ADVANTEST®

ADVANTEST CORPORATION

R3860A/R3770/R3768 Operation Manual

MANUAL NUMBER FOE-8440128F01

Applicable Models
R3860A RF Component Analyzer
R3770 Network Analyzer
R3768 Network Analyzer

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Printed in Japan

CAUTIONS WHEN USING THIS UNIT

1. SAFETY PRECAUTIONS

This unit has Microsoft Windows NT Embedded or Windows XP Embedded pre-installed.

The measuring function of this unit is dependent on the Windows environment. Do not alter the Windows operating environment in any way other than described in this manual.

Furthermore, this unit is not a data processor. Operate it only as described in this manual.

1. Non-permitted actions:
   - Installing other application programs.
   - Changing or deleting items in the control panel (except for "A.3 Network Settings" and "A.4 Printer Installation Method").
   - Opening or operating the existing files in C drive.
   - Operating other application programs during the measurement.
   - Upgrading the Windows operating system.
   - If this unit does not function correctly due to any of the above, reinstall the system using the system recovery disk.
   - For information on system recovery method, see section A.2, "R3860A/R3770/R3768 System Recovery Procedure).
2. Computer viruses

   Depending on the operating environment and method, the system can be contaminated by a computer virus. To use the system securely, it is recommended to take the following counter measures:
   - Run a virus check before loading a file or media from an outside source.
   - Make sure that any network has safety measures against computer viruses before connecting.
   - If infected with a computer virus:
   - Delete all files in the D drive. Re-install the system using the recovery disk.
   - For information on system recovery method, see section A.2, "R3860A/R3770/R3768 System Recovery Procedure).
3. Application software:

   When executing application programs on this unit, some operations may differ due to the Windows environment.

2. Limitations Imposed when Using Windows NT or Windows XP

2.1 Limitations Imposed when Using Windows NT

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This is to certify, that

Component Analyzer

R3860A/R3770/R3768 Series

instrument, type, designation

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ADVANTEST Corp.

Tokyo, Japan

ROHDE&SCHWARZ

Engineering and Sales GmbH
Munich, Germany

3860A/3770/3768.04

PREFACE

This manual provides the information necessary to check functionality, operate and program this analyzer

1. Organization of this manual

   This manual consists of the following chapters:

Safety Summary	To use the analyzer safely, be sure to read this manual first.
1. INTRODUCTION	Explains the Analyzer, standard accessories, operating environment, and safety precautions. Read this chapter before operating the analyzer.
2. OPERATION • Explanation of Panel Surface • Screen Explanation • Measurement Channels and Windows • Basic Operation	Describes the names, functions and each part on the panels. You can learn the basic operations of the analyzer through the examples shown in this chapter.
3. MULTI-CHANNEL MEASUREMENT • Channel and Window Settings • Measurement Port, Frequency, and Other Measurement Conditions • Trace Settings • Window Expansion Setting • Measurement Example	Explains how to set the active channel and traces. You can learn the basic operations of the analyzer through the measurement examples in this chapter.
4. CALIBRATION • 1 to 6-Port Full Calibration • Normalize • Calibration Kit Selection • Measurement Example • Extending the Measurement Reference Surface	Explains calibration. You can learn the basic operations of the analyzer through the measurement examples in this chapter.
5. SOFTWARE FIXTURE	Explains the functions and how to operate the analyzer using these functions. You can learn the basic operations of the analyzer through the measurement examples in this chapter.
6. PROGRAM SWEEP • Program Sweep Editing • Measurement Example	Explains how to edit program sweeps. You can learn the basic operations of the analyzer through the measurement examples in this chapter.
7. MARKER FUNCTION	Explains how to set markers.

8. SAVING MEASUREMENT DATA • Save All S-parameters • Saving Specified Data Only • Saving Picture Image Data	Explains how to save measurement data.
9. LIMIT TEST • How to Set the Limit Test Function • Limit Test Result Window • Measurement Sample	Explains the limit test.
10. TIME DOMAIN FUNCTION • Time Domain Transformation Function • Window Processing • Gate Function • Time Domain Transformation Mode • Transformation of the Time Domain Horizontal Axis	Explains the Time Domain function.
11. DEVICE POWER SUPPLY	Explains the device power source function.
12. FREQUENCY CONVERSION DEVICE MEASUREMENT • Overview • Independent Settings of the Power Source and the Receiver • Mixer Measurement • Mixer Measurement Example	Explains the measurement of frequency conversion device.
13. REFERENCE • Menu Index • Function Explanations	Lists menus and explains functions for each menu item.
14. REMOTE PROGRAMMING	Explains how to set up the GPIB. Also lists programming commands and shows programming examples.
15. PERFORMANCE VERIFICATION	The analyzer performance test methods are described.
16. SPECIFICATIONS	Provides the specifications for the analyzer.
APPENDIX	Provides information such as message and procedure descriptions necessary for using the analyzer.

2. Typeface conventions used in this manual

- Panel keys and soft keys are printed in a contrasting typeface to make them stand out from the text as follows:

Panel keys: Boldface type	Example: **SINGLE, STOP**
Soft keys: Boldface and italic type	Example: ***Channel, Sweep***

- When a series of key operations are described using a comma between two keys.
- The software menu allows toggling between settings like an ON/OFF switch.
  For example, when turning off the ***Trace Display ON/OFF*** function, the annotation "***Trace Display ON/OFF*** (OFF)" is used.

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1. INTRODUCTION

This chapter gives a brief explanation of this unit, standard accessories, operating environment, and safety precautions. Read this chapter before operating the analyzer.

1.1 Product Description

This unit is the best analyzer for evaluating the performance of RF components in the frequency range of 300 kHz to 20 GHz. This analyzer features to analyze characteristics of RF devices that have been including complex functions such as balanced input and output devices, and multi-port devices.

- High-speed measurement

  The high-speed measurement of 5 μs / point can significantly reduce test costs.

- Multi-ports

  This analyzer can be equipped with a maximum of 6 test ports.

  When the analyzer is equipped with 3 ports, an evaluation of unbalanced input devices and balanced output devices can be performed.

  When the analyzer is equipped with 4 ports, an evaluation of balanced input and output devices can be performed.

  In the 6-port type, the S-parameter for up to 6 ports and the 3-port balance device can be measured.

- Analysis function

  A wide variety of evaluations can be performed with capabilities of impedance conversion, removing jig circuit characteristics, matching circuit, balanced analysis, and time domain analysis, allows testing of various kinds of devices.

- This unit can evaluate the frequency conversion devices such as dividers and doublers by setting the signal source and the receiver independently.
- Adding the second signal source enables the mixer phase characteristics evaluation.
- Measurement channels

  Eight combinations (channels) for independent measurements are available. Each channel allows testing of 16 different characteristics simultaneously.

- Large screen display

  This analyzer is equipped with a 12.1-inch color LCD with a touch screen function. This allows easy viewing and analysis of the complicated devices.

- Detachable front panel for production use (R3860A)

  The front panel is detachable. When this analyzer is installed in automated test equipment, the front panel can be placed in a separate location for production use. The front panels of the R3770 and the R3768 cannot be removed.

1.2 Accessories

Table 1-1 lists the standard accessories shipped with the analyzer. If any of the accessories are damaged or missing, contact a sales representative. Order new accessories by type name.

Table 1-1 Standard Accessories List

Name of accessory	Type name	Quantity	Remarks
Power cable	A01413	1	3pins plug
Special touch screen panel pen	SHN-STPEN-1	1	For touch screen panel operation
Ferrite core	ESD-SR-250	1	For Ethernet cable
System recovery disk	-	1	For system recovery
Operation Manual	ER3860A	1	

1.2.1 Accessory for VSIM

Table 1-2 lists the accessories which are shipped with the analyzer that includes the built-in VSIM function.

If the accessories listed in Table 1-2 are damaged or missing at the time of delivery, contact Advantest or an Advantest sales representative. Order new accessories by model name.

Table 1-2 Accessory for VSIM

Name of accessory	Type name	Quantity	Remarks
Ferrite core	ESD-SR-250	4	For BNC cable

1.3 Application Models and Accessories

Can select the model by which the best functions are combined (application model) for this unit depending on the usage.

1.3.1 Function

2-PORT: 2-PORT test set
The basic model for 2-PORT network analysis.

3-PORT: 3-PORT test set
It is effective in measuring the three port devices such as an antenna duplexer and the unbalance to balance conversion.

4-PORT: 4-PORT test set
It is effective in measuring the four port device of the balance input to balance output type.

6-PORT: In the 6-port type, the S-parameter for up to 6 ports and the 3-port balance device can be measured.

ATT: 8-GHz electronic output attenuator
20-GHz mechanical output attenuator
It is effective in measuring active devices such as amplifiers.

2nd SG: The second signal source
Using the 2nd SG as the local signal enables the mixer phase measurement.

2nd ATT: 8-GHz electronic output attenuator for the second signal source
20-GHz mechanical output attenuator for the second signal source

VSIM: Device power source
It is used for the power source of amplifiers and the control voltage of switch modules.

Nonlinear analysis:
Independent settings of the power source and the receiver
Function of measuring the frequency conversion devices such as harmonics, dividers, and doublers.

MDAS: Complicated measurement conditions for the multi port device measurement application software and for the balance devices can be set graphically.

EXT AMP port:
The external amplifier can be connected to the EXT AMP port, which is added to PORT1, for measurements in the range from 500 MHz to 8 GHz (8 GHz type) or from 500 MHz to 20 GHz (20 GHz type). (Only PORT1 can be added.)
The S-parameter of the power amplifier in the full 2-port calibration can be measured by adding the appropriate attenuators to the mixer direct connection ports which are added to R, A, and B ch.
Up to 1 W can be output from the amplifier.

1.3.2 Application Model

Functions marked with ✓ are included as standard equipment.

- R3860A 8-GHz type Component Analyzer

Model	ATT	2nd SG	2nd ATT	VSIM	EXT AMP port	Nonlinear	MDAS
2-port Basic Model						✓	
2-port Nonlinear Passive Device		✓				✓	
2-port Active Device	✓			✓		✓	
2-port Nonlinear Active Device	✓	✓	✓	✓		✓	
3-port Basic Model						✓	
4-port Basic Model						✓	✓
4-port Nonlinear Passive Device		✓				✓	✓
4-port Active Device	✓			✓		✓	✓
4-port Nonlinear Active Device	✓	✓	✓	✓		✓	✓
4-port High-power Active Device					✓	✓	✓
4-port High-power Amplifier	✓			✓	✓	✓	✓
6-port Basic Model						✓	✓

- R3860A 20-GHz type Component Analyzer

Model	ATT	2nd SG	2nd ATT	VSIM	EXT AMP port	Nonlinear	MDAS
2-port Basic Model						✓	
2-port Nonlinear Passive Device		✓				✓	
2-port Active Device	✓			✓		✓	
2-port Nonlinear Active Device	✓	✓	✓	✓		✓	
3-port Basic Model						✓	
4-port Basic Model						✓	✓
4-port Nonlinear Passive Device		✓				✓	✓
4-port Active Device	✓			✓		✓	✓
4-port Nonlinear Active Device	✓	✓	✓	✓		✓	✓
4-port High-power Active Device					✓	✓	✓
4-port High-power Amplifier	✓			✓	✓	✓	✓
6-port Basic Model						✓	✓

- R3768 8 GHz Network Analyzer

Model	ATT	VSIM	EXTAMP port	Nonlinear	MDAS
2-port Basic Model					
2-port Output Power Expansion	✓			✓	
3-port Basic Model					
4-port Basic Model					✓
4-port Output power expansion	✓			✓	✓
4-port For switch modules		✓		✓	✓
4-port High-power Active Device			✓	✓	✓
4-port High-power Amplifier	✓	✓	✓	✓	✓

- R3770 20 GHz Network Analyzer

Model	ATT	VSIM	EXTAMP port	Nonlinear	MDAS
2-port Basic Model					
2-port Output Power Expansion	✓			✓	
3-port Basic Model					
4-port Basic Model					✓
4-port Output power expansion	✓			✓	✓
4-port For switch modules		✓		✓	✓
4-port High-power Active Device			✓	✓	✓
4-port High-power Amplifier	✓	✓	✓	✓	✓

1.3.3 Accessories

Rack mounting kit
Panel extension cable
Multi port test set
Automatic calibration kit

1.4 Operating Environment

- Operating Environment

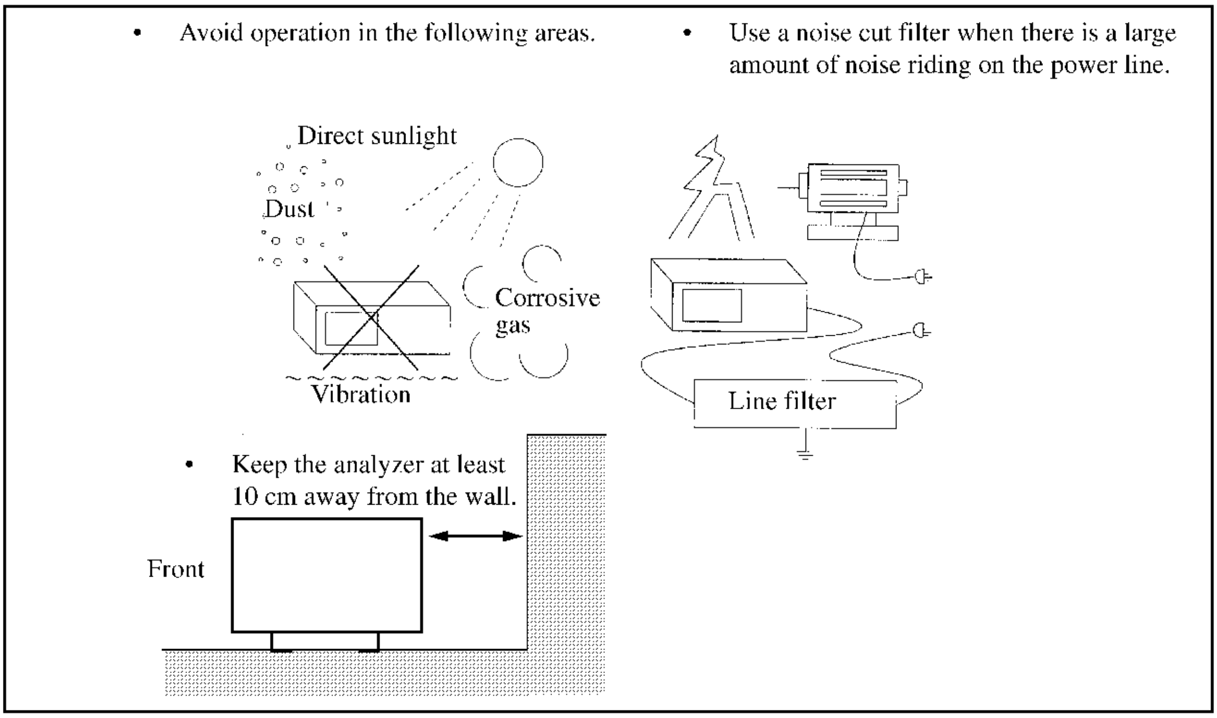


Figure 1-1 Operating Environment

This unit should be installed in an area which satisfies the following conditions:

- Ambient temperature: +5°C to +40°C (Operating temperature range)
  -20°C to +60°C (Storage temperature range)
- Relative humidity: 80% or less (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 unit has been designed to withstand a certain amount of noise riding on the AC power line, it should be used in an area of low noise. Use a noise cut filter when ambient noise is unavoidable. For highly accurate measurement, turn the power ON after this unit temperature has reached the room temperature level, and warm up this unit for 30 minutes.
- Installation position
  This unit has an air outlet hole on its rear panel. Never block or plug the hole, as the resulting internal temperature rise will affect measurement accuracy.

- Installation position
    - There are blowout type cooling fans on the rear panel and sides. Additionally, there are ventilation holes on the sides.
      An increase in the internal temperature affects measurement accuracy, so do not block the fans and ventilation holes.
    - Do not use the analyzer in the upright position to prevent injury.

1.5 Supply Description

1.5.1 Power Supply Specifications

WARNING: ***Safety use this unit according to the power requirement.***
This unit might be damaged in the case not following the power requirement.

The power requirement of this unit is shown in the following.
Use the power supply by which the power requirement of this unit is satisfied.

	$100V_{AC}$ operation	$220V_{AC}$ operation
Input voltage range	90 V - 132 V	198 V - 250 V
Frequency range	48 Hz - 66 Hz	
Power consumption	500 VA or below	

* The supply voltage of this unit is automatically changed over (100/240 V).

1.5.2 Connecting the Power Cable

WARNING:

1. ***Power cable***
   - ***Use power cable of the attachment for prevention electric shock and fire.***
   - ***Use power cable in accordance with the safety standard of the country for use excluding Japan. A separately-sold plug for overseas use is available. For more information, contact the Advantest service department.***
   - ***When you connect power cable with the outlet, turn off the power switch.***
   - ***When you pull out power cable from the outlet, have the plug.***
2. ***Protective earth***
   - ***Connect the power plug cable with the power outlet which has the protective earth terminal.***
   - ***If the code for the extension without the protective earth terminal is used, grounding will be defeated.***

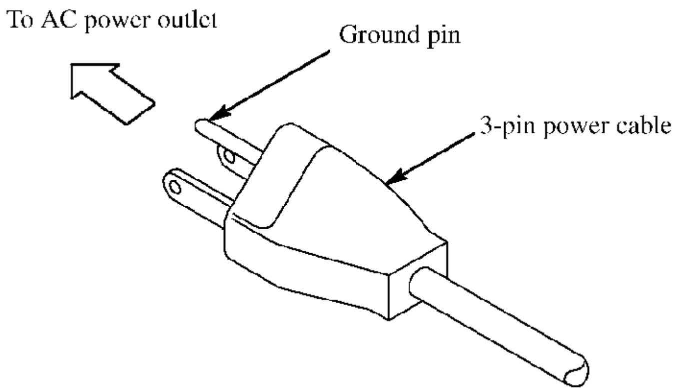


Figure 1-2 Power Cable

1.6 System Setup Cautions

1.6.1 Notes on the Use of Parallel I/O Ports

1. In +5V power output from parallel I/O port, maximum current capacity is 100mA.
   Use it within 100mA.
2. An overcurrent protective device is installed in the +5 V power supply, which supplies power through the parallel I/O port. If an overcurrent flow of more than 100 mA occurs, the power supply shuts down.
   When the problem causing the overcurrent is solved, the power supply is automatically resumed.
3. Use the shield cable for the cable for parallel I/O port. (To prevent malfunction by noise)
4. The standard of the cable for the radiation test of this unit is MO-27.
5. Do not bundle I/O cable and AC power line when wiring.

1.6.2 Notes on the Use of Serial I/O Ports

1. The length of the cable used for serial I/O port is 15 m or less.
2. Use the shield cable for the cable for serial I/O port. (To prevent malfunction by noise)
3. The standard of the cable used for the radiation test of this unit is A01235.
4. Do not bundle I/O cable and AC power line when wiring.

1.6.3 Note on the Probe Connector

When a cable is connected to the probe connector for any purposes other than the automatic calibration kit (R17050), the cable must have countermeasures against radiation installed.
For more information on countermeasures against radiation, contact an Advantest service representative.

1.7 Measurement Time

The sweeping time of this unit is determined by frequency set-up time and data acquiring time.

As the SWEEP TIME on the display screen shows the data acquiring time, the actual sweep time becomes longer than the displayed SWEEP TIME under the influence of frequency set-up time.

1.8 Test Port Overload Cautions

The maximum input level for the test port is +10 dBm in the 8-GHz type, and +1 dBm in the 20-GHz type.

If a power exceeding at least 5 dB more than the maximum measurement level is input, "Overload" is displayed.

Make sure the test port is not overloaded. An overload may damage the analyzer.

If an electrically charged measurement item is connected to the test port, a transient voltage is applied and the analyzer may become damaged. Do not input ±16 V or more.

CAUTION:

1. ***When using this analyzer on automated machinery, make sure it is well grounded. Poor grounding may electrically charge the measurement item.***
2. ***If a voltage is applied to the measurement item, discharge the electricity before connecting the measurement item to this analyzer.***

1.9 Notes on Use

1. Before starting the measurement

   When turning on the power, don't connect DUT.

   Before starting the measurement, check to see the output power level.

   CAUTION: ***Due to the initial settings, the 8-GHz type outputs a +10 dBm signal and the 20-GHz type outputs a +0 dBm signal to each test port.***

2. Removing of case

   Do not open the case to one except service personnel of our company.

   This unit has a high temperature part and a high pressure part.

3. When abnormality occurs

   When smoke rises from this unit, smell nastily, or rear unusual sound feel, turn off the power switch. Pull out power cable from the outlet. And contact to our company.

   When the error message is displayed as "Source Unlevel", the output signal of this unit is under abnormal conditions.
   Stop measuring promptly and contact us because the measurement device may be damaged.

   The address and the telephone number of our company are in the end of this manual.

4. Warm up

   After this unit temperature has reached the room temperature level, turn the power switch ON and warm it up for 30 minutes.

5. Electromagnetic interference.

   High frequency noise of the small power is generated at this unit use.

   Therefore, electromagnetic interference is generated to the television or the radio by an improper installation and use of this unit.

   If the power of this unit is turned off, and the electromagnetic interference is reduced, then this unit is the cause it.

   Prevent electromagnetic interference by the following procedure.

   - Change the direction of antenna of the television or the radio.
   - Place this unit the other side of the television or the radio.
   - Place this unit away from the television or the radio.
   - Use another line of power source for the television or the radio than this unit.

6. Prevention of Electrostatic Buildup

   To prevent damages to semiconductor parts from electrostatic discharge (ESD), the precautions shown below should be taken. We recommend that two or more measures be combined to provide adequate protection from ESD. (Static electricity can easily be built up when a person moves or an insulator is rubbed.)

   Countermeasure example

Human body:	Use of a wrist strap (see Figure 1-3).
Floor in the work area:	Installation of a conductive mat, the use of conductive shoes, and grounding (see Figure 1-4).
Workbench:	Installation of a conductive mat and grounding (see Figure 1-5).

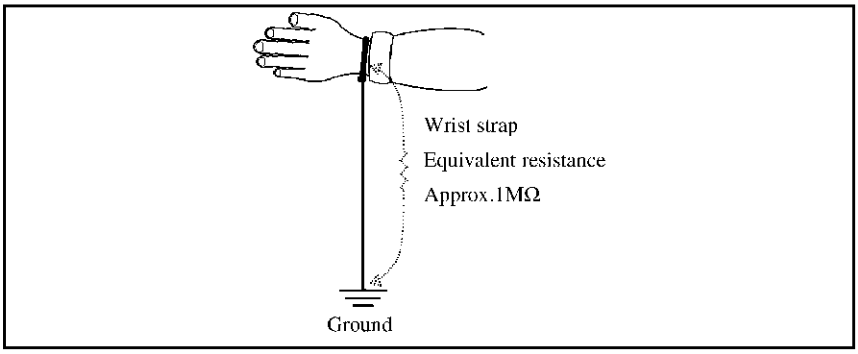


Figure 1-3   Countermeasures for Static Electricity of Human Bodies

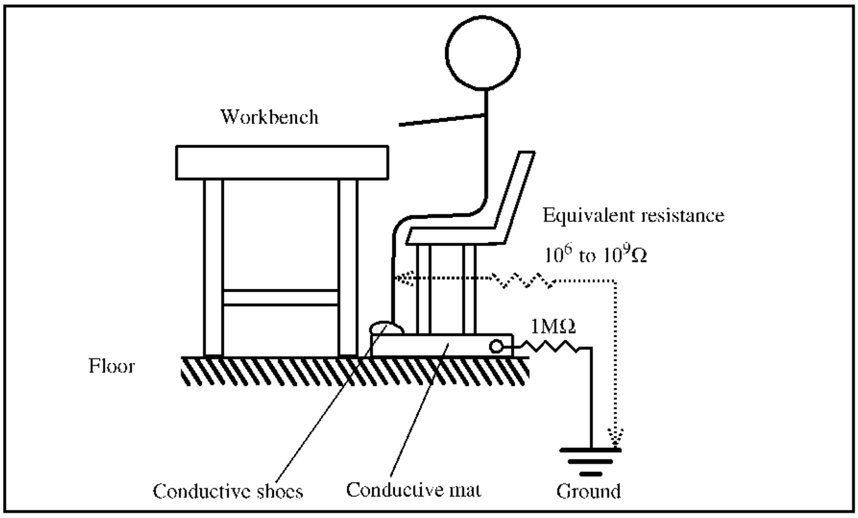


Figure 1-4   Countermeasures for Static Electricity of Work Site Floor

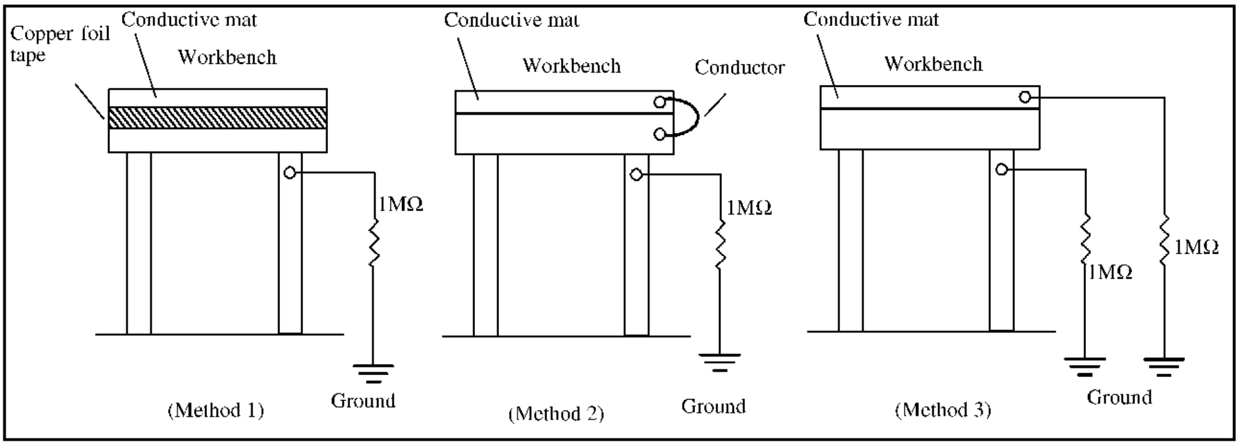


Figure 1-5   Countermeasures for Static Electricity of Workbench

7. Transport precautions

   Handle the analyzer with care due to its heavy weight.

8. Precautions when turning the power ON

   Do not touch the panel and keyboard during the system startup immediately after the power is ON. Doing so could cause malfunctioning of the system.

   Turning the power switch OFF causes the analyzer to begin shutdown processing. Do not touch the power switch during shutdown processing. Doing so could cause the system to restart.

9. Precautions for the network connection

   When the analyzer is connected to a network and "Obtain IP address from DHCP server" is set in the IP address setting. If the IP address cannot be obtained, the analyzer cannot boot as a measuring instrument. In that event, connect the keyboard, select "Set the IP address," and set an appropriate value.

10. Message Boxes

    A message box is displayed in the event of system problems or improper operation. Entering values or menu operation is not ignored while a message box is displayed. Perform operations after the message box disappears.

11. Dialog Boxes

    The following dialog boxes are not deleted when preset. Click the close button of each dialog box to delete.

    Explorer Dialog Box
    Network Setup Dialog Box
    Add Printer Dialog Box
    Adjust Time Dialog Box

12. Handling the Touch Screen Display

    The touch screen includes a glass. Strong shocks can break the panel, so do not apply excessive force to the screen.

    Be sure to use the included special touch screen pen during operation. Do not use a mechanical pencil, ball-point pen, or other hard pointed object. Doing so will damage the screen.

13. Forced Termination of the System

    The power cannot be turned off even if the power switch is pressed when the system stops responding. In such cases, keep pressing the power switch (for about 5 seconds) to force termination of the system.

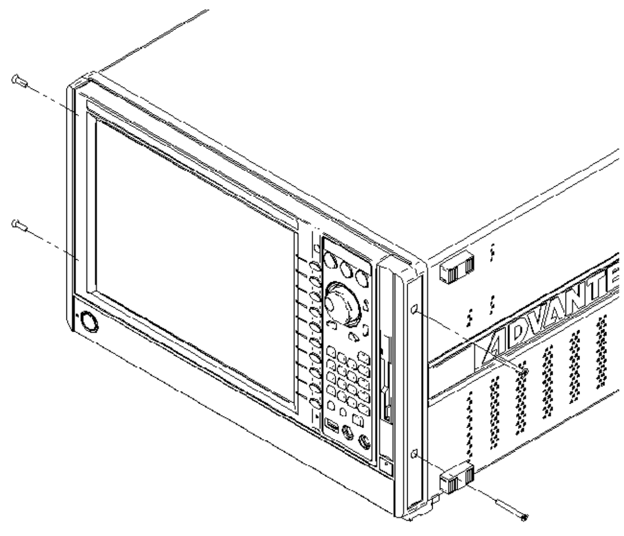
1.10 Precautions for Attaching and Detaching the Panel

As for the R3860A, the panel can be used detaching from the measuring part.

Read the following precautions before detaching the front panel.

NOTE: ***An optional cable is required when using the analyzer with the panel detached.***

- If the power is ON, turn the power OFF and remove the power cable from the analyzer to ensure that the analyzer is not operating.
- Be careful not to catch your fingers when attaching or detaching the panel.
- Place the analyzer on a stable and horizontal workbench when attaching or detaching the front panel.
- Remove the screws from the four locations indicated on the front sides of the analyzer.
- Hold the panel firmly when removing the screws to prevent it from falling.
- Pull the panel forward after removing all the screws from the four locations.
- Remove the cable connected between the front panel and the main unit.
- Use the analyzer only after replacing the connection cable with a different connection cable suited to the application.
- Use the following types of screws when screws are lost.
  Two screws on the right side: Flat-head screws M4X35 (iron or stainless steel)
  Two screws on the left side: Flat-head screws M4X14 (iron or stainless steel)



1.10.1 Precautions for Transport and Operation

- Ensure the panel is secured with screws during transport.
- Do not stand the panel in the upright position during operation.

1.11 Cables Used to Connect External Devices

The following cables are recommended for connecting external devices to this unit.

Table 1-3 Recommended Cables for External Devices

Name	Port name	Length	Remarks
VGA cable	KCR-VGA2K	2 m	Shield cable with core
Printer cable	KPU-DOSV2K	2 m	Shield cable with core
Serial cable	KRS-DV9FF2K	2 m	Shield cable with core
USB cable	KB-USB-2BK	2 m	Shield cable
Ethernet cable	KB-STP-05K	5 m	Shield cable (refer to Figure 1-6)
BNC cable	A01037-1500	1.5 m	Shield cable (for VSIM)

Use the Ethernet cable with the supplied ferrite core (ESD-SR-25) assembled as shown in Figure 1-6.

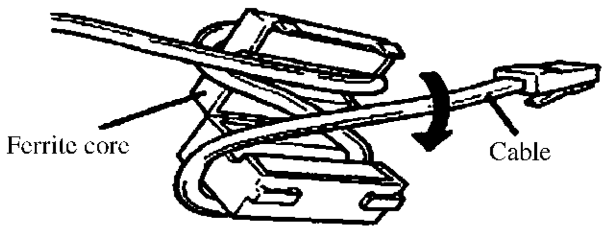


Figure 1-6 Ferrite Core Assembly

When using the BNC cable that is connected to the VSIM port, attach the supplied ferrite core (ESD-SR-250) to the BNC cable as close to the main unit as possible.

1.12 Cleaning, Storage and Transportation

1. Cleaning
   Wipe the dirt of this unit off with a soft cloth (or wet cloth). At this time, attend to the following points.
   - Do not remain the fluff of the cloth and do not soak water into the internal of this unit.
   - Do not use an organic solvent (for example, benzene and acetone, etc.) which changes plastics in quality.
2. Storage
   Storage temperature of this unit 0 is from -20°C to +60°C. Do not store it out of this temperature range.
   The cases in which this unit is not used for a long time, cover with the vinyl cover or put in the cardboard box and prevent dust. Keep it in a dry place where dust and direct sunshine are prevented.
3. Transportation
   When you transport this unit, pack it equally to the first packing material or any more.

Packing procedure

1. Wrap this unit itself with cushion material and put in the cardboard box.
2. After putting attachment, put cushion again.
3. Shut the lid of the cardboard box. Fix the outside with a string or tape.

1.13 Calibration

This analyzer system requires yearly calibration. Calibration work should be done at an Advantest Corporation site. Please contact Advantest Corporation concerning the calibration.

1.14 Replacing Parts with Limited Life

This unit uses the following parts with limited life that are not listed in Safety Summary.

Replace the parts listed below after their expected lifespan has expired.

Part name	Life
Panel key switch	1,000,000 times operating life (Estimated)
LCD (liquid crystal display) back light	50,000 hours operating life (Estimated)
Rotary encoder	2,500,000 operations (Estimated)
Fan	40,000 hours in operation (Estimated)
Lithium battery for memory backup	Approximately 3 years (Estimated)
Mechanical output attenuator	2,000,000 times

1.15 Product Disposal and Recycle

Disposal of this product should comply with 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 when maximum configuration	Remarks
Mercury	LCD backlight	Front panel	1	
Batteries	Lithium batteries	CPU board AAT-4470AT705	1	
Printed circuit boards	PLK-**, PEK-** PLB-**, PEB-** PEF-**	Inside the instrument	65	
Plastic containing halogenated flame retardants	-	-	-	
CRT	-	-	-	
LCD	AHN-TN8031*17	Front panel	1	
External electric cables	DCB-**	Accessories	1	Power cable
	DCP-**		4	Semi-rigid cable (OPT17)
Arsenic compound semiconductors	GaAs amplifier GaAs switch GaAs attenuator GaAs FET	BEF-030002 BEK-030356 BEK-030057 THK012 THK080 THK084 THK092 THK103	225	

2. OPERATION

2.1 Explanation of Panel Surface

2.1.1 Front Panel

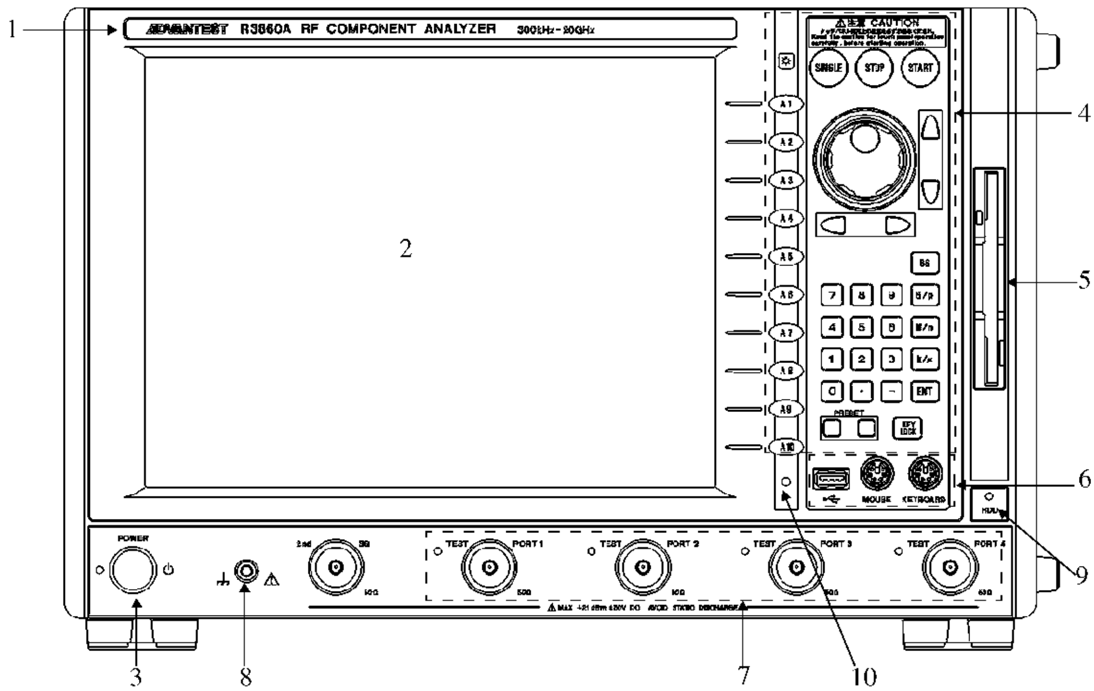
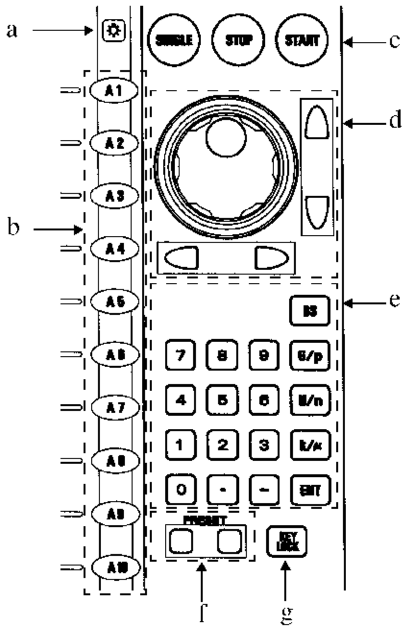


Figure 2-1 Front Panel

1. Nameplate — The nameplates vary depending on the model.
2. Touch panel display — Displays measurement data, setting conditions, and other information. Setting conditions can also be changed using the touch panel function.
3. Power switch — Power ON/OFF switch. Power is turned OFF after system shutdown when OFF is selected.
4. Entry key block — Key switch block for changing settings.
5. Floppy disk drive — 3.5-inch floppy disk drive.
6. I/F connector block — I/F connector block for the keyboard and mouse.
7. Test port block — Test port connector block for measurements differs depending on the model.

8. Grounding terminal	Grounding terminal for wrist strap connection to prevent static electricity shocks. It is connected to the chassis ground of the analyzer.
9. HDD access lamp	Lights when the hard disk drive (HDD) is accessed.
10. Power lamp	Lights when the power is ON.

- Entry key block



a. Backlight key	Turns the backlight of the display ON/OFF.
b. Application keys	Keys for selecting applications on the side menu display.
c. Program keys	Measurement control keys. SINGLE: Executes one measurement. STOP: Stops continuous measurement. START: Starts continuous measurement.

d. Encoder and up and down keys

Encoder and up and down keys

CAUTION: ***Rotating the data knob too quickly may negate the setting accuracy.***

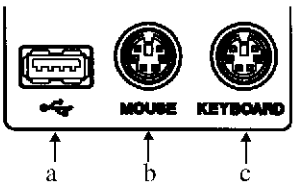
e. Unit input keys — Keys for input of values.

BS:	Backspace key
G/p:	Unit key - GHz for frequency data; psec for time data.
M/n:	Unit key - MHz for frequency data; nsec for time data.
k/μ:	Unit key - KHz for frequency data; μsec for time data.
ENT:	Basic unit key - Hz for frequency data; sec for time data.

f. Reset keys — Keys for initialization of the unit. Pressing both keys simultaneously performs initialization.

g. Key lock key — Locks key input. Operation toggles between ON/OFF.

- I/F connector block



a. Serial I/O connector — Serial I/O connector for accessories.

b. Mouse connector — Mouse connector. Connect the mouse before turning the power ON.

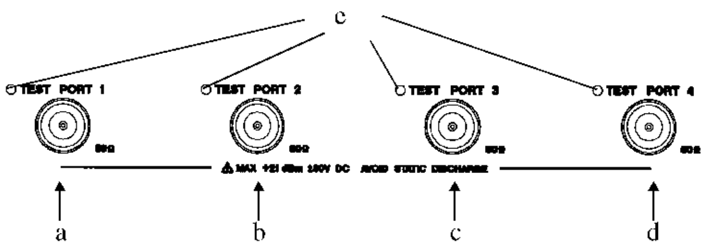
NOTE: The mouse cannot be used if it is connected after power ON.

c. Keyboard connector — Keyboard connector.

NOTE:

1. ***The keyboard cannot be used if it is connected after power ON.***
2. ***Do not operate the front panel while pressing any keys on the keyboard.***

- 2/3/4-port type test port block



a. Test port 1 — Test port 1 input connector

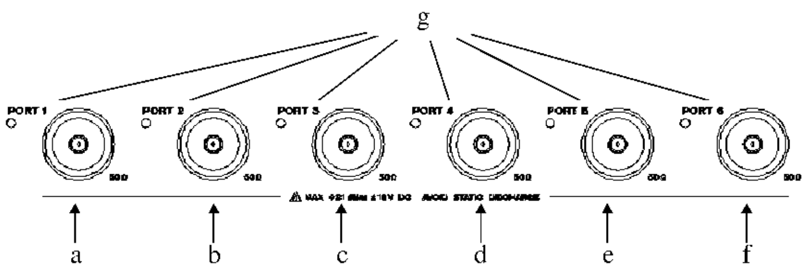
b. Test port 2 — Test port 2 input connector

c. Test port 3 — Test port 3 input connector (3-port and 4-port type)

d. Test port 4 — Test port 4 input connector (4-port type)

e. Test port LED — Signal is output from the port with the lit LED.

- 6-port type test port block



a. Test port 1 — Test port 1 input connector

b. Test port 2 — Test port 2 input connector

c. Test port 3 — Test port 3 input connector

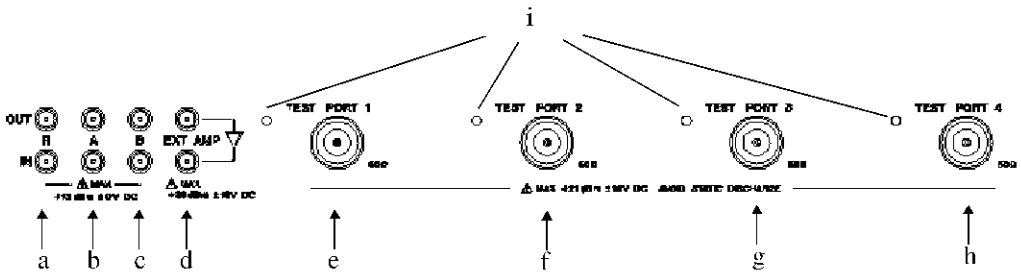
d. Test port 4 — Test port 4 input connector

e. Test port 5 — Test port 5 input connector

f. Test port 6 — Test port 6 input connector

g. Test port LED — Signal is output from the port with the lit LED.

- EXT AMP port type test port block



a.	Rch port	Rch input connector
b.	Ach port	Ach input connector
c.	Bch port	Bch input connector
d.	External amplifier port	External amplifier connector
e.	Test port 1	Test port 1 input connector
f.	Test port 2	Test port 2 input connector
g.	Test port 3	Test port 3 input connector
h.	Test port 4	Test port 4 input connector
i.	Test port LED	Signal is output from the port with the lit LED.

2.1.2 Rear Panel

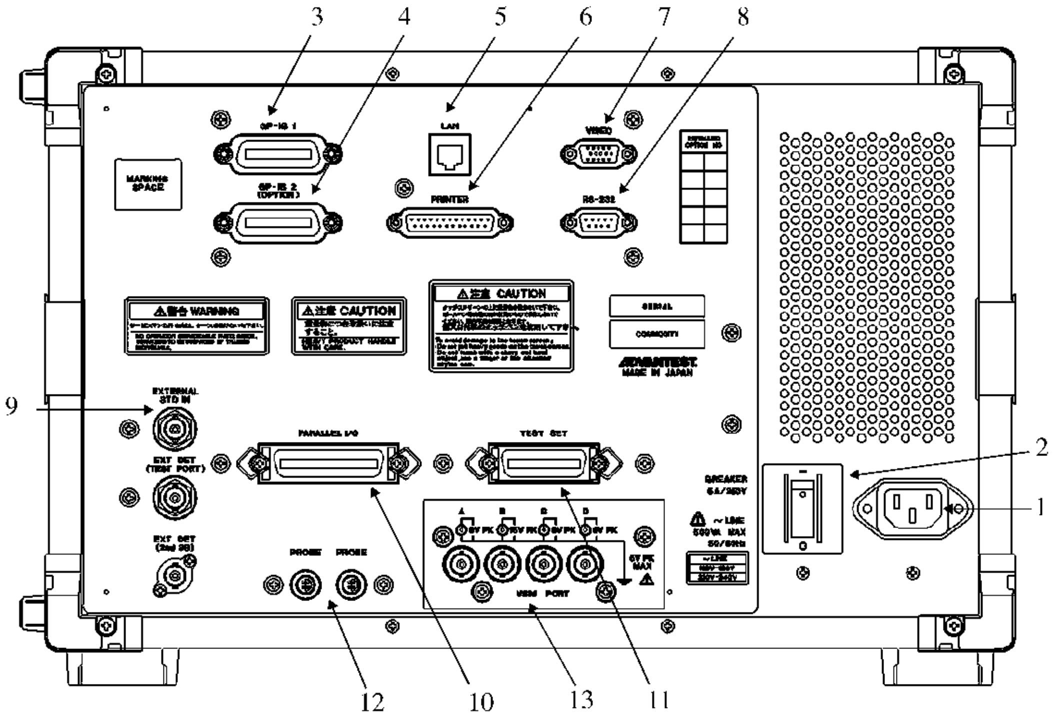


Figure 2-2 Rear Panel

1.	AC power connector	3-pin terminal which uses the middle pin for the ground.
2.	Power breaker	Power breaker. Forces OFF when the flow of current is excessive.
3.	GP-IB connector 1	GP-IB connector for non-controller.
4.	GP-IB connector 2	GP-IB connector for controller (option).
5.	LAN connector	LAN connector for 10BaseT.
6.	Printer connector	Connector for printer connection.
7.	Video connector	Video output connector.
8.	RS-232 connector	RS-232 connector for accessories.
9.	External standard source connector	Connector for input of external standard frequency.
10.	Parallel I/O connector	I/O port used for telecommunications with automatic machinery and other external equipment.
11.	Test set connector	Test set connector for accessories.
12.	Probe connector	Connectors for probe power (±15V output).
13.	VSIM connector	Output connectors for the device power supply (VSIM).

2.2 Screen Explanation

2.2.1 Operation Menus

Five types of operation menus are displayed on the screen. The menus are operated using the touch panel or mouse.

The side menu can also be operated from the panel keys.

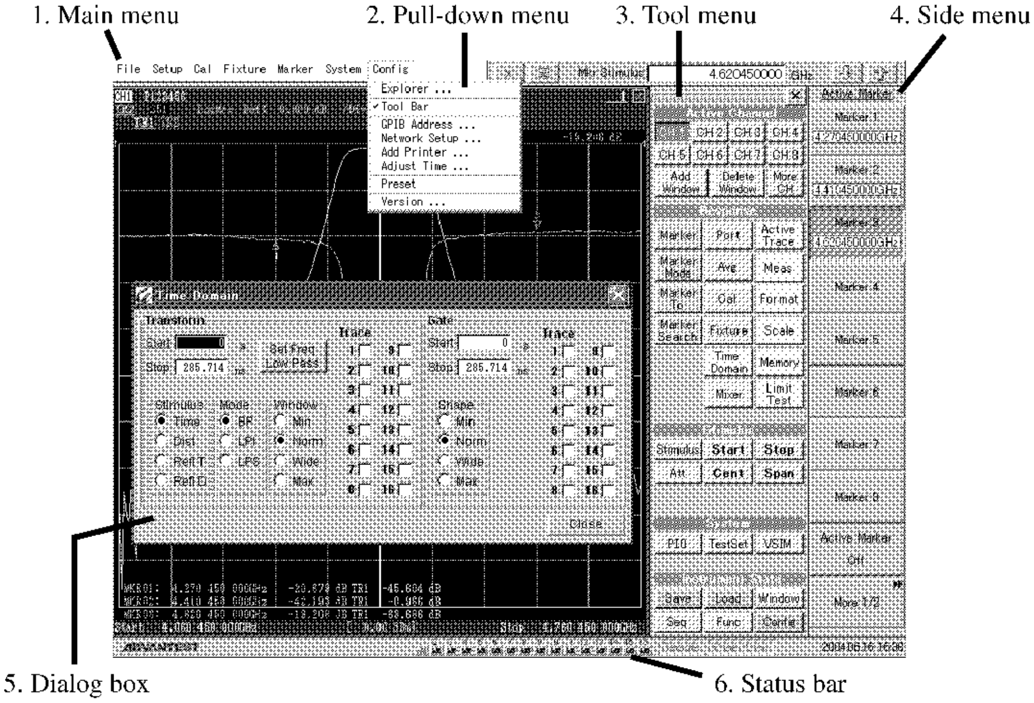


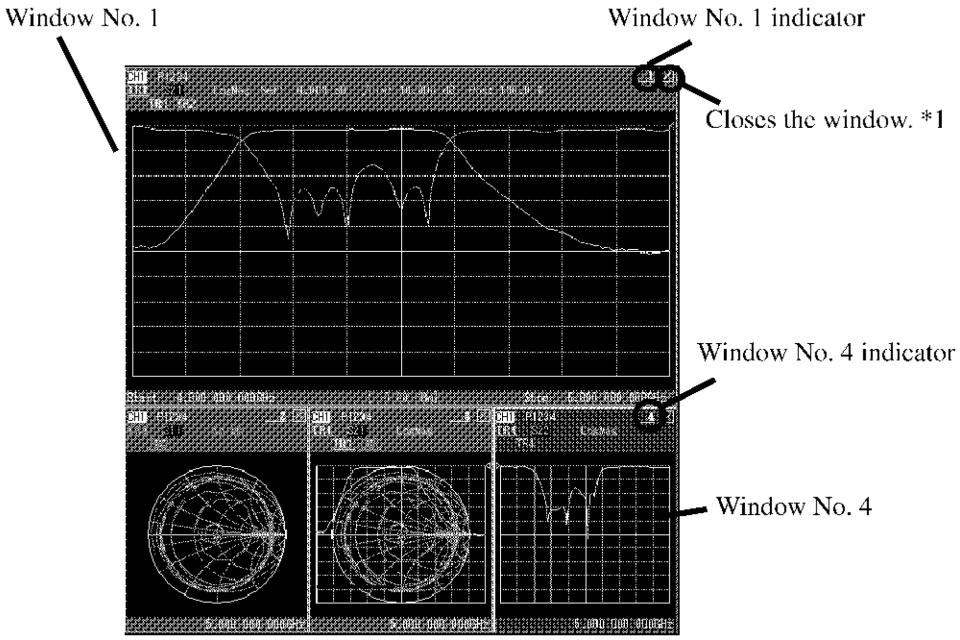
Figure 2-3 Operation Menus

1.	Main menu	All functions can be operated from this menu. Clicking on the menu displays the pull-down menu.
2.	Pull-down menu	... on a menu indicates that it is a dialog box. Clicking on a menu with ... displays a dialog box.
3.	Tool menu	Changes command execution of the side menu.
4.	Side menu	⏬ on the menu indicates that the side menu is hierarchized. Clicking on a menu with ⏬ displays the hierarchical menu.
5.	Dialog box	Displays the box of menus which set the measurement conditions and execute the measurements.
6.	Status bar	Indicates the operating status of the unit. The channel number which executes the measurement lights up.

CAUTION: ***This operation manual describes the menus that are available when the unit's configuration is at a maximum.***
The displayed menus may differ depending on the model, number of ports, or the configuration of options.

2.2.2 Windows

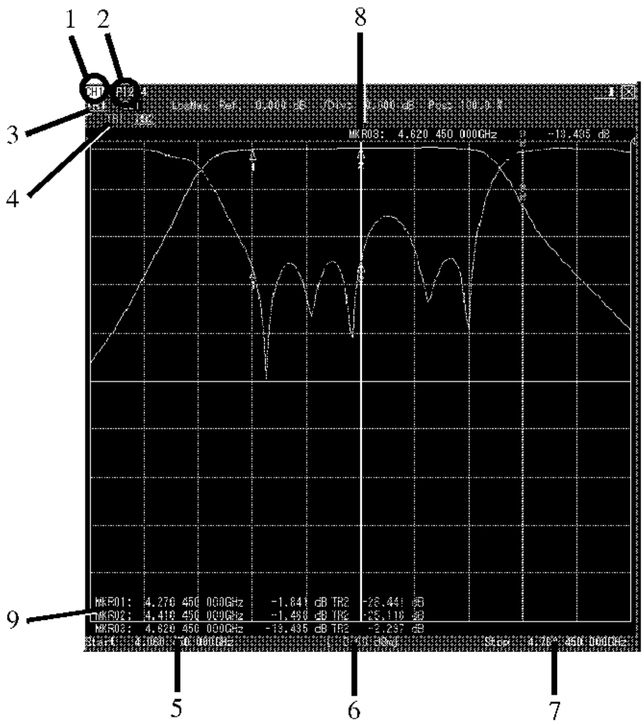
A maximum of 16 windows indicating the range of measurement data can be displayed.



*1 This button operates in the same way as the Delete Window button on the tool menu.

Figure 2-4 Window

Each window displays the main setting conditions as annotations. These annotations vary depending on the number of displayed windows.



1. Channel — Displays the channel number of the window.
2. Measurement port — Displays the measurement port setting.
3. Active trace — Displays active trace information.
4. Non-active trace — Displays non-active trace numbers. Clicking it changes to the active trace.
5. Start Frequency — Displays the start frequency.
6. Output power — Displays output power.
7. Stop Frequency — Displays the stop frequency.
8. Marker — Displays the active marker value.
9. Marker list — Displays the marker list.

2.2.3 Trace

Traces display the results of format processing and calculation processing of measurement data. Sixteen traces can be displayed in one window.

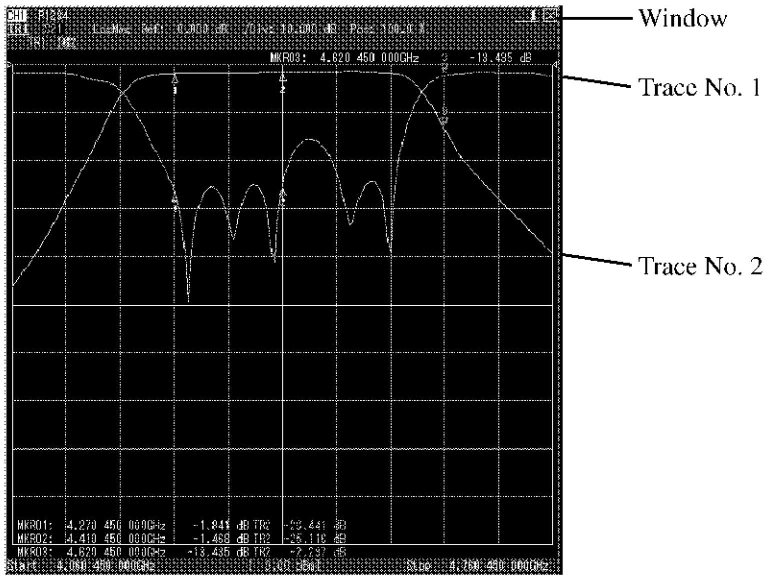
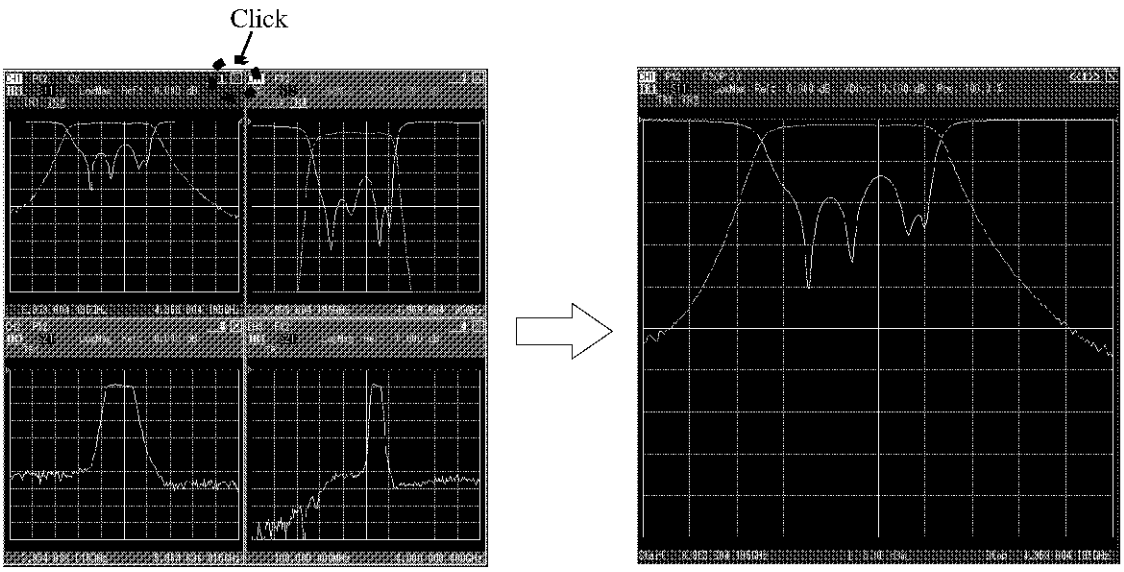


Figure 2-5 Trace

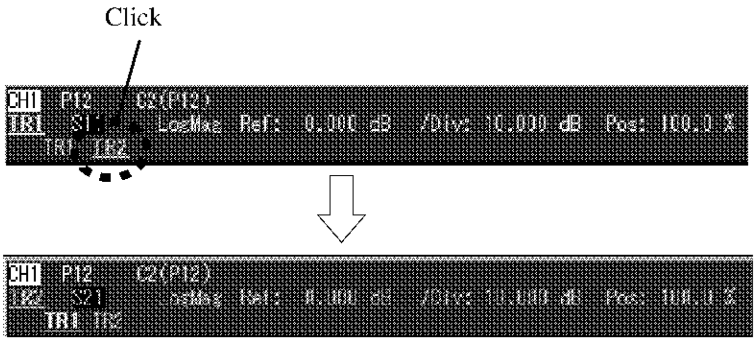
2.2.4 Window and Trace Click Actions

When multiple windows are displayed, click on the displayed window to switch the active channel and the active window.
In addition, click on the window number and the trace number to zoom in on the clicked window and trace.

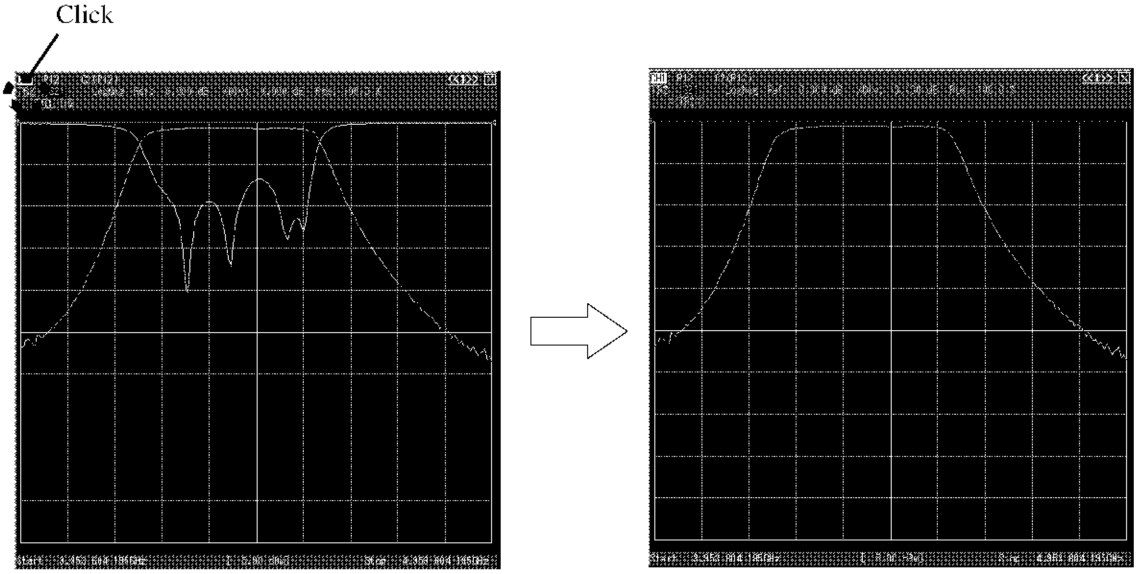
1. When four windows are displayed, click on the window number 1 to zoom in on Window 1. The window number display changes to <<1>> to indicate that the window is zoomed in on.
   Click again on the window number <<1>> to return to display multiple windows.



2. Click on the non-active trace number TR2 to switch Trace 2 into the active trace and display the trace information.



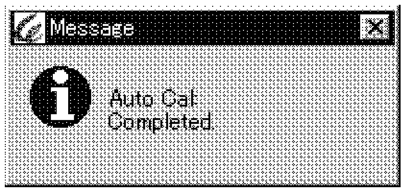
3. Click on the active trace number TR2 to display only the active trace.
   The active trace number display changes to <<TR2>> to indicate that only the active trace is displayed. Click again on the active trace number TR2 to return to display multiple traces.



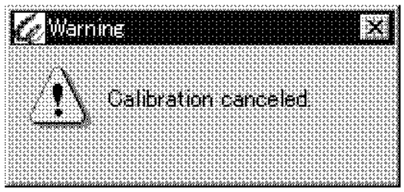
2.2.5 Messages

The unit displays the operating status in message boxes.

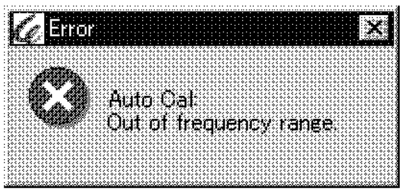
1. Message — Indicates normal operating status.



2. Warning — The operating conditions change if an operation other than the operating conditions of the unit is executed and this warning message is displayed.



3. Error — Displayed in the event of erroneous operation or improper execution.



See the Message List in the "A.1 Message List" for explanations of warning and error messages.

2.3 Measurement Channels and Windows

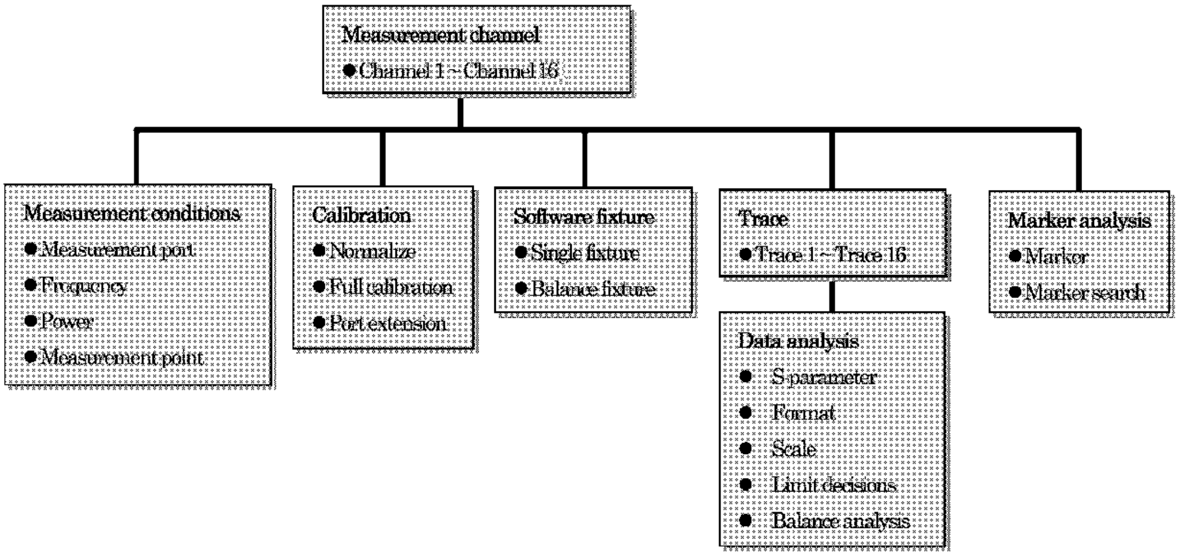
The unit uses a concept of measurement channels and windows. Measurements are executed using measurement channels, and measurement results are displayed in windows.

2.3.1 Measurement Channels

This model has sixteen independent measurement channels.

Measurement conditions, calibration, software fixtures, and trace can be set separately for each measurement channel. Therefore, up to sixteen different types of measurements can be effected simultaneously.

Up to 16 traces can be set for a channel. S-parameters, formats, and other data analysis can be set for each trace.



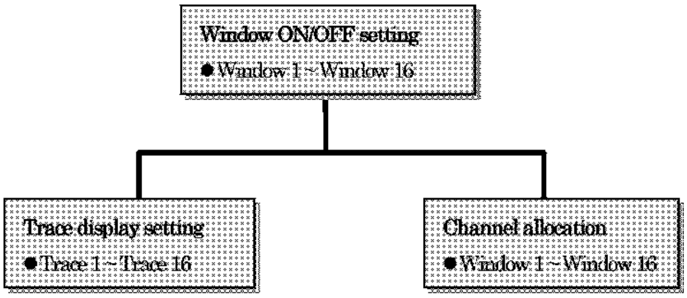
2.3.2 Windows

Screens which display measurement data are called windows.

There are a total of 16 windows. Measurement channels are allocated to each of these windows.

A maximum of 16 traces can be displayed in one window.

Even if trace is set for the measurement channel, trace results are not displayed unless valid. (However, the measurement is executed.)



2.4 Basic Operation

2.4.1 Use of Operation Menus

The functions of this model are operated from the main menu and tool menu.

The functions can be operated by using the dialog box from the main menu. The list of operation menus is displayed in the dialog box and it is useful when setting complicated measurement conditions.

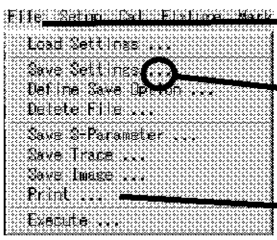
Frequently used functions can be easily operated from the tool menu using the side menu. It is useful when changing the measurement conditions while watching the measurement on-screen.

Use the touch panel for menu operation. Additionally, use the panel keys for input of values within menus. The mouse and keyboard also can be used.

1. Main menu

Clicking on the main menu displays the pull-down menu. As shown below, there are three operation formats in the pull-down menu.

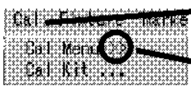
1. Directly execute the clicked menu function.
2. Displays the side menu. >> is at the end of the menu.
3. Display a dialog box. ... is included at the end of the menu.



Clicking ***File*** displays the File pull-down menu.

Clicking ***Save Settings...*** displays the Save dialog box.
(As in three, above.)

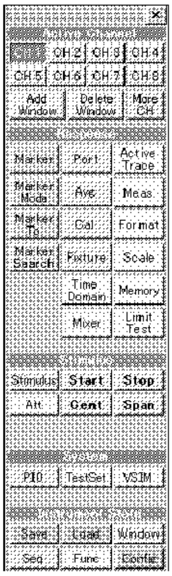
Clicking ***Print*** executes print.
(As in one, above.)



Clicking ***Cal*** displays the Cal pull-down menu.

Clicking ***Cal Menu*** displays the Cal Menu side menu.
(As in two, above.)

2. Tool Menu



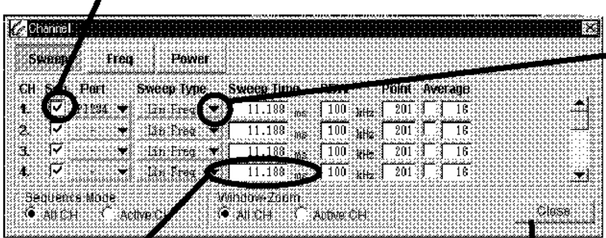
Clicking the menu displays frequently used functions in the side menu. Inclusion of frequently used functions allows ease of operation.

3. Dialog Boxes

As shown below, there are four formats in dialog boxes.

1. Directly execute the clicked menu function.
2. Toggle between ON/OFF. A check mark is displayed for ON.
3. Display the pull-down menu and select the menu. The selected menu is indicated.
4. Input values.

Check box
Clicking on the check box switches the sequence measurement ON and OFF.
A check mark is displayed for ON.
(Two cases)



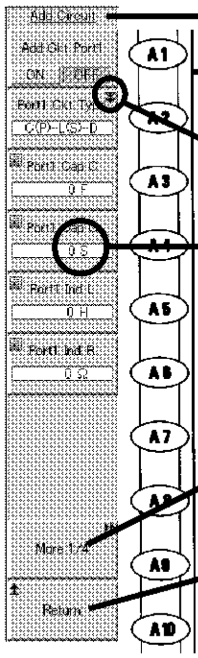
Pull-down menu
Clicking the ***Lin Freq***▼displays the pull-down menu.
(Three cases)

Value input box
Input values using the ten-key pad after clicking the box.
(Four cases)

Execution switch
Clicking ***Close*** closes the dialog box.
(One case)

4. Side Menu

The main menu and tool menu are operated from the touch panel or mouse, and all side menus can be operated from the panel keys.



Side menu

Application keys
Select or execute the corresponding menu.

Pull down menu
Clicking the menu or pressing the application key displays the menus in the directory immediately below.

Value input
Clicking the menu or pressing the application key selects the textbox and allows data entry.

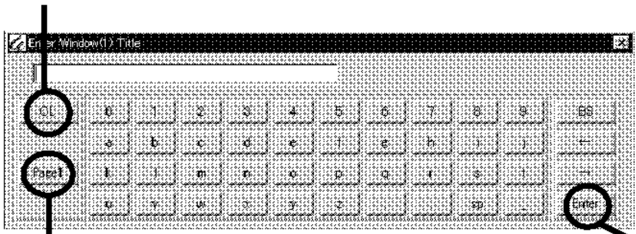
More menu
Clicking the menu or pressing the application key displays the menu on the next page.

Return menu
Clicking the menu or pressing the application key displays the menu in the directory immediately above.

5. Software keyboard

The software keyboard is used to enter character strings such as window titles and status titles.

Clear key
Erases all the entered characters.



Page key
Page 1: Capital letters
Page 2: Lower-case letters

Enter key
Applies the entered characters and closes the software keyboard.

2.4.2 Simple Measurement Example

This section explains operation of the tool menu for measurement of an 4 GHz bandpass filter.

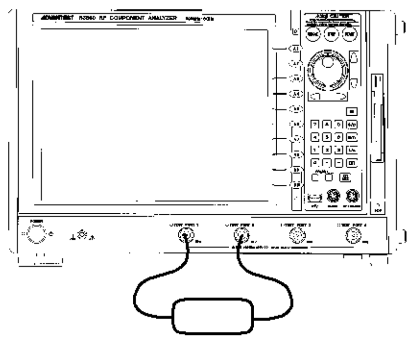
Power ON

1. Connect the power cable only after confirming that both the power breaker on the back and power switch on the front panel are OFF.
2. Turn ON the power breaker on the back first, and then turn ON the power switch on the front panel.
3. The initial screen will be displayed in approximately three minutes.

NOTE: ***Use the unit within the ambient temperature range to ensure exact measurement. Additionally, let the unit warm up for about 30 minutes after power ON.***

---

4. Connect Test port 1 and Test port 2 to the filter as shown in the diagram below.



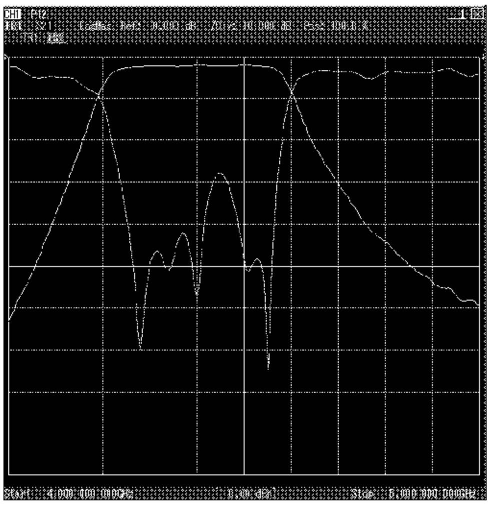
Measurement port and frequency settings

5. Press ***Port*** on the tool menu to display the Port side menu.
6. Press ***P12*** to set the measurement port to the 2-port of Port 1 and Port 2.
7. Press ***Start*, 4, G/p, *Stop*, 5** and **G/p** to set the Start Frequency to 4 GHz and the Stop Frequency to 5 GHz.

Trace and scale settings

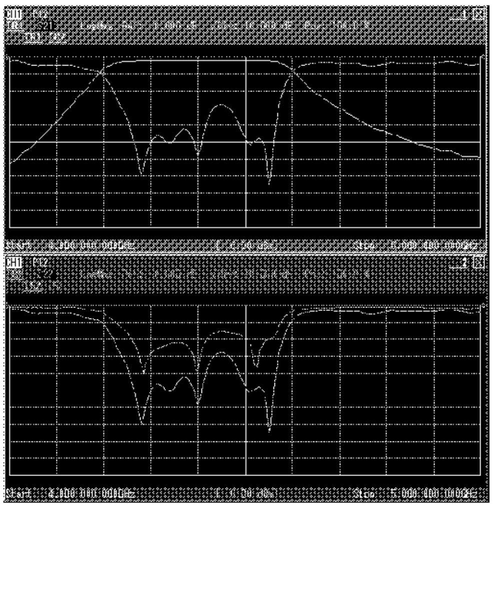
8. Press ***Meas*** in the tool menu and then ***S21*** in the side menu to set Trace 1 to S-Parameter: S21.
9. Press ***Activate Trace*** in the tool menu and then ***Trace 2*** in the side menu to set Trace 2 to Active Trace.

10. Press ***Meas*** in the tool menu and then ***S11*** in the side menu to set Trace 2 to S-Parameter: S11.



Window 2 settings

11. Press ***Add Window*** in the tool menu to display Window 2.
12. Press ***Active Trace*** in the tool menu to display the Active Trace side menu.
13. Press ***Trace 1 On*** twice. The ON display disappears and Trace 1 disappears from Window 2.
14. Press ***Trace 3***. The menu is switched to ON and display Trace 3 in Window 2.
15. Press ***Meas*** in the tool menu and then ***S22*** in the side menu to set Trace 3 to S-Parameter: S22.



Power OFF

16. Turn the power switch OFF. The power will be turned OFF after system shut-down processing is completed.

3. MULTI-CHANNEL MEASUREMENT

This model has sixteen measurement channels. The measurement port, frequency, and other measurement conditions can be set for each measurement channel. Therefore, a maximum of sixteen measurements can be executed simultaneously.

Additionally, up to 16 display screens can be selected for each measurement channel, which allows optimum multi-channel measurement.

3.1 Channel and Window Settings

Click ***Add Window*** in the tool menu to display a window for the active channel. Click ***Delete Window*** to close the window.

