW1(J3 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 1c ~ PORT 1>
SW4(J0 → J2) → DUT → SW1(J2 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 1d ~ PORT 1>
SW4(J0 → J2) → DUT → SW1(J1 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 1a ~ PORT 1>
SW4(J0 → J1) → DUT → SW1(J4 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 1b ~ PORT 1>
SW4(J0 → J1) → DUT → SW1(J3 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 1c ~ PORT 1>
SW4(J0 → J1) → DUT → SW1(J2 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 1d ~ PORT 1>
SW4(J0 → J1) → DUT → SW1(J1 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 1a ~ PORT 1>
SW4(J0 → J4) → DUT → SW1(J4 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 1b ~ PORT 1>
SW4(J0 → J4) → DUT → SW1(J3 → J0)

<PORT 4 ~ PORT 4d ~ DUT ~ PORT 1c ~ PORT 1>
SW4(J0 → J4) → DUT → SW1(J2 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 1d ~ PORT 1>
SW4(J0 → J4) → DUT → SW1(J1 → J0)

7. S32

<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3a ~ PORT 3>
SW2(J0 → J3) → DUT → SW3(J4 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3b ~ PORT 3>
SW2(J0 → J3) → DUT → SW3(J3 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3c ~ PORT 3>
SW2(J0 → J3) → DUT → SW3(J2 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3d ~ PORT 3>
SW2(J0 → J3) → DUT → SW3(J1 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3a ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J4 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3b ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J3 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3c ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J2 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3d ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J1 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3a ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J4 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3b ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J3 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3c ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J2 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3d ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J1 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 3a ~ PORT 3>
SW2(J0 → J4) → DUT → SW3(J4 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 3b ~ PORT 3>
SW2(J0 → J4) → DUT → SW3(J3 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 3c ~ PORT 3>
SW2(J0 → J4) → DUT → SW3(J2 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 3d ~ PORT 3>
SW2(J0 → J4) → DUT → SW3(J1 → J0)

8. S23

<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J4) → DUT → SW2(J3 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J4) → DUT → SW2(J2 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J4) → DUT → SW2(J1 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2d ~ PORT 2>
SW3(J0 → J4) → DUT → SW2(J4 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J3) → DUT → SW2(J3 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J3) → DUT → SW2(J2 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J3) → DUT → SW2(J1 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2d ~ PORT 2>
SW3(J0 → J3) → DUT → SW2(J4 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J2) → DUT → SW2(J3 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J2) → DUT → SW2(J2 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J2) → DUT → SW2(J1 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2d ~ PORT 2>
SW3(J0 → J2) → DUT → SW2(J4 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J1) → DUT → SW2(J3 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J1) → DUT → SW2(J2 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J1) → DUT → SW2(J1 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2d ~ PORT 2>
SW3(J0 → J1) → DUT → SW2(J4 → J0)

9. S42

<PORT 2 ~ PORT 2a ~ DUT ~ PORT 4a ~ PORT 4>
SW2(J0 → J3) → DUT → SW4(J3 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 4b ~ PORT 4>
SW2(J0 → J3) → DUT → SW4(J2 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 4c ~ PORT 4>
SW2(J0 → J3) → DUT → SW4(J1 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 4d ~ PORT 4>
SW2(J0 → J3) → DUT → SW4(J4 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 4a ~ PORT 4>
SW2(J0 → J2) → DUT → SW4(J3 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 4b ~ PORT 4>
SW2(J0 → J2) → DUT → SW4(J2 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 4c ~ PORT 4>
SW2(J0 → J2) → DUT → SW4(J1 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 4d ~ PORT 4>
SW2(J0 → J2) → DUT → SW4(J4 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 4a ~ PORT 4>
SW2(J0 → J1) → DUT → SW4(J3 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 4b ~ PORT 4>
SW2(J0 → J1) → DUT → SW4(J2 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 4c ~ PORT 4>
SW2(J0 → J1) → DUT → SW4(J1 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 4d ~ PORT 4>
SW2(J0 → J1) → DUT → SW4(J4 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 4a ~ PORT 4>
SW2(J0 → J4) → DUT → SW4(J3 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 4b ~ PORT 4>
SW2(J0 → J4) → DUT → SW4(J2 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 4c ~ PORT 4>
SW2(J0 → J4) → DUT → SW4(J1 → J0)
<PORT 2 ~ PORT 2d ~ DUT ~ PORT 4d ~ PORT 4>
SW2(J0 → J4) → DUT → SW4(J4 → J0)

10. S24

<PORT 4 ~ PORT 4a ~ DUT ~ PORT 2a ~ PORT 2>
SW4(J0 → J3) → DUT → SW2(J3 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 2b ~ PORT 2>
SW4(J0 → J3) → DUT → SW2(J2 → J0)

<PORT 4 ~ PORT 4a ~ DUT ~ PORT 2c ~ PORT 2>
SW4(J0 → J3) → DUT → SW2(J1 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 2d ~ PORT 2>
SW4(J0 → J3) → DUT → SW2(J4 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 2a ~ PORT 2>
SW4(J0 → J2) → DUT → SW2(J3 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 2b ~ PORT 2>
SW4(J0 → J2) → DUT → SW2(J2 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 2c ~ PORT 2>
SW4(J0 → J2) → DUT → SW2(J1 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 2d ~ PORT 2>
SW4(J0 → J2) → DUT → SW2(J4 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 2a ~ PORT 2>
SW4(J0 → J1) → DUT → SW2(J3 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 2b ~ PORT 2>
SW4(J0 → J1) → DUT → SW2(J2 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 2c ~ PORT 2>
SW4(J0 → J1) → DUT → SW2(J1 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 2d ~ PORT 2>
SW4(J0 → J1) → DUT → SW2(J4 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 2a ~ PORT 2>
SW4(J0 → J4) → DUT → SW2(J3 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 2b ~ PORT 2>
SW4(J0 → J4) → DUT → SW2(J2 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 2c ~ PORT 2>
SW4(J0 → J4) → DUT → SW2(J1 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 2d ~ PORT 2>
SW4(J0 → J4) → DUT → SW2(J4 → J0)

11. S43

<PORT 3 ~ PORT 3a ~ DUT ~ PORT 4a ~ PORT 4>
SW3(J0 → J4) → DUT → SW4(J3 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 4b ~ PORT 4>
SW3(J0 → J4) → DUT → SW4(J2 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 4c ~ PORT 4>
SW3(J0 → J4) → DUT → SW4(J1 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 4d ~ PORT 4>
SW3(J0 → J4) → DUT → SW4(J4 → J0)

<PORT 3 ~ PORT 3b ~ DUT ~ PORT 4a ~ PORT 4>
SW3(J0 → J3) → DUT → SW4(J3 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 4b ~ PORT 4>
SW3(J0 → J3) → DUT → SW4(J2 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 4c ~ PORT 4>
SW3(J0 → J3) → DUT → SW4(J1 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 4d ~ PORT 4>
SW3(J0 → J3) → DUT → SW4(J4 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 4a ~ PORT 4>
SW3(J0 → J2) → DUT → SW4(J3 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 4b ~ PORT 4>
SW3(J0 → J2) → DUT → SW4(J2 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 4c ~ PORT 4>
SW3(J0 → J2) → DUT → SW4(J1 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 4d ~ PORT 4>
SW3(J0 → J2) → DUT → SW4(J4 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 4a ~ PORT 4>
SW3(J0 → J1) → DUT → SW4(J3 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 4b ~ PORT 4>
SW3(J0 → J1) → DUT → SW4(J2 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 4c ~ PORT 4>
SW3(J0 → J1) → DUT → SW4(J1 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 4d ~ PORT 4>
SW3(J0 → J1) → DUT → SW4(J4 → J0)

12. S34

<PORT 4 ~ PORT 4a ~ DUT ~ PORT 3a ~ PORT 3>
SW4(J0 → J3) → DUT → SW3(J4 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 3b ~ PORT 3>
SW4(J0 → J3) → DUT → SW3(J3 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 3c ~ PORT 3>
SW4(J0 → J3) → DUT → SW3(J2 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 3d ~ PORT 3>
SW4(J0 → J3) → DUT → SW3(J1 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 3a ~ PORT 3>
SW4(J0 → J2) → DUT → SW3(J4 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 3b ~ PORT 3>
SW4(J0 → J2) → DUT → SW3(J3 → J0)

<PORT 4 ~ PORT 4b ~ DUT ~ PORT 3c ~ PORT 3>
SW4(J0 → J2) → DUT → SW3(J2 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 3d ~ PORT 3>
SW4(J0 → J2) → DUT → SW3(J1 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 3a ~ PORT 3>
SW4(J0 → J1) → DUT → SW3(J4 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 3b ~ PORT 3>
SW4(J0 → J1) → DUT → SW3(J3 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 3c ~ PORT 3>
SW4(J0 → J1) → DUT → SW3(J2 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 3d ~ PORT 3>
SW4(J0 → J1) → DUT → SW3(J1 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 3a ~ PORT 3>
SW4(J0 → J4) → DUT → SW3(J4 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 3b ~ PORT 3>
SW4(J0 → J4) → DUT → SW3(J3 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 3c ~ PORT 3>
SW4(J0 → J4) → DUT → SW3(J2 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 3d ~ PORT 3>
SW4(J0 → J4) → DUT → SW3(J1 → J0)

6.4 R3969/R3970 OPT17

6.4.1 Block Diagram

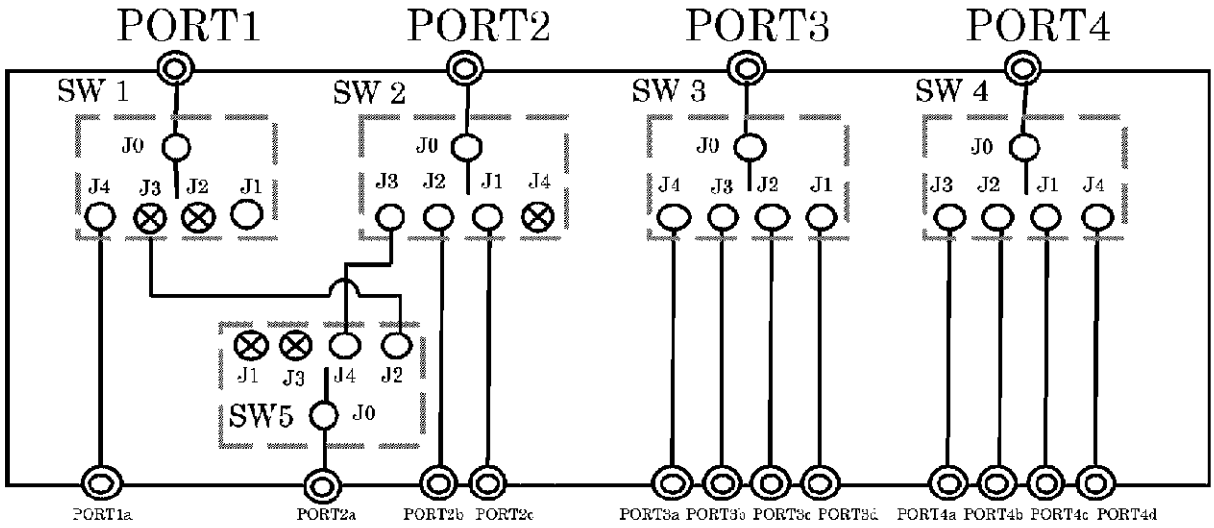


Figure 6-4 Block Diagram of the R3969 and the R3970 OPT17

6.4.2 Reflection Characteristics

According to the following paths, signals output from the R3860A, R3770, or R3768 are input to each port of this instrument and reflection characteristics are analyzed.