Active channels can be selected from the ***CH No.*** in the tool menu. CH 1 to CH 8 can be set on the window as they are displayed by default. Click More CH to display and set CH 9 to CH 16.

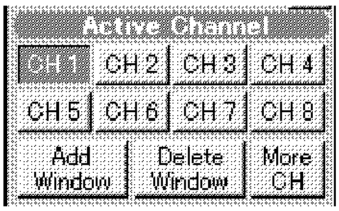


Figure 3-1 Active CH Tool Menu

Set an active channel. Measurement ports and frequencies are set to the active channel. Channel 1 is set as the active channel by default. A channel, which has no window displayed, can also be set as the active channel.

3.2 Measurement Port, Frequency, and Other Measurement Conditions

Set the measurement port, frequency, and other measurement conditions here for the active channel set in part 3.1. The measurement conditions can be set in ***Port***, ***Stimulus***, ***Start***, ***Stop***, ***Cent***, and ***Span*** in the tool menu.

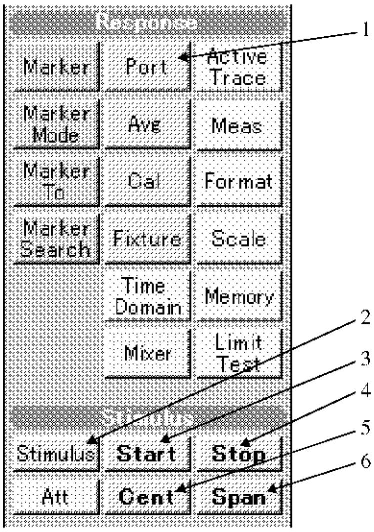


Figure 3-2 Measurement Conditions Settings

1. ***Port*** — Sets a measurement port in the Port side menu. When ***None*** is selected, no measurement is performed.
2. ***Stimulus*** — Sets the sweep time, sweep type, trigger mode, the number of measurement points, and output power in the Stimulus side menu.
3. ***Start*** — Sets the start frequency.
   Clicking ***Start*** displays the entry menu in the upper right of the screen. The value can be entered from either the panel key or the entry menu.
4. ***Stop*** — Sets the stop frequency.
   Clicking ***Stop*** displays the entry menu at the upper right of the screen. The value can be entered from either the panel key or the entry menu.

5. ***Cent*** — Sets the center frequency.
   Clicking ***Cent*** displays the entry menu at the upper right of the screen. The value can be entered from either the panel key or the entry menu.
6. ***Span*** — Sets the frequency span.
   Clicking ***Span*** displays the entry menu at the upper right of the screen. The value can be entered from either the panel key or the entry menu.

3.3 Trace Settings

Measurement results are analyzed as traces. There are 16 traces for each measurement channel. Therefore, a maximum of 16 different analyses can be executed for each channel.

Traces can be set in ***Active Trace***, ***Meas***, and ***Format*** in the tool menu.

Set the trace here for the active channel set in part 3.1.

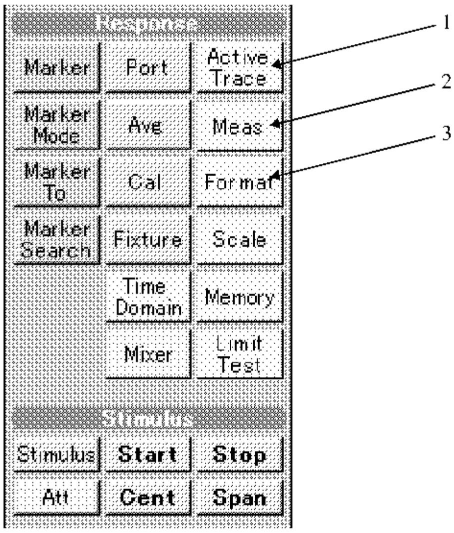


Figure 3-3 Trace Settings

1. ***Active Trace*** — Turn on and set the trace selected in the Active Trace side menu as the active trace. Select the active trace again to turn off the trace.

2. ***Meas*** — Sets the active trace S-Parameter in the Meas side menu.

3. ***Format*** — Sets an active trace format in the Format side menu. ***LogMag***, ***Phase***, ***Delay***, ***Smith***, or ***Polar*** can be selected.

3.3.1 Trace Memory

Trace memory is an internal domain used for storing displayed trace data. A trace memory section is available for each trace data item. Channel measurements can have 16 trace data items stored in 16 trace memory sections.
Displayed trace data items are copied to the trace memory. Trace data or calculation results of trace data and memory can be displayed.

Click ***Memory*** in the tool menu to display the Memory side menu.

1.	***Disp Data ON/OFF***	Sets the trace memory waveform display to ON or OFF.
2.	***Disp Mem ON/OFF***	Sets the trace memory waveform display to ON or OFF. When ***Data to Mem*** is executed, the display is set to ON automatically.
3.	***Data to Mem***	Copies displayed trace data to trace memory. Trace data items selected in the ***Active Trace*** are copied.
4.	***Trace Math off***	Turns off the four basic mathematical calculations between trace data and trace memory.
5.	***Trace Math Data/Mem***	Divides the data into memory and displays the results as trace data.
6.	***Trace Math Data-Mem***	Subtracts the memory from the data and displays the results as trace data.
7.	***Trace Math Data*Mem***	Multiplies the data and memory and displays the results as trace data.
8.	***Trace Math Data+Mem***	Adds the data and memory and displays the results as trace data.

3.4 Window Expansion Setting

The window layout can be changed freely.
The screen is split into rows or columns and a number of windows to display in each row (column) can be specified. The display can be divided up to 4 rows or columns and each row or column can have up to 5 windows.

Click ***Window*** in the tool menu and then click ***Display Mode*** in the side menu.

Display Mode side menu

1. ***Split Mode Standard***	Displays all windows equally. The Column and Size (%) settings are ignored.
2. ***Split Mode Horizontal***	Splits the display horizontally into the number of windows specified in Column.
3. ***Split Mode Vertical***	Splits the display vertically into the number of windows specified in Column.
4. ***Window Size***	Displays the Window Size side menu which sets the number and the ratio of split-screen displays.

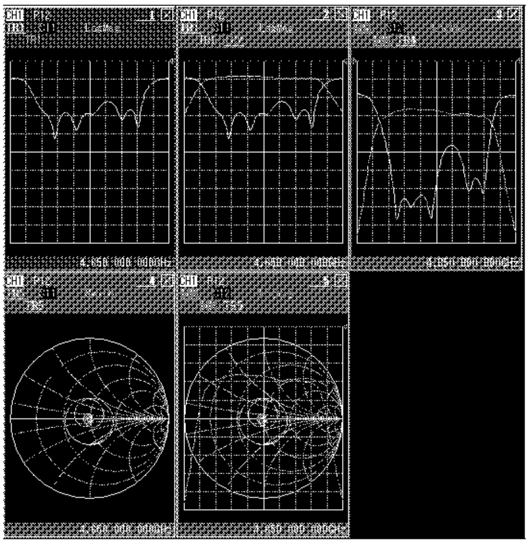
Window Size side menu

1. ***Row 1 to 4 Column***	Specifies numbers of windows to be displayed in each row and column. A maximum of five windows can be specified for each row or column.
2. ***Row 1 to 4 Size (%)***	Specifies size distributions for rows (columns) in percentages.

In the following example, the display layout for all windows is changed.

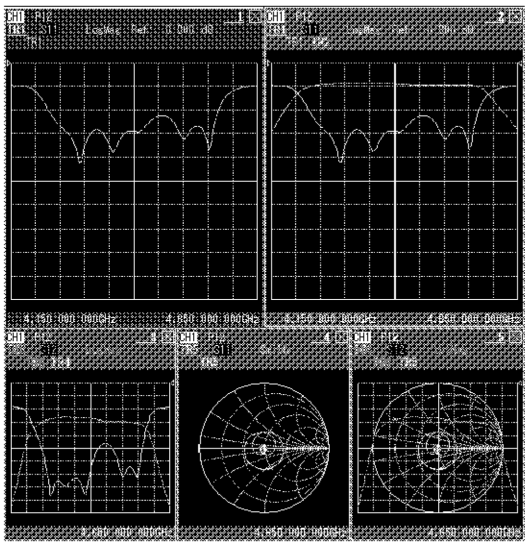
1. Standard split

   The following is the standard display layout for each window. All windows have the same dimensional size.



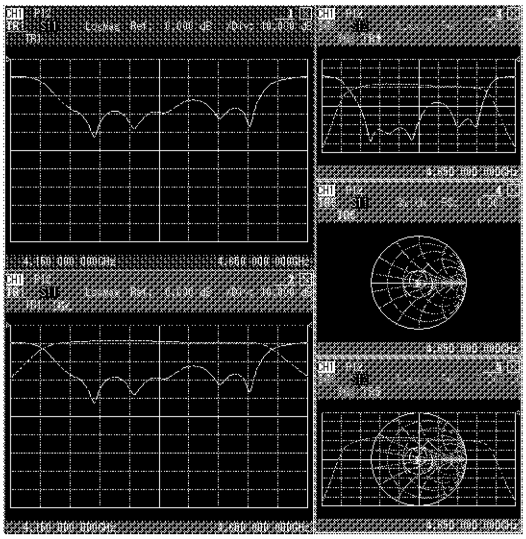
2. Horizontal split

   The display is split horizontally into 2 rows. The first row is set to have 2 windows and the second row is set to have 3 windows.
   Size distributions are 60% for the first row and 40% for the second row.



3. Vertical split

   The display is split vertically into 2 columns. The first column is set to have 2 windows and the second column is set to have 3 windows.
   Size distributions are 60% for the first column and 40% for the second column.

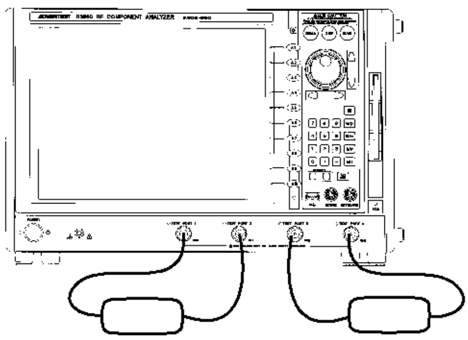


3.5 Measurement Example

This example explains simultaneous measurement of an 800 MHz band filter and 1.9 GHz band filter using two measurement channels.

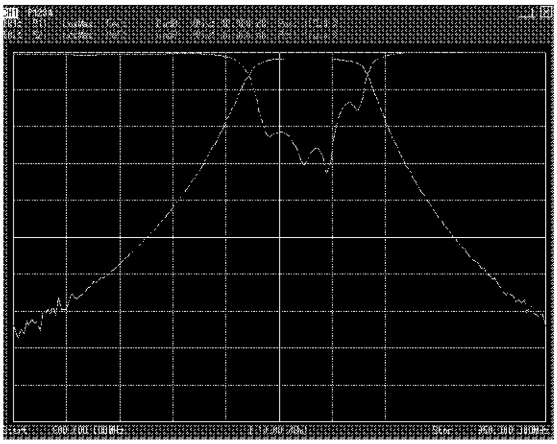
The procedures outlined below begin with the model in initialized status.

Connect test port 1 and test port 2 to the 800 MHz filter, and test port 3 and test port 4 to the 1.9 GHz filter as shown in the diagram below.



Measurement Channel 1 Settings

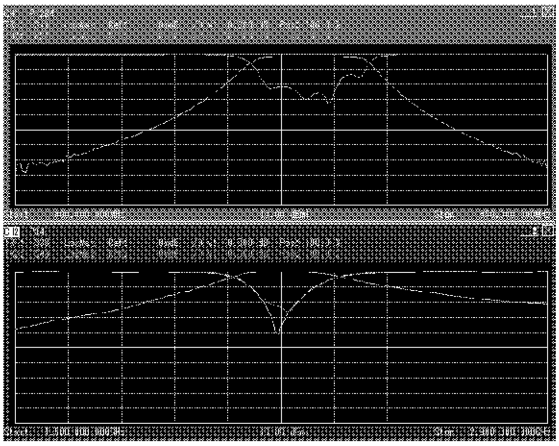
1. Click ***Port*** in the tool menu to display the Port side menu.
   Measurement channel 1 is the valid channel when the model is in initialized status. Therefore, the following operations are set for Measurement channel 1.
2. Click ***P12*** to set the measurement port to the 2-port of Port 1-Port 2.
3. Press ***Start*, 8, 0, 0, M/n, *Stop*, 9, 0, 0** and **M/n** to set the Start Frequency to 800 MHz and the Stop Frequency to 900 MHz.
4. Click ***Active Trace*** in the tool menu to display the Active Trace side menu.
5. Press ***Trace* 2** to display Trace 2. Trace 1 is set to S11 and Trace 2 is set to S21 in initialized status.
6. Then, press ***Trace 3*** to display Trace 3. Click ***Meas*** in the tool menu and the ***S 22*** side menu to set the parameter to S22.
7. The above operation measures the reflection characteristics (S11 and S22) and transmission characteristics (S21) of the 800 MHz band filter.



Measurement Channel 2 Settings

8. Click ***CH2*** in the tool menu to set Channel 2 as the active channel.
9. Click ***Add Window*** to display Window 2.
   Window 2 is set as the active window. Therefore, the following operations are set for Window 2. Be careful here because clicking the display area of Window 1 will set Window 1 as the active window.
10. Click ***Port*** in the tool menu to display the Port side menu and click ***More 1/2*** to display the second page.
11. Click ***P34*** to set the measurement port to the 2-port of Port 3-Port 4.
12. Press ***Start*, 1, 8, 0, 0, M/n, *Stop*, 2, 0, 0, 0** and **M/n** to set the Start Frequency to 1800 MHz and the Stop Frequency to 2000 MHz.
13. Click ***Active Trace*** in the tool menu to display the Active Trace side menu.
14. Press ***Trace 2*** to display Trace 2. Then, click ***Meas*** and ***More 1/2*** from the tool menu and the ***S43*** side menu to set the parameter to S43.
15. Click ***Active Trace*** in the tool menu to display the Active Trace side menu.
16. Press ***Trace 3*** to display Trace 3. Then, click ***Meas*** and ***More 1/2*** from the tool menu and the ***S44*** side menu to set the parameter to S44.

17. The above operation measures the reflection characteristics (S33 and S44) and transmission characteristics (S43) of the 1.9 GHz band filter.



4. CALIBRATION

Calibration includes normalize calibration, which normalizes only the frequency characteristics, and full calibration, which also compensates for impedance irregularities and errors.

Full calibration has 1-port full calibration, 2-port full calibration, 3-port full calibration, 4-port full calibration, 5-port full calibration, and 6-port full calibration depending on the measurement port.

- Normalize Calibration

  Normalize Calibration normalizes the frequency characteristics. It can be easily executed, but exact measurement is not permitted because impedance irregularities and errors cannot be eliminated.

- Full Calibration

  Full Calibration eliminates frequency characteristics and impedance irregularities and errors, which allows exact measurement. A mistake in calibration procedures can induce errors of high magnitude. Therefore, adhere to the following points to execute calibration using the proper procedures.

  Cautionary Points

  1. Selection of calibration kit
  2. Compensation of Thru Standard
     Refer to Section 4.8, "Calibration Kit Selection."

4.1 6-Port Full Calibration

In measurement of 6-port devices, directivity, source match, load match, frequency tracking, and isolation errors are calibrated, and 36 completely compensated S-parameters are measured.

This calibration method can be executed only 6-port type.

1. The following four types of calibration standards are necessary.
   - Open Standard
   - Short Standard
   - Load Standard (Two required in isolation calibration.)
   - Thru Standard

4.2 5-Port Full Calibration

In measurement of 5-port devices, directivity, source match, load match, frequency tracking, and isolation errors are calibrated, and 25 completely compensated S-parameters are measured.

This calibration method can be executed only 6-port type.

1. The following four types of calibration standards are necessary.
   - Open Standard
   - Short Standard
   - Load Standard (Two required in isolation calibration.)
   - Thru Standard

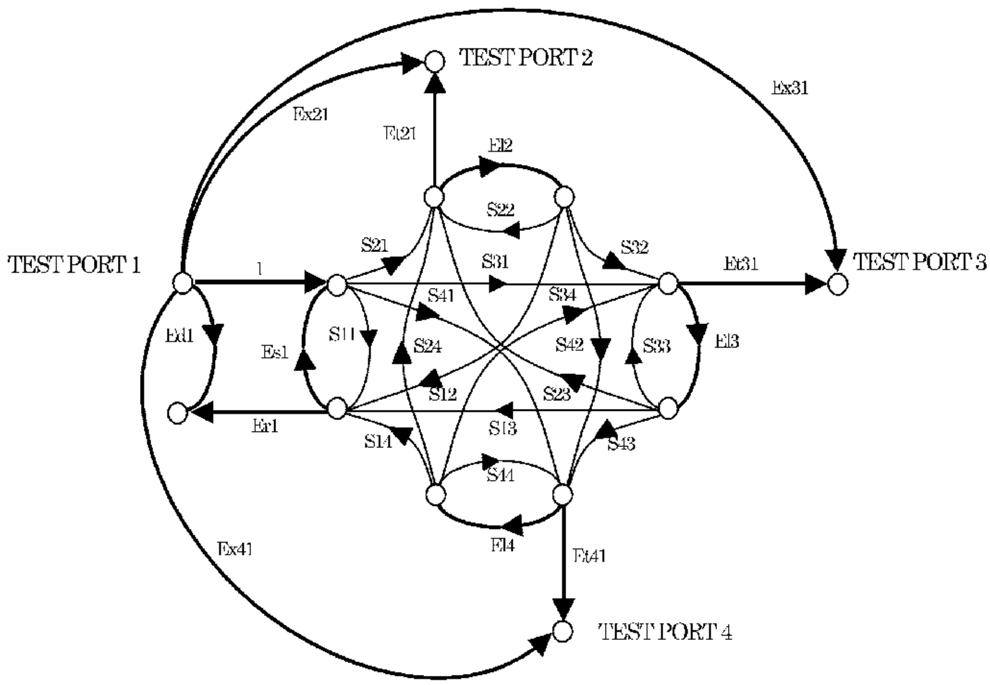
4.3 4-Port Full Calibration

In measurement of 4-port devices, directivity, source match, load match, frequency tracking, and isolation errors are calibrated, and 16 completely compensated S-parameters are measured.

This calibration method can be executed 4-port type and 6-port type.

1. The following four types of calibration standards are necessary.
   - Open Standard
   - Short Standard
   - Load Standard (Two required in isolation calibration.)
   - Thru Standard
2. An error model is shown as a signal flow graph.

Port 1 as the Signal Source



Bold lines indicate error items (E), and regular lines indicate S-parameters (S) of measurement items.

An error model with Port 2, Port 3, and Port 4 as signal sources in the same manner has a total of 40 error items defined.

Directivity	Ed1, Ed2, Ed3, Ed4
Source match	Es1, Es2, Es3, Es4
Load match	El1, El2, El3, El4
Transmission tracking	Et21, Et31, Et41, Et12, Et32, Et42 Et13, Et23, Et43, Et14, Et24, Et34
Reflection tracking	Er1, Er2, Er3, Er4
Isolation	Ex21, Ex31, Ex41, Ex12, Ex32, Ex42 Ex13, Ex23, Ex43, Ex14, Ex24, Ex34

Note: Numbers of error items indicate the port numbers.

Ed1 indicates the directivity of Port 1, and Et21 indicates transmission tracking from Port 1 to Port 2. 4-Port Full Calibration completely compensates for the errors of 4-port networks. Therefore, measurements between all ports are always effected even for measurements only between Port 1 and Port 2.

In short, measurement of six paths is effected (Port 1-Port 2, Port 1-Port 3, Port 1-Port 4, Port 2-Port 3, Port 2-Port 4, and Port 3-Port 4), and data is obtained for all S-parameters (16) of 4-port devices.

4.4 3-Port Full Calibration

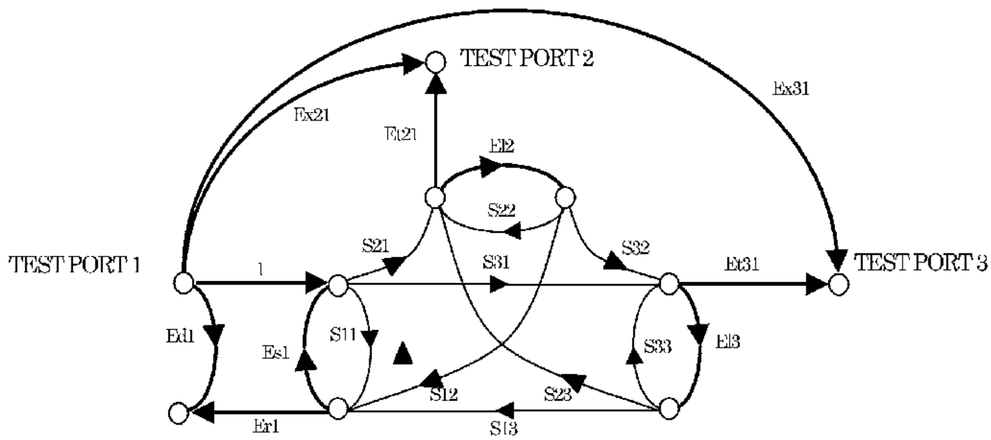
In measurement of 3-port devices, directivity, source match, load match, frequency tracking, and isolation errors are calibrated, and nine completely compensated S-parameters are measured.

This calibration method can be executed with Port 1-Port 2-Port 3 in 3-port type.

This method can be executed in 4-port type and 6-port type with the combinations of Port 1-Port 2-Port 3, Port 1-Port 2-Port 4, Port 1-Port 3-Port 4, and Port 2-Port 3-Port 4.

1. The following four types of calibration standards are necessary.
   - Open Standard
   - Short Standard
   - Load Standard (Two required in isolation calibration.)
   - Thru Standard
2. An error model is shown as a signal flow graph (using Port 1-Port 2-Port 3).

Port 1 as the Signal Source



Bold lines indicate error items (E), and regular lines indicate S-parameters (S) of measurement items.

An error model with Port 2 and Port 3 as signal sources in the same manner has a total of 24 error items defined.

Directivity	Ed1, Ed2, Ed3
Source match	Es1, Es2, Es3
Load match	El1, El2, El3
Transmission tracking	Et21, Et31, Et12, Et32, Et13, Et23
Reflection tracking	Er1, Er2, Er3
Isolation	Ex21, Ex31, Ex12, Ex32, Ex13, Ex23

Note: Numbers of error items indicate the port numbers.

Ed1 indicates the directivity of Port 1, and Et21 indicates transmission tracking from Port 1 to Port 2.

3-Port Full Calibration completely compensates for the errors of 3-port networks. Therefore, measurements between all ports are always effected even for measurements only between Port 1 and Port 2.

In short, measurement of three paths is effected (Port 1-Port 2, Port 1-Port 3, and Port 2-Port 3), and data is acquired for all S-parameters (9) of 4-port devices.

4.5 2-Port Full Calibration

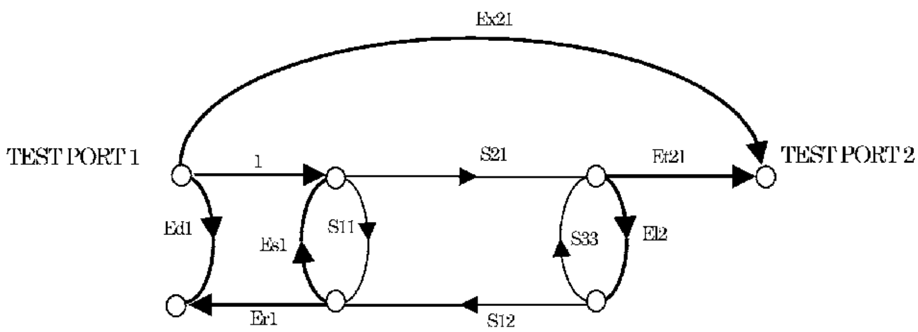
In measurement of 2-port devices, directivity, source match, load match, frequency tracking, and isolation errors are calibrated, and four completely compensated S-parameters are measured.

This calibration method can be executed with Port 1-Port 2, Port 1-Port 3, and Port 2-Port 3 in 3-port type.

This method can be executed in 4-port type and 6-port type with the combinations of Port 1-Port 2, Port 1-Port 3, Port 1-Port 4, Port 2-Port 3, Port 2-Port 4, and Port 3-Port 4.

1. The following four types of calibration standards are necessary.
   - Open Standard
   - Short Standard
   - Load Standard (Two required in isolation calibration.)
   - Thru Standard
2. An error model is shown as a signal flow graph (using Port 1-Port 2).

Port 1 as the Signal Source



Bold lines indicate error items (E), and regular lines indicate S-parameters (S) of measurement items.

An error model with Port 2 as the signal source in the same manner has a total of 12 error items defined.

Directivity	Ed1, Ed2
Source match	Es1, Es2
Load match	El1, El2
Transmission tracking	Et21, Et12
Reflection tracking	Er1, Er2
Isolation	Ex21, Ex12

Note: Numbers of error items indicate the port numbers.

Ed1 indicates the directivity of Port 1, and Et21 indicates transmission tracking from Port 1 to Port 2.

2-Port Full Calibration completely compensates for the errors of 2-port networks. Therefore, measurements between all ports are always effected.

4.6 1-Port Full Calibration

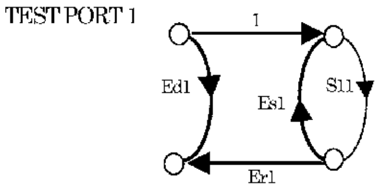
In measurement of 1-port devices, directivity, source match, load match, frequency tracking, and isolation errors are calibrated, and one completely compensated S-parameter is measured.

This calibration method can be executed with Port 1 or Port 2 in 2-port type.

This calibration method can be executed with Port 1, Port 2, or Port 3 in 3-port type.

This method can be executed Port 1, Port 2, Port 3, or Port 4 in 4-port type.

1. The following three types of calibration standards are necessary.
    - Open Standard
    - Short Standard
    - Load Standard
2. An error model is shown as a signal flow graph (using Port 1).



Bold lines indicate error items (E), and regular lines indicate S-parameters (S) of measurement items.

Directivity	Ed1
Source match	Es1
Reflection tracking	Er1

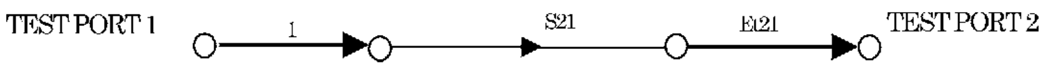
Note: Numbers of error items indicate the port numbers.

4.7 Normalize

Frequency characteristics are compensated. Exact measurement is not permitted because impedance irregularities and errors cannot be compensated.

Calibration standards and error models differ for transmission characteristics and reflection characteristics.

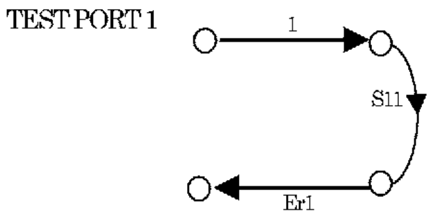
1. Either of the following calibration standards is required.
    - Thru Standard (for transmission characteristics)
    - Open Standard or Short Standard (for reflection characteristics)
2. An error model of transmission characteristics is shown as a signal flow graph (using Port 1-Port 2).



Bold lines indicate error items (E), and regular lines indicate S-parameters (S) of measurement items.

Transmission tracking	Et21

3. An error model of reflection characteristics is shown as a signal flow graph (using Port 1).



Bold lines indicate error items (E), and regular lines indicate S-parameters (S) of measurement items.

Reflection tracking	Er1

4.8 Calibration Kit Selection

An appropriate calibration kit must be selected to properly execute calibration.

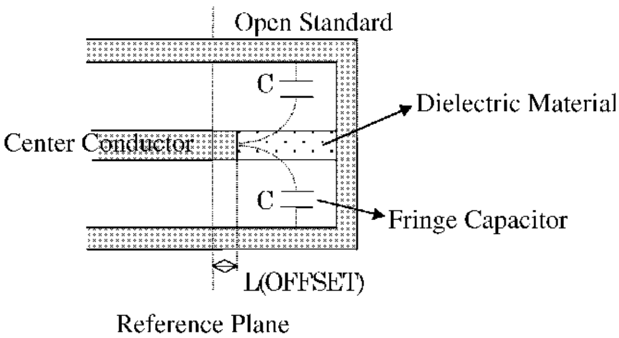
It is physically impossible to fabricate an ideal calibration kit. Values varying from ideal values exist in actual calibration kits.

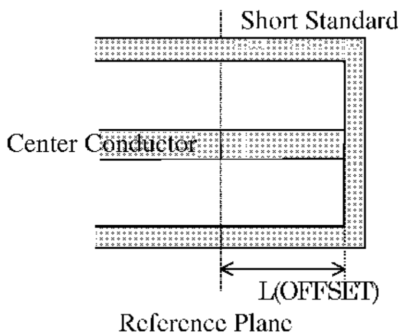
Calibration is executed based on these values which vary from ideal values.

CAUTION: ***Selection of the calibration kit is unnecessary for automatic calibration.***

4.8.1 Setting Values of Single-Axis Calibration Kits

For single-axis calibration kits (N-connectors and 3.5-mm connectors), the values indicated in the diagram below are determined for the Open Standard and Short Standard.





In the Open Standard, the center conductor and contact portion are offset, and a fringe capacitor (floating capacity) assigns a value.

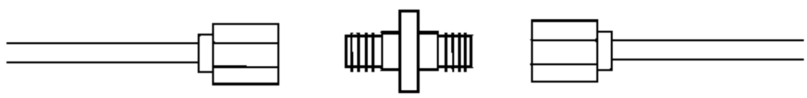
In the Short Standard, an offset value from the center conductor to the ground surface is assigned.

Selection of the connector type and polarity of the calibration kit determines the compensation value.

4.8.2 Thru Standard

Connection between test ports is necessary to obtain the frequency characteristics and load match of transmission characteristics. The Thru Standard must be used in the connection if the connector polarity of test ports is identical.

In this event, ignoring the delay (electrical length) of the Thru Standard may cause errors of high magnitude.

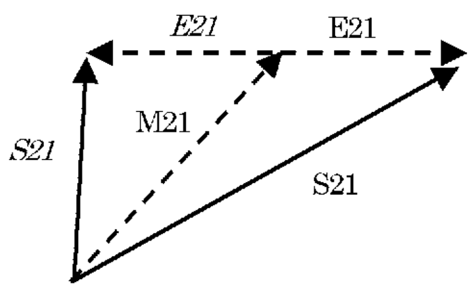


The delay (electrical length) of the Thru Standard must be properly compensated for to allow proper measurement.

It should be cautioned here that delay (electrical length) is more important than the loss of the Thru Standard. Even if an ideal adapter with no loss is used, error will arise due to delay (electrical length).

The measurement value before error compensation, error compensation value, and measurement value after error compensation are represented as vectors in the following diagram.

A mistaken phase of the error compensation value due to the delay (electrical length) of the Thru Standard will induce errors of great magnitude in measurement values. The loss of the Thru Standard only alters the size of the error compensation value vector.



M21:	Measurement value before error compensation
E21:	Exact error compensation value
S21:	Measurement value after exact error compensation
E21:	Improper error compensation value due to the delay (electrical length) of the Thru Standard
S21:	Measurement value after improper error compensation due to the delay (electrical length) of the Thru Standard

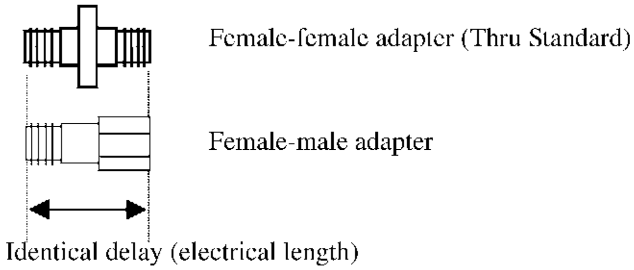
There are two methods for compensating for the delay (electrical length) of the Thru Standard.

1. Compensation method which assigns the value of the calibration kit

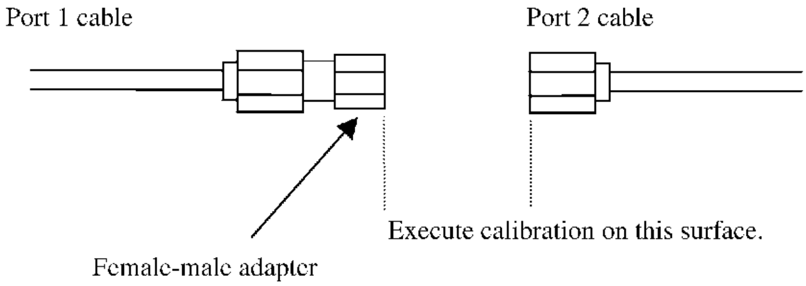
   In selecting the calibration kit, select User define kit and set the delay (electrical length) of the Thru adapter. The automatically assigned delay (electrical length) will be compensated for and the error will be determined when calibration is executed.

2. Method using conversion adapters

   The electrical length is physically corrected by using a female-male adapter and a female-female adapter of equal electrical length as shown in the figure below.

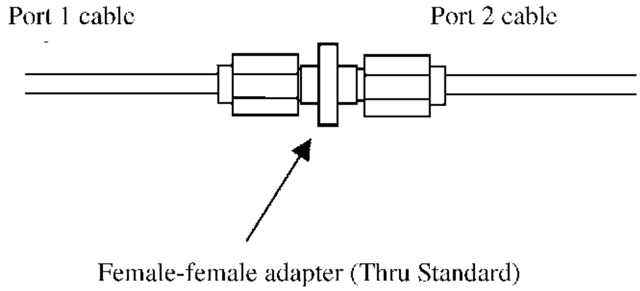


- Connect a female-male adapter to the tip of actual test port (cable tip) for execution of the Open Standard, Short Standard, and Load Standard. Execute calibration with the adapter tip.

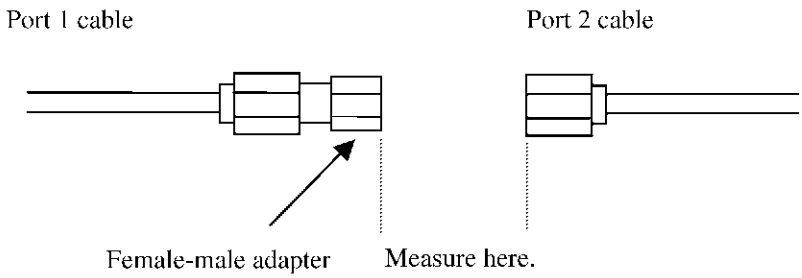


- Execution of the Thru Standard

  Remove the female-male adapter, connect a female-female adapter (Thru Standard), and execute calibration.



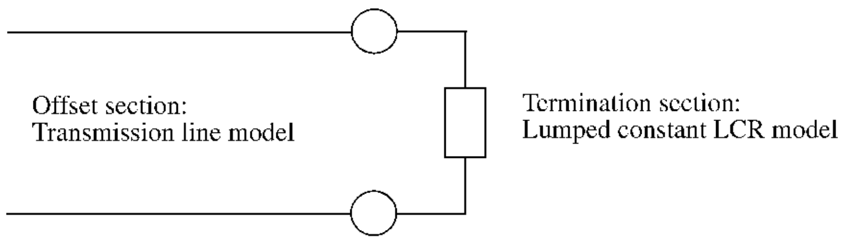
- Execution of measurement



Attach a female-male adapter and perform measurement after calibration is complete.

4.8.3 User-defined Calibration Kit

The coaxial calibration kit is described in the following model.



The offset section is a transmission line model which includes conductor loss.

[Setting items]

Impedance: Characteristic impedance of the transmission line

Delay: Transmission line length (time basis)

Loss: Serial resistance of the transmission line (resistance value per unit length is multiplied by light speed)

[Termination section]

Open standard: Capacitor model (capacitance $C = C_0 f + C_1 f^2 + C_2 f^2 + C_3 f^3$)

Short standard: Inductor model (inductance $L = L_0 f + L_1 f^2 + L_2 f^2 + L_3 f^3$)

Load standard: Resistor model (resistance R)

The multiplication factor of the frequency power-expansion is set to give the frequency characteristics for the open standard and short standard.

Table 4-1 shows the above description.

Table 4-1 User-defined Setting Items

Standard	Offset section			Termination section		
	Impedance Zo[Ω]	Delay Delay[delay]	LossLoss [GΩ/sec]	Capacitance (*1) C0,C1,C2,C3	Inductance (*2) L0,L1,L2,L3	Resistance R[Ω]
Open	√	√	√	√	-	-
Short	√	√	√	-	√	-
Load	√	√	√	-	-	√
Through	√	√	√	-	-	-

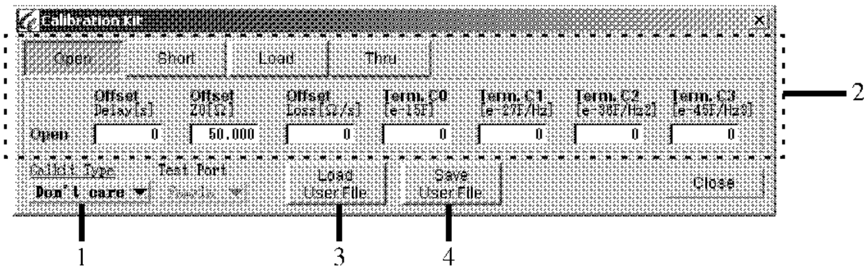
Unit: *1; C0[F],C1[F/Hz^2],C2[F/Hz^2],C3[F/Hz^3]

*2; L0[H],L1[H/Hz],L2[H/Hz^2],L3[H/Hz^3]

4.8.4 Calibration Kit Setting Methods

Click ***Cal*** in the tool menu to display the Calibration side menu.

Click ***Standard Cal*** and ***Cal Kit*** on the side menu to display the Calibration Kit dialog box.



1. ***Cal Kit Type*** — Displays a pull-down menu for selecting the type of Calibration Kit.

Don't Care:	Ideal calibration kit without compensation values
N50Ω:	N-type 50Ω calibration kit
N75Ω:	N-type 75Ω calibration kit
3.5 mm:	3.5 mm-type 50Ω calibration kit
7 mm:	7 mm-type 50Ω calibration kit
User:	User-defined calibration kit

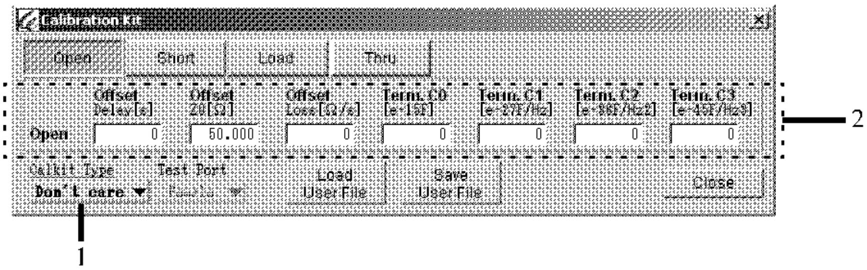
2. ***Define Standard*** — Displays a dialog box for setting a user-defined calibration kit. The settings are applied to all ports. Refer to 4.8.5, "User-defined Calibration Kit Setting Methods."

3. ***Load User File*** — Loads the user-defined correction value from the file.

4. ***Save User File*** — Saves the user-defined correction value in the file.

4.8.5 User-defined Calibration Kit Setting Methods

Sets the calibration kit.
Operation of ***Cal*** and ***Cal Kit...*** in the main menu displays this dialog box.



1. ***Cal Kit type***

Specifies the type of calibration kit, and sets the open capacity and delay compensation values.

Don't Care:	Selects an ideal calibration kit and does not perform compensation.
N50Ω:	Selects an N-type 50 Ω calibration kit, and sets the compensation values.
N75Ω:	Selects an N-type 75 Ω calibration kit, and sets the compensation values.
3.5 mm:	Selects a 3.5 mm-type calibration kit, and sets the compensation values.
7 mm:	Selects a 7 mm-type calibration kit, and sets the compensation values.
User:	Selects a user-defined calibration kit, and sets the compensation values.

2. ***Open Standard***

Displays the Open Standard dialog box.

Open Offset

Delay	Inputs the delay of the Open Standard.
Z0	Inputs the offset impedance of the Open Standard.
Loss	Inputs the loss of the Open Standard.

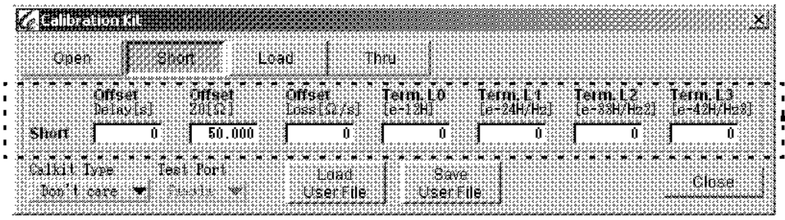
Open Termination

Open C0 e^{-15} Inputs open capacity C0 of the Open Standard.

Open C1 e^{-27} Inputs open capacity C1 of the Open Standard.

Open C2 e^{-36} Inputs open capacity C2 of the Open Standard.

Open C3 e^{-45} Inputs open capacity C3 of the Open Standard.



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3. ***Short Offset***

Delay Inputs the delay of the Short Standard.

Z0 Inputs the offset impedance of the Short Standard.

Loss Inputs the loss of the Short Standard.

Short Termination

Inductance L0 e^{-12}

Inputs inductance L0 of the Short Standard.

Inductance L1 e^{-24}

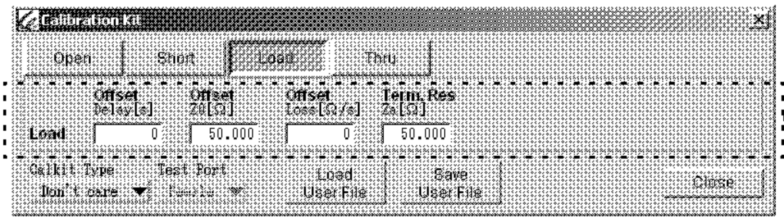
Inputs inductance L1 of the Short Standard.

Inductance L2 e^{-33}

Inputs inductance L2 of the Short Standard.

Inductance L3 e^{-42}

Inputs inductance L3 of the Short Standard.



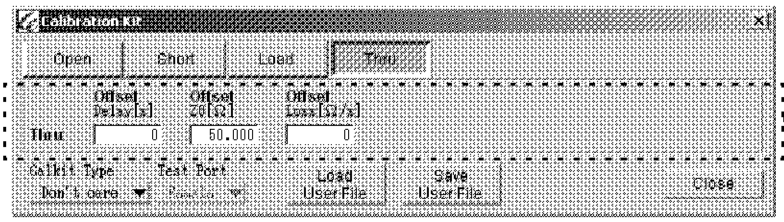
4

4. ***Load Offset***

Delay	Inputs the delay of the Load Standard.
Z0	Inputs the offset impedance of the Load Standard.
Loss	Inputs the loss of the Load Standard.

Load Termination

Resistance	Inputs the impedance of the Load Standard.



5

5. ***Thru Offset***

Commonly sets to the forward and reverse directions.

Delay	Inputs the delay of the Thru Standard.
Z0	Inputs the offset impedance of the Thru Standard.
Loss	Inputs the loss of the Thru Standard.

4.9 Measurement Example

This section provides measurement examples for the various calibrations.

Frequency and other measurement conditions have been set, and this section explains calibration operations using a 3.5 mm, male adapter cable connected to the test port.

If Normalize Calibration and an Automatic Calibration Kit are used, calibration can be executed again without deleting the calibration data.

4.9.1 6-Port Full Calibration

1. Click ***Cal*** in the tool menu to display the Calibration side menu.
2. Click ***Standard Cal*** and ***Cal Kit*** on the side menu to display the Calibration Kit dialog box.
3. Click ***Cal Kit Type, 3.5mm*** and ***male*** in the dialog box to set the calibration kit to the 3.5 mm type with male polarity for all ports. Click ***Close*** after the settings are completed to close the dialog box.
4. Click ***Full 6-port Cal*** to display the 6-port Calibration side menu.
5. Connect the Open Standard to Port 1, and click ***Port 1 Open***.
6. Connect the Short Standard to Port 1, and click ***Port 1 Short***.
7. Connect the Load Standard to Port 1, and click ***Port 1 Load***.
8. Connect the Open Standard to Port 2, and click ***Port 2 Open***.
9. Connect the Short Standard to Port 2, and click ***Port 2 Short***.
10. Connect the Load Standard to Port 2, and click ***Port 2 Load***.
11. Click More 2/4 to display page 2 of four pages.
12. Connect the Open Standard to Port 3, and click ***Port 3 Open***.
13. Connect the Short Standard to Port 3, and click ***Port 3 Short***.
14. Connect the Load Standard to Port 3, and click ***Port 3 Load***.
15. Connect the Open Standard to Port 4, and click ***Port 4 Open***.
16. Connect the Short Standard to Port 4, and click ***Port 4 Short***.
17. Connect the Load Standard to Port 4, and click ***Port 4 Load***.
18. Click More 3/4 to display page 3 of four pages.
19. Connect the Open Standard to Port 5, and click ***Port 5 Open***.
20. Connect the Short Standard to Port 5, and click ***Port 5 Short***.

21. Connect the Load Standard to Port 5, and click ***Port 5 Load***.
22. Connect the Open Standard to Port 6, and click ***Port 6 Open***.
23. Connect the Short Standard to Port 6, and click ***Port 6 Short***.
24. Connect the Load Standard to Port 6, and click ***Port 6 Load***.
25. Click More 4/4 to display page 4 of four pages.
26. Connect Port 1 and Port 4 with the Thru Standard, and click ***P1-P4 Thru***.
27. Connect Port 1 and Port 3 with the Thru Standard, and click ***P1-P3 Thru***.
28. Connect Port 1 and Port 2 with the Thru Standard, and click ***P1-P2 Thru***.
29. Connect Port 2 and Port 5 with the Thru Standard, and click ***P2-P5 Thru***.
30. Connect Port 2 and Port 3 with the Thru Standard, and click ***P2-P3 Thru***.
31. Connect Port 3 and Port 6 with the Thru Standard, and click ***P3-P6 Thru***.
32. Click ***Omit Isolation***. Isolation calibration is omitted here.
33. Click ***Done***.

The above procedure completes 6-port full calibration.

4.9.2 6-Port Full Calibration (Automatic Calibration)

The automatic calibration can be executed by using the R17051A or R17052A USB type 4-port automatic calibration kit.
The automatic calibration can be used only when port P123456 is selected.

1. Click ***Cal*** in the tool menu to display the Calibration side menu.
2. Click ***Auto Cal***.
3. Connect Port 1 Port 2, Port 3 and Port 4 to the Automatic Calibration Kit, and click ***Aquire P1234***.
4. Connect Port 2, Port 3, Port 5, and Port 6 to the Automatic Calibration Kit, and click ***Aquire P2356***.
5. Click ***Done***.

The above procedure completes 6-port full calibration.

4.9.3 5-Port Full Calibration

1. Click ***Cal*** in the tool menu to display the Calibration side menu.
2. Click ***Standard Cal*** and ***Cal Kit*** on the side menu to display the Calibration Kit dialog box.
3. Click ***Cal Kit Type, 3.5mm*** and ***male*** in the dialog box to set the calibration kit to the 3.5 mm type with male polarity for all ports. Click ***Close*** after the settings are completed to close the dialog box.
4. Click ***Full 5-port Cal*** to display the 6-port Calibration side menu.
5. Connect the Open Standard to Port 1, and click ***Port 1 Open***.
6. Connect the Short Standard to Port 1, and click ***Port 1 Short***.
7. Connect the Load Standard to Port 1, and click ***Port 1 Load***.
8. Connect the Open Standard to Port 2, and click ***Port 2 Open***.
9. Connect the Short Standard to Port 2, and click ***Port 2 Short***.
10. Connect the Load Standard to Port 2, and click ***Port 2 Load***.
11. Click More 2/4 to display page 2 of four pages.
12. Connect the Open Standard to Port 3, and click ***Port 3 Open***.
13. Connect the Short Standard to Port 3, and click ***Port 3 Short***.
14. Connect the Load Standard to Port 3, and click ***Port 3 Load***.
15. Connect the Open Standard to Port 4, and click ***Port 4 Open***.
16. Connect the Short Standard to Port 4, and click ***Port 4 Short***.
17. Connect the Load Standard to Port 4, and click ***Port 4 Load***.
18. Click More 3/4 to display page 3 of four pages.
19. Connect the Open Standard to Port 5, and click ***Port 5 Open***.
20. Connect the Short Standard to Port 5, and click ***Port 5 Short***.
21. Connect the Load Standard to Port 5, and click ***Port 5 Load***.
22. Click More 4/4 to display page 4 of four pages.
23. Connect Port 1 and Port 4 with the Thru Standard, and click ***P1-P4 Thru***.
24. Connect Port 1 and Port 3 with the Thru Standard, and click ***P1-P3 Thru***.
25. Connect Port 1 and Port 2 with the Thru Standard, and click ***P1-P2 Thru***.
26. Connect Port 2 and Port 5 with the Thru Standard, and click ***P2-P5 Thru***.

27. Connect Port 2 and Port 3 with the Thru Standard, and click ***P2-P3 Thru***.
28. Click ***Omit Isolation***. Isolation calibration is omitted here.
29. Click ***Done***.

The above procedure completes 5-port full calibration.

4.9.4 5-Port Full Calibration (Automatic Calibration)

The automatic calibration can be executed by using the R17051A or R17052A USB type 4-port automatic calibration kit.
The automatic calibration can be used only when port P12345 is selected.

1. Click ***Cal*** in the tool menu to display the Calibration side menu.
2. Click ***Auto Cal***.
3. Connect Port 1 Port 2, Port 3 and Port 4 to the Automatic Calibration Kit, and click ***Aquire P1234***.
4. Connect Port 1, Port 2, Port 3, and Port 5 to the Automatic Calibration Kit, and click ***Aquire P1235***.
5. Click ***Done***.

The above procedure completes 5-port full calibration.

4.9.5 4-Port Full Calibration

1. Click ***Cal*** in the tool menu to display the Calibration side menu.
2. Click ***Standard Cal*** and ***Cal Kit*** on the side menu to display the Calibration Kit dialog box.
3. Click ***Cal Kit Type, 3.5mm*** and ***Male*** in the dialog box to set the calibration kit to the 3.5 mm type with male polarity for all ports. Click ***Close*** after the settings are completed to close the dialog box.
4. Click ***Full 4-port Cal*** to display the 4-port Calibration side menu.
5. Connect the Open Standard to Port 1, and click ***Port 1 Open***.
6. Connect the Short Standard to Port 1, and click ***Port 1 Short***.
7. Connect the Load Standard to Port 1, and click ***Port 1 Load***.
8. Connect the Open Standard to Port 2, and click ***Port 2 Open***.
9. Connect the Short Standard to Port 2, and click ***Port 2 Short***.

10. Connect the Load Standard to Port 2, and click ***Port 2 Load***.
11. Click More 1/4 to display page 2 of four pages.
12. Connect the Open Standard to Port 3, and click ***Port 3 Open***.
13. Connect the Short Standard to Port 3, and click ***Port 3 Short***.
14. Connect the Load Standard to Port 3, and click ***Port 3 Load***.
15. Connect the Open Standard to Port 4, and click ***Port 4 Open***.
16. Connect the Short Standard to Port 4, and click ***Port 4 Short***.
17. Connect the Load Standard to Port 4, and click ***Port 4 Load***.
18. Click More 2/4 to display page 3 of four pages.
19. Connect Port 1 and Port 2 with the Thru Standard, and click ***P1-P2 Thru***.
20. Connect Port 1 and Port 3 with the Thru Standard, and click ***P1-P3 Thru***.
21. Connect Port 1 and Port 4 with the Thru Standard, and click ***P1-P4 Thru***.
22. Connect Port 2 and Port 3 with the Thru Standard, and click ***P2-P3 Thru***.
23. Connect Port 2 and Port 4 with the Thru Standard, and click ***P2-P4 Thru***.
24. Connect Port 3 and Port 4 with the Thru Standard, and click ***P3-P4 Thru***.
25. Click ***Omit Isolation***. Isolation calibration is omitted here.
26. Click ***Done***.

The above procedure completes 4-port full calibration.

4.9.6 4-Port Full Calibration (Automatic Calibration)

1. Click ***Cal*** in the tool menu to display the Calibration side menu.
2. When using the 2-port model automatic calibration kit, click ***Auto Cal*** to display the 4-port auto calibration side menu.

   When using the 4-port model automatic calibration kit, click ***Auto Cal*** to start the automatic calibration. Click ***Auto Cal*** after connecting ports 1, 2, 3 and 4 to the automatic calibration kit. Steps 3 to 7 are unnecessary.
3. Connect Port 1 and Port 2 to the Automatic Calibration Kit, and click ***Aquire P1-P2***.
4. Connect Port 1 and Port 4 to the Automatic Calibration Kit, and click ***Aquire P1-P4***.
5. Connect Port 1 and Port 3 to the Automatic Calibration Kit, and click ***Aquire P1-P3***.

6. Connect Port 2 and Port 3 to the Automatic Calibration Kit, and click ***Aquire P2-P3***.
7. Click ***Done***.

The above procedure completes 4-port full calibration.

4.9.7 3-Port Full Calibration (Port 1-Port 2-Port 3)

1. Click ***Cal*** in the tool menu to display the Calibration side menu.
2. Click ***Standard Cal*** and ***Cal Kit*** to display the Calibration Kit dialog box.
3. Click ***Cal Kit Type***, ***3.5mm*** and ***Male*** in the dialog box to set the calibration kit to the 3.5 mm type with male polarity for all ports. Click ***Close*** after the settings are completed to close the dialog box.
4. Click ***Full 3-port Cal*** and ***P1-P2-P3*** to display the 3-port Calibration side menu for Ports 1, 2, and 3.
5. Connect the Open Standard to Port 1, and click ***Port 1 Open***.
6. Connect the Short Standard to Port 1, and click ***Port 1 Short***.
7. Connect the Load Standard to Port 1, and click ***Port 1 Load***.
8. Connect the Open Standard to Port 2, and click ***Port 2 Open***.
9. Connect the Short Standard to Port 2, and click ***Port 2 Short***.
10. Connect the Load Standard to Port 2, and click ***Port 2 Load***.
11. Click More 1/3 to display page 2 of three pages.
12. Connect the Open Standard to Port 3, and click ***Port 3 Open***.
13. Connect the Short Standard to Port 3, and click ***Port 3 Short***.
14. Connect the Load Standard to Port 3, and click ***Port 3 Load***.
15. Connect Port 1 and Port 2 with the Thru Standard, and click ***P1-P2 Thru***.
16. Connect Port 1 and Port 3 with the Thru Standard, and click ***P1-P3 Thru***.
17. Connect Port 2 and Port 3 with the Thru Standard, and click ***P2-P3 Thru***.
18. Click ***Omit Isolation***. Isolation calibration is omitted here.
19. Click ***Done***.

The above procedure completes 3-port full calibration.

4.9.8 3-Port Full Calibration (Port 1-Port 2-Port 3, Automatic Calibration)

1. Click ***Cal*** in the tool menu to display the Calibration side menu.
2. When using the 2-port model automatic calibration kit, click ***Auto Cal*** to display the 3-port auto calibration side menu.

   When using the 4-port model automatic calibration kit, click ***Auto Cal*** to start the automatic calibration. Click ***Auto Cal*** after connecting ports 1, 2 and 3 to the automatic calibration kit. Steps 3 to 6 are unnecessary.
3. Connect Port 1 and Port 2 to the Automatic Calibration Kit, and click ***Acquire P1-P2***.
4. Connect Port 1 and Port 3 to the Automatic Calibration Kit, and click ***Acquire P1-P3***.
5. Connect Port 2 and Port 3 to the Automatic Calibration Kit, and click ***Acquire P2-P3***.
6. Click ***Done***.

The above procedure completes 3-port full calibration.

4.9.9 2-Port Full Calibration (Port 1-Port 2)

1. Click ***Cal*** in the tool menu to display the Calibration side menu.
2. Click ***Standard Cal*** and ***Cal Kit*** to display the Calibration Kit dialog box.
3. Click ***Cal Kit Type***, ***3.5mm*** and ***Male*** in the dialog box to set the calibration kit to the 3.5 mm type with male polarity for all ports. Click ***Close*** after the settings are completed to close the dialog box.
4. Click ***Full 2-port Cal*** and ***P1-P2*** to display the 2-port Calibration side menu for Ports 1 and 2.
5. Connect the Open Standard to Port 1, and click ***Port 1 Open***.
6. Connect the Short Standard to Port 1, and click ***Port 1 Short***.
7. Connect the Load Standard to Port 1, and click ***Port 1 Load***.
8. Connect the Open Standard to Port 2, and click ***Port 2 Open***.
9. Connect the Short Standard to Port 2, and click ***Port 2 Short***.
10. Connect the Load Standard to Port 2, and click ***Port 2 Load***.
11. Click More 1/2 to display page 2 of two pages.
12. Connect Port 1 and Port 2 with the Thru Standard, and click ***P1-P2 Thru***.
13. Click ***Omit Isolation***. Isolation calibration is omitted here.

14. Click ***Done***.

The above procedure completes 2-port full calibration.

4.9.10 2-Port Full Calibration (Port 1-Port 2, Automatic Calibration)

1. Click ***Cal*** in the tool menu to display the Calibration side menu.
2. Connect Port 1 and Port 2 to the Automatic Calibration Kit, and click ***Auto Cal***.

The above procedure completes 2-port full calibration.

4.9.11 1-Port Full Calibration (Port 1)

1. Click ***Cal*** in the tool menu to display the Calibration side menu.
2. Click ***Standard Cal*** and ***Cal Kit*** to display the Calibration Kit dialog box.
3. Click ***Cal Kit Type, 3.5mm*** and ***Male***, in the dialog box to set the calibration kit to the 3.5 mm type with male polarity for the port. Click ***Close*** after the settings are completed to close the dialog box.
4. Click ***Full 1-port Cal*** and ***Port 1*** to display the 1-port Calibration side menu for Port 1.
5. Connect the Open Standard to Port 1, and click ***Port 1 Open***.
6. Connect the Short Standard to Port 1, and click ***Port 1 Short***.
7. Connect the Load Standard to Port 1, and click ***Port 1 Load***.
8. Click ***Done***.

The above procedure completes 1-port full calibration.

4.9.12 1-Port Full Calibration (Port 1, Automatic Calibration)

1. Click ***Cal*** in the tool menu to display the Calibration side menu.
2. Connect Port 1 to the Automatic Calibration Kit, and click ***Auto Cal***.

The above procedure completes 1-port full calibration.

4.9.13 Normalize Calibration (Port 1 - Port 2 Transmission Characteristics)

1. Set the S-Parameter to S21.
2. Click ***Cal*** in the tool menu to display the Calibration side menu.
3. Connect Port 1 and Port 2 with the Thru Standard, and click ***Standard Cal*** and ***Normalize Open/Thru***.

The above procedure completes Normalize Calibration.

4.9.14 Normalize Calibration (Port 1 Reflection Characteristics, Open Standard)

1. Set the S-Parameter to S11.
2. Click ***Cal*** in the tool menu to display the Calibration side menu.
3. Connect the Open Standard to Port 1, and click ***Standard Cal*** and ***Normalize Open/Thru***.

The above procedure completes Normalize Calibration.

4.9.15 Normalize Calibration (Port 1 Reflection Characteristics, Short Standard)

1. Set the S-Parameter to S11.
2. Click ***Cal*** in the tool menu to display the Calibration side menu.
3. Connect the Short Standard to Port 1, and click ***Standard Cal*** and ***Normalize Short***.

The above procedure completes Normalize Calibration.

4.10 Extending the Measurement Reference Surface

The following functions move the calibrated surface to the cable tip when an extension cable is connected to the test port after performing a calibration. The electrical delay for the extended part is corrected as if a perfect, no power dissipating cable has been added. The phase shift in the extension is adjusted and the phase characteristics can be gained in a sample portion.

- Port extension

  Takes measurements assuming that the extended cable has an electrical delay which was set in the measurement port. The electrical delay is corrected automatically corresponding to a measurement port change.

  For an example: Setting 10 ns for Port 1 and 20 ns for Port 2 makes following adjustments.
  In the S11 measurement, (Port 1) × 2 = 20 ns
  In the S21 measurement, (Port 1) + (Port 2) = 30 ns

- Electrical delay correction

  Corrects the measurement data with the set electrical delay value. There are no distinctions between measurement ports. The electrical delay correction can be performed when measuring the electrical delay in a cable. Electrical delay values can be set for individual traces.

- Phase Offset

  Regardless to the frequency, adds a constant offset phase value. Offsetting phase values can be set for individual traces.

- Velocity Factor

  The velocity factor used for calculating electrical delays.
  The default value is 1.

- Phase Adjustment Quantity (deg)

$$\phi = S \times f \times 360 + \theta = \frac{L}{vf \times c} \times f \times 360 + \theta$$

S: Electrical delay correction (time)
L: Electrical delay correction (distance)
θ: Phase offset
f: Frequency at each measurement point
vf: Velocity factor
c: Light speed

4.10.1 How to Set the Port Extension

Select ***Cal*** in the main menu. Then, select ***Port Extension*** to display the side menu.

1.	***Port Extension ON/OFF***	Sets the port extension function to ON or OFF.
2.	***Extension Port 1***	Sets the Port 1 extension value in time.
3.	***Extension Port 2***	Sets the Port 2 extension value in time.
4.	***Extension Port 3***	Sets the Port 3 extension value in time.
5.	***Extension Port 4***	Sets the Port 4 extension value in time.
6.	***Extension Port 5***	Sets the Port 5 extension value in time.
7.	***Extension Port 6***	Sets the Port 6 extension value in time.
8.	***Marker To Extension***	Sets the active marker value as the port extension value. Available for reflection measurements.

4.10.2 How to Set Electrical Delay Correction, Phase Offset, and Velocity Factor

Select ***Cal*** in the main menu. Then, select ***Elec Delay*** to display the side menu.

1.	***Electrical Delay ON/OFF***	Sets the electrical delay correction function to ON or OFF.
2.	***Delay Time***	Sets the electrical length correction values of active traces in time. Can be set for individual traces.
3.	***Delay Length***	Sets the electrical length correction values of active traces in distance. Can be set for individual traces.
4.	***Vel Factor***	Sets the velocity factor.
5.	***Phase Offset ON/OFF***	Sets the phase offset function to ON or OFF.
6.	***Phase Offset***	Sets phase offset values of active traces. Can be set for individual traces.
7.	***Maker To Delay***	Sets the active marker value as the electrical delay correction value. Available for active marker.

4.11 Calibration Data Interpolation (Interpolate)

Interpolate is a function which can change the frequency range and number of measurement points without re-acquiring correction data.

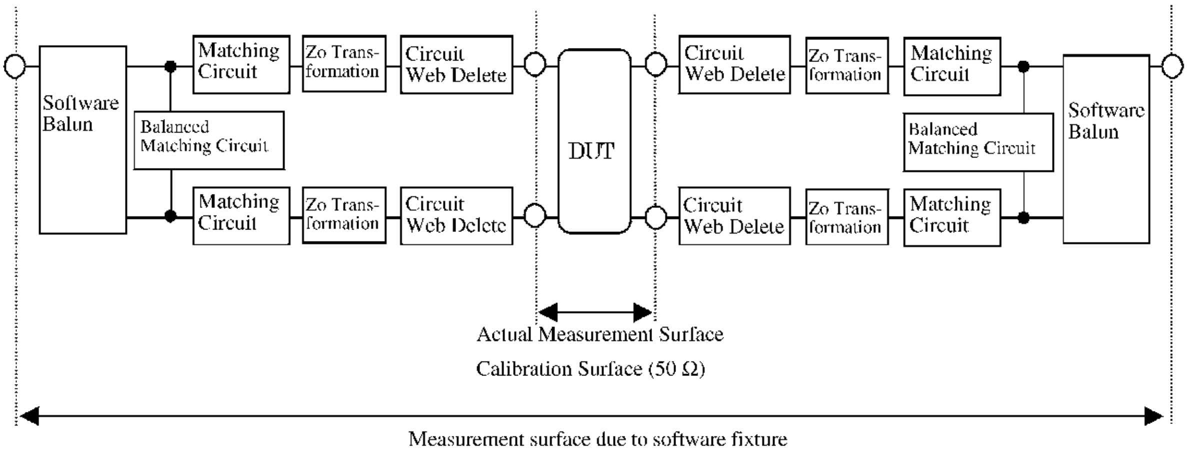
When Interpolate is set to ON, the correction data interpolation after the setting is changed is calculated by using the acquired correction data.

5. SOFTWARE FIXTURE

This feature transforms and analyzes items measured at 50 Ω impedance to an optional impedance with an impedance conversion function. Also, a matching circuit function allows analysis of characteristics added by an optional matching circuit. Additionally, a circuit web delete function eliminates the influence of measurement fittings which allows measurement of only the characteristics of measurement items.

The 3-port type, 4-port type, and 6-port type allow easy analysis of balanced components and floating components as well as unbalanced components.

[Measurement Flow]



5.1 Circuit Web Delete Function

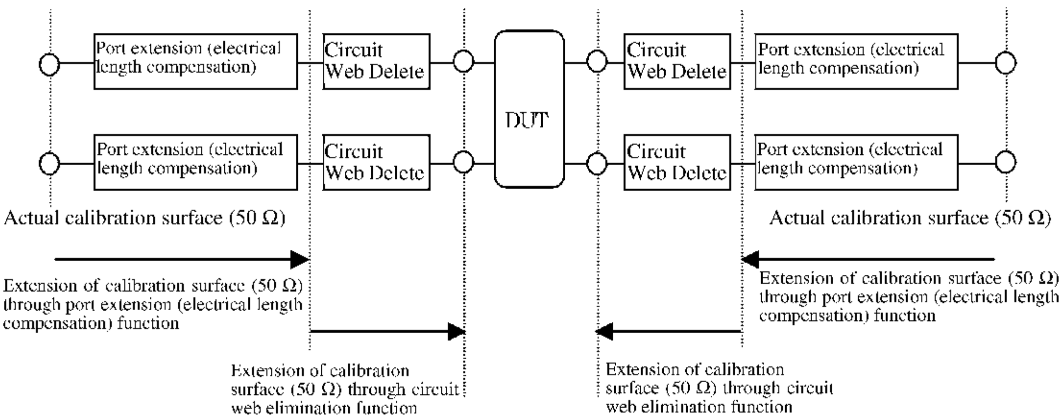
A known 2-port circuit web is deleted for each measurement port before measurement.

If the characteristics of measurement fittings can be determined beforehand, then only the characteristics of measurement items (DUT) can be determined by using this function to eliminate the characteristics of fittings.

In the past, a port extension (electrical length compensation) function was used to extend the calibration surface to the measurement item to eliminate the characteristics of fittings. However, only the phase characteristics (electrical length) could be corrected. With the circuit web delete function, a complete 2-port circuit web, including phase, magnitude, and impedance, is eliminated to extend the calibration surface. Therefore, the characteristics of measurement items can be properly measured.

The port extension function and circuit web delete function can be used at the same time (see diagram below).

The circuit web to be deleted is set by the S-parameter file (user-defined circuit file) of a T.S. file (touchstone file format).



5.2 Impedance Transformation Function

The impedance is transformed to optional characteristic impedance value (real number value) for each measurement port before measurement.

- Dynamic range when impedance conversion is executed

  When devices other than 50Ω devices are measured using the impedance transformation function, the dynamic range is lower than when 50Ω devices are measured. The lower proportion is shown in Figure 5-1. Use this figure as a rough guide of the maximum dynamic range during measurement.

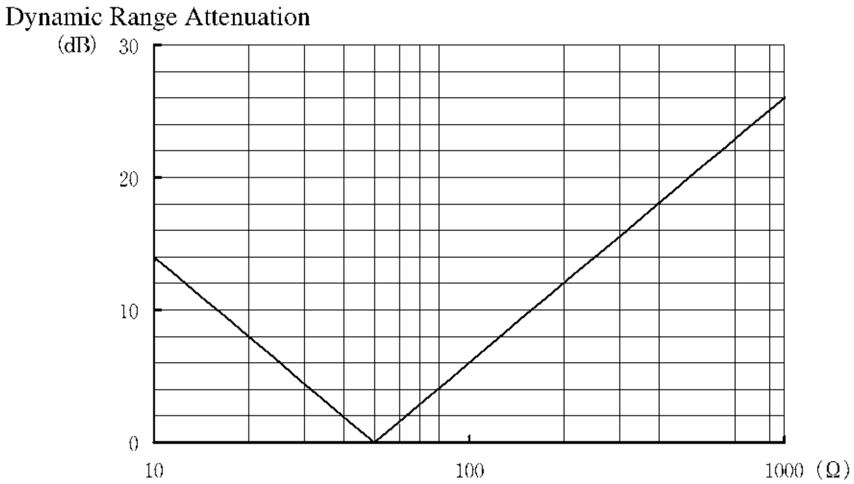


Figure 5-1 Impedance after Transformation

- S-Parameter and Characteristic Impedance

  This functions permits the setting of optional values to characteristic impedance to allow description of the S-parameters.

  For port i, defining the Voltage as Vi, Current as Ii, and Impedance as Zi, yields Incident Wave ai and Reflected Wave bi from the following formulas.

$$a_i = \frac{1}{2}\left(\frac{V_i}{\sqrt{Z_i}} + I_i\sqrt{Z_i}\right) \qquad b_i = \frac{1}{2}\left(\frac{V_i}{\sqrt{Z_i}} - I_i\sqrt{Z_i}\right)$$

From Incident Wave ai and Reflected Wave bi, the S-parameters, Sij, of a device with n ports are defined by the following matrix.

$$\begin{pmatrix} b_1 \\ b_2 \\ \vdots \\ b_n \end{pmatrix} = \begin{pmatrix} S_{11} & S_{12} & \cdots & S_{1n} \\ S_{21} & S_{22} & \cdots & S_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ S_{n1} & S_{n2} & \cdots & S_{nn} \end{pmatrix} \begin{pmatrix} a_1 \\ a_2 \\ \vdots \\ a_n \end{pmatrix}$$

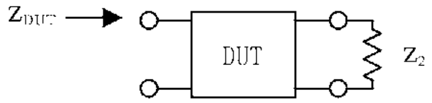
As shown above, the S-parameters are defined as components of a matrix, and the various parameters can be individually calculated the simple circuit calculations.

Taking measurement using a 2-port device as an example, the following section explains the calculation method when port 1 has Impedance Z1 and port 2 has Impedance Z2.

1. Reflection Parameter S11

   Defining the final impedance from the device's output port (port 2) as Impedance Z2 and the impedance observed from the input port (port 1) of the device as Impedance Z_{DUT}, allows calculation of S11 from the following formula.

$$S11 = \frac{Z_{DUT} - Z_2}{Z_{DUT} + Z_2}$$



2. Transmission Parameter S21

   When Impedance Z1 of the signal source and Impedance Z2 of the duty (receiving portion) are known:

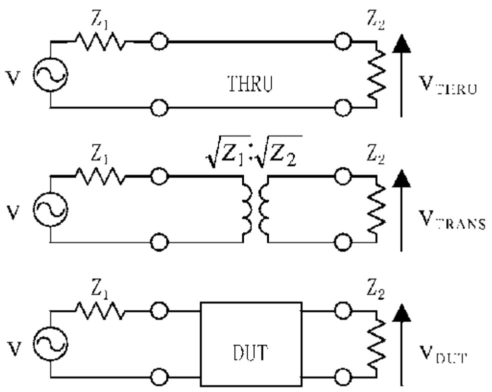
   The voltage arising in the duty when the signal source and duty are directly connected is: V_{THRU}

   The voltage arising in the duty when a transformer is connected between the signal source and the duty is: V_{TRANS}

   The voltage arising in the duty when a device is between the signal source and the duty is: V_{DUT}

   Thus, S21 can be calculated by the following formula.

$$S21 = \frac{V_{DUT}}{V_{TRANS}}$$



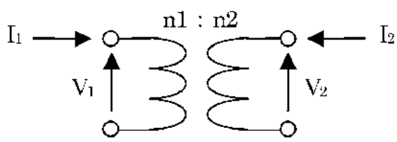
In particular, when Z1 = Z2, then $V_{TRANS} = V_{THRU}$, and the formula holds.

Conversely, when Z1 ≠ Z2, then $V_{TRANS} \neq V_{THRU}$, and the formula becomes.

(Reference)

An n1: n2 transformer is a circuit with the following voltage and current relationships.

When a transformer is specified by Impedances Z1 and Z2, the S-parameters are S11 = S22 = 0, and S21 = S12 = 1.



$V_1 : V_2 =$ n1 : n2

$I_1 : I_2 =$ 1/n1 : 1/n2

5.3 Matching Circuit Function

An optional matching circuit is added for each measurement port to transform the characteristics for measurement.

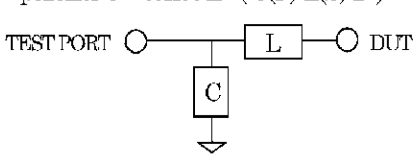
There are the following two methods for setting the matching circuit.

- Setting through combination of a capacitor and inductor

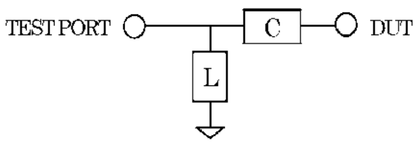
  Capacitance C and Inductance L can be set to optional values. Additionally, conductance component G of the capacitor and resistance component R of the inductor can also be set.

  There are the following five matching circuit models for setting methods which use C and L.

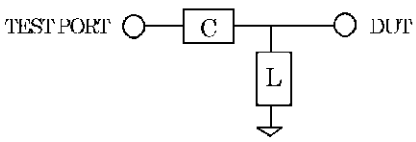
1. parallel C – series L (C(P)-L(S)-D)



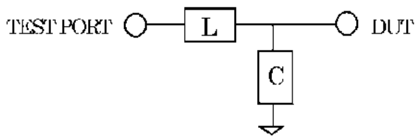
2. parallel L – series C (L(P)-C(S)-D)



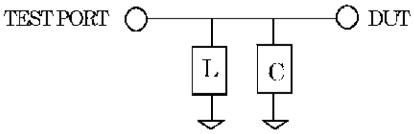
3. series C – parallel L (C(S)-L(P)-D)



4. series L – parallel C (L(S)-C(P)-D)



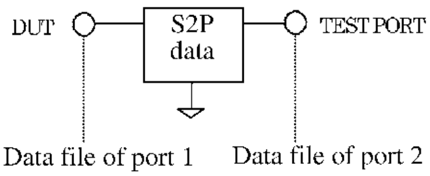
5. parallel L – parallel C (L(P)-C(P)-D)



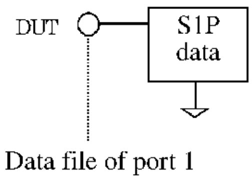
- Setting using an S-parameter file

  Setting can be accomplished using an optional S-parameter file (user-defined circuit file) generated by circuit simulators and other equipment. The parameters are set in T.S file (touchstone file) format. There are the following two matching circuit models for setting methods which use S-parameter files.

  1. 2-port matching circuit (S2P data file)



  2. 1-port matching circuit (S1P data file)



CAUTION: ***Use of S1P data ensures that the port uses the equivalent reflection factor of the S1P data.***

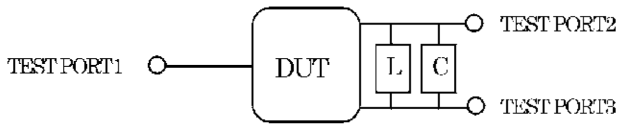
5.4 Balance Matching Circuit Function

Matching circuits operated through Capacitance C and Inductance L are added between measurement ports to transform characteristics for measurement. Capacitance C and Inductance L can be set to optional values. Additionally, conductance component G of the capacitor and resistance component R of the inductor can also be set.

The matching circuit function adds a matching circuit between the measurement port and the ground, and the balance matching circuit function adds a matching circuit that straddles measurement ports.

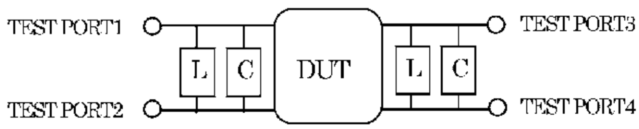
- 3-port devices (3-port type or 4-port type)

  A balance matching circuit can be added between Test port 2 and Test port 3.



- 4-port devices (4-port type)

  Balance matching circuits can be added between Test port 1 and Test port 2 and between Test port 3 and Test port 4.



5.5 Balance Parameter Analysis Function

5.5.1 Full Balance Parameter BB

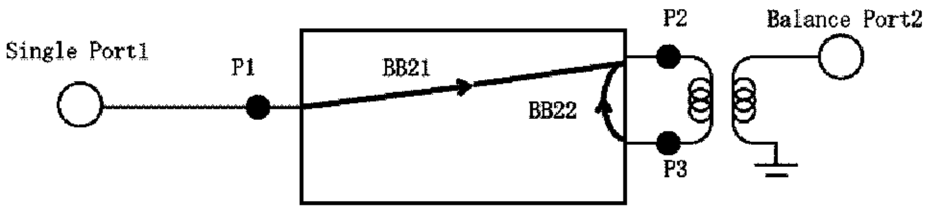
The full balance parameter BB_{IJ} indicates the balance parameter (in dB and deg) of the two signals, which are output to balance port I when a signal is input to single port J or an ideal balance signal is input to balance port J.

For example, in the UB analysis of the 3-port device when the signal is input in single port 1, BB21 is defined as the balance parameter between two transmitted signals which are output to balance port 2.

In the BB analysis of the 4-port device, when the signal is input in balance port 1, BB21 is defined as the balance parameter between two transmitted signals which are output to balance port 2 and BB11 is defined as the balance parameter between two reflected signals which are output to balance port 1.

All balance parameters, which are defined in the 3-port UB type, 4-port BB type and 5-port UBB type, are shown below as the concrete examples.

- 3-port UB type

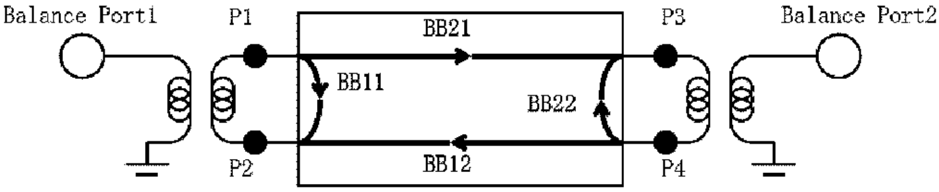


$$\begin{pmatrix} BB11 & BB12 & BB13 & BB14 & BB15 \\ \boldsymbol{BB21} & \boldsymbol{BB22} & BB23 & BB24 & BB25 \\ BB31 & BB32 & BB33 & BB34 & BB35 \\ BB41 & BB42 & BB43 & BB44 & BB45 \\ BB51 & BB52 & BB53 & BB54 & BB55 \end{pmatrix}$$

$$BB21 = -\frac{S21}{S31}$$

$$BB22 = -\frac{S21 - S23}{S32 - S33}$$

- 4-port BB type



$$\begin{pmatrix} \boldsymbol{BB}11 & \boldsymbol{BB}12 & BB13 & BB14 & BB15 \\ \boldsymbol{BB}21 & \boldsymbol{BB}22 & BB23 & BB24 & BB25 \\ BB31 & BB32 & BB33 & BB34 & BB35 \\ BB41 & BB42 & BB43 & BB44 & BB45 \\ BB51 & BB52 & BB53 & BB54 & BB55 \end{pmatrix}$$

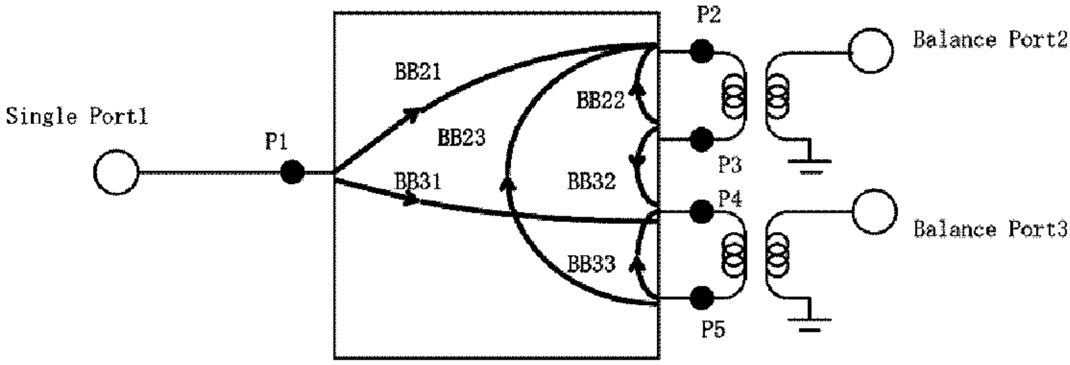
$$BB11 = -\frac{S11 - S12}{S21 - S22}$$

$$BB12 = -\frac{S13 - S14}{S23 - S24}$$

$$BB21 = -\frac{S31 - S32}{S41 - S42}$$

$$BB22 = -\frac{S33 - S34}{S43 - S44}$$

- 5-port UBB type



$$\begin{pmatrix} BB11 & BB12 & BB13 & BB14 & BB15 \\ \boldsymbol{BB}21 & \boldsymbol{BB}22 & \boldsymbol{BB}23 & BB24 & BB25 \\ \boldsymbol{BB}31 & \boldsymbol{BB}32 & \boldsymbol{BB}33 & BB34 & BB35 \\ BB41 & BB42 & BB43 & BB44 & BB45 \\ BB51 & BB52 & BB53 & BB54 & BB55 \end{pmatrix}$$

$$BB21 = -\frac{S21}{S31}$$

$$BB22 = -\frac{S22 - S23}{S32 - S33}$$

$$BB23 = -\frac{S24 - S25}{S34 - S35}$$

$$BB31 = -\frac{S41}{S51}$$

$$BB32 = -\frac{S42 - S43}{S52 - S53}$$

$$BB33 = -\frac{S44 - S45}{S54 - S55}$$

CAUTION: ***The full balance parameter BB can be used only when Balance Device Port is set to Balance Device Port (Port Model).***

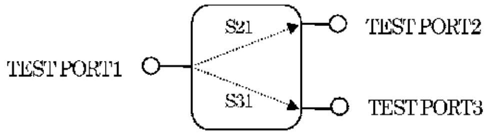
5.5.2 Balance Parameter B

The balance parameters of amplitude and phase in the transmission characteristics are measured in the balance parameter B measurement.

Complete balance is obtained when measurement results are magnitude = 0 dB and phase = 0 deg.

The definition of balance is as follows.

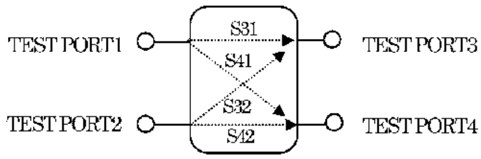
- 3-port devices (3-port Type or 4-port Type)



Balance between test port 2 and test port 3 (B23) = -(S21/S31)

Balance between test port 3 and test port 2 (B32) = -(S31/S21)

- 4-port devices (4-port Type)



Balance between test port 3 and test port 4 (B34) = -(S31-S32)/(S41-S42)

Balance between test port 4 and test port 3 (B43) = -(S41-S42)/(S31-S32)

Balance between test port 1 and test port 2 (B12) = -(S13-S14)/(S23-S24)

Balance between test port 2 and test port 1 (B21) = -(S23-S24)/(S13-S14)

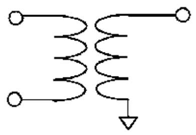
CAUTION: ***The balance parameter B can be used only when Balance Device Port is set to Compatible.***

5.6 Software Balun Function

An ideal balun connected between measurement ports, and balanced devices are transformed to unbalanced 2-port devices for measurement of characteristics. One of two types of ideal baluns, a floating balun or differential balun, can be selected.

1. Floating balun

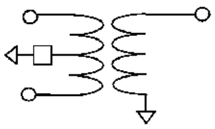
Floating balun



The floating type of balun is an ideal transformer divorced from the Ground. This type of balun is used for evaluation of floating devices that do not accept the effects of mutual impedance between the measurement port and the Ground.

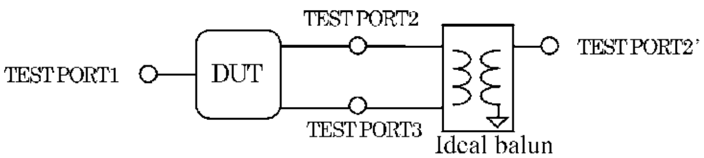
2. Differential balun

Differential balun



The differential type of balun is a differential-type of ideal transformer with impedance at the center point. It is used for evaluation of devices with measurement ports balanced with respect to the Ground.

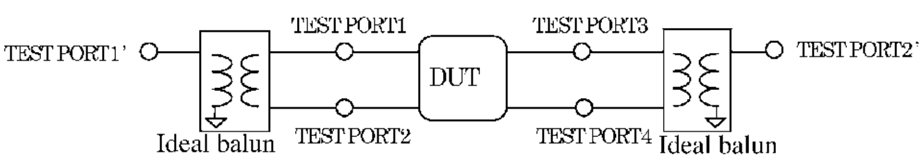
- 3-port devices (3-port type or 4-port type)



An ideal balun is connected between Test port 2 and Test port 3, which is transformed to balance port Test port 2'.

Test port 1 and Test port 2' are measured as a 2-port network, and the S-parameters are displayed as SS11, SS21, SS12, and SS22.

- 4-port devices (4-port type)

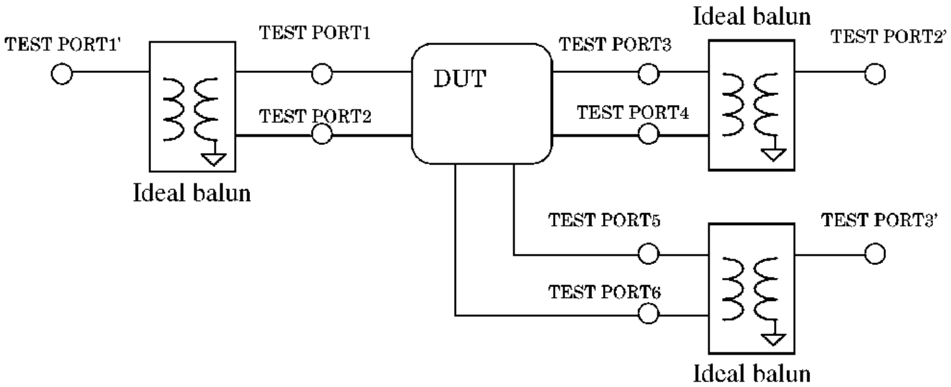


An ideal balun is connected between Test port 1 and Test port 2, which is transformed to balance port Test port 1'.

An ideal balun is connected between Test port 3 and Test port 4, which is transformed to balance port Test port 2'.

Test port 1' and Test port 2' are measured as a 2-port network, and the S-parameters are displayed as SS11, SS21, SS12, and SS22.

- 6-port devices (6-port type)



An ideal balun is connected between Test port 1 and Test port 2, which is transformed to balance port Test port 1'.

An ideal balun is connected between Test port 3 and Test port 4, which is transformed to balance port Test port 2'.

An ideal balun is connected between Test port 5 and Test port 6, which is transformed to balance port Test port 3'.

Test port 1', Test port 2' and Test port 3' are measured as a 3-port network, and the S-parameters are displayed as SS11, SS21, SS31, SS12, SS22, SS32, SS13, SS23 and SS33.

5.7 Mode Analysis Function

This function measures balanced devices by common and differential components.

Common components are signal components that arise between the center points of balance ports and the Ground. Differential components are signal components that arise between balance ports.

There are the following four type of mode analysis.

1. Differential input/differential output: S-parameters are displayed as Sdd11, Sdd21, Sdd12, and Sdd22.
2. Differential input/common output: S-parameters are displayed as Scd11, Scd21, Scd12, and Scd22.
3. Common input/differential output: S-parameters are displayed as Sdc11, Sdc21, Sdc12, and Sdc22.
4. Common input/ common output: S-parameters are displayed as Scc11, Scc21, Scc12, and Scc22.

The characters appended to S-parameters indicate the mode with alphabetic characters and the measurement port with numeric characters. Both the alphabetic and numeric characters follow the order of output and input of general S-parameters.

Alphabetic characters	d:	Differential
	c:	Common
Numeric characters	1:	Indicates Test port 1 for 3-port devices, and Balance port 1 formed from Test port 1 and Test port 2 for 4-port devices.
	2:	Indicates Balance port 2 formed from Test port 2 and Test port 3 for 3-port devices, and Balance port 2 formed from Test port 3 and Test port 4 for 4-port devices.

Examples:

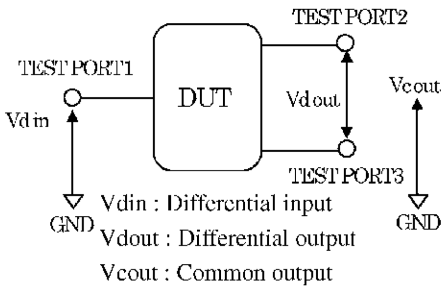
Sdc21 indicates transmission characteristics of common input to Port 1 and differential output from Port 2.

Scd22 indicates reflection characteristics of differential input to Port 2 and common output from Port 2.

- 3-port devices (3-port type or 4-port type)

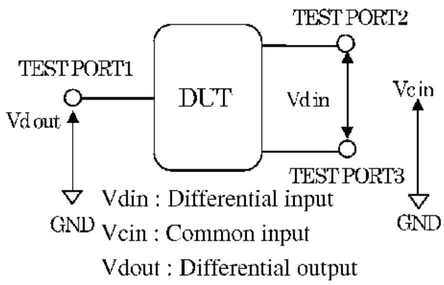
  Test port 1 is an unbalanced port, so there is no distinction between common and differential. Measurement is differential.

  1. Forward (Test port 1 is the input, and Test port 2 and Test port 3 are outputs)



Differential/differential input reflection characteristics: Sdd11
Differential/differential forward transmission characteristics: Sdd21
Differential/common forward transmission characteristics: Scd21

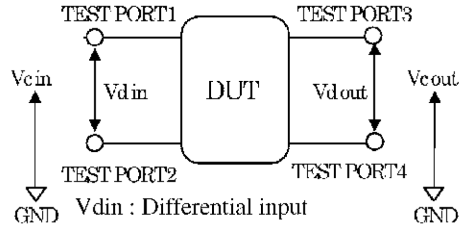
  2. Reverse (Test port 1 is the output, and Test port 2 and Test port 3 are inputs)



Differential/differential output reflection characteristics: Sdd22
Differential/common output reflection characteristics: Scd22
Common/common output reflection characteristics: Scc22
Common/differential output reflection characteristics: Sdc22
Differential/differential reverse transmission characteristics: Sdd12
Differential/common reverse transmission characteristics: Sdc12

- 4-port devices (4-port type)

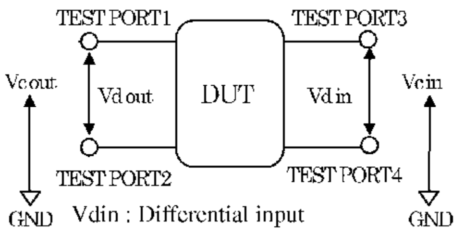
1. Forward (Test port 1 and Test port 2 are the inputs, and Test port 3 and Test port 4 are the outputs)



Vdin : Differential input
Vcin : Common input
Vdout : Differential output
Vcout : Common output

Differential/differential input reflection characteristics: Sdd11
Differential/common input reflection characteristics: Scd11
Common/common input reflection characteristics: Scc11
Common/differential input reflection characteristics: Sdc11
Differential/differential forward transmission characteristics: Sdd21
Differential/common forward transmission characteristics: Scd21
Common/common forward transmission characteristics: Scc21
Common/differential forward transmission characteristics: Sdc21

2. Reverse (Test port 1 and Test port 2 are the outputs, and Test port 3 and Test port 4 are the inputs)

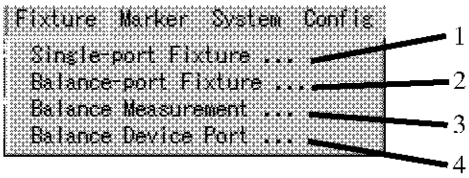


Vdin : Differential input
Vcin : Common input
Vdout : Differential output
Vcout : Common output

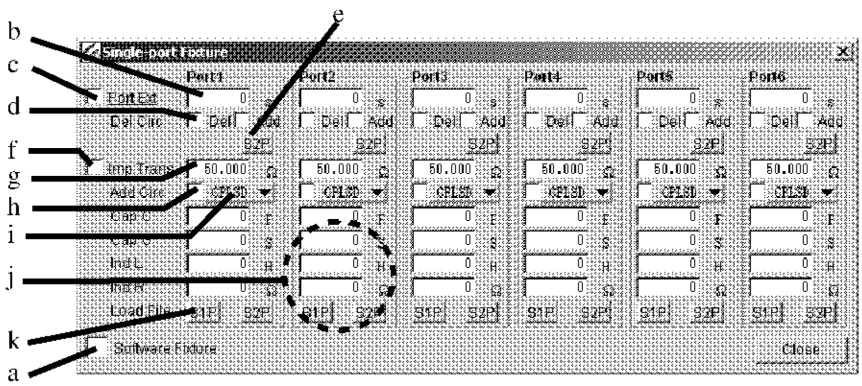
Differential/differential input reflection characteristics: Sdd22
Differential/common input reflection characteristics: Scd22
Common/common input reflection characteristics: Scc22
Common/differential input reflection characteristics: Sdc22
Differential/differential forward transmission characteristics: Sdd12
Differential/common forward transmission characteristics: Scd12
Common/common forward transmission characteristics: Scc12
Common/differential forward transmission characteristics: Sdc12

5.8 Operation Methods

Click ***Fixture*** in the main menu to display the pull-down menu.



1. ***Single-port Fixture*** Displays the Single-port Fixture dialog box for setting the port extension function, circuit web delete function, impedance conversion function, and matching circuit function.



(a) Sets ON/OFF for the entire software fixture function.

(b) Sets port extension values by test port.

(c) Sets ON/OFF of the port extension function.

(d) Set the circuit web delete function to ON or OFF and the circuit add function to ON or OFF for each test port.

(e) Loads the user-defined circuit file for use in the circuit web delete function by test port.

(f) Sets ON/OFF of the impedance conversion function.

(g) Sets impedance conversion values by test port.

(h) Sets ON/OFF of the matching circuit function by test port.

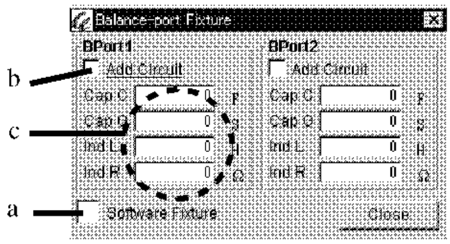
(i) Sets the type of matching circuit by test port.

(j) Sets the constants of the matching circuit by test port.

(k) Loads the user-defined circuit file for use in the matching circuit by test port.

2. ***Balance-port Fixture***

Displays the Balance-port Fixture dialog box for setting the balance matching circuit function.



(a) Sets ON/OFF for the entire software fixture function.

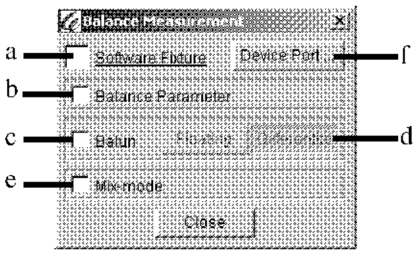
(b) Sets the type of balance matching circuit by balance port.

(c) Sets ON/OFF of the balance matching circuit function by balance port.

(d) Sets the constants of the balance matching circuit by balance port.

3. ***Balance Measurement***

Displays the Balance Measurement dialog box for setting the Balance measurement function, Software balun function, and Mode analysis function.



(a) Sets ON/OFF for the entire software fixture function.

(b) Sets ON/OFF for the Balance measurement function.

(c) Sets ON/OFF for the Software balun function.

(d) Selects the type (differential/floating) of software balun.

(e) Sets ON/OFF for the Mode analysis function.

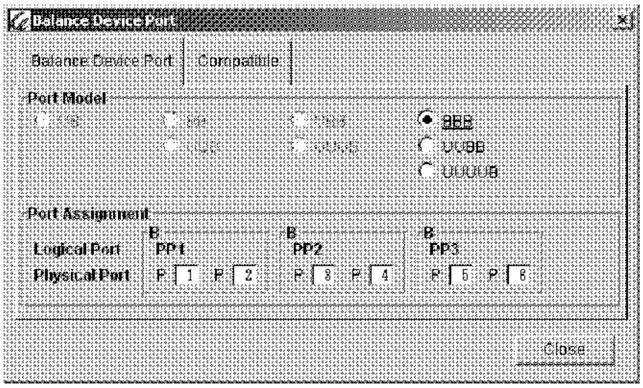
(f) Displays the Device Port dialog box.

CAUTION: ***In the Balance Device Port dialog box, if the Balance Device Port (Port Model) mode is switched to the Compatible mode or in the reverse case, (b) Balance Parameter, (c) Balun, and (e) Mix-mode in the Balance Measurement dialog box are forcefully set to unselected.***
Therefore, to continue the balance measurement, these items must be re-set.

---

4. ***Balance Device Port*** Displays the Balance Device Port dialog box.

- Balance Device Port (Port Model) menu



- Port Model

  BBB:

  Select when using a 6-port device which consists of three pairs of balance ports.

  UUBB:

  Select when using a 6-port device which consists of two unbalance ports and two pairs of balance ports.

  UUUUB:

  Select when using a 6-port device which consists of four unbalance ports and a pair of balance port.

  UBB:

  Select when using a 5-port device which consists of an unbalance port and two pairs of balance ports.

  UUUB:

  Select when using a 5-port device which consists of three unbalance ports and a pair of balance port.

  BB:

  Select when using a 4-port device (P1234) which consists of two pairs of balance ports.

  UUB:

  Select when using a 4-port device (P1234) which consists of two unbalance ports and a pair of balance port.

  UB:

  Select when using a 3-port device (P123) which consists of an unbalance port and a pair of balance port.

- Port Assignment

  U: Input which unbalance port to select.

  B: Input the port which is selected as a balance port.

CAUTION: ***Trace parameter notations in balance measurements (balance parameter, balun, and mode analysis) list not actual measurement port numbers, but basic condition port numbers as explained below.***

- ***In 3-port devices.***

  The unbalance port is referred to as Port 1, and unbalance ports are referred to as Port 2 and Port 3 in calculations.

  [Example]

  When a device U(P2)-B(P34) is selected, balance parameter is as follow:

  BB21 = the balance parameter between Port 3 and Port 4

- ***In 4-port devices.***

  The balance port 1 is referred to as Port 1 and Port 2, and the balance port 2 is referred to as Port 3 and Port 4 in calculations.

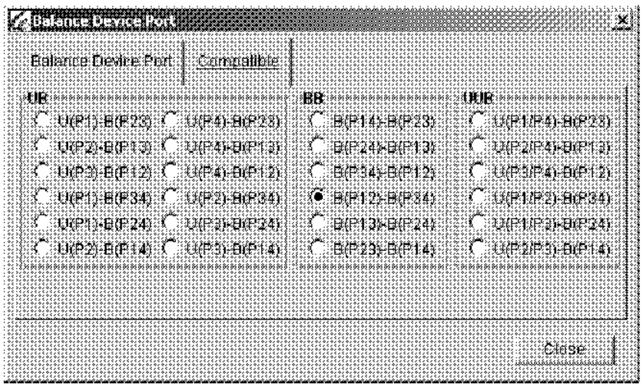
  [Example]

  When a device B(P13)-B(P24) is selected, balance parameters are as follows:

  BB21 = the balance parameter between Ports 2 and Port 4

  BB12 = the balance parameter between Ports 1 and Port 3

- Compatible menu



- 3-port device / Unbalance - balance

  U(P1)-B(P34) :

  Sets Port 1 to the unbalance port, and sets Ports 3 and 4 to balance ports.

  U(P2)-B(P34) :

  Sets Port 2 to the unbalance port, and sets Ports 3 and 4 to balance ports.

  U(P1)-B(P24) :

  Sets Port 1 to the unbalance port, and sets Ports 2 and 4 to balance ports.

U(P3)-B(P24) :
  Sets Port 3 to the unbalance port, and sets Ports 2 and 4 to balance ports.
U(P1)-B(P23) :
  Sets Port 1 to the unbalance port, and sets Ports 2 and 3 to balance ports.
U(P4)-B(P23) :
  Sets Port 4 to the unbalance port, and sets Ports 2 and 3 to balance ports.
U(P2)-B(P14) :
  Sets Port 2 to the unbalance port, and sets Ports 1 and 4 to balance ports.
U(P3)-B(P14) :
  Sets Port 3 to the unbalance port, and sets Ports 1 and 4 to balance ports.
U(P2)-B(P13) :
  Sets Port 2 to the unbalance port, and sets Ports 1 and 3 to balance ports.
U(P4)-B(P13) :
  Sets Port 4 to the unbalance port, and sets Ports 1 and 3 to balance ports.
U(P3)-B(P12) :
  Sets Port 3 to the unbalance port, and sets Ports 1 and 2 to balance ports.
U(P4)-B(P12) :
  Sets Port 4 to the unbalance port, and sets Ports 1 and 2 to balance ports.

- 4-port device / balance - balance.

  B(P12)-B(P34) :
    Sets Ports 1 and 2 to unbalance port 1, and sets Ports 3 and 4 to balance port 2.
  B(P13)-B(P24) :
    Sets Ports 1 and 3 to unbalance port 1, and sets Ports 2 and 4 to balance port 2.
  B(P14)-B(P23) :
    Sets Ports 1 and 4 to unbalance port 1, and sets Ports 2 and 3 to balance port 2.
  B(P23)-B(P14) :
    Sets Ports 2 and 3 to unbalance port 1, and sets Ports 1 and 4 to balance port 2.
  B(P24)-B(P13) :
    Sets Ports 2 and 4 to unbalance port 1, and sets Ports 1 and 3 to balance port 2.
  B(P34)-B(P12) :
    Sets Ports 3 and 4 to unbalance port 1, and sets Ports 1 and 2 to balance port 2.

- 4-port device / unbalance - unbalance - balance.

  U(P1/P2)-B(P34) :

  Sets Ports 1 and 2 to unbalance ports, and sets Ports 3 and 4 to balance ports.

  U(P1/P3)-B(P24) :

  Sets Ports 1 and 3 to unbalance ports, and sets Ports 2 and 4 to balance ports.

  U(P1/P4)-B(P23) :

  Sets Ports 1 and 4 to unbalance ports, and sets Ports 2 and 3 to balance ports.

  U(P2/P3)-B(P14) :

  Sets Ports 2 and 3 to unbalance ports, and sets Ports 1 and 4 to balance ports.

  U(P2/P4)-B(P13) :

  Sets Ports 2 and 4 to unbalance ports, and sets Ports 1 and 3 to balance ports.

  U(P3/P4)-B(P12) :

  Sets Ports 3 and 4 to unbalance ports, and sets Ports 1 and 2 to balance ports.

CAUTION:

1. ***Trace parameter notations in balance measurements (balance degree, balun, and mode analysis) list not actual measurement port numbers, but basic condition port numbers as explained below.***
   - ***In 3-port devices.***

     The unbalance port is referred to as Port 1, and unbalance ports are referred to as Port 2 and Port 3 in calculations.

     [Example]

     When a device U(P2)-B(P34) is selected, balance degrees are as follows:

     B23 = the balance degree between Port 3 and Port 4

     B32 = the balance degree between Port 4 and Port 3
   - ***In 4-port devices.***

     The balance port 1 is referred to as Port 1 and Port 2, and the balance port 2 is referred to as Port 3 and Port 4 in calculations.

     [Example]

     When a device B(P13)-B(P24) is selected, balance degrees are as follows:

     B34 = the balance degree between Ports 2 and 4

     B43 = the balance degree between Ports 4 and 2

     B12 = the balance degree between Ports 1 and 3

     B21 = the balance degree between Ports 3 and 1

2. ***When a Dual U-B item is selected, an index letter "b" is added to the second unbalance port trace parameters to distinguish 2 unbalance port balance measurements (balance degree, balun, and mode analysis).***

   [Example]
   When a device U(P1/P2)-(P34) is selected, balun waveforms are as follows:
   SS11, SS21, SS12, and SS22
   = the balun waveform for U(P1)-B(P34)
   SS11b, SS21b, SS12b, and SS22b
   = the balun waveform for U(P2)-B(P34)

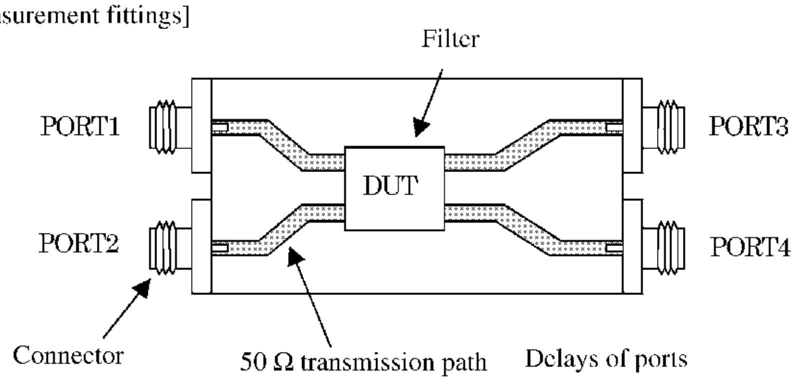
5.9 Measurement Example

This section explains a measurement example of a filter (4-port device) with balance input and balance output.

The filter is measured with the fittings attached as shown in the diagram below. Port 1 and Port 2 are balance input, and Port 3 and Port 4 are balance output.

4-port type is required for this measurement example.

[Measurement fittings]



Delays of ports
Port1-DUT transmission path: 70 psec
Port2-DUT transmission path: 70 psec
Port3-DUT transmission path: 135 psec
Port4-DUT transmission path: 135 psec

Calibration execution

Set the frequencies for measurement of the filter to CENTER 200 MHz and SPAN 300 MHz, and execute 4-port calibration.
Refer to 4 "CALIBRATION" for calibration procedures.

Port extension settings

Set port extension to exclude the effects of measurement fittings.

1. Click ***Fixture*** and ***Single-port Fixture*** in the main menu to open the Single-port fixture dialog box.
2. Input ***PORT1***, **7**, **0**, **G/p**, ***PORT2***, **7**, **0**, **G/p**, ***PORT3***, **1**, **3**, **5**, **G/p**, ***PORT4***, **1**, **3**, **5** and **G/p** to set the port extensions of the ports.
3. Click the ***Port Ext*** box to activate the port extensions.

CAUTION: ***When the matching circuit, software balun, and other software fixture functions are used, the effects of the measurement fittings must be eliminated. Setting the matching circuit, software balun, and other functions to ON without port extensions causes the values for the matching circuit and software balun to be added to the tip of the PORT rather than the tip of the device. Therefore, a measurement value completely different than the actual characteristics of the device will result.***

Impedance conversion settings

The device in this measurement example is a 50 Ω device. Therefore, set the impedance of ports to 50 Ω. Impedance conversion is not necessary for 50 Ω, so there is no problem even if this setting is not implemented.

4. Input ***PORT1*, 5, 0, ENT, *PORT2*, 5, 0, ENT, *PORT3*, 5, 0, ENT** and ***PORT4*, 5, 0, ENT** to set the impedances of the ports.
5. Click the ***Imp Trans*** box to activate impedance conversion.
6. Click ***Close*** to close the Single-port fixture dialog box.

Software balun settings

Software baluns are added to transform a 4-port device into a 2-port device for measurement.

7. Click ***Fixture*** and ***Balance Measurement*** in the main menu to open the Balance measurement dialog box.
8. Click the ***Balun*** box to activate software balun.

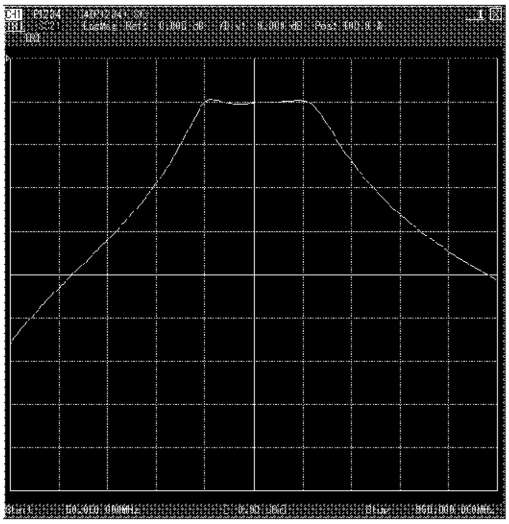
The basic settings of the software fixture function have been completed, but execution of the following software fixture function is necessary for execution of the function (measurement).

Software fixture function execution

Execute the software fixture function and measure transmission characteristics SS21.

9. Click the ***Software Fixture*** box to activate the Software fixture function.
10. Click ***Close*** to close the Balance measurement dialog box.
11. Click ***Meas*** in the tool menu to display the Measure side menu.
12. Click ***Measure More*** to open the Measure dialog box.
13. Click ***SS21***.

Measurement of the transmission characteristics (SS21) of the balance filter can be accomplished as shown below.



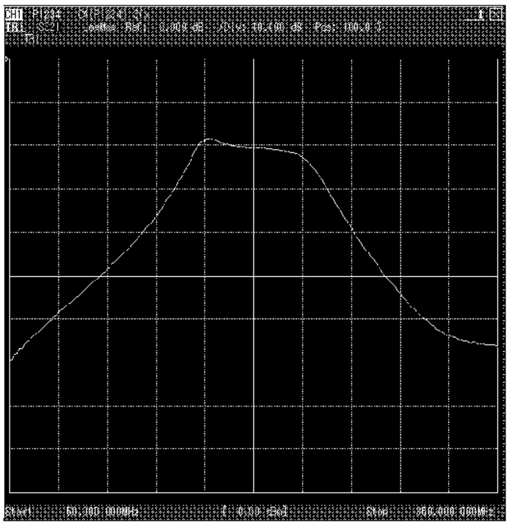
Matching circuit function settings

Add a matching circuit to Port 4.

The matching circuit uses a user-defined circuit. User-defined circuit file "sfadd4.s2p" has been prepared with data equivalent to adding a 150 nH inductor.

14. Insert a floppy disk with saved User-defined circuit file "sfadd4.s2p" into the floppy disk drive.
15. Click ***Fixture*** and ***Single-port Fixture*** in the main menu to open the Single-port fixture dialog box.
16. Click ***Load File S2P File*** of Port 4 to load User-defined circuit file "sfadd4.s2p."
17. Click the ***Add Circ*** pull-down menu of Port 4 to set the matching circuit to a user-defined circuit, ***User***.
18. Click the ***Add Circ*** box of Port 4 to activate the matching circuit function.

Adding this matching circuit destroys balance and causes waveform chaos during execution.

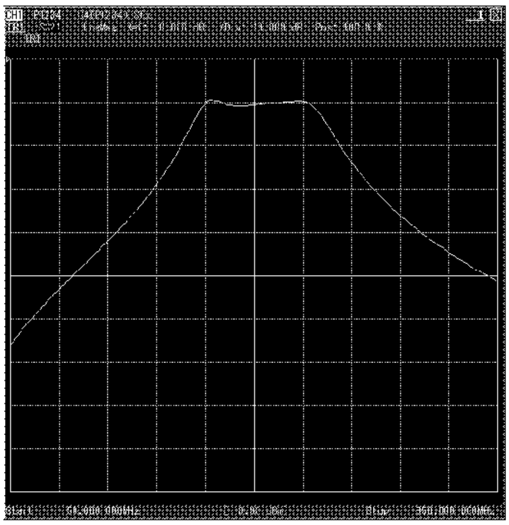


Circuit web delete function settings

Delete the matching circuit added to Port 4 and the equivalent circuit web.
User-defined circuit file "sfdel4.s2p" has been prepared for this purpose.

19. Click ***Del Circ S2P File*** of Port 4 to load user-defined circuit file "sfdel4.s2p."
20. Click the ***Del*** box of ***Del Circ*** of Port 4 to activate the circuit web delete function.
21. Click ***Close*** to close the Single-port fixture dialog box.

The chaotic waveform will return to the waveform obtained before the matching circuit was added.

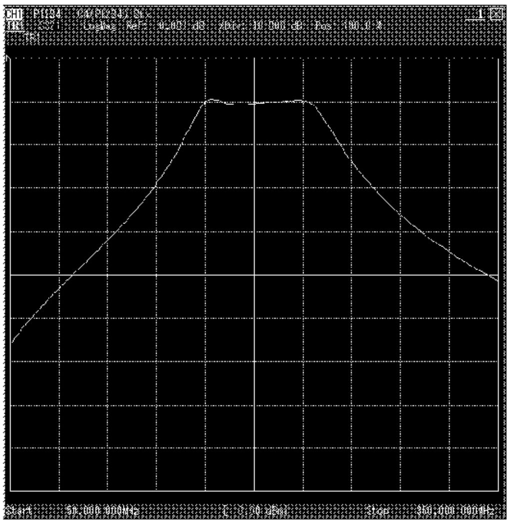


Floating balun settings

Change the software balun from a differential balun to a floating balun.

22. Click ***Fixture*** and ***Balance Measurement*** in the main menu to open the Balance measurement dialog box.
23. Click ***Floating*** to change the setting to ***Floating balun***.
24. Click ***Close*** to close the Balance measurement dialog box.

The filter to be used in the measurement example is balanced, so no difference appears between the floating balun and the differential balun.



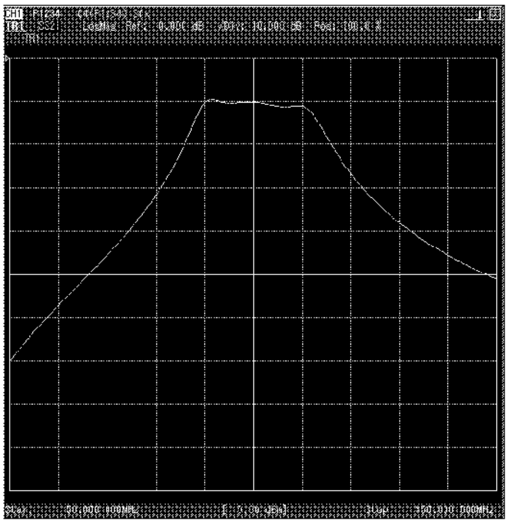
(Reference)
When an unbalanced type of filter is measured, a clear difference appears between the floating balun and the differential balun.

Balance matching circuit settings.

Add a 18 pF capacitor as the balance matching circuit between Port 3 and Port 4 (Balance Port 2).

25. Click ***Fixture*** and ***Balance-port Fixture*** to open the Balance-port fixture dialog box.
26. Input ***Bport2 Cap, C,* 1, 8** and **G/p** to set a capacity value of 18 pF.
27. Click the ***Bport2 Add Circuit*** box to activate the balance matching circuit.
28. Click ***Close*** to close the Balance-port fixture dialog box.

The measured data is varied according to the matching circuit.

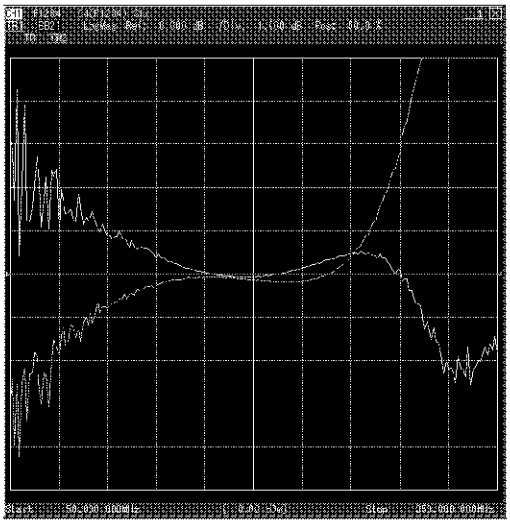


Balance measurement

Measure the balance between Port 1 and Port 2.

29. Click ***Fixture*** and ***Balance Measurement*** in the main menu to open the Balance measurement dialog box.
30. Click the ***Balance Parameter*** box to activate balance measurement.
31. Click ***Close*** to close the Balance measurement dialog box.
32. Click ***Meas*** in the tool menu to display the Measure side menu.
33. Click ***Measure More*** to open the Measure dialog box.
34. Click ***Trace Parameter*** and ***BB21*** to set to balance BB21.
    Also set the trace 2 to BB21 Phase.

As shown by the data below, it can be understood that the path is well balanced. 0 dB and 0 deg result when balance occurs.



Setting conditions

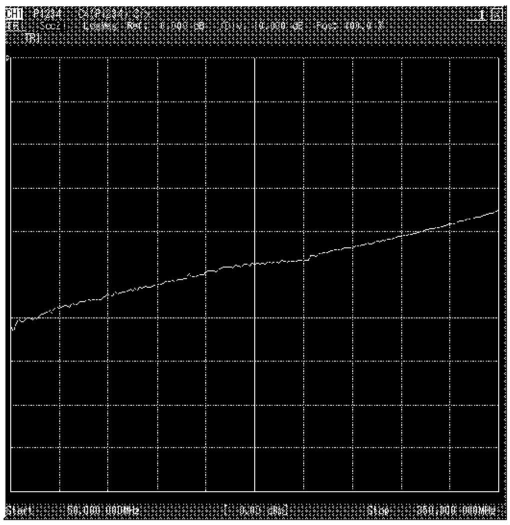
Trace 1	BB21 LogMag	
	Ref.Posion	50%
	Ref.Value	0 dB
	/Div	1 dB
Trace 2	BB21 Phase	
	Ref.Posion	50%
	Ref.Value	0 deg
	/Div	10 deg

Mode Analysis Execution

Discriminate and measure the common components and differential components.

35. Click ***Fixture*** and ***Balance Measurement*** in the main menu to open the Balance measurement dialog box.
36. Click the ***Mix-mode*** box to activate mode analysis.
37. Click ***Meas*** in the tool menu to display the Measure side menu.
38. Click ***Measure More*** to open the Measure dialog box and click ***Scc21*** to set to common input-common output measurement.

It can be seen that the common component is transmitted with approximately 45 dB excluded at the center frequency.

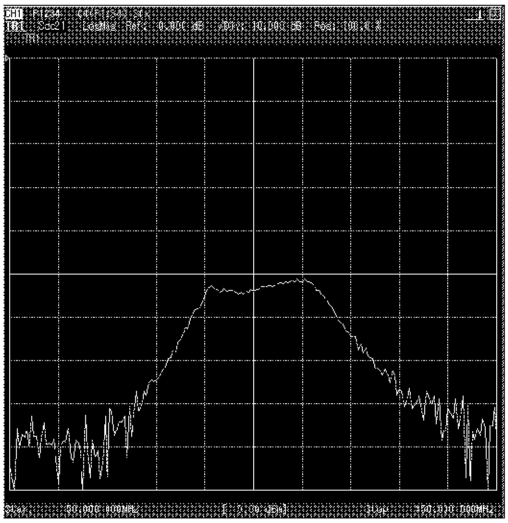


Setting conditions

Trace 1	Scc21 LogMag	
	Ref.Posion	100%
	Ref.Value	0 dB
	/Div	10 dB

39. Click ***Measure More*** to open the Measure dialog box and click ***Sdc21*** to set to common input-differential output measurement.

It can be seen that the common component is transformed to a differential component and is transmitted at approximately -50 dB at the center frequency.

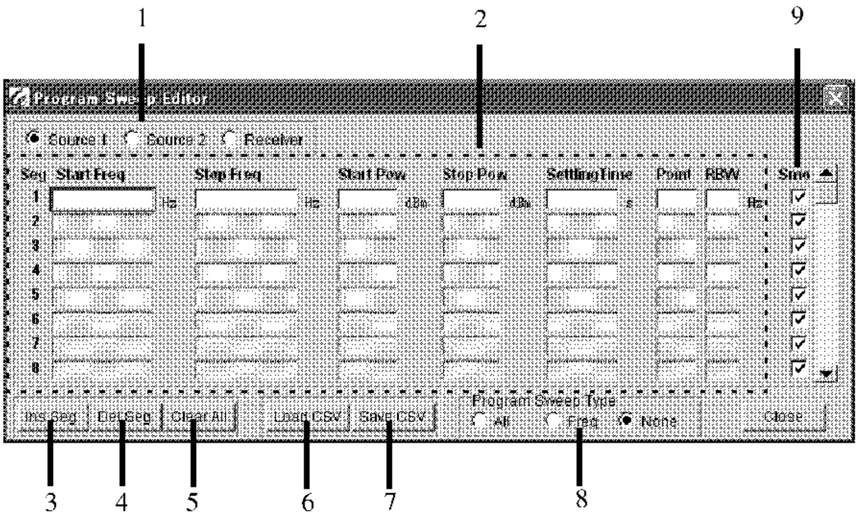


6. PROGRAM SWEEP

Program Sweep divides the measurement range into segments, and allows optional settings for the measurement points of frequency, RBW, and power by segment. Optimum measurement conditions for measurement items can be set, so measurement accuracy can be raised and measurement time can be reduced.

6.1 Program Sweep Editing

Click ***Setup*** in the main menu to display the pull-down menu. Click ***Edit Program Sweep*** in the pull-down menu to display the dialog box.



1. Selection to be set

Source 1: Sets the program sweep conditions to the first signal source.
Conditions can be set to all items: the Frequencies, Powers, Settling Time, Point, and RBW.

Source 2: Sets the program sweep conditions to the second signal source.
Conditions can be set to the Frequencies and Powers. Conditions for the Settling Time, Point, and RBW are the same as those of the first signal source.

Receiver: Sets the program sweep conditions to the receiver.
Conditions can be set to the Frequencies. Conditions for the Settling Time, Point, and RBW are the same as those of the first signal source.

2. ***Segment Display Area*** — Adds a segment.
   Input the items to set the segment.

Start Freq :	Start frequency of the segment
Stop Freq :	Stop frequency of the segment
Start Pow :	Start power of the segment
Stop Pow :	Stop power of the segment
Settling Time :	Start waiting time of the segment
Point :	Number of points in the segment
RBW :	RBW of the segment

3. ***Ins Seg*** — Inserts a new segment before the selected segment.
4. ***Del Seg*** — Deletes the selected segment.
5. ***Clear All*** — Clears all segments.
6. ***Load CSV*** — Loads the Program Sweep setting conditions from a CSV file.
7. ***Save CSV*** — Saves the Program Sweep setting conditions to a CSV file.
8. ***Program Sweep Type*** — Confirms the edited content of the segment, and sets the type of program sweep.
   - All: Activates all frequencies, levels, times, points, and RBW specified by the segment.
   - Freq: Activates only the frequencies and points specified by the segment.
   - None: Does not execute program sweep.
9. ***Smo*** — Sets whether to enable smoothing in each segment when smoothing is set to ON.

CAUTION: ***Only a file that was created by using "Save CSV" in "Program Sweep Editor" can be loaded by using "Load CSV". If the content of the saved file changes, the settings which are read from the file may be incorrect. As a result, the instrument may not operate correctly.***

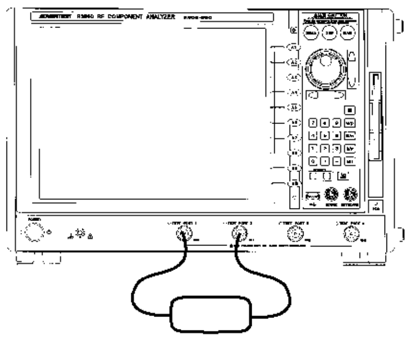
6.2 Measurement Example

This section explains an example of measurement of the sweep and 2X and 3X spurious of an 800 MHz band filter using settings optimized by Program Sweep.

Set up the analyzer as shown in the diagram below. Additionally, the following operational procedures are procedures for the analyzer in initialized status.

Place the analyzer in initialized status by turning the power On again or executing preset.

Connect the filter to Port 1 and Port 2 as shown in the diagram below.



Segment 1 settings

1. Click ***Port*** in the tool menu to display the Port side menu.
   Measurement channel 1 is activated in initialized status, so the following procedure is set for Measurement channel 1.
2. Click ***P12*** to set the measurement port to the 2-port of Port 1-Port 2.
3. Click ***Meas*** in the tool menu to display the Measure side menu.
4. Click ***S21*** to measure the sweep characteristics.
5. Click ***Stimulus*** in the tool menu and then click ***Sweep Type*** and ***Edit Prgm Sweep*** side menu to display the Program Sweep dialog box.
6. Set a start frequency of 700 MHz and stop frequency of 800 MHz to measure the interference range in Segment 1. Set to measurement point 100 to align with a measurement resolution of 1 MHz. Set the RBW of the receiver to 10 kHz for high-precision measurement.
7. Input **7, 0, 0, M/n** as the Start Freq cell of Segment 1 is active.
8. Input **8, 0, 0, M/n** as the Stop Freq cell of Segment 1 is active.
9. Click the Point cell of Segment 1, and input **1, 0, 0** and **ENT**.
10. Input **1, 0, k/μ** as the RBW cell of Segment 1 is active.

Segment 2 settings

11. Set a start frequency of 860 MHz and stop frequency of 900 MHz to measure the passband in Segment 2. Set to measurement point 200 to align with a measurement resolution of 200 kHz. Set the RBW of the receiver to 10 kHz for high-precision measurement.
12. Input **8, 6, 0, M/n** as the Start Freq cell of Segment 2 is active.
13. Input **9, 0, 0, M/n** as the Stop Freq cell of Segment 2 is active.
14. Click the Point cell of Segment 2, and input **2, 0, 0** and **ENT**.
15. Input **1, 0, k/μ** as the RBW cell of Segment 2 is active.

Segment 3 settings

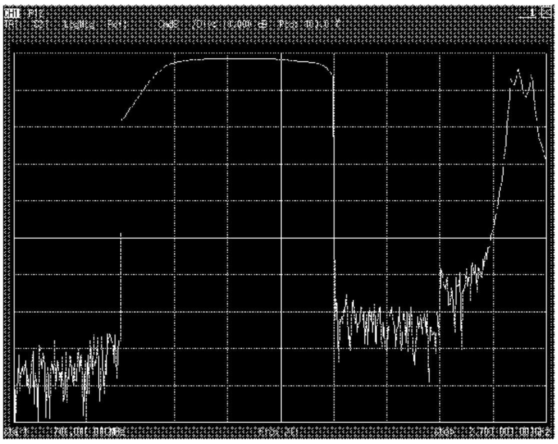
16. Set a start frequency of 1600 MHz and stop frequency of 1800 MHz for measurement of a 2X spurious in Segment 3. Set to measurement point 100 to align with a measurement resolution of 2 MHz. Set the RBW of the receiver to 100 kHz for high-speed measurement.
17. Input **1, 6, 0, 0, M/n** as the Start Freq cell of Segment 3 is active.
18. Input **1, 8, 0, 0, M/n** as the Stop Freq cell of Segment 3 is active.
19. Click the Point cell of Segment 3, and input **1, 0, 0** and **ENT**.
20. Input **1, 0, 0, k/μ** as the RBW cell of Segment 3 is active.

Segment 4 settings

21. Set a start frequency of 2400 MHz and stop frequency of 2700 MHz for measurement of a 3X spurious in Segment 4. Set to measurement point 100 to align with a measurement resolution of 3 MHz. Set the RBW of the receiver to 400 kHz for high-speed measurement.
22. Input **2, 4, 0, 0, M/n** as the Start Freq cell of Segment 4 is active.
23. Input **2, 7, 0, 0, M/n** as the Stop Freq cell of Segment 4 is active.
24. Click the Point cell of Segment 4, and input **1, 0, 0** and **ENT**.
25. Input **4, 0, 0, k/μ** as the RBW cell of Segment 4 is active.

Program Sweep Execution

26. Click ***All*** (O) in the dialog box to execute Program Sweep.
27. Click ***Close*** to close the dialog box.
28. As shown in the graph below, the interference range, sweep, and 2X and 3X spurious values of the filter are measured. Refer to Section 4 and execute calibration to ensure proper measurement.

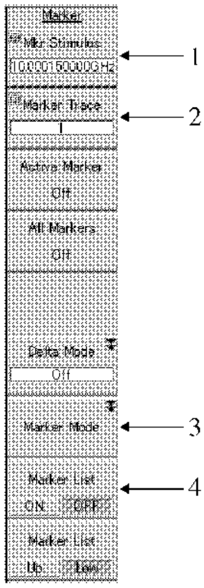


7. MARKER FUNCTION

Measurement data can be read by using markers. For each measurement channel, 16 markers can be used. Markers can be used to search for maximum and minimum values.

7.1 Setting Markers

Select ***Marker*** in the tool menu to display the Marker side menu.
Marker 1 is specified as an active marker. The marker relevant to the clicked No. is specified as an active marker and is displayed.
Markers are set in the active channel.
Click ***Marker Mode*** in the tool menu to display the Marker Mode side menu.



1. Setting the marker frequency — Click ***Mkr Stimulus*** to specify the active marker frequency (or the power value for the power sweep).
   Specifies the frequency (or power) by using a relative value when the delta mode is set to Ref = Act Mkr or Ref = Dlt Mkr.

2. Selecting a trace for the marker display
   Click ***Marker Trace*** to specify a trace for the active marker display. Only displayed traces can be specified.

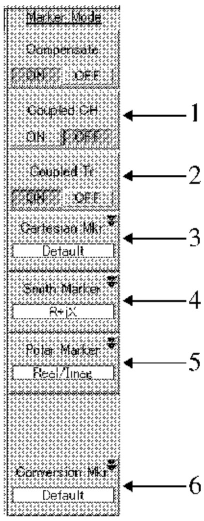
3. Setting a marker mode — Click ***Marker Mode*** to display the Marker Mode side menu. Various marker display modes can be selected. For more information on the marker mode, refer to 13.2.2.5, "Marker."

4. Displaying the marker list — Click ***Marker List ON/OFF*** to set ***Marker List On*** and display all the marker data in a list. Clicking ***Marker List Up/Low*** changes the display position.

7.2 Marker Coupling

The Marker Coupling function is used to couple markers between channels and traces. The coupling function can be set for each channel.

Click ***Marker Mode*** and ***Marker Mode*** from the tool menu to display the Marker Mode side menu.



1. Coupling function between channels
   Clicking the ***Coupled CH ON/OFF*** to set ***Coupled CH ON***, all channel markers couple with active channel markers. The ON or OFF setting is common for all channels.

2. Coupling function between traces
   Clicking the ***Coupled Tr ON/OFF*** to set ***Coupled Tr OFF***, it is possible to set markers independently for each trace displayed by the active channel. Each channel can be set to ON or OFF.

3. Cartesian Mkr
   Specifies the marker display form in the Cartesian coordinate format.

Default:	Displays the value which corresponds to the data format.
R+jX:	Displays the complex impedance.
G+jB:	Displays the complex admittance.

4. Smith Marker
   Specifies the marker display form in the Smith Chart format.

Lin/Phase:	Displays the linear amplitude and phase.
Log/Phase:	Displays the logarithmic amplitude and phase.
Real/Imag:	Displays the complex data.
R+jX:	Displays the complex impedance.
G+jB:	Displays the complex admittance.

5. Polar Marker
   Specifies the marker display form in the Polar coordinate format.

Lin/Phase:	Displays the linear amplitude and phase.
Log/Phase:	Displays the logarithmic amplitude and phase.
Real/Imag:	Displays the complex data.

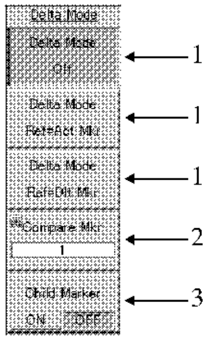
6. Conversion Mkr

Specifies the marker display form in the parameter conversion.

Default:	Displays the value which corresponds to the data format.
Lin/Phase:	Displays the linear amplitude and phase.
Real/Imag:	Displays the complex data.

7.3 Delta Mode

Select ***Marker Mode*** in the tool menu and then select ***Delta Mode*** to display the Delta Mode side menu.



1. Delta analysis mode setting — Sets the analysis mode for performing a delta analysis.

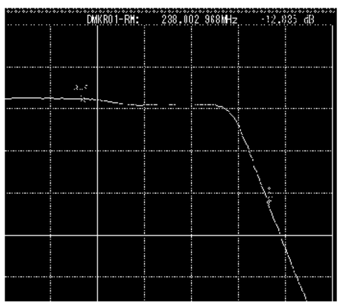
   Delta Mode Off — Cancels the delta mode.

   Delta Mode Ref=Act Mkr — Sets Active Marker as the reference marker and finds the difference with the marker number set in ***Compare Mkr.***
   Partial Search and Tracking need to be set for each active marker and Compare Marker.

   Delta Mode Ref=Dlt Mkr — Sets the reference marker as a child marker and obtains the difference with the active marker. If the child marker is not displayed when setting, the child marker is displayed. The child marker disappears by setting the Delta Mode to Off or clicking ***Child Marker Off***.
   Each setting of Partial Search and Tracking of the child marker is coupled to the active marker.

2. Setting the compare marker — Specifies the comparison marker for when Ref=Act Mkr is set in Delta Mode. Only the displaying marker number can be set.

3. Setting the child marker — Clicking ***Child Marker ON/OFF*** to set ***Child Marker ON*** displays the child marker if the active marker is set.
   When Delta Mode is set to Off, the child marker is displayed and Delta Mode is set to Ref=Ref Mkr.

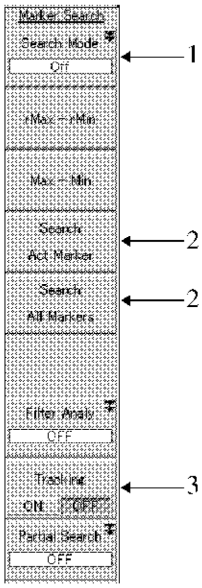


Active Marker(▽) and Child marker(*).

7.4 Marker Search

Select ***Marker*** in the tool menu. Select ***Marker Search*** as selections appear to display the Marker Search side menu.

Search settings can be set for each marker independently.

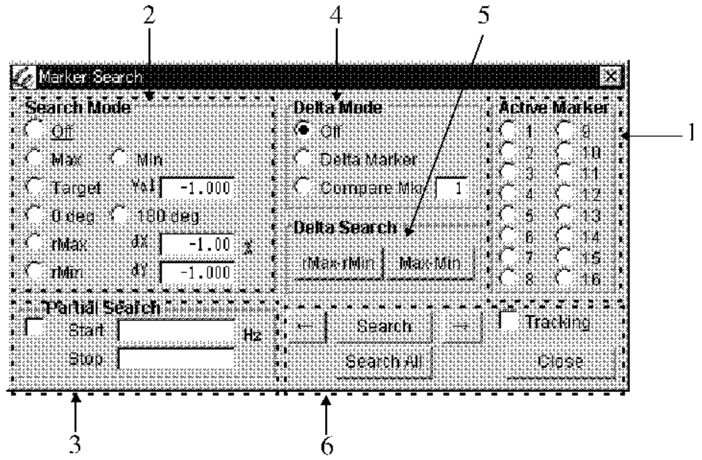


1.	Setting search conditions	Click Search Mode to display the Search Mode side menu. Search conditions can be set in the side menu. For more information on setting search conditions, refer to Section 7.5, "Search Setup" or 13.2.2.5, "Marker."
2.	Executing a search	Click ***Search Act Marker*** to execute a search according to the active marker search conditions. Click ***Search All Markers*** to execute a search according to the search conditions of each marker.
3.	Executing a continuous search	Click ***Tracking ON/OFF*** to set ***Tracking ON*** and execute a search on completion of each sweep. Each marker can be set to ON or OFF independently. The ON or OFF state of Tracking of the child marker is coupled to the active marker when the delta analysis mode is set to Delta Mode Ref =Dlt Mkr.

7.5 Search Setup

The search condition settings can be specified in a dialog box.

Select ***Marker*** in the main menu. Select ***Marker*** and ***Marker Search...*** as selections appear to display the Search Setup dialog box.



1. ***Active Marker*** — Sets the Activate Marker. The selected marker is the target of operation.

2. ***Search Mode*** — Sets the active marker search related settings. Each item can be set independently for every marker.
   The settings include Search mode, Target Value, Ripple dX, and Ripple dY. For further details on Search Mode, refer to 13.2.2.5, "Marker."

3. ***Partial Search*** — Sets the Partial Search mode.
   Each item can be set for individual markers. Each setting of the Partial Search mode of the child marker is coupled to the active marker when the delta analysis mode is set to Delta Mode Ref=Dlt Mkr.

   Partial Search: Sets Partial Search to ON or OFF.
   Checking the box sets Partial Search to ON.

   Start: Specifies the partial range analysis start point.

   Stop: Specifies the partial range analysis stop point.

4. ***Delta Mode*** — Sets Delta Mode.

   Off: Turns off the Delta Mode.

   Delta Marker: Sets the child marker as the reference marker to find the difference between the child marker and the active marker.
   Each setting of Partial Search and Tracking of the child marker is coupled to the active marker.

Compare Mkr: Sets the active marker as the reference marker to find the difference between the active marker and the marker relevant to the selected number.
Partial Search and Tracking need to be set for each active marker and Compare Mkr.

5. ***Delta Search***

Sets the search mode and delta mode combined analysis.
If Delta Mode is set to Compare Mkr, the analysis is performed in the Compare Mkr mode. If Delta Mode is set to any other setting, the analysis is performed in the Delta Marker mode.

rMax-rMin: Finds the greatest maxima value and smallest minima value, and validates delta mode to find the difference of two.

Max-Min: Finds the maximum and minimum values, and validates delta mode to find the difference of two.

6. ***Search***

Executes a search.

Search: Performs an active marker search.

Search All: Performs search for all markers which has a valid search mode (if not set to OFF).

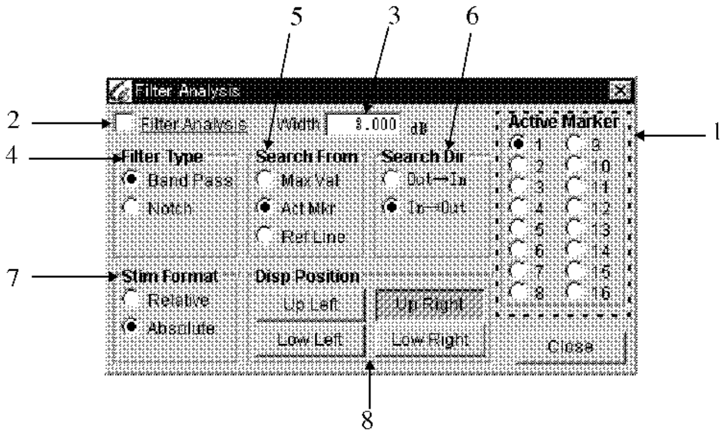
←: Searches for data to the left of the active marker.

→: Searches for data to the right of the active marker.

Tracking: Sets each sweep search to ON or OFF.
Each marker can be set to ON or OFF independently.
The ON or OFF state of Tracking of the child marker is coupled to the active marker when the delta analysis mode is set to Delta Mode Ref=Dlt Mkr.

7.6 Filter Analysis

Select ***Marker*** in the main menu. Select ***Marker*** and ***Filter Analysis...*** as selections appear to display the Filter Analysis Setup dialog box.



1. ***Active Marker*** — Sets the active marker.

2. ***Filter Analysis*** — Sets the filter analysis function to ON or OFF. Selecting the function (check the box) sets the filter analysis function to ON.

   Following analysis results are displayed.

   - C.F: The bandwidth center frequency specified in the value of level decay (XdB) from the reference point.
   - L.F: When displaying the absolute value, the bandwidth left side frequency is displayed. When displaying in the relative value, the difference of the bandwidth left side frequency and center frequency is displayed.
   - R.F: When displaying in the absolute value, the bandwidth right side frequency is displayed. When displaying in the relative value, the difference of the bandwidth right side frequency and center frequency is displayed.
   - B.W: The bandwidth is displayed.
   - Q: The Q factor is displayed.
   - S.F: The shaping factor is displayed.

   For details on Filter Analysis, refer to < Filter Analysis Details>.

3. ***Width*** — Specifies the bandwidth to analyze in the value of level decay (dB) from the reference point.

4. ***Filter type***

Specifies the filter type.

Band-Pass: Executes the band-pass filter analysis.

Notch: Executes the notch filter analysis.

For details on Filter Analysis search references, refer to <Filter analysis result examples>.

5. ***Search From***

Sets the search reference point.

Max Val: Sets the maximum value as the search reference point.

Active Mkr: Sets the active marker as the search reference point.

Ref Line: Sets the reference line as the search reference point.

For details on Filter Analysis search references, refer to <Filter analysis>.

6. ***Search Dir***

Specifies the search direction on the stimulus-axis.

OUT → IN: Analysis is performed from the outside to the search reference point.

IN → OUT: Analysis is performed from the search reference point to the outside.

7. ***Stim Format***

Selects the bandwidth display format.

Relative: Displays the bandwidth by using the relative value from the center frequency.

Absolute: Displays the bandwidth by using the absolute value.

8. ***Disp Position***

Used to specify the position to display analysis results.

Up Left: Displays results in the upper left part of the screen.

Low Left: Displays results in the lower left part of the screen.

Up Right: Displays results in the upper right part of the screen.

Low Right: Displays results in the lower right part of the screen.

The above stated settings can also be specified by clicking ***Marker Search*** in the tool menu and then ***Filter Analysis*** from the side menu.

< Filter Analysis Details>

- Search references

  Search references (stimulus-axis and level-axis) set in Search Reference are as follows:

	MAX Reference		Active Marker reference		Reference line reference	
	Stimulus-axis	Level-axis	Stimulus-axis	Level-axis	Stimulus-axis	Level-axis
Band-Pass filter analysis	MAX	MAX	Active Marker	Active Marker	MAX	Reference line
Notch filter analysis	MIN	MAX	MIN	Active Marker	MIN	Reference line

MAX: Minimum loss point and MIN: Maximum loss point

For example: Selecting MAX as the reference point when executing the Band-Pass filter analysis sets the stimulus-axis direction search reference point to MAX (minimum point loss) and the level-axis direction search reference point to MIN (maximum point loss).

- Q factor/Shaping Factor

  The Q factor is found by using the following equation; where B.W' is the bandwidth at 3 dB below than the minimum loss point in the range and C/F' is the center frequency in the bandwidth.

  Q = C.F' / B.W'

  The Shaping Factor is found by using the following equation; where B.W' is the bandwidth at 3 dB below than the minimum loss point and B.W" is the bandwidth at 60 dB below than the minimum loss point in the range.

  S.F = B.W" / B.W'

  Regardless to the level reference set in the search reference settings (Search From), Stimulus and Level references for finding Q factor and shaping factor are as follows:

	Stimulus reference	Level reference
Band-Pass filter analysis	Minimum loss point	Minimum loss point
Notch filter analysis	Maximum loss point	Minimum loss point

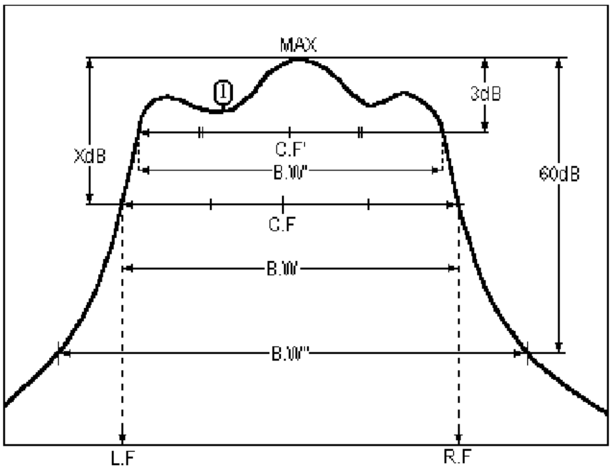


Figure 7-1 Band-Pass Filter and MAX Reference

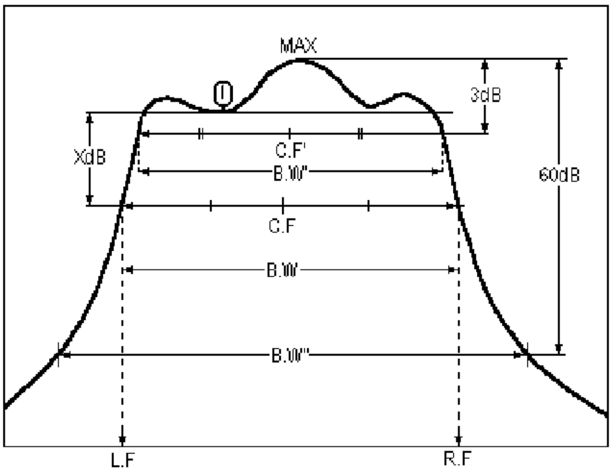


Figure 7-2 Band-Pass Filter and Active Marker Reference

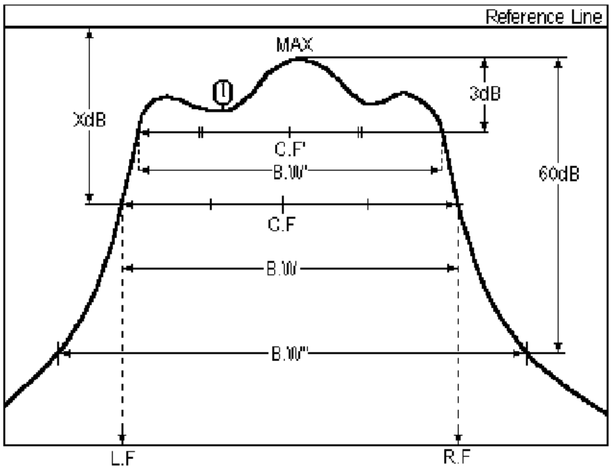


Figure 7-3 Band-Pass Filter and Reference Line Reference

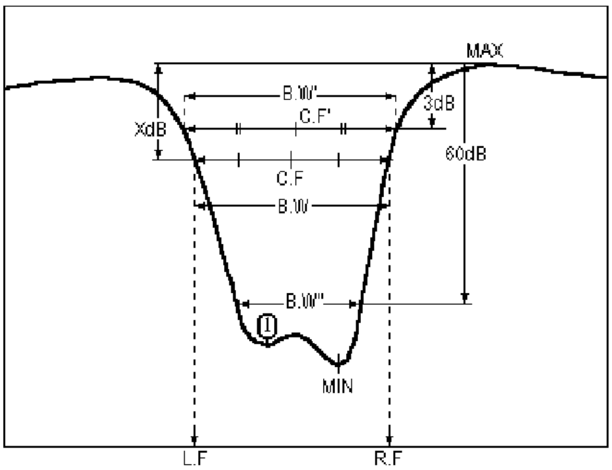


Figure 7-4 Notch Filter and MAX Reference

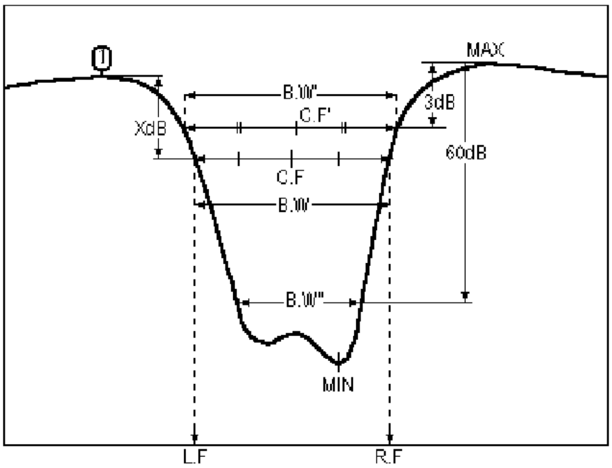


Figure 7-5 Notch Filter and Active Marker Reference

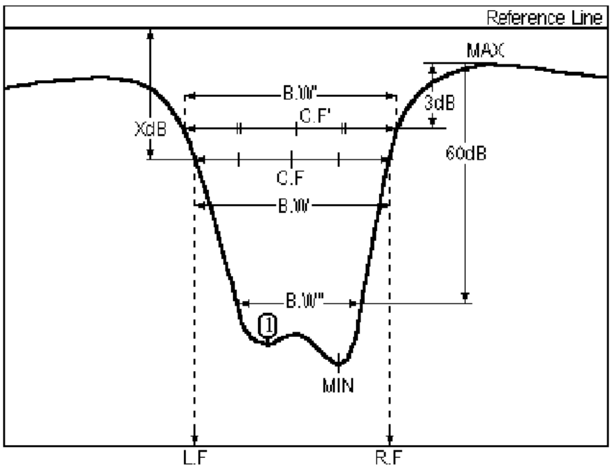


Figure 7-6 Notch Filter and Reference Line Reference

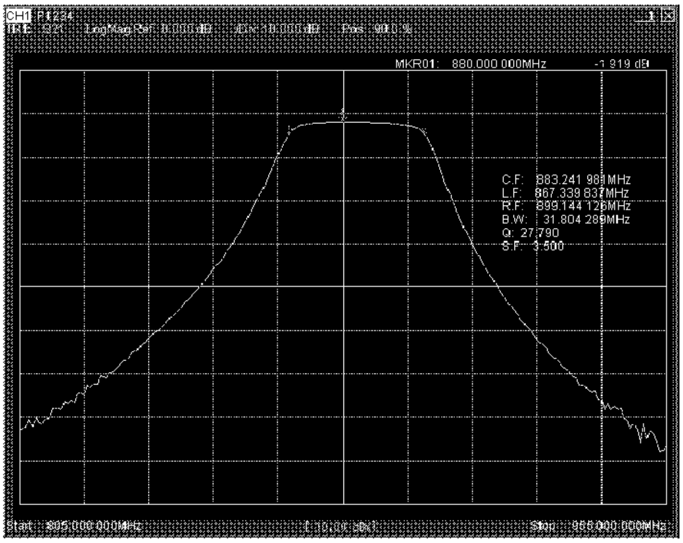


Figure 7-7 Filter Analysis Performed Sample

8. SAVING MEASUREMENT DATA

Measurement data can be saved to the internal hard disk (D drive) or a floppy disk (A drive).