1. S11

<PORT 1a>
SW1(J0 → J4) → DUT → SW1(J4 → J0)
<PORT 2a>
SW1(J0 → J1)→SW5(J2 → J0) → DUT → SW5(J0 → J2) → SW1(J1 → J0)

2. S22

<PORT 2a>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 2b>
SW2(J0 → J2) → DUT → SW2(J2 → J0)
<PORT 2c>
SW2(J0 → J1) → DUT → SW2(J1 → J0)

3. S33

<PORT 3a>
SW3(J0 → J4) → DUT → SW3(J4 → J0)
<PORT 3b>
SW3(J0 → J3) → DUT → SW3(J3 → J0)
<PORT 3c>
SW3(J0 → J2) → DUT → SW3(J2 → J0)
<PORT 3d>
SW3(J0 → J1) → DUT → SW3(J1 → J0)

4. S44

<PORT 4a>
SW4(J0 → J3) → DUT → SW4(J3 → J0)
<PORT 4b>
SW4(J0 → J2) → DUT → SW4(J2 → J0)
<PORT 4c>
SW4(J0 → J1) → DUT → SW4(J1 → J0)
<PORT 4d>
SW4(J0 → J4) → DUT → SW4(J4 → J0)

6.4.3 Transmission Characteristics

According to the following paths, signals output from the R3860A, R3768, or R3770 are input to each port of this instrument and transmission characteristics are analyzed.

1. S21

<PORT 1 - PORT 1a - DUT - PORT 2a - PORT 2>
SW1(J0 → J4) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 1 - PORT 1a - DUT - PORT 2b - PORT 2>
SW1(J0 → J4) → DUT → SW2(J2 → J0)
<PORT 1 - PORT 1a - DUT - PORT 2c - PORT 2>
SW1(J0 → J4) → DUT → SW2(J1 → J0)
<PORT 1 - PORT 2a - DUT - PORT 2b - PORT 2>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW2(J2 → J0)
<PORT 1 - PORT 2a - DUT - PORT 2c - PORT 2>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW2(J1 → J0)

2. S12

<PORT 2 ~ PORT 2a ~ DUT ~ PORT 1a ~ PORT 1>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW1(J4 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 1a ~ PORT 1>
SW2(J0 → J2) → DUT → SW1(J4 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 2a ~ PORT 1>
SW2(J0 → J2) → DUT → SW5(J0 → J4) → SW1(J1 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 1a ~ PORT 1>
SW2(J0 → J1) → DUT → SW1(J4 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 2a ~ PORT 1>
SW2(J0 → J1) → DUT → SW5(J0 → J2) → SW1(J1 → J0)

3. S31

<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3a ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J4 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3b ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J3 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3c ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J2 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 3d ~ PORT 3>
SW1(J0 → J4) → DUT → SW3(J1 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 3a ~ PORT 3>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW3(J4 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 3b ~ PORT 3>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW3(J3 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 3c ~ PORT 3>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW3(J2 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 3d ~ PORT 3>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW3(J1 → J0)

4. S13

<PORT 3 ~ PORT 3a ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J4) → DUT → SW1(J4 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2a ~ PORT 1>
SW3(J0 → J4) → DUT → SW5(J0 → J2) → SW1(J1 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J3) → DUT → SW1(J4 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2a ~ PORT 1>
SW3(J0 → J3) → DUT → SW5(J0 → J2) → SW1(J1 → J0)

<PORT 3 ~ PORT 3c ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J2) → DUT → SW1(J4 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2a ~ PORT 1>
SW3(J0 → J2) → DUT → SW5(J0 → J2) → SW1(J1 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 1a ~ PORT 1>
SW3(J0 → J1) → DUT → SW1(J4 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2a ~ PORT 1>
SW3(J0 → J1) → DUT → SW5(J0 → J2) → SW1(J1 → J0)

5. S41

<PORT 1 ~ PORT 1a ~ DUT ~ PORT 4a ~ PORT 4>
SW1(J0 → J4) → DUT → SW4(J3 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 4b ~ PORT 4>
SW1(J0 → J4) → DUT → SW4(J2 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 4c ~ PORT 4>
SW1(J0 → J4) → DUT → SW4(J1 → J0)
<PORT 1 ~ PORT 1a ~ DUT ~ PORT 4d ~ PORT 4>
SW1(J0 → J4) → DUT → SW4(J4 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 4a ~ PORT 4>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW4(J3 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 4b ~ PORT 4>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW4(J2 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 4c ~ PORT 4>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW4(J1 → J0)
<PORT 1 ~ PORT 2a ~ DUT ~ PORT 4d ~ PORT 4>
SW1(J0 → J1) → SW5(J2 → J0) → DUT → SW4(J4 → J0)

6. S14

<PORT 4 ~ PORT 4a ~ DUT ~ PORT 1a ~ PORT 1>
SW4(J0 → J3) → DUT → SW1(J4 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 2a ~ PORT 1>
SW4(J0 → J3) → DUT → SW5(J0 → J2) → SW1(J1 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 1a ~ PORT 1>
SW4(J0 → J2) → DUT → SW1(J4 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 2a ~ PORT 1>
SW4(J0 → J2) → DUT → SW5(J0 → J2) → SW1(J1 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 1a ~ PORT 1>
SW4(J0 → J1) → DUT → SW1(J4 → J0)

<PORT 4 ~ PORT 4c ~ DUT ~ PORT 2a ~ PORT 1>
SW4(J0 → J1) → DUT → SW5(J0 → J2) → SW1(J1 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 1a ~ PORT 1>
SW4(J0 → J4) → DUT → SW1(J4 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 2a ~ PORT 1>
SW4(J0 → J4) → DUT → SW5(J0 → J2) → SW1(J1 → J0)

7. S32

<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3a ~ PORT 3>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW3(J4 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3b ~ PORT 3>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW3(J3 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3c ~ PORT 3>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW3(J2 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 3d ~ PORT 3>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW3(J1 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3a ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J4 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3b ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J3 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3c ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J2 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 3d ~ PORT 3>
SW2(J0 → J2) → DUT → SW3(J1 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3a ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J4 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3b ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J3 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3c ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J2 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 3d ~ PORT 3>
SW2(J0 → J1) → DUT → SW3(J1 → J0)

8. S23

<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J4) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J4) → DUT → SW2(J2 → J0)

<PORT 3 ~ PORT 3a ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J4) → DUT → SW2(J1 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J3) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J3) → DUT → SW2(J2 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J3) → DUT → SW2(J1 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J2) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J2) → DUT → SW2(J2 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J2) → DUT → SW2(J1 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2a ~ PORT 2>
SW3(J0 → J1) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2b ~ PORT 2>
SW3(J0 → J1) → DUT → SW2(J2 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 2c ~ PORT 2>
SW3(J0 → J1) → DUT → SW2(J1 → J0)

9. S42

<PORT 2 ~ PORT 2a ~ DUT ~ PORT 4a ~ PORT 4>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW4(J3 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 4b ~ PORT 4>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW4(J2 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 4c ~ PORT 4>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW4(J1 → J0)
<PORT 2 ~ PORT 2a ~ DUT ~ PORT 4d ~ PORT 4>
SW2(J0 → J3) → SW5(J4 → J0) → DUT → SW4(J4 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 4a ~ PORT 4>
SW2(J0 → J2) → DUT → SW4(J3 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 4b ~ PORT 4>
SW2(J0 → J2) → DUT → SW4(J2 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 4c ~ PORT 4>
SW2(J0 → J2) → DUT → SW4(J1 → J0)
<PORT 2 ~ PORT 2b ~ DUT ~ PORT 4d ~ PORT 4>
SW2(J0 → J2) → DUT → SW4(J4 → J0)

<PORT 2 ~ PORT 2c ~ DUT ~ PORT 4a ~ PORT 4>
SW2(J0 → J1) → DUT → SW4(J3 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 4b ~ PORT 4>
SW2(J0 → J1) → DUT → SW4(J2 → J0)
<PORT 2 ~ PORT 2c ~ DUT ~ PORT 4c ~ PORT 4>
SW2(J0 → J1) → DUT → SW4(J1 → J0)
<PORT 1 ~ PORT 2c ~ DUT ~ PORT 4d ~ PORT 4>
SW2(J0 → J1) → DUT → SW4(J4 → J0)

10. S24

<PORT 4 ~ PORT 4a ~ DUT ~ PORT 2a ~ PORT 2>
SW4(J0 → J3) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 2b ~ PORT 2>
SW4(J0 → J3) → DUT → SW2(J2 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 2c ~ PORT 2>
SW4(J0 → J3) → DUT → SW2(J1 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 2a ~ PORT 2>
SW4(J0 → J2) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 2b ~ PORT 2>
SW4(J0 → J2) → DUT → SW2(J2 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 2c ~ PORT 2>
SW4(J0 → J2) → DUT → SW2(J1 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 2a ~ PORT 2>
SW4(J0 → J1) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 2b ~ PORT 2>
SW4(J0 → J1) → DUT → SW2(J2 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 2c ~ PORT 2>
SW4(J0 → J1) → DUT → SW2(J1 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 2a ~ PORT 2>
SW4(J0 → J4) → DUT → SW5(J0 → J4) → SW2(J3 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 2b ~ PORT 2>
SW4(J0 → J4) → DUT → SW2(J2 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 2c ~ PORT 2>
SW4(J0 → J4) → DUT → SW2(J1 → J0)

11. S43

<PORT 3 ~ PORT 3a ~ DUT ~ PORT 4a ~ PORT 4>
SW3(J0 → J4) → DUT → SW4(J3 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 4b ~ PORT 4>
SW3(J0 → J4) → DUT → SW4(J2 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 4c ~ PORT 4>
SW3(J0 → J4) → DUT → SW4(J1 → J0)
<PORT 3 ~ PORT 3a ~ DUT ~ PORT 4d ~ PORT 4>
SW3(J0 → J4) → DUT → SW4(J4 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 4a ~ PORT 4>
SW3(J0 → J3) → DUT → SW4(J3 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 4b ~ PORT 4>
SW3(J0 → J3) → DUT → SW4(J2 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 4c ~ PORT 4>
SW3(J0 → J3) → DUT → SW4(J1 → J0)
<PORT 3 ~ PORT 3b ~ DUT ~ PORT 4d ~ PORT 4>
SW3(J0 → J3) → DUT → SW4(J4 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 4a ~ PORT 4>
SW3(J0 → J2) → DUT → SW4(J3 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 4b ~ PORT 4>
SW3(J0 → J2) → DUT → SW4(J2 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 4c ~ PORT 4>
SW3(J0 → J2) → DUT → SW4(J1 → J0)
<PORT 3 ~ PORT 3c ~ DUT ~ PORT 4d ~ PORT 4>
SW3(J0 → J2) → DUT → SW4(J4 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 4a ~ PORT 4>
SW3(J0 → J1) → DUT → SW4(J3 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 4b ~ PORT 4>
SW3(J0 → J1) → DUT → SW4(J2 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 4c ~ PORT 4>
SW3(J0 → J1) → DUT → SW4(J1 → J0)
<PORT 3 ~ PORT 3d ~ DUT ~ PORT 4d ~ PORT 4>
SW3(J0 → J1) → DUT → SW4(J4 → J0)

12. S34

<PORT 4 ~ PORT 4a ~ DUT ~ PORT 3a ~ PORT 3>
SW4(J0 → J3) → DUT → SW3(J4 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 3b ~ PORT 3>
SW4(J0 → J3) → DUT → SW3(J3 → J0)

6.4.3 Transmission Characteristics

<PORT 4 ~ PORT 4a ~ DUT ~ PORT 3c ~ PORT 3>
SW4(J0 → J3) → DUT → SW3(J2 → J0)
<PORT 4 ~ PORT 4a ~ DUT ~ PORT 3d ~ PORT 3>
SW4(J0 → J3) → DUT → SW3(J1 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 3a ~ PORT 3>
SW4(J0 → J2) → DUT → SW3(J4 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 3b ~ PORT 3>
SW4(J0 → J2) → DUT → SW3(J3 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 3c ~ PORT 3>
SW4(J0 → J2) → DUT → SW3(J2 → J0)
<PORT 4 ~ PORT 4b ~ DUT ~ PORT 3d ~ PORT 3>
SW4(J0 → J2) → DUT → SW3(J1 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 3a ~ PORT 3>
SW4(J0 → J1) → DUT → SW3(J4 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 3b ~ PORT 3>
SW4(J0 → J1) → DUT → SW3(J3 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 3c ~ PORT 3>
SW4(J0 → J1) → DUT → SW3(J2 → J0)
<PORT 4 ~ PORT 4c ~ DUT ~ PORT 3d ~ PORT 3>
SW4(J0 → J1) → DUT → SW3(J1 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 3a ~ PORT 3>
SW4(J0 → J4) → DUT → SW3(J4 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 3b ~ PORT 3>
SW4(J0 → J4) → DUT → SW3(J3 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 3c ~ PORT 3>
SW4(J0 → J4) → DUT → SW3(J2 → J0)
<PORT 4 ~ PORT 4d ~ DUT ~ PORT 3d ~ PORT 3>
SW4(J0 → J4) → DUT → SW3(J1 → J0)

7. PERFORMANCE TEST

This chapter describes how to test this instrument for maintaining the performance.
For the test methods excluding the items described in this chapter, contact an Advantest sales representative.