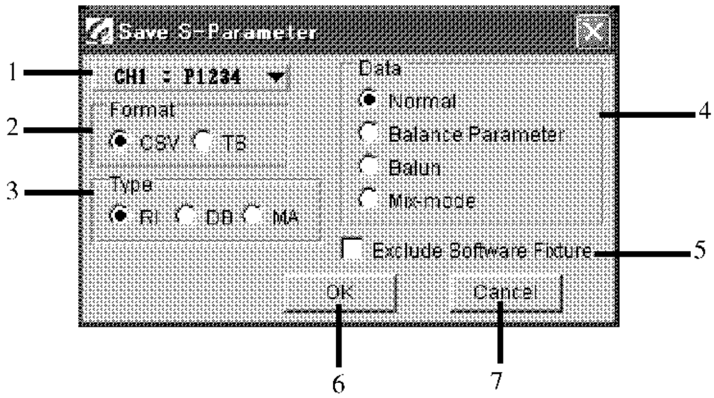
The two save methods allow saving of all measured S-parameters or specified measurement data only.

8.1 Save All S-parameters

This method saves all S-parameters measured by the specified measurement channel.

Display the File pull-down menu from the main menu, and click ***Save S-Parameter*** to display the Save S-Parameter dialog box.

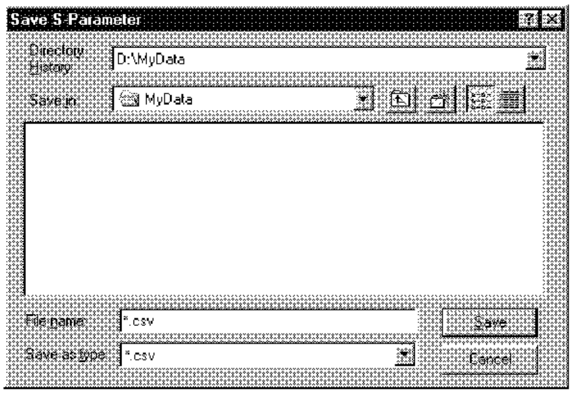
CAUTION: ***Use only after full calibration has been executed.***



1. ***CH***	Specifies the measurement channel. The data of the measurement channel specified here will be saved.	
2. ***Format***	Specifies the format of the data to be saved.	
	TS:	Touchstone format
	CSV:	CSV format
3. ***Type***	Specifies the type of data to be saved.	
	RI:	Real/Imaginary
	DB:	Magnitude (dB)/Phase (deg)
	MA:	Linear Magnitude/Phase
4. ***Data***	Specifies the data to be saved.	
	Normal:	Normal S-parameters
	Balance Parameter:	Balance parameters
	Balun:	S-parameters after balun transformation
	Mix-mode:	S-parameters after mode analysis

5. ***Exclude Software Fixture*** — If a check mark is entered into the check box, the S-parameters in the invalid state of the software fixture are saved. However, the port extension is still valid.

6. ***OK*** — Displays the dialog box for specifying the file name and executing the save.
D:\MyData is specified as the saving directory.
A folder can be selected from the Directory History.



7. ***Cancel*** — Cancels the settings and closes the dialog box.

Reference: TS Files and CSV Files

- T.S Files (Touchstone Files)

  For n-Port devices in mode analysis, all S-parameters (n x n) are saved in Touchstone file format. The file extension is "snp" (n is the number of ports). The data format of S-parameters allows selection of magnitude (dB)/phase (deg) and Real/Imaginary.

  The saved data is arrayed by measurement frequency in the sequence of the following items (for magnitude (dB)/phase (deg) format). Impedance 50 Ω is indicated in the file header portion.

1. 1-port devices
   Frequency S11(dB) S11(deg)
2. 2-port devices
   Frequency S11(dB) S11(deg) S21(dB) S21(deg) S12(dB) S12(deg) S22(dB) S22(deg)
3. 3-port devices
   Frequency S11(dB) S11(deg) S12(dB) S12(deg) S13(dB) S13(deg) !LF
   S21(dB) S21(deg) S22(dB) S22(deg) S23(dB) S23(deg) !LF
   S31(dB) S31(deg) S32(dB) S32(deg) S33(dB) S33(deg) !LF
4. 4-port devices
   Frequency S11(dB) S11(deg) S12(dB) S12(deg) S13(dB) S13(deg) S14(dB) S14(deg) !LF
   S21(dB) S21(deg) S22(dB) S22(deg) S23(dB) S23(deg) S24(dB) S24(deg) !LF
   S31(dB) S31(deg) S32(dB) S32(deg) S33(dB) S33(deg) S34(dB) S34(deg) !LF
   S41(dB) S41(deg) S42(dB) S42(deg) S43(dB) S43(deg) S44(dB) S44(deg) !LF

5. 5-port devices
Frequency S11(dB) S11(deg) S12(dB) S12(deg) S13(dB) S13(deg) S14(dB) S14(deg) !LF
S15(dB) S15(deg) !LF
S21(dB) S21(deg) S22(dB) S22(deg) S23(dB) S23(deg) S24(dB) S24(deg) !LF
S25(dB) S25(deg) !LF
S31(dB) S31(deg) S32(dB) S32(deg) S33(dB) S33(deg) S34(dB) S34(deg) !LF
S35(dB) S35(deg) !LF
S41(dB) S41(deg) S42(dB) S42(deg) S43(dB) S43(deg) S44(dB) S44(deg) !LF
S45(dB) S45(deg) !LF
S51(dB) S51(deg) S52(dB) S52(deg) S53(dB) S53(deg) S54(dB) S54(deg) !LF
S55(dB) S55(deg) !LF

6. 6-port devices
Frequency S11(dB) S11(deg) S12(dB) S12(deg) S13(dB) S13(deg) S14(dB) S14(deg) !LF
S15(dB) S15(deg) S16(dB) S16(deg) !LF
S21(dB) S21(deg) S22(dB) S22(deg) S23(dB) S23(deg) S24(dB) S24(deg) !LF
S25(dB) S25(deg) S26(dB) S26(deg) !LF
S31(dB) S31(deg) S32(dB) S32(deg) S33(dB) S33(deg) S34(dB) S34(deg) !LF
S35(dB) S35(deg) S36(dB) S36(deg) !LF
S41(dB) S41(deg) S42(dB) S42(deg) S43(dB) S43(deg) S44(dB) S44(deg) !LF
S45(dB) S45(deg) S46(dB) S46(deg) !LF
S51(dB) S51(deg) S52(dB) S52(deg) S53(dB) S53(deg) S54(dB) S54(deg) !LF
S55(dB) S55(deg) S56(dB) S56(deg) !LF
S61(dB) S61(deg) S62(dB) S62(deg) S63(dB) S63(deg) S64(dB) S64(deg) !LF
S65(dB) S65(deg) S66(dB) S66(deg) !LF

- CSV File

For n-Port devices in mode analysis, all S-parameters (n x n) are saved in CSV file format.

The file extension is "csv." The data format of S-parameters allows selection of magnitude (dB)/phase (deg) and Real/Imaginary.

The saved data is arrayed by measurement frequency in the sequence of the following items (for magnitude (dB)/phase (deg) format).

1. 1-port devices
Frequency S11(dB) S11(deg)

2. 2-port devices
Frequency S11(dB) S11(deg) S21(dB) S21(deg) S12(dB) S12(deg) S22(dB) S22(deg)

3. 3-port devices
Frequency S11(dB) S11(deg) S12(dB) S12(deg) S13(dB) S13(deg) !No LF
S21(dB) S21(deg) S22(dB) S22(deg) S23(dB) S23(deg) !No LF
S31(dB) S31(deg) S32(dB) S32(deg) S33(dB) S33(deg) !No LF

4. 4-port devices
Frequency S11(dB) S11(deg) S12(dB) S12(deg) S13(dB) S13(deg) S14(dB) S14(deg) !No LF
S21(dB) S21(deg) S22(dB) S22(deg) S23(dB) S23(deg) S24(dB) S24(deg) !No LF
S31(dB) S31(deg) S32(dB) S32(deg) S33(dB) S33(deg) S34(dB) S34(deg) !No LF
S41(dB) S41(deg) S42(dB) S42(deg) S43(dB) S43(deg) S44(dB) S44(deg) !No LF

5. 5-port devices
   Frequency S11(dB) S11(deg) S12(dB) S12(deg) S13(dB) S13(deg) S14(dB) S14(deg) S15(dB) S15(deg) !No LF
   S21(dB) S21(deg) S22(dB) S22(deg) S23(dB) S23(deg) S24(dB) S24(deg) S25(dB) S25(deg) !No LF
   S31(dB) S31(deg) S32(dB) S32(deg) S33(dB) S33(deg) S34(dB) S34(deg) S35(dB) S35(deg) !No LF
   S41(dB) S41(deg) S42(dB) S42(deg) S43(dB) S43(deg) S44(dB) S44(deg) S45(dB) S45(deg) !No LF
   S51(dB) S51(deg) S52(dB) S52(deg) S53(dB) S53(deg) S54(dB) S54(deg) S55(dB) S55(deg) !No LF
6. 6-port devices
   Frequency S11(dB) S11(deg) S12(dB) S12(deg) S13(dB) S13(deg) S14(dB) S14(deg) S15(dB) S15(deg) S16(dB) S16(deg) !No LF
   S21(dB) S21(deg) S22(dB) S22(deg) S23(dB) S23(deg) S24(dB) S24(deg) S25(dB) S25(deg) S26(dB) S26(deg) !No LF
   S31(dB) S31(deg) S32(dB) S32(deg) S33(dB) S33(deg) S34(dB) S34(deg) S35(dB) S35(deg) S36(dB) S36(deg) !No LF
   S41(dB) S41(deg) S42(dB) S42(deg) S43(dB) S43(deg) S44(dB) S44(deg) S45(dB) S45(deg) S46(dB) S46(deg) !No LF
   S51(dB) S51(deg) S52(dB) S52(deg) S53(dB) S53(deg) S54(dB) S54(deg) S55(dB) S55(deg) S56(dB) S56(deg) !No LF
   S61(dB) S61(deg) S62(dB) S62(deg) S63(dB) S63(deg) S64(dB) S64(deg) S65(dB) S65(deg) S66(dB) S66(deg) !No LF

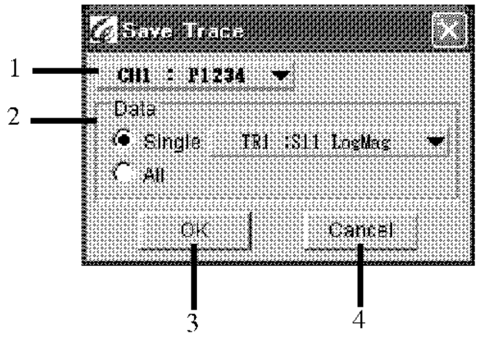
T.S files have line feeds (LF) for devices with three or more ports. CSV files represent all data as a single line (with no line feeds).

8.2 Saving Specified Data Only

The specified trace of the specified measurement channel is saved.

Display the File pull-down menu from the main menu, and click ***Save Trace*** to display the Save Trace dialog box.

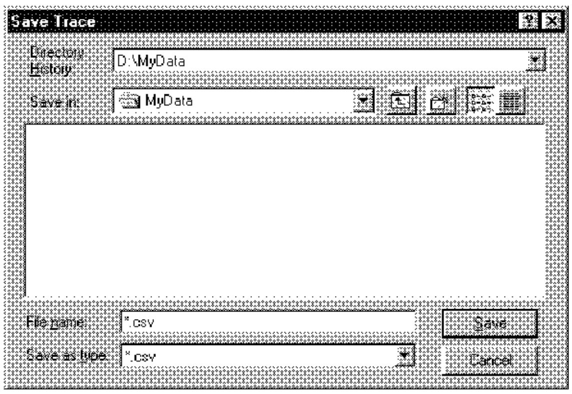
The file extension of the saved file is "csv." Data is arrayed in the order of measurement frequency and measurement data.



1. ***CH*** — Specifies the measurement channel. The data of the measurement channel specified here is saved.

2. ***Data*** — Specifies the trace to be saved.
   Single Trace: Saves the trace of the specified number.
   All Trace: All Trace: Saves all valid traces.

3. ***OK*** — Displays the dialog box for specifying the file name and executing the save.
   D:\MyData is specified as the saving directory.
   A folder can be selected from the Directory History.

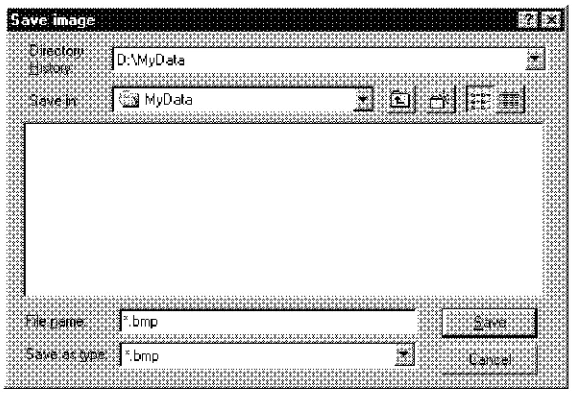


4. ***Cancel*** — Cancels the settings and closes the dialog box.

8.3 Saving Picture Image Data

Displayed picture image data can be saved into the system hard disk (D drive) or a floppy disk.

Select ***File*** in the main menu. Then, select ***Save Image*** to display the file saving dialog box.

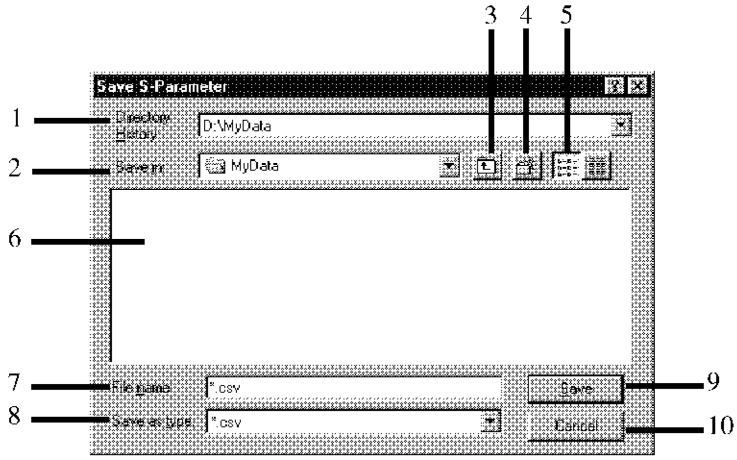


Specify a file name and save.
One of the following file formats can be selected.

- Bitmap format (*.bmp)
- PNG format (*.png)
- HPGL format (*.hgl)

8.4 File Dialog Box

This chapter describes the dialog box displayed when each measurement data is saved.



1. ***Directory History*** — Displays the folder history.
   Displays the folder selection.
2. ***Save in*** — Specify the folder in which the file is saved.
3.  — Moves to the parent directory.
4.  — Creates a new folder.
5.  — Changes the display menu.
6. List — Displays the files which are saved in the specified folder and the folder list.
7. ***File name*** — Enter a file name.
8. ***Save as type*** — Specify the file type.
9. ***Save*** — Saves the file.
10. ***Cancel*** — Does not save the file and closes the dialog box.

9. LIMIT TEST

The Limit Test function compares measurement data with set limit values and decides pass or fail.

Limit values are defined as the segment upper and lower limits and they can be set independently for each channel and trace.

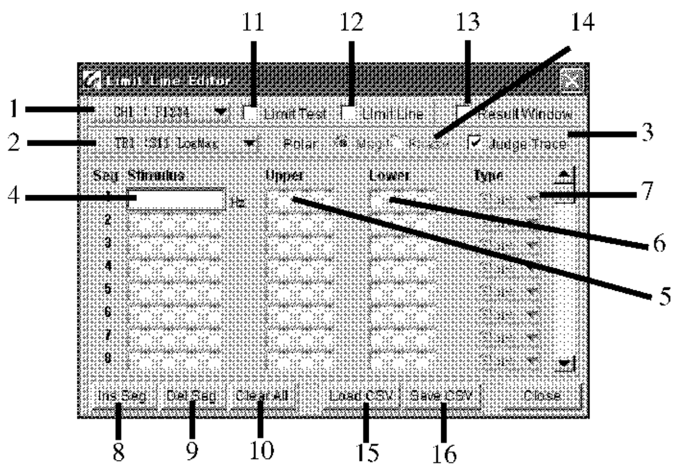
The pass or fail results are output in following methods.

- The PASS or FAIL result is displayed in each window.
- The overall PASS or FAIL result is displayed in the limit test result window in full size.
- When the result is FAIL, the corresponding Limit Status Register bit is set.
- The waveform data in a failed range is displayed in red.

CAUTION: ***The limit evaluation is performed at the sweep completion.***
The evaluation result remains unrevised until the next time the sweep is performed.

9.1 How to Set the Limit Test Function

Select ***Setup*** in the main menu. Then, select ***Edit Limit Line...*** to display the dialog box.



1.	***CH No.***	Selects the channel which sets the limit line.
2.	***TR No.***	Selects the trace which sets the limit line.
3.	***Judge Trace***	Sets each trace judgment to ON or OFF.
4.	***Stimulus***	Sets the frequency.
5.	***Upper***	Sets the upper limit line.
6.	***Lower***	Sets the lower limit line.

7. ***Type***

Sets the limit line type.

Point : Evaluates by using a single frequency. The upper limit is displayed as ∨ and the lower limit is displayed as ∧.
Signs are also used as the endpoints of the Slop limit line and the Flat limit line.

Slope : Connects the segments with a sloped line.

Flat : Connects the segments with a horizontal line.

8. ***Ins Seg*** — Inserts a segment into the editing part.

9. ***Del Seg*** — Deletes a segment from the editing part.

10. ***Clear All*** — Clears all segments.

11. ***Limit Test*** — Sets the limit test to ON or OFF.

12. ***Limit Line*** — Sets the limit line display to ON or OFF.

13. ***Result Window*** — Sets the limit test result window display to ON or OFF.

14. ***Polar***

LinMag and Phase can be set as limit lines when the polar coordinate is displayed (when the Polar and Smith Format are set).

Mag: Sets the LinMag data limit line when the polar coordinate is displayed.
The limit line is expressed with a concentric circle.

Phase: Sets the Phase data limit line when the polar coordinate is displayed. The limit line is expressed with a sector form.

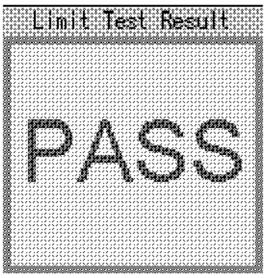
15. ***Load CSV*** — Loads the saved limit value.

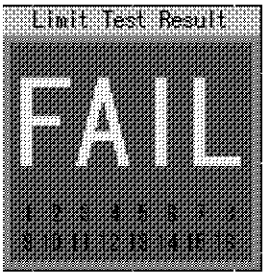
16. ***Save CSV*** — Saves the set limit value.

CAUTION: ***Only a file that was created by using "Save CSV" in "Limit Line Editor" can be loaded by using "Load CSV". If the content of the saved file changes, the settings which are read from the file may be incorrect. As a result, the instrument may not operate correctly.***

9.2 Limit Test Result Window

Displays all channels and traces overall limit test result in easy to view size.
Click ***Limit Test*** in the tool menu to display the Limit Test side menu.
Click ***Result Window ON/OFF*** to set to ON.





1. ***PASS***	All limit test results are PASS.
2. ***FAIL***	One or more limit test resulted in FAIL. The FAIL trace channel number(s) is displayed in the window.
3. ***NONE***	No limit test was set to perform.

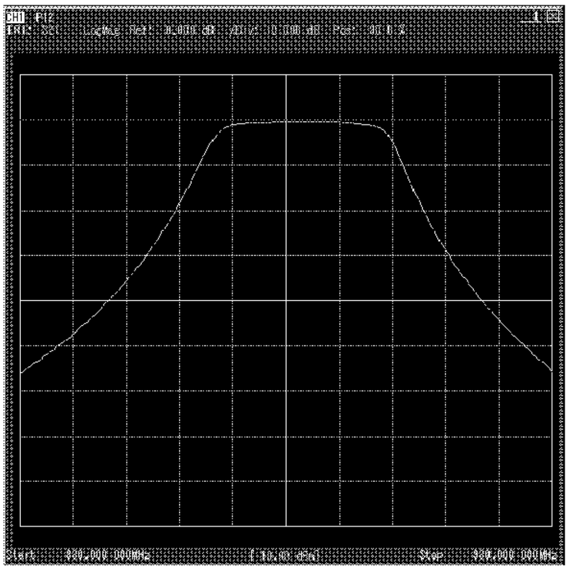
9.3 Measurement Sample

In the following example, a band path filter having 880 MHz frequency center is used to explain how to set limits.
Connect the device between the unit test port 1 and test port 2.

1. Set measurement conditions.

   Select following items in the tool menu and set corresponding values.

   ***Port*, *P12*, *Center*, 8, 8, 0, M/n, *Span*, 1, 0, 0, M/n, *Meas*, *S21*, *Scale*, *Ref Position*, 9, 0, ENT**



2. Display the Limit Line Editor dialog box.

   Use Limit Line Editor dialog box for editing limit lines.

   Select ***Limit Test*** and ***Edit Limit Line*** as they appear in selections. The Limit Line Editor dialog box displays.

3. Edit limit lines.

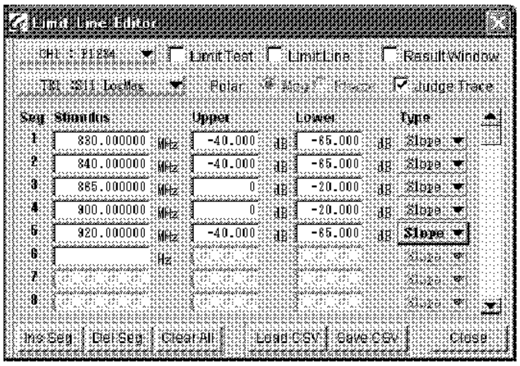
   For this example, set following limit lines.

Seg	1	2	3	4	5
Stimulus	830 MHz	840 MHz	865 MHz	900 MHz	920 MHz
Upper	-40 dB	-40 dB	0 dB	0 dB	-40 dB
Lower	-65 dB	-65 dB	-20 dB	-20 dB	-65 dB
Type	Slope	Slope	Slope	Slope	Slope

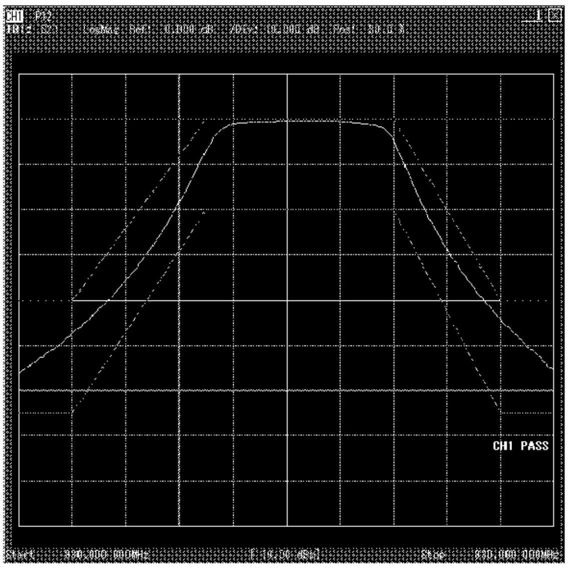
Set limit lines in order, starting with the segment 1.

1. Select Seg 1 column for Stimulus and input **8**, **3**, **0**, and **M/n**.
2. Next Seg 1 column, for Upper is selected automatically. Input **-**, **4**, **0**, and **ENT**.
3. Input **-**, **6**, **5**, and **ENT** when the next column is selected. For Type, select ***Slope***.

Follow same procedures to set segments 2 to 5.



4. Validate the limit test.
   Click ***Limit Test*** to turn ON.
5. Validate the limit line display.
   Click ***Limit Line*** to turn ON.
   Editing is complete.
   Click ***Close*** to close the Limit Line Editor dialog box.
   The screen display is as shown below.



10. TIME DOMAIN FUNCTION

10.1 Time Domain Transformation Function

A measurement result in the frequency domain can be transformed into the corresponding response in the time domain by using the Time domain transformation function. The result in the time domain will be represented as an impulse response or step response of the DUT.

The relationship between a frequency domain response and the corresponding time domain response of this analyzer is defined by the Fourier transformation. The time domain result can be obtained by calculating a frequency domain measurement result with the inverse Fourier transformation.

1. Transformation Mode

   The bandpass and low pass modes are available for transforming the frequency domain data into time domain data.

   The bandpass mode is a general purpose mode which allows the user to set the frequency range freely. This mode is used to measure a DUT impulse response with its limited bands.

   Using the low pass mode, the user can obtain information about points of discontinuity. In the low pass mode, the impulse mode and the step mode are available. The former is used to obtain the response by an impulse input to a DUT ; and the latter, to obtain the response by a step input to DUT.

   In the low pass mode, however, frequency range settings are restricted. Frequency data must be spaced equally in the range from the virtual DC point to the stop frequency:

   (Start frequency) × (number of measuring points) = (stop frequency)

   It is necessary that the above relation must be maintained.

   The user can easily set frequency ranges to meet the condition above using ***Set Frequency Low Pass*** function.

2. Distance display mode

   The horizontal axis is set to a time axis (sec) immediately after the time domain transformation function is turned ON. This time axis can be transformed into a distance axis (m). At this time, however, only the annotations (values and units) on the horizontal axis are transformed and the waveform data on the vertical axis remains unchanged.

When the distance display mode is set, the horizontal axis is transformed from time to distance using the following formula.

$$L = c \times Vf \times T$$

Where,

L := Distance(m)

c := Velocity of light(m/s) $\cong 3 \times 10^8$

Vf := Propagation constant (Note)

T := Time(s)

When the reflection from the cable is measured, the actual physical distance is half of the measured distance because the measured distance is equivalent to a round-trip path where the signal goes and returns. For this reason, values of time and distance are cut in half and displayed as the ***Reflection Time*** and ***Reflection Distance*** measurements.

NOTE: ***Set the propagation constant using Vel Factor.***
The velocity factor of Teflon and polyethylene dielectric is approximately 0.70 and 0.66, respectively.

---

3. Magnification of the time axis domain

   The time span T_{span} in the time axis domain is determined by the frequency span F_{span} and the number of measurement points N.

$$T_{span} = \frac{N - 1}{F_{span}}$$

   The waveform in the time domain can be magnified by changing the time range settings (START, STOP, and SPAN). START and STOP can freely be set within the range of $-T_{span}$ to T_{span}. (Note)

   The magnification rate z automatically changes starting from the set time range. The time span T'_{span} that is actually displayed is represented by the following expression.

$$T'_{span} = \frac{N - 1}{F_{span} \times z}$$

NOTE: ***If the time span exceeds T_{span}, the displayed data includes redundant information.***

Operating procedure:

1. Click ***Time Domain*** in the tool menu to display the Time Domain side menu.

Time Domain side menu

Transform ON/OFF	Toggles the time domain display ON or OFF. ON: Displays the time domain. OFF: Displays the frequency domain.
Transform Mode	Calls the Trans Mode side menu. For more information, refer to Chapter 10.4.
Transform Stimulus	Calls the Trans Stimulus side menu. For more information, refer to Chapter 10.5.
Transform Window	Calls the Trans Window side menu to select a window. For more information, refer to Chapter 10.2.
Gate ON/OFF	Switches ON/OFF of the gate function. For more information, refer to Chapter 10.3.
Gate Start	Sets the gate start time. For more information, refer to Chapter 10.3.
Gate Stop	Sets the gate stop time, refer to Chapter 10.3.
Gate Shape	Selects the gate type, refer to Chapter 10.3.

10.2 Window Processing

Leakage phenomenon in Fourier transformation occurs due to data discontinuity in the frequency domain, or data truncation in the start and stop frequencies. This leakage phenomenon consequently causes the ripples called ringing. Window processing is required to reduce this, so that the window is applied to the frequency domain data to reduce ripples in the time domain.

Three types of windows are available: MAXIMUM provides the maximum effect to reduce the ringing, but the rise time (impulse width) is longer. On the other hand, MINIMUM does not suppress the ringing, but sharp rising characteristics can be obtained.

Procedure:

1. Click ***Time Domain*** in the tool menu to display the Time Domain side menu.
2. Press ***Transform Window*** to display the Trans Window menu.

Trans Window menu

Minimum	Specifies the rectangular type. Window processing is not performed.
Normal	Specifies the 2-term Hamming type.
Wide	Specifies the 3-term Blackman-Harris type.
Maximum	Specifies the 4-term Blackman-Harris type. The maximum reduction can be obtained.

10.3 Gate Function

The necessary components can be extracted from a result of the time domain response using this function. Peculiar frequency components can be either extracted or removed using a type of filter in the time domain response.

The results can be seen in both the frequency and time domains.

When the gate span is positive, the specified range is extracted; when negative, the specified range is removed.

There are four types of gate functions: for MAXIMUM, the attenuation at the cutoff region can be obtained to the maximum and the ripple at the pass region can be minimized. The cutoff time characteristics are degraded however. For MINIMUM, very sharp cutoff characteristics can be obtained, but the attenuation at the cutoff region is reduced.

Procedure:

1. Click ***Time Domain*** in the tool menu to display the Time Domain side menu.

Time Domain menu

Gate ON/OFF	Toggles the gate function ON or OFF.
Gate Start [ ]	Sets the gate start time.
Gate Stop [ ]	Sets the gate stop time.
Gate Shape [ ]	Calls the gate shape menu to set a type of gates.

Gate Shape menu

Minimum	Specifies the rectangular type.
Normal	Specifies the 2-term Hamming type.
Wide	Specifies the 3-term Blackman-Harris type.
Maximum	Specifies the 4-term Blackman-Harris type. The maximum attenuation can be obtained in the cutoff region.

10.4 Time Domain Transformation Mode

Sets the transformation mode to the time domain.

Procedure:

1. Click ***Time Domain*** in the tool menu to display the Time Domain side menu.
2. Press ***Transform Mode*** to display the Trans Mode menu.

Trans Mode menu

Band Pass	Selects the bandpass transformation mode.
Low Pass Impulse	Selects the low pass impulse transformation mode.
Low Pass Step	Selects the low pass step transformation mode.
Set Frequency Low Pass	Sets a frequency range which conforms to the low pass mode restrictions.

10.5 Transformation of the Time Domain Horizontal Axis

Sets the annotation of the horizontal axis to a time or distance display.

Procedure:

1. Click ***Time Domain*** in the tool menu to display the Time Domain side menu.
2. Press ***Transform Stimulus*** to display the Trans Stimulus menu.

Trans Stimulus menu

Time	Sets the annotation of the horizontal axis to time (sec).
Distance	Sets the annotation of the horizontal axis to distance (m).
Reflection Time	Sets the annotation of the horizontal axis to time (sec) and displays half of the TIME value when measuring the reflection time.
Reflection Distance	Sets the annotation of the horizontal axis to distance (m) and displays half of the DISTANCE value.
Vel Factor	Sets the velocity factor.

11. DEVICE POWER SUPPLY

11.1 Overview

The device power supply (Voltage Source & Current (I) Measurement. Hereafter called VSIM.) corresponds to this unit network analyzer measurement functions and applies the DC voltage to a device to measure current.
The VSIM has four independent channels and the DC voltage is output from the BNC connectors on the rear panel of this unit.

11.2 Functions

- Voltage output functions from four independent channels.
- A maximum of 16 settings, which correspond to 16 this unit measurement channels, can be specified. (The program sweep settings on the measurement channels are not applied.)
- Current measurement functions.
- Current limit functions.
- Current burst measurement functions.

Table 11-1 Output Voltage Range

Channel	Output voltage range	Setting resolution	Maximum output current
CH A	-1 to +6 V	0.001 V	500 mA
CH B	-1 to +15 V	0.001 V	120 mA
CH C	-1 to +6 V	0.001 V	30 mA
CH D	-1 to +6 V	0.001 V	30 mA

Table 11-2 Current Measurement Range

Channel	Range	Measurement range	Measurement resolution
A ch	500 mA	-100 to +500 mA	20 μA
	50 mA	± 50 mA	2 μA
	1 mA	± 1 mA	50 nA
	200 μA	± 200 μA	10 nA
B ch	120 mA	-100 to +120 mA	5 μA
	50 mA	± 50 mA	2 μA
	1 mA	± 1 mA	50 nA
	200 μA	± 200 μA	10 nA
C ch	30 mA	± 30 mA	2 μA
	1 mA	± 1 mA	50 nA
	200 μA	± 200 μA	10 nA
D ch	30 mA	± 30 mA	2 μA
	1 mA	± 1 mA	50 nA
	200 μA	± 200 μA	10 nA

11.3 Menu

The VSIM functions can be set either in the VSIM side menu or in the VSIM dialog box.

11.3.1 VSIM Side Menu

The VSIM side menu is displayed by selecting VSIM from the tool menu.

1. VSIM menu

VSIM ON/OFF	Sets the VSIM functions to ON or OFF.
VS CH State	Displays the VS CH State menu.
V Source	Displays the V Source menu.
I Meas	Displays the I Meas menu.
Display	Displays the Display menu.
Sweep State Bias/Vsrc	Selects the voltage output during the sweep. Bias: Outputs the Bias voltage. Vsrc: Outputs the V Source voltage.

2. VS CH State menu

CH A ON/OFF	Sets the output of channel A to ON or OFF.
CH B ON/OFF	Sets the output of channel B to ON or OFF.
CH C ON/OFF	Sets the output of channel C to ON or OFF.
CH D ON/OFF	Sets the output of channel D to ON or OFF.
CH A Bias	Sets the output bias value of channel A.
CH B Bias	Sets the output bias value of channel B.
CH C Bias	Sets the output bias value of channel C.
CH D Bias	Sets the output bias value of channel D.

NOTE: ***Use the numeric pad when changing the positive and negative output bias value.***
The polarity of the voltage cannot be changed by using the encoder to prevent a reverse voltage from being generated by over rotating the encoder.

3. V Source menu

Sets the output conditions of CH A, CH B, CH C, and CH D. The settings are valid when the channel output in the VS CH State menu is set to ON.
The conditions can be set to each active channel (CH 1 to CH 16) of the analyzer independently.

V Source ON/OFF	Switches the voltage value output, which is set in Output, to ON or OFF. When Off is set, the bias value set in the VS CH State menu is output.

Output	Sets output voltage. For more information on the setting ranges of each channel, refer to Table 11-1 Output Voltage Range.

NOTE: ***Use the numeric pad when changing the positive and negative output voltage.***
The polarity of the voltage cannot be changed by using the encoder to prevent a reverse voltage from being generated by over rotating the encoder.

Current Limit	Sets output current limit values. For more information on the setting ranges of each channel, refer to Table 11-1 Output Voltage Range.

4. I Measure menu

   Sets the current measurement conditions of CH A, CH B, CH C, and CH D.

   The conditions can be set to each active channel (CH 1 to CH 16) of the analyzer independently.

(1 of 4 page CH A)

I Meas ON/OFF	Sets the current measurement functions of channel A to ON or OFF.
500mA	Sets the measurement range to 500 mA.
50mA	Sets the measurement range to 50 mA.
1mA	Sets the measurement range to 1 mA.
200uA	Sets the measurement range to 200 μA.
Burst Mode ON/OFF	Sets the burst measurement to ON or OFF. ON: Performs measurements for the length of burst time set in ***Burst Time***, and then averages and displays the results. The number of the average is the burst time/unit measurement time. The unit measurement time of the analyzer is 50 μs. OFF: Displays a single measurement result.
Burst Time	Sets the burst measurement time.

(2 of 4 page, CH B)

I Meas ON/OFF	Sets the current measurement functions of channel B to ON or OFF.
120mA	Sets the measurement range to 120 mA.
50mA	Sets the measurement range to 50 mA.
1mA	Sets the measurement range to 1 mA.
200uA	Sets the measurement range to 200 μA.
Burst Mode ON/OFF	Sets the burst measurement to ON or OFF. ON: Performs measurements for the length of burst time set in ***Burst Time***, and then averages and displays the results.

The number of the average is the burst time/unit measurement time. The unit measurement time of the analyzer is 50 µs.

OFF: Displays a single measurement result.

Burst Time Sets the burst measurement time.

(3 of 4 page, CH C)

I Meas ON/OFF Sets the current measurement functions of channel C to ON or OFF.

30mA Sets the measurement range to 30 mA.

1mA Sets the measurement range to 1 mA.

200uA Sets the measurement range to 200 µA.

Burst Mode ON/OFF Sets the burst measurement to ON or OFF.

ON: Performs measurements for the length of burst time set in ***Burst Time***, and then averages and displays the results.
The number of the average is the burst time/unit measurement time. The unit measurement time of the analyzer is 50 µs.

OFF: Displays a single measurement result.

Burst Time Sets the burst measurement time.

(4 of 4 page, CH D)

I Meas ON/OFF Sets the current measurement functions of channel D to ON or OFF.

30mA Sets the measurement range to 30 mA.

1mA Sets the measurement range to 1 mA.

200uA Sets the measurement range to 200 µA.

Burst Mode ON/OFF Sets the burst measurement to ON or OFF.

ON: Performs measurements for the length of burst time set in ***Burst Time***, and then averages and displays the results.
The number of the average is the burst time/unit measurement time. The unit measurement time of the analyzer is 50 µs.

OFF: Displays a single measurement result.

Burst Time Sets the burst measurement time.

5. Display menu

CH A ON/OFF Sets the display of the channel A result to ON or OFF.

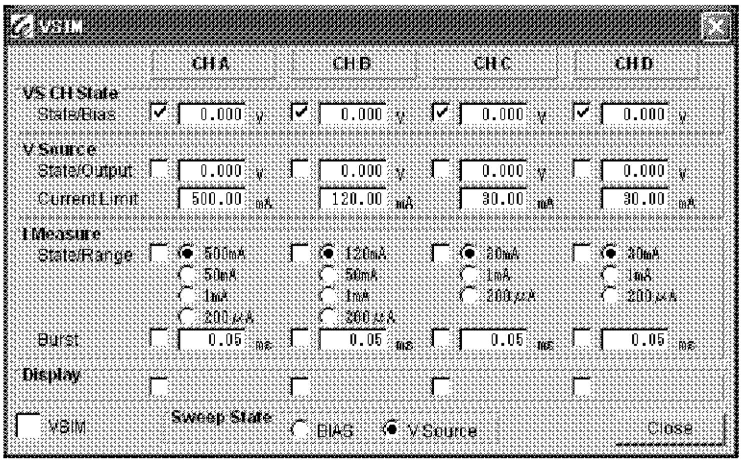
CH B ON/OFF Sets the display of the channel B result to ON or OFF.

CH C ON/OFF Sets the display of the channel C result to ON or OFF.

CH D ON/OFF Sets the display of the channel D result to ON or OFF.

11.3.2 VSIM Dialog Box

Sets the VSIM function conditions for each channel.
The dialog box is displayed by selecting ***System*** and ***VSIM*** from the main menu.



VSIM Sets the VSIM functions to ON or OFF.

VS CH State

- ***State/Bias*** Sets the voltage output to ON or OFF and sets the voltage bias value.

V Sourc

- ***State/Output*** Sets the output voltage value and its ON or OFF.
- ***Current Limit*** Sets the output current limit value.

I Measure

- ***State/Range*** Sets the current measurement function to ON or OFF and the measurement range.
- ***Burst*** Sets the current burst measurement function to ON or OFF and the burst measurement time.

Display Sets the results display to ON or OFF.

Sweep State Selects the voltage output during the sweep.

- ***BIAS*** Outputs the Bias voltage.
- ***V Source*** Outputs the V Source voltage.

11.4 Example Settings

This section shows examples of the switch control voltage settings used to measure the EGSM/DCS dual band FEM (Front End Module). (This measurement process requires the R3968 Multi Port Test Set in addition to the VSIM function.)
The example settings below show only the VSIM function settings.
Each measurement channel setting is in accordance with the actual device measurement settings.

Setting table

Table 11-3 EGSM/DCS Dual Band FEM Control

	Control 1	Control 2	This unit measurement channel
Sending EGSM	ON	OFF	CH 1
Sending DCS	OFF	ON	CH 2
Receiving EGSM	OFF	OFF	CH 3
Receiving DCS	OFF	OFF	CH 4

Control 1 : VSIM CH A
Control 2 : VSIM CH B

Sending the EGSM

1. Activate measurement channel 1 (CH1).
2. Select ***VSIM*** in the ***System*** main menu to display the VSIM dialog box.
3. Set channel A to ON (3 V) and channel B to OFF (0 V) as shown in Figure 11-1 according to the settings in Table 11-3.
4. Set a current measurement range according to the device specifications. The example below sets channel A to 50 mA and channel B to 200 μA.

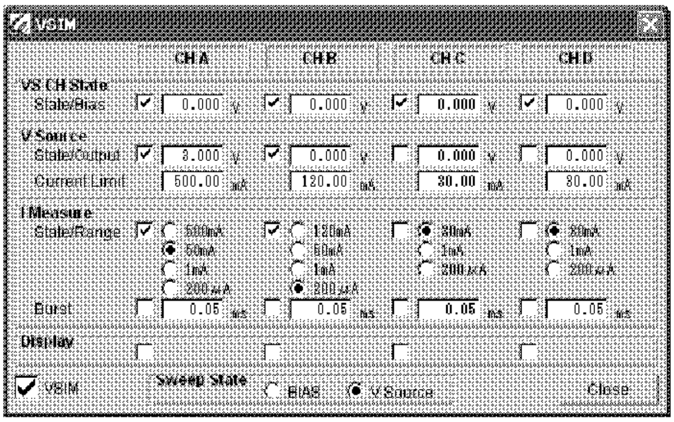


Figure 11-1 Sending the EGSM

Sending the DCS

1. Activate measurement channel 2 (CH2).
2. Set channels A and B as shown in Figure 11-2 according to the settings in Table 11-3.
3. Set a current measurement range according to the device specifications. The example below sets channel A to 200 μA and channel B to 50 mA.

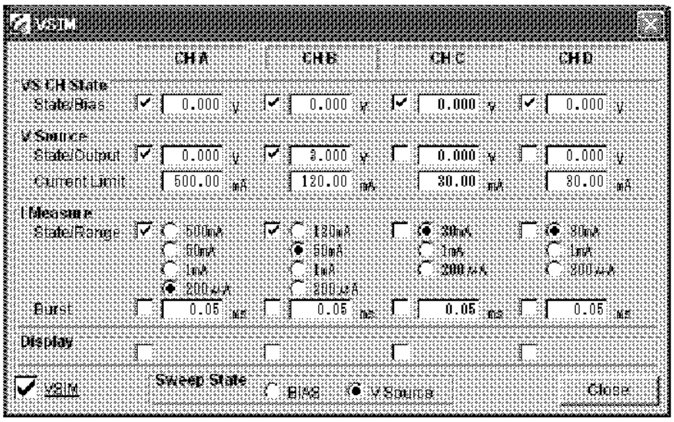


Figure 11-2 Sending the DCS

Receiving the EGSM

1. Activate measurement channel 3 (CH3).
2. Set channels A and B as shown in Figure 11-3 according to the settings in Table 11-3.
3. Set a current measurement range according to device specifications. The example below sets channel A to 200 μA and channel B to 200 μA.

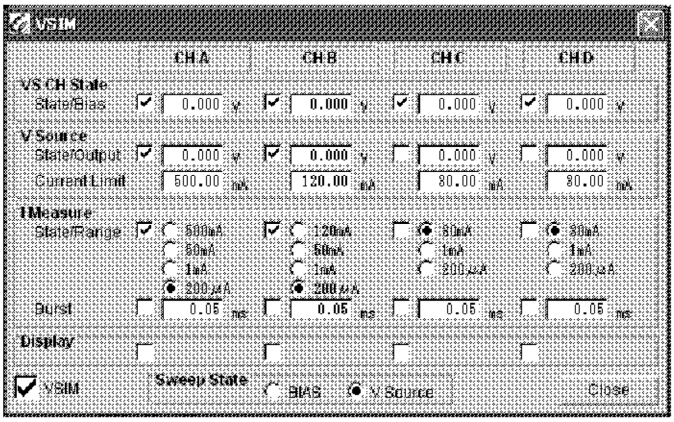


Figure 11-3 Receiving the EGSM

Receiving the DCS

1. Activate measurement channel 4 (CH4).
2. Set channels A and B as shown in Figure 11-4 according to the settings in Table 11-3.
3. Set a current measurement range according to the device specifications. The example below sets channel A to 200 µA and channel B to 200 µA.

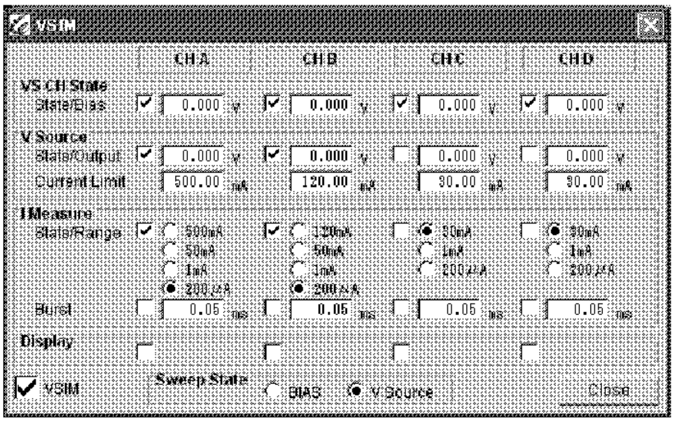
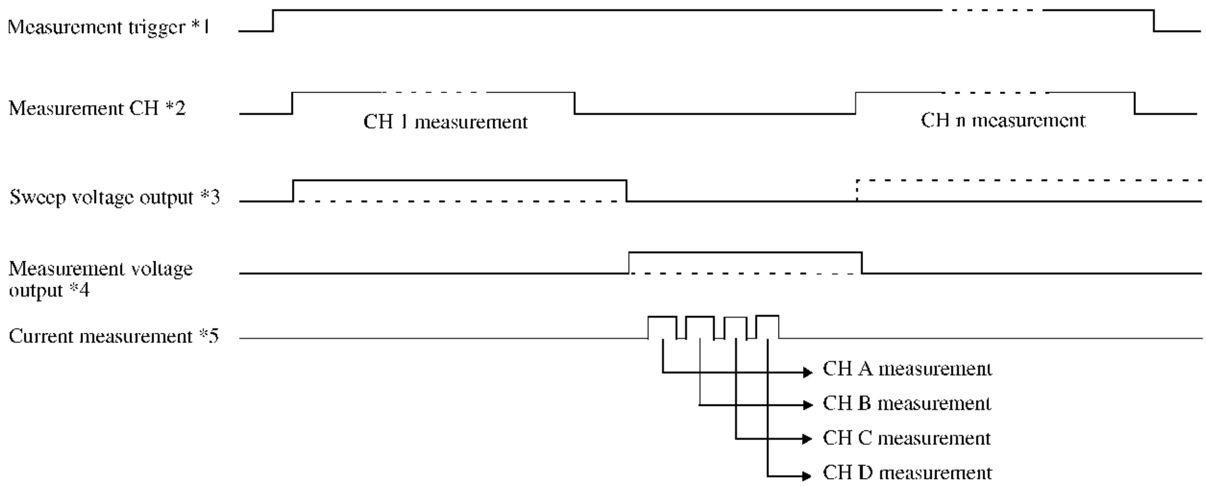


Figure 11-4 Receiving the DCS

11.5 Timing Chart

<VSIM voltage settings and current measurement timing>



*1: Internal measurement trigger of this unit.

*2: Network analyzer measurement channel

*3: If V Source is set to ON and Sweep State is set to V Source, the V Source voltage is output. If V Source and Sweep State are set to any other settings, the Bias voltage is output.

*4: If V Source is set to ON, the V Source voltage is output. If V Source is set to OFF, the Bias voltage is output.

*5: The current is measured in channels A, B, C, and D, in order.

11.6 Error Message

Message	Explanation
VSIM Error Limiter:<V_ch>(<M_ch>)	A limiter error occurred in the VSIM channel <V_ch> which was set to the <M_ch> channel of the analyzer. <Required Action> Contact Advantest Sales Office or a local representative.
VSIM Error Oscillator:<V_ch>(<M_ch>)	An oscillation error occurred in the VSIM channel <V_ch> which was set to the <M_ch> channel of the analyzer. <Required Action> Contact Advantest Sales Office or a local representative.
VSIM Error Overload:<V_ch>(<M_ch>)	An excessive level was input in the VSIM channel <V_ch> which was set to the <M_ch> channel of the analyzer. The VSIM functions will be terminated. <Required Action> Contact Advantest Sales Office or a local representative.
VSIM Error Overheat	An abnormal temperature rise was detected in the VSIM controller. The VSIM functions will be terminated. <Required Action> Turn the power of the analyzer OFF, and consult with Advantest or an authorized service agency.

<V_ch> : VSIM channel numbers A, B, C and D.
<M_ch> : Measurement channel numbers 1 to 16.

12. FREQUENCY CONVERSION DEVICE MEASUREMENT

12.1 Overview

This unit can measure the harmonics of amplifiers and the dividers by setting the signal source frequency and the receiver frequency independently. This unit can also measure various characteristics of the mixer in vector by having the second power source built-in to be used as a local signal source of the mixer.

12.2 Independent Settings of the Power Source and the Receiver

Click ***Setup*** in the main menu to open the pull down menu. Click ***Multi Frequency*** in the pull down menu to open the Multi Frequency dialog box.

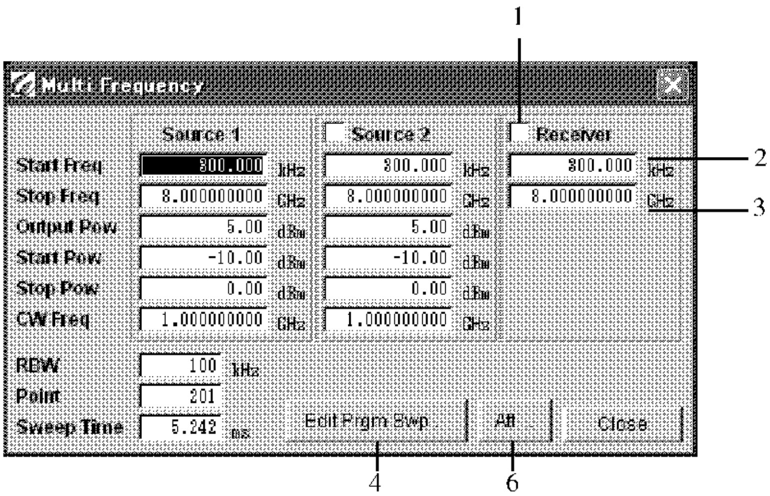


Figure 12-1 Multi Frequency Dialog Box

1. Turns the independent setting of the receiver ON or OFF. ✓ indicates that the setting is turned ON.
2. Sets the start frequency when the receiver is set in a independent mode.
3. Sets the stop frequency when the receiver is set in a independent mode.
4. Opens the Program Sweep Editor dialog box.

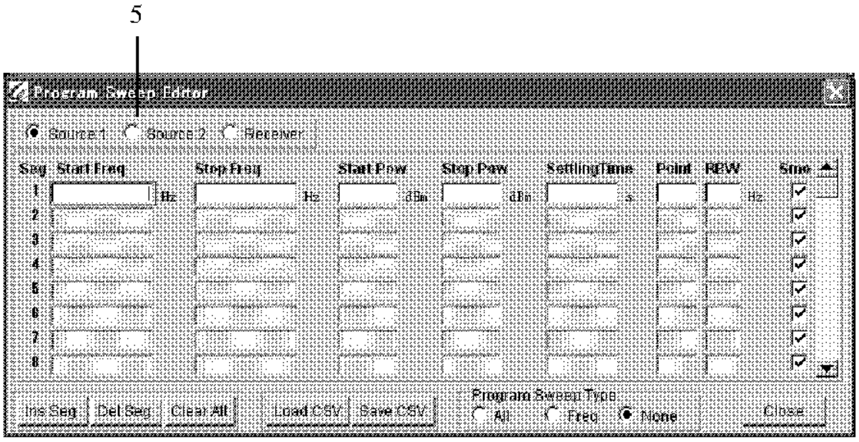


Figure 12-2 Program Sweep Editor Dialog Box

5. Selects the signal source and the receiver.

Source 1	Sets the program sweep conditions to the first signal source. Conditions can be set to all items: the Frequencies, Powers, Settling Time, Point, and RBW.
Source 2	Sets the program sweep conditions to the second signal source. Conditions can be set to the Frequencies and Powers. Conditions for the Settling Time, Point, and RBW are the same as those of the first signal source.
Receiver	Sets the program sweep conditions to the receiver. Conditions can be set to the Frequencies. Conditions for the Settling Time, Point, and RBW are the same as those of the first signal source.

6. Opens the Attenuator dialog box which includes the second signal source.

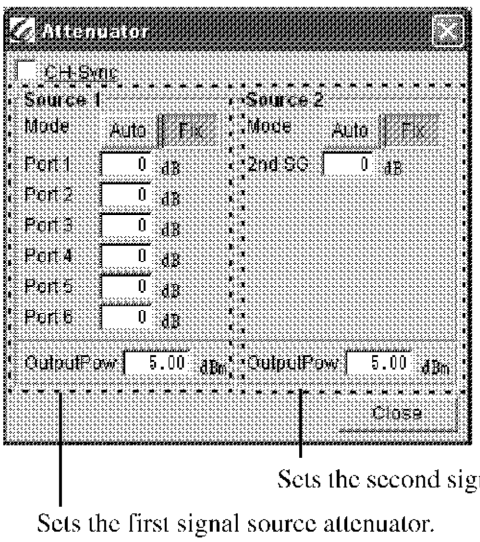


Figure 12-3 Attenuator Dialog Box

12.3 Mixer Measurement

Click ***Setup*** in the main menu to open the pull down menu. Click ***Mixer...*** in the pull down menu to open the Mixer dialog box.

Five channels are used to execute the mixer measurement. For example, when the mixer measurement is executed by CH1, CH1 to CH5 are used to execute the measurement and the result is displayed on CH1.

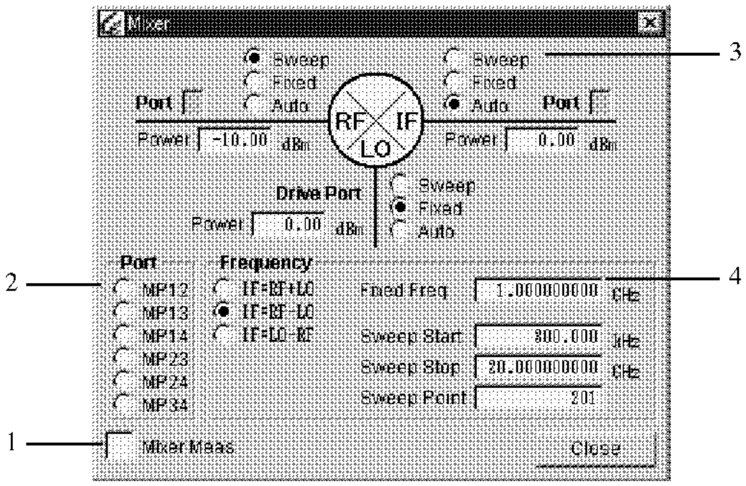


Figure 12-4 Mixer Dialog Box

1. Sets the Mixer measurement to ON or OFF. ✓ indicates that the setting is turned ON.
2. Sets the mixer measurement port.
3. Sets the frequency sweep conditions of each port.

Sweep	Sweeps the frequency range which is set in step 4. and described below.
Fixed	Sets to the fixed frequency which is set in step 4. and described below.
Auto	Sets the conditions automatically from the set frequencies of Sweep and Fixed according to the conversion type selected in step 2. above.
Power	Sets the power.

4. Sets the frequency.

Fixed Freq	Sets the fixed frequency.
Sweep Start	Sets the sweep start frequency.
Sweep Stop	Sets the sweep stop frequency.
Sweep Point	Sets the number of the sweep point.
IF=RF+LO	Sets the conversion type of the IF frequency.
IF=RF-LO	Sets the conversion type of the IF frequency.
IF=LO-RF	Sets the conversion type of the IF frequency.

12.4 Mixer Measurement Example

Describes the measurement example of the 800 MHz-band down converter. Operation starts from the tool menu here.

Setting the measurement conditions

1. Click ***Mixer*** in the tool menu to display the Mixer side menu.
2. Click ***Mixer Sweep***, ***Sweep Mode***, and ***RF=Sweep LO=Auto IF=Fixed***.

   The RF port is set to Sweep, the IF port is set to the Fixed frequency, and the LO port is set to the Auto sweep conditions.
3. Enter ***Return***, ***Fixed Freq***, **1**, **4**, **0**, and **M/n** to set the IF fixed frequency to 140 MHz.
4. Enter ***Sweep Start***, **7**, **0**, **0**, and **M/n** to set the RF start frequency to 700 MHz.
5. Enter ***Sweep Stop***, **1**, **0**, **0**, **0**, and **M/n** to set the RF stop frequency to 1000 MHz.
6. Click ***Return***, and ***Mixer Meas ON/OFF*** to turn on the mixer measurement.

   Click ***Yes***, as the message "Setting of CH1 - CH5 will be changed in mixer mode. OK?" appears on the screen.

   CH1 to CH5 are set in the mixer measurement mode.

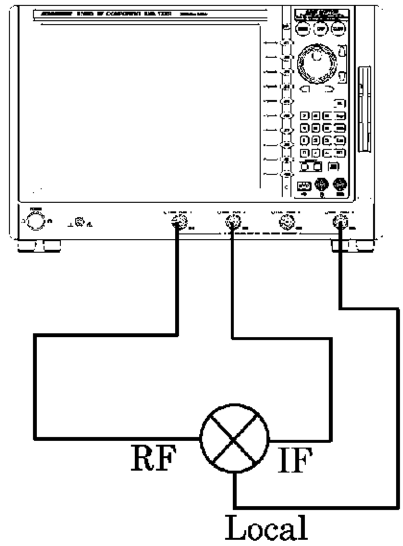
Calibration

1. Connect the Automatic Calibration Kit R17050/R17051 between Port1 and Port2, and click ***Mixer Cal*** and ***Auto Cal*** to calibrate.
2. When the message "Auto Cal: Complete" appears on the screen, connect a reciprocal mixer for the calibration and click ***Standard Mixer***.
3. Press ***Done Mixer Cal*** after a buzzer rings.

   The calibration is complete.

Measurement

1. Connect Port1 to the RF terminal of the mixer and connect Port2 to the IF terminal of the mixer. Connect the second signal source to the LO terminal of the mixer.



2. Click ***Return***, ***Mixer Meas***, and ***M21*** to measure the conversion gain.
3. Click ***Active Trace*** in the tool menu to display the Active Trace side menu.
4. Click ***Trace2*** to turn on Trace 2.
5. Click ***Format*** in the tool menu to display the Format side menu.
6. Click ***Phase*** to set Trace 2 to display the phase.

   With this, Trace 1 displays the amplitude and Trace 2 displays the phase.

13. REFERENCE

This section explains the functions of the main menu, dialog boxes, side menus, and tool menus.

13.1 Menu Index

Use this menu index as an index for Section 13.

13.2 Function Explanations

13.2.1 Main Menu

The main menu includes the following menus which are grouped by the functions of this unit. Click on the menus to display the pull down menus.

File Displays the File pull-down menu which executes the save, the load and print, and the application software.

Setup Displays the Setup pull-down menu which sets the measurement conditions and the display screen.

Cal Displays the Cal pull-down menu which executes the calibration.

Fixture Displays the Fixture pull-down menu which executes the software fixture.

Marker Displays the Marker pull-down menu which sets the marker function.

System Displays the System pull-down menu which sets the PIO, Test set, and VSIM function.

Config Displays the Config pull-down menu which sets the Explorer, GP-IB, and Network.

Func Displays the installed application softwares in the pull-down menu and executes the clicked application software.

1. File pull-down menu

Load Settings Displays the Load dialog box which loads the measurement condition files.

Save Settings Displays the Save dialog box which saves the measurement condition files.

Define Save Option Displays the Define Save Option dialog box which defines the saving conditions for the measurement condition files.

Delete File Deletes the measurement condition files.

Save S-parameter Displays the Save S-parameter dialog box which saves the test result in S-parameter.

Save Trace Displays the Save Trace dialog box which saves the test result as displayed on the screen.

Save Image Displays the Save Image dialog box which saves the display screen in image data.

Print Executes the print.
Requires the printer driver installation.

Execute Displays the Execute dialog box which executes the application software.

2. Setup pull-down menu

Window	Displays the Window dialog box which sets the display screen.
Channel	Displays the Channel dialog box which sets the channel measurement conditions.
Trace	Displays the Trace dialog box which sets the measurement data.
Time Domain	Displays the Time Domain dialog box which sets the Time Domain measurement.
Edit Program Sweep	Displays the Edit Program Sweep dialog box which sets the program sweep.
Edit Limit Line	Displays the Edit Limit Line dialog box which sets the limit line.
Multi Frequency	Displays the Multi Frequency dialog box which sets the signal source and the receiver independently.
Mixer	Displays the Mixer dialog box which sets the mixer measurement.
Attenuator (OPT10)	Displays the Attenuator dialog box which sets the output attenuator (extended power).

3. Cal pull-down menu

Cal Menu	Displays the Cal side menu which executes the calibration.
Cal Kit	Displays the Cal Kit dialog box which sets the calibration kit.

4. Fixture pull-down menu

Single-port Fixture	Displays the Single-port Fixture dialog box which sets each port.
Balance-port Fixture	Displays the Balance-port Fixture dialog box which sets the balance-port.
Balance Measurement	Displays the Balance Measurement dialog box which sets the balance measurement.
Balance Device Port	Displays the Balance Device Port dialog box which sets the balance measurement port.

5. Marker pull-down menu

Marker Settings	Displays the Marker Settings dialog box which sets the marker.
Marker Search	Displays the Marker Search dialog box which sets the marker search.
Filter Analysis	Displays the Filter Analysis dialog box which sets the filter analysis.

6. System pull-down menu

PIO	Displays the PIO dialog box which sets the parallel I/O.
Test Set	Displays the Test Set dialog box which sets the R3968 Test set.
VSIM (OPT13)	Displays the VSIM dialog box which sets the device power source (VSIM).

7. Config pull-down menu

Explorer	Opens the Explorer.
Tool Bar	Sets the tool menu to ON or OFF. ✓ mark is displayed when the menu is ON.
GPIB Address	Displays the GPIB Address dialog box which sets the GPIB address.
Network Setup	Sets the network. For more information, refer to A.3 "Network Settings."
Add Printer	Installs the printer driver. For more information, refer to A.4 "Printer Installation Method."
Adjust Time	Displays the Adjust Time dialog box which sets the time.
Preset	Resets the measurement conditions of this unit.
Version	Displays the version of this unit.

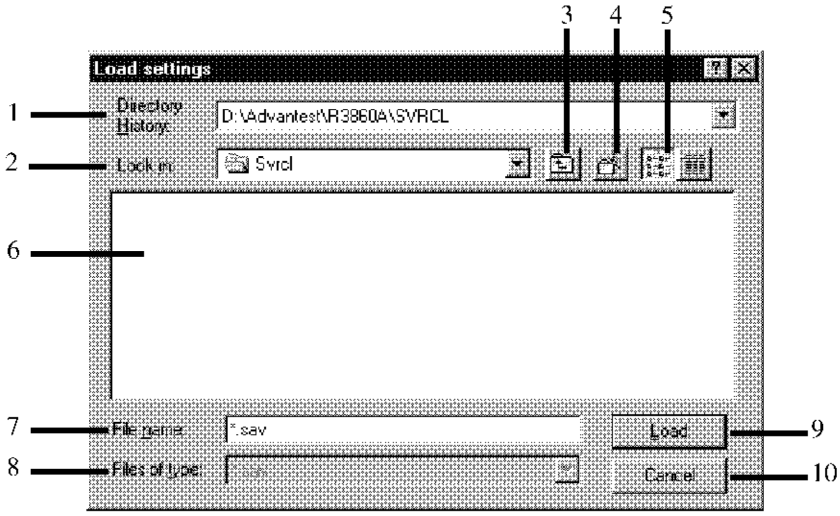
13.2.2 Dialog Boxes

This section explains dialog boxes displayed by the main menu or side menus.

13.2.2.1 File

1. Load Settings dialog box

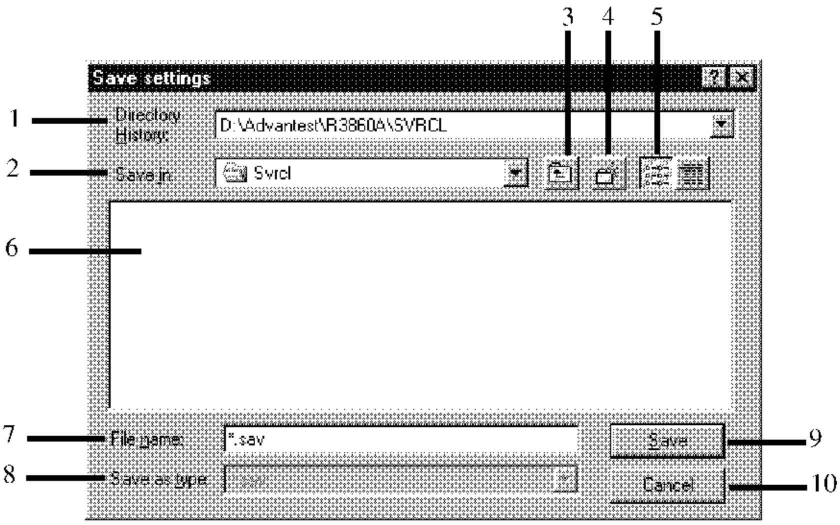
   Loads the file in which the setting conditions of this unit are saved.
   Select ***File***, ***Load Setting...*** from the main menu to display the Load Settings dialog box.



1.	***Directory History***	Displays the folder history. Displays the folder selection.
2.	***Look in***	Specifies the folder in which the file is saved.
3.		Moves to the parent directory.
4.		Creates a new folder.
5.		Changes the display menu.
6.	List	Displays the files which are saved in the specified folder and the folder list.
7.	***File name***	Enter the file name to be loaded.
8.	***Files of type***	The setting condition file type "sav" is selected.
9.	***Load***	Loads the file.
10.	***Cancel***	Does not save the file and closes the dialog box.

2. Save Settings dialog box

   Saves the setting condition of this unit as a file.
   Select ***File***, ***Save Setting...*** from the main menu to display the Save Settings dialog box.

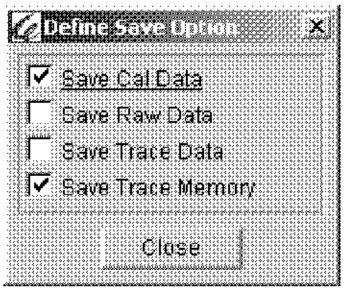


1. ***Directory History*** — Displays the folder history. Displays the folder selection.
2. ***Save in*** — Specify the folder in which the file is saved.
3.  — Moves to the parent directory.
4.  — Creates a new folder.
5.  — Changes the display menu.
6. List — Displays the files which are saved in the specified folder and the folder list.
7. ***File name*** — Enter a file name.
8. ***Save as type*** — The setting condition file type "sav" is selected.
9. ***Save*** — Saves the file.
10. ***Cancel*** — Does not save the file and closes the dialog box.

3. Define Save Option dialog box

   Saves the measurement condition settings by using Save Settings.

   Select ***File*** in the main menu. Then, select ***Define Save Option*** to display the dialog box.

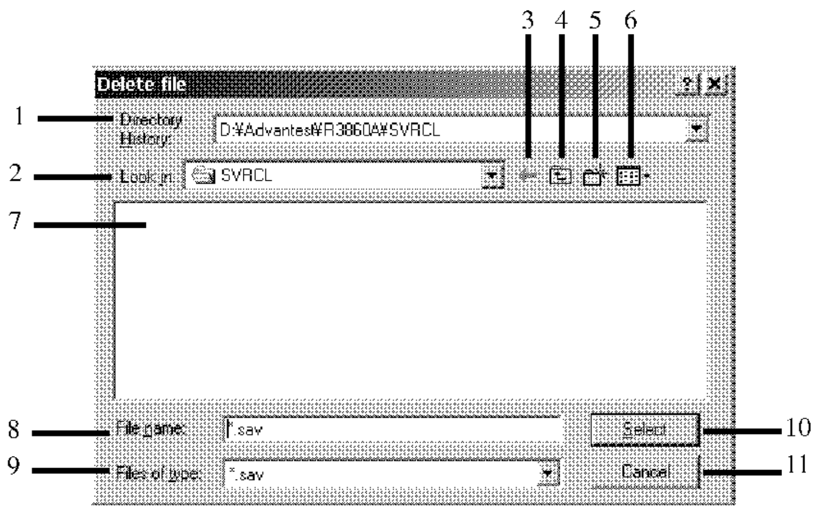


Save Cal Data	Selecting this item saves the calibration data when Save Settings is executed.
Save Raw Data	Selecting this item saves the raw measurement data when Save Settings is executed. Executing Load Settings automatically stops the sweep.
Save Trace Data	Selecting this item saves the pre-formatted trace data. Executing Load Settings automatically stops the sweep.
Save Trace Memory	Selecting this item saves the trace memory.
Close	Closes the dialog box.

4. Delete File dialog box

   Deletes the setting condition file.

   Select ***File***, ***Delete File*** from the main menu to display the Delete File dialog box.



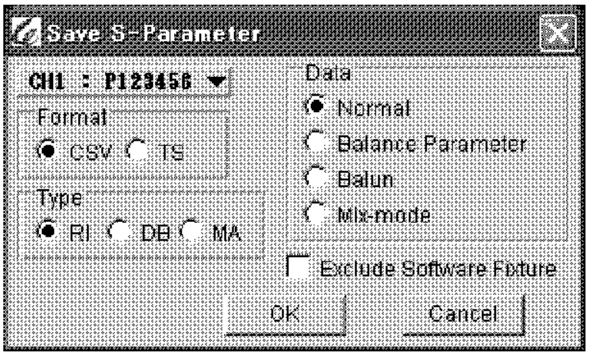
1. ***Directory History***	Displays the folder history. Displays the folder selection.

2. ***Look in***	Specify the folder in which the file is saved.
3. 	Moves to the last displayed folder.
4. 	Moves to the parent directory.
5. 	Creates a new folder.
6. 	Changes the display menu.
7. List	Displays the files which are saved in the specified folder and the folder list.
8. ***File name***	Enter the file name to be deleted.
9. ***Save as type***	The setting condition file type "sav" is selected.
10. ***Select***	Deletes the file.
11. ***Cancel***	Does not delete the file and closes the dialog box.

5. Save S-parameter dialog box

   Saves all measurement data to a file as S-parameters.

   Operation of ***File*** and ***Save S-parameter*** in the main menu displays this dialog box.



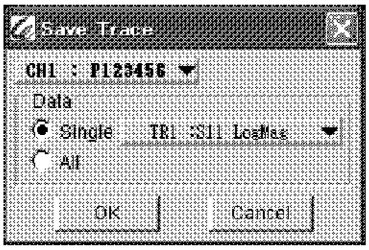
CH	Sets the measurement channels to be saved.	
Format	Selects the format.	
	CSV:	Specifies CSV format.
	TS:	Specifies TS format.
Type	Selects the data type.	
	RI:	Real/Imaginary
	DB:	dB/Degree
	MA:	Linear/Degree

Data	Selects the data.
	Normal: S-parameters
	Balance Parameter: Balance parameters
	Balun: Balun transformation results
	Mix-mode: Mode analysis results
Exclude Software Fixture	If a check mark is entered into the check box, the software fixture is disabled while the S-parameters are saved. However, the port extension is still enabled.
OK	Displays the dialog box for saving to a file.
Cancel	Cancels settings.

6. Save Trace dialog box

   Saves only the displayed data to a file.

   Operation of ***File*** and ***Save Trace*** in the main menu displays this dialog box.



CH	Sets the measurement channels to be saved.
Data	Selects the data.
	Single: Saves the trace specified in the pull-down menu.
	All: Saves all valid traces.
OK	Displays the dialog box for saving to a file.
Cancel	Cancels settings.

13.2.2.2 Setup

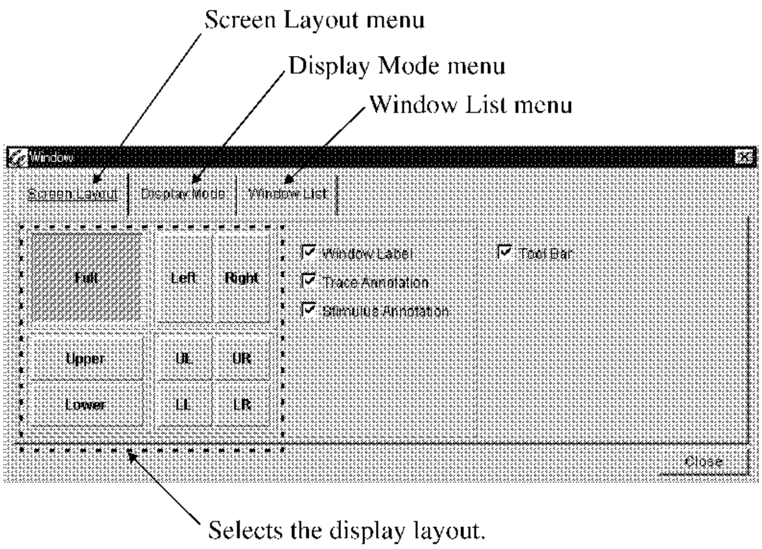
Sets the operating status of this unit.