7.1 Before Starting the Measurement

7.1.1 Warm-up

Before testing, turn on the power and warm up the instrument for 60 minutes or more.
Press ***Config*** → ***Preset*** on the main menu to initialize and then start each test item.

7.1.2 Preparation of Instrument

Prepare the instruments in accordance with the test item which is described in Table 7-1.

Table 7-1 Required Instruments for Performance Test

Test item	Instrument	Remarks
Test port load match	R3860A, R3770, or R3768 RF Component Analyzer	See Section 7.2
	Calibration kit *1	
	RF cable (TEST CABLE) *2	
Insertion loss	R3860A/R3770/R3768 RF Component Analyzer	See Section 7.3
	Calibration kit *1	
	RF cable (TEST CABLE) *2	

*1 : Calibration kit
Model9617F3 (20 GHz, 3.5 mm connector)
*2: RF cable:
Use an RF cable that has a frequency characteristic of approximately 0.25 dB/GHz and includes the SMA connectors in both ends.

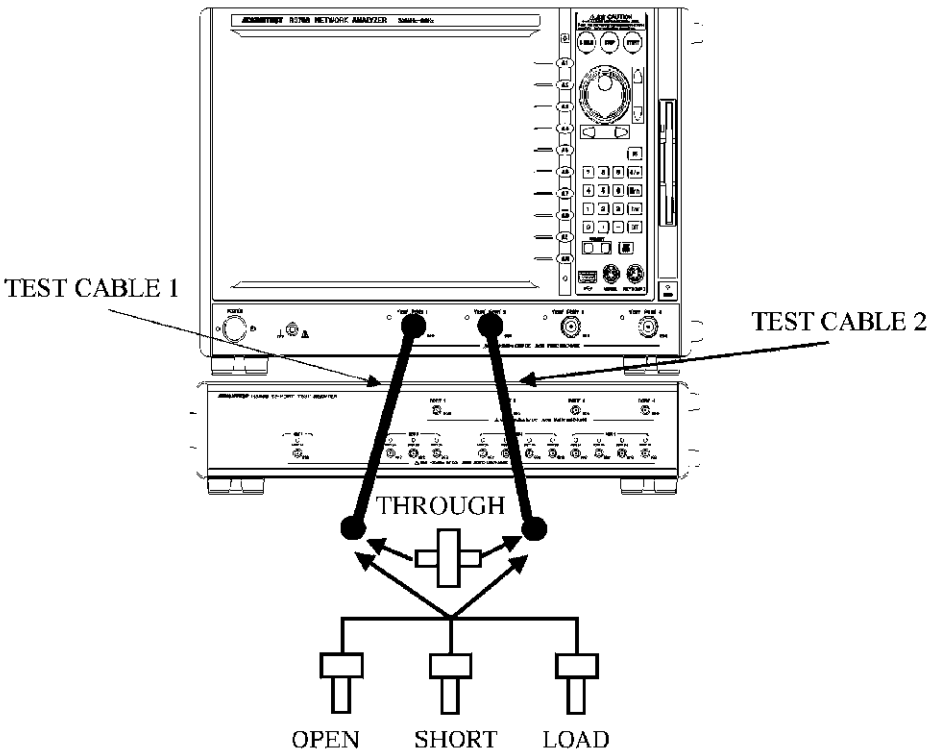
7.1.3 General Precautions

- Use the AC power supply in voltage range of 90 V to 250 V and frequency range of 48 Hz to 66 Hz.
- Connect the power cable after turning off the power of R3860A, R3770, or R3768.
- Test in following conditions.
  Temperature range: +23°C ± 5°C
  Relative humidity: 80% or less (no condensation)
  An area free from dust, vibration, and noise

7.2 Test Port Load Match

Test procedure

1. Connect the test cable to this instrument (R3969/R3970+OPT12/15/16/17) and R3860A/R3768/R3770 series.
2. Connect TEST CABLE 1 to TEST PORT 1 of R3860A/R3768/R3770 series, TEST CABLE 2 to TEST PORT 2 of R3860A/R3768/R3770 series, and then perform the 2-port full calibration.



(The figure shows the combination of R3768 and R3969+OPT16.)

3. Connect the OPEN standard to the end of TEST CABLE 1.
   Acquire the open calibration data by the following procedure.
   Cal on the tool menu → ***Standard Cal*** on the side menu →
   Full2-PORT Cal → P1-P2 → PORT 1 Open
4. Connect the SHORT standard to the end of TEST CABLE 1.
   Acquire the short calibration data by the following procedure.
   PORT 1 Short
5. Connect the LOAD standard to the end of TEST CABLE 1.
   Acquire the load calibration data by the following procedure.
   PORT 1 Load

6. Connect the OPEN standard to the end of TEST CABLE 2.
   Acquire the open calibration data by the following procedure.
   PORT 2 Open
7. Connect the SHORT standard to the end of TEST CABLE 2.
   Acquire the short calibration data by the following procedure.
   PORT 2 Short
8. Connect the LOAD standard to the end of TEST CABLE 2.
   Acquire the load calibration data by the following procedure.
   PORT 2 Load
9. Connect the THROUGH connector to the end of TEST CABLE 1 and TEST CABLE 2.
   Acquire the through calibration data by the following procedure.
   P1-P2 Thru
10. Remove the THROUGH connector from TEST CABLE 1 and TEST CABLE 2.
    Acquire the isolation calibration data by the following procedure.
    Omit Isolation
11. The 2-port full calibration is complete by the following procedure.
    Done

Next section describes the test procedure of the test port load match in each option.

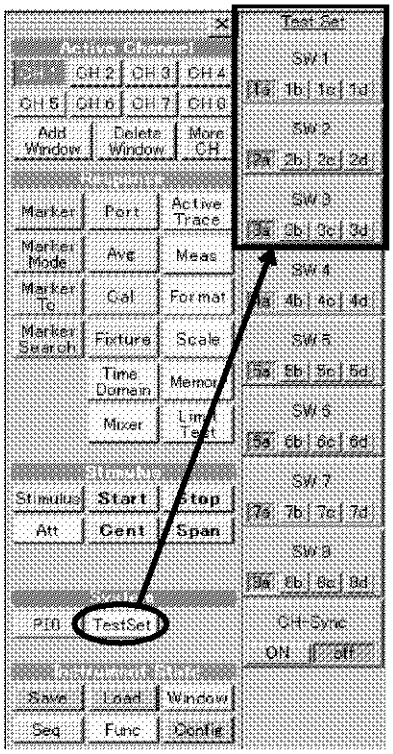
7.2.1 R3969/R3970 OPT12

Test procedure

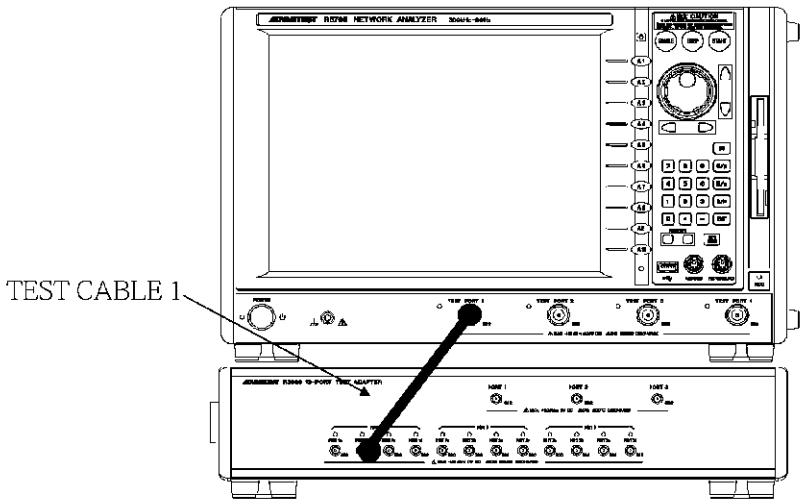
1. Set the measurement function of R3860A, R3770, or R3768 to S11.
   Response on the tool menu → ***Meas*** → ***Measure*** on the side menu → ***S11***
2. Perform the termination setting in each PORT by the following procedure.
   System on the tool menu → ***Test Set*** → ***Test Set*** on the side menu → (For the path through the switch, see the table below.)
3. Connect the TEST CABLE 1 to each PORT of this instrument and read the value of the load match from the marker on the waveform. (The TEST CABLE 2 is not used in this measurement.)

Table 7-2 Path Selection of the Test Set (OPT12)

PORT \ Switch	SW1	SW2	SW3
1a	1b	2a	3a
1b	1a		
1c			
1d			
2a		2b	
2b		2a	
2c			
2d			
3a			3b
3b			3a
3c			
3d			



(Example) Load Match at PORT 1b



4. Check that the measured value in each port meets the value described in the tables below.

R3969 OPT12

PORT 1a/b/c/d PORT 2a/b/c/d PORT 3a/b/c/d	300 kHz to 1 MHz	10 dB or more
	1 MHz to 2.6 GHz	19 dB or more
	2.6 GHz to 4 GHz	18 dB or more
	4 GHz to 8 GHz	11 dB or more

R3970 OPT12

PORT 1a/b/c/d PORT 2a/b/c/d PORT 3a/b/c/d	300 kHz to 1 MHz	10 dB or more
	1 MHz to 2.6 GHz	19 dB or more
	2.6 GHz to 4 GHz	18 dB or more
	4 GHz to 8 GHz	11 dB or more
	8 GHz to 12 GHz	9 dB or more
	12 GHz to 15 GHz	8 dB or more
	15 GHz to 18 GHz	7 dB or more
	18 GHz to 20 GHz	5 dB or more

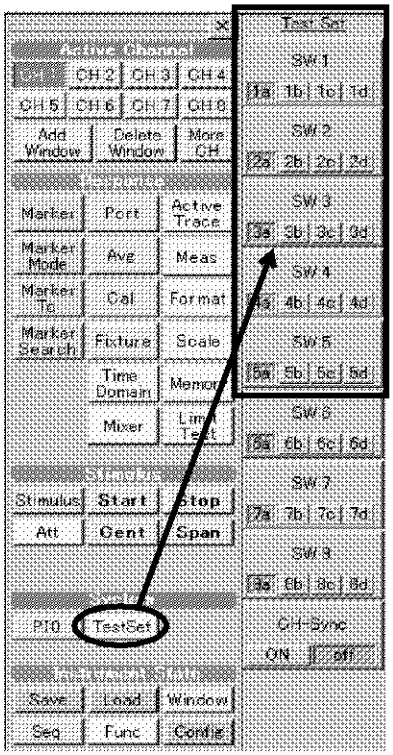
7.2.2 R3969/R3970 OPT15

Test procedure

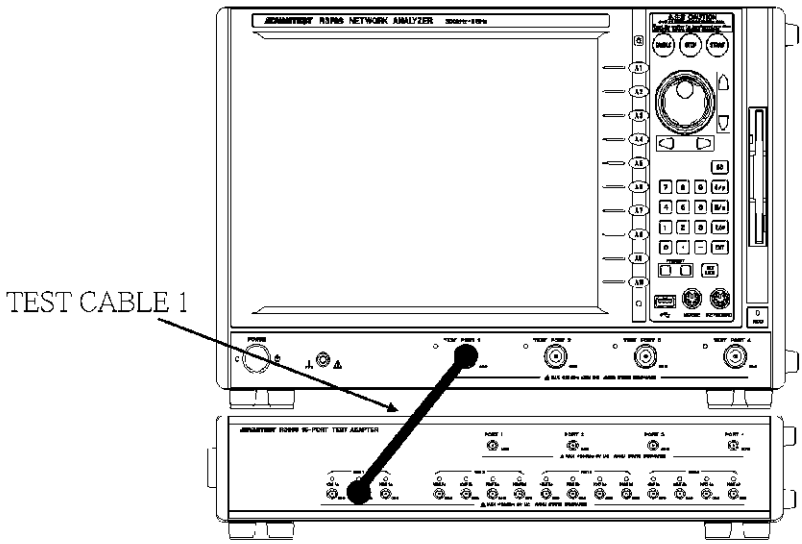
1. Set the measurement function of R3860A, R3770, or R3768 to S11.
   Response on the tool menu → ***Meas*** → ***Measure*** on the side menu → ***S11***
2. Perform the termination setting in each PORT by the following procedure.
   System on the tool menu → ***Test Set*** → ***Test Set*** on the side menu → (For the path through the switch, see the table below.)
3. Connect the TEST CABLE 1 to each PORT of this instrument and read the value of the load match from the marker on the waveform. (The TEST CABLE 2 is not used in this measurement.)