1. Window dialog box

   Select ***Setup***, ***Window...*** from the main menu to display the Window dialog box.
   The Window dialog box contains three tabs: Screen Layout, Display Mode, and Window List.

   - Screen Layout menu

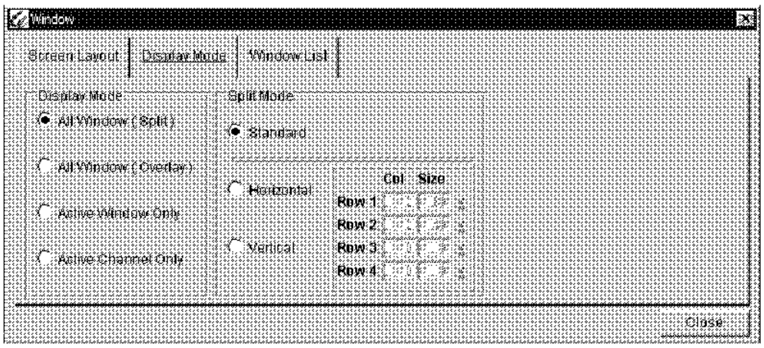
     Sets the display area, the comment display, and the toolbar display of the screen.



Window Label	Sets the Window Label display to ON or OFF.
Trace Annotation	Sets the Trace Annotation to ON or OFF.
Stimulus Annotation	Sets the Stimulus Annotation to ON or OFF.
Tool Bar	Sets the tool menu display to ON or OFF.

- Display Mode menu

  Sets the display mode and the number of windows.



Display Mode

Selects the windows display mode.

All Window(Split):
Displays and tiles all the selected windows.

All Window(Overlay):
Displays and overlays all the selected windows.

Active Window Only:
Displays only the active window.

Active Channel Only:
Displays only the windows to which the active channels are assigned.

Split Mode

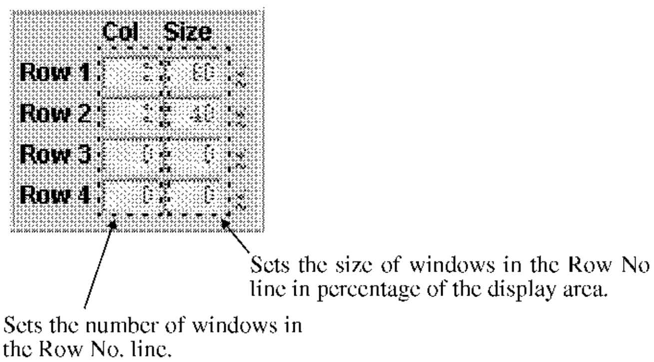
Sets the ratios of split displays.

Standard: Splits the display area equally between all windows.

Horizontal: Splits the display area horizontally and displays multiple windows according to the Col specification.

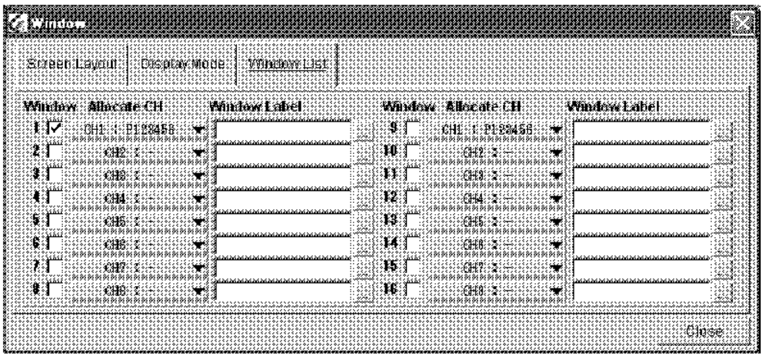
Vertical: Splits the display area vertically and displays multiple windows according to the Col specification.

Row No.: Specifies the number and size of windows that are laid out in the n line by Col and Size.



- Window List menu

  Sets the window display and the channel allocation.



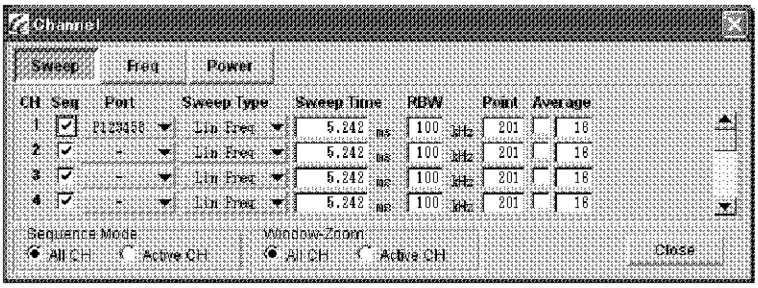
Window	Sets the window to ON or OFF.
Allocate CH	Allocates channels to the windows.
Window Label	Specifies the window label. Click... to open the keyboard and enter the window label.
Close	Closes the dialog box.

2. Channel dialog box

   Sets the measurement conditions of the measurement channels of this unit.
   Select ***Setup***, ***Channel...*** from the main menu to display the Channel dialog box.
   The channel dialog box contains three buttons: Sweep, Freq, and Power.

   - Sweep menu

     Sets the sweep condition.



Seq — Sets the sequence measurement to ON or OFF.

Port — Sets the measurement port.

Sweep Type — Sets the sweep type.

Sweep Time — Sets the sweep time.

RBW — Sets the RBW.

Point — Sets the number of measurement points.

Average — Sets the average.
Check the checkbox to set the averaging count.

Sequence Mode — Sets the sequence measurement mode.

- All CH: Measures all channels, whose sequence measurement boxes are checked, in numeric order of the channels.
- Active CH: Measures the only active channel.

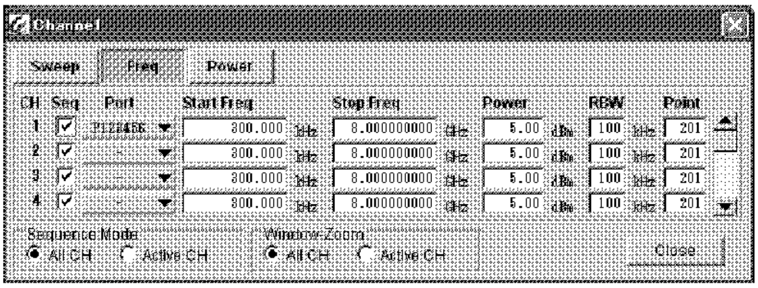
Window Zoom — Sets the measurement sequence when the window is zoomed in on.

- All CH: Measures all channels, whose sequence measurement boxes are checked.
- Active CH: Measures the only active channel.

Close — Closes the dialog box.

- Freq menu

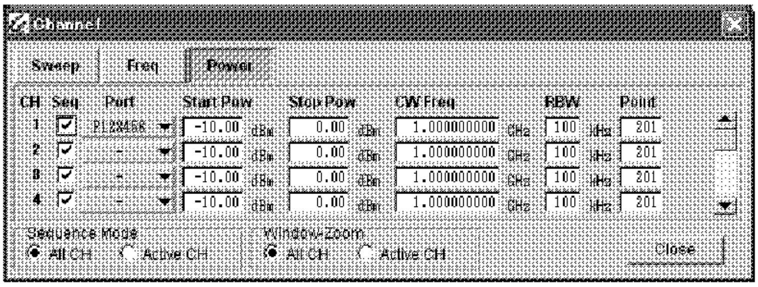
  Sets the frequency conditions.



Start Freq	Sets the start frequency.
Stop Freq	Sets the stop frequency.
Power	Sets the power.
RBW	Sets the RBW.
Point	Sets the number of measurement points.
Close	Closes the dialog box.

- Power menu

  Sets the power sweep conditions.

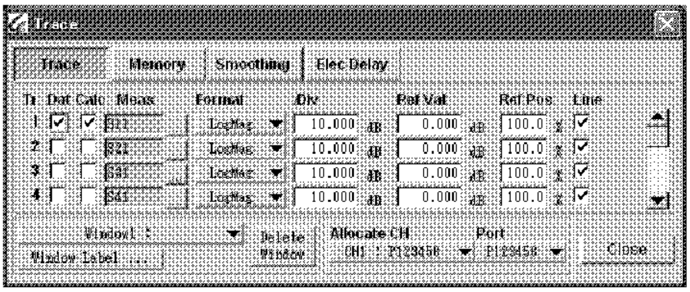


Start Pow	Sets the start power.
Stop Pow	Sets the stop power.
CW Freq	Sets the CW frequency.
RBW	Sets the RBW.
Point	Sets the number of measurement points.
Close	Closes the dialog box.

3. Trace dialog box

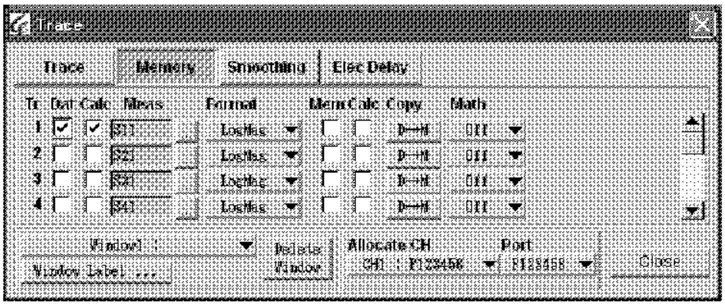
   Sets the measurement conditions of the measurement channels of this unit.
   Select ***Setup*, *Trace...*** from the main menu to display the Trace dialog box.
   The Trace dialog box contains four buttons: Trace, Memory, Smoothing, and Elec Delay.

   - Trace menu



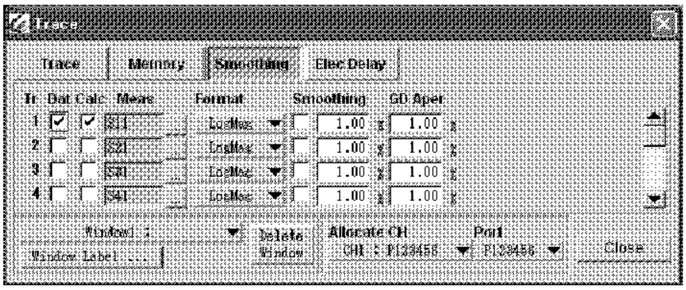
Dat	Sets the data display to ON or OFF. The measurement is executed when the Calc is checked, even if Dat is clear.
Calc	Sets the measurement parameter and the format calculation to ON or OFF.
Meas	Sets the measurement parameter. Click ... to open the Meas dialog box and set.
Format	Sets the measurement format.
/Div	Sets the scale.
Ref Val	Sets the reference values.
Ref Pos	Sets the reference position.
Line	Sets the reference line display to ON or OFF.
Window No.	Selects the window No.
Window Label	Sets the window label. Click Window Label to open the label-setup keyboard.
Delete Window	Closes the active window.
Allocate CH	Allocates a channel to the active window.
Port	Sets the measurement port of the active channel.
Close	Closes the dialog box.

- Memory menu



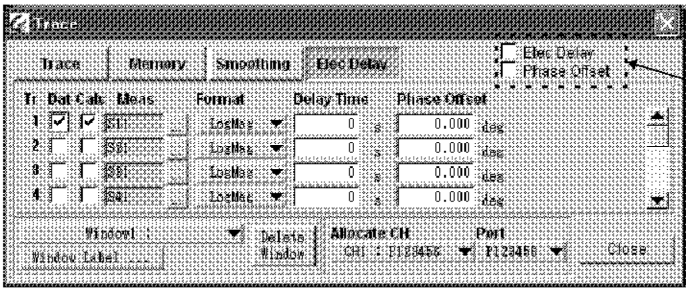
Mem	Sets the memory data display to ON or OFF.
Calc	Sets the measurement parameter and the format calculation to ON or OFF.
Copy	Copies the data to the memory data.
Math	Sets the calculation between the data and the memory data.
Close	Closes the dialog box.

- Smoothing menu



Smoothing	Sets the smoothing to ON or OFF and aperture.
GD Aper	Sets the group delay aperture.
Close	Closes the dialog box.

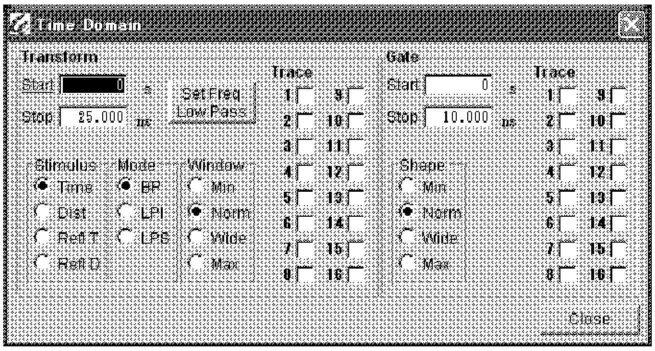
- Elec Delay menu



Delay Time	Sets the electrical length compensation value.
Phase Offset	Sets the phase offset value.
Close	Closes the dialog box.

4. Time Domain dialog box

   Sets the measurement conditions of the measurement channels of this unit.
   Select ***Setup***, ***Time Domain...*** from the main menu to display the Time Domain dialog box.



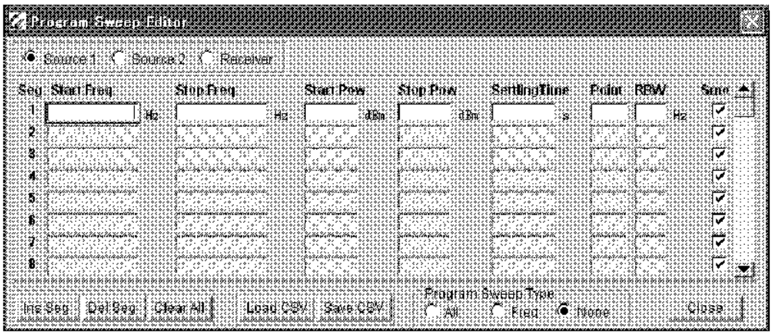
Transform

Start	Sets the start time.
Stop	Sets the stop time.
Set Freq Low Pass	Sets the frequency range which complies with the restriction of the low pass mode.
Stimulus	Selects the time axis type.
	Time: Time display
	Dist: Distance display
	Refl T: Time display during reflection measurements.
	Refl D: Distance display during reflection measurements.

	Mode	Selects the conversion mode.
		BP: Band-pass mode
		LPI: Low-pass impulse mode
		LPS: Low-pass step mode
	Window	Specifies the window form.
	Trace	Selects the trace which converts the time axis.
Gate		
	Start	Sets the start time.
	Stop	Sets the stop time.
	Shape	Selects the gate conversion mode.
	Trace	Selects the trace which performs gate processing.
Close		Closes the dialog box.

5. Program Sweep Editor dialog box

   Sets the program sweep.
   Select ***Setup***, ***Edit Program Sweep...*** from the main menu to display the Edit Program Sweep dialog box.



Source 1 — Sets the program sweep conditions to the first signal source. Conditions can be set to all items: the Frequencies, Powers, Settling Time, Point, and RBW.

Source 2 — Sets the program sweep conditions to the second signal source. Conditions can be set to the Frequencies and Powers. Conditions for the Settling Time, Point, and RBW are the same as those of the first signal source.

Receiver — Sets the program sweep conditions to the receiver. Conditions can be set to the Frequencies. Conditions for the Settling Time, Point, and RBW are the same as those of the first signal source.

Start Freq — Sets the start frequency of the segment.

Stop Freq — Sets the stop frequency of the segment.

Start Pow — Sets the start power of the segment.

Stop Pow Sets the stop power of the segment.

Settling Time Sets the settling time of the segment.

Point Sets the number of points of the segment.

RBW Sets the RBW of the segment.

Ins Seg Inserts a segment into the editing part.

Del Seg Deletes a segment from the editing part.

Clear All Clears all segments.

Load CSV Loads the Program Sweep setting conditions from a CSV file.

Save CSV Saves the Program Sweep setting conditions to a CSV file.

Program Sweep Type

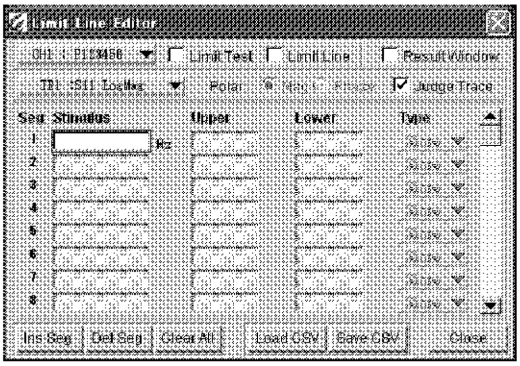
- All: Executes the program sweep with all items activated.
- Freq: Executes the program sweep with the frequencies and the points valid.
- None: Executes no program sweep.

Smo Sets whether to enable smoothing in each segment when smoothing is set to ON.

Close Closes the dialog box.

6. Limit Line Editor dialog box

   Sets the limit line.
   Select ***Setup***, ***Edit Limit Line...*** from the main menu to display the Edit Limit Line dialog box.



CH No. Selects the channel which sets the limit line.

TR No. Selects the trace which sets the limit line.

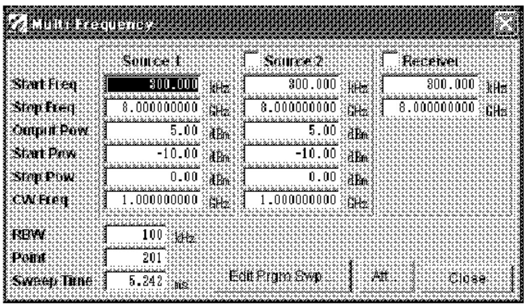
Polar LinMag and Phase can be set as limit lines when the polar coordinate is displayed (when the Polar and Smith Format are set).

- Mag: Sets the LinMag data limit line when the polar coordinate is displayed.
  The limit line is expressed with a concentric circle.
- Phase: Sets the Phase data limit line when the polar coordinate is displayed. The limit line is expressed with a sector form.

Judge Trace	Sets each trace judgment to ON or OFF.
Stimulus	Sets the frequency.
Upper	Sets the upper limit line.
Lower	Sets the lower limit line.
Type	Sets the limit line type.
	Point: Evaluates by using a single frequency. The upper limit is displayed as ∨ and the lower limit is displayed as ∧. Signs are also used as the endpoints of the Slop limit line and the Flat limit line.
	Slope: Connects the segments with a sloped line.
	Flat: Connects the segments with a horizontal line.
Ins Seg	Inserts a segment into the editing part.
Del Seg	Deletes a segment from the editing part.
Clear All	Clears all segments.
Limit Test	Sets the limit test to ON or OFF.
Limit Line	Sets the limit line display to ON or OFF.
Result Window	Sets the limit test result window display to ON or OFF.
Load CSV	Loads the saved limit value.
Save CSV	Saves the set limit value.
Close	Closes the dialog box.

7. Multi Frequency dialog box

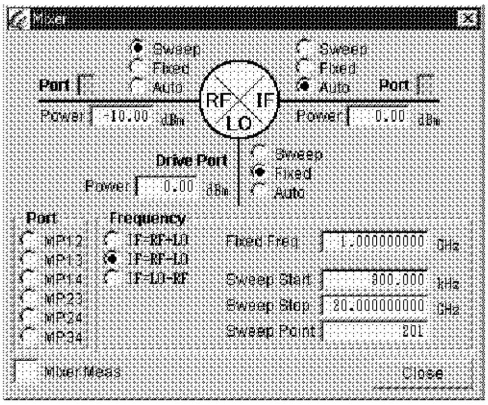
   Sets the independent operations of the signal source and the receiver and sets the second signal source.
   Select **Setup**, ***Multi Frequency...*** from the main menu to display the Multi Frequency dialog box.



Source 2	Sets the second signal source to ON or OFF.
Receiver	Sets the independent setting of the receiver to ON or OFF.
Edit Prgm Swp...	Opens the dialog box which sets the program sweep.
Att...	Opens the dialog box which sets the attenuator.
Close	Closes the dialog box.

8. Mixer dialog box

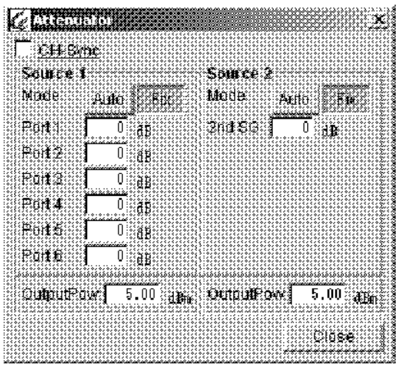
   Sets the mixer measurement.
   Select ***Setup***, ***Mixer...*** from the main menu to display the Mixer dialog box.



Sweep	Sets to the sweep mode.	
Fixed	Sets to the fixed frequency.	
Auto	Sets to the auto mode.	
Power	Sets the power.	
Port	Sets the mixer measurement port.	
Frequency	Sets the frequency.	
	Fixed Freq:	Sets the frequency.
	Sweep Start:	Sets the sweep start frequency.
	Sweep Stop:	Sets the sweep stop frequency.
	Sweep Point:	Sets the number of the sweep point.
	IF=xx ± xx:	Sets the conversion type of the IF frequency.
Mixer Meas	Sets the mixer measurement to ON or OFF.	
Close	Closes the dialog box.	

9. Attenuator dialog box (OPT10)

   Sets the Attenuator.
   Select **Setup**, ***Attenuator...*** from the main menu to display the Attenuator dialog box.



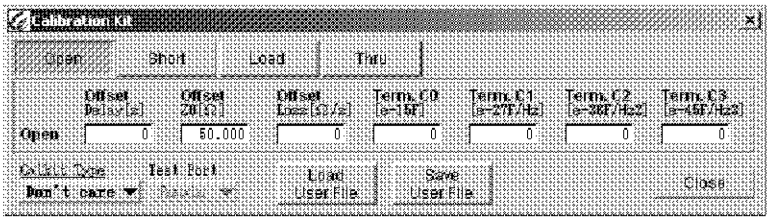
CH-Sync	Sets the coupled channels to ON or OFF.
Port No.	Sets the attenuator value for each port No of the first signal source.
Mode	Sets the operating mode. Auto: Switches the attenuator automatically according to the power setting. Fix: Fixes the set value of each port regardless of the power setting.
Output Pow	Sets the power.
2nd SG	Sets the second signal source attenuator value.
Close	Closes the dialog box.

13.2.2.3 Cal

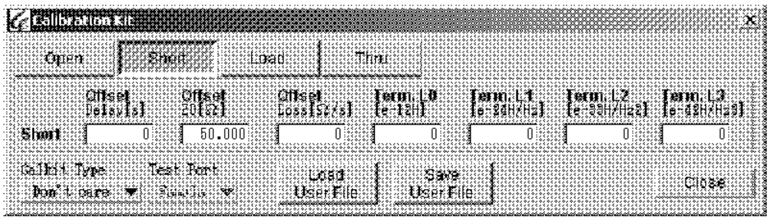
1. Calibration Kit dialog box

   Sets the calibration kit.

   Operation of ***Cal*** and ***Cal Kit...*** in the main menu displays this dialog box.



Cal Kit type	Specifies the type of calibration kit, and sets the open capacity and delay compensation values. Don't Care: Selects an ideal calibration kit and does not perform compensation. N50Ω: Selects an N-type 50 Ω calibration kit, and sets the compensation values. N75Ω: Selects an N-type 75 Ω calibration kit, and sets the compensation values. 3.5 mm: Selects a 3.5 mm-type calibration kit, and sets the compensation values. 7 mm: Selects a 7 mm-type calibration kit, and sets the compensation values. User: Selects a user-defined calibration kit, and sets the compensation values.
Port Female/Male	Specifies the polarity of the Test port.
Load User File	Loads the user-defined correction value from the file.
Save User File	Saves the user-defined correction value in the file.
Open Offset	
Delay	Inputs the delay of the Open Standard.
Z0	Inputs the offset impedance of the Open Standard.
Loss	Inputs the loss of the Open Standard.
Open Termination	
Open C0 e^{-15}	Inputs open capacity C0 of the Open Standard.
Open C1 e^{-27}	Inputs open capacity C1 of the Open Standard.
Open C2 e^{-36}	Inputs open capacity C2 of the Open Standard.
Open C3 e^{-45}	Inputs open capacity C3 of the Open Standard.

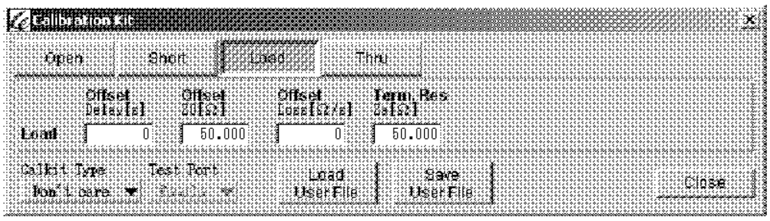


Short Offset

Delay	Inputs the delay of the Short Standard.
Z0	Inputs the offset impedance of the Short Standard.
Loss	Inputs the loss of the Short Standard.

Short Termination

Inductance L0 e^{-12}	Inputs inductance L0 of the Short Standard.
Inductance L1 e^{-24}	Inputs inductance L1 of the Short Standard.
Inductance L2 e^{-33}	Inputs inductance L2 of the Short Standard.
Inductance L3 e^{-42}	Inputs inductance L3 of the Short Standard.

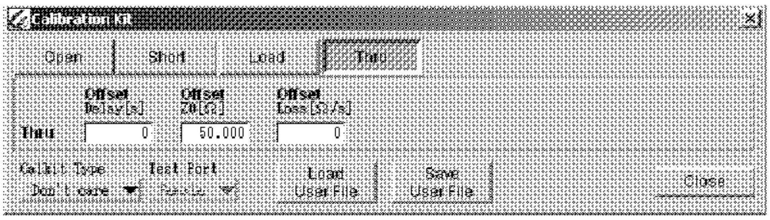


Load Offset

Delay	Inputs the delay of the Load Standard.
Z0	Inputs the offset impedance of the Load Standard.
Loss	Inputs the loss of the Load Standard.

Load Termination

Resistance	Inputs the impedance of the Load Standard.



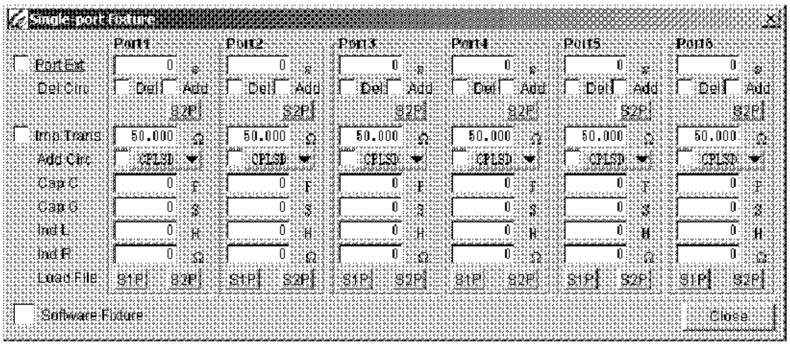
Thru Offset	Commonly sets to the forward and reverse directions.
Delay	Inputs the delay of the Thru Standard.
Z0	Inputs the offset impedance of the Thru Standard.
Loss	Inputs the loss of the Thru Standard.

13.2.2.4 Fixture

1. Single-port Fixture dialog box

   Sets conditions for each port of the software fixture.

   Operation of ***Fixture*** and ***Single-port Fixture*** in the main menu displays this dialog box.



Software Fixture Sets ON/OFF of the software fixture function.

Port Ext Sets ON/OFF of the port extension function and the extension values.

Del Circ Selects the circuit web delete function and loads the user defined file.

Del: Deletes the circuit web.

Add: Adds the circuit web.

S2P: Loads the 2-port user defined file.

Imp Trans Sets ON/OFF of the impedance transformation function and the impedance values.

Add Circ Sets ON/OFF of the balancing circuit function and the type of balancing circuit.

C(P)-L(S)-D:
Sets the device type to parallel C - series L.

L(P)-C(S)-D:
Sets the device type to parallel L - series C.

C(S)-L(P)-D:
Sets the device type to series C - parallel L.

L(S)-C(P)-D:
Sets the device type to series L - parallel C.

C(P)-L(P)-D:
Sets the device type to parallel C - parallel L.

Cap C Sets the value of Capacitance C.

Cap G Sets the value of Capacitance G.

Ind L Sets the value of Inductance L.

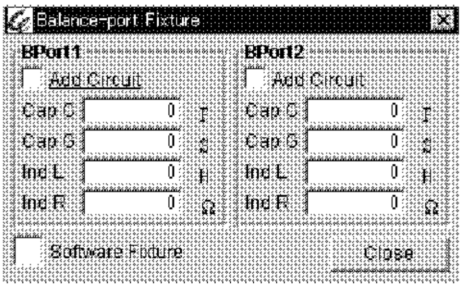
Ind R Sets the value of Inductance R.

Load File	Loads user-defined file.	
	S1P:	Loads 1-port user-defined file.
	S2P:	Loads 2-port user-defined file.

2. Balance-port Fixture dialog box

Sets the port conditions after balance transformation.

Operation of ***Fixture*** and ***Balance-port Fixture*** in the main menu displays this dialog box.

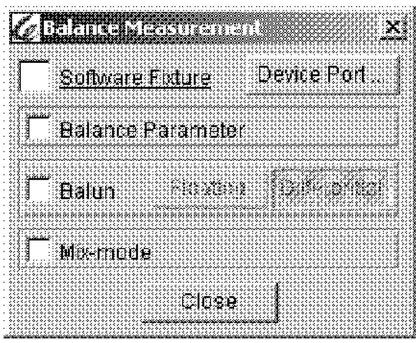


Software Fixture	Sets ON/OFF of the software fixture function.
Add Circuit	Sets ON/OFF of the balancing circuit function.
Cap C	Sets the value of Capacitance C.
Cap G	Sets the value of Capacitance G.
Ind L	Sets the value of Inductance L.
Ind R	Sets the value of Inductance R.

3. Balance Measurement dialog box

Sets the balance measurement.

Operation of ***Fixture*** and ***Balance Measurement*** in the main menu displays this dialog box.



Software Fixture	Sets ON/OFF of the software fixture function.
Device Port	Displays the Balance Device Port dialog box.
Balance Parameter	Sets the balance measurement.

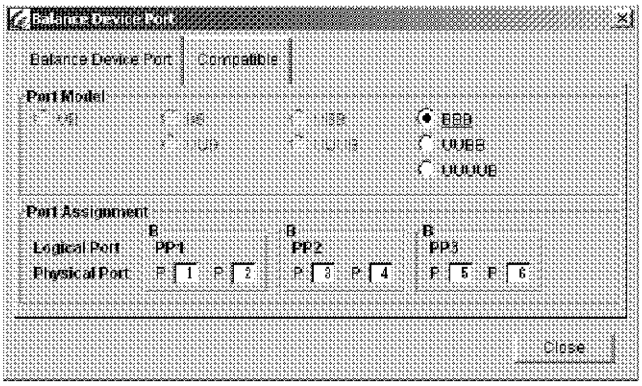
Balun	Sets the balun function. Differential: Sets the differential balun function. Floating: Sets the floating balun function.
Mix-mode	Sets the mode analysis.

4. Balance Device Port dialog box

   Sets balance measurements balance port combinations.

   Select ***Fixture*** in the main menu. Then, select ***Balance Measurement*** and ***Device Port*** to display the dialog box.

- Balance Device Port (Port Model) menu



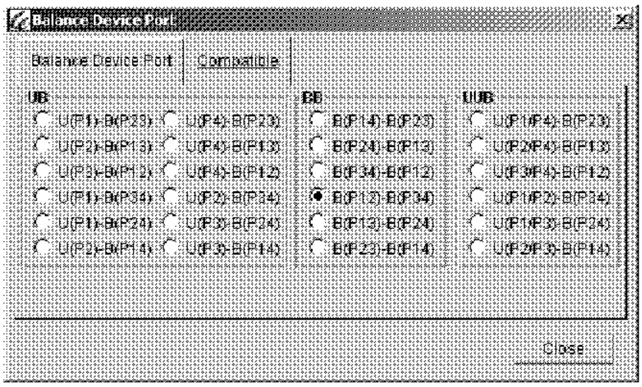
- Port Model

BBB	Select when using a 6-port device which consists of three pairs of balance ports.
UUBB	Select when using a 6-port device which consists of two unbalance ports and two pairs of balance ports.
UUUUB	Select when using a 6-port device which consists of four unbalance ports and a pair of balance port.
UBB	Select when using a 5-port device which consists of an unbalance port and two pairs of balance ports.
UUUB	Select when using a 5-port device which consists of three unbalance ports and a pair of balance port.
BB	Select when using a 4-port device (P1234) which consists of two pairs of balance ports.
UUB	Select when using a 4-port device (P1234) which consists of two unbalance ports and a pair of balance port.
UB	Select when using a 3-port device (P123) which consists of an unbalance port and a pair of balance port.

- Port Assignment

U	Input which unbalance port to select.
B	Input the port which is selected as a balance port.

- Compatible menu



U(P1)-B(P34)	Sets Port 1 to an unbalance port, and sets Ports 3 and 4 to balance ports.
U(P2)-B(P34)	Sets Port 2 to an unbalance port, and sets Ports 3 and 4 to balance ports.
U(P1)-B(P24)	Sets Port 1 to an unbalance port, and sets Ports 2 and 4 to balance ports.
U(P3)-B(P24)	Sets Port 3 to an unbalance port, and sets Ports 2 and 4 to balance ports.
U(P1)-B(P23)	Sets Port 1 to an unbalance port, and sets Ports 2 and 3 to balance ports.
U(P4)-B(P23)	Sets Port 4 to an unbalance port, and sets Ports 2 and 3 to balance ports.
U(P2)-B(P14)	Sets Port 2 to an unbalance port, and sets Ports 1 and 4 to balance ports.
U(P3)-B(P14)	Sets Port 3 to an unbalance port, and sets Ports 1 and 4 to balance ports.
U(P2)-B(P13)	Sets Port 2 to an unbalance port, and sets Ports 1 and 3 to balance ports.
U(P4)-B(P13)	Sets Port 4 to an unbalance port, and sets Ports 1 and 3 to balance ports.
U(P3)-B(P12)	Sets Port 3 to an unbalance port, and sets Ports 1 and 2 to balance ports.
U(P4)-B(P12)	Sets Port 4 to an unbalance port, and sets Ports 1 and 2 to balance ports.

B(P12)-B(P34)	Sets Ports 1 and 2 to balance port 1, and sets Ports 3 and 4 to balance port 2.
B(P13)-B(P24)	Sets Ports 1 and 3 to balance port 1, and sets Ports 2 and 4 to balance port 2.
B(P14)-B(P23)	Sets Ports 1 and 4 to balance port 1, and sets Ports 2 and 3 to balance port 2.
B(P23)-B(P14)	Sets Ports 2 and 3 to balance port 1, and sets Ports 1 and 4 to balance port 2.

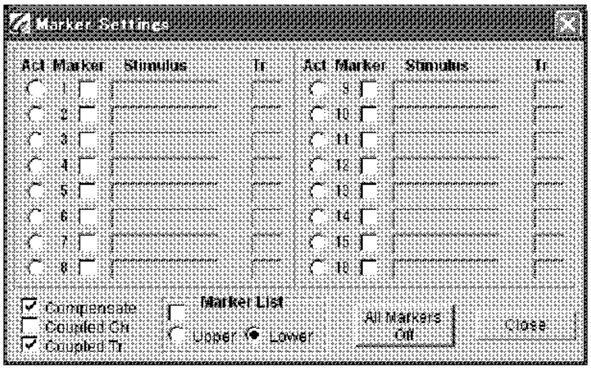
B(P24)-B(P13)	Sets Ports 2 and 4 to balance port 1, and sets Ports 1 and 3 to balance port 2.
B(P34)-B(P12)	Sets Ports 3 and 4 to balance port 1, and sets Ports 1 and 2 to balance port 2.
U(P1/P2)-B(P34)	Sets Ports 1 and 2 to unbalance ports, and sets Ports 3 and 4 to balance ports.
U(P1/P3)-B(P24)	Sets Ports 1 and 3 to unbalance ports, and sets Ports 2 and 4 to balance ports.
U(P1/P4)-B(P23)	Sets Ports 1 and 4 to unbalance ports, and sets Ports 2 and 3 to balance ports.
U(P2/P3)-B(P14)	Sets Ports 2 and 3 to unbalance ports, and sets Ports 1 and 4 to balance ports.
U(P2/P4)-B(P13)	Sets Ports 2 and 4 to unbalance ports, and sets Ports 1 and 3 to balance ports.
U(P3/P4)-B(P12)	Sets Ports 3 and 4 to unbalance ports, and sets Ports 1 and 2 to balance ports.

13.2.2.5 Marker

1. Marker Setup dialog box

   Performs the basic settings of the marker.

   Operation of ***Marker*** and ***Marker Settings*** in the main menu displays this dialog box.

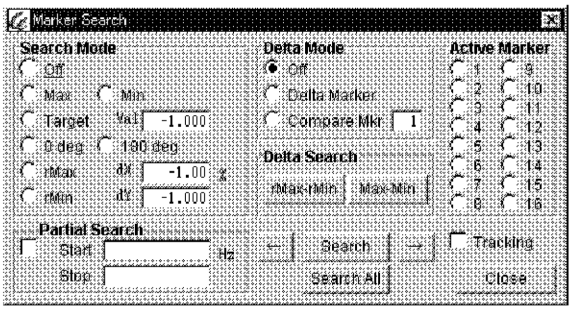


Act	Specifies the active marker. If the specified marker is not displayed, display the marker and set the marker as the active marker.
Marker	Sets the marker display to ON or OFF.
Stimulus	Sets the marker frequency.
Tr	Specifies the number of the trace in which the marker is displayed.
Marker List	Sets the marker list display to ON or OFF. The display area can be specified by either Upper or Lower.
Compensate	Sets the marker compensation function to ON or OFF. OFF: The marker can be only displayed at the measurement point. ON: The marker can be displayed in between measurement points. The marker value is found by linearly interpolating from the measurement point.
Coupled Ch	Used to set the marker coupling function between channels to ON or OFF. When selected (checked), the active marker selected at the time will be the subject for coupling.
Coupled Tr	Used to select channels to execute marker in-between traces coupling. Channels which have this function selected (checked) will have coupling functions performed between traces.
All Markers Off	Sets the all marker to OFF.

2. Marker Search dialog box

   Performs the basic settings of the delta marker.

   Operation of ***Marker*** and ***Marker Search*** in the main menu displays this dialog box.



Delta Mode

Sets the analysis mode for performing a delta analysis.

Off: Cancels the delta mode.

Delta Marker:
Sets child marker as the reference marker and finds the difference with the active marker. If the child marker is not displayed at the time the child marker is set, the child marker will be displayed. If the delta mode is set to OFF, the displayed child marker disappears. Each setting of Partial Search and Tracking of the child marker is coupled to the active marker.

Compare Mkr:
Sets Active Marker as the reference marker and finds the difference with the marker number set in Compare Mkr. Partial Search and Tracking need to be set for each active marker and Compare Mkr.

Active Marker

Sets the active marker. Set the selected marker as the active marker.

Search Mode

Sets the active marker search related settings. Each item can be set independently for every marker.

Off: Sets the search to OFF.

Max: Searches for the maximum value.

Min: Searches for the minimum value.

Target: Searches for the value specified by Val.

0 deg: Searches for the 0 deg value.

180 deg: Searches for the 180 deg value.

rMax: Searches for the ripple maximum value.

rMin: Searches for the ripple minimum value.

dX: Sets the ΔX to search for the ripple maximum value or the ripple minimum value.

dY: Sets the ΔY to search for the ripple maximum value or the ripple minimum value.

Partial Search

Sets the Partial Search mode.
Each item can be set for individual markers. Each setting of the Partial Search mode of the child marker is coupled to the active marker when the delta analysis mode is set to Delta Mode Ref=Dlt Mkr.

Partial Search:
Sets Partial Search to ON or OFF.

Start: Specifies the partial range analysis start point.

Stop: Specifies the partial range analysis stop point.

Delta Search

Sets the search mode and delta mode combined analysis. If Delta Mode is set to Compare Mkr, the analysis is performed in the Compare Mkr mode. If Delta mode is set to any other setting, the analysis is performed in the Delta Marker mode.

rMax-rMin: Finds the ripple maximum value and the ripple minimum value, and validates delta mode to find the difference of two.

Max-Min: Finds the maximum and minimum values, and validates delta mode to find the difference of two.

Search

Executes a search.

Search All:
Performs search for all markers which has a valid search mode (if not set to OFF).

Search: Performs an active marker search.

←: Searches for data to the left of the active marker.

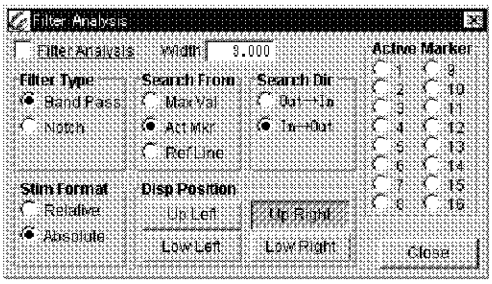
→: Searches for data to the right of the active marker.

Tracking: Sets each sweep search to ON or OFF. Each marker can be set to ON or OFF independently. The ON or OFF state of Tracking of the child marker is coupled to the active marker when the delta analysis mode is set to Delta Mode Ref =Dlt Mkr.

3. Filter Analysis dialog box

   Specifies the filter analysis settings.

   Operation of ***Marker*** and ***Filter Analysis*** in the main menu displays this dialog box.



Filter Analysis

Sets the filter analysis function to ON or OFF. Selecting the function (check the box) sets the filter analysis function to ON. Following analysis results are displayed.

C.F: The bandwidth center frequency specified in the value of level decay (XdB) from the reference point.

L.F: When displaying the absolute value, the bandwidth left side frequency is displayed.
When displaying in the relative value, the difference of the bandwidth left side frequency and center frequency is displayed.

R.F: When displaying in the absolute value, the bandwidth right side frequency is displayed.
When displaying in the relative value, the difference of the bandwidth right side frequency and center frequency is displayed.

B.W: The bandwidth is displayed.

Q: The Q factor is displayed.

S.F: The shaping factor is displayed.

For details on Filter Analysis, refer to < Filter Analysis Details>.

Width

Specifies the bandwidth to analyze in the value of level decay (dB) from the reference point.

Active Marker

Sets the active marker.

Filter Type

Specifies the filter type.

Band Pass:
Executes the band-pass filter analysis.

Notch: Executes the notch filter analysis.

For details on Filter Analysis search references, refer to <Filter analysis result examples>.

Search From

Sets the search reference point.

Max Val: Sets the maximum value as the search reference point.

Act Mkr: Sets the active marker as the search reference point.

Ref Line: Sets the reference line as the search reference point.

For details on Filter Analysis search references, refer to <Filter analysis>.

Search Dir

Specifies the search direction on the stimulus-axis.

Out → In: Analysis is performed from the outside to the search reference point.

In → Out: Analysis is performed from the search reference point to the outside.

Stim Format

Selects the bandwidth display format.

Relative: Displays the bandwidth by using the relative value from the center frequency.

Absolute: Displays the bandwidth by using the absolute value.

Disp Position

Used to specify the position to display analysis results.

Up Left: Displays results in the upper left of the screen.

Low Left: Displays results in the lower left of the screen.

Up Right: Displays results in the upper right of the screen.

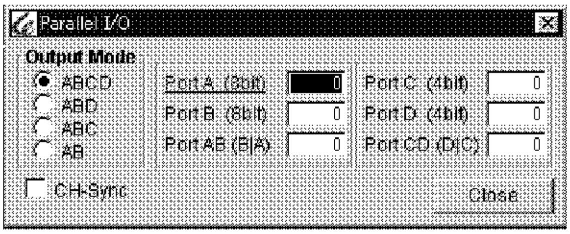
Low Right: Displays results in the lower right of the screen.

13.2.2.6 System

1. PIO dialog box

   Sets parallel I/O.

   Operation of ***System*** and ***PIO*** in the main menu displays this dialog box.

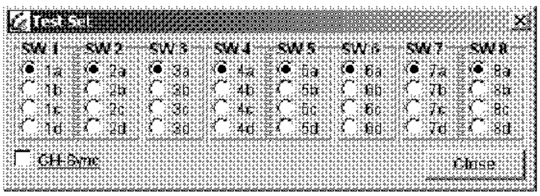


CH-Sync	Selects the channel synchronization setting. Synchronization setting outputs the set data by measured channel.
Output Mode	Sets the output mode.
	ABCD: Sets Ports A, B, C, and D to output.
	ABD: Sets Ports A, B, and D to output, and Port C to input.
	ABC: Sets Ports A, B, and C to output, and Port D to input.
	AB: Sets Ports A and B to output, and Ports C and D to input.

2. Test set dialog box

   Controls the R3969, R3970, or R3971 Test Set.

   Operation of ***System*** and ***Test Set*** in the main menu displays this dialog box.



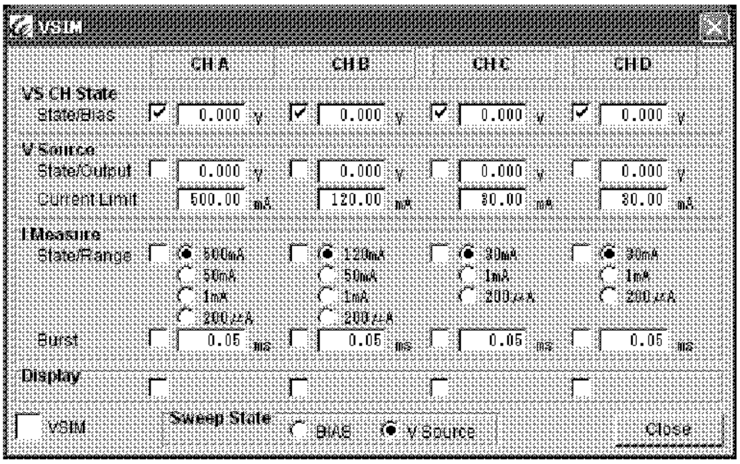
CH-Sync	Selects the channel synchronization setting. Synchronization setting toggles the set port by measured channel.
SW1 to ***SW8***	Sets all the ports of the R3969, R3970, or R3971. For more information on setting the ports, refer to the manual of each Test Set.
Port 1	Sets Port 1 of the R3968.
	1a: Sets to the Port 1a.
	2a: Sets to the Port 2a.
Port 2	Sets Port 2 of the R3968.
	2a: Sets to the Port 2a.
	2b: Sets to the Port 2b.

Port 3	Sets Port 3 of the R3968.	
	3a:	Sets to the Port 3a.
	3b:	Sets to the Port 3b.
	3c:	Sets to the Port 3c.
	3d:	Sets to the Port 3d.
Port 4	Sets Port 4 of the R3968.	
	4a:	Sets to the Port 4a.
	4b:	Sets to the Port 4b.
	4c:	Sets to the Port 4c.
	4d:	Sets to the Port 4d.

3. VSIM dialog box

   Sets the VSIM function conditions for each channel.

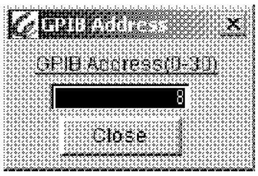
   The dialog box is displayed by selecting ***System*** and ***VSIM*** from the main menu.



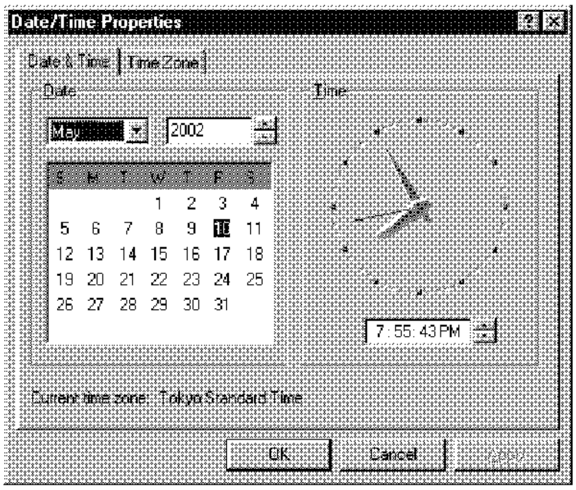
VSIM	Sets the VSIM functions to ON or OFF.
VS CH State/Bias	Sets the voltage output to ON or OFF and sets the voltage bias value.
V Source	Sets the output voltage value and its ON or OFF.
Current Limit	Sets the output current limit value.
I Measure	Sets the current measurement function to ON or OFF and the measurement range.
Burst	Sets the current burst measurement function to ON or OFF and the burst measurement time.
Display	Sets the results display to ON or OFF.
Sweep State Bias/Vsrc	Selects the voltage output during the sweep.
	Bias: Outputs the Bias voltage.
	Vsrc: Outputs the V Source voltage.

13.2.2.7 Config

1. Explorer dialog box
   Opens Explorer.
2. Tool Bar
   Sets the tool menu and side menu to ON or OFF.
3. GPIB dialog box
   Sets the GPIB address.
   Operation of ***Config*** and ***GPIB Address*** in the main menu displays this dialog box.



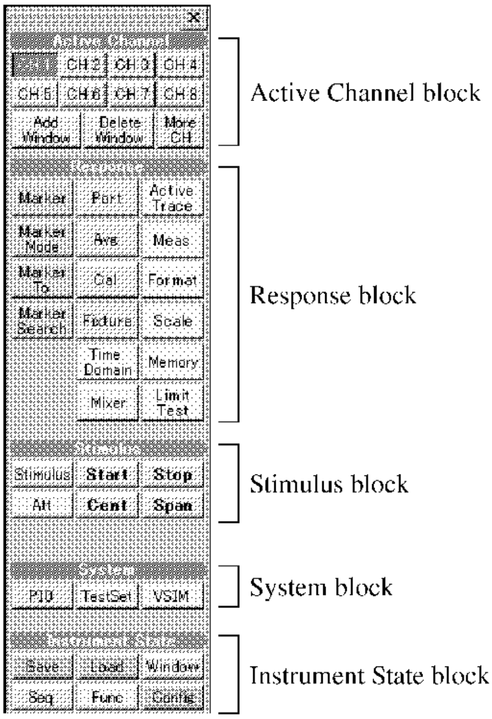
4. Network Setup dialog box
   Refer to Section A.3 "Network Settings."
5. Add Printer dialog box
   Refer to Section A.4 "Printer Installation Method."
6. Adjust Time dialog box
   Sets the time adjustment.
   Operation of ***Config*** and ***Adjust Time*** in the main menu displays this dialog box.



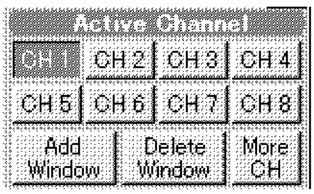
7. Version dialog box
   Displays the version information of the analyzer.
   Operation of ***Config*** and ***Version*** in the main menu displays this dialog box.
   The Version information is displayed.

13.2.3 Tool Menus

The tool menu contains the menu which directly controls this unit and the menu that displays the side menu from which controls this unit.

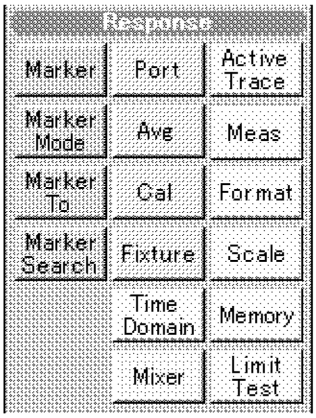


13.2.3.1 Active Channel Block



CH 1 to ***CH 8***	Sets the active channel. Select ***More CH*** to switch the active channel display into CH 9 to CH 16.
Add Window	Sets the window for the active channel.
Delete Window	Sets the window for the active channel to OFF.
More CH	Switches the active channel display. Displays the CH 1 to CH 8 and the CH 9 to CH 16 alternately.

13.2.3.2 Response Block



Port

1. Port side menu
   Sets measurement ports.

P123456	Sets 6-port measurement of Port 1, Port 2, Port 3, Port 4, Port 5, and Port 6.
P12345	Sets 5-port measurement of Port 1, Port 2, Port 3, Port 4, and Port 5.
P1234	Sets 4-port measurement of Port 1, Port 2, Port 3, and Port 4.
P123	Sets 3-port measurement of Port 1, Port 2, and Port 3.
P124	Sets 3-port measurement of Port 1, Port 2, and Port 4.
P134	Sets 3-port measurement of Port 1, Port 3, and Port 4.
P234	Sets 3-port measurement of Port 2, Port 3, and Port 4.
P12	Sets 2-port measurement of Port 1 and Port 2.
P13	Sets 2-port measurement of Port 1 and Port 3.
P14	Sets 2-port measurement of Port 1 and Port 4.
P23	Sets 2-port measurement of Port 2 and Port 3.
P24	Sets 2-port measurement of Port 2 and Port 4.
P34	Sets 2-port measurement of Port 3 and Port 4.
P1	Sets 1-port measurement of Port 1.
P2	Sets 1-port measurement of Port 2.
P3	Sets 1-port measurement of Port 3.
P4	Sets 1-port measurement of Port 4.
None	Does not execute measurement.

Active Trace

1. Active Trace side menu

Trace n	Sets the selected trace as the active trace. Select the active trace again to turn it off.
Trace Settings	Displays the Trace dialog box.

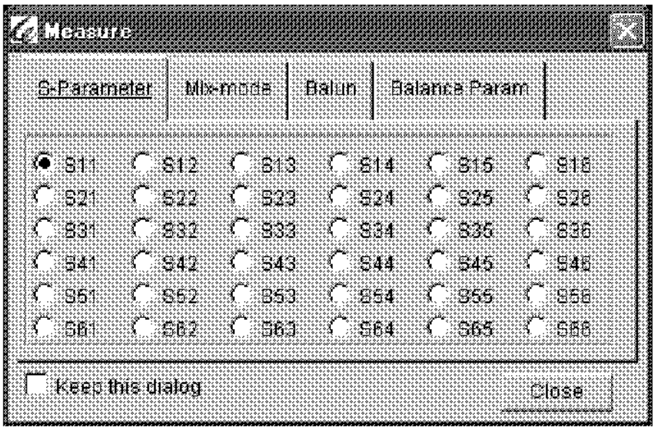
Meas

1. Measure side menu

   Sets an active trace measurement parameter.

S11 to ***S66***	Sets the S parameter.
Measure More	Displays the Measure dialog box.

2. Measure dialog box



1. S-Parameter

S11 to ***S66***	Sets the S parameter.

2. Mix-mode

Sdd11 to ***Scc33***	Sets the mixed S parameter. For more information on the mixed S parameter, refer to Section 5.7, "Mode Analysis Function."

3. Balun

SS11 to ***SS55***	Sets the S parameter after the balun setting. For more information on the balun setting, refer to Section 5.6, "Software Balun Function."

4. Balance Param

BB11 to ***BB55***, ***B12*** to ***B34***	Sets a balance parameter. For more information on the balance parameter, refer to Section 5.5, "Balance Parameter Analysis Function."
Keep this dialog	If a check mark is entered into the check box, this dialog does not close when the setting is changed.

Avg

1. Averaging side menu

Averaging ON/OFF	Sets averaging to ON or OFF.
Avg Factor	Sets the averaging factor.
Avg Restart	Restarts the averaging.
IF RBW	Displays the IF RBW menu.

2. IF RBW side menu

400kHz to ***10Hz***	Sets the IF RBW.

Format

1. Format side menu

   Sets the format of the specified trace (the active trace of the active channel).

   (1/2 page)

LogMag	Sets to the logarithmic magnitude format.
Phase	Sets to the phase format.
Delay	Sets to the group delay format.
SWR	Sets to the SWR (standing wave ratio) format.
Smith	Sets to the Smith chart (Z) format.
iSmith	Sets to the Smith chart (Y) format.
Polar	Sets to the polar coordinates format.
Conversion	Displays the Conversion menu.
Smoothing	Displays the Smoothing menu.

   (2/2 page)

LinMag	Sets to the linear magnitude format.
Real	Sets to the real number format.
Imag	Sets to the imaginary number format.
uPhase	Sets to the continuous (unwrap) phase format.
Conversion	Displays the Conversion menu.
Smoothing	Displays the Smoothing menu.

2. Conversion side menu

   Sets the parameter conversion, which converts the measured data into the impedance, admittance, and inverse S-parameter.

None	Does not convert the parameter.
Z	Converts into impedance.
Y	Converts into admittance.
1/S	Converts into inverse S-parameter.
Conv Imp	Sets the characteristic impedance in the impedance conversion and admittance conversion.

3. Smoothing side menu

Smoothing ON/OFF	Sets smoothing to ON or OFF.
Smo Aperture	Sets the smoothing aperture.
Dly Aperture	Sets the group delay aperture.

Marker

1. Marker side menu

Marker 1 to ***Marker 16***	Specifies the active marker. If the marker is not displayed, display the marker first and set to the active marker.
Active Marker Off	Sets the active marker to OFF.

Marker Mode

1. Marker Mode side menu

Mkr Stimulus	Sets the frequency of the active marker.
Marker Trace	Specifies the trace for displaying the marker.
Active Marker Off	Turns the active marker OFF.
All Markers Off	Turns all markers OFF.
Delta Mode	Displays the Delta Mode menu.
Marker Mode	Displays the Marker Mode menu.
Marker List ON/OFF	Selects Marker List ON or OFF.
Marker List Up/Low	Sets the display position of the marker list. Up: Displays at the upper left on the screen. Low: Displays at the lower left on the screen.

2. Delta Mode side menu
   Sets an analysis mode for the delta analysis.

Delta Mode Off	Cancels the delta mode.
Ref=Act Mkr	Sets Active Marker as the reference marker and finds the difference with the marker number set in Compare Marker. Partial Search and Tracking need to be set for each active marker and Compare Marker.
Ref=Dlt Mkr	Sets child marker as the reference marker and finds the difference with the active marker. If the child marker is not displayed at the time the child marker is set, the child marker will be displayed. The displayed child marker disappears by setting the delta mode to OFF or the child marker to OFF. Each setting of Partial Search and Tracking of the child marker is coupled to the active marker.
Compare Mkr	Specifies the comparison marker for when Ref=Act Mkr is set in Delta Mode. Only the displaying marker number can be set.

Child Marker ON/OFF Displays a child marker by setting a child marker to ON if the active marker is set.
Displays the child marker and sets the delta mode to Ref=Dlt Mkr if the delta mode is set to OFF.

3. Marker Mode side menu

Compensate ON/OFF Sets the marker compensation function to ON or OFF.

ON: The marker can be displayed in between measurement points. The marker value is found by linearly interpolating from the measurement point.

OFF: The marker can be only displayed at the measurement point.

Coupled CH ON/OFF Sets the marker coupling function between channels to ON or OFF.

ON: The active channel marker is the subject for coupling.

OFF: The active channel marker is not the subject for coupling.

Coupled Tr ON/OFF Sets the active channel marker coupling function between traces to ON or OFF.

ON: The active marker is the subject for coupling.

OFF: The active marker is not the subject for coupling.

Cartesian Mkr Displays the Cartesian Mkr menu.

Smith Marker Displays the Smith Marker menu.

Polar Marker Displays the Polar Marker menu.

Conversion Mkr Displays the Conversion Mkr menu.

4. Cartesian Mkr side menu

Sets the marker display format which excludes the Smith-chart and polar coordinate format.

Default Displays the format which corresponds to the Format setting.

R+jX Displays the complex impedance.

G+jB Displays the complex admittance.

5. Smith Marker side menu

Sets the Smith chart marker display format.

Lin/Phase Displays linear magnitude and phase.

Log/Phase Displays logarithmic magnitude and phase.

Real/Imag Displays complex numbers.

R+jX Displays complex impedance.

G+jB Displays complex admittance.

6. Polar Marker side menu

Sets the Polar coordinates marker display format.

Lin/Phase Displays linear magnitude and phase.

Log/Phase Displays logarithmic magnitude and phase.

Real/Imag	Displays complex numbers.

7. Conversion Mkr side menu

Sets the marker display form in the parameter conversion.

Default	Displays the format which corresponds to the Format setting.
Lin/Phase	Displays linear magnitude and phase.
Real/Imag	Displays complex numbers.

Marker To

1. Marker To side menu

Marker To Start	Changes the sweep start value of the signal source to the position of the active marker.
Marker To Stop	Changes the sweep stop value of the signal source to the position of the active marker.
Marker To Center	Changes the sweep center value of the signal source to the position of the active marker.
Delta Mkr To Span	Sets the delta marker value to the sweep span value.
Marker To Ref Value	Changes the reference line value of rectangular coordinates to the position of the active marker.
Marker to Extension	The port extension value is changed according to the frequency and phase at the active marker position.
Marker to Delay	The electrical length correction value is changed according to the frequency and phase at the active marker position.

Marker Search

1. Mkr Search side menu

Search Mode	Displays the Search Mode menu.
rMax-rMin	Finds the values of the ripple maximum value and the ripple minimum and enables the delta mode to find the difference between the two. If Delta Mode is set to Ref=Act Mkr, the analysis is performed in the Ref=Act Mkr mode. If Delta Mode is set to any other mode, the analysis is performed in the Ref=Dlt Mkr mode.
Max-Min	Finds the maximum and minimum values and enables the delta mode to find the difference between the two. If Delta Mode is set to Ref=Act Mkr, the analysis is performed in the Ref=Act Mkr mode. If Delta Mode is set to any other setting, the analysis is performed in the Ref=Dlt Mkr mode.
Search Act Marker	Performs an active marker search.
Search All Markers	Performs search for all markers in a valid search mode (not set to OFF).
Filter Analy	Displays the Filter Analysis menu.
Tracking ON/OFF	Sets each sweep search to ON or OFF. Each marker can be set to ON or OFF independently. The ON or OFF state of Tracking of the child marker is coupled to the active marker when the delta analysis mode is set to Delta Mode Ref =Dlt Mkr.

Partial Search Displays the Partial Search menu.

2. Search Mode side menu

   Sets the active marker search related settings. The settings can be specified for each marker separately.

Search Off	Sets the search to OFF.
Max Search	Searches for the maximum value. *1
Min Search	Searches for the minimum value. *1
Target Search	Displays the Target Search menu.
Ripple Search	Displays the Ripple Search menu.

*1: LogMag data is referred in the Smith or Polar Format.

3. Target Search side menu

Target	Searches for the value specified by Val. *1
0 deg	Searches for the 0 deg value. *2
180 deg	Searches for the 180 deg value. *2
Target Value	Sets the specified value (response value) used to perform a search when Target (target search mode) is selected in the Search Mode menu.
Search Left	Searches data to the left of the active marker.
Search Right	Searches data to the right of the active marker.

4. Ripple Search side menu

Ripple Max	Searches for the ripple maximum value. *1
Ripple Min	Searches for the ripple minimum value. *1
Ripple dx	Sets the ΔX to search for the ripple maximum value or the ripple minimum value. Sets a rate to the whole screen in %.
Ripple dy	Sets the ΔY to search for the ripple maximum value or the ripple minimum value.

*1: LogMag data is referred in the Smith or Polar Format.

*2: Phase data is referred in the Phase or uPhase Format.

5. Filter Analy side menu

Filter Analysis ON/OFF Sets the filter analysis function to ON or OFF.
Displays the analysis results described below by setting the function to ON.

C.F: The bandwidth center frequency specified in the value of level decay (XdB) from the reference point.

L.F: When displaying the absolute value, the bandwidth left side frequency is displayed.
When displaying in the relative value, the difference of the bandwidth left side frequency and center frequency is displayed.

R.F: When displaying in the absolute value, the bandwidth right side frequency is displayed.
When displaying in the relative value, the difference of the bandwidth right side frequency and center frequency is displayed.

B.W: The bandwidth is displayed.

Q: The Q factor is displayed.

S.F: The shaping factor is displayed.

For details on Filter Analysis, refer to < Filter Analysis Details>.

Width Value Specifies the bandwidth to analyze in the value of level decay (dB) from the reference point.

Filter Type Notch/Band Specifies the filter type.

Band: Executes the band-pass filter analysis.

Notch: Executes the notch filter analysis.

Search From Displays the Search From menu.

Display Mode Abs/Rel Selects the bandwidth display format.

Abs: Displays the bandwidth by using the absolute value.

Rel: Displays the bandwidth by using the relative value from the center frequency.

Search Dir In->Out/Out->In Specifies the search direction on the stimulus-axis.

In -> Out: Analysis is performed from the search reference point to the outside.

Out -> In: Analysis is performed from the outside to the search reference point.

Disp Position Displays the Disp Position menu.

6. Search From side menu

Max Value Sets the maximum value as the search reference point.

Active Marker Sets the active marker as the search reference point.

Reference Line Sets the reference line as the search reference point.

7. Disp Position side menu

Specifies a position to display analysis results.

Upper Left Displays the results on the upper left of the screen.

Upper Right Displays the results on the upper right of the screen.

Lower Left Displays the results on the lower left of the screen.

Lower Right Displays the results on the lower right of the screen.

8. Partial Search side menu

   Sets the Partial Search mode.

   Each marker can be set independently in the Partial Search mode.

   Each setting of the Partial Search mode of the child marker is coupled to the active marker when the delta analysis mode is set to Delta Mode Ref=Dlt Mkr.

Partial Search ON/OFF	Sets Partial Search to ON or OFF. ON: Analyzes only a specified range. OFF: Analyzes any range.
Range Start	Specifies the partial range analysis start point.
Range Stop	Specifies the partial range analysis stop point.

Cal

1. Calibration side menu

Correct ON/OFF	Selects calibration ON/OFF.
Auto Cal	Perform the Auto Calibration. Displays the Auto Cal menu when the Auto Calibration port selection is needed.
Standard Cal	Displays the Standard Cal menu.
Interpolate ON/OFF	Sets the interpolation error correction measurement to ON or OFF.
Clear Cal Data	Deletes calibration data.
Port Extension	Displays the Port Ext menu.
Elec Delay	Displays the Elec Delay menu.
Auto Cal Verify & Setup	Displays the Verify and Setup menu.

2. Auto Cal side menu

1-Port Auto Cal	Displays the Auto C1 menu.
2-Port Auto Cal	Displays the Auto C2 menu.
3-Port Auto Cal	Displays the Auto C3 menu.
4-Port Auto Cal	Perform the 4-port Auto Calibration. Displays the Auto C4 menu when the Auto Calibration port selection is needed.
Auto Cal Verify	Displays the Verify menu.
Auto Cal Setup	Displays the Cal Setup menu.
Verify Setup	Displays the Verify Setup menu.
Clear Result	Deletes the Auto Cal error results display.

3. Auto C1 side menu

P1 Auto Cal	Executes 1-port Auto Calibration for Port 1.
P2 Auto Cal	Executes 1-port Auto Calibration for Port 2.
P3 Auto Cal	Executes 1-port Auto Calibration for Port 3.

P4 Auto Cal	Executes 1-port Auto Calibration for Port 4.

4. Auto C2 side menu

P1 - P2 Auto Cal	Executes 2-port Auto Calibration for Port 1 - Port 2.
P1 - P3 Auto Cal	Executes 2-port Auto Calibration for Port 1 - Port 3.
P2 - P3 Auto Cal	Executes 2-port Auto Calibration for Port 2 - Port 3.
P1 - P4 Auto Cal	Executes 2-port Auto Calibration for Port 1 - Port 4.
P2 - P4 Auto Cal	Executes 2-port Auto Calibration for Port 2 - Port 4.
P3 - P4 Auto Cal	Executes 2-port Auto Calibration for Port 3 - Port 4.

5. Auto C3 side menu

P1 - P2 - P3	Perform the 3-port Auto Calibration. Displays the Auto C3 (P123) menu when the Auto Calibration port selection is needed.
P1 - P2 - P4	Perform the 3-port Auto Calibration. Displays the Auto C3 (P124) menu when the Auto Calibration port selection is needed.
P1 - P3 - P4	Perform the 3-port Auto Calibration. Displays the Auto C3 (P134) menu when the Auto Calibration port selection is needed.
P2 - P3 - P4	Perform the 3-port Auto Calibration. Displays the Auto C3 (P234) menu when the Auto Calibration port selection is needed.

6. Auto C3(P123) side menu (Displayed only when the 2 Port Auto Calibration Kit is connected.)

Acquire P1 - P2	Acquires the correction coefficients of Port 1 - Port 2.
Acquire P1 - P3	Acquires the correction coefficients of Port 1 - Port 3.
Acquire P2 - P3	Acquires the correction coefficients of Port 2 - Port 3.
Done	Executes P123 3-port Auto Calibration.

7. Auto C3(P124) side menu (Displayed only when the 2 Port Auto Calibration Kit is connected.)

Acquire P1 - P2	Acquires the correction coefficients of Port 1 - Port 2.
Acquire P1 - P4	Acquires the correction coefficients of Port 1 - Port 4.
Acquire P2 - P4	Acquires the correction coefficients of Port 2 - Port 4.
Done	Executes P124 3-port Auto Calibration.

8. Auto C3(P134) side menu (Displayed only when the 2 Port Auto Calibration Kit is connected.)

Acquire P1 - P3	Acquires the correction coefficients of Port 1 - Port 3.
Acquire P1 - P4	Acquires the correction coefficients of Port 1 - Port 4.
Acquire P3 - P4	Acquires the correction coefficients of Port 3 - Port 4.
Done	Executes P134 3-port Auto Calibration.

9. Auto C3(P234) side menu (Displayed only when the 2 Port Auto Calibration Kit is connected.)

Acquire P2 - P3	Acquires the correction coefficients of Port 2 - Port 3.
Acquire P2 - P4	Acquires the correction coefficients of Port 2 - Port 4.

Acquire P3 - P4	Acquires the correction coefficients of Port 3 - Port 4.
Done	Executes P234 3-port Auto Calibration.

10. Auto C4 side menu (Displayed only when the 2 Port Auto Calibration Kit is connected.)

Acquire P1 - P2	Acquires the correction coefficients of Port 1 - Port 2.
Acquire P1 - P4	Acquires the correction coefficients of Port 1 - Port 4.
Acquire P1 - P3	Acquires the correction coefficients of Port 1 - Port 3.
Acquire P2 - P3	Acquires the correction coefficients of Port 2 - Port 3.
Done	Executes 4-port Auto Calibration.

11. Standard Cal side menu

Normalize Open/Thru	Executes Open or Thru normalize.
Normalize Short	Executes Short normalize.
Full 1-Port Cal	Displays the C1 menu.
Full 2-Port Cal	Displays the C2 menu.
Full 3-Port Cal	Displays the C3 menu.
Full 4-Port Cal	Displays the C4 menu.
Full 5-Port Cal	Displays the C5 menu.
Full 6-Port Cal	Displays the C6 menu.
Cal Kit	Displays the Cal Kit dialog box.

12. C1 side menu

Port 1	Displays the C1(P1) menu of Port 1.
Port 2	Displays the C1(P2) menu of Port 2.
Port 3	Displays the C1(P3) menu of Port 3.
Port 4	Displays the C4(P4) menu of Port 4.

13. C1(Pn) side menu

Port n Open	Acquires the Open correction coefficients of Port n.
Port n Short	Acquires the Short correction coefficients of Port n.
Port n Load	Acquires the Load correction coefficients of Port n.
Done	Executes 1-Port Cal.

NOTE: "n" indicates a port number.

14. C2 side menu

P1 - P2	Displays the C2(P12) menu of Port 1 - Port 2.
P1 - P3	Displays the C2(P13) menu of Port 1 - Port 3.
P2 - P3	Displays the C2(P23) menu of Port 2 - Port 3.
P1 - P4	Displays the C2(P14) menu of Port 1 - Port 4.
P2 - P4	Displays the C2(P24) menu of Port 2 - Port 4.

P3 - P4	Displays the C2(P34) menu of Port 3 - Port 4.

15. C2(Pnm) side menu
    (Page 1 of 2)

Port n Open	Acquires the Open correction coefficients of Port n.
Port n Short	Acquires the Short correction coefficients of Port n.
Port n Load	Acquires the Load correction coefficients of Port n.
Port m Open	Acquires the Open correction coefficients of Port m.
Port m Short	Acquires the Short correction coefficients of Port m.
Port m Load	Acquires the Load correction coefficients of Port m.
Done	Executes 2-Port Cal.

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Pn - Pm Thru	Acquires the Thru correction coefficients of Port n - Port m.
Pn - Pm Isolation	Acquires the Isolation correction coefficients of Port n - Port m.
Omit Isolation	Omits isolation coefficients.
Done	Executes 2-Port Cal.

NOTE: "n" and "m" indicate port numbers.

16. C3 side menu

P1 - P2 - P3	Displays the C3(P123) menu of Port 1 - Port 2 - Port 3.
P1 - P2 - P4	Displays the C3(P124) menu of Port 1 - Port 2 - Port 4.
P1 - P3 - P4	Displays the C3(P134) menu of Port 1 - Port 3 - Port 4.
P2 - P3 - P4	Displays the C3(P234) menu of Port 2 - Port 3 - Port 4.

17. C3(Pnmj) side menu
    (Page 1 of 3)

Port n Open	Acquires the Open correction coefficients of Port n.
Port n Short	Acquires the Short correction coefficients of Port n.
Port n Load	Acquires the Load correction coefficients of Port n.
Port m Open	Acquires the Open correction coefficients of Port m.
Port m Short	Acquires the Short correction coefficients of Port m.
Port m Load	Acquires the Load correction coefficients of Port m.
Done	Executes 3-Port Cal.

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Port j Open	Acquires the Open correction coefficients of Port j.
Port j Short	Acquires the Short correction coefficients of Port j.
Port j Load	Acquires the Load correction coefficients of Port j.
Pn - Pm Thru	Acquires the Thru correction coefficients of Port n - Port m.

Pn - Pj Thru	Acquires the Thru correction coefficients of Port n - Port j.
Pm - Pj Thru	Acquires the Thru correction coefficients of Port m - Port j.
Omit Isolation	Omits isolation coefficients.
Done	Executes 3-Port Cal.

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Pn - Pm Isolation	Acquires the Isolation correction coefficients of Port n - Port m.
Pn - Pj Isolation	Acquires the Isolation correction coefficients of Port n - Port j.
Pm - Pj Isolation	Acquires the Isolation correction coefficients of Port m - Port j.
Omit Isolation	Omits isolation coefficients.
Done	Executes 3-Port Cal.

NOTE: "n", "m" and "j" indicate port numbers.