Table 7-3 Path Selection of the Test Set (OPT15)

PORT \ Switch	SW1	SW2	SW3	SW4	SW5
1a	1b	2a	3a	4a	5a
1b	1a	2b	3b	4b	
1c		2a			
2a					
2b					
2c					
2d					
3a					
3b					
3c					
3d					
4a					
4b					
4c					
4d					



(Example) Load Match at PORT 1b



4. Check that the measured value in each port meets the value described in the tables below.

   R3969 OPT15

PORT 1a/b/c PORT 2b/c/d PORT 3a/b/c/d PORT 4a/b/c/d	300 kHz to 1 MHz	10 dB or more
	1 MHz to 2.6 GHz	19 dB or more
	2.6 GHz to 4 GHz	18 dB or more
	4 GHz to 8 GHz	11 dB or more
PORT 2a	300 kHz to 1 MHz	8 dB or more
	1 MHz to 2.6 GHz	12 dB or more
	2.6 GHz to 4 GHz	7 dB or more
	4 GHz to 8 GHz	6 dB or more

R3970 OPT15

PORT 1a/b/c PORT 2b/c/d PORT 3a/b/c/d PORT 4a/b/c/d	300 kHz to 1 MHz	10 dB or more
	1 MHz to 2.6 GHz	19 dB or more
	2.6 GHz to 4 GHz	18 dB or more
	4 GHz to 8 GHz	11 dB or more
	8 GHz to 12 GHz	9 dB or more
	12 GHz to 15 GHz	8 dB or more
	15 GHz to 18 GHz	7 dB or more
	18 GHz to 20 GHz	5 dB or more
PORT 2a	300 kHz to 1 MHz	8 dB or more
	1 MHz to 2.6 GHz	11 dB or more
	2.6 GHz to 4 GHz	7 dB or more
	4 GHz to 8 GHz	6 dB or more
	8 GHz to 12 GHz	5 dB or more
	12 GHz to 15 GHz	5 dB or more
	15 GHz to 18 GHz	5 dB or more
	18 GHz to 20 GHz	5 dB or more

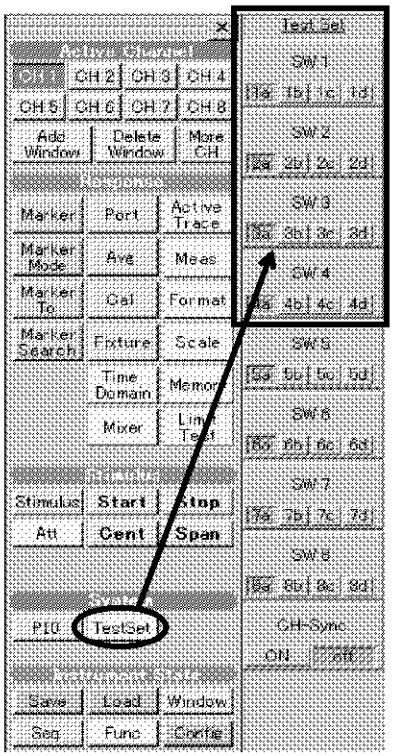
7.2.3 R3969/R3970 OPT16

Test procedure

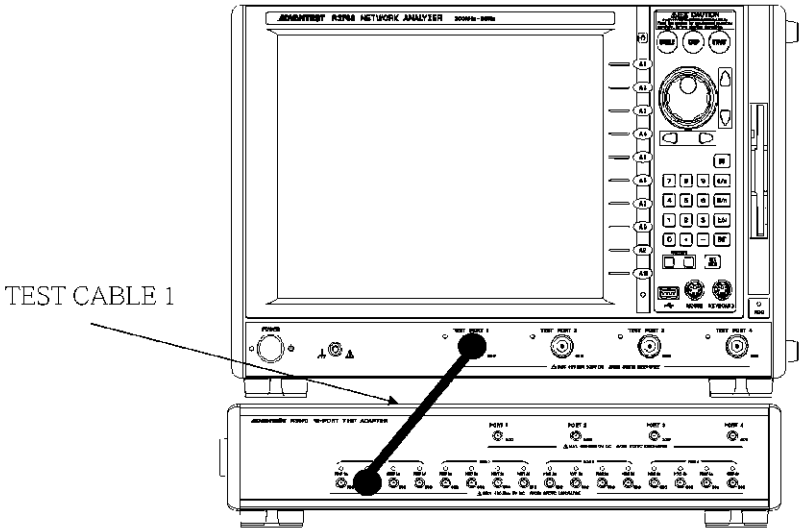
1. Set the measurement function of R3860A, R3770, or R3768 to S11.
   Response on the tool menu → ***Meas*** → ***Measure*** on the side menu → ***S11***
2. Perform the termination setting in each PORT by the following procedure.
   System on the tool menu → ***Test Set*** → ***Test Set*** on the side menu → (For the path through the switch, see the table below.)
3. Connect the TEST CABLE 1 to each PORT of this instrument and read the value of the load match from the marker on the waveform. (The TEST CABLE 2 is not used in this measurement.)

Table 7-4 Path Selection of the Test Set (OPT16)

PORT \ Switch	SW1	SW2	SW3	SW4
1a	1b	2a	3a	4a
1b	1a			
1c				
1d				
2a		2b		
2b		2a		
2c				
2d				
3a			3b	
3b			3a	
3c				
3d				
4a				4b
4b				4a
4c				
4d				



(Example) Load Match at PORT 1b



4. Check that the measured value in each port meets the value described in the tables below.

R3969 OPT16

PORT 1a/b/c/d PORT 2a/b/c/d PORT 3a/b/c/d PORT 4a/b/c/d	300 kHz to 1 MHz	10 dB or more
	1 MHz to 2.6 GHz	19 dB or more
	2.6 GHz to 4 GHz	18 dB or more
	4 GHz to 8 GHz	11 dB or more

R3970 OPT16

PORT 1a/b/c/d PORT 2a/b/c/d PORT 3a/b/c/d PORT 4a/b/c/d	300 kHz to 1 MHz	10 dB or more
	1 MHz to 2.6 GHz	19 dB or more
	2.6 GHz to 4 GHz	18 dB or more
	4 GHz to 8 GHz	11 dB or more
	8 GHz to 12 GHz	9 dB or more
	12 GHz to 15 GHz	8 dB or more
	15 GHz to 18 GHz	7 dB or more
	18 GHz to 20 GHz	5 dB or more

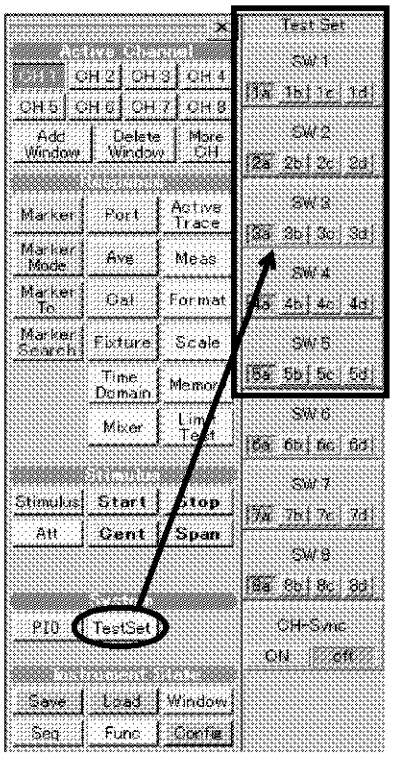
7.2.4 R3969/R3970 OPT17

Test procedure

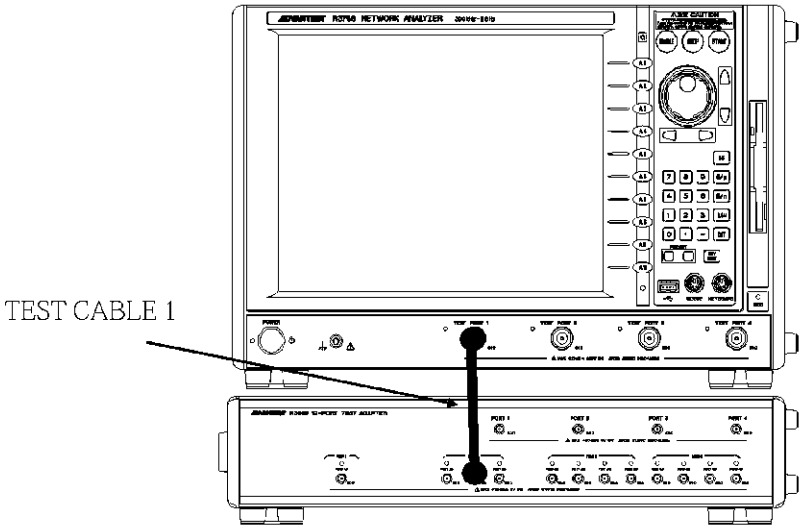
1. Set the measurement function of R3860A, R3770, or R3768 to S11.
   Response on the tool menu → ***Meas*** → ***Measure*** on the side menu → ***S11***
2. Perform the termination setting in each PORT by the following procedure.
   System on the tool menu → ***Test Set*** → ***Test Set*** on the side menu → (For the path through the switch, see the table below.)
3. Connect the TEST CABLE 1 to each PORT of this instrument and read the value of the load match from the marker on the waveform. (The TEST CABLE 2 is not used in this measurement.)

Table 7-5 Path Selection of the Test Set (OPT17)

PORT \ Switch	SW1	SW2	SW3	SW4	SW5
1a	1b	2a	3a	4a	5a
2a	1a	2b			
2b		2a			
2c					
3a			3b		
3b			3a		
3c					
3d					
4a				4b	
4b				4a	
4c					
4d					



(Example) Load Match at PORT 2b



4. Check that the measured value in each port meets the value described in the tables below.

R3969 OPT17

PORT 1a PORT 2b/c PORT 3a/b/c/d PORT 4a/b/c/d	300 kHz to 1 MHz	10 dB or more
	1 MHz to 2.6 GHz	19 dB or more
	2.6 GHz to 4 GHz	18 dB or more
	4 GHz to 8 GHz	11 dB or more
PORT 2a	300 kHz to 1 MHz	8 dB or more
	1 MHz to 2.6 GHz	12 dB or more
	2.6 GHz to 4 GHz	7 dB or more
	4 GHz to 8 GHz	6 dB or more