18. C4 side menu
(Page 1 of 4)

Port 1 Open	Acquires the Open correction coefficients of Port 1.
Port 1 Short	Acquires the Short correction coefficients of Port 1.
Port 1 Load	Acquires the Load correction coefficients of Port 1.
Port 2 Open	Acquires the Open correction coefficients of Port 2.
Port 2 Short	Acquires the Short correction coefficients of Port 2.
Port 2 Load	Acquires the Load correction coefficients of Port 2.
Done	Executes 4-Port Cal.

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Port 3 Open	Acquires the Open correction coefficients of Port 3.
Port 3 Short	Acquires the Short correction coefficients of Port 3.
Port 3 Load	Acquires the Load correction coefficients of Port 3.
Port 4 Open	Acquires the Open correction coefficients of Port 4.
Port 4 Short	Acquires the Short correction coefficients of Port 4.
Port 4 Load	Acquires the Load correction coefficients of Port 4.
Done	Executes 4-Port Cal.

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P1 - P2 Thru	Acquires the Thru correction coefficients of Port 1 - Port 2.
P2 - P3 Thru	Acquires the Thru correction coefficients of Port 2 - Port 3.
P1 - P3 Thru	Acquires the Thru correction coefficients of Port 1 - Port 3.
P1 - P4 Thru	Acquires the Thru correction coefficients of Port 1 - Port 4.
Omit Isolation	Omits isolation coefficients.
Done	Executes 4-Port Cal.

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P1 - P2 Isolation	Acquires the Isolation correction coefficients of Port 1 - Port 2.
P1 - P3 Isolation	Acquires the Isolation correction coefficients of Port 1 - Port 3.
P1 - P4 Isolation	Acquires the Isolation correction coefficients of Port 1 - Port 4.
P2 - P4 Isolation	Acquires the Isolation correction coefficients of Port 2 - Port 4.
P2 - P3 Isolation	Acquires the Isolation correction coefficients of Port 2 - Port 3.
P3 - P4 Isolation	Acquires the Isolation correction coefficients of Port 3 - Port 4.
Omit Isolation	Omits isolation coefficients.
Done	Executes 4-Port Cal.

19. C5 side menu

(Page 1 of 4)

Port 1 Open	Acquires the Open correction coefficients of Port 1.
Port 1 Short	Acquires the Short correction coefficients of Port 1.
Port 1 Load	Acquires the Load correction coefficients of Port 1.
Port 2 Open	Acquires the Open correction coefficients of Port 2.
Port 2 Short	Acquires the Short correction coefficients of Port 2.
Port 2 Load	Acquires the Load correction coefficients of Port 2.
Done	Executes 5-Port Cal.

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Port 3 Open	Acquires the Open correction coefficients of Port 3.
Port 3 Short	Acquires the Short correction coefficients of Port 3.
Port 3 Load	Acquires the Load correction coefficients of Port 3.
Port 4 Open	Acquires the Open correction coefficients of Port 4.
Port 4 Short	Acquires the Short correction coefficients of Port 4.
Port 4 Load	Acquires the Load correction coefficients of Port 4.
Done	Executes 5-Port Cal.

(Page 3 of 4)

Port 5 Open	Acquires the Open correction coefficients of Port 5.
Port 5 Short	Acquires the Short correction coefficients of Port 5.
Port 5 Load	Acquires the Load correction coefficients of Port 5.
Done	Executes 5-Port Cal.

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P1 - P4 Thru	Acquires the Thru correction coefficients of Port 1 - Port 4.
P1 - P3 Thru	Acquires the Thru correction coefficients of Port 1 - Port 3.
P1 - P2 Thru	Acquires the Thru correction coefficients of Port 1 - Port 2.
P2 - P5 Thru	Acquires the Thru correction coefficients of Port 2 - Port 5.

P2 - P3 Thru	Acquires the Thru correction coefficients of Port 2 - Port 3.
Omit Isolation	Omits isolation coefficients.
Done	Executes 5-Port Cal.

20. C6 side menu

(Page 1 of 4)

Port 1 Open	Acquires the Open correction coefficients of Port 1.
Port 1 Short	Acquires the Short correction coefficients of Port 1.
Port 1 Load	Acquires the Load correction coefficients of Port 1.
Port 2 Open	Acquires the Open correction coefficients of Port 2.
Port 2 Short	Acquires the Short correction coefficients of Port 2.
Port 2 Load	Acquires the Load correction coefficients of Port 2.
Done	Executes 6-Port Cal.

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Port 3 Open	Acquires the Open correction coefficients of Port 3.
Port 3 Short	Acquires the Short correction coefficients of Port 3.
Port 3 Load	Acquires the Load correction coefficients of Port 3.
Port 4 Open	Acquires the Open correction coefficients of Port 4.
Port 4 Short	Acquires the Short correction coefficients of Port 4.
Port 4 Load	Acquires the Load correction coefficients of Port 4.
Done	Executes 6-Port Cal.

(Page 3 of 4)

Port 5 Open	Acquires the Open correction coefficients of Port 5.
Port 5 Short	Acquires the Short correction coefficients of Port 5.
Port 5 Load	Acquires the Load correction coefficients of Port 5.
Port 6 Open	Acquires the Open correction coefficients of Port 6.
Port 6 Short	Acquires the Short correction coefficients of Port 6.
Port 6 Load	Acquires the Load correction coefficients of Port 6.
Done	Executes 6-Port Cal.

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P1 - P4 Thru	Acquires the Thru correction coefficients of Port 1 - Port 4.
P1 - P3 Thru	Acquires the Thru correction coefficients of Port 1 - Port 3.
P1 - P2 Thru	Acquires the Thru correction coefficients of Port 1 - Port 2.
P2 - P5 Thru	Acquires the Thru correction coefficients of Port 2 - Port 5.
P2 - P3 Thru	Acquires the Thru correction coefficients of Port 2 - Port 3.
P3 - P6 Thru	Acquires the Thru correction coefficients of Port 3 - Port 6.
Omit Isolation	Omits isolation coefficients.
Done	Executes 6-Port Cal.

21. Port Extension side menu

Port Extension ON/OFF	Sets the port extension function to ON or OFF.
Ext Port 1	Sets the port 1 extension value in time.
Ext Port 2	Sets the port 2 extension value in time.
Ext Port 3	Sets the port 3 extension value in time.
Ext Port 4	Sets the port 4 extension value in time.
Ext Port 5	Sets the port 5 extension value in time.
Ext Port 6	Sets the port 6 extension value in time.
Marker to Extension	The port extension value is changed according to the frequency and phase at the active marker position.

22. Elec Delay side menu

Elec Delay ON/OFF	Sets the electrical delay correction function to ON or OFF.
Delay Time	Sets the electrical delay correction value in time.
Delay Length	Sets the electrical delay correction value in distance.
Vel Factor	Sets the velocity factor value.
Phase Offset ON/OFF	Sets the phase offset function to ON or OFF.
Phase Offset	Sets the phase offset value.
Marker to Delay	The electrical length correction value is changed according to the frequency and phase at the active marker position.

23. Verify/Setup side menu

Auto Cal Verify	Displays the Verify menu.
Auto Cal Setup	Displays the Cal Setup menu.
Verify Setup	Displays the Verify Setup menu.
Clear Result	Deletes the Auto Cal error results display.

24. Auto Cal Verify side menu

Verify 1-Port	Displays the Verify 1-Port menu.
Verify 2-Port	Displays the Verify 2-Port menu.
Verify 3-Port	Displays the Verify 3-Port menu.
Verify 4-Port	Displays the Verify 4-Port menu.
Clear Result	Deletes the verification results display.

25. Verify C1 side menu

Verify P1	Executes verification of Port 1.
Verify P2	Executes verification of Port 2.
Verify P3	Executes verification of Port 3.
Verify P4	Executes verification of Port 4.
Clear Result	Deletes the verification results display.

26. Verify C2 side menu

Verify P1-P2	Executes verification of Ports 1 and 2.
Verify P1-P4	Executes verification of Ports 1 and 4.
Verify P1-P3	Executes verification of Ports 1 and 3.
Verify P2-P3	Executes verification of Ports 2 and 3.
Verify P2-P4	Executes verification of Ports 2 and 4.
Verify P3-P4	Executes verification of Ports 3 and 4.
Clear Result	Deletes the verification results display.

27. Verify C3 side menu (Displayed only when the 2 Port Auto Calibration Kit is connected.)

Verify P1-P2	Executes verification of Ports 1 and 2.
Verify P1-P4	Executes verification of Ports 1 and 4.
Verify P1-P3	Executes verification of Ports 1 and 3.
Verify P2-P3	Executes verification of Ports 2 and 3.
Verify P2-P4	Executes verification of Ports 2 and 4.
Verify P3-P4	Executes verification of Ports 3 and 4.
Clear Result	Deletes the verification results display.

28. Verify C4 side menu (Displayed only when the 2 Port Auto Calibration Kit is connected.)

Verify P1-P2	Executes verification of Ports 1 and 2.
Verify P1-P4	Executes verification of Ports 1 and 4.
Verify P1-P3	Executes verification of Ports 1 and 3.
Verify P2-P3	Executes verification of Ports 2 and 3.
Clear Result	Deletes the verification results display.

29. Cal Setup side menu

Avg Factor Auto/Spec — Selects an averaging factor setting mode.

Auto: Executes averaging for the same number of measurements in 0.2 seconds. Averaging is not executed if a sweep takes 0.2 seconds or more.

Spec: Executes averaging for the number set in Avg Factor.

Avg Factor — Sets averaging factor for calibration execution.

Port Check RBW — Displays the Port Check RBW menu, which sets RBW used when connections are checked in Auto Calibration.

Load Cal Data — Transfers the auto calibration kit ID and reference data to the analyzer. Overwrites the data if the reference data with the same ID is already saved in the analyzer.

NOTE: ***The auto calibration kit stores the ID (identification number) and reference data in the embedded memory. When executing the calibration, the ID and reference data is read and stored in the memory of the analyzer. If the reference data is already stored in the memory, read the ID and then compare it with the saved reference data ID. If the two IDs match, the reference data is not transferred. This saves the transfer time of the reference data.***
The ID and reference data, which are stored in the backup memory, are not erased if the power is turned OFF or the initialization command "SYSTem:PRESet" is executed.
The reference data of the auto calibration kit is used either to calculate calibration data or as the reference data of the verification.

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30. Port Check RBW side menu

400kHz to ***10Hz*** — Sets RBW used when connections are checked in Auto Calibration.

31. Verify Setup side menu

Result ON/OFF — Selects how the verification results are displayed.

ON: Always displays the results regardless of the verification results.

OFF: Displays the results only when the verification results exceed acceptable values.

Span Auto/Spec — Selects a setting mode of the specified range.

Auto: Sets a ±10% of the center frequency.

Spec: Sets a value by selecting ***1st Freq*** or ***2nd Freq***.

1st Freq — Sets the first frequency in the specified range.

2nd Freq — Sets the second frequency in the specified range.

Judge Range All/Part — Selects a judgement range.

All: Selects the entire measurement range for the judgement.

Part: Selects only the specified range for the judgement.

LogMag Limit — Sets the magnitude limit.

Phase Limit — Sets the phase limit.

Scale

1. Scale side menu

Auto Scale — Executes automatic setting of the scale.

/Div — Sets the graduated scale of rectangular coordinates.

Ref Val/Full — Sets the reference line of rectangular coordinates or the scale value of polar coordinates.

Ref Position	Sets the reference line position of rectangular coordinates.
Ref Line ON/OFF	Sets ON/OFF of the reference line of rectangular coordinates.

Fixture

1. Soft Fixture side menu

Soft Fixture ON/OFF	Selects ON/OFF of the software fixture function.
Port Extension	Displays the Port Ext menu.
Delete Circuit	Displays the Delete Circuit menu.
Imp Trans	Displays the Imp Trans menu.
Add Circuit	Displays the Add Circuit menu.
Balance Meas	Displays the Balance Meas menu.
Add Balance Ckt	Displays the Balance Ckt menu.

2. Port Extension side menu

Port Extension ON/OFF	Selects ON/OFF of the port extension function.
Ext Port 1	Sets the port extension function of Port 1.
Ext Port 2	Sets the port extension function of Port 2.
Ext Port 3	Sets the port extension function of Port 3.
Ext Port 4	Sets the port extension function of Port 4.
Ext Port 5	Sets the port extension function of Port 5.
Ext Port 6	Sets the port extension function of Port 6.
Marker to Extension	The port extension value is changed according to the frequency and phase at the active marker position.

3. Delete Circuit side menu

Del Ckt Port1 Off/Del/Add	Selects the Port 1 circuit web Off, Del or Add function.
Del Ckt Port2 Off/Del/Add	Selects the Port 2 circuit web Off, Del or Add function.
Del Ckt Port3 Off/Del/Add	Selects the Port 3 circuit web Off, Del or Add function.
Del Ckt Port4 Off/Del/Add	Selects the Port 4 circuit web Off, Del or Add function.
Del Ckt Port5 Off/Del/Add	Selects the Port 5 circuit web Off, Del or Add function.
Del Ckt Port6 Off/Del/Add	Selects the Port 6 circuit web Off, Del or Add function.
Hyper Port Ext	Sets the function which deletes the path from the measurement (CAL) point to the device on the jig.
Load File Port1 s2p	Loads the circuit web user-defined file of Port 1.
Load File Port2 s2p	Loads the circuit web user-defined file of Port 2.
Load File Port3 s2p	Loads the circuit web user-defined file of Port 3.
Load File Port4 s2p	Loads the circuit web user-defined file of Port 4.
Load File Port5 s2p	Loads the circuit web user-defined file of Port 5.
Load File Port6 s2p	Loads the circuit web user-defined file of Port 6.

4. Hyper Port Ext side menu

Open	Acquires the Open measured data at all measurement ports.
Short	Acquires the Short measured data at all measurement ports.
Done	Creates the s2p circuit based on the acquired results and applies it as the Delete Circuit to all measurement ports.
Save s2p File	Displays the Save S2P File side menu.

5. Save S2P File side menu

Save File Port1 s2p	Saves the created S2P circuit for Port1 in a file.
Save File Port2 s2p	Saves the created S2P circuit for Port2 in a file.
Save File Port3 s2p	Saves the created S2P circuit for Port3 in a file.
Save File Port4 s2p	Saves the created S2P circuit for Port4 in a file.
Save File Port5 s2p	Saves the created S2P circuit for Port5 in a file.
Save File Port6 s2p	Saves the created S2P circuit for Port6 in a file.

6. Imp Trans side menu

Imp Trans ON/OFF	Selects ON/OFF of the impedance transformation function.
Port1 Imp	Sets the impedance of Port 1.
Port2 Imp	Sets the impedance of Port 2.
Port3 Imp	Sets the impedance of Port 3.
Port4 Imp	Sets the impedance of Port 4.
Port5 Imp	Sets the impedance of Port 5.
Port6 Imp	Sets the impedance of Port 6.

7. Add Circuit side menu

Add Ckt Port n ON/OFF	Selects ON/OFF of the balancing circuit function for Port n.
Port n Ckt Type	Displays the P n Ckt Type menu.
Port n Cap C	Sets the value of C.
Port n Cap G	Sets the value of G.
Port n Ind L	Sets the value of L.
Port n Ind R	Sets the value of R.

NOTE: ***"n" indicates a port number.***

8. P n Ckt Type side menu

C(P)-L(S)-D	Sets the device type to parallel C - series L.
L(P)-C(S)-D	Sets the device type to parallel L - series C.
C(S)-L(P)-D	Sets the device type to series C - parallel L.
L(S)-C(P)-D	Sets the device type to series L - parallel C.
C(P)-L(P)-D	Sets the device type to parallel C - parallel L.

User	Sets to the user-defined file.
Load File Port n s1p	Loads the 1-port circuit web user-defined file of Port n.
Load File Port n s2p	Loads the 2-port circuit web user-defined file of Port n.

NOTE: "n" indicates a port number.

9. Balance Meas side menu

Balance Param ON/OFF	Selects ON/OFF of the Balance parameter function.
Balun ON/OFF	Selects ON/OFF of the balun function.
Balun Type Float/Diff	Selects floating balun/differential balun.
Mix-mode ON/OFF	Sets the mode analysis.
Device Port	Displays the Device Port dialog box.

10. Add Balance Ckt side menu

Add Ckt BPort n ON/OFF	Selects ON/OFF of the balancing circuit function for Balance-Port n. C(P)-L(P)-D: Sets the device type to parallel C - parallel L.
BPort n Cap C	Sets the value of C.
BPort n Cap G	Sets the value of G.
BPort n Ind L	Sets the value of L.
BPort n Ind R	Sets the value of R.
Del S4P Bport n Off/Del/Add	Selects the connection of the matching circuit (s4p) which corresponds to balance port n.
Load File Bport n s4p	Loads the matching circuit file (s4p) which corresponds to balance port n.

Limit Test

1. Limit Test side menu

Limit Test ON/OFF	Sets the limit test function to ON or OFF.
Limit Line ON/OFF	Sets the limit line display to ON or OFF.
Edit Limit Line	Displays the Limit Line Editor dialog box.
Judge Trace	Displays the Judge Trace menu.
Stim Offset	Sets the stimulus (frequency) offset value.
Resp Offset	Sets the response (measured value) offset value.
Polar Mag/Phase	LinMag and Phase can be set as limit lines when the polar coordinate is displayed (when the Polar and Smith Format are set). Mag: Sets the LinMag data limit line when the polar coordinate is displayed. The limit line is expressed with a concentric circle.

Phase: Sets the Phase data limit line when the polar coordinate is displayed. The limit line is expressed with a sector form.

Beep — Set the beep in the limit test.

Result Window ON/OFF — Sets the limit test result window display to ON or OFF.

2. Beep side menu

OFF — Does not beep in the limit test.

FAIL — Beeps at the FAIL judgment in the limit test.

PASS — Beeps at the PASS judgment in the limit test.

Tone — Adjusts the beep tone. (0 to 7)

Duration — Sets the beep duration.

3. Judge Trace side menu

Trace n ON/OFF — Sets whether or not to perform the limit test for each trace.

ON: Performs the limit test.

OFF: Not performs the limit test.
The trace is handled as Pass.

NOTE: "n" indicates a trace number.

Memory

1. Memory side menu

Disp Data ON/OFF — Sets the trace display to ON or OFF.

Disp Mem ON/OFF — Sets the trace memory waveform display to ON or OFF.

Data to Mem — Copies specified trace data to trace memory.

Trace Math off — Sets four basic mathematical calculations between trace data and trace memory data to OFF. The Trace Math cannot be set if the trace memory has no data.

Trace Math Data/Mem — Divides the trace data by the trace memory data, and displays the result as trace data.

Trace Math Data-Mem — Subtracts the trace memory data from the trace data, and displays the result as trace data.

Trace Math Data*Mem — Multiplies the trace data and trace memory data, and displays the result as trace data.

Trace Math Data+Mem — Adds the trace data and trace memory data, and displays the result as trace data.

Time Domain

1. Time Domain side menu

Transform ON/OFF — Sets the Time Domain display to ON or OFF.

Transform Mode — Displays the Trans Mode menu.

Transform Stimulus — Displays the Trans Stim menu.

Transform Window	Displays the Trans Window menu.
Gate ON/OFF	Sets the gate function to ON or OFF.
Gate Start	Sets the gate start time.
Gate Stop	Sets the gate stop time.
Gate Shape	Display the Gate Shape menu.

2. Transform Mode side menu

Band Pass	Sets the band pass transformation mode.
Low Pass Impulse	Sets the low pass impulse transformation mode.
Low Pass Step	Sets the low pass step transformation mode.
Set Frequency Low Pass	Sets the frequency range which meets the low pass mode restriction.

3. Transform Stimulus side menu

Time	The time axis type is displayed by the time.
Distance	The time axis type is displayed by the distance.
Reflection Time	The time axis type is displayed by the time in the reflection measurement.
Reflection Distance	The time axis type is displayed by the distance in the reflection measurement.
Vel Factor	Sets the velocity factor value.

4. Transform Window side menu

Minimum	Sets the Rectangular shape.
Normal	Sets the 2-term Hamming shape.
Wide	Sets the 3-term Blackman/Harris shape.
Maximum	Sets the 4-term Blackman/Harris shape.

5. Gate Shape side menu

Minimum	Sets the Rectangular shape.
Normal	Sets the 2-term Hamming shape.
Wide	Sets the 3-term Blackman/Harris shape.
Maximum	Sets the 4-term Blackman/Harris shape.

Mixer

1. Mixer side menu

Mixer Meas ON/OFF	Sets the mixer measurement to ON or OFF.
Mixer Port	Displays the Mixer Port menu.
Mixer Sweep	Displays the Mixer Sweep menu.
Mixer Meas	Displays the Mixer Meas menu.
Mixer Cal	Displays the Mixer Cal menu.

2. Mixer Port side menu

MP12	Sets Ports 1 and 2 as mixer measurement ports.
MP13	Sets Ports 1 to 3 as mixer measurement ports.
MP14	Sets Ports 1 to 4 as mixer measurement ports.
MP23	Sets Ports 2 and 3 as mixer measurement ports.
MP24	Sets Ports 2 to 4 as mixer measurement ports.
MP34	Sets Ports 3 and 4 as mixer measurement ports.

3. Mixer Sweep side menu

Sweep Mode	Displays the Sweep Mode menu.
IF Freq	Displays the IF Freq menu.
Fixed Freq	Sets the fixed frequency.
Sweep Start	Sets the sweep start frequency.
Sweep Stop	Sets the sweep stop frequency.
Sweep Point	Sets the point number.
Sweep Time	Sets the sweep time.
IF RBW	Displays the IF RBW menu.

4. Sweep Mode side menu

RF=Sweep/LO=Auto/IF=Fixed
Sets the RF Port, LO Port, and IF Port sweep modes.

RF=Sweep/LO=Fixed/IF=Auto
Sets the RF Port, LO Port, and IF Port sweep modes.

RF=Fixed/LO=Auto/IF=Sweep
Sets the RF Port, LO Port, and IF Port sweep modes.

RF=Fixed/LO=Sweep/IF=Auto
Sets the RF Port, LO Port, and IF Port sweep modes.

RF=Auto/LO=Fixed/IF=Sweep
Sets the RF Port, LO Port, and IF Port sweep modes.

RF=Auto/LO=Sweep/IF=Fixed
Sets the RF Port, LO Port, and IF Port sweep modes.

5. IF Freq side menu

IF=RF+LO	Sets the IF frequency equal to the RF frequency plus (+) the LO frequency.
IF=RF-LO	Sets the IF frequency equal to the RF frequency minus (-) the LO frequency.
IF=LO-RF	Sets the IF frequency equal to the LO frequency minus (-) the RF frequency.

6. IF RBW side menu

400kHz to ***10Hz***	Sets the IF RBW.

7. Mixer Meas side menu

M11 to ***M44***	Sets the M parameter.

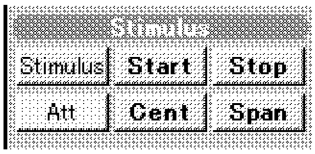
8. Mixer Cal side menu

Correct ON/OFF	Sets the Mixer Cal to ON or OFF.
Standard Cal	Displays the Mixer Cal (Standard Cal) menu.
Auto Cal	Acquires the Mixer Cal (Auto Cal).
Done Mixer Cal	Executes the Mixer Cal.

9. Mixer Cal (Standard Cal) side menu

RF Port Open	Acquires the RF Port open correction coefficients.
RF Port Short	Acquires the RF Port short correction coefficients.
RF Port Load	Acquires the RF Port load correction coefficients.
IF Port Open	Acquires the IF Port open correction coefficients.
IF Port Short	Acquires the IF Port short correction coefficients.
IF Port Load	Acquires the IF Port load correction coefficients.
Thru	Acquires the through correction coefficients between RF Port and IF Port.
Save Standard Cal	Saves the Standard Cal correction coefficients.

13.2.3.3 Stimulus Block



Start	Sets the start frequency.
Stop	Sets the stop frequency.
Cent	Sets the center frequency.
Span	Sets the span frequency.
Stimulus	

1. Stimulus side menu

Sweep Time	Sets the sweep time.
Sweep Type	Displays the Sweep Type menu.
Sweep Trigger	Displays the Sweep Trigger menu.
Meas Point	Sets the number of measurement points.
Output Power	Sets the output power.
CW Freq	Sets the CW frequency during power sweep.
Multi Frequency	Displays the Multi Frequency dialog box. (For more information, refer to page 13-28.)

2. Sweep Type side menu

Lin Freq	Sets the linear frequency sweep.
Log Freq	Sets the log frequency sweep.
Power	Sets the power sweep.
Program Sweep Freq	Sets the program sweep (the frequency and the number of points).
Program Sweep All	Sets the program sweep (all items).
Edit Program Sweep	Displays the Edit Program Sweep dialog box.

3. Sweep Trigger side menu

Continuous	Performs continuous measurement.
Single	Performs a single measurement.
Hold	Stops the measurement.
Trig Source Internal	Sets the trigger source to the internal trigger.
Trig Source External	Sets the trigger source to the external trigger.
Trig Source Bus	*TRG and GET are used as the trigger.
Trig Source Hold	Suspends the detection.
Trigger Delay	Sets the trigger delay time.

Att

1. Att(Src1) side menu (Output power expansion)
   (ATT is available only when the optional feature is stored.)
   Sets the first signal source built-in attenuator.
   (Page 1 of 2)

Output Power	Sets output power.
Att Mode Auto/Fix*	Selects an attenuator operating mode. Auto or Manual can be specified for each channel. Auto: Switches all port attenuators automatically according to the output power setting. Fix: Manually sets attenuator values for each port.
Port 1 Att*	Sets the attenuator value for port 1 of the first signal source.
Port 2 Att*	Sets the attenuator value for port 2 of the first signal source.
Port 3 Att*	Sets the attenuator value for port 3 of the first signal source.
Port 4 Att*	Sets the attenuator value for port 4 of the first signal source.
Port 5 Att*	Sets the attenuator value for port 5 of the first signal source.
Port 6 Att*	Sets the attenuator value for port 6 of the first signal source.
Att CH-Sync ON/OFF*	Sets the attenuator-channel synchronization setting to ON or OFF. ON: Switches the attenuator setting according to sweep channels. OFF: Sets the channel 1 attenuator setting to all channels.

*: The setting can be specified only in an 8-GHz type analyzer. (The attenuator value cannot be set for each port in a 20-GHz type analyzer.)

Att(Src2) (Page 2 of 2)

Sets the second signal source built-in attenuator.

Output Power Sets output power.

Att Mode Auto/Fix* Selects an attenuator operating mode. Auto or Manual can be specified for each channel.

Auto: Switches all port attenuators automatically according to the output power setting.

Fix: Manually sets attenuator values for each port.

2nd SG Att* Sets the second signal source attenuator value.

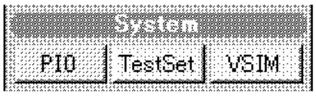
Att CH-Sync ON/OFF* Sets the attenuator-channel synchronization setting to ON or OFF.

ON: Switches the attenuator setting according to sweep channels.

OFF: Sets the channel 1 attenuator setting to all channels.

*: The setting can be specified only in an 8-GHz type analyzer. (The attenuator value cannot be set for each port in a 20-GHz type analyzer.)

13.2.3.4 System Block



PIO

1. PIO side menu

Sets the parallel I/O.

Output Mode Displays the Output Mode menu which sets the I/O port mode.

Port A Sets the output data of Port A.

Port B Sets the output data of Port B.

Port AB Sets the output data of Port AB.

Port C Sets the output data of Port C.

Port D Sets the output data of Port D.

Port CD Sets the output data of Port CD.

CH-Sync ON/OFF Selects the channel synchronization setting to ON or OFF. When the setting is ON, each channel is set individually. When the setting is OFF, all channels are set to the same.

2. Output Mode side menu

Port ABCD	Sets Ports A, B, C, and D as output ports.
Port ABD	Sets Ports A, B, and D as output ports, and Port C as an input port.
Port ABC	Sets Ports A, B, and C as output ports, and Port D as an input port.
Port AB	Sets Ports A and B as output ports, and Port C and D as input ports.

Test Set (The Test Set is available only when the optional feature is connected.)

1. Test Set side menu

- When the R3968 + 11(+13) Test Set is connected.

Port 1 1a/2a	Sets the R3968 Port 1. Selected by toggling 1a and 2a.
Port 2 2a/2b	Sets the R3968 Port 2. Selected by toggling 2a and 2b.
Port 3 3a/3b/3c/3d	Sets the R3968 Port 3. Selected by toggling 3a, 3b, 3c, and 3d.
Port 4 4a/4b/4c/4d	Sets the R3968 Port 4. Selected by toggling 4a, 4b, 4c, and 4d.
CH-Sync ON/OFF	Selects the channel synchronization setting to ON or OFF. When the setting is ON, each channel is set individually. When the setting is OFF, all channels are set to the same.

- When the test set, except for R3968 + 11(+13), is connected.

SW1 1a/1b/1c/1d	Sets switch 1 of the test set. Selected by toggling 1a, 1b, 1c, and 1d.
SW2 2a/2b/2c/2d	Sets switch 2 of the test set. Selected by toggling 2a, 2b, 2c, and 2d.
SW3 3a/3b/3c/3d	Sets switch 3 of the test set. Selected by toggling 3a, 3b, 3c, and 3d.
SW4 4a/4b/4c/4d	Sets switch 4 of the test set. Selected by toggling 4a, 4b, 4c, and 4d.
SW5 5a/5b/5c/5d	Sets switch 5 of the test set. Selected by toggling 5a, 5b, 5c, and 5d.
SW6 6a/6b/6c/6d	Sets switch 6 of the test set. Selected by toggling 6a, 6b, 6c, and 6d.
SW7 7a/7b/7c/7d	Sets switch 7 of the test set. Selected by toggling 7a, 7b, 7c, and 7d.
SW8 8a/8b/8c/8d	Sets switch 8 of the test set. Selected by toggling 8a, 8b, 8c, and 8d.
CH-Sync ON/OFF	Selects the channel synchronization setting to ON or OFF. When the setting is ON, each channel is set individually. When the setting is OFF, all channels are set to the same.

VSIM (VSIM is available only when the optional feature is stored.)

1. VSIM side menu

   Sets the device power source (VSIM).

VSIM ON/OFF	Sets the VSIM function to ON or OFF.
VS CH State	Displays the VS CH State side menu which sets each VSIM chan-

nel state.

V Source	Displays the V Source side menu which sets the output voltage.
I Measure	Displays the I Measure side menu which sets the current measurement.
Display	Displays the Display side menu which sets the current measurement result display to ON or OFF.

2. VS CH State side menu

CH A ON/OFF	Sets CH A to ON or OFF.
CH B ON/OFF	Sets CH B to ON or OFF.
CH C ON/OFF	Sets CH C to ON or OFF.
CH D ON/OFF	Sets CH D to ON or OFF.
CH A Bias	Sets the CH A bias value.
CH B Bias	Sets the CH B bias value.
CH C Bias	Sets the CH C bias value.
CH D Bias	Sets the CH D bias value.

3. V Source side menu

(Page 1 of 4: CH A setting)

V Source ON/OFF	Switches the output of the voltage which is set by Output to ON or OFF.
Output	Sets the output voltage of CH A.
Current Limit	Sets the current limit value of CH A.

(Page 2 of 4: CH B setting)

V Source ON/OFF	Switches the output of the voltage which is set by Output to ON or OFF.
Output	Sets the output voltage of CH B.
Current Limit	Sets the current limit value of CH B.

(Page 3 of 4: CH C setting)

V Source ON/OFF	Switches the output of the voltage which is set by Output to ON or OFF.
Output	Sets the output voltage of CH C.
Current Limit	Sets the current limit value of CH C.

(Page 4 of 4: CH D setting)

V Source ON/OFF	Switches the output of the voltage which is set by Output to ON or OFF.
Output	Sets the output voltage of CH D.
Current Limit	Sets the current limit value of CH D.

4. I Measure side menu

(Page 1 of 4: CH A setting)

I Measure ON/OFF	Sets the current measurement of CH A to ON or OFF.

500mA	Sets the current measurement range of CH A to 500 mA.
50mA	Sets the current measurement range of CH A to 50 mA.
1mA	Sets the current measurement range of CH A to 1 mA.
200μA	Sets the current measurement range of CH A to 200 μA.
Burst Mode ON/OFF	Sets the burst mode to ON or OFF.
Burst Time	Sets the burst time.

(Page 2 of 4: CH B setting)

I Measure ON/OFF	Sets the current measurement of CH B to ON or OFF.
120mA	Sets the current measurement range of CH B to 120 mA.
50mA	Sets the current measurement range of CH B to 50 mA.
1mA	Sets the current measurement range of CH B to 1 mA.
200μA	Sets the current measurement range of CH B to 200 μA.
Burst Mode ON/OFF	Sets the burst mode to ON or OFF.
Burst Time	Sets the burst time.

(Page 3 of 4: CH C setting)

I Measure ON/OFF	Sets the current measurement of CH C to ON or OFF.
30mA	Sets the current measurement range of CH C to 30 mA.
1mA	Sets the current measurement range of CH C to 1 mA.
200μA	Sets the current measurement range of CH C to 200 μA.
Burst Mode ON/OFF	Sets the burst mode to ON or OFF.
Burst Time	Sets the burst time.

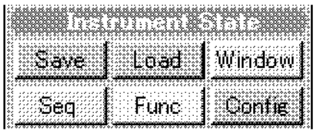
(Page 4 of 4: CH D setting)

I Measure ON/OFF	Sets the current measurement of CH D to ON or OFF.
30mA	Sets the current measurement range of CH D to 30 mA.
1mA	Sets the current measurement range of CH D to 1 mA.
200μA	Sets the current measurement range of CH D to 200 μA.
Burst Mode ON/OFF	Sets the burst mode to ON or OFF.
Burst Time	Sets the burst time.

5. Display side menu

CH A ON/OFF	Sets the current measurement result display of CH A to ON or OFF.
CH B ON/OFF	Sets the current measurement result display of CH B to ON or OFF.
CH C ON/OFF	Sets the current measurement result display of CH C to ON or OFF.
CH D ON/OFF	Sets the current measurement result display of CH D to ON or OFF.

13.2.3.5 Instrument State Block



Save

1. Save side menu

   Saves the analyzer's setting conditions to a file.

Save Settings	Displays the Save settings dialog box.
Define Save Option	Displays the Save Option menu.
Delete File	Displays the Delete file dialog box.
Save S-Parameter	Displays the Save S-Parameter dialog box.
Save Trace	Displays the Save Trace dialog box.
Save Image	Displays the Save image dialog box.

2. Save Option side menu

   Sets the contents to be saved when saving the setting conditions.

Cal Data ON/OFF	Sets the calibration data saving to ON or OFF. Saves the calibration data when ON is selected.
Raw Data ON/OFF	Sets the raw measurement data saving to ON or OFF. Saves the raw measurement data when ON is selected. Executing Load automatically stops the sweep.
Trace Data ON/OFF	Sets the pre-formatted trace data saving to ON or OFF. Saves the pre-formatted trace data when ON is selected. Executing Load automatically stops the sweep.
Trace Mem ON/OFF	Sets the trace memory saving to ON or OFF. Saves the trace memory when ON is selected.

Load — Displays the Load dialog box. Loads and opens the analyzer's setting conditions file.

Seq

1. Sequence side menu

Sequence Act CH/All CH	Sets the sequence of the measured channel.
	Act CH: Measures only the active channel.
	All CH: Measures all channels which are set to ON by the Sequence Channel.
Sequence Channel	Displays the Sequence CH side menu which sets the measurement sequence to ON or OFF.
Window Zoom Act CH/All CH	Sets the measurement sequence when the window is zoomed in on.
	Act CH: Measures only the active channel.
	All CH: Measures all channels which are set to ON by the Sequence Channel.

2. Sequence CH side menu

CH n ON/OFF	Sets the measurement sequence of CH n to ON or OFF.

NOTE: ***n indicates the channel numbers.***

Window

1. Window Setup side menu

Screen Layout	Displays the Scrn Layout menu.
Display Mode	Displays the Display Mode menu.
Window List	Displays the Wind List menu.
Window Label	Displays the Softkeyboard used to set window titles. Each title is displayed at the top of each window.
Status Label	Displays the Softkeyboard used to set a status title. Each title is displayed at the bottom of the screen.
Window Label ON/OFF	Sets the window title display to ON or OFF.
	ON: Displays the set window title.
	OFF: Displays no window title.
Trace Annotation ON/OFF	Sets the trace annotation display to ON or OFF.
Stimulus Annotation ON/OFF	Sets the stimulus annotation display to ON or OFF.

2. Scrn Layout side menu

Full	Uses the entire screen as the windows display.
Upper	Uses the upper half of the screen as the windows display.
Lower	Uses the lower half of the screen as the windows display.
Left	Uses the left half of the screen as the windows display.
Right	Uses the right half of the screen as the windows display.
Upper Left	Uses the upper left quarter as the windows display.
Lower Left	Uses the lower left quarter as the windows display.
Upper Right	Uses the upper right quarter as the windows display.
Lower Right	Uses the lower right quarter as the windows display.

3. Display Mode side menu

Disp Mode All Window(Split)	Displays all the measurement channels, for which measurement ports are set, in multiple windows.
Disp Mode All Window(Overlay)	Displays all the measurement channels, for which measurement ports are set, in overlaid windows.
Disp Mode Active Window	Displays only the measurement channel displayed in the active window.
Disp Mode Active CH	Displays only the active measurement channel.
Split Mode Standard	Displays all windows evenly. The Column and Size % settings are ignored.
Split Mode Horizontal	Splits the display horizontally into the number of windows specified in Column.
Split Mode Vertical	Splits the display vertically into the number of windows specified in Column.
Window Size	Displays the Wind Size menu.

4. Wind Size side menu (Available in both Split Mode Horizontal and Split Mode Vertical)

Row n Col	Specifies the number of windows aligned in the nth row.
Row n Size %	Specifies the nth row display size.

5. Wind List side menu

Window N n	Displays the channel numbers displayed on Window N. Click to set to the active window. Click the active window to OFF the window.

Func	Displays the installed application software. Click to execute the application software.

Config

1. Config menu

Color Setting	Displays the Color Setting menu.
GPIB Setting	Displays the GPIB Setting menu.
Network Setting	Displays the Network Setting menu.
Service Menu	Displays the service menu.

CAUTION: ***Only the service personnel can operate.***

2. Color Setting menu

Standard	Sets to the standard color.
Grayscale	Sets to the gray scale.
Monochrome	Sets to the monochrome color.
Negative	Sets to the inversion color.
Load Color File	Loads the color file.
Restore Default	Sets to the default.
Save Color File	Saves the color file.
Save As Default	Sets the displayed colors as the default.

3. GPIB Setting menu

GPIB Address	Sets the GPIB Address.

4. Network Setting menu

Network Setup	Sets the network. For more information, refer to A.3 "Network Settings."
Disconnect Network	Disconnects the network.

14. REMOTE PROGRAMMING

14.1 GPIB Command Index

Use this GPIB Command Index as an index for Section 14.7 Command Reference.

1. Common Commands

2. R3860A Command

14.2 GPIB Remote Programming

The network analyzer is equipped with a GPIB (General-Purpose Interface Bus) as standard, which complies with IEEE standards 488.1-1987 and 488.2-1987 and can be remotely controlled by means of an external controller.

The following describes the method of control using the GPIB remote control functions.

14.2.1 GPIB

The GPIB is a high-performance interface bus used to connect the measuring instruments to the computer.

The operations of the GPIB are defined by IEEE standard 488.1-1987. Since the GPIB has a bus-configured interface, it can specify a device by assigning a specific address to each device. Up to 15 devices can be connected in parallel to a single bus. GPIB devices have one or more of the following functions:

- Talker

  The talker is a device which is specified to send data to the bus. Only one active talker can exist on the GPIB bus.

- Listener

  The listener is a device which is specified to receive data from the bus. Multiple active listeners can exist on the GPIB bus.

- Controller

  The controller is a device which specifies the talker and listener. Only one active controller can operate on the GPIB bus. Controllers which control IFC and REN messages are called "system controllers".

  The GPIB bus can have only one system controller on it. If there are multiple controllers on the bus, the system controller becomes the active controller, while other devices which have a control function operate as addressable devices when the system is started up.

  The TCT (Take Control) interface message is used to set a controller other than the system controller as the active controller. After setting, the system controller will become the non-active controller.

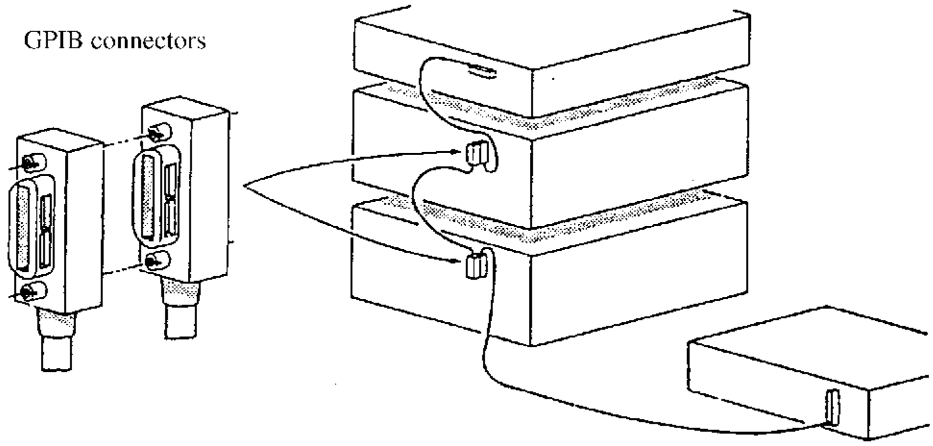
  The controller controls the entire system by sending interface messages or device messages to each measuring instrument. The functions of the messages are:

  - Interface message: Control of the GPIB bus
  - Device message: Control of the measuring instrument

14.2.2 GPIB Setup

1. Connecting GPIB

   The following shows the standard GPIB connector. Secure the GPIB connector with the two screws to prevent it from coming loose during use.



The following precautions should be observed when using the GPIB interface:

- The total GPIB cable length in a single bus system should not exceed n × 2 meters, where n = the number of devices to be connected, including the GPIB controller. In no case should the cable length exceed 20 meters.
- Up to 15 devices can be connected to a single bus system.
- There are no restrictions concerning the method of connection between cables. However, no more than three GPIB connectors should be connected to a single device, since the use of excessive force could damage the connector mounting.

  For example, the total cable length in a system with five devices should be 10 meters or less (2 meters × 5 devices = 10 meters).The total cable length can be distributed freely within the range of the maximum allowed cable length. However, if more than ten devices are to be connected, some of them should be connected using cables of less than 2 meters so that the total cable length does not exceed 20 meters.
- Connect the GPIB cable to the GP-IB 1 connector on the rear panel of the unit.

2. Setting GPIB address

   GPIB addresses can be set in the GPIB Address dialog box, which is accessed by selecting GPIB Address in the Config menu.

14.3 GPIB Bus Functions

14.3.1 GPIB Interface Functions

Code	Description
SH1	With source handshake function
AH1	With acceptor handshake function
T6	Basic talker function, serial polling function, listener-specified talker cancel function
TE0	Without extended talker function
L4	Basic listener function, talker-specified listener cancel function
LE0	Without extended listener function
SR1	With service request function
RL1	Remote function, local function, local lockout function
PP0	Without parallel polling function
DC1	Device clear function
DT1	Device trigger function
C1	System controller function
C2	IFC transmission, controller in charge function
C3	REN transmission function
C4	SRQ response function
C12	Transmission of interface messages, control transfer function
E1	Using open-collector bus driver

14.3.2 Responses to Interface Messages

The responses of the analyzer to interface messages are defined by IEEE standards 488.1-1987 and 488.2-1987 and are described in this section.

For information on how to send interface messages to the analyzer, refer to the instruction manual of the controller to be used.

14.3.2.1 Interface Clear (IFC)

The IFC message is transmitted directly to the analyzer through a signal line. The message allows the analyzer to stop the operation of the GPIB bus. Although all input/output operation is stopped, the input/output buffer is not cleared. Note that the DCL is used to clear the buffer.

14.3.2.2 Remote Enable (REN)

The REN message is transmitted directly to the analyzer through a signal line. If the analyzer is specified as a listener when the message is true, the analyzer is in the remote mode. The analyzer remains in the remote mode until the GTL message is received, or the REN becomes false, or the LOCAL key is pressed.

When the analyzer is in the local mode, it ignores all the received data. When the analyzer is in the remote mode, it ignores all key inputting other than LOCAL key inputting. When the analyzer is in the LOCAL LOCKOUT mode (LLO; see section 14.3.2.8), it ignores all key inputting.

14.3.2.3 Serial Polling Enable (SPE)

When the analyzer receives a message from external devices, it is in the serial polling mode. If the analyzer is specified as a talker in this mode, it sends status bytes instead of normal messages. The analyzer remains in the serial polling mode until the SPD (Serial Polling Disable) message or the IFC message is received.

When the analyzer sends an SRQ (Service Request) message to the controller, bit 6 (RQS bit) of the response data is set to 1 (true). When the analyzer has finished sending this message, the RQS bit reverts to 0 (false). The SRQ (Service Request) message is sent directly through a signal line.

14.3.2.4 Group Execute Trigger (GET)

If the following conditions are satisfied when this message triggers the analyzer, the analyzer will start the measuring operation.

- The trigger source becomes the GPIB bus (TRIG: SOUR BUS).
- The analyzer is in the trigger waiting state (see "14.6 Trigger System").

The GET operates in the same manner as the *TRG but differently from TRIG:IMM and TRIG:SIG. The GET, *TRG, TRIG:IMM and TRIG:SIG are stacked in the input buffer and executed in order of reception.

14.3.2.5 Device Clear (DCL)

When the analyzer receives the DCL message, it performs the following:

- Clearing of the input and output buffers
- Resetting of syntax (program) analysis, execution control and response data generation
- Cancellation of all commands that prevent the remote command from being executed next
- Cancellation of commands that are paused to wait for other parameters
- Cancellation of *OPC and *OPC?

It does not perform the following:

- Changing of data set or stored in the analyzer
- interruption of the front panel operation
- Modification or interruption of analyzer operations being executed
- Changing of status bytes other than MAV. (MAV becomes 0 when the output buffer is cleared.)

14.3.2.6 Selected Device Clear (SDC)

The SDC message operates in the same manner as the DCL message. However, it is executed only when the analyzer is as a listener.In other cases, it is ignored.

14.3.2.7 Go To Local (GTL)

The GTL message places the analyzer in the local mode. In the local mode, all the operations on the front panel are available.

14.3.2.8 Local Lockout (LLO)

The LLO message places the analyzer in the local lockout mode. If the analyzer is set to the remote mode in this mode, all the operations on the front panel will be inhibited. (Note that in the normal remote mode, front panel operations can be performed using the LOCAL key.)

The following three methods can be used to set the analyzer to the local mode from the local lockout mode:

- Sending a GTL message to the analyzer
- Setting the REN message to false (In this case, the local lockout mode will be canceled.)
- Switching on the analyzer power again

14.3.3 Message Exchange Protocol

The analyzer receives program messages from controllers or other devices through the GPIB bus and generates response data. The program messages include commands, queries (commands used to query response data) and data. The procedure used to exchange these commands, queries and data is explained in this section.

14.3.3.1 GPIB Buffers

The analyzer is equipped with the following three buffers:

- Input buffer
  The input buffer is used to store data temporarily for command analysis (1024 bytes).
  Either of the following two methods can be used to clear the input buffer:
  - Switching on the analyzer power
  - Execution of the DCL or the SDC
- Output buffer
  The output buffer is used to store data which are to be read from the controller (1024 bytes).
  Either of the following two methods can be used to clear the output buffer:
  - witching on the analyzer power
  - Execution of the DCL or the SDC
- Error queue
  The error queue is available only for IEEE488.2-1987 command mode. It is used to store up to ten error messages for remote commands. Each time an error occurs during remote command analysis or in execution, an error message is stored in the queue. The SYST:ERR command is used to read out these messages. When a message is read out, it is removed from the queue.
  Either of the following two methods can be used to clear the error queue:
  - Switching on the analyzer power
  - Execution of the *CLS

14.3.3.2 IEEE488.2-1987 Command Mode

IEEE488.2-1987 command mode performs the sending and receiving of messages in accordance with the message exchange protocol in compliance with IEEE standard 488.2-1987.

The following are the most important events when another controller or device receives messages from the analyzer in this mode:

- Response data are generated when a query is received.
- Data are generated in the order of query execution.

Parser

The parser receives command messages in the order of reception from the input buffer, analyzes the syntax and determines what the received command is to execute.

The parser traces the tree structure of the commands when analyzing the command program. It memorizes which part of the tree structure is to be used to start analysis when analyzing the next command. This information is returned to the head of the structure when the parser is cleared.

Any of the following four methods can be used to clear the parser:

- Switching on the analyzer power
- Reception of the DCL or the SDC
- Reception of ":" following ";"
- Reception of the terminator or the EOI signal

Generating response data

When the parser executes a query, the analyzer generates data in the output buffer in response to it (that is, to output data a query must be sent immediately before the data). The procedure implies that unless the controller reads out the data generated through the query, the data will never be cleared.

Apart from the controller read operation, there are two conditions under which the data are cleared. A query error will occur under the following conditions:

- Unterminated condition

  When the controller has read the response data without terminating (LF code of ASCII or END message of GPIB) or sending the query
- Interrupted condition:

  When the controller has received the next program message before reading the response data

14.4 Command Syntax

14.4.1 IEEE488.2-1987 Command Mode

For characters input in IEEE488.2-1987 command mode other than character string data and block data, no distinction is made between upper case and lower case.

14.4.1.1 Command Syntax

The command syntax is defined by the following format:

Header	→	Space (space character)	⇒	data

NOTE: *"⇒ " indicates repetition.*

1. Header

   The header has a hierarchical structure consisting of multiple mnemonics separated by a colon. A four-character (or three-character) "short form" is provided for each mnemonic consisting of four characters or more. (Mnemonics which are not abbreviated are called "long forms".) It is possible to use any form in any combination.

   Any command with a header followed immediately by "?" becomes a query command.

2. Space (space character)

   One space or more is required in this field; otherwise, a syntax error will occur.

3. Data

   When the command requires multiple data, the data should be separated with commas. A space may be inserted before or after the each comma.

   For details of data types, refer to "14.4.1.2 Data Formats".

4. Writing multiple commands

   In IEEE488.2-1987 command mode, it is possible to write multiple commands by separating them with semicolons.If commands are written in this way, they should be executed while changing the current path in the hierarchical structure of the header.

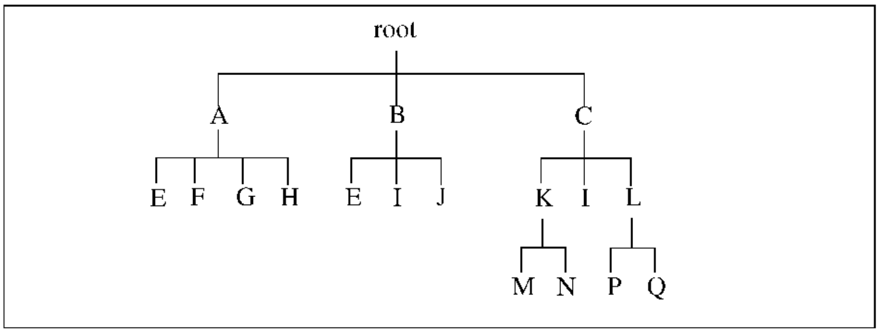
5. Changing the current path

   The current path should be changed in accordance with the following rules:

   - Switching on: The current path is set to "root".
   - Terminator: The current path is set to "root".
   - Colon (:): The current path is changed to the layer immediately below in the command tree. If the colon is at the beginning of the command, the current path will be changed to "root".
   - Semicolon (;): The current path is not changed.
   - Common command:
     The command can be executed regardless of the current path position. When the

*RST command is executed, the current path is set to "root". (See the example below.)

The following header structure is given as an example:



In this example, the current path is changed as follows:

1. :A:E;:B:E

   Since the colon in the second command changes the current path to "root", commands "A:E" and "B:E" are both valid.

2. :A:E<END> B:E

   Since <END> (terminator) changes the current path to "root", commands "A:E" and "B:E" are both valid.

3. :A:E;F;G;H

   Since the semicolon does not change the current path, ":A:E;F;G;H" results in the four commands "A:E", "A:F", "A:G" and "A:H".

4. :C:I;K:N;M

   Since the colon changes the current path, "K:N" is viewed from the ":C:" layer. Therefore, "K:N" results in "C:K:N". At the same time, since "K:N" includes a colon, the current path is changed to ":C:K:" and the last "M" is interpreted as "C:K:M".

5. :A:E;*ESR 16

   Since the common command is independent of the current path, "*ESR 16" will be executed correctly.

6. :A:E;*ESR 16;F;G;H

   Since the common command does not change the current path, the third item, "F", will be searched for using the current path ":A:" set by the first item ":A:E". Therefore, "F", "G" and "H" result in "A:F", "A:G" and "A:H", respectively.

The following examples show syntax errors.

1. :A:E;B:E

   Since "A:E" changes the current path to ":A:", "B:E" will be searched for in the layer of ":A:". However, because the mnemonic "B" is not found, an error will occur.

2. :C:K:M;L:P

   Since ":C:K:M" changes the current path to ":C:K:", "L:P" will be searched for in the layer of ":C:K:". However, because the mnemonic "L" is not found, an error will occur.

14.4.1.2 Data Formats

In IEEE488.2-1987 command mode, the analyzer uses the data formats for data input/output shown in this section.

1. Numeric data

   There are three numeric data formats, any of which can be used for numeric data input. (The data are rounded up or down in accordance with the data format to be input.)

   Some commands add the units to the data at data inputting. For information on units, refer to 5 below.

   The following shows the format of the character data.

   - Integer type: NR1 format

     [Sign] → Number ⇒

   - Fixed-point type: NR2 format

     [Sign] → Number ⇒ . → Number ⇒

   - Floating-point type: NR3 format

     [Sign] → Number ⇒ . → Number ⇒ E or e

     → Sign → Number ⇒

NOTE: " ⇒ " indicates repetition. Signs at the beginning may be omitted.

2. Character data

   Alphabetic character → Alphanumeric character or _ ⇒

NOTE: "⇒ " indicates repetition.

3. Character string data

   There are two character string data formats.

   " → Character/ " " ⇒ "

   ' → Character/ ' ' ⇒ '

   Each format can be used as an ASCII 7-bit code character in the character string data.

NOTE: In character string data starting with ["], ["] must be represented by [""]. In character string data starting with ['], ['] must be represented by [’’]. "⇒" indicates repetition.

When the response data are character string data, character string data starting with |"| should be output.

4. Block data

There are two block data formats. Either can be used for inputting into the analyzer.

Fixed-length format: $\boxed{\#} \rightarrow \boxed{\text{Number}} \rightarrow \boxed{\text{Number}} \Rightarrow \boxed{\text{DATA}} \Rightarrow$

Undefined-length format: $\boxed{\#} \rightarrow \boxed{0} \rightarrow \boxed{\text{DATA}} \Rightarrow \boxed{\text{LF\^{}EOI}}$

NOTE: "⇒" indicates repetition.

In the fixed-length format, the one-digit number following "#" represents the number of digits for the bytes in the data following that number. “0” cannot be used, because it indicates the undefined-length format.

Example: Block data #3128 <data byte>
"3" following "#" represents the number of digits in the character string (128) following "3", while "128" represents the number of bytes in <data byte> following that number.

5. Units

Units are the suffix following a numeric value. The suffix can be used as a prefix for the unit. The table below lists the suffixes and the units which can be used.

<table>
<tr><th colspan="2">Suffixes</th><th>Unit</th><th>Usable command example</th></tr>
<tr><td rowspan="7">1E18
1E15
1E12
1E9
1E6
1E3
1E-3
1E-6
1E-9
1E-12
1E-15
1E-18</td><td rowspan="7">EX
PE
T
G
MA
K
M *
U
N
P
F
A</td><td>Hz</td><td>[SENSe:]BANDwidth[:RESolution]
[SOURce:]FREQuency:CENTer
[SOURce:]FREQuency:CW
[SOURce:]FREQuency:SPAN
[SOURce:]FREQuency:STARt
[SOURce:]FREQuency:STOP
[SOURce:]PSWeep:FREQuency</td></tr>
<tr><td>DEG</td><td>[SENSe:]CORRection:OFFSet:PHASe</td></tr>
<tr><td>DB</td><td>MARKer:FANalysis:WIDTh</td></tr>
<tr><td>DBM</td><td>[SOURce:]POWer[:LEVel][:AMPLitude]
[SOURce:]POWer:STARt
[SOURce:]POWer:STOP</td></tr>
<tr><td>M</td><td>[SENSe:]CORRection:EDELay:DISTance</td></tr>
<tr><td>S</td><td>CALCulate:TRANsform:SFIXture:DEVice:TIME
[SENSe:]CORRection:CKIT:DEFine:STANdard:ODELay
[SENSe:]CORRection:CKIT:DEFine:STANdard:SDELay
[SENSe:]CORRection:CKIT:DEFine:STANdard:LDELay
[SENSe:]CORRection:CKIT:DEFine:STANdard:TFDelay
[SENSe:]CORRection:CKIT:DEFine:STANdard:TRDelay
[SOURce:]SWEep:TIME
TRIGger[:SEQuence]:DELay</td></tr>
<tr><td>OHM</td><td>[SENSe:]CORRection:CKIT:DEFine:STANdard:OIMPedance
[SENSe:]CORRection:CKIT:DEFine:STANdard:SIMPedance
[SENSe:]CORRection:CKIT:DEFine:STANdard:LIMPedance
[SENSe:]CORRection:CKIT:DEFine:STANdard:TFIMpedance
[SENSe:]CORRection:CKIT:DEFine:STANdard:TRIMpedance
CALCurate:TRANsform:SFIXture:DEVice:IMPedance
CALCurate:TRANsform:SFIXture:DEVice:RINDuctance
CALCurate:TRANsform:SFIXture:BALance:RINDuctance</td></tr>
</table>

NOTE: For commands not listed in the table, only the suffix can be used.

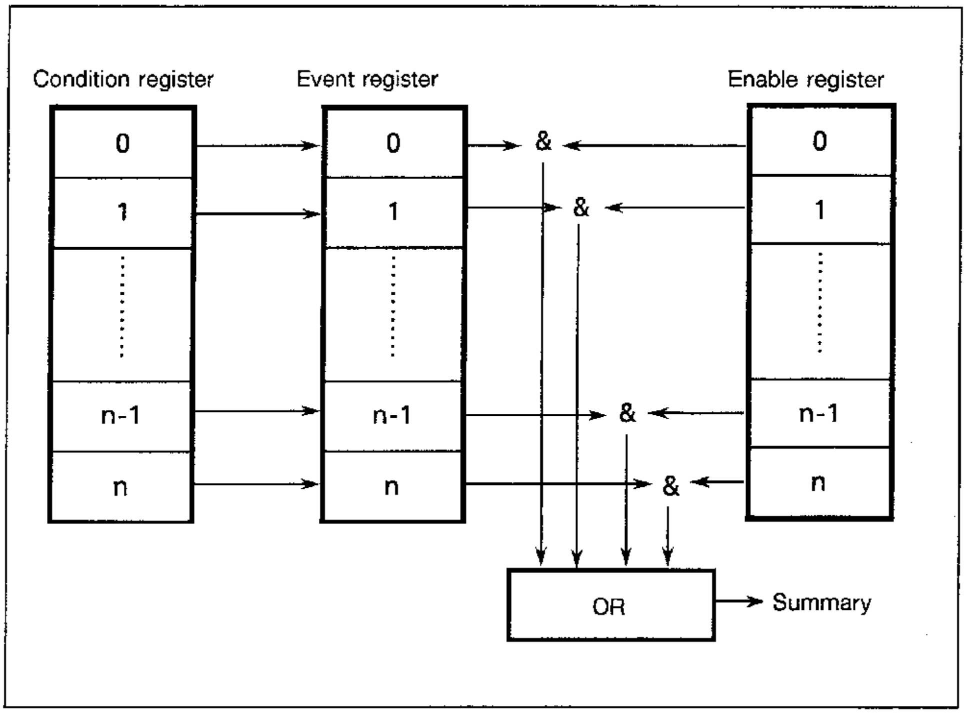
*: If HZ or OHM is used as the unit, the command will be executed using the suffix 1E6 (equivalent to MA).

14.5 Status Bytes

The analyzer has a hierarchical status register structure in compliance with IEEE standard 488.2-1987, which is used to send various device status information to the controller. This chapter explains the operational models of the status byte and event assignments.

1. Status Register

   The analyzer employs the status register model defined by IEEE standard 488.2-1987 and consists of a condition register, an event register and an enable register.



a. Condition register

   The condition register continuously monitors the status of devices, that is, retains the latest status of devices. No data can be written into this register.

b. Event register

   The event register latches and retains the status information from the condition register. (In some cases, it retains status changes.)

   Once the register is set, the condition is maintained until a query command reads out the information or the register is reset by means of the *CLS command. No data can be written into this register.

c. Enable register

   The enable register specifies which bit in the event register is to be used as the valid status to generate a summary. The enable register is ANDed with the event register. The OR of the result of the AND operation is generated as a summary. The summary is written into the following status registers. Any data can be written into these registers.

The analyzer has following 5 status register types.

- Status byte register
- Standard event register
- Standard operation status register
- Questionable status register
- Limit status register

The arrangement of the status registers of the analyzer are shown in Figure 14-1.

The status registers are shown in detail in Figure 14-2.

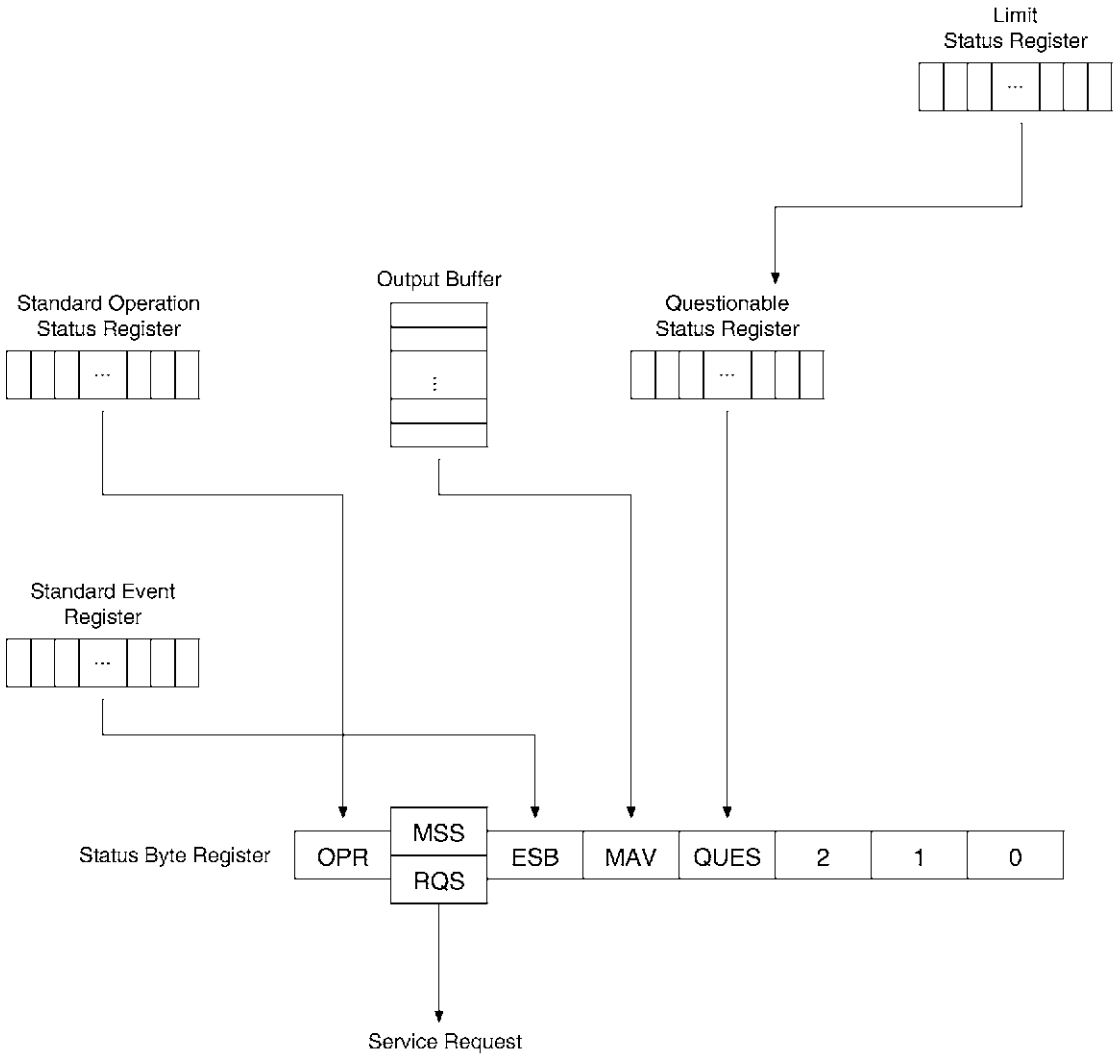


Figure 14-1 Arrangement of the Three Status Registers

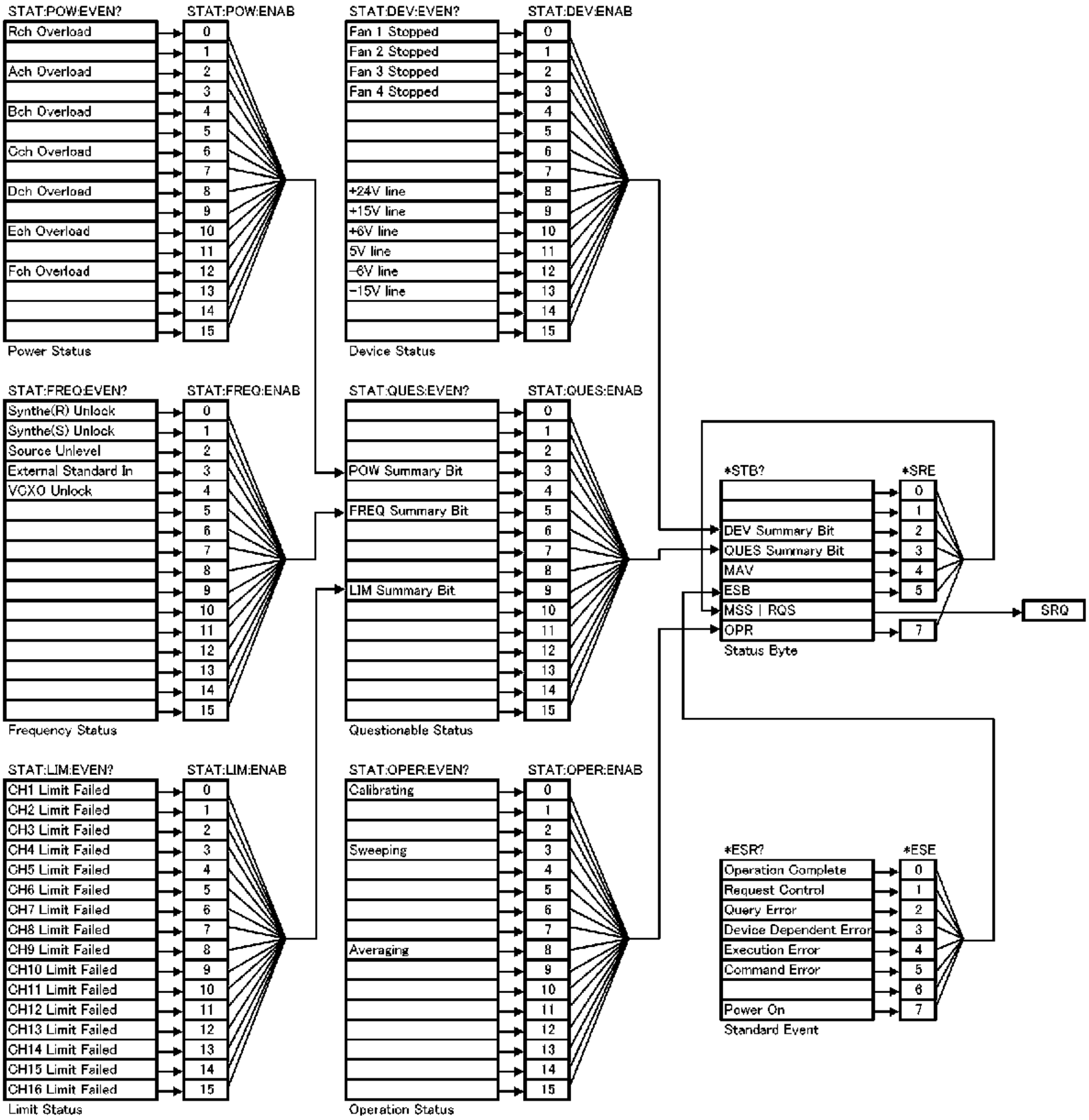


Figure 14-2 Details of the Three Status Registers

2. Event Enable Register

   Each event register has an enable register to determine which bit is available. The enable register sets the corresponding bit in decimal value.

   - Set of Service Request Enable Register: *SRE
   - Set of Standard Even Status Enable Register: *ESE
   - Set of Operation Status Enable Register: OPR

3. Standard Operation Status Register

   Bit assignments for the event register (which represents the standard operation status) is listed below:

Bit	Functional definition	Description
15 to 9		This is always 0
8	Averaging	This is set to 1 when averaging is completed
7 to 4		This is always 0
3	Sweeping	This is set to 1 when sweeping is completed
2 to 1		This is always 0
0	Calibrating	This is set to 1 when calibration data acquisition finishes

4. Status Byte Register

   The status byte register summarizes the information from the status register. In addition, a summary of the status byte register is sent to the controller as a service request. As a result, this register operates slightly differently from the status register. This section explains the status byte register.

   The structure of the status byte register is shown in Figure 14-3.

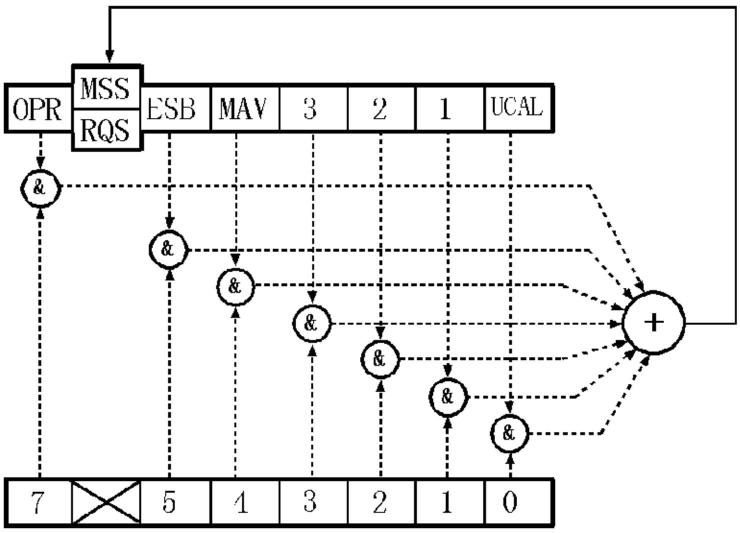


Figure 14-3 Structure of the Status Byte Register

This status byte register has the same functions as the status register, except for the following three points:

- The summary of the status byte register is written in bit 6 of the status byte register.
- Bit 6 of the enable register is always valid and cannot be changed.
- Bit 6 (MSS) of the status byte register writes the RQS of the service request.

The register responds to serial polling from the controller. On doing so, bits 0 to 5 and bit 7 of the status byte register and the RQS are read out, and then the RQS is reset to 0. Other bits are not cleared until each factor has been reset to 0.

The status byte register, RQS, and MSS can be cleared by executing "*CLS," the SRQ line is now false.

The table below explains the meanings of the bits in the status byte register.

Bit	Functional definition	Description
7	OPR	The OPR bit is a summary of the standard operation status register.
6	MSS	The RQS bit is true when the MSS bit of the status byte register is set to 1. The MSS bit is the summary bit for the entire status data structure. The serial poll cannot read out the MSS bit. (However, the MSS bit is understood to be 1 when the RQS bit is 1.) To read the MSS bit, use the common command *STB?. The *STB? command can read out bit 0 to 5 and bit 7 of the status byte register and the MSS bit. In this case, neither the status byte register nor the MSS bit can be cleared. The MSS bit cannot become 0 until all the unmasked factors in the status register structure have been cleared.
5	ESB	The ESB bit is a summary of the standard event register.
4	MAV	Summary bit for the output buffer. “1” while there is output data in the output buffer. “0” after data has been read out.
3 to 0		This is always 0.

5. Standard event register

The table below explains the meanings of the bits in the standard event register.

Bit	Functional definition	Description
7	Power on	This is set to 1 when the spectrum analyzer is switched on
6		This is always 0
5	Command Error	This is set to 1 when the parser finds a syntax error
4	Execution Error	This is set to 1 when the system fails to execute an instruction received as a GPIB command for some reason (such as out-of-range parameter)
3	Device Dependent Error	This is set to 1 when errors other than command errors, execution errors, or query errors occur
2	Query Error	This is set to 1 when no data exists or data has been deleted when the controller attempts to read out data from the spectrum analyzer
1	Request Control	"1" is set when the analyzer must become the active controller.
0	Operation Complete	"1" is set after an *OPC command is received and there are no more commands left for the analyzer to execute.

6. Limit Status Register

   The Limit Status Register bit allocations are as follows.

Bit	Defined function	Description
0	CH1 Limit Failed	Is set to 1 if the waveform in channel 1 is judged to be FAIL.
1	CH2 Limit Failed	Is set to 1 if the waveform in channel 2 is judged to be FAIL.
2	CH3 Limit Failed	Is set to 1 if the waveform in channel 3 is judged to be FAIL.
3	CH4 Limit Failed	Is set to 1 if the waveform in channel 4 is judged to be FAIL.
4	CH5 Limit Failed	Is set to 1 if the waveform in channel 5 is judged to be FAIL.
5	CH6 Limit Failed	Is set to 1 if the waveform in channel 6 is judged to be FAIL.
6	CH7 Limit Failed	Is set to 1 if the waveform in channel 7 is judged to be FAIL.
7	CH8 Limit Failed	Is set to 1 if the waveform in channel 8 is judged to be FAIL.
8	CH9 Limit Failed	Is set to 1 if the waveform in channel 9 is judged to be FAIL.
9	CH10 Limit Failed	Is set to 1 if the waveform in channel 10 is judged to be FAIL.
10	CH11 Limit Failed	Is set to 1 if the waveform in channel 11 is judged to be FAIL.
11	CH12 Limit Failed	Is set to 1 if the waveform in channel 12 is judged to be FAIL.
12	CH13 Limit Failed	Is set to 1 if the waveform in channel 13 is judged to be FAIL.
13	CH14 Limit Failed	Is set to 1 if the waveform in channel 14 is judged to be FAIL.
14	CH15 Limit Failed	Is set to 1 if the waveform in channel 15 is judged to be FAIL.
15	CH16 Limit Failed	Is set to 1 if the waveform in channel 16 is judged to be FAIL.