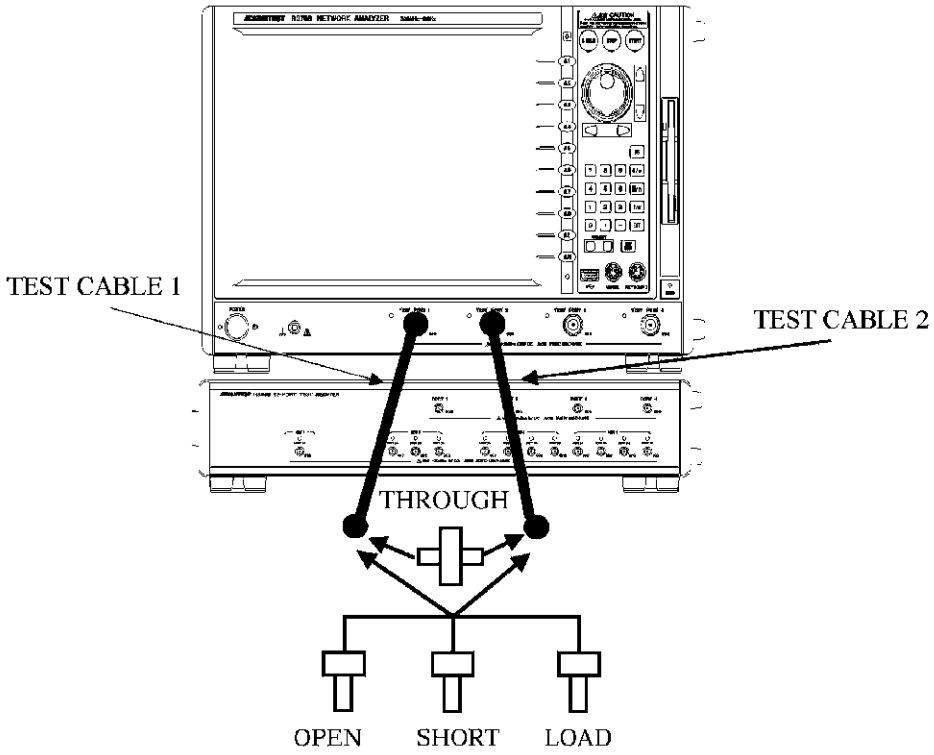
R3970 OPT17

PORT 1a PORT 2b/c PORT 3a/b/c/d PORT 4a/b/c/d	300 kHz to 1 MHz	10 dB or more
	1 MHz to 2.6 GHz	19 dB or more
	2.6 GHz to 4 GHz	18 dB or more
	4 GHz to 8 GHz	11 dB or more
	8 GHz to 12 GHz	9 dB or more
	12 GHz to 15 GHz	8 dB or more
	15 GHz to 18 GHz	7 dB or more
	18 GHz to 20 GHz	5 dB or more
PORT 2a	300 kHz to 1 MHz	8 dB or more
	1 MHz to 2.6 GHz	11 dB or more
	2.6 GHz to 4 GHz	7 dB or more
	4 GHz to 8 GHz	6 dB or more
	8 GHz to 12 GHz	5 dB or more
	12 GHz to 15 GHz	5 dB or more
	15 GHz to 18 GHz	5 dB or more
	18 GHz to 20 GHz	5 dB or more

7.3 Insertion Loss

Test procedure

1. Connect the test cable to this instrument (R3969/R3970+OPT12/15/16/17) and R3860A/R3768/R3770 series.
2. Connect TEST CABLE 1 to TEST PORT 1 of R3860A/R3768/R3770 series, TEST CABLE 2 to TEST PORT 2 of R3860A/R3768/R3770 series, and then perform the 2-port full calibration.



(The figure shows the combination of R3768 and R3969+OPT16.)

3. Connect the OPEN standard to the end of TEST CABLE 1.
   Acquire the open calibration data by the following procedure.
   Cal on the tool menu → ***Standard Cal*** on the side menu →
   Full2-PORT Cal → ***P1-P2*** → ***PORT 1 Open***
4. Connect the SHORT standard to the end of TEST CABLE 1.
   Acquire the short calibration data by the following procedure.
   PORT 1 Short
5. Connect the LOAD standard to the end of TEST CABLE 1.
   Acquire the load calibration data by the following procedure.
   PORT 1 Load

6. Connect the OPEN standard to the end of TEST CABLE 2.
   Acquire the open calibration data by the following procedure.
   PORT 2 Open
7. Connect the SHORT standard to the end of TEST CABLE 2.
   Acquire the short calibration data by the following procedure.
   PORT 2 Short
8. Connect the LOAD standard to the end of TEST CABLE 2.
   Acquire the load calibration data by the following procedure.
   PORT 2 Load
9. Connect the THROUGH connector to the end of TEST CABLE 1 and TEST CABLE 2.
   Acquire the through calibration data by the following procedure.
   P1-P2 Thru
10. Remove the THROUGH connector from TEST CABLE 1 and TEST CABLE 2.
    Acquire the isolation calibration data by the following procedure.
    Omit Isolation
11. The 2-port full calibration is complete by the following procedure.
    Done

Next section describes the test procedure of the insertion loss in each option.

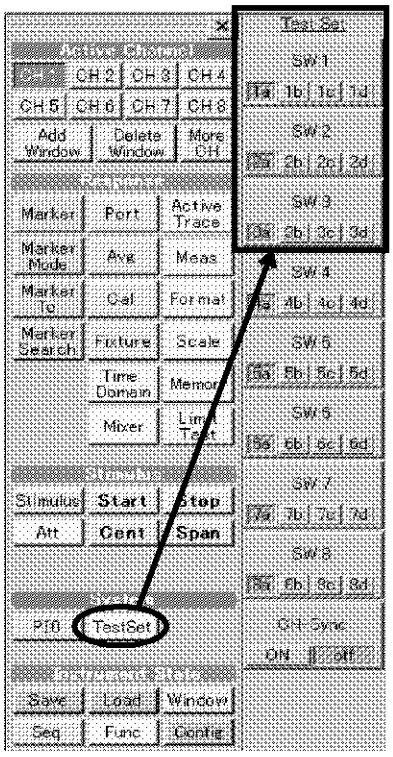
7.3.1 R3969/R3970 OPT12

Test procedure

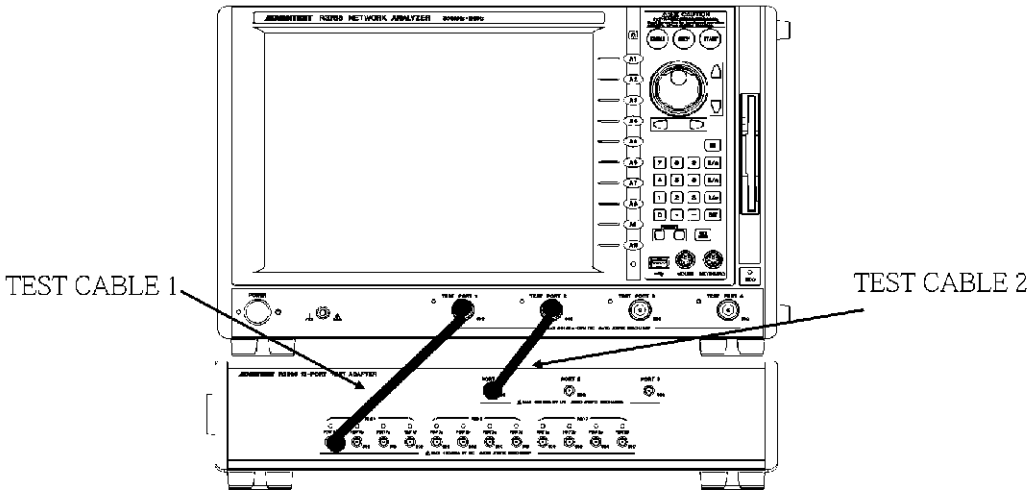
1. Set the measurement function of R3860A, R3770, or R3768 to S21.
   Response on the tool menu → ***Meas*** → ***Measure*** on the side menu → ***S21***
2. Perform the path setting between each PORT by the following procedure.
   System on the tool menu → ***Test Set*** → ***Test Set*** on the side menu → (The path selection through the switch, see the table below.)
3. ***Response*** on the tool menu → ***Scale*** → ***/Div*** on the side menu → **1** → **0** → **ENTER**
4. Connect the TEST CABLE 1 and TEST CABLE 2 to each PORT a/b/c/d and PORT 1/2/3 of this instrument, and read the value of the insertion loss from the marker on the waveform.

Table 7-6 Path Selection of the Test Set (OPT12)

Path selection \ Switch	SW1	SW2	SW3
PORT 1 → PORT 1a	1a	2a	3a
PORT 1 → PORT 1b	1b		
PORT 1 → PORT 1c	1c		
PORT 1 → PORT 1d	1d		
PORT 2 → PORT 2a	1a	2a	
PORT 2 → PORT 2b		2b	
PORT 2 → PORT 2c		2c	
PORT 2 → PORT 2d		2d	
PORT 3 → PORT 3a		2a	3a
PORT 3 → PORT 3b			3b
PORT 3 → PORT 3c			3c
PORT 3 → PORT 3d			3d



(Example) PORT 1 → PORT 1a



5. Check the insertion loss between each PORT and TEST PORT.

R3969 OPT12

PORT 1 to PORT 1a/b/c/d PORT 2 to PORT 2a/b/c/d PORT 3 to PORT 3a/b/c/d	300 kHz to 2 GHz	4 dB or less
	2 GHz to 4 GHz	6 dB or less
	4 GHz to 6 GHz	9 dB or less
	6 GHz to 8 GHz	11 dB or less

R3970 OPT12

PORT 1 to PORT 1a/b/c/d PORT 2 to PORT 2a/b/c/d PORT 3 to PORT 3a/b/c/d	300 kHz to 2 GHz	4 dB or less
	2 GHz to 4 GHz	6 dB or less
	4 GHz to 6 GHz	7 dB or less
	6 GHz to 8 GHz	8.5 dB or less
	8 GHz to 12 GHz	11.5 dB or less
	12 GHz to 15 GHz	12 dB or less
	15 GHz to 18 GHz	13 dB or less
	18 GHz to 20 GHz	14 dB or less

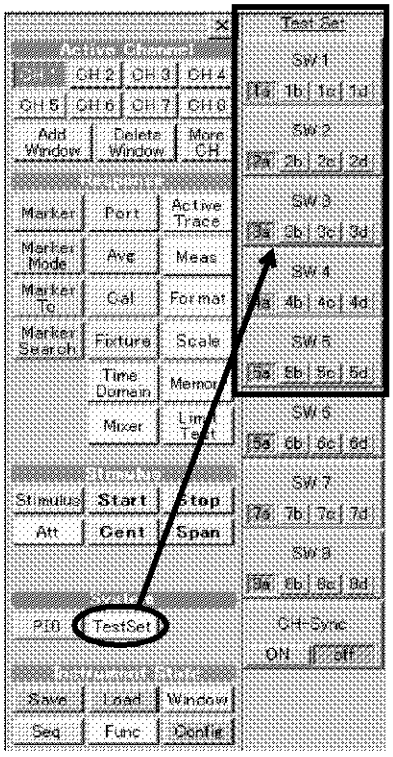
7.3.2 R3969/R3970 OPT15

Test procedure

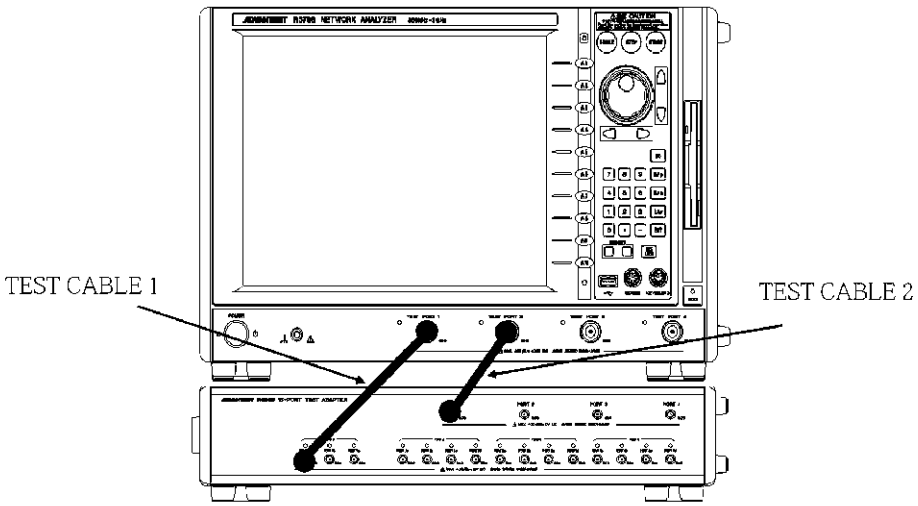
1. Set the measurement function of R3860A, R3770, or R3768 to S21.
   Response on the tool menu → ***Meas*** → ***Measure*** on the side menu → ***S21***
2. Perform the path setting between each PORT by the following procedure.
   System on the tool menu → ***Test Set*** → ***Test Set*** on the side menu → (The path selection through the switch, see the table below.)
3. ***Response*** on the tool menu → ***Scale*** → ***/Div*** on the side menu → **1** → **0** → **ENTER**
4. Connect the TEST CABLE 1 and TEST CABLE 2 to each PORT a/b/c/d and PORT 1/2/3/4 of this instrument, and read the value of the insertion loss from the marker on the waveform.