14.6 Trigger System

This chapter describes the trigger system.

The trigger system is used to synchronize measurement with a specified event. The event may be a GET interface message, a GPIB command such as the *TRG command, or an external trigger signal. The delay time from an event to the start of measurement can also be specified using the trigger system.

14.6.1 Trigger Model

The following shows the model of the trigger system for the analyzer.

Switching on power

:ABORt → Idle state — See section 14.6.2.
*RST

↓ ↑

Trigger waiting state — See section 14.6.3.

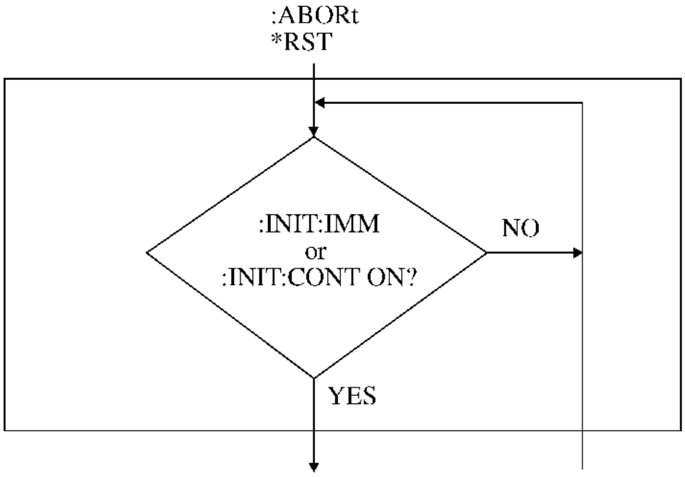
↓ ↑

Measuring state — See section 14.6.4.

When the analyzer is switched on or when the :ABORt command or the *RST command is executed, the trigger state changes to the idle state. The idle and trigger waiting states wait for conditions that are required for measurement.

14.6.2 Idle State

When the analyzer is switched on, the trigger system of the analyzer changes to the idle state. Also, the execution of the :ABORt command or the *RST command forcibly changes the trigger system to the idle state. The state changes as follows:

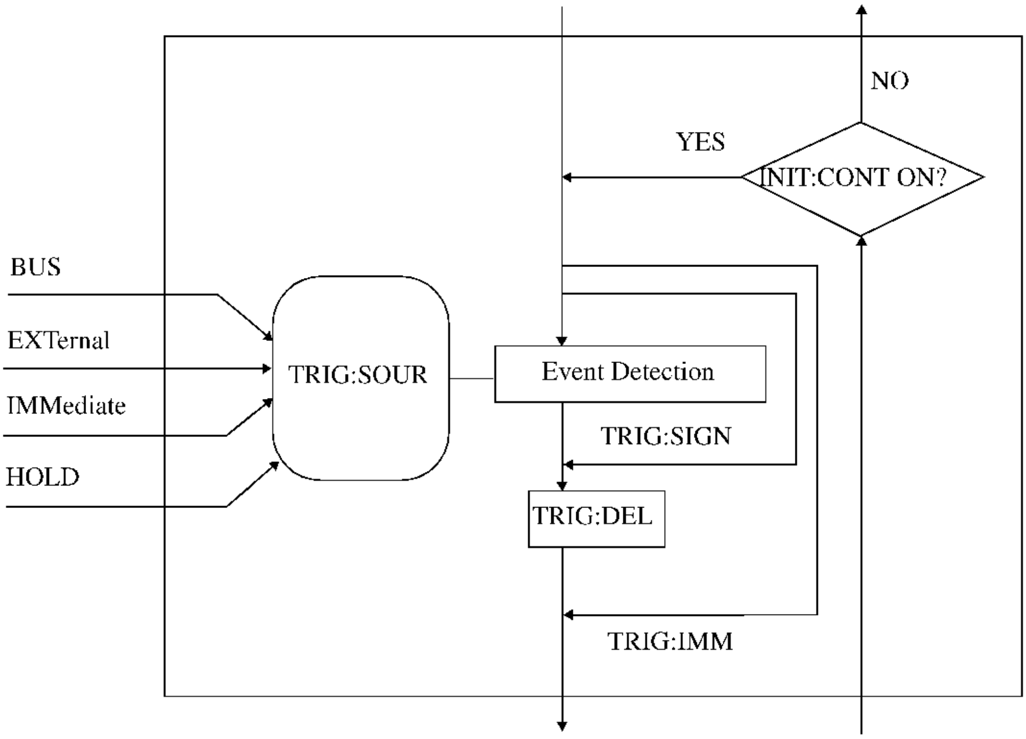


The trigger system does not leave this state until INITiate [:IMMediate] or INITiate:CONTinuous ON. Either of these conditions changes the trigger system to the trigger waiting state.

NOTE: ***Since the execution of the *RST command sets INITiate:CONTinuous to OFF, measurement stops.***

When the trigger system exits the idle state, the operation pending flag of the analyzer is always set. Also, when the analyzer enters in the idle state, the operation pending flag is cleared. *OPC, *OPC? and *WAI refer to the operation pending flag.

14.6.3 Trigger Waiting State

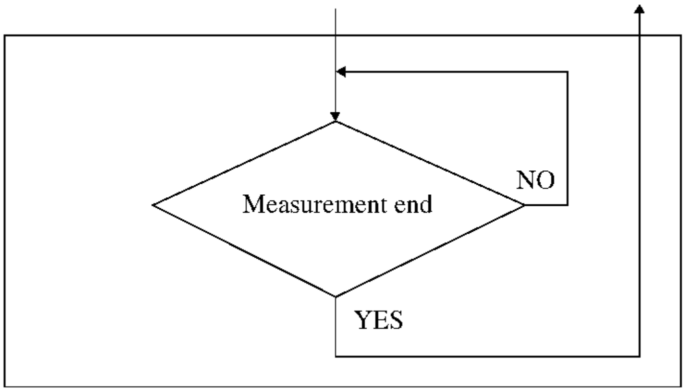


The above is a flowchart of the trigger waiting state of the analyzer. The TRIGger:SOURce command sets the trigger source, and the event detection detects a trigger factor. When the analyzer is triggered and leaves the event detection state, it enters the next state after the time specified by the TRIGger:DELay command has elapsed.

If the analyzer receives the TRIGger:SIGNal command in the trigger waiting state, it will enter the measuring state immediately without entering the event detection state. If it receives the TRIGger [:IMMediate] command in the trigger waiting state, it will enter the measuring state immediately without entering the TRIGger:DELay state.

If the INITiate:CONTinuous signal is set to OFF when the analyzer exits the measuring state, the analyzer will not return to the idle state but will directly enter the next trigger waiting state.

14.6.4 Measuring State



The analyzer performs measurement in this state. When the analyzer enters the measuring state, it performs sweeping and acquires measurement data.

14.7 Command Reference

This chapter explains the program for all the remote commands of the analyzer (command syntax, or query syntax, or both), formats of response data (when there is a query), and other details.

NOTE:

1. ***When referring to a command, note that part of the command mnemonic can be omitted.***

   Example: Although the following two commands have different syntax, they function in the same way:
   SOURCE:SWEEP:TIME 1S
   SWEEP:TIME 1S

2. ***If you were unable to find this command in the command references using a description of SWEEP:TIME, search for a complete description of the command using the attached command list, then refer to the references. If you have a complete description of the command, you can search for it in the table of contents.***

The commands are grouped in the following subsystems:

Common Command:	Is used for identical operation of all measuring instruments.
File Command:	Is used for saving or opening a file.
Configuration Command:	Is used for setting the operating status of the channel.
Channel Command:	Is used for setting the channel.
Sweep Command:	Is used for setting the measurement conditions.
Cal Command:	Is used for setting calibration.
Fixture Command:	Is used for setting the software fixture.
Trace Command:	Is used for setting traces.
Window Command:	Is used for setting the window.
Marker Command:	Is used for marker-related settings.
Time Domain Command:	Is related to the Time Domain measurement.
Frequency Conversion Command:	Is related to the frequency conversion device measurement.
Device Power Source Command:	Is related to the device power source.
System Command:	Is used for system-related information.
GP-IB Command:	Is used for GP-IB control.

14.7.1 Command Description Format

The following section explains the command mode of IEEE488.2-1987 in detail.

The following precautions should be taken:

CAUTION:

1. ***The command and response data formats are described using the following symbols:***

   <>: *Indicates an element of syntax. The contents are written after the symbol.*

   | : *Indicates selection of one item from among multiple items.*
   Example: A | B | C Means that A, B, or C is selectable.

   []: *Indicates that the enclosed item is an option (omissible).*

   {}: *Indicates that the enclosed item is a group of selections separated by | and that you can select one of them.*

2. ***The headings mean the following:***

Command/Query:	*Indicates that both a command and a query are available.*
Command:	*Indicates that only a command is available.*
Query:	*Indicates that only a query is available.*

3. ***A mnemonic with four characters or more has a short form. In this document, upper-case characters indicate Query commands must have "?" as their header. For a query which requires parameters, the query format must be described.***

4. ***The description format of parameters used commonly in this section are indicated below:***

<ch>:	*Channel No.*	*1 - 16, When omitted = Active Channel*
<win>:	*Window No.*	*1 - 16, When omitted = Active Window*
<tr>:	*Trace No.*	*1 - 16, When omitted = Active Trace*
<port>:	*Port No.*	*1 = Port 1, 2 = Port 2, 3 = Port 3, 4 = Port 4, 5 = Port 5, 6 = Port 6, Cannot be omitted*
<cport>:	*Port Path No.*	*1 = P1P2, 2 = P1P3, 3 = P1P4, 4 = P2P3, 5 = P2P4, 6 = P3P4, Cannot be omitted*
<bport>:	*Balance Port No.*	*1 = BPort 1, 2 = Bport 2, Cannot be omitted*
<seg>:	*Segment No.*	*1 - 32, Cannot be omitted*
<mkr>:	*Marker No.*	*1 - 16, When omitted = Active Marker*
<pio>:	*PIO port number*	*1=A, 2=B, 3=C, 4=D, 7=AB, 8=CD, cannot be omitted.*
<src>:	*Source number*	*1 = Source 1, 2 = Source 2, none = Source 1*
<vsim>:	*VSIM channel number*	*1 = A, 2 = B, 3 = C, 4 = D, cannot be omitted.*
<limpar>:	*Polar Limit:*	*1 = Mag, 2 = phase, none = Mag*
<bool>:	*Truth Value*	*0, 1, OFF, or ON (0 = OFF, 1 = ON)*
<int>:	*Integer Value*	
<real>:	*Real Number Value*	
<str>:	*"Character string"*	
<block>:	*Block Data*	
?:	*No specified parameter*	
×:	*Not available*	

14.7.2 Common Commands

1. *CLS

• Function	Clearing status byte and related data
• Presence of command and query	Command
• Command	*CLS
• Description	The *CLS command clears the status data structure and forcibly cancels *OPC and *OPC?. It also clears the error queue. Since this command does not clear the output buffer, the MAV bit is not cleared when output data is present. If this command is executed at the beginning of the line, all the status bits, including the MAV status bit, are cleared. The *CLS command also clears the error queue.

2. *DDT

• Function	Macro definition for GET
• Presence of command and query	Command / Query
• Command	*DDT <block>
• Parameter	<block>
• Response type	<block>
• Description	The *DDT command defines the command sequence which is to be executed when the *TRG interface message or the *GET interface message is received. That is, it replaces the *TRG operation with a series of commands which has been written into the <block> data. The length of the sequence to be defined must not exceed 255 characters. If the *DDT command defines block data (#10) with a length of 0, the *TRG interface message or the GET interface message will execute nothing. The macro can be canceled by executing the *RST command. Block data are used to respond a query. If the *DDT? command is executed with the macro not yet defined, block data (#10) with a length of 0 will be returned.
• Caution	Do not use the *TRG interface message in this definition. If it is used in the definition with the *DDT command, the sequence set by the *DDT command will be called instead of the trigger, and thus an endless loop will be formed. (Actually, a macro error will occur because of nesting limitation.)
• Example	When the *DDT command is #214INIT;TRIG:SIGN, *TRG replaces INIT;TRIG:SIGN.

3. *DMC

• Function	Macro definition
• Presence of command and query	Command
• Command	*DMC <str>,<block>
• Parameter	<str> <block>
• Description	The *DMC command defines the command sequence in the macro label specified by <str>. When <str> is received, the definition allows the system to operate as if it has received <block> itself. (However, *EMC must be 1.) A hierarchical command can be used for this macro label. In addition, it is possible to overwrite the macro on command defined in advance. (However, it is not possible to overwrite on the common command.) Then, when the macro is enabled by *EMC 1, the system will perform the original operation by disabling a series of commands which has been replaced with the macro using *EMC 0. Use the *PMC command to delete the macro which has been defined by the *DMC command. Once registered, a macro cannot be re-registered until it has been cleared by the *PMC command. Follow the grammar of command to write the macro body. Up to nine parameters ($1 to $9) can be given to the macro command. "1" must be given to the parameter following the macro command, "2" to the next parameter, and so on. Also, the macro definition can include the macro. Up to nine levels of nesting are supported. Up to 30 macros can be registered as new macros (depending on the condition). See *PMC, *GMC?, *LMC? and *EMC.
• Example	When the *DMC command is "SWPINIT", #221FREQ:START $1;STOP $2, SWPINIT 100MHZ,500MHZ replaces FREQ:START 100MHZ:STOP 500MHZ.

4. *EMC

• Function	Permission for macro execution
• Presence of command and query	Command / Query
• Command	*EMC<int>
• Parameter	<int>
• Response type	0 | 1
• Description	The *EMC command permits (1) or inhibits (0) the execution of the macro. This command does not affect the contents of the macro definition. It is used to execute an original command which has been overwritten by the macro. *RST inhibits the execution of the macro. See *DMC, *PMC, *GMC? and *LMC?.

5. *ESE

• Function	Setting of standard event status enable register
• Presence of command and query	Command / Query
• Command	*ESE <int>
• Parameter	<int>
• Response type	NR1 (integer value)
• Description	The *ESE command sets the enable register in the standard event status register. The standard event status register corresponding to the bit set to 1 in this register is reflected in the status byte register as a valid bit. For details, see the description of the status data structure and *ESR?.
• Example	When the operation control bit (bit 3) and the device dependent error bit (bit 0) are set to "enable", calculate: $2^3 + 2^0 = 8 + 1 = 9$ and set *ESE 9.

6. *ESR?

- Function: Readout of standard event status register
- Presence of command and query: Query
- Query: *ESR?
- Response type: NR1 (integer value)
- Description: The *ESR command reads out the standard event status register value. When the register is read out, it is cleared and the corresponding bit (bit 5) of the status byte is cleared.

  For details, see the description of the status data structure.

Table 14-1 Table Standard Event Register Assignments

bit		Description
7	Power on	Set to 1 when the system is switched on
6		Always 0
5	Command Error	Set to 1 when the parser detects a grammar error
4	Execution Error	Set to 1 when the system fails to execute the instruction which has been received as a GPIB command for some reason (such as parameter out of range)
3	Device Dependent Error	Set to 1 when an error other than a command error, an execution error, or a query error occurs
2	Query Error	Set to 1 if there are no data or if data have been deleted when the controller attempts to read out data from the analyzer
1	Request Control	Set to 1 when the analyzer is required to be active controller
0	Operation Control	Set to 1 when the analyzer has no command to be executed after it has received the *OPC command

7. *GMC?

• Function	Query of macro definition
• Presence of command and query	Query
• Query	*GMC? <name>
• Parameter	<name>
• Response type	<block>
• Description	The *GMC? command reads out the macro definition specified by <name>. If the command reads out an undefined <name> macro, block data (#10) with a length of 0 will be returned. See *DMC, *PMC?, *LMC? and *EMC.

8. *IDN?

• Function	Query of devices
• Presence of command and query	Query
• Query	*IDN?
• Response type	"<manufacturer>,<model>,<serial number>, <firmware version>" <manufacturer> = Advantest <model> = Model name <serial number> = Serial number <firmware version> = System version
• Description	The *IDN? extracts system identification information. This command outputs four items in the character string format, as shown in the response format above.

9. *LMC?

• Function	Readout of all macros
• Presence of command and query	Query
• Query	*LMC?
• Response type	"<macro label>"[,"<macro label>"...] <macro label> = Macro header
• Description	Answers all the macro headers in the character string format. When multiple macros are defined, they are separated by ",". If there is no defined macro, the system responds with a character string with a length of 0 (""). See *DMC, *PMC, *GMC? and *EMC.

10. *OPC
    - Function: Notification of end of all operations in progress
    - Presence of command and query: Command / Query
    - Command: *OPC
    - Response type: 1
    - Description: The *OPC command sets the 'Operation Control' bit of the standard event status register to 1 when all commands being executed have been completed. If the next command is received before the command being executed finishes, the *OPC command waits until the execution of that command has been completed. Therefore, if the analyzer does not execute a command after receiving the *OPC command, the status register will be set.

      The *OPC? writes 1 into the output buffer while the *OPC command above sets the 'Operation Control' bit. Therefore, the *OPC? command allows the command to be finished when the controller receives the response from the analyzer.

      Both *OPC and *OPC? can be canceled by using a DCL interface message, the *CLS command, or the *RST command. See *WAI.

11. *PMC
    - Function: Deletion of all macro definitions
    - Presence of command and query: Command
    - Command: *PMC
    - Description: The *PMC command deletes all the macro definitions. This command deletes all the macro headers and bodies from the memory of the analyzer, making it possible to register new macros.

      See *DDT, *DMC, *GMC?, *LMC? and *EMC.

12. *RCL

• Function	Recalls the device settings
• Presence of command and query	Command
• Command	*RCL {<int>}
• Parameter	<int> = register number
• Description	The *RCL command recalls the analyser settings from the specified internal register.

13. *RST

• Function	Resetting of devices
• Presence of command and query	Command
• Command	*RST
• Description	The *RST command resets the analyzer. The following operations are performed on the system:

1. System initialization
2. Initialization of the macro defined by the *DDT command.
3. Invalidation of the macro (Same as *EMC 0)
4. Invalidation of the *OPC bit and the *OPC? bit
5. Resetting of the trigger system

The resetting does not affect:

1. GPIB bus condition
2. GPIB address
3. Output buffer
4. Status data structure
5. Macro defined by the *DMC command
6. Calibration data of the device

See SYSTem:PRESet(IP).

14. *SAV

- Function — Saves the device settings
- Presence of command and query — Command
- Command — *SAV <int>
- Parameter — <int>
- Description — The *SAV command saves the analyser settings in an internal register with a specified number.

  Using the save register function, measurement conditions and measurement data can be saved in the built-in hard disk of the analyzer (each save register function saves one set of measurement conditions and measurement data).

15. *SRE

- Function — Setting of service request enable register
- Presence of command and query — Command / Query
- Command — *SRE <int>
- Parameter — <int>
- Response type — NR1 (integer value)
- Description — The *SRE command sets the service request enable register. The status byte register corresponding to the bit in this register which is set to 1 is reflected in the MSS bit as a valid bit.

  Bit 6 of the response data for the query command is always 0.

  For details, see the description of the status data structure.

  See *STB?.
- Example — If the OPR bit (bit 7), the ESB bit (bit 5) and the MAV bit (bit 4) are set to "enable", calculate:

  $2^7 + 2^5 + 2^4 = 128 + 32 + 16 = 176$ and set *SRE 176.

16. *STB?

- Function — Readout of status byte register
- Presence of command and query — Query
- Query — *STB?
- Response type — NR1 (integer value)
- Description — The *STB? command reads out the contents of the status byte register.

  The summary bit of the request to be read out here is the MSS bit.

  This register and the MSS bit are not cleared, even if the register is read out.

  For details, see the description of the status data structure.

Table 14-2 Status Byte Register Assignments

bit		Description
7	OPR	OPR is a summary of the standard operation status register.
6	MSS	When the MSS bit of the status byte register is set to 1, the RQS bit is TRUE and the MSS bit is the summary bit for all of the status data structure.
		The service request cannot read out the MSS bit. (However, when the RQS bit is 1, it is understood that the MSS bit is 1.)
		To read the MSS bit, the common command *STB? should be used. The *STB? command can read out bits 0 to 5 and bit 7 of the status byte register and the MSS bit. In this case, the status byte register and the MSS bit are not cleared.
		The MSS bit does not become 0 until all the unmasked factors in the status register structure are cleared.
5	ESB	The ESB bit is a summary of the standard event register.
4	MAV	The MAV bit is a summary bit of the output buffer. The MAV bit is 1 when the output buffer has data to be output and it is 0 when the data are read out.
3	QUES	The QUES is a summary of the questionable status register.
2	DEV	The DEV is a summary of the device status register.
0 to 1		Always 0

17. *TRG

• Function	Triggering device
• Presence of command and query	Command
• Command	*TRG
• Description	The *TRG command triggers devices. This command has exactly the same effect as the GET interface message. If the analyzer receives the *TRG interface message when TRIG:SOUR is set to BUS and the analyzer is in the trigger waiting state (see "14.6 Trigger System"), it starts measurement. Under conditions other than above, this command is ignored. Both the *TRG interface message and the GET interface message are stored in the input buffer and they are processed in the order of inputting.

18. *TST?

• Function	Query of self test result
• Presence of command and query	Query
• Query	*TST?
• Response type	0 | error code
• Description	The *TST? command allows the analyzer to start the self test and return the result. Answering with 0 indicates that the test has been passed, while other answers indicate error codes.

19. *WAI

• Function	Waiting for end of all operations being performed
• Presence of command and query	Command
• Command	*WAI
• Description	The *WAI command is used to wait for the completion of all the commands which are being executed. If this command is executed, all commands input after that time will be delayed until all the commands being executed have been completed. *WAI can be canceled by means of the DCL interface message.

14.7.3 File Commands

File command example (short forms are used for the description).

Select ON to save the calibration data (Cal Data), the measurement waveform raw data (Raw Data), and the memory waveform data (Trace Memory), select OFF to not save the measurement waveform data (trace Data). Save those data and the set conditions of this unit into the file named SAVE_FILE01 and load the file.

`FILE:STAT:CORR ON`	Selects to save the calibration data.
`FILE:STAT:RAW ON`	Selects to save the measurement waveform raw data.
`FILE:STAT:DATA OFF`	Selects to not save the measurement waveform data.
`FILE:STAT:MEM ON`	Selects to save the memory waveform data.
`FILE:STOR "SAVE_FILE01"`	Saves the set conditions of this unit, the calibration data, the waveform data, and other data into the file named SAVE_FILE01.
`FILE:LOAD "SAVE_FILE01"`	Loads the file named SAVE_FILE01.

Function	Command	Parameter (Summary Content)	Query
Load			
Loading a file	FILE:LOAD	<str> = "File name" *	×
Save			
Storing a file	FILE:STORe	<str> = "File name" *	×
Save option			
Cal Data	FILE:STATe: CORRection	<bool>	0|1
Raw Data	FILE:STATe:RAW	<bool>	0|1
Trace Data	FILE:STATe:DATA	<bool>	0|1
Trace Memory	FILE:STATe:MEMory	<bool>	0|1
Storing data			
Storing all S-parameters	FILE:STORe: SPARameter<ch>	<str>[,<data>,<form>,<type>] <str> = "File name" <data>= NORMal|BPARameter|BALun|MMODe <form> = CSV|TS <type> = RI|DB|MA	×
Storing the specified data	FILE:STORe: DISPlay<ch>:TRACe<tr>	<str> = "File name"	×
Storing the screen data	FILE:STORe:IMAGe	<str> = "File name"	×

*: There is no need to specify the file extensions.

14.7.4 Configuration Commands

Configuration command example (short forms are used for the description).

Set the split-screen display and set to the sequence mode which measures only the active channel.

`DISP:FORM SPL`	Selects the split-screen display.
`INST:SEL ACT`	Sets to the sequence mode which measures only the active channel.

Set the test set path to (Port1a-Port2a-Port3a-Port4a) in Channel 1, and (Port1a-Port2a-Port3a-Port4b) in Channel 2 to set to the channel synchronization measurement.

`ROUT:PATH1:SEL 0`	Sets Channel 1 as Port1a-Port2a-Port3a-Port4a path.
`ROUT:PATH2:SEL 4096`	Sets Channel 2 as Port1a-Port2a-Port3a-Port4b path.
`ROUT:PATH1:SYNC ON`	Sets to the channel synchronization measurement.

Specify A-port and B-port of the parallel I/O as an output to synchronize with Channel 1, and output the data (7) from the parallel A.

`COMM1:PAR:MODE AB`	Specifies A-port and B-port of the parallel I/O as an output.
`COMM1:PAR1:DATA 7`	Sets to output the data (7) to A-port in Channel 1.
`COMM2:PAR2:DATA 0`	Sets to output the data (0) to B-port in Channel 2.
`COMM:PAR:SYNC ON`	Sets the synchronous operation of the channel and the parallel I/O.

Function	Command	Parameter (Summary Content)	Query
Channel			
Suspend/Run	INSTrument<ch>: STATe	<bool> = 0:Suspend, 1:Run	0|1
Sequence mode	INSTrument:SELect	ALL|ACTive	ALL|ACT
Display mode	DISPlay:FORMat	SPLit|WINDow| SINGle|SPLit|OVERlay	SPL|WIND| SING|OVER
Test set			
Path	ROUTe:PATH<ch>: SELect	<int> = See *1	<int> = See *1
Synchronizing Channels	ROUTe:PATH: SYNChronize	<bool>	0|1

Function	Command	Parameter (Summary Content)	Query
PIO			
Output mode	[SYSTem:] COMMunicate<ch>: PARallel:MODE	ABCD|ABD|ABC|AB	ABCD|ABD| ABC|AB
Output data	[SYSTem:] COMMunicate<ch>: PARallel<pio>:DATA	<int>	<int>
Synchronizing Channels	[SYSTem:] COMMunicate<ch>: PARallel<ch>: SYNChronize	<bool>	0|1

*1: Path setting of the test set

- R3968 + 11(+13) Test Set

  Every four bits from the least significant bit of the bit pattern corresponds to Port1, Port2, Port3, and Port4 in the network analyzer respectively.

  In each set of four bits, the lower two bits indicate connector a, b, c, and d in Test Set; 0=a, 1=b, 2=c, and 3=d and the upper two bits indicate the test port number in Test Set; 0=the same number as the Port number in the network analyzer, 1=(the Port number in the network analyzer) +1, 2=(the Port number in the network analyzer) -1.

Port4		Port3		Port2		Port1	
Port number in the test set	Test Set	Port number in the test set	Test Set	Port number in the test set	Test Set	Port number in the test set	Test Set
00 - the same as the Port number 01 - the Port number +1	00 - a 01 - b 10 - c 11 - d	00 - the same as the Port number 01 - the Port number +1	00 - a 01 - b 10 - c 11 - d	00 - the same as the Port number 01 - the Port number +1	00 - a 01 - b 10 - c 11 - d	00 - the same as the Port number 01 - the Port number +1	00 - a 01 - b 10 - c 11 - d

* Hexadecimal

Code	Connection			
0x***0	Port1 = 1a			
0x***4	Port1 = 2a			
0x**0*		Port2 = 2a		
0x**1*		Port2 = 2b		
0x*0**			Port3 = 3a	
0x*1**			Port3 = 3b	
0x*2**			Port3 = 3c	
0x*3**			Port3 = 3d	
0x0***				Port4 = 4a

Code	Connection			
0x1***				Port4 = 4b
0x2***				Port4 = 4c
0x3***				Port4 = 4d

[Example] Code 0x0000 Port1a - Port2a - Port3a - Port4a

0x0010 Port1a - Port2b - Port3a - Port4a

0x0100 Port1a - Port2a - Port3b - Port4a

0x2214 Port2a - Port2b - Port3c - Port4c

- Test set except for the R3968 + 11(+13)

  Every two bits from the least significant bit of the bit pattern corresponds from SW1 to SW8 respectively.

  The two bits in each SW indicate the following: 0=a, 1=b, 2=c, and 3=d.

SW8	SW7	SW6	SW5	SW4	SW3	SW2	SW1
00 - a 01 - b 10 - c 11 - d	00 - a 01 - b 10 - c 11 - d	00 - a 01 - b 10 - c 11 - d	00 - a 01 - b 10 - c 11 - d	00 - a 01 - b 10 - c 11 - d	00 - a 01 - b 10 - c 11 - d	00 - a 01 - b 10 - c 11 - d	00 - a 01 - b 10 - c 11 - d

* Hexadecimal

Code	Connection			
0x***0	SW1 = 1a			
0x***1	SW1 = 1b			
0x***2	SW1 = 1c			
0x***3	SW1 = 1d			
0x***0		SW2 = 2a		
0x***4		SW2 = 2b		
0x***8		SW2 = 2c		
0x***c		SW2 = 2d		
0x**0*			SW3 = 3a	
0x**1*			SW3 = 3b	
0x**2*			SW3 = 3c	
0x**3*			SW3 = 3d	
0x**0*				SW4 = 4a
0x**4*				SW4 = 4b
0x**8*				SW4 = 4c
0x**c*				SW4 = 4d

Code	Connection			
0x*0**	SW5 = 5a			
0x*1**	SW5 = 5b			
0x*2**	SW5 = 5c			
0x*3**	SW5 = 5d			
0x*0**		SW6 = 6a		
0x*4**		SW6 = 6b		
0x*8**		SW6 = 6c		
0x*c**		SW6 = 6d		
0x0***			SW7 = 7a	
0x1***			SW7 = 7b	
0x2***			SW7 = 7c	
0x3***			SW7 = 7d	
0x0***				SW8 = 8a
0x4***				SW8 = 8b
0x8***				SW8 = 8c
0xc***				SW8 = 8d

[Example] Code 0x0000 SW1a - SW2a - SW3a - SW4a - SW5a - SW6a - SW7a - SW8a

0x0010 SW1a - SW2a - SW3b - SW4a - SW5a - SW6a - SW7a - SW8a

0x0100 SW1a - SW2a - SW3a - SW4a - SW5b - SW6a - SW7a - SW8a

0x2214 SW1a - SW2b - SW3b - SW4a - SW5c - SW6a - SW7c - SW8a

14.7.5 Channel Commands

Channel command example (short forms are used for the description).

Allocate Channel 1 to Window 1 and Channel 2 to Window 2, and set Channel 1 as the active channel.

`DISP:WIND1:ATT 1`	Allocates Channel 1 to Window 1.
`DISP:WIND2:ATT 2`	Allocates Channel 2 to Window 2.
`DISP:ACT 1`	Sets Channel 1 as the active channel.

Function	Command	Parameter (Summary Content)	Query
Channel			
Channel allocation to the window	DISPlay:WINDow<win> :ATTach	<int>	<int>
Active Channel	DISPlay:ACTivate	<int>	<int>

14.7.6 Sweep Commands

Sweep command example (short forms are used for the description).

Set Channel 1 to Port 12 of the test port, the start frequency of 300 kHz, the stop frequency of 3 GHz, and 1601 points, then set the sweep type to the logarithm frequency sweep.

`FUNC1:POW P12`	Sets to Port 12 of the test port.
`FREQ1:STAR 300KHZ`	Sets to the start frequency of 300 kHz.
`FREQ1:STOP 3GHZ`	Sets to the stop frequency of 3 GHz.
`SWE1:POIN 1601`	Sets to 1601 points.
`SWE1:SPAC LOG`	Sets to the log frequency sweep.

Set Channel 1 as the program sweep to execute the single sweep.

`INIT:CONT OFF`	Sets the continuous sweep to OFF.
`PSW1:FREQ1 500MHZ,700MHZ`	Sets the segment 1 frequency range from 500 MHz to 700 MHz.
`PSW1:POIN1 100`	Sets the number of measurement points of the segment 1 to 100 points.
`PSW1:FREQ2 1GHZ,2GHZ`	Sets the segment 2 frequency range from 1 GHz to 2 GHz.
`PSW1:POIN2 100`	Sets the number of measurement points of the segment 2 to 100 points.
`PSW1:FREQ3 3GHZ`	Sets the segment 3 frequency at 3 GHz.
`PSW1:POIN3 1`	Sets the number of measurement points of the segment 3 to 1 points.
`PSW1:MODE FREQ`	Sets the sweep type to the frequency condition program sweep.
`INIT`	Executes the single sweep.
`OPC?`	Returns the query by finishing the single sweep.

<table>
<tr><th>Function</th><th>Command</th><th>Parameter (Summary Content)</th><th>Query</th></tr>
<tr><td>Test port</td><td>[SENSe:]FUNCtion<ch>:POWer</td><td>P1|P2|P3|P4|P12|P13|P14|P23|P24|P34|P123|P124|P134|P234|P1234|P12345|P123456|NONE
= See *2</td><td>P1|P2|P3|P4|P12|P13|P14|P23|P24|P34|P123|P124|P134|P234|P1234|P12345|P123456|NONE
= See *2</td></tr>
<tr><td>Frequency</td><td></td><td></td><td></td></tr>
<tr><td>Start</td><td>[SOURce:]FREQuency<ch>:STARt</td><td><real></td><td><real></td></tr>
<tr><td>Stop</td><td>[SOURce:]FREQuency<ch>:STOP</td><td><real></td><td><real></td></tr>
<tr><td>Center</td><td>[SOURce:]FREQuency<ch>:CENTer</td><td><real></td><td><real></td></tr>
<tr><td>Span</td><td>[SOURce:]FREQuency<ch>:SPAN</td><td><real></td><td><real></td></tr>
<tr><td>CW</td><td>[SOURce:]FREQuency<ch>:CW</td><td><real></td><td><real></td></tr>
</table>

Function	Command	Parameter (Summary Content)	Query
Output power			
Power	[SOURce:]POWer <ch>[:LEVel]	<real>	<real>
Start	[SOURce:]POWer <ch>:STARt	<real>	<real>
Stop	[SOURce:]POWer <ch>:STOP	<real>	<real>
Built-in attenuator (Output power expansion)			
Attenuator value	OUTPut<ch>: ATTenuation<port>	<real>	<real>
Mode (Auto/Manual)	OUTPut<ch>: ATTenuation:AUTO	<bool>	0|1
Channel synchronization ON/OFF	OUTPut:ATTenuation: SYNChronize	<bool>	0|1
Point	[SOURce:]SWEep <ch>:POINt	<int>	<int>
Time	[SOURce:]SWEep <ch>:TIME	<real>	<real>
RBW	[SENSe:]BANDwidth <ch>[:RESolution]	<real>	<real>
Sweep type			
Frequency sweep	[SOURce:]FREQuency <ch>:MODE	SWEep|CW	SWE|CW = SWE: Linear/Log sweep = CW: Others
Power sweep	[SOURce:]POWer <ch>:MODE	SWEep|FIX	SWE|FIX = SWE: Power sweep = FIX: Others
Program sweep	[SOURce:]PSWeep<ch> :MODE	FREQuency|ALL|NONE = FREQ:Frequency = ALL:All items = NONE:Others	FREQ|ALL|NONE
Linear/Log	[SOURce:]SWEep<ch> :SPACing	LINear|LOGarithmic = LIN:Linear frequency = LOG:Log frequency	LIN|LOG

Function	Command	Parameter (Summary Content)	Query
Trigger			
Trigger	TRIGger[:SEQuence][:IMMediate]	-	×
Trigger	TRIGger[:SEQuence]:SIGNal	-	×
Delay	TRIGger<ch>[:SEQuence]:DELay	<real>	<real>
Source	TRIGger[:SEQuence]:SOURce	IMMediate|EXTernal|BUS|HOLD	IMM|EXT|BUS|HOLD
Continuous sweep	INITiate:CONTinuous	<bool>	0|1
Single sweep	INITiate[:IMMediate]	-	×
Program sweep editing			
Frequency	[SOURce:]PSWeep<ch>:FREQuency<seg>	<real>[,<real>]	<real>,<real>
Power	[SOURce:]PSWeep<ch>:POWer<seg>	<real>[,<real>]	<real>,<real>
RBW	[SOURce:]PSWeep<ch>:BANDwidth<seg>	<real>	<real>
Point	[SOURce:]PSWeep<ch>:POINt<seg>	<int>	<int>
Settling time	[SOURce:]PSWeep<ch>:SETTling<seg>	<real>	<real>
Segment clear	[SOURce:]PSWeep<ch>:CLEar<seg>	-	×
All clear	[SOURce:]PSWeep<ch>:CLEar:ALL	-	×
Load	FILE:LOAD:PSWeep<ch>	<str>= "File name"	×
Save	FILE:STORe:PSWeep<ch>	<str>= "File name"	×
Averaging			
ON/OFF	[SENSe:]AVERaging<ch>[:STATe]	<bool>	0|1
Count	[SENSe:]AVERaging<ch>:COUNt	<int>	<int>
Restart	[SENSe:]AVERaging<ch>:RESTart	-	×

14.7.7 Cal Commands

Cal command example (short forms are used for the description).

Execute 1-port Full Cal in Channel 1.

`CORR1:CSET:STAT 0`	Sets Cal to OFF.
`CORR1:COLL:DEL`	Clears the calibration data.
`CORR1:COLL:METH P1`	Selects Port 1 1-Port Full Cal.
`CORR1:COLL STAN1`	Acquires the calibration (OPEN) data.
`CORR1:COLL STAN2`	Acquires the calibration (SHORT) data.
`CORR1:COLL STAN3`	Acquires the calibration (LOAD) data.
`CORR1:COLL:SAVE`	Sets Cal to ON after calculating the error coefficient from the calibration data.

<table>
<tr><th>Function</th><th>Command</th><th>Parameter (Summary Content)</th><th>Query</th></tr>
<tr><td>Calibration</td><td></td><td></td><td></td></tr>
<tr><td>ON/OFF</td><td>[SENSe:]CORRection<ch>:CSET:STATe</td><td><bool></td><td>0|1</td></tr>
<tr><td>Interpolate</td><td>[SENSe:]CORRection:CSET:INTerpolate</td><td><bool></td><td>0|1</td></tr>
<tr><td>Cal data clear</td><td>[SENSe:]CORRection<ch>:COLLect:DELete</td><td>-</td><td>×</td></tr>
<tr><td>Standard Cal</td><td></td><td>NORMalize|SNORmalize|</td><td>NORM|SNOR|</td></tr>
<tr><td>Type</td><td>[SENSe:]CORRection<ch>:COLLect:METHod</td><td>P1|P2|P3|P4|P12|P13|P14|P23|P24|P34|P123|P124|P134|P234|P1234|P12345|P123456
= See *2</td><td>P1|P2|P3|P4|P12|P13|P14|P23|P24|P34|P123|P124|P134|P234|P1234|P12345|P123456|NONE
= See *2</td></tr>
<tr><td>Standards</td><td>[SENSe:]CORRection<ch>:COLLect[:ACQuire]</td><td>STANdard{1-49}
= See *3</td><td>×</td></tr>
<tr><td>Cal end</td><td>[SENSe:]CORRection<ch>:COLLect:SAVE</td><td>-</td><td>×</td></tr>
<tr><td>Auto Cal</td><td>[SENSe:]CORRection<ch>:AUTO:COLLect[:ACQuire]</td><td>P1|P2|P3|P4|P12|P13|P14|P23|P24|P34|P123|P124|P134|P234|P1234|P1235|P2356|P12345|P123456
= See *2</td><td>×</td></tr>
<tr><td>Calibration data load</td><td>[SENSe:]CORRection<ch>:AUTO:LOAD</td><td>-</td><td>×</td></tr>
<tr><td>Verification execution</td><td>[SENSe:]CORRection<ch>:AUTO:VERification</td><td>P1|P2|P3|P4|P12|P13|P14|P23|P24|P34</td><td>OFF|PASS|FAIL</td></tr>
<tr><td>Averaging factor setting mode</td><td>[SENSe:]CORRection<ch>:AUTO:AVERaging:FACTor</td><td>SPECification|AUTO</td><td>SPEC|AUTO</td></tr>
</table>

Function	Command	Parameter (Summary Content)	Query
Averaging factor (count)	[SENSe:]CORRection <ch>:AUTO:AVERaging: COUNt	<int>	<int>
RBW for connection check	[SENSe:]CORRection: AUTO:CBANdwidth [:RESolution]	<real>	<real>
Result display ON/OFF	[SENSe:]CORRection <ch>:AUTO:VERification: VIEW	<bool>	0|1
Specified range setting	[SENSe:]CORRection <ch>:AUTO:VERification: SPAN	AUTO|SPECification	AUTO|SPEC
Specified range frequency setting	[SENSe:]CORRection<ch>: AUTO:VERification: FREQuency{1|2}	<real>	<real>
Judgement range selection	[SENSe:]CORRection <ch>:AUTO:VERification: RANGe	PART|ALL	PART|ALL
Magnitude limit setting	[SENSe:]CORRection <ch>:AUTO:VERification: MLIMit	<real>	<real>
Phase limit setting	[SENSe:]CORRection <ch>:AUTO:VERification: PLIMit	<real>	<real>
Verification result clear	[SENSe:]CORRection <ch>:AUTO:VERification: CLEar	-	×
Verification result output	[SENSe:]CORRection <ch>:AUTO:VERification: REPort?	×	<real>, <real>, ... = S11 magnitude(A11) S11 phase(A11) S11 magnitude(Part) S11 phase(Part) S21 magnitude(A11) ... , S44 phase(Part)
Calibration kit			
Type	[SENSe:]CORRection <ch>:CKIT:TYPE	<int> =0: Don't care =1: N50Ω =2: N75Ω =3: 3.5mm =4: 7mm =5: User	<int> =0: Don't care =1: N50Ω =2: N75Ω =3: 3.5mm =4: 7mm =5: User

Function	Command	Parameter (Summary Content)	Query
Port polarity	[SENSe:]CORRection <ch>:CKIT:TERMinal <port>	FEMale|MALE	FEM|MALE
User defined Open standard			
Capacitance	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<port>: OCAPacitance{0|1|2|3}	<real>	<real>
Offset impedance	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<port>: OIMPedance	<real>	<real>
Offset delay	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<port>: ODELay	<real>	<real>
Offset loss	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<port>:OLOSs	<real>	<real>
User defined Short standard			
Inductance	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<port>: SINDuctance{0|1|2|3}	<real>	<real>
Offset impedance	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<port>: SIMPedance	<real>	<real>
Offset delay	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<port>:SDELay	<real>	<real>
Offset loss	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<port>:SLOSs	<real>	<real>
User defined Load standard			
Resistance	[SENSe:]CORRection <ch>:CKIT:DEFine:STANdard<port>:LRESistance	<real>	<real>

Function	Command	Parameter (Summary Content)	Query
Offset impedance	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<port>: LIMPedance	<real>	<real>
Offset delay	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<port>:LDELay	<real>	<real>
Offset loss	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<port>:LLOSs	<real>	<real>
User defined			
Thru standard			
Forward impedance	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<cport>: TFIMpedance	<real>	<real>
Forward delay	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<cport>: TFDelay	<real>	<real>
Forward loss	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<cport>:TFLoss	<real>	<real>
Reverse impedance	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<cport>: TRIMpedance	<real>	<real>
Reverse delay	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<cport>: TRDelay	<real>	<real>
Reverse loss	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<cport>: TRLoss	<real>	<real>
Save	[SENSe:]CORRection <ch>:CKIT:DEFine: SAVE	<str> = "File name"	×
Load	[SENSe:]CORRection <ch>:CKIT:DEFine: LOAD	<str> = "File name"	×

Function	Command	Parameter (Summary Content)	Query
Electrical delay correction			
ON/OFF	[SENSe:]CORRection <ch>:EDELay:STATe	<bool>	0|1
Electrical delay (time)	[SENSe:]CORRection <ch>:EDELay:TIME<tr>	<real>	<real>
Electrical delay (distance)	[SENSe:]CORRection <ch>:EDELay: DISTance<tr>	<real>	<real>
Velocity factor	[SENSe:]CORRection <ch>:RVELocity:COAX	<real>	<real>
Phase offset			
ON/OFF	SENSe:]CORRection <ch>:OFFSet:STATe	<bool>	0|1
Offset value	[SENSe:]CORRection <ch>:OFFset:PHASe<tr>	<real>	<real>
Port extension			
ON/OFF	[SENSe:]CORRection <ch>:PEXTension:STATe	<bool>	0|1
Port extension value	[SENSe:]CORRection <ch>:PEXTension:TIME <port>	<real>	<real>
Marker To	MARKer<ch>:LET	PEXTension|DELay	×

*2: Test port and calibration type

Setting Value	Test Port	Standard Calibration	Auto Calibration
P1	Port1	Port1 1port Cal.	Port1 Auto Cal.
P2	Port2	Port2 1port Cal.	Port2 Auto Cal.
P3	Port3	Port3 1port Cal.	Port3 Auto Cal.
P4	Port4	Port4 1port Cal.	Port4 Auto Cal.
P12	Port1-Port2	Port1-Port2 2port Cal.	Port1-Port2 Auto Cal.
P13	Port1-Port3	Port1-Port3 2port Cal.	Port1-Port3 Auto Cal.
P14	Port1-Port4	Port1-Port4 2port Cal.	Port1-Port4 Auto Cal.
P23	Port2-Port3	Port2-Port3 2port Cal.	Port2-Port3 Auto Cal.
P24	Port2-Port4	Port2-Port4 2port Cal.	Port2-Port4 Auto Cal.
P34	Port3-Port4	Port3-Port4 2port Cal.	Port3-Port4 Auto Cal.

Setting Value	Test Port	Standard Calibration	Auto Calibration
P123	Port1-Port2-Port3	Port1-Port2-Port3 3port Cal.	Port1-Port2-Port3 Auto Cal.
P124	Port1-Port2-Port4	Port1-Port2-Port4 3port Cal.	Port1-Port2-Port4 Auto Cal.
P134	Port1-Port3-Port4	Port1-Port3-Port4 3port Cal.	Port1-Port3-Port4 Auto Cal.
P234	Port2-Port3-Port4	Port2-Port3-Port4 3port Cal.	Port2-Port3-Port4 Auto Cal.
P1234	Port1-Port2-Port3-Port4	Port1-Port2-Port3-Port4 4port Cal.	Port1-Port2-Port3-Port4 Auto Cal.
P12345	Port1-Port2-Port3-Port4 -Port5	Port1-Port2-Port3-Port4-Port5 5port Cal.	Port1-Port2-Port3-Port4-Port5 Auto Cal.
P123456	Port1-Port2-Port3-Port4 -Port5-Port6	Port1-Port2-Port3-Port4-Port5 -Port6 6port Cal.	Port1-Port2-Port3-Port4-Port5 -Port6 Auto Cal.
NONE	No measurement	No calibration (Query only)	×

*3: Standards

- Full 1-Port Cal

STAN1	Open
STAN2	Short
STAN3	Load

- Full 2-Port Cal

	Port1-Port2	Port1-Port3	Port1-Port4	Port2-Port3	Port2-Port4	Port3-Port4
STAN1	Port1 Open	Port1 Open	Port1 Open	Port2 Open	Port2 Open	Port3 Open
STAN2	Port1 Short	Port1 Short	Port1 Short	Port2 Short	Port2 Short	Port3 Short
STAN3	Port1 Load	Port1 Load	Port1 Load	Port2 Load	Port2 Load	Port3 Load
STAN4	Port2 Open	Port3 Open	Port4 Open	Port3 Open	Port4 Open	Port4 Open
STAN5	Port2 Short	Port3 Short	Port4 Short	Port3 Short	Port4 Short	Port4 Short
STAN6	Port2 Load	Port3 Load	Port4 Load	Port3 Load	Port4 Load	Port4 Load
STAN7	Thru	Thru	Thru	Thru	Thru	Thru
STAN8	Isolation	Isolation	Isolation	Isolation	Isolation	Isolation
STAN9	Omit Iso.	Omit Iso.	Omit Iso.	Omit Iso.	Omit Iso.	Omit Iso.

- Full 3-Port Cal

	Port1-Port2-Port3	Port1-Port2-Port4	Port1-Port3-Port4	Port2-Port3-Port4
STAN1	Port1 Open	Port1 Open	Port1 Open	Port2 Open
STAN2	Port1 Short	Port1 Short	Port1 Short	Port2 Short
STAN3	Port1 Load	Port1 Load	Port1 Load	Port2 Load
STAN4	Port2 Open	Port2 Open	Port3 Open	Port3 Open
STAN5	Port2 Short	Port2 Short	Port3 Short	Port3 Short
STAN6	Port2 Load	Port2 Load	Port3 Load	Port3 Load
STAN7	Port3 Open	Port4 Open	Port4 Open	Port4 Open
STAN8	Port3 Short	Port4 Short	Port4 Short	Port4 Short
STAN9	Port3 Load	Port4 Load	Port4 Load	Port4 Load
STAN10	Port1-Port2 Thru	Port1-Port2 Thru	Port1-Port3 Thru	Port2-Port3 Thru
STAN11	Port1-Port3 Thru	Port1-Port4 Thru	Port1-Port4 Thru	Port2-Port4 Thru
STAN12	Port2-Port3 Thru	Port2-Port4 Thru	Port3-Port4 Thru	Port3-Port4 Thru
STAN13	Port1-Port2 Iso.	Port1-Port2 Iso.	Port1-Port3 Iso.	Port2-Port3 Iso.
STAN14	Port1-Port3 Iso.	Port1-Port4 Iso.	Port1-Port4 Iso.	Port2-Port4 Iso.
STAN15	Port2-Port3 Iso.	Port2-Port4 Iso.	Port3-Port4 Iso.	Port3-Port4 Iso.
STAN16	Omit Iso.	Omit Iso.	Omit Iso.	Omit Iso.

- Full 4-Port Cal

	Port1-Port2-Port3-Port4
STAN1	Port1 Open
STAN2	Port1 Short
STAN3	Port1 Load
STAN4	Port2 Open
STAN5	Port2 Short
STAN6	Port2 Load
STAN7	Port3 Open
STAN8	Port3 Short
STAN9	Port3 Load
STAN10	Port4 Open
STAN11	Port4 Short
STAN12	Port4 Load
STAN13	Port1-Port2 Thru
STAN14	Port1-Port3 Thru
STAN15	Port1-Port4 Thru
STAN16	Port2-Port3 Thru
STAN17	Unused
STAN18	Unused
STAN19	Port1-Port2 Iso.
STAN20	Port1-Port3 Iso.
STAN21	Port1-Port4 Iso.
STAN22	Port2-Port3 Iso.
STAN23	Port2-Port4 Iso.
STAN24	Port3-Port4 Iso.
STAN25	Omit Iso.

- Full 5-Port Cal

	Port1-Port2-Port3-Port4-Port5
STAN1	Port1 Open
STAN2	Port1 Short
STAN3	Port1 Load
STAN4	Port2 Open
STAN5	Port2 Short
STAN6	Port2 Load
STAN7	Port3 Open
STAN8	Port3 Short
STAN9	Port3 Load
STAN10	Port4 Open
STAN11	Port4 Short
STAN12	Port4 Load
STAN13	Port5 Open
STAN14	Port5 Short
STAN15	Port5 Load
STAN16	Port1- Port2 Thru
STAN17	Port1- Port3 Thru
STAN18	Port1- Port4 Thru
STAN19	Unused
STAN20	Port2- Port3 Thru
STAN21	Unused
STAN22	Port2- Port5 Thru
STAN23	Unused
STAN24	Unused
STAN25	Unused
STAN26	Unused
STAN30	Unused
STAN36	Omit Iso.

- Full 6-Port Cal

	Port1-Port2-Port3-Port4-Port5-Port6
STAN1	Port1 Open
STAN2	Port1 Short
STAN3	Port1 Load
STAN4	Port2 Open
STAN5	Port2 Short
STAN6	Port2 Load
STAN7	Port3 Open
STAN8	Port3 Short
STAN9	Port3 Load
STAN10	Port4 Open
STAN11	Port4 Short
STAN12	Port4 Load
STAN13	Port5 Open
STAN14	Port5 Short
STAN15	Port5 Load
STAN16	Port6 Open
STAN17	Port6 Short
STAN18	Port6 Load
STAN19	Port1- Port2 Thru
STAN20	Port1- Port3 Thru
STAN21	Port1- Port4 Thru
STAN22	Unused
STAN23	Unused
STAN24	Port2- Port3 Thru
STAN25	Unused
STAN26	Port2- Port5 Thru
STAN30	Port3- Port6 Thru
STAN36	Unused
STAN49	Omit Iso.

14.7.8 Fixture Commands

Fixture command example (short forms are used for the description).

Execute the software fixture in Channel 1. Set the impedance conversion, the balance parameter, and mixed mode Sdd and Scc to ON.

CAUTION: ***Execute 4-port Full Cal before executing the software fixture.***

`CALC1:TRAN:SFIX:DEV1:IMP 25OHM`	Sets the impedance conversion value of 25 Ω in Port 1.
`CALC1:TRAN:SFIX:DEV2:IMP 25OHM`	Sets the impedance conversion value of 25 Ω in Port 2.
`CALC1:TRAN:SFIX:DEV3:IMP 75OHM`	Sets the impedance conversion value of 75 Ω in Port 3.
`CALC1:TRAN:SFIX:DEV4:IMP 75OHM`	Sets the impedance conversion value of 75 Ω in Port 4.
`CALC1:TRAN:SFIX:DEV:STAT ON`	Sets the impedance conversion to ON.
`CALC1:TRAN:SFIX:BPAR ON`	Sets the balance parameter to ON.
`CALC1:TRAN:SFIX:MMOD1:STAT ON`	Sets the Mix-mode Sdd to ON.
`CALC1:TRAN:SFIX:MMOD4:STAT ON`	Sets the Mix-mode Scc to ON.
`CALC1:TRAN:SFIX:STAT ON`	Sets the software fixture to ON.
`DISP:WIND1:TRAC1:STAT ON`	Displays Trace 1 on Window 1.
`DISP:WIND1:TRAC2:STAT ON`	Displays Trace 2 on Window 1.
`DISP:WIND1:TRAC3:STAT ON`	Displays Trace 3 on Window 1.
`CALC1:TRAC1:PAR B34`	Sets Trace 1 to the balance parameter B34.
`CALC1:TRAC2:PAR SDD21`	Sets Trace 2 to the Mix-mode Sdd 21.
`CALC1:TRAC2:PAR SCC21`	Sets Trace 3 to the Mix-mode Scc 21.

Function	Command	Parameter (Summary Content)	Query
ON/OFF	CALCulate<ch>:TRANsform: SFIXture:STATe	<bool>	0|1
Single port			
Port extension	CALCulate<ch>:TRANsform: SFIXture:PEXTension	<bool>	0|1
Port extension value	CALCulate<ch>:TRANsform: SFIXture:PEXTension<port>: TIME	<real>	<real>
Circuit deletion	CALCulate<ch>:TRANsform: SFIXture:DEVice<port>: SMATching	<bool>	0|1
	CALCulate<ch>:TRANsform: SFIXture:DEVice<port>: DCIRcuit	{OFF|DELete|ADD}	OFF|DEL|ADD
Impedance transformation	CALCulate<ch>:TRANsform: SFIXture:DEVice:STATe	<bool>	0|1
Impedance value	CALCulate<ch>:TRANsform: SFIXture:DEVice<port>: IMPedance	<real>	<real>

Function	Command	Parameter (Summary Content)	Query
Matching circuit	CALCulate<ch>:TRANsform: SFIXture:DEVice<port>: MATChing	<bool>	0|1
Matching circuit type	CALCulate<ch>:TRANsform: SFIXture:DEVice<port>: MODel	CPLS|LPCS|CSLP|LSCP|LPCP|S2PF	CPLS|LPCS|CSLP|LSCP|LPCP|S2PF
Capacitance value	CALCulate<ch>:TRANsform: SFIXture:DEVice<port>: CAPacitance	<real>	<real>
Conductance value	CALCulate<ch>:TRANsform: SFIXture:DEVice<port>: GCAPacitance	<real>	<real>
Inductance value	CALCulate<ch>:TRANsform: SFIXture:DEVice<port>: INDuctance	<real>	<real>
Resistor value	CALCulate<ch>:TRANsform: SFIXture:DEVice<port>: RINDuctance	<real>	<real>
Balance port			
Matching circuit	CALCulate<ch>:TRANsform: SFIXture:BALance<bport>: MATChing	<bool>	0|1
Capacitance value	CALCulate<ch>:TRANsform: SFIXture:BALance<bport>: CAPacitance	<real>	<real>
Conductance value	CALCulate<ch>:TRANsform: SFIXture:BALance<bport>: GCAPacitance	<real>	<real>
Inductance value	CALCulate<ch>:TRANsform: SFIXture:BALance<bport>: INDuctance	<real>	<real>
Resistor value	CALCulate<ch>:TRANsform: SFIXture:BALance<bport>: RINDuctance	<real>	<real>
Balance measurement			
Balance parameter	CALCulate<ch>:TRANsform: SFIXture:BPARameter	<bool>	0|1
Balance transformation	CALCulate<ch>:TRANsform: SFIXture:BALun	<bool>	0|1
Balun type	CALCulate<ch>:TRANsform: SFIXture:BALun:TYPE	FLOating|DIFFerential	FLO|DIFF

<table>
<tr><th>Function</th><th>Command</th><th>Parameter (Summary Content)</th><th>Query</th></tr>
<tr><td>Mixed mode
(Select mode)</td><td>CALCulate<ch>:TRANsform:
SFIXture:MMODe</td><td>SCC|SCD|SDC|SDD|
OFF</td><td>SCC|SCD|SDC|
SDD|OFF</td></tr>
<tr><td>Mixed mode
(Individual
specification mode)</td><td>CALCulate<ch>:TRANsform:
SFIXture:<MMODe>:STATe</td><td><bool></td><td>0|1</td></tr>
<tr><td>Device port</td><td>CALCulate<ch>:TRANsform:
SFIXture:DEVice:
SPECification</td><td>U1B34|U2B13|
U3B12|U1B24|
U2B14|U4B12|
U1B23|U3B14|
U4B13|U2B34|
U3B24|U4B23|
U12B34|U13B24|
U14B23|U23B14|
U24B13|U34B12|
B12B34|B13B24|
B14B23|B23B14|
B24B13|B34B12</td><td>U1B34|U2B13|
U3B12|U1B24|
U2B14|U4B12|
U1B23|U3B14|
U4B13|U2B34|
U3B24|U4B23|
U12B34|U13B24|
U14B23|U23B14|
U24B13|U34B12|
B12B34|B13B24|
B14B23|B23B14|
B24B13|B34B12</td></tr>
<tr><td>Model selection</td><td>CALCulate<ch>:TRANsform:
SFIXture:DEVice:PMODel</td><td>UB|UUB|BB|UUUB|
UBB|UUUUB|UUBB|
BBB</td><td>UB|UUB|BB|
UUUB|UBB|
UUUUB|UUBB|
BBB</td></tr>
<tr><td>Port number selection</td><td>CALCulate<ch>:TRANsform:
SFIXture:DEVice<port>:
ASSign</td><td><int></td><td><int></td></tr>
<tr><td>Loading the matching circuit file
1-port File

2-port File</td><td>
FILE:LOAD:SFIXture
<ch>:ADD:S1P<port>
FILE:LOAD:SFIXture
<ch>:ADD:S2P<port></td><td>
<str>
= “File name”
<str>
= “File name”</td><td>
-

-</td></tr>
<tr><td>Loading the circuit deletion file
2-port File</td><td>
FILE:LOAD:SFIXture
<ch>:DELete:S2P<port></td><td>
<str>
= “File name”</td><td>
×</td></tr>
<tr><td>Deleting the path pattern from the measurement (CAL) point to the device on the jig</td><td>CALCulate<ch>:TRANsform:
SFIXture:DEVice:HYPer</td><td>OPEN|SHORt|DONE</td><td>×</td></tr>
<tr><td>Storing the calculated S2P circuit</td><td>FILE:STORe:SFIXture<ch>:
DELete:S2P<port></td><td><str>
= “File name”</td><td>×</td></tr>
</table>

14.7.9 Trace Commands

Trace command example (short forms are used for the description).

Display Trace 1 and Trace 2 on Window 1, set Trace 1 to S11 and Trace 2 to S22, and execute the auto scale of Trace 1.

`DISP:WIND1:TRAC1:STAT ON`	Displays Trace 1 on Window 1.
`DISP:WIND1:TRAC2:STAT ON`	Displays Trace 2 on Window 1.
`CALC1:TRAC1:PAR S11`	Sets Trace 1 to S11.
`CALC1:TRAC2:PAR S22`	Sets Trace 2 to S22.
`DISP1:Y1:SCAL:AUTO ONCE`	Executes the auto scale of Trace 1.

<table>
<tr><th>Function</th><th>Command</th><th>Parameter
(Summary Content)</th><th>Query</th></tr>
<tr><td>Trace</td><td></td><td></td><td></td></tr>
<tr><td>Active</td><td>DISPlay:WINDow:TRACe:
ACTive</td><td><tr></td><td><tr></td></tr>
<tr><td>Display ON/OFF</td><td>DISPlay:WINDow<win>:
TRACe<tr>:STATe</td><td><bool></td><td>0|1</td></tr>
<tr><td>Measurement ON/OFF</td><td>CALCulate<ch>:
TRACe<tr>:STATe</td><td><bool></td><td>0|1</td></tr>
<tr><td>Parameter</td><td></td><td></td><td></td></tr>
<tr><td>Trace parameter</td><td>CALCulate<ch>
[:TRACe<tr>]:PARameter</td><td>S11|S12|S13|S14|S21|S22|S23|
S24|S31|S32|S33|S34|S41|S42|
S43|S44|SS11|SS12|SS21|SS22|
B12|B21|B23|B32|B34|B43|
SDD11|SDD12|SDD21|SDD22|
SDC11|SDC12|SDC21|SDC22|
SCD11|SCD12|SCD21|SCD22|
SCC11|SCC12|SCC21|SCC22|
B23B|B32B|SDD11B|SDD12B|
SDD21B|SDD22B|SDC12B|
SDC22B|SCD21B|SCD22B|
SCC22B|S51|S61|S52|S62|S53|S63|
S54|S64|S15|S25|S35|S45|S55|S65|
S16|S26|S36|S46|S56|S66|SDD31|
SDD41|SDD51|SDD32|SDD42|
SDD52|SDD13|SDD23|SDD33|
SDD43|SDD53|SDD14|SDD24|
SDD34|SDD44|SDD54|SDD15|
SDD25|SDD35|SDD45|SDD55|
SDC31|SDC32|SDC13|SDC23|
SDC33|SDC43|SDC14|SDC24|
SDC34|SDC44|SDC15|SDC25|
SDC35|SDC45|SDC55|SCD31|
SCD41|SCD51|SCD32|SCD42|
SCD52|SCD13|SCD23|SCD33|
SCD43|SCD53|SCD34|SCD44|
SCD54|SCD55|SCC31|SCC32|
SCC13|SCC23|SCC33|SCC43|
SCC34|SCC44| SCC55</td><td>S11|S12|S13|S14|S21|S22|S23|
S24|S31|S32|S33|S34|S41|S42|
S43|S44|SS11|SS12|SS21|SS22|
B12|B21|B23|B32|B34|B43|
SDD11|SDD12|SDD21|SDD22|
SDC11|SDC12|SDC21|SDC22|
SCD11|SCD12|SCD21|SCD22|
SCC11|SCC12|SCC21|SCC22|
B23B|B32B|SDD11B|SDD12B|
SDD21B|SDD22B|SDC12B|
SDC22B|SCD21B|SCD22B|
SCC22B|S51|S61|S52|S62|S53|
S63|S54|S64|S15|S25|S35|S45|S55|
S65|S16|S26|S36|S46|S56|S66|
SDD31|SDD41|SDD51|SDD32|
SDD42|SDD52|SDD13|SDD23|
SDD33|SDD43|SDD53|SDD14|
SDD24|SDD34|SDD44|SDD54|
SDD15|SDD25|SDD35|SDD45|
SDD55|SDC31|SDC32|SDC13|
SDC23|SDC33|SDC43|SDC14|
SDC24|SDC34|SDC44|SDC15|
SDC25|SDC35|SDC45|SDC55|
SCD31|SCD41|SCD51|SCD32|
SCD42|SCD52|SCD13|SCD23|
SCD33|SCD43|SCD53|SCD34|
SCD44|SCD54|SCD55|SCC31|
SCC32|SCC13|SCC23|SCC33|
SCC43|SCC34|SCC44|SCC55</td></tr>
<tr><td>Format</td><td>CALCulate<ch>
[:TRACe<tr>]:FORMat</td><td>MLOGarithmic|MLINear|
PHASe|DELay|SWR|
UPHase|POLar|SCHart|
ISCHart|REAL|IMAGinary</td><td>MLOG|MLIN|PHAS|DEL|
SWR|UPH|POL|SCH|ISCH|
REAL|IMAG</td></tr>
</table>

Function	Command	Parameter (Summary Content)	Query
Scale			
Auto scale	DISPlay[:WINDow<win>]:Y<tr>:SCALe:AUTO	ONCE	×
/div	DISPlay<ch>[:WINDow]:Y<tr>:SCALe:PDIVision	<real>	<real>
Reference level	DISPlay<ch>[:WINDow]:Y<tr>:SCALe:RLEVel	<real>	<real>
Reference position	DISPlay<ch>[:WINDow]:Y<tr>:SCALe:RPOSition	<real>	<real>
Reference line ON/OFF	DISPlay<ch>[:WINDow]:Y<tr>:RLINe	<bool>	0|1
Parameter conversion			
Conversion mode	CALCulate<ch>:TRANsform:IMPedance<tr>:TYPE	NONE|Z|Y|INVersion	NONE|Z|Y|INV
Conversion impedance	CALCulate<ch>:TRANsform:IMPedance:CIMPedance	<real>	<real>
Smoothing			
ON/OFF	CALCulate<ch>:SMOothing<tr>:STATe	<bool>	0|1
Aperture	CALCulate<ch>:SMOothing<tr>:APERture	<real>	<real>
Group delay aperture	CALCulate<ch>:GDAPerture<tr>:APERture	<real>	<real>
Program sweep segment	CALCulate<ch>:PSWeep:SMOothing<seg>	<bool>	0|1
Trace memory			
Display ON/OFF	DISPlay:WINDow<win>:MEMory<tr>:STATe	<bool>	0|1
Measurement ON/OFF	CALCulate<ch>:MEMory<tr>:STATe	<bool>	0|1
Copy	TRACe<ch>:COPY	<tr>	×
Calculation	CALCulate<ch>:MATH<tr>:[EXPRession:]NAME	NONE|DDM|DSM|DMM|DAM =Off|D/M|D-M|D*M|D+M	NONE|DDM|DSM|DMM|DAM
Limit test			
Limit test ON/OFF	DISPlay<ch>:LIMit:STATe	<bool>	0|1

Function	Command	Parameter (Summary Content)	Query
Limit line ON/OFF	DISPlay<ch>:LIMit:LINE	<bool>	0|1
Test trace ON/OFF	DISPlay<ch>:LIMit: TRACe<tr>:STATe	<bool>	0|1
Result window display ON/OFF	DISPlay:LIMit:SUMMary: WINDow	<bool>	0|1
Segment edit	DISPlay<ch>:LIMit<tr>: [:PARameter<limpar>]: SEGMent<seg>	<real>,<real>,<real>,{SLINe|FLINe|SPOint} =Stimulus,Upper,Lower,Type	<real>,<real>,<real>, {SLIN|FLIN|SPO},<int>, <int>
All segment clear	DISPlay<ch>:LIMit<tr>: [:PARameter<limpar>]: CLEar	-	×
Test result output	DISPlay<ch>:LIMit: RESult?	-	OFF|PASS|FAIL
Test result summary output	DISPlay:LIMit:SUMMary?	-	OFF|PASS|FAIL
Offset	DISPlay<ch>:LIMit<tr> [:OFFSet<limpar>]: STIMulus	<real>	<real>
	DISPlay<ch>:LIMit<tr> [:OFFSet<limpar>]: RESPonse	<real>	<real>
Beep	DISPlay:LIMit:BEEP: MODE	OFF|PASS|FAIL	OFF|PASS|FAIL
	DISPlay:LIMit:BEEP: TONE	<int>	<int>
	DISPlay:LIMit:BEEP: DURation	<real>	<real>
Limit line loading	FILE:LOAD:LIMit<ch>: TRACe<tr> [:PARameter<limpar>]	<str>= "File name"	×
Limit line saving	FILE:STORe:LIMit<ch>: TRACe<tr> [:PARameter<limpar>] <limpar>=1:Mag 2:Phase	<str>= "File name"	×

14.7.10 Window Commands

Window command example (short forms are used for the description).

Set Window 1, Window 2, and Window 3 to split the display horizontally, and display Window 1 and Window 2 on the first column and Window 3 on the second column.

`DISP:WIND1:STAT ON`	Displays Window 1.
`DISP:WIND2:STAT ON`	Displays Window 2.
`DISP:WIND2:ATT 2`	Allocates Channel 2 to Window 2.
`DISP:WIND3:STAT ON`	Displays Window 3.
`DISP:WIND3:ATT 3`	Allocates Channel 3 to Window 3.
`DISP:WIND:SPL:METH HOR`	Sets to the horizontal split display.
`DISP:WIND:SPL:COL1 2`	Sets the number of windows displayed in the first column to 2.
`DISP:WIND:SPL:COL2 1`	Sets the number of windows displayed in the second column to 1.

Function	Command	Parameter (Summary Content)	Query
Window			
ON/OFF	DISPlay:WINDow<win>:STATe	<bool>	0|1
Active	DISPlay:WINDow:ACTive	<int>	<int>
Attach	DISPlay:WINDow<win>:ATTach	<int>	<int>
Layout	DISPlay:WINDow:LAYout	FULL|UPPer|LOWer|LEFT|RIGHt|ULEFt|URIGht|LLEFt|LRIGht	FULL|UPP|LOW|LEFT|RIGH|ULEF|URIG|LLEF|LRIG
Window title	DISPlay:WINDow<win>:TEXT	<str>	<str>
Title display ON/OFF	DISPlay:WINDow:TITLe	<bool>	0|1
Status title	DISPlay:TEXT	<str>	<str>
Message dialog clear	DISPlay:MESSage:CLEar	-	×
Window layout			
Layout method	DISPlay:WINDow:SPLit:METHod	STANdard|HORizontal|VERTical	STAN|HOR|VERT
Number of windows per row (column)	DISPlay:WINDow:SPLit:COLumn<n>	<int>	<int>
Size of row (column)	DISPlay:WINDow:SPLit:SIZE<n>	<int>	<int>

Function	Command	Parameter (Summary Content)	Query
Annotation display			
Trace annotation	DISPlay:ANNotation:TRACe	<bool>	0|1
Stimulus annotation	DISPlay:ANNotation:STIMulus	<bool>	0|1
Tool menu display	DISPlay[:WINDow]:MENU:TOOL	<bool>	0|1

14.7.11 Marker Commands

Marker command example (short forms are used for the description).

Set Marker 1 frequency to 1 GHz in Channel 1, and execute the MAX search in Marker 2 and the MIN search in Marker 3.

`MARK1:ACT 1,1GHZ`	Sets Marker 1 as the active marker.
`MARK1:ACT 2`	Sets Marker 2 as the active marker.
`MARK1:SEAR MAX`	Executes the MAX search in the active marker.
`MARK1:ACT 3`	Sets Marker 3 as the active marker.
`MARK1:SEAR MIN`	Executes the MIN search in the active marker.

Function	Command	Parameter (Summary Content)	Query
Marker			
Activate	MARKer<ch>: ACTivate[:NUMBer]	<int>[,<real>] = Marker No., Frequency (Power during Power sweep)	<int>,<real>
Frequency setting	MARKer<ch>: ACTivate:STIMulus	<real>	<real>
Trace specify	MARKer<ch>: ACTivate:TRACe	<int>	<int>
ON/OFF	MARKer<ch>: ACTivate:STATe	<bool>	0|1
All marker OFF	MARKer<ch>:AOFF	-	×
Compensate ON/OFF	MARKer<ch>: COMPensate	<bool>	0|1
Polar marker	MARKer<ch>:POLar	MLINear|MLOGarithmic| RIMaginary	MLIN|MLOG|RIM
Smith marker	MARKer<ch>:SMITh	MLINear|MLOGarithmic| RIMaginary|IMPedance| ADMittance	MLIN|MLOG|RIM|IMP| ADM
Conversion marker	MARKer<ch>: CONVersion	DEFault|IMPedance| ADMittance	DEF|IMP|ADM
Marker list	MARKer<ch>:LIST	<bool>	0|1
List display position	MARKer<ch>:LIST: DISPlay	LOWer|UPPer	LOW|UPP
Channel definition	MARKer<ch>:COUPle: CHANnel<ch>:DEFine	<bool>	0|1

Function	Command	Parameter (Summary Content)	Query
Marker couple			
Couple channel	MARKer:COUPle:CHANnel[:STATe]	<bool>	0|1
Couple trace	MARKer:COUPle:TRACe[:STATe]	<bool>	0|1
Delta mode			
Mode	MARKer<ch>:DELTa[:MODE]	OFF|CHILd|COMPare	OFF|CHIL|COMP
Compare marker	MARKer<ch>:DELTa:COMPare	<int>[,<real>]	<int>,<real>
Marker To	MARKer<ch>:LET	STARt|STOP|CENTer|SPAN|RLEVel	×
Search			
Search	MARKer<ch>:SEARch[:MODE]	OFF|MAX|MIN|TARGet|RIPPle	OFF|MAX|MIN|TARG|RIPP
Ripple Search	MARKer<ch>:SEARch:RIPPle[:MODE]	MAX|MIN|BOTH|PPEak	MAX|MIN|BOTH|PPE
Ripple Sensitivity	MARKer<ch>:SEARch:RIPPle{:DX|:DY}	<real>	<real>
Target Search	MARKer<ch>:SEARch:TARGet[:MODE]	ZERO|PI|VALue	ZERO|PI|VAL
Target	MARKer<ch>:SEARch:TARGet:VALue	<real>	<real>
Left Search	MARKer<ch>:SEARch:TARGet:LEFT	-	×
Right Search	MARKer<ch>:SEARch:TARGet:RIGHt	-	×
Tracking	MARKer<ch>:SEARch:TRACking	<bool>	0|1
Partial area search			
ON/OFF	MARKer:SEARch:PARTial[:STATe]	<bool>	0|1
Start point	MARKer:SEARch:PARTial:STARt	<real>	<real>
Stop point	MARKer:SEARch:PARTial:STOP	<real>	<real>

Function	Command	Parameter (Summary Content)	Query
Marker data output			
Active Marker	FETCh<ch>[:MARKer] [:ACTivate]?	-	<real>,<real>,<real>, <real>,<int> = Refer to *4
Specified Marker	FETCh<ch>[:MARKer] :NUMBer<mkr>?	-	<real>,<real>,<real>, <real>,<int> = Refer to *4

*4: Marker data output
Response format = <stimulus>, <data 1>, <data 2>, <data 3>, and <status>
<stimulus>: Stimulus value at marker position
Each value of <data1>, <data2> and <data3> depends on the format and marker mode.
<status>: 0: normal, others: error.
When there is no valid data: invalid value (+1.0e38).