Table 7-7 Path Selection of the Test Set (OPT15)

Path selection \ Switch	SW1	SW2	SW3	SW4	SW5
PORT 1 → PORT 1a	1a	2a	3a	4a	5a
PORT 1 → PORT 2a	1d				5a
PORT 1 → PORT 1b	1b				5a
PORT 1 → PORT 1c	1c				5b
PORT 2 → PORT 2a	1a	2b			5a
PORT 2 → PORT 2b		2c			
PORT 2 → PORT 2c		2d			
PORT 2 → PORT 2d		2a	3a		
PORT 3 → PORT 3a			3b		
PORT 3 → PORT 3b			3c		
PORT 3 → PORT 3c			3d		
PORT 3 → PORT 3d			3a	4a	
PORT 4 → PORT 4a				4b	
PORT 4 → PORT 4b				4c	
PORT 4 → PORT 4c				4d	
PORT 4 → PORT 4d					



(Example) PORT 1 → PORT 1a



5. Check the insertion loss between each PORT and TEST PORT.
   R3969 OPT15

PORT 1 to PORT 1a/b/c PORT 2 to PORT 2b/c/d PORT 3 to PORT 3a/b/c/d PORT 4 to PORT 4a/b/c/d	300 kHz to 2 GHz	4 dB or less
	2 GHz to 4 GHz	6 dB or less
	4 GHz to 6 GHz	9 dB or less
	6 GHz to 8 GHz	11 dB or less
PORT 1 to PORT 2a PORT 2 to PORT 2a	300 kHz to 2 GHz	8 dB or less
	2 GHz to 4 GHz	12 dB or less
	4 GHz to 6 GHz	18 dB or less
	6 GHz to 8 GHz	22 dB or less

R3970 OPT15

PORT 1 to PORT 1a/b/c PORT 2 to PORT 2b/c/d PORT 3 to PORT 3a/b/c/d PORT 4 to PORT 4a/b/c/d	300 kHz to 2 GHz	4 dB or less
	2 GHz to 4 GHz	6 dB or less
	4 GHz to 6 GHz	7 dB or less
	6 GHz to 8 GHz	8.5 dB or less
	8 GHz to 12 GHz	11.5 dB or less
	12 GHz to 15 GHz	12 dB or less
	15 GHz to 18 GHz	13 dB or less
	18 GHz to 20 GHz	14 dB or less
PORT 1 to PORT 2a PORT 2 to PORT 2a	300 kHz to 2 GHz	8 dB or less
	2 GHz to 4 GHz	12 dB or less
	4 GHz to 6 GHz	14 dB or less
	6 GHz to 8 GHz	17 dB or less
	8 GHz to 12 GHz	23 dB or less
	12 GHz to 15 GHz	24 dB or less
	15 GHz to 18 GHz	26 dB or less
	18 GHz to 20 GHz	28 dB or less

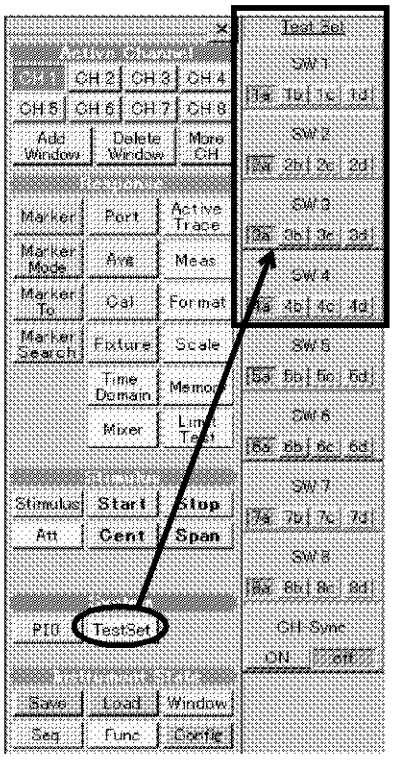
7.3.3 R3969/R3970 OPT16

Test procedure

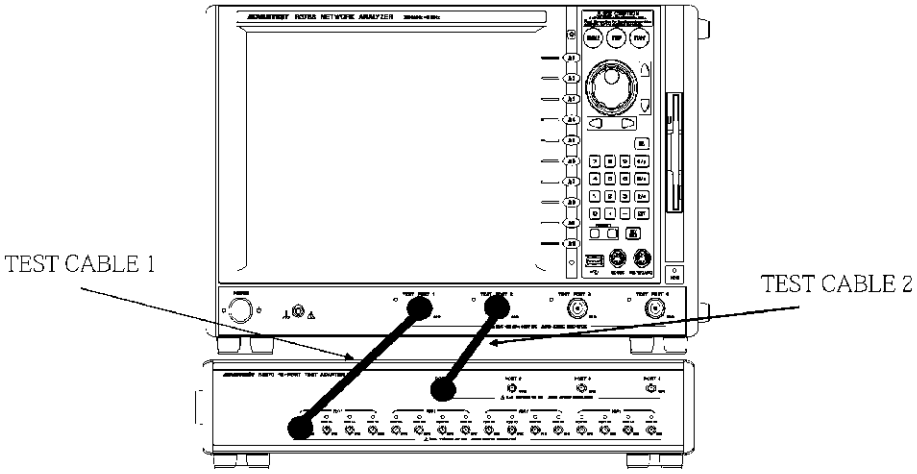
1. Set the measurement function of R3860A, R3770, or R3768 to S21.
   Response on the tool menu → ***Meas*** → ***Measure*** on the side menu → ***S21***
2. Perform the path setting between each PORT by the following procedure.
   System on the tool menu → ***Test Set*** → ***Test Set*** on the side menu → (The path selection through the switch, see the table below.)
3. ***Response*** on the tool menu → ***Scale*** → ***/Div*** on the side menu → **1** → **0** → **ENTER**
4. Connect the TEST CABLE 1 and TEST CABLE 2 to each PORT a/b/c/d and PORT 1/2/3/4 of this instrument, and read the value of the insertion loss from the marker on the waveform.

Table 7-8 Path Selection of the Test Set (OPT16)

Path selection \ Switch	SW1	SW2	SW3	SW4
PORT 1 → PORT 1a	1a	2a	3a	4a
PORT 1 → PORT 1b	1b			
PORT 1 → PORT 1c	1c			
PORT 1 → PORT 1d	1d			
PORT 2 → PORT 2a	1a	2a		
PORT 2 → PORT 2b		2b		
PORT 2 → PORT 2c		2c		
PORT 2 → PORT 2d		2d		
PORT 3 → PORT 3a		2a	3a	
PORT 3 → PORT 3b			3b	
PORT 3 → PORT 3c			3c	
PORT 3 → PORT 3d			3d	
PORT 4 → PORT 4a			3a	4a
PORT 4 → PORT 4b				4b
PORT 4 → PORT 4c				4c
PORT 4 → PORT 4d				4d



(Example) PORT 1 → PORT 1a



5. Check the insertion loss between each PORT and TEST PORT.

R3969 OPT16

PORT 1 to PORT 1a/b/c/d PORT 2 to PORT 2a/b/c/d PORT 3 to PORT 3a/b/c/d PORT 4 to PORT 4a/b/c/d	300 kHz to 2 GHz	4 dB or less
	2 GHz to 4 GHz	6 dB or less
	4 GHz to 6 GHz	9 dB or less
	6 GHz to 8 GHz	11 dB or less

R3970 OPT16

PORT 1 to PORT 1a/b/c/d PORT 2 to PORT 2a/b/c/d PORT 3 to PORT 3a/b/c/d PORT 4 to PORT 4a/b/c/d	300 kHz to 2 GHz	4 dB or less
	2 GHz to 4 GHz	6 dB or less
	4 GHz to 6 GHz	7 dB or less
	6 GHz to 8 GHz	8.5 dB or less
	8 GHz to 12 GHz	11.5 dB or less
	12 GHz to 15 GHz	12 dB or less
	15 GHz to 18 GHz	13 dB or less
	18 GHz to 20 GHz	14 dB or less

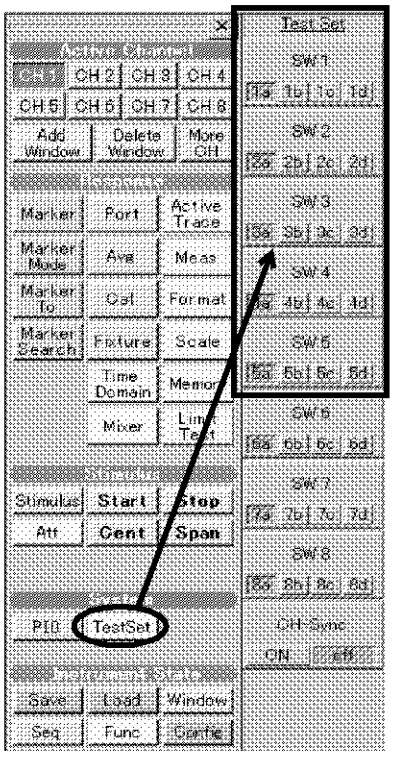
7.3.4 R3969/R3970 OPT17

Test procedure

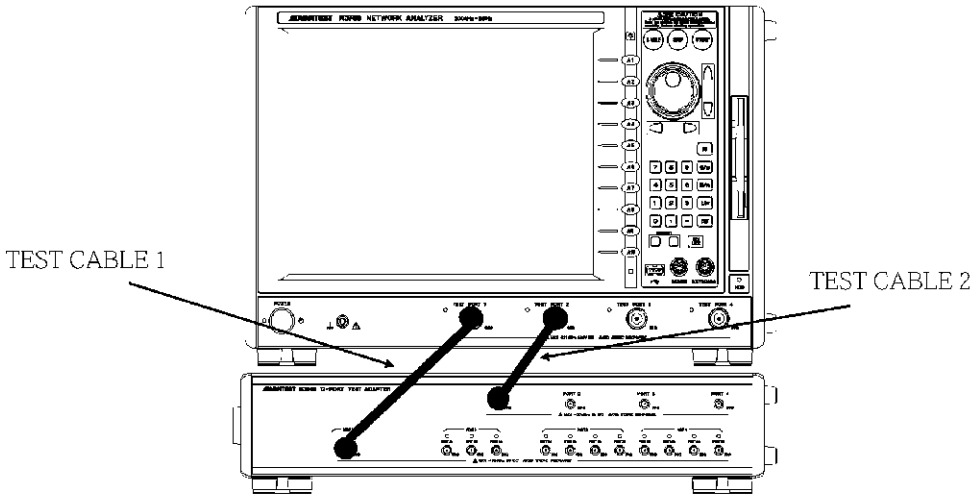
1. Set the measurement function of R3860A, R3770, or R3768 to S21.
   Response on the tool menu → ***Meas*** → ***Measure*** on the side menu → ***S21***
2. Perform the path setting between each PORT by the following procedure.
   System on the tool menu → ***Test Set*** → ***Test Set*** on the side menu → (The path selection through the switch, see the table below.)
3. ***Response*** on the tool menu → ***Scale*** → ***/Div*** on the side menu → **1** → **0** → **ENTER**
4. Connect the TEST CABLE 1 and TEST CABLE 2 to each PORT a/b/c/d and PORT 1/2/3/4 of this instrument, and read the value of the insertion loss from the marker on the waveform.

Table 7-9 Path Selection of the Test Set (OPT17)

Path selection \ Switch	SW1	SW2	SW3	SW4	SW5
PORT 1 → PORT 1a	1a	2a	3a	4a	5a
PORT 1 → PORT 2a	1b				5a
PORT 2 → PORT 2a	1a				5b
PORT 2 → PORT 2b		2b			5a
PORT 2 → PORT 2c		2c			
PORT 3 → PORT 3a		2a	3a		
PORT 3 → PORT 3b			3b		
PORT 3 → PORT 3c			3c		
PORT 3 → PORT 3d			3d		
PORT 4 → PORT 4a			3a	4a	
PORT 4 → PORT 4b				4b	
PORT 4 → PORT 4c				4c	
PORT 4 → PORT 4d				4d	



(Example) PORT 1 → PORT 1a



5. Check the insertion loss between each PORT and TEST PORT.
   R3969 OPT17

PORT 1 to PORT 1a PORT 2 to PORT 2b/c PORT 3 to PORT 3a/b/c/d PORT 4 to PORT 4a/b/c/d	300 kHz to 2 GHz	4 dB or less
	2 GHz to 4 GHz	6 dB or less
	4 GHz to 6 GHz	9 dB or less
	6 GHz to 8 GHz	11 dB or less
PORT 1 to PORT 2a PORT 2 to PORT 2a	300 kHz to 2 GHz	8 dB or less
	2 GHz to 4 GHz	12 dB or less
	4 GHz to 6 GHz	18 dB or less
	6 GHz to 8 GHz	22 dB or less

R3970 OPT17

PORT 1 to PORT 1a PORT 2 to PORT 2b/c PORT 3 to PORT 3a/b/c/d PORT 4 to PORT 4a/b/c/d	300 kHz to 2 GHz	4 dB or less
	2 GHz to 4 GHz	6 dB or less
	4 GHz to 6 GHz	7 dB or less
	6 GHz to 8 GHz	8.5 dB or less
	8 GHz to 12 GHz	11.5 dB or less
	12 GHz to 15 GHz	12 dB or less
	15 GHz to 18 GHz	13 dB or less
	18 GHz to 20 GHz	14 dB or less
PORT 1 to PORT 2a PORT 2 to PORT 2a	300 kHz to 2 GHz	8 dB or less
	2 GHz to 4 GHz	12 dB or less
	4 GHz to 6 GHz	14 dB or less
	6 GHz to 8 GHz	17 dB or less
	8 GHz to 12 GHz	23 dB or less
	12 GHz to 15 GHz	24 dB or less
	15 GHz to 18 GHz	26 dB or less
	18 GHz to 20 GHz	28 dB or less

8. SPECIFICATIONS

8.1 R3969/R3970 OPT12

Item		Specification	
1. Characteristic impedance		50 Ω	
2. Frequency range		R3969: 300 kHz to 8 GHz R3970: 300 kHz to 20 GHz	
3. Insertion loss			
	R3969 OPT12		
	PORT 1 to PORT 1a/b/c/d	300 kHz to 2 GHz	4 dB or less
	PORT 2 to PORT 2a/b/c/d	2 GHz to 4 GHz	6 dB or less
	PORT 3 to PORT 3a/b/c/d	4 GHz to 6 GHz	9 dB or less
		6 GHz to 8 GHz	11 dB or less
	R3970 OPT12		
	PORT 1 to PORT 1a/b/c/d	300 kHz to 2 GHz	4 dB or less
	PORT 2 to PORT 2a/b/c/d	2 GHz to 4 GHz	6 dB or less
	PORT 3 to PORT 3a/b/c/d	4 GHz to 6 GHz	7 dB or less
		6 GHz to 8 GHz	8.5 dB or less
		8 GHz to 12 GHz	11.5 dB or less
		12 GHz to 15 GHz	12 dB or less
		15 GHz to 18 GHz	13 dB or less
		18 GHz to 20 GHz	14 dB or less
4. Test port load match			
	R3969 OPT12		
	PORT 1a/b/c/d	300 kHz to 1 MHz	10 dB or more
	PORT 2a/b/c/d	1 MHz to 2.6 GHz	19 dB or more
	PORT 3a/b/c/d	2.6 GHz to 4 GHz	18 dB or more
		4 GHz to 8 GHz	11 dB or more
	R3970 OPT12		
	PORT 1a/b/c/d	300 kHz to 1 MHz	10 dB or more
	PORT 2a/b/c/d	1 MHz to 2.6 GHz	19 dB or more
	PORT 3a/b/c/d	2.6 GHz to 4 GHz	18 dB or more
		4 GHz to 8 GHz	11 dB or more
		8 GHz to 12 GHz	9 dB or more
		12 GHz to 15 GHz	8 dB or more
		15 GHz to 18 GHz	7 dB or more
		18 GHz to 20 GHz	5 dB or more
5. Operating environment		Temperature range: +5°C to +40°C Relative humidity: 80% or less	

Item	Specification
6. Programming	All functions are controlled from the R3860A, R3770, or R3768. Also remote control can be performed through the GPIB interface of R3860A, R3770, and R3768.
7. Storage environment	Temperature range: -20°C to +60°C Relative humidity: 80% or less
8. Dimensions	Approx. 424 (Width) × 88 (Height) × 530 (Depth) mm
9. Weight	8.0 kg or less
10. RF damage level	~ +20 dBm max
11. Accessories	R3969 OPT12 N(m)-SMA(f) adapter × 4 Semi-rigid cable × 4
	R3970 OPT12 Semi-rigid cable × 4

8.2 R3969/R3970 OPT15

Item		Specification	
1. Characteristic impedance		50 Ω	
2. Frequency range		R3969: 300 kHz to 8 GHz R3970: 300 kHz to 20 GHz	
3. Insertion loss			
	R3969 OPT15		
	PORT 1 to PORT 1a/b/c	300 kHz to 2 GHz	4 dB or less
	PORT 2 to PORT 2b/c/d	2 GHz to 4 GHz	6 dB or less
	PORT 3 to PORT 3a/b/c/d	4 GHz to 6 GHz	9 dB or less
	PORT 4 to PORT 4a/b/c/d	6 GHz to 8 GHz	11 dB or less
	PORT 1 to PORT 2a	300 kHz to 2 GHz	8 dB or less
	PORT 2 to PORT 2a	2 GHz to 4 GHz	12 dB or less
		4 GHz to 6 GHz	18 dB or less
		6 GHz to 8 GHz	22 dB or less
	R3970 OPT15		
	PORT 1 to PORT 1a/b/c	300 kHz to 2 GHz	4 dB or less
	PORT 2 to PORT 2b/c/d	2 GHz to 4 GHz	6 dB or less
	PORT 3 to PORT 3a/b/c/d	4 GHz to 6 GHz	7 dB or less
	PORT 4 to PORT 4a/b/c/d	6 GHz to 8 GHz	8.5 dB or less
		8 GHz to 12 GHz	11.5 dB or less
		12 GHz to 15 GHz	12 dB or less
		15 GHz to 18 GHz	13 dB or less
		18 GHz to 20 GHz	14 dB or less
	PORT 1 to PORT 2a	300 kHz to 2 GHz	8 dB or less
	PORT 2 to PORT 2a	2 GHz to 4 GHz	12 dB or less
		4 GHz to 6 GHz	14 dB or less
		6 GHz to 8 GHz	17 dB or less
		8 GHz to 12 GHz	23 dB or less
		12 GHz to 15 GHz	24 dB or less
		15 GHz to 18 GHz	26 dB or less
		18 GHz to 20 GHz	28 dB or less
4. Test port load match			
	R3969 OPT15		
	PORT 1a/b/c	300 kHz to 1 MHz	10 dB or more
	PORT 2b/c/d	1 MHz to 2.6 GHz	19 dB or more
	PORT 3a/b/c/d	2.6 GHz to 4 GHz	18 dB or more
	PORT 4a/b/c/d	4 GHz to 8 GHz	11 dB or more

Item		Specification	
	PORT 2a	300 kHz to 1 MHz	8 dB or more
		1 MHz to 2.6 GHz	12 dB or more
		2.6 MHz to 4 GHz	7 dB or more
		4 MHz to 8 GHz	6 dB or more
	R3970 OPT15		
	PORT 1a/b/c PORT 2b/c/d PORT 3a/b/c/d PORT 4a/b/c/d	300 kHz to 1 MHz	10 dB or more
		1 MHz to 2.6 GHz	19 dB or more
		2.6 GHz to 4 GHz	18 dB or more
		4 GHz to 8 GHz	11 dB or more
		8 GHz to 12 GHz	9 dB or more
		12 GHz to 15 GHz	8 dB or more
		15 GHz to 18 GHz	7 dB or more
		18 GHz to 20 GHz	5 dB or more
	PORT 2a	300 kHz to 1 MHz	8 dB or more
		1 MHz to 2.6 GHz	11 dB or more
		2.6 GHz to 4 GHz	7 dB or more
		4 GHz to 8 GHz	6 dB or more
		8 GHz to 12 GHz	5 dB or more
		12 GHz to 15 GHz	5 dB or more
		15 GHz to 18 GHz	5 dB or more
		18 GHz to 20 GHz	5 dB or more
5. Operating environment		Temperature range: +5 °C to +40°C Relative humidity: 80% or less	
6. Programming		All functions are controlled from the R3860A, R3770, or R3768. Also remote control can be performed through the GPIB interface of R3860A, R3770, and R3768.	
7. Storage environment		Temperature range: -20°C to +60°C Relative humidity: 80% or less	
8. Dimensions		Approx. 424 (Width) × 88 (Height) × 530 (Depth) mm	
9. Weight		8.0 kg or less	
10. RF damage level		~ +20 dBm max	
11. Accessories		R3969 OPT15 N(m)-SMA(f) adapter × 4 Semi-rigid cable × 4	
		R3970 OPT15 Semi-rigid cable × 4	

8.3 R3969/R3970 OPT16

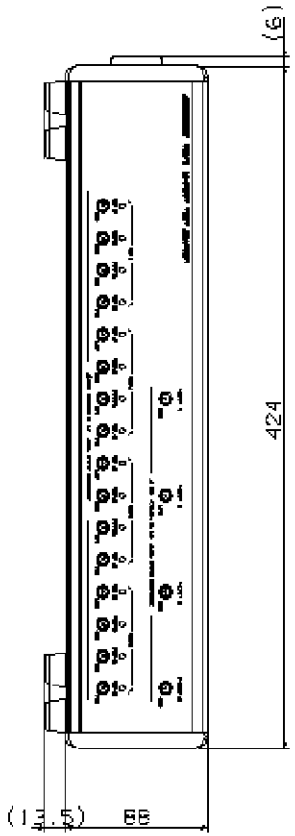
Item		Specification	
1. Characteristic impedance		50 Ω	
2. Frequency range		R3969: 300 kHz to 8 GHz R3970: 300 kHz to 20 GHz	
3. Insertion loss			
	R3969 OPT16		
	PORT 1 to PORT 1a/b/c/d	300 kHz to 2 GHz	4 dB or less
	PORT 2 to PORT 2a/b/c/d	2 GHz to 4 GHz	6 dB or less
	PORT 3 to PORT 3a/b/c/d	4 GHz to 6 GHz	9 dB or less
	PORT 4 to PORT 4a/b/c/d	6 GHz to 8 GHz	11 dB or less
	R3970 OPT16		
	PORT 1 to PORT 1a/b/c/d	300 kHz to 2 GHz	4 dB or less
	PORT 2 to PORT 2a/b/c/d	2 GHz to 4 GHz	6 dB or less
	PORT 3 to PORT 3a/b/c/d	4 GHz to 6 GHz	7 dB or less
	PORT 4 to PORT 4a/b/c/d	6 GHz to 8 GHz	8.5 dB or less
		8 GHz to 12 GHz	11.5 dB or less
		12 GHz to 15 GHz	12 dB or less
		15 GHz to 18 GHz	13 dB or less
		18 GHz to 20 GHz	14 dB or less
4. Test port load match			
	R3969 OPT16		
	PORT 1a/b/c/d	300 kHz to 1 MHz	10 dB or more
	PORT 2a/b/c/d	1 MHz to 2.6 GHz	19 dB or more
	PORT 3a/b/c/d	2.6 GHz to 4 GHz	18 dB or more
	PORT 4a/b/c/d	4 GHz to 8 GHz	11 dB or more
	R3970 OPT16		
	PORT 1a/b/c/d	300 kHz to 1 MHz	10 dB or more
	PORT 2a/b/c/d	1 MHz to 2.6 GHz	19 dB or more
	PORT 3a/b/c/d	2.6 GHz to 4 GHz	18 dB or more
	PORT 4a/b/c/d	4 GHz to 8 GHz	11 dB or more
		8 GHz to 12 GHz	9 dB or more
		12 GHz to 15 GHz	8 dB or more
		15 GHz to 18 GHz	7 dB or more
		18 GHz to 20 GHz	5 dB or more
5. Operating environment		Temperature range: +5°C to +40°C Relative humidity: 80% or less	
6. Programming		All functions are controlled from the R3860A, R3770, or R3768. Also remote control can be performed through the GPIB interface of R3860A, R3770, and R3768.	

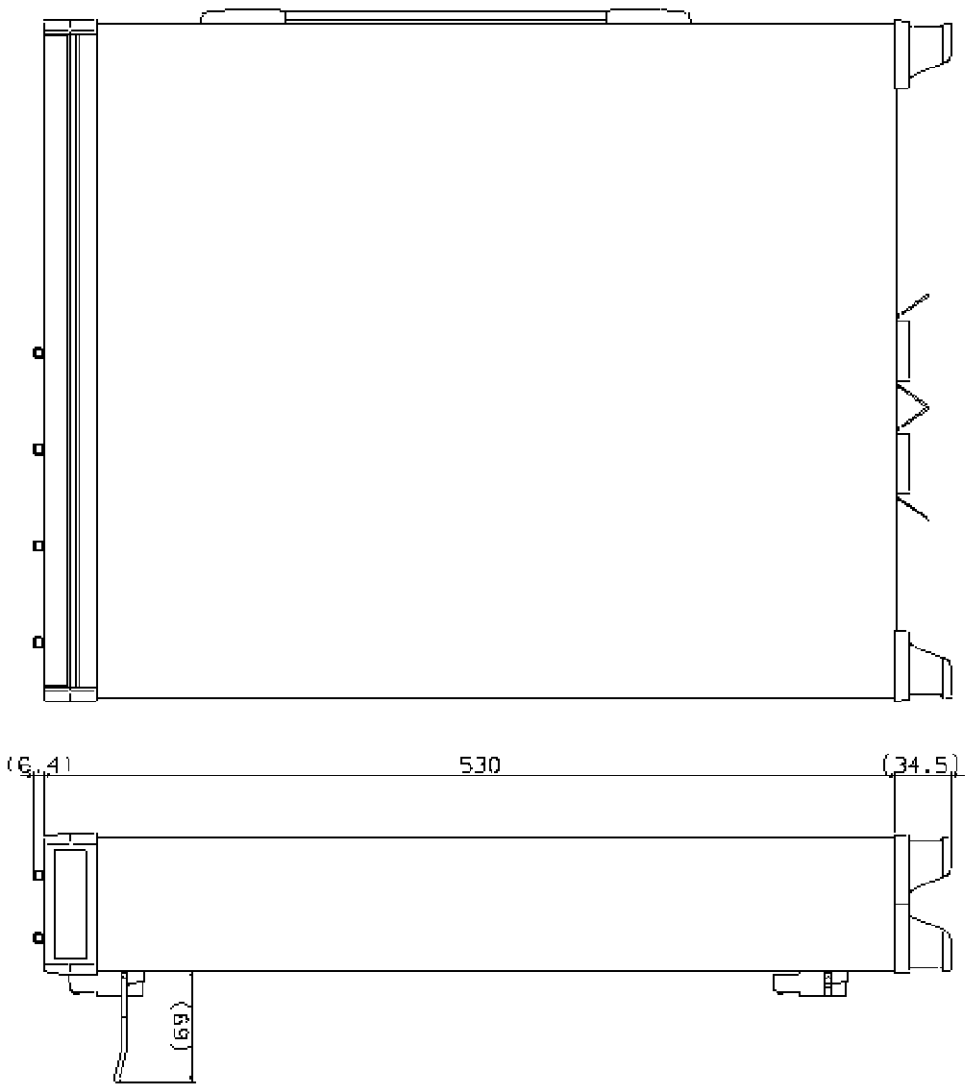
Item	Specification
7. Storage environment	Temperature range: -20°C to +60°C Relative humidity: 80% or less
8. Dimensions	Approx. 424 (Width) × 88 (Height) × 530 (Depth) mm
9. Weight	8.0 kg or less
10. RF damage level	~ +20 dBm max
11. Accessories	R3969 OPT16 N(m)-SMA(f) adapter × 4 Semi-rigid cable × 4
	R3970 OPT16 Semi-rigid cable × 4

8.4 R3969/R3970 OPT17

Item		Specification	
1. Characteristic impedance		50 Ω	
2. Frequency range		R3969: 300 kHz to 8 GHz R3970: 300 kHz to 20 GHz	
3. Insertion loss			
	R3969 OPT17		
	PORT 1 to PORT 1a	300 kHz to 2 GHz	4 dB or less
	PORT 2 to PORT 2b/c	2 GHz to 4 GHz	6 dB or less
	PORT 3 to PORT 3a/b/c/d	4 GHz to 6 GHz	9 dB or less
	PORT 4 to PORT 4a/b/c/d	6 GHz to 8 GHz	11 dB or less
	PORT 1 to PORT 2a	300 kHz to 2 GHz	8 dB or less
	PORT 2 to PORT 2a	2 GHz to 4 GHz	12 dB or less
		4 GHz to 6 GHz	18 dB or less
		6 GHz to 8 GHz	22 dB or less
	R3970 OPT17		
	PORT 1 to PORT 1a	300 kHz to 2 GHz	4 dB or less
	PORT 2 to PORT 2b/c	2 GHz to 4 GHz	6 dB or less
	PORT 3 to PORT 3a/b/c/d	4 GHz to 6 GHz	7 dB or less
	PORT 4 to PORT 4a/b/c/d	6 GHz to 8 GHz	8.5 dB or less
		8 GHz to 12 GHz	11.5 dB or less
		12 GHz to 15 GHz	12 dB or less
		15 GHz to 18 GHz	13 dB or less
		18 GHz to 20 GHz	14 dB or less
	PORT 1 to PORT 2a	300 kHz to 2 GHz	8 dB or less
	PORT 2 to PORT 2a	2 GHz to 4 GHz	12 dB or less
		4 GHz to 6 GHz	14 dB or less
		6 GHz to 8 GHz	17 dB or less
		8 GHz to 12 GHz	23 dB or less
		12 GHz to 15 GHz	24 dB or less
		15 GHz to 18 GHz	26 dB or less
		18 GHz to 20 GHz	28 dB or less
4. Test port load match			
	R3969 OPT17		
	PORT 1a	300 kHz to 1 MHz	10 dB or more
	PORT 2b/c	1 MHz to 2.6 GHz	19 dB or more
	PORT 3a/b/c/d	2.6 GHz to 4 GHz	18 dB or more
	PORT 4a/b/c/d	4 GHz to 8 GHz	11 dB or more

Item		Specification	
	PORT 2a	300 kHz to 1 MHz	8 dB or more
		1 MHz to 2.6 GHz	12 dB or more
		1 MHz to 4 GHz	7 dB or more
		4 MHz to 8 GHz	6 dB or more
	R3970 OPT17		
	PORT 1a PORT 2b/c PORT 3a/b/c/d PORT 4a/b/c/d	300 kHz to 1 MHz	10 dB or more
		1 MHz to 2.6 GHz	19 dB or more
		2.6 GHz to 4 GHz	18 dB or more
		4 GHz to 8 GHz	11 dB or more
		8 GHz to 12 GHz	9 dB or more
		12 GHz to 15 GHz	8 dB or more
		15 GHz to 18 GHz	7 dB or more
		18 GHz to 20 GHz	5 dB or more
	PORT 2a	300 kHz to 1 MHz	8 dB or more
		1 MHz to 2.6 GHz	11 dB or more
		2.6 GHz to 4 GHz	7 dB or more
		4 GHz to 8 GHz	6 dB or more
		8 GHz to 12 GHz	5 dB or more
		12 GHz to 15 GHz	5 dB or more
		15 GHz to 18 GHz	5 dB or more
		18 GHz to 20 GHz	5 dB or more
5. Operating environment		Temperature range: +5 °C to +40°C Relative humidity: 80% or less	
6. Programming		All functions are controlled from the R3860A, R3770, or R3768. Also remote control can be performed through the GPIB interface of R3860A, R3770, and R3768.	
7. Storage environment		Temperature range: -20°C to +60°C Relative humidity: 80% or less	
8. Dimensions		Approx. 424 (Width) × 88 (Height) × 530 (Depth) mm	
9. Weight		8.0 kg or less	
10. RF damage level		~ +20 dBm max	
11. Accessories		R3969 OPT17 N(m)-SMA(f) adapter × 4 Semi-rigid cable × 4	
		R3970 OPT17 Semi-rigid cable × 4	





Unit: mm

NOTE:

This drawing shows the dimensions of this instrument.

Appearance may differ depending on the product series and options.

DIMENSIONAL OUTLINE DRAWING

ALPHABETICAL INDEX

IMPORTANT INFORMATION FOR ADVANTEST SOFTWARE

PLEASE READ CAREFULLY: This is an important notice for the software defined herein. Computer programs including any additions, modifications and updates thereof, operation manuals, and related materials provided by Advantest (hereafter referred to as "SOFTWARE"), included in or used with hardware produced by Advantest (hereafter referred to as "PRODUCTS").

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LIMITED WARRANTY

1. Unless otherwise specifically agreed by Seller and Purchaser in writing, Advantest will warrant to the Purchaser that during the Warranty Period this Product (other than consumables included in the Product) will be free from defects in material and workmanship and shall conform to the specifications set forth in this Operation Manual.

2. The warranty period for the Product (the "Warranty Period") will be a period of one year commencing on the delivery date of the Product.

3. If the Product is found to be defective during the Warranty Period, Advantest will, at its option and in its sole and absolute discretion, either (a) repair the defective Product or part or component thereof or (b) replace the defective Product or part or component thereof, in either case at Advantest's sole cost and expense.

4. This limited warranty will not apply to defects or damage to the Product or any part or component thereof resulting from any of the following:

   (a) any modifications, maintenance or repairs other than modifications, maintenance or repairs (i) performed by Advantest or (ii) specifically recommended or authorized by Advantest and performed in accordance with Advantest 's instructions;

   (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);

   (c) use of the Product under operating conditions or environments different than those specified in the Operation Manual or recommended by Advantest, including, without limitation, (i) instances where the Product has been subjected to physical stress or electrical voltage exceeding the permissible range and (ii) instances where the corrosion of electrical circuits or other deterioration was accelerated by exposure to corrosive gases or dusty environments;

   (d) use of the Product in connection with software, interfaces, products or parts other than software, interfaces, products or parts supplied or recommended by Advantest;

   (e) incorporation in the Product of any parts or components (i) provided by Purchaser or (ii) provided by a third party at the request or direction of Purchaser or due to specifications or designs supplied by Purchaser (including, without limitation, any degradation in performance of such parts or components);

   (f) Advantest's incorporation or use of any specifications or designs supplied by Purchaser;

   (g) the occurrence of an event of force majeure, including, without limitation, fire, explosion, geological change, storm, flood, earthquake, tidal wave, lightning or act of war; or

   (h) any negligent act or omission of the Purchaser or any third party other than Advantest.

5. **EXCEPT TO THE EXTENT EXPRESSLY PROVIDED HEREIN, ADVANTEST HEREBY EXPRESSLY DISCLAIMS, AND THE PURCHASER HEREBY WAIVES, ALL WARRANTIES, WHETHER EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, (A) ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND (B) ANY WARRANTY OR REPRESENTATION AS TO THE VALIDITY, SCOPE, EFFECTIVENESS OR USEFULNESS OF ANY TECHNOLOGY OR ANY INVENTION.**

6. **THE REMEDY SET FORTH HEREIN SHALL BE THE SOLE AND EXCLUSIVE REMEDY OF THE PURCHASER FOR BREACH OF WARRANTY WITH RESPECT TO THE PRODUCT.**

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CUSTOMER SERVICE DESCRIPTION

In order to maintain safe and trouble-free operation of the Product and to prevent the incurrence of unnecessary costs and expenses, Advantest recommends a regular preventive maintenance program under its maintenance agreement.

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.

Some of the components and parts of this Product have a limited operating life (such as, electrical and mechanical parts, fan motors, unit power supply, etc.). Accordingly, these components and parts will have to be replaced on a periodic basis. If the operating life of a component or part has expired and such component or part has not been replaced, there is a possibility that the Product will not perform properly. Additionally, if the operating life of a component or part has expired and continued use of such component or part damages the Product, the Product may not be repairable. Please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest's sales representatives to determine the operating life of a specific component or part, as the operating life may vary depending on various factors such as operating condition and usage environment.

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