The <data1>, <data2> and <data3> depends on the format setting.

Format	<data1>	<data2>	<data3>	Description
LogMag	Logarithmic magnitude	Invalid value	Invalid value	Depends on the Marker Mode when the Marker Mode excludes the Default.
Phase	Phase	Invalid value	Invalid value	
Delay	Group delay	Invalid value	Invalid value	
SWR	Standing wave ratio	Invalid value	Invalid value	
Smith	-	-	-	Depends on the Marker Mode
iSmith	-	-	-	
Polar	-	-	-	
LinMag	Linear magnitude	Invalid value	Invalid value	Depends on the Marker Mode when the Marker Mode excludes the Default.
Real	Real part	Invalid value	Invalid value	
Imag	Imaginary part	Invalid value	Invalid value	
uPhase	Continuous phase	Invalid value	Invalid value	

The <data1>, <data2> and <data3> depends on the marker mode setting.

Marker Mode	<data1>	<data2>	<data3>
Lin/Phase	Linear magnitude	Phase	Invalid value
Log/Phase	Logarithmic magnitude	Phase	Invalid value
Real/Imag	Real part	Imaginary part	Invalid value
R+jX	R value of complex impedance.	X value of complex impedance.	Inductance value or capacitance value
G+jB	G value of complex admittance.	B value of complex admittance.	Inductance value or capacitance value

Function	Command	Parameter (Summary Content)	Query
Filter analysis			
ON/OFF	MARKer:FANalysis [:STATe]	<bool>	0|1
Path bandwidth	MARKer:FANalysis: WIDTh	<real>	<real>
Analysis type	MARKer:FANalysis: TYPE	BAND|NOTCh	BAND|NOTC
Search reference	MARKer:FANalysis: REFerence	ACTive|MAXimum|RLINe	ACT|MAX|RLIN
Search direction	MARKer:FANalysis: DIRection	IN|OUT	IN|OUT
Analysis trace number	MARKer:FANalysis: TRACe	<int>	<int>
Frequency display format	MARKer:FANalysis: FORMat	ABSolute|RELative	ABS|REL
Result display position	MARKer:FANalysis: DISPlay	URIGht|LRIGht|ULEFt| LLEFt	URIG|LRIG|ULEF|LLEF
Analysis result output	FETCh[:MARKer]: FANalysis?	-	<real>,<real>,<real>, <real>,<real>,<real>, <int> = Refer to *5

*5: Filter analysis result output
Response format = <center>, <left>, <right>, <band>, <quality>, <shape>, and <status>
<center> : Filter frequency center.
<left> : The searched band width left side frequency.
<right> : The searched band width right side frequency.
<band> : The searched band width.
<quality> : Quality factor.
<shape> : Shape factor
<status> : Normal when 0. Error when other than 0.
When there is no valid data available, an invalid value (+1.0e38) is returned.

14.7.12 Time Domain Command

Time Domain command example (short forms are used for the description).

Display the time domain on Trace 1 of Channel 1.

```
CALC1:TRAN:TIME1:STAT ON        Sets Time Domain on Trace 1 to ON.
CALC1:TRAN:TIME:STAR 0S         Sets the start time to 0 sec.
CALC1:TRAN:TIME:STOP 20NS       Sets the start time to 20 nsec.
```

Function	Command	Parameter (Summary Content)	Query
ON/OFF	CALCulate<ch>: TRANsform:TIME<tr>: STATe	<bool>	0|1
Transform function			
Start time	CALCulate<ch>: TRANsform:TIME:STARt	<real>	<real>
Stop time	CALCulate<ch>: TRANsform:TIME:STOP	<real>	<real>
Transform mode	CALCulate<ch>: TRANsform:TIME:MODE	BPASs|LPIMpulse|LPSTep	BPAS|LPIM|LPST
Low pass range setting	SOURce:FREQuency<ch>: LPASs	-	×
Time axis display	CALCulate<ch>: TRANsform:TIME: DISPlay	TIME|DISTance|RTIMe| RDIStance	TIME|DIST|RTIM|RDIS
Velocity Factor	[SENSe:]CORRection<ch>: RVELocity:COAX	<real>	<real>
Window	CALCulate<ch>: TRANsform:TIME: WINDow	MINimum|NORMal|WIDE| MAXimum	MIN|NORM|WIDE|MAX
Gate function			
ON/OFF	CALCulate<ch>: GATE:TIME<tr>:STATe	<bool>	0|1
Start time	CALCulate<ch>:GATE: TIME:STARt	<real>	<real>
Stop time	CALCulate<ch>:GATE: TIME:STOP	<real>	<real>
Gate type	CALCulate<ch>:GATE: TIME:WINDow	MINimum|NORMal|WIDE| MAXimum	MIN|NORM|WIDE|MAX

14.7.13 Frequency Conversion Device Measurement Command

Frequency conversion device measurement command example (short forms are used for the description).

The signal source sweeps the frequency from 500 MHz to 1 GHz in Channel 1 and the receiver measures the double frequency of the signal source from 1 GHz to 2 GHz.

`FREQ1:STAR 500MHZ`	Sets to the start frequency of 500 MHz.
`FREQ1:STOP 1GHZ`	Sets to the stop frequency of 1 GHz.
`SWE1:STAT SEP`	Sets the independent setting of the receiver to ON.
`SENS:FREQ1:STAR 1GHZ`	Sets the start frequency of the receiver to 1 GHz.
`SENS:FREQ1:STOP 2GHZ`	Sets the stop frequency of the receiver to 2 GHz.

Function	Command	Parameter (Summary Content)	Query
Independent setting of receiver			
ON/OFF	[SOURce:]SWEep<ch>:STATe1	ON|SEParate	ON|SEP
Start frequency	SENSe:FREQuency<ch>:STARt	<real>	<real>
Stop frequency	SENSe:FREQuency<ch>:STOP	<real>	<real>
The second signal source			
ON/OFF	[SOURce:]SWEep<ch>:STATe2	OFF|ON	OFF|ON
Start frequency	[SOURce:]FREQuency<ch>:STARt2	<real>	<real>
Stop frequency	[SOURce:]FREQuency<ch>:STOP2	<real>	<real>
CW frequency	[SOURce:]FREQuency<ch>:CW2	<real>	<real>
Output power	[SOURce:]POWer<ch>:LEVel2	<real>	<real>
Start power	[SOURce:]POWer<ch>:STARt2	<real>	<real>
Stop power	[SOURce:]POWer<ch>:STOP2	<real>	<real>
Mixer Measurement			
ON/OFF	[SOURce:]SWEep<ch>:MIXer:STATe	<bool>	0|1
Port setting	[SENSe:]FUNCtion<ch>:POWer	MP12|MP13|MP14|MP23|MP24|MP34	MP12|MP13|MP14|MP23|MP24|MP34

14.7.13 Frequency Conversion Device Measurement Command

Function	Command	Parameter (Summary Content)	Query
Sweep mode	[SOURce:]SWEep<ch>: MIXer:MODE	SAF|SFA|FAS|FSA|ASF| AFS =SAF RF:Sweep, LO:Auto, IF:Fixed =SFA RF:Sweep, LO:Fixed, IF:Auto =FAS RF:Fixed, LO:Auto, IF:Sweep =FSA RF:Fixed, LO:Sweep, IF:Auto =ASF RF:Auto, LO:Sweep, IF:FIXED =AFS RF:Auto, LO:Fixed, IF:SWEEP	SAF|SFA|FAS|FSA|ASF| AFS
IF type	[SOURce:]SWEep<ch>: MIXer:FREQuency	RAL|RSL|LSR =RAL: IF=RF+LO, =RSL: IF=RF-LO =LSR: IF=LO-RF	RAL|RSL|LSR
Start frequency	[SOURce:]FREQuency <ch>:MIXer:STARt	<real>	<real>
Stop frequency	[SOURce:]FREQuency <ch>:MIXer:STOP	<real>	<real>
Fixed frequency	[SOURce:]FREQuency <ch>:MIXer:FIXed	<real>	<real>
RF port power	[SOURce:]POWer<ch>: MIXer:RF	<real>	<real>
LO port power	[SOURce:]POWer<ch>: MIXer:LO	<real>	<real>
IF port power	[SOURce:]POWer<ch>: MIXer:IF	<real>	<real>
Measurement parameter	CALCulate<ch> [:TRACe<tr>]:PARameter	M11|M12|M13|M14| M21|M22|M23|M24| M31|M32|M33|M34| M41|M42|M43|M44	M11|M12|M13|M14| M21|M22|M23|M24| M31|M32|M33|M34| M41|M42|M43|M44
Calibration	[SENSe:]CORRection <ch>:MIXer	METHod|STANdard{1-9}| SAVE|AUTO|DONE =METH: standard CAL =STAN1: RF PORT Open =STAN2: RF PORT Short =STAN3: RF PORT Load =STAN4: IF PORT Open =STAN5: IF PORT Short =STAN6: IF PORT Load =STAN7: Thru =SAVE: Done standard cal =AUTO: Auto Cal =DONE: Done Mixer Cal	-

14.7.14 Device Power Source Command

Device power source command example (short forms are used for the description).

Output 3.3 V to VSIM Channel A and 0 V to VSIM Channel B in Channel 1, and 0 V to VSIM Channel A and 3.3 V to VSIM Channel B in Channel 2.

`VOLT:CHAN1 ON`	Sets Channel A to ON.
`VOLT:BIAS1 0V`	Sets the bias value of Channel A to 0 V.
`VOLT:CHAN2 ON`	Sets Channel B to ON.
`VOLT:BIAS2 0V`	Sets the bias value of Channel B to 0 V.
`VOLT1:STAT1 ON`	Sets the VSIM Channel A output to ON in the measurement channel 1.
`VOLT1:AMPL1 3.3V`	Sets the VSIM Channel A output to 3.3 V in the measurement channel 1.
`CURR1:LIM1 100MA`	Sets the current limit of VSIM Channel A to 100 mA in the measurement channel 1.
`VOLT1:STAT2 ON`	Sets the VSIM Channel B output to ON in the measurement channel 1.
`VOLT1:AMPL2 0V`	Sets the VSIM Channel B output to 0 V in the measurement channel 1.
`CURR1:LIM2 100MA`	Sets the current limit of VSIM Channel B to 100 mA in the measurement channel 1.
`VOLT2:STAT1 ON`	Sets the VSIM Channel A output to ON in the measurement channel 2.
`VOLT2:AMPL1 0V`	Sets the VSIM Channel A output to 0 V in the measurement channel 2.
`CURR2:LIM1 100MA`	Sets the current limit of VSIM Channel A to 100 mA in the measurement channel 2.
`VOLT2:STAT2 ON`	Sets the VSIM Channel B output to ON in the measurement channel 2.
`VOLT2:AMPL2 3.3V`	Sets the VSIM Channel B output to 3.3 V in the measurement channel 2.
`CURR2:LIM2 100MA`	Sets the current limit of VSIM Channel B to 100 mA in the measurement channel 2.
`VSIM:STAT ON`	Sets the VSIM function to ON.

<table>
<tr><th>Function</th><th>Command</th><th>Parameter
(Summary Content)</th><th>Query</th></tr>
<tr><td>VSIM setting</td><td></td><td></td><td></td></tr>
<tr><td>ON/OFF</td><td>[SOURce:]VSIM:STATe</td><td><bool></td><td>0|1</td></tr>
<tr><td>SWEEP STATE</td><td>[SOURce:]VSIM:BIAS</td><td><bool></td><td>0|1</td></tr>
<tr><td>VS Channel setting</td><td></td><td></td><td></td></tr>
<tr><td>ON/OFF</td><td>[SOURce:]VOLTage:
CHANnel<vsim></td><td><bool></td><td>0|1</td></tr>
<tr><td>Output bias value</td><td>[SOURce:]VOLTage:
BIAS<vsim></td><td><real></td><td><real></td></tr>
<tr><td>Channel output condition</td><td></td><td></td><td></td></tr>
<tr><td>Output ON/OFF</td><td>[SOURce:]VOLTage<ch>:
STATe<vsim></td><td><bool></td><td>0|1</td></tr>
<tr><td>Output voltage</td><td>[SOURce:]VOLTage<ch>:
AMPLitude<vsim></td><td><real></td><td><real></td></tr>
<tr><td>Current limit value</td><td>[SOURce:]CURRent<ch>:
LIMit<vsim></td><td><real></td><td><real></td></tr>
</table>

Function	Command	Parameter (Summary Content)	Query
Current measurement function			
ON/OFF	SENSe:CURRent<ch>: STATe<vsim>	<bool>	0|1
Measurement range	SENSe:CURRent<ch>: RANGe<vsim>	<real>	<real>
Burst measurement ON/OFF	SENSe:CURRent<ch>: BURSt<vsim>	<bool>	0|1
Burst measurement time	SENSe:CURRent<ch>: TIME<vsim>	<real>	<real>
Current measurement value output	FETCh<ch>: CURRent<vsim>?	-	<real>
Measurement error output	SENSe:CURRent<ch>: CONDition?	-	<int> = Error code (from lower bits) LimitA, B, C, D, OscillatorA, B, C, D, OverloadA, B, C, D, Overheat
Result display			
ON/OFF	DISPlay<ch>:WINDow: VSIM<vsim>	<bool>	0|1

<ch> : Channel numbers 1 to 16. Omitted = active channels

<vsim> : VSIM channel numbers 1=A, 2=B, 3=C, and 4=D. Cannot be omitted.

14.7.15 System Command

System command example (short forms are used for the description).

* How to reset this unit is described below.

SYST:PRES	Presets this unit.

Function	Command	Parameter (Summary Content)	Query
Reset	SYSTem:PRESet	-	×
Built-in Correction			
Source Correction	[SOURce:]CORRection <ch>:GAIN:STATe<src>	<bool>	0|1
Input Correction	[SENSe:]CORRection <ch>:GPHase:STATe	<bool>	0|1

14.7.16 GPIB Dedicated Commands

GPIB dedicated command example (short forms are used for the description).

Output the formatted data in Trace 1 of Channel 1.

`FORM:DATA REAL,32`	Sets the output form as the 32-bit binary data.
`FORM:BORD SWAP`	Sets the byte sequence to the swap mode (for the CPUs designed by Intel).
`TRAC? 0`	Outputs the formatted data in Trace 1 of Channel 1 in the form of block data.

Function	Command	Parameter (Summary Content)	Query
Data Input/Output			
	FORMat:DATA	REAL,{32|64}	REAL,{32|64}
		ASCii,{0|8-22}	ASC,{0|8-22}
	FORMat:BORDer	SWAPped|NORMal	SWAP|NORM
Data input	TRACe[:DATA]	<Data number>,<real>,... <Data number>,<block>	×
Data output	TRACe[:DATA]?	<Data number> =See *6 below.	<real>,...<block>
Error Request	SYSTem:ERRor?	-	<int>,<str>
	SYSTem:ERRor:ALL?	-	<int>,<str>, ...
Standard operation status	STATus:OPERation:ENABle	<int>	<int>
	STATus:OPERation:EVENt?	-	<int>
	STATus:OPERation:CONDition?	-	<int>
Questionable status	STATus:QUEStionable :ENABle	<int>	<int>
	STATus:QUEStionable :EVENt?	-	<int>
	STATus:QUEStionable : CONDition?	-	<int>
Limit status	STATus:LIMit:ENABle	<int>	<int>
	STATus:LIMit:EVENt?	-	<int>
	STATus:LIMit:CONDition?	- Refer to 14.5 "Status Bytes."	<int>

*6: Data No.
When the data expression is in real numbers, there is one data item for each measurement point.
For complex numbers, there are two data items for each measurement point.

Function	Command	Parameter (Summary Content)	Query
Power status	STATus:POWer:ENABle	<int>	<int>
	STATus:POWer:EVENt?	×	<int>
	STATus:POWer:CONDition?	×	<int>
Frequency status	STATus:FREQuency:ENABle	<int>	<int>
	STATus:FREQuency:EVENt?	×	<int>
	STATus:FREQuency:CONDition?	×	<int>
Device status	STATus:DEVice:ENABle	<int>	<int>
	STATus:DEVice:EVENt?	×	<int>
	STATus:DEVice:CONDition?	×	<int>

Data	No.	Expression	Remarks
Data after formatting	(Channel No. - 1) × 1024 + (Trace No. -1)	Real Number	Undefined for polar coordinates
Data before formatting	(Channel No. - 1) × 1024 + (Trace No. -1) + 32	Complex Number	
Magnitude data	(Channel No. - 1) × 1024 + (Trace No. -1) + 64	Real Number	Can be output regardless of the format
Phase Data	(Channel No. - 1) × 1024 + (Trace No. -1) + 80	Real Number	Can be output regardless of the format
Real number portion of polar coordinates display	(Channel No. - 1) × 1024 + (Trace No. -1) + 96	Real Number	Undefined except for polar coordinates
Imaginary number portion of polar coordinates display	(Channel No. - 1) × 1024 + (Trace No. -1) + 112	Real Number	Undefined except for polar coordinates
S-parameters after calibration		Complex Number	
S11	(Channel No. - 1) × 1024 + 144		
S21	(Channel No. - 1) × 1024 + 145		
S31	(Channel No. - 1) × 1024 + 146		
S41	(Channel No. - 1) × 1024 + 147		
S51	(Channel No. - 1) × 1024 + 668		
S61	(Channel No. - 1) × 1024 + 669		
S12	(Channel No. - 1) × 1024 + 148		
S22	(Channel No. - 1) × 1024 + 149		
S32	(Channel No. - 1) × 1024 + 150		

Data	No.	Expression	Remarks
S42	(Channel No. - 1) × 1024 + 151	Complex Number	
S52	(Channel No. - 1) × 1024 + 670		
S62	(Channel No. - 1) × 1024 + 671		
S13	(Channel No. - 1) × 1024 + 152		
S23	(Channel No. - 1) × 1024 + 153		
S33	(Channel No. - 1) × 1024 + 154		
S43	(Channel No. - 1) × 1024 + 155		
S53	(Channel No. - 1) × 1024 + 672		
S63	(Channel No. - 1) × 1024 + 673		
S14	(Channel No. - 1) × 1024 + 156		
S24	(Channel No. - 1) × 1024 + 157		
S34	(Channel No. - 1) × 1024 + 158		
S44	(Channel No. - 1) × 1024 + 159		
S54	(Channel No. - 1) × 1024 + 674		
S64	(Channel No. - 1) × 1024 + 675		
S15	(Channel No. - 1) × 1024 + 676		
S25	(Channel No. - 1) × 1024 + 677		
S35	(Channel No. - 1) × 1024 + 678		
S45	(Channel No. - 1) × 1024 + 679		
S55	(Channel No. - 1) × 1024 + 680		
S65	(Channel No. - 1) × 1024 + 681		
S16	(Channel No. - 1) × 1024 + 682		
S26	(Channel No. - 1) × 1024 + 683		
S36	(Channel No. - 1) × 1024 + 684		
S46	(Channel No. - 1) × 1024 + 685		
S56	(Channel No. - 1) × 1024 + 686		
S66	(Channel No. - 1) × 1024 + 687		
S-parameters before calibration		Complex Number	
S11	(Channel No. - 1) × 1024 + 208		
S21	(Channel No. - 1) × 1024 + 209		
S31	(Channel No. - 1) × 1024 + 210		
S41	(Channel No. - 1) × 1024 + 211		

Data	No.	Expression	Remarks
S51	(Channel No. - 1) × 1024 + 628	Complex Number	
S61	(Channel No. - 1) × 1024 + 629		
S12	(Channel No. - 1) × 1024 + 212		
S22	(Channel No. - 1) × 1024 + 213		
S32	(Channel No. - 1) × 1024 + 214		
S42	(Channel No. - 1) × 1024 + 215		
S52	(Channel No. - 1) × 1024 + 630		
S62	(Channel No. - 1) × 1024 + 631		
S13	(Channel No. - 1) × 1024 + 216		
S23	(Channel No. - 1) × 1024 + 217		
S33	(Channel No. - 1) × 1024 + 218		
S43	(Channel No. - 1) × 1024 + 219		
S53	(Channel No. - 1) × 1024 + 632		
S63	(Channel No. - 1) × 1024 + 633		
S14	(Channel No. - 1) × 1024 + 220		
S24	(Channel No. - 1) × 1024 + 221		
S34	(Channel No. - 1) × 1024 + 222		
S44	(Channel No. - 1) × 1024 + 223		
S54	(Channel No. - 1) × 1024 + 634		
S64	(Channel No. - 1) × 1024 + 635		
S15	(Channel No. - 1) × 1024 + 636		
S25	(Channel No. - 1) × 1024 + 637		
S35	(Channel No. - 1) × 1024 + 638		
S45	(Channel No. - 1) × 1024 + 639		
S55	(Channel No. - 1) × 1024 + 640		
S65	(Channel No. - 1) × 1024 + 641		
S16	(Channel No. - 1) × 1024 + 642		
S26	(Channel No. - 1) × 1024 + 643		
S36	(Channel No. - 1) × 1024 + 644		
S46	(Channel No. - 1) × 1024 + 645		
S56	(Channel No. - 1) × 1024 + 646		
S66	(Channel No. - 1) × 1024 + 647		

Data	No.	Expression	Remarks
Full Calibration Error Factor		Complex Number	Undefined when no error factor exists
Directivity Port 1: Ed1	(Channel No. - 1) × 1024 + 256		
Directivity Port 2: Ed2	(Channel No. - 1) × 1024 + 257		
Directivity Port 3: Ed3	(Channel No. - 1) × 1024 + 258		
Directivity Port 4: Ed4	(Channel No. - 1) × 1024 + 259		
Directivity Port 5: Ed5	(Channel No. - 1) × 1024 + 688		
Directivity Port 6: Ed6	(Channel No. - 1) × 1024 + 689		
Source Match Port 1: Es1	(Channel No. - 1) × 1024 + 260		
Source Match Port 2: Es2	(Channel No. - 1) × 1024 + 261		
Source Match Port 3: Es3	(Channel No. - 1) × 1024 + 262		
Source Match Port 4: Es4	(Channel No. - 1) × 1024 + 263		
Source Match Port 5: Es5	(Channel No. - 1) × 1024 + 690		
Source Match Port 6: Es6	(Channel No. - 1) × 1024 + 691		
Tracking S11: Er1	(Channel No. - 1) × 1024 + 264		
Tracking S22: Er2	(Channel No. - 1) × 1024 + 265		
Tracking S33: Er3	(Channel No. - 1) × 1024 + 266		
Tracking S44: Er4	(Channel No. - 1) × 1024 + 267		
Tracking S55: Er5	(Channel No. - 1) × 1024 + 692		
Tracking S66: Er6	(Channel No. - 1) × 1024 + 693		
Load Match Port 1: El1	(Channel No. - 1) × 1024 + 268		
Load Match Port 2: El2	(Channel No. - 1) × 1024 + 269		
Load Match Port 3: El3	(Channel No. - 1) × 1024 + 270		
Load Match Port 4: El4	(Channel No. - 1) × 1024 + 271		
Load Match Port 5: El5	(Channel No. - 1) × 1024 + 694		
Load Match Port 6: El6	(Channel No. - 1) × 1024 + 695		
Tracking S21: Et21	(Channel No. - 1) × 1024 + 272		
Tracking S12: Et12	(Channel No. - 1) × 1024 + 273		
Tracking S31: Et31	(Channel No. - 1) × 1024 + 274		
Tracking S13: Et13	(Channel No. - 1) × 1024 + 275		
Tracking S41: Et41	(Channel No. - 1) × 1024 + 276		
Tracking S14: Et14	(Channel No. - 1) × 1024 + 277		
Tracking S32: Et32	(Channel No. - 1) × 1024 + 278		

Data	No.	Expression	Remarks
Tracking S23: Et23	(Channel No. - 1) × 1024 + 279	Complex Number	Undefined when no error factor exists
Tracking S42: Et42	(Channel No. - 1) × 1024 + 280		
Tracking S24: Et24	(Channel No. - 1) × 1024 + 281		
Tracking S43: Et43	(Channel No. - 1) × 1024 + 282		
Tracking S34: Et34	(Channel No. - 1) × 1024 + 283		
Tracking S51: Et51	(Channel No. - 1) × 1024 + 696		
Tracking S15: Et15	(Channel No. - 1) × 1024 + 697		
Tracking S61: Et61	(Channel No. - 1) × 1024 + 698		
Tracking S16: Et16	(Channel No. - 1) × 1024 + 699		
Tracking S52: Et52	(Channel No. - 1) × 1024 + 700		
Tracking S25: Et25	(Channel No. - 1) × 1024 + 701		
Tracking S62: Et62	(Channel No. - 1) × 1024 + 702		
Tracking S26: Et26	(Channel No. - 1) × 1024 + 703		
Tracking S53: Et53	(Channel No. - 1) × 1024 + 704		
Tracking S35: Et35	(Channel No. - 1) × 1024 + 705		
Tracking S63: Et63	(Channel No. - 1) × 1024 + 706		
Tracking S36: Et36	(Channel No. - 1) × 1024 + 707		
Tracking S54: Et54	(Channel No. - 1) × 1024 + 708		
Tracking S45: Et45	(Channel No. - 1) × 1024 + 709		
Tracking S64: Et64	(Channel No. - 1) × 1024 + 710		
Tracking S46: Et46	(Channel No. - 1) × 1024 + 711		
Tracking S65: Et65	(Channel No. - 1) × 1024 + 712		
Tracking S56: Et56	(Channel No. - 1) × 1024 + 713		
Isolation S21: Ex21	(Channel No. - 1) × 1024 + 284		
Isolation S12: Ex12	(Channel No. - 1) × 1024 + 285		
Isolation S31: Ex31	(Channel No. - 1) × 1024 + 286		
Isolation S13: Ex13	(Channel No. - 1) × 1024 + 287		
Isolation S41: Ex41	(Channel No. - 1) × 1024 + 288		
Isolation S14: Ex14	(Channel No. - 1) × 1024 + 289		
Isolation S32: Ex32	(Channel No. - 1) × 1024 + 290		
Isolation S23: Ex23	(Channel No. - 1) × 1024 + 291		
Isolation S42: Ex42	(Channel No. - 1) × 1024 + 292		
Isolation S24: Ex24	(Channel No. - 1) × 1024 + 293		

Data	No.	Expression	Remarks
Isolation S43: Ex43	(Channel No. - 1) × 1024 + 294	Complex Number	Undefined when no error factor exists
Isolation S34: Ex34	(Channel No. - 1) × 1024 + 295		
Isolation S51: Ex51	(Channel No. - 1) × 1024 + 714		
Isolation S15: Ex15	(Channel No. - 1) × 1024 + 715		
Isolation S61: Ex61	(Channel No. - 1) × 1024 + 716		
Isolation S16: Ex16	(Channel No. - 1) × 1024 + 717		
Isolation S52: Ex52	(Channel No. - 1) × 1024 + 718		
Isolation S25: Ex25	(Channel No. - 1) × 1024 + 719		
Isolation S62: Ex62	(Channel No. - 1) × 1024 + 720		
Isolation S26: Ex26	(Channel No. - 1) × 1024 + 721		
Isolation S53: Ex53	(Channel No. - 1) × 1024 + 722		
Isolation S35: Ex35	(Channel No. - 1) × 1024 + 723		
Isolation S63: Ex63	(Channel No. - 1) × 1024 + 724		
Isolation S36: Ex36	(Channel No. - 1) × 1024 + 725		
Isolation S54: Ex54	(Channel No. - 1) × 1024 + 726		
Isolation S45: Ex45	(Channel No. - 1) × 1024 + 727		
Isolation S64: Ex64	(Channel No. - 1) × 1024 + 728		
Isolation S46: Ex46	(Channel No. - 1) × 1024 + 729		
Isolation S65: Ex65	(Channel No. - 1) × 1024 + 730		
Isolation S56: Ex56	(Channel No. - 1) × 1024 + 731		
Normalize Error Factor		Complex Number	Undefined when no error factor exists
Normalize: S11	(Channel No. - 1) × 1024 + 296		
Normalize: S21	(Channel No. - 1) × 1024 + 297		
Normalize: S31	(Channel No. - 1) × 1024 + 298		
Normalize: S41	(Channel No. - 1) × 1024 + 299		
Normalize: S51	(Channel No. - 1) × 1024 + 776		
Normalize: S61	(Channel No. - 1) × 1024 + 777		
Normalize: S12	(Channel No. - 1) × 1024 + 300		
Normalize: S22	(Channel No. - 1) × 1024 + 301		
Normalize: S32	(Channel No. - 1) × 1024 + 302		
Normalize: S42	(Channel No. - 1) × 1024 + 303		
Normalize: S52	(Channel No. - 1) × 1024 + 778		
Normalize: S62	(Channel No. - 1) × 1024 + 779		

Data	No.	Expression	Remarks
Normalize: S13	(Channel No. - 1) × 1024 + 304	Complex Number	Undefined when no error factor exists
Normalize: S23	(Channel No. - 1) × 1024 + 305		
Normalize: S33	(Channel No. - 1) × 1024 + 306		
Normalize: S43	(Channel No. - 1) × 1024 + 307		
Normalize: S53	(Channel No. - 1) × 1024 + 780		
Normalize: S63	(Channel No. - 1) × 1024 + 781		
Normalize: S14	(Channel No. - 1) × 1024 + 308		
Normalize: S24	(Channel No. - 1) × 1024 + 309		
Normalize: S34	(Channel No. - 1) × 1024 + 310		
Normalize: S44	(Channel No. - 1) × 1024 + 311		
Normalize: S54	(Channel No. - 1) × 1024 + 782		
Normalize: S64	(Channel No. - 1) × 1024 + 783		
Normalize: S15	(Channel No. - 1) × 1024 + 784		
Normalize: S25	(Channel No. - 1) × 1024 + 785		
Normalize: S35	(Channel No. - 1) × 1024 + 786		
Normalize: S45	(Channel No. - 1) × 1024 + 787		
Normalize: S55	(Channel No. - 1) × 1024 + 788		
Normalize: S65	(Channel No. - 1) × 1024 + 789		
Normalize: S16	(Channel No. - 1) × 1024 + 790		
Normalize: S26	(Channel No. - 1) × 1024 + 791		
Normalize: S36	(Channel No. - 1) × 1024 + 792		
Normalize: S46	(Channel No. - 1) × 1024 + 793		
Normalize: S56	(Channel No. - 1) × 1024 + 794		
Normalize: S66	(Channel No. - 1) × 1024 + 795		
Frequency	(Channel No. - 1) × 1024 + 384	Real Number	
Output Power	(Channel No. - 1) × 1024 + 385	Real Number	

15. PERFORMANCE VERIFICATION

This section explains testing methods for maintaining the performance of the analyzer.

Contact the company for testing methods for items others than those addressed in this section.

15.1 Before Testing

15.1.1 Warm-up

Let the analyzer warm up for at least 30 minutes after power ON before executing performance testing.

15.1.2 Setup of Measurement Equipment

Prepare measurement equipment for the test items as shown in the following table.

Table 15-1 Measurement Equipment Required for Performance Testing (1 of 2)

Test Item	Measurement Equipment		Remarks
Frequency Accuracy and Range	• Counter Frequency: 300 kHz to 20 GHz Display: 7 lines or more Accuracy: 0.1 ppm or less	R5373 (-26 GHz) (Advantest products)	Refer to Section 15.2.
	• RF Cable: BNC-BNC, N-N type		
I/O Level Accuracy and Flatness	• Power Meter Frequency: 300 kHz to 20 GHz Power Range: -25 dBm to +17 dBm	NRVS (R&S) (Equipment calibrated using national standards)	Refer to Section 15.3.
	• Power Sensor Frequency: 300 kHz to 20 GHz Power Range: -25 dBm to +17 dBm	NRV-Z51 (R&S) (DC - 8 GHz) NRV-Z52 (R&S) (DC - 20 GHz)	
Output Level Linearity	• Power Meter Frequency: 300 kHz to 20 GHz Power Range: -25 dBm to +17 dBm	NRVS (R&S) (Equipment calibrated using national standards)	Refer to Section 15.4.
	• Power Meter Frequency: 300 kHz to 20 GHz Power Range: -25 dBm to +17 dBm	NRV-Z51 (R&S) (DC - 8 GHz) NRV-Z52 (R&S) (DC - 20 GHz)	

Table 15-1 Measurement Equipment Required for Performance Testing (2 of 2)

Test Item	Measurement Equipment		Remarks
Directivity	• Calibration Kit	Model 8850Q03 (DC - 8 GHz, N-type connector) Model 8050Q03 (DC - 20 GHz, 3.5 mm connector)	Refer to Section 15.5.
Load Match of Test Port	• Calibration Kit	Model 8850Q03 (DC - 8 GHz, N-type connector) Model 8050Q03 (DC - 20 GHz, 3.5 mm connector)	Refer to Section 15.6.
Crosstalk	• Calibration Kit	Model 8850Q03 (DC - 8 GHz, N-type connector) Model 8050Q03 (DC - 20 GHz, 3.5 mm connector)	Refer to Section 15.8.
Dynamic Level Accuracy	• Step Attenuator Variable Range: 0 dB - 90 dB Accuracy: Within 0.02 dB	HP8496B (Equipment calibrated using national standards)	Refer to Section 15.9.
	• RF Cable (SMA(m)/SMA(m) 50Ω) x 2	HRM-554S	
	• Transformer Connectors (N(m)/SMA (f)) x 2	AT-103	
	• 3 dB Fixed Attenuator (SMA(f)/SMA(m)) x 2		
Attenuation Accuracy	• RF Cable (SMA(m)/SMA(m) 50Ω)		
	• Transformer Connectors (N(m)/SMA (f)) x 2		
Output Voltage Accuracy	• Digital Multimeter Voltage measurement range: -1 V to 15 V Measurement accuracy: Within ±0.05%	R6581 (Equipment calibrated using national standards)	Refer to Section 15.11.
	• Digital Multimeter input cable	A01035	
Measurement Current Accuracy	• Digital Multimeter Current measurement range: 0 mA to 500 mA Measurement accuracy: Within ±0.05%	R6581 (Equipment calibrated using national standards)	Refer to Section 15.12.
	• Digital Multimeter input cable	A01035	

15.1.3 General Cautionary Points

- Use AC source voltage of 90V-250V and a power source frequency of 48-66 Hz.
- Connect power source cables only after turning the POWER switch OFF.
- Perform testing under the following environmental conditions.
  Test temperature range: +23°C±5°C
  Relative humidity: 80% or lower
  Locations free of dust, vibration, and noise

15.2 Frequency Accuracy and Range

Testing Procedure

1. Connect Test Port 1 to the counter as shown in the following diagram.

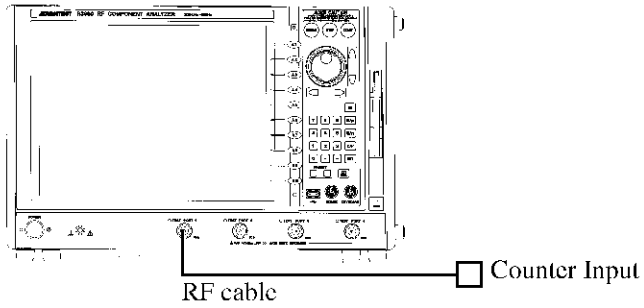


Figure 15-1 Frequency Accuracy and Range

2. Press ***Center*, 3, 0, 0, k/μ, *Span*, 0, ENT** and **STOP**.
   Center Frequency is set to 300 kHz, and Frequency Span is set to 0 Hz.

   <Confirm> Frequency range read by the counter = 299.997 KHz - 300.003 MHz

3. Press ***Center*, 3, G/p** and **SINGLE**.
   The Center Frequency is set to 3 GHz.

   <Confirm> Frequency range read by the counter = 2.99997 GHz - 3.00003 GHz

4. Press ***Center*, 8, G/p** and **SINGLE**.
   The Center Frequency is set to 8 GHz.

   <Confirm> Frequency range read by the counter = 7.99992 GHz - 8.00008 GHz

5. Press ***Center*, 2, 0, G/p** and **SINGLE**.
   The Center Frequency is set to 20 GHz.

   <Confirm> Frequency range read by the counter =
   19.99980 GHz - 20.00020 GHz

15.3 Output Level Accuracy and Flatness

Testing Procedure

1. Press ***Port, More 1/2*** and ***P1*** (***P3*** in the 6-port type).
2. Connect the power sensor to Test Port 1 (Test Port 3 in the 6-port type) as shown in the following diagram.

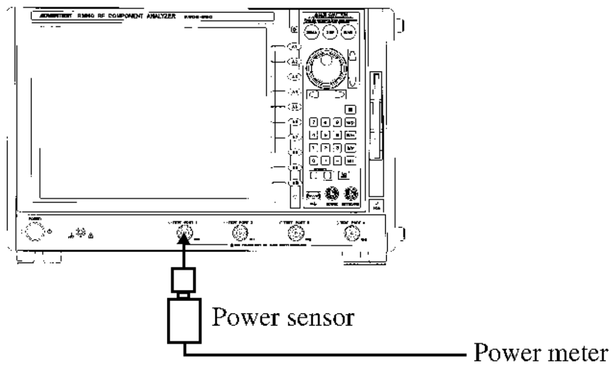


Figure 15-2 Output Level Accuracy and Flatness

3. Press ***Center***, **5, 0, M/n,** ***Span***, **0, ENT,** ***Output power***, **0, ENT** and **STOP**.
   This operation sets Center Frequency to 50 MHz, Frequency Span to 0 Hz, and Output power to 0 dBm.

   <Confirm> Reading range of the power meter = -0.5 dBm - +0.5 dBm

4. Press ***Center***, **3, 0, 0, k/μ** and **SINGLE**.
   The Center Frequency is set to 300 kHz.

   Record the read value of the power meter.

5. Press ***Center***, **1, 0, M/n** and **SINGLE**.
   The Center Frequency is set to 10 MHz.

   Record the read value of the power meter.

6. Press ***Center***, **1, 0, 0, M/n** and **SINGLE**.
   The Center Frequency is set to 100 MHz.

   Record the read value of the power meter.

7. Press ***Center***, **5, 0, 0, M/n** and **SINGLE**.
   The Center Frequency is set to 500 MHz.

   Record the read value of the power meter.

8. In the same manner, use an optional number of frequencies to record the read values of the power meter up to 20 GHz.

   <Confirm> Difference between the minimum and maximum recorded read values of the power meter is within 2 dB

15.4 Output Level Linearity

Testing Procedure

1. Press ***Port, More 1/2*** and ***P1*** (***P3*** in the 6-port type).
2. Perform ZERO Calibration on the power meter.
3. Connect the power sensor to Test Port 1 (Test Port 3 in the 6-port type) as shown in the following diagram.

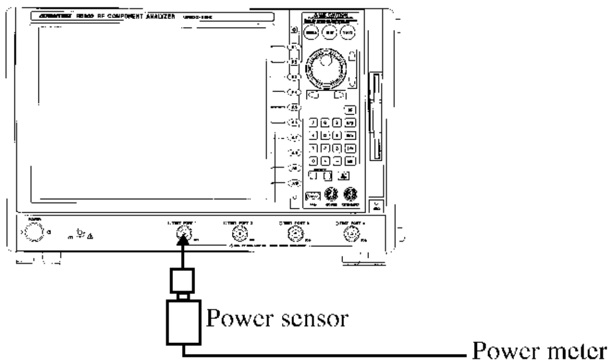


Figure 15-3 Output Level Linearity

4. Press ***Center,*** **5, 0, M/n,** ***Span,*** **0, ENT,** ***Output power,*** **0, ENT** and **STOP**.
   This operation sets Center Frequency to 50 MHz, Frequency Span to 0 Hz, and Output power to 0 dBm.

   Record the read value of the power meter. This value serves as the reference for linearity.
5. Press ***Output power,*** **1, ENT** and **SINGLE**.
   The Output Power is set to +1 dBm.
6. Subtract the reference value recorded in step 3 from the read value of the power meter. The difference between this value and the setting value of +1 dBm is the linearity.

   Example: When the reference values = -0.23 dBm and the read value at +1 dBm setting = +0.81 dBm,
   Linearity = (+0.81 dBm - (-0.23 dBm)) - (+1 dBm - (0 dBm)) = 0.04 dB
7. In the same manner, change the output power settings to confirm linearity.
8. Change the center frequency to confirm linearity.

   <Confirm> ±0.7 dB (The center value in the changed output power range is provided as a reference for the linearity.)

15.5 Directivity

Testing Procedure

1. Connect the Short Standard to Test Port 1 as shown in the following diagram.

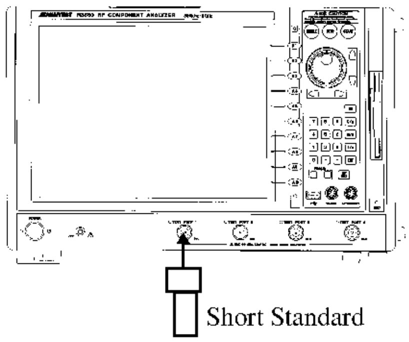


Figure 15-4 Directivity

2. Press ***Start*, 3, 0, 0, k/μ, *Stop*, 2, 0** and **G/p**.
   Start Frequency is set to 300 KHz, and Stop Frequency is set to 20 GHz.

3. Press ***Cal, Standard Cal*** and ***Normalize Short***.
   Short Normalize is executed.

4. Disconnect the Short Standard from Test Port 1, and connect the Load Standard.
   The displayed S11 data is the directivity. Confirm the value using a marker.

   <Confirm> -13 dB or lower at 300 kHz - 500 MHz
   -23 dB or lower at 500 MHz - 1.2 GHz
   -20 dB or lower at 1.2 GHz - 4.5 GHz
   -12 dB or lower at 4.5 GHz - 18 GHz
   -8 dB or lower at 18 GHz - 20 GHz

   If the external power amplifier connection port is added.
   -13 dB or lower at 300 kHz - 500 MHz
   -23 dB or lower at 500 MHz - 1.2 GHz
   -18 dB or lower at 1.2 GHz - 4.5 GHz
   -9 dB or lower at 4.5 GHz - 18 GHz
   -8 dB or lower at 18 GHz - 20 GHz

   In the 6-port type
   -13 dB or lower at 300 kHz - 500 MHz
   -22 dB or lower at 500 MHz - 1.2 GHz
   -20 dB or lower at 1.2 GHz - 4.5 GHz
   -12 dB or lower at 4.5 GHz - 18 GHz
   -8 dB or lower at 18 GHz - 20 GHz

5. Press ***Meas***, ***Measure More*** and ***S22***.
   The Trace parameter is changed to S22.

6. Connect the Short Standard to Test Port 2.
   Press ***Cal, Standard Cal*** and ***Normalize Short***.
   Short Normalize is executed.

7. Disconnect the Short Standard from Test Port 2, and connect the Load Standard.

   The displayed S22 data is the directivity. Confirm the value using a marker.

   <Confirm> -13 dB or lower at 300 kHz - 500 MHz
   -23 dB or lower at 500 MHz - 1.2 GHz
   -20 dB or lower at 1.2 GHz - 4.5 GHz
   -12 dB or lower at 4.5 GHz - 18 GHz
   -8 dB or lower at 18 GHz - 20 GHz

   If the external power amplifier connection port is added.
   -13 dB or lower at 300 kHz - 500 MHz
   -23 dB or lower at 500 MHz - 1.2 GHz
   -18 dB or lower at 1.2 GHz - 4.5 GHz
   -9 dB or lower at 4.5 GHz - 18 GHz
   -8 dB or lower at 18 GHz - 20 GHz

   In the 6-port type
   -13 dB or lower at 300 kHz - 500 MHz
   -22 dB or lower at 500 MHz - 1.2 GHz
   -20 dB or lower at 1.2 GHz - 4.5 GHz
   -12 dB or lower at 4.5 GHz - 18 GHz
   -8 dB or lower at 18 GHz - 20 GHz

For 3-port type, 4-port type and 6-port type

8. Press ***Meas***, ***Measure More*** and ***S33***.
   The Trace parameter is changed to S33.

9. Connect the Short Standard to Test Port 3.
   Press ***Cal, Standard Cal*** and ***Normalize Short***.
   Short Normalize is executed.

10. Disconnect the Short Standard from Test Port 3, and connect the Load Standard.

    The displayed S33 data is the directivity. Confirm the value using a marker.

    <Confirm> -13 dB or lower at 300 kHz - 500 MHz
    -23 dB or lower at 500 MHz - 1.2 GHz
    -20 dB or lower at 1.2 GHz - 4.5 GHz
    -12 dB or lower at 4.5 GHz - 18 GHz
    -8 dB or lower at 18 GHz - 20 GHz

    If the external power amplifier connection port is added.
    -13 dB or lower at 300 kHz - 500 MHz
    -23 dB or lower at 500 MHz - 1.2 GHz
    -18 dB or lower at 1.2 GHz - 4.5 GHz
    -9 dB or lower at 4.5 GHz - 18 GHz
    -8 dB or lower at 18 GHz - 20 GHz

    In the 6-port type
    -13 dB or lower at 300 kHz - 500 MHz
    -22 dB or lower at 500 MHz - 1.2 GHz
    -20 dB or lower at 1.2 GHz - 4.5 GHz
    -12 dB or lower at 4.5 GHz - 18 GHz
    -8 dB or lower at 18 GHz - 20 GHz

For 4-port type and 6-port type

11. Press ***Meas***, ***Measure More*** and ***S44***.
    The Trace parameter is changed to S44.

12. Connect the Short Standard to Test Port 4.
    Press ***Cal, Standard Cal*** and ***Normalize Short***.
    Short Normalize is executed.

13. Disconnect the Short Standard from Test Port 4, and connect the Load Standard.

    The displayed S44 data is the directivity. Confirm the value using a marker.

    <Confirm> -13 dB or lower at 300 kHz - 500 MHz
    -23 dB or lower at 500 MHz - 1.2 GHz
    -20 dB or lower at 1.2 GHz - 4.5 GHz
    -12 dB or lower at 4.5 GHz - 18 GHz
    -8 dB or lower at 18 GHz - 20 GHz

    If the external power amplifier connection port is added.
    -13 dB or lower at 300 kHz - 500 MHz
    -23 dB or lower at 500 MHz - 1.2 GHz
    -18 dB or lower at 1.2 GHz - 4.5 GHz
    -9 dB or lower at 4.5 GHz - 18 GHz
    -8 dB or lower at 18 GHz - 20 GHz

    In the 6-port type
    -13 dB or lower at 300 kHz - 500 MHz
    -22 dB or lower at 500 MHz - 1.2 GHz
    -20 dB or lower at 1.2 GHz - 4.5 GHz
    -12 dB or lower at 4.5 GHz - 18 GHz
    -8 dB or lower at 18 GHz - 20 GHz

For 6-port type

14. Press ***Meas***, ***Measure More*** and ***S55***.
    The Trace parameter is changed to S55.

15. Connect the Short Standard to Test Port 5.
    Press ***Cal, Standard Cal*** and ***Normalize Short***.
    Short Normalize is executed.

16. Disconnect the Short Standard from Test Port 5, and connect the Load Standard.

    The displayed S55 data is the directivity. Confirm the value using a marker.

    <Confirm> -13 dB or lower at 300 kHz - 500 MHz
    -22 dB or lower at 500 MHz - 1.2 GHz
    -20 dB or lower at 1.2 GHz - 4.5 GHz
    -12 dB or lower at 4.5 GHz - 18 GHz
    -8 dB or lower at 18 GHz - 20 GHz

17. Press ***Meas***, ***Measure More*** and ***S66***.
    The Trace parameter is changed to S66.

18. Connect the Short Standard to Test Port 6.
    Press ***Cal, Standard Cal*** and ***Normalize Short***.
    Short Normalize is executed.

19. Disconnect the Short Standard from Test Port 6, and connect the Load Standard.

    The displayed S66 data is the directivity. Confirm the value using a marker.

    <Confirm> -13 dB or lower at 300 kHz - 500 MHz
    -22 dB or lower at 500 MHz - 1.2 GHz
    -20 dB or lower at 1.2 GHz - 4.5 GHz
    -12 dB or lower at 4.5 GHz - 18 GHz
    -8 dB or lower at 18 GHz - 20 GHz

15.6 Load Match

Testing Procedure

1. Connect the RF Cable to Test Port 2 as shown in the following diagram.

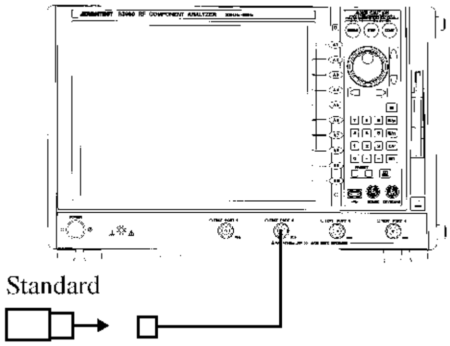


Figure 15-5 Load Match

2. Press ***Start*, 3, 0, 0, k/μ, *Stop*, 2, 0, G/p, *Meas*, *Measure More*** and ***S22***.
   This operation sets Start Frequency to 300 kHz, Stop Frequency to 20 GHz, and the Trace parameter to S22.

3. Press ***Cal, Standard Cal, Full 1-port Cal*** and ***Port 2***.
   Connect the Open Standard to the RF cable tip, and press ***Port2 Open***.
   Connect the Short Standard to the RF cable tip, and press ***Port2 Short***.
   Connect the Load Standard to the RF cable tip, and press ***Port2 Load***.
   This operation executes 1-port full calibration for Test Port 2.

NOTE: ***Before executing the 1-port full calibration, select or enter the characteristic values in each standards of open, short, and load. For more information, refer to 4, "CALIBRATION".***

4. Press ***Done***.
   Calibration is completed.

5. Disconnect the Load Standard from the RF Cable, and connect the RF Cable to Test Port 1. The displayed S22 is the Load Match of Test Port 1. Confirm the value using a marker.

   <Confirm> -14 dB or lower at 300 kHz - 1 MHz
   -20 dB or lower at 1 MHz - 1.0 GHz
   -18 dB or lower at 1.0 GHz - 4.0 GHz
   -12 dB or lower at 4.0 GHz - 8.0 GHz
   -10 dB or lower at 8.0 GHz - 20 GHz

6. Press ***Meas*** and ***S11***.
   The Trace parameter is set to S11.

7. Disconnect the RF Cable from Test Port 2.
   Press ***Cal, Standard Cal, Full 1-port Cal*** and ***Port 1***.
   Connect the Open Standard to the RF Cable tip, and press ***Port1 Open***.
   Connect the Short Standard to the RF Cable tip, and press ***Port1 Short***.
   Connect the Load Standard to the RF Cable tip, and press ***Port1 Load***.
   This operation executes 1-port full calibration for Test Port 1.

NOTE: ***Before executing the 1-port full calibration, select or enter the characteristic values in each standards of open, short, and load. For more information, refer to 4, "CALIBRATION".***

---

8. Press ***Done***.
   Calibration is completed.

9. Disconnect the Load Standard from the RF Cable, and connect the RF Cable to Test Port 2. The displayed S11 is the Load Match of Test Port 2. Confirm the value using a marker.

   <Confirm> -14 dB or lower at 300 kHz - 1 MHz
   -20 dB or lower at 1 MHz - 1.0 GHz
   -18 dB or lower at 1.0 GHz - 4.0 GHz
   -12 dB or lower at 4.0 GHz - 8.0 GHz
   -10 dB or lower at 8.0 GHz - 20 GHz

For 3-port type, 4-port type and 6-port type

10. Disconnect the RF Cable from Test Port 2, and connect it to Test Port 3. The displayed S11 is the Load Match of Test Port 3. Confirm the value using a marker.

    <Confirm> -14 dB or lower at 300 kHz - 1 MHz
    -20 dB or lower at 1 MHz - 1.0 GHz
    -18 dB or lower at 1.0 GHz - 4.0 GHz
    -12 dB or lower at 4.0 GHz - 8.0 GHz
    -10 dB or lower at 8.0 GHz - 20 GHz

For 4-port type and 6-port type

11. Disconnect the RF Cable from Test Port 3, and connect it to Test Port 4. The displayed S11 is the Load Match of Test Port 4. Confirm the value using a marker.

    <Confirm> -14 dB or lower at 300 kHz - 1 MHz
    -20 dB or lower at 1 MHz - 1.0 GHz
    -18 dB or lower at 1.0 GHz - 4.0 GHz
    -12 dB or lower at 4.0 GHz - 8.0 GHz
    -10 dB or lower at 8.0 GHz - 20 GHz

For 6-port type

12. Disconnect the RF Cable from Test Port 4, and connect it to Test Port 5. The displayed S11 is the Load Match of Test Port 5. Confirm the value using a marker.

    <Confirm> -14 dB or lower at 300 kHz - 1 MHz
    -20 dB or lower at 1 MHz - 1.0 GHz
    -18 dB or lower at 1.0 GHz - 4.0 GHz
    -12 dB or lower at 4.0 GHz - 8.0 GHz
    -10 dB or lower at 8.0 GHz - 20 GHz

13. Disconnect the RF Cable from Test Port 5, and connect it to Test Port 6. The displayed S11 is the Load Match of Test Port 6. Confirm the value using a marker.

    <Confirm> -14 dB or lower at 300 kHz - 1 MHz
    -20 dB or lower at 1 MHz - 1.0 GHz
    -18 dB or lower at 1.0 GHz - 4.0 GHz
    -12 dB or lower at 4.0 GHz - 8.0 GHz
    -10 dB or lower at 8.0 GHz - 20 GHz

15.7 Noise Level

Testing Procedure

1. Connect the Load Standard to Test Port 1 as shown in the following diagram.

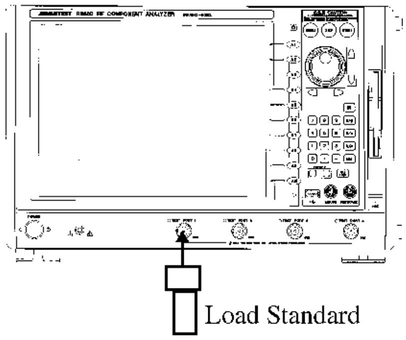


Figure 15-6 Noise Level

2. Press ***Start***, **3, 0, 0, k/μ**, ***Stop***, **7, 0, 0, M/n,** ***Output Power***, **-, 1, 0, ENT,** ***Measurement Point***, **1, 6, 0, 1, ENT,** ***Avg***, ***IF RBW*** and ***100 KHz***.
   This operation sets Start Frequency to 300 kHz, Stop Frequency to 700 MHz, Output power to -10 dBm, Measurement Point to 1601, and RBW to 100 kHz.

3. Press ***Format***, ***Smoothing***, ***Smoothing off***, ***Smoothing Aperture***, **2, 0** and **ENT**.
   This operation sets Smoothing to ON and a Smoothing Aperture of 20%.

4. Press ***Config***, ***Service Menu***, ***Absolute Meas***, ***Source Port 2*** and ***A***.
   This operation sets signal output to Port 2, and A as the trace parameter from the service mode.

   The displayed data is the noise level of Test Port 1 at 300 kHz to 700 MHz. Confirm the value using a marker.

   <Confirm> 8-GHz type -75 dB or less
   20-GHz type -77 dB or less

   If the external power amplifier connection port is added or in the 6-port type
   8-GHz type -70 dB or less
   20-GHz type -72 dB or less

5. Press ***Start***, **7**, **0**, **0**, **M/n**, ***Stop***, **8** (press **7**, **.**, **9**, **2** when using 20-GHz type), and **G/p**.
   Sets the start frequency to 700 MHz and the stop frequency to 8 GHz (7.92 GHz when using a 20-GHz type).

   The displayed data is the noise level of the Test Port 1 when the frequency is from 700 MHz to 8 GHz (7.92 GHz when using a 20-GHz type). Check the value by the marker.

   <Confirm> 8-GHz type -80 dB or less
   20-GHz type -89 dB or less

   If the external power amplifier connection port is added and in the 6-port type
   8-GHz type -75 dB or less
   20-GHz type -84 dB or less

6. Press ***Start***, **7**, **.**, **9**, **2**, **G/p**, ***Stop***, **2**, **0** and **G/p**.
   This operation sets Start Frequency to 7.92 GHz, and Stop Frequency to 20 GHz.

   The displayed data is the noise level of Test Port 1 at 7.92 GHz to 20 GHz. Confirm the value using a marker.

   <Confirm> -74 dB or less

   If the external power amplifier connection port is added and in the 6-port type
   -69 dB or less

7. Disconnect the Load Standard from Test Port 1, and connect it to Test Port 2.

8. Press ***Start***, **3**, **0**, **0**, **k/μ**, ***Stop***, **7**, **0**, **0** and **M/n**.
   This operation sets Start Frequency to 300 kHz, and Stop Frequency to 700 MHz.

9. Press ***Config***, ***Service Menu***, ***Absolute Meas***, ***Source Port 1*** and ***B***.
   This operation sets signal output to Port 1, and B as the trace parameter from the service mode.

   The displayed data is the noise level of Test Port 2 at 300 kHz to 700 MHz. Confirm the value using a marker.

   <Confirm> 8-GHz type -75 dB or less
   20-GHz type -77 dB or less

   If the external power amplifier connection port is added and in the 6-port type
   8-GHz type -70 dB or less
   20-GHz type -72 dB or less

10. Press ***Start***, **7**, **0**, **0**, **M/n**, ***Stop***, **8** (press **7**, **.**, **9**, **2** when using 20-GHz type), and **G/p**.
    Sets the start frequency to 700 MHz and the stop frequency to 8 GHz (7.92 GHz when using a 20-GHz type).

    The displayed data is the noise level of the Test Port 1 when the frequency is from 700 MHz to 8 GHz (7.92 GHz when using a 20-GHz type). Check the value by the marker.

    <Confirm> 8-GHz type -80 dB or less
    20-GHz type -89 dB or less

    If the external power amplifier connection port is added and in the 6-port type
    8-GHz type -75 dB or less
    20-GHz type -84 dB or less

11. Press ***Start***, **7**, **.**, **9**, **2**, **G/p**, ***Stop***, **2**, **0** and **G/p**.
    This operation sets Start Frequency to 7.92 GHz, and Stop Frequency to 20 GHz.

    The displayed data is the noise level of Test Port 1 at 7.92 GHz to 20 GHz. Confirm the value using a marker.

    <Confirm> -74 dB or less

    If the external power amplifier connection port is added and in the 6-port type
    -69 dB or less

For 3-port type, 4-port type and 6-port type

12. Disconnect the Load Standard from Test Port 2, and connect it to Test Port 3.

13. Press ***Start*, 3, 0, 0, k/μ, *Stop*, 7, 0, 0** and **M/n**.
This operation sets Start Frequency to 300 kHz, and Stop Frequency to 700 MHz.

14. Press ***Config*, *Service Menu*, *Absolute Meas*, *Source Port 1*** and ***C***.
This operation sets C as the trace parameter from the service mode.

The displayed data is the noise level of Test Port 3 at 300 kHz to 700 MHz. Confirm the value using a marker.

<Confirm> 8-GHz type -75 dB or less
20-GHz type -77 dB or less

If the external power amplifier connection port is added and in the 6-port type
8-GHz type -70 dB or less
20-GHz type -72 dB or less

15. Press ***Start*, 7, 0, 0, M/n, *Stop*, 8** (press **7, ., 9, 2** when using 20-GHz type), and **G/p**.
Sets the start frequency to 700 MHz and the stop frequency to 8 GHz (7.92 GHz when using a 20-GHz type).

The displayed data is the noise level of the Test Port 1 when the frequency is from 700 MHz to 8 GHz (7.92 GHz when using a 20-GHz type). Check the value by the marker.

<Confirm> 8-GHz type -80 dB or less
20-GHz type -89 dB or less

If the external power amplifier connection port is added and in the 6-port type
8-GHz type -75 dB or less
20-GHz type -84 dB or less

16. Press ***Start*, 7, ., 9, 2, G/p, *Stop*, 2, 0** and **G/p**.
This operation sets Start Frequency to 7.92 GHz, and Stop Frequency to 20 GHz.

The displayed data is the noise level of Test Port 1 at 7.92 GHz to 20 GHz. Confirm the value using a marker.

<Confirm> -74 dB or less

If the external power amplifier connection port is added and in the 6-port type
-69 dB or less

For 4-port type and 6-port type

17. Disconnect the Load Standard from Test Port 3, and connect it to Test Port 4.

18. Press ***Start*, 3, 0, 0, k/μ, *Stop*, 7, 0, 0** and **M/n**.
    This operation sets Start Frequency to 300 kHz, Stop Frequency to 700 MHz, and RBW to 10 kHz.

19. Press ***Config*, *Service Menu*, *Maintenance Meas*, *Source Port 1*** and ***D***.
    This operation sets D as the trace parameter from the service mode.

    The displayed data is the noise level of Test Port 4 at 300 kHz to 700 MHz. Confirm the value using a marker.

    <Confirm> 8-GHz type -75 dB or less
    20-GHz type -77 dB or less

    If the external power amplifier connection port is added and in the 6-port type
    8-GHz type -70 dB or less
    20-GHz type -72 dB or less

20. Press ***Start***, **7**, **0**, **0**, **M/n**, ***Stop***, **8** (press **7**, **.**, **9**, **2** when using 20-GHz type), and **G/p**.
    Sets the start frequency to 700 MHz and the stop frequency to 8 GHz (7.92 GHz when using a 20-GHz type).

    The displayed data is the noise level of the Test Port 1 when the frequency is from 700 MHz to 8 GHz (7.92 GHz when using a 20-GHz type). Check the value by the marker.

    <Confirm> 8-GHz type -80 dB or less
    20-GHz type -89 dB or less

    If the external power amplifier connection port is added and in the 6-port type
    8-GHz type -75 dB or less
    20-GHz type -84 dB or less

21. Press ***Start*, 7, ., 9, 2, G/p, *Stop*, 2, 0** and **G/p**.
    This operation sets Start Frequency to 7.92 GHz, and Stop Frequency to 20 GHz.

    The displayed data is the noise level of Test Port 1 at 7.92 GHz to 20 GHz. Confirm the value using a marker.

    <Confirm> -74 dB or less

    If the external power amplifier connection port is added and in the 6-port type
    -69 dB or less

For 6-port type

22. Disconnect the Load Standard from Test Port 4, and connect it to Test Port 5.

23. Press ***Start*, 3, 0, 0, k/μ, *Stop*, 7, 0, 0** and **M/n**.
    This operation sets Start Frequency to 300 kHz, Stop Frequency to 700 MHz, and RBW to 10 kHz.

24. Press ***Config, Service Menu, Maintenance Meas, Source Port 1*** and ***E***.
    This operation sets E as the trace parameter from the service mode.

    The displayed data is the noise level of Test Port 5 at 300 kHz to 700 MHz. Confirm the value using a marker.

    <Confirm> 8-GHz type -70 dB or less
    20-GHz type -72 dB or less

25. Press ***Start***, **7**, **0**, **0**, **M/n**, ***Stop***, **8** (press **7**, **.**, **9**, **2** when using 20-GHz type), and **G/p**.
    Sets the start frequency to 700 MHz and the stop frequency to 8 GHz (7.92 GHz when using a 20-GHz type).

    The displayed data is the noise level of the Test Port 5 when the frequency is from 700 MHz to 8 GHz (7.92 GHz when using a 20-GHz type). Check the value by the marker.

    <Confirm> 8-GHz type -75 dB or less
    20-GHz type -84 dB or less

26. Press ***Start***, **7**, **.**, **9**, **2**, **G/p**, ***Stop***, **2**, **0** and **G/p**.
    This operation sets Start Frequency to 7.92 GHz, and Stop Frequency to 20 GHz.

    The displayed data is the noise level of Test Port 5 at 7.92 GHz to 20 GHz. Confirm the value using a marker.

    <Confirm> -69 dB or less

27. Disconnect the Load Standard from Test Port 5, and connect it to Test Port 6.

28. Press ***Start***, **3**, **0**, **0**, **k/μ**, ***Stop***, **7**, **0**, **0** and **M/n**.
    This operation sets Start Frequency to 300 kHz, Stop Frequency to 700 MHz, and RBW to 10 kHz.

29. Press ***Config, Service Menu, Maintenance Meas, Source Port 1*** and ***F***.
    This operation sets F as the trace parameter from the service mode.

    The displayed data is the noise level of Test Port 6 at 300 kHz to 700 MHz. Confirm the value using a marker.

    <Confirm> 8-GHz type -70 dB or less
    20-GHz type -72 dB or less

30. Press ***Start***, **7**, **0**, **0**, **M/n**, ***Stop***, **8** (press **7**, **.**, **9**, **2** when using 20-GHz type), and **G/p**.
    Sets the start frequency to 700 MHz and the stop frequency to 8 GHz (7.92 GHz when using a 20-GHz type).

    The displayed data is the noise level of the Test Port 6 when the frequency is from 700 MHz to 8 GHz (7.92 GHz when using a 20-GHz type). Check the value by the marker.

    <Confirm> 8-GHz type -75 dB or less
    20-GHz type -84 dB or less

31. Press ***Start***, **7**, **.**, **9**, **2**, **G/p**, ***Stop***, **2**, **0** and **G/p**.
    This operation sets Start Frequency to 7.92 GHz, and Stop Frequency to 20 GHz.

    The displayed data is the noise level of Test Port 6 at 7.92 GHz to 20 GHz. Confirm the value using a marker.

    <Confirm> -69 dB or less

15.8 Crosstalk

Testing Procedure

1. Press ***Start*, 3, 0, 0, k/μ, *Stop*, 2, 0, G/p, *IF RBW, 10 Hz, Format, Smoothing, Smoothing off, Smoothing Aperture*, 1, ENT, *Stimulus, Output Power*, 1, 3** and **ENT**.
   Sets the start frequency to 300 kHz, the stop frequency to 20 GHz, RBW to 10 Hz, the smoothing to ON, the smoothing aperture to 1%, and the output POWER to +13 dBm (some products are limited by MAX POWER).

Test Port 1 Crosstalk

2. Connect the Load Standard to Test Port 1 and the Short Standard to Test Port 2 as shown in the following diagram.

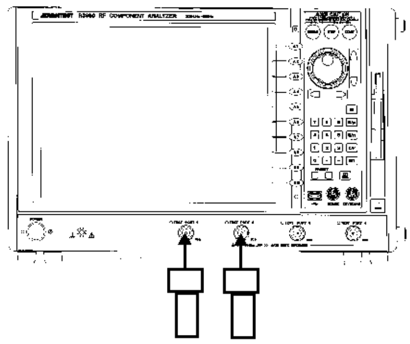


Figure 15-7 Crosstalk

3. Press ***Meas*, *Measure More*** and ***S12***.
   The Trace parameter is set to S12.

   The displayed S12 is the crosstalk from Test Port 2 to Test Port 1. Confirm the value using a marker.

   <Confirm> -110 dB or lower at 300 kHz - 700 MHz
   -120 dB or lower at 700 MHz - 4 GHz
   -110 dB or lower at 4 GHz - 8 GHz
   -105 dB or lower at 8 GHz - 16 GHz
   -100 dB or lower at 16 GHz - 20 GHz

   If the external power amplifier connection port is added.
   -100 dB or lower at 300 kHz - 700 MHz
   -105 dB or lower at 700 MHz - 4 GHz
   -100 dB or lower at 4 GHz - 8 GHz
   -95 dB or lower at 8 GHz - 16 GHz
   -90 dB or lower at 16 GHz - 20 GHz

   In the 6-port type
   -90 dB or lower at 300 kHz - 700 MHz
   -100 dB or lower at 700 MHz - 4 GHz
   -90 dB or lower at 4 GHz - 8 GHz
   -85 dB or lower at 8 GHz - 16 GHz
   -80 dB or lower at 16 GHz - 20 GHz

For 3-port type, 4-port type and 6-port type

4. Disconnect the Short Standard from Test Port 2, and connect it to Test Port 3.

5. Press ***Meas***, ***Measure More*** and ***S13***.
The Trace parameter is set to S13.

The displayed S13 is the crosstalk from Test Port 3 to Test Port 1. Confirm the value using a marker.

<Confirm> -110 dB or lower at 300 kHz - 700 MHz
-120 dB or lower at 700 MHz - 4 GHz
-110 dB or lower at 4 GHz - 8 GHz
-105 dB or lower at 8 GHz - 16 GHz
-100 dB or lower at 16 GHz - 20 GHz

If the external power amplifier connection port is added.
-100 dB or lower at 300 kHz - 700 MHz
-105 dB or lower at 700 MHz - 4 GHz
-100 dB or lower at 4 GHz - 8 GHz
-95 dB or lower at 8 GHz - 16 GHz
-90 dB or lower at 16 GHz - 20 GHz

In the 6-port type
-90 dB or lower at 300 kHz - 700 MHz
-100 dB or lower at 700 MHz - 4 GHz
-90 dB or lower at 4 GHz - 8 GHz
-85 dB or lower at 8 GHz - 16 GHz
-80 dB or lower at 16 GHz - 20 GHz

For 4-port type and 6-port type

6. Disconnect the Short Standard from Test Port 3, and connect it to Test Port 4.

7. Press ***Meas***, ***Measure More*** and ***S14***.
The Trace parameter is set to S14.

The displayed S14 is the crosstalk from Test Port 4 to Test Port 1. Confirm the value using a marker.

<Confirm> -110 dB or lower at 300 kHz - 700 MHz
-120 dB or lower at 700 MHz - 4 GHz
-110 dB or lower at 4 GHz - 8 GHz
-105 dB or lower at 8 GHz - 16 GHz
-100 dB or lower at 16 GHz - 20 GHz

If the external power amplifier connection port is added.
-100 dB or lower at 300 kHz - 700 MHz
-105 dB or lower at 700 MHz - 4 GHz
-100 dB or lower at 4 GHz - 8 GHz
-95 dB or lower at 8 GHz - 16 GHz
-90 dB or lower at 16 GHz - 20 GHz

In the 6-port type
-90 dB or lower at 300 kHz - 700 MHz
-100 dB or lower at 700 MHz - 4 GHz
-90 dB or lower at 4 GHz - 8 GHz
-85 dB or lower at 8 GHz - 16 GHz
-80 dB or lower at 16 GHz - 20 GHz

For 6-port type

8. Disconnect the Short Standard from Test Port 4, and connect it to Test Port 5.

9. Press ***Meas***, ***Measure More*** and ***S15***.
The Trace parameter is set to S15.

The displayed S15 is the crosstalk from Test Port 5 to Test Port 1. Confirm the value using a marker.

<Confirm> -90 dB or lower at 300 kHz - 700 MHz
-100 dB or lower at 700 MHz - 4 GHz
-90 dB or lower at 4 GHz - 8 GHz
-85 dB or lower at 8 GHz - 16 GHz
-80 dB or lower at 16 GHz - 20 GHz

10. Disconnect the Short Standard from Test Port 5, and connect it to Test Port 6.

11. Press ***Meas, Measure More*** and ***S16***.
The Trace parameter is set to S16.

The displayed S16 is the crosstalk from Test Port 6 to Test Port 1. Confirm the value using a marker.

<Confirm> -90 dB or lower at 300 kHz - 700 MHz
-100 dB or lower at 700 MHz - 4 GHz
-90 dB or lower at 4 GHz - 8 GHz
-85 dB or lower at 8 GHz - 16 GHz
-80 dB or lower at 16 GHz - 20 GHz

Test Port 2 Crosstalk

12. Connect the Load Standard to Test Port 2 and the Short Standard to Test Port 1.

13. Press ***Meas***, ***Measure More*** and ***S21***.
The Trace parameter is set to S21.

The displayed S21 is the crosstalk from Test Port 1 to Test Port 2. Confirm the value using a marker.

<Confirm> -110 dB or lower at 300 kHz - 700 MHz
-120 dB or lower at 700 MHz - 4 GHz
-110 dB or lower at 4 GHz - 8 GHz
-105 dB or lower at 8 GHz - 16 GHz
-100 dB or lower at 16 GHz - 20 GHz

If the external power amplifier connection port is added.
-100 dB or lower at 300 kHz - 700 MHz
-105 dB or lower at 700 MHz - 4 GHz
-100 dB or lower at 4 GHz - 8 GHz
-95 dB or lower at 8 GHz - 16 GHz
-90 dB or lower at 16 GHz - 20 GHz

In the 6-port type
-90 dB or lower at 300 kHz - 700 MHz
-100 dB or lower at 700 MHz - 4 GHz
-90 dB or lower at 4 GHz - 8 GHz
-85 dB or lower at 8 GHz - 16 GHz
-80 dB or lower at 16 GHz - 20 GHz

For 3-port type, 4-port type and 6-port type

14. Disconnect the Short Standard from Test Port 1, and connect it to Test Port 3.

15. Press ***Meas***, ***Measure More*** and ***S23***.
    The Trace parameter is set to S23.

    The displayed S23 is the crosstalk from Test Port 3 to Test Port 2. Confirm the value using a marker.

    <Confirm> -110 dB or lower at 300 kHz - 700 MHz
    -120 dB or lower at 700 MHz - 4 GHz
    -110 dB or lower at 4 GHz - 8 GHz
    -105 dB or lower at 8 GHz - 16 GHz
    -100 dB or lower at 16 GHz - 20 GHz

    If the external power amplifier connection port is added.
    -100 dB or lower at 300 kHz - 700 MHz
    -105 dB or lower at 700 MHz - 4 GHz
    -100 dB or lower at 4 GHz - 8 GHz
    -95 dB or lower at 8 GHz - 16 GHz
    -90 dB or lower at 16 GHz - 20 GHz

    In the 6-port type
    -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

For 4-port type and 6-port type

16. Disconnect the Short Standard from Test Port 3, and connect it to Test Port 4.

17. Press ***Meas***, ***Measure More*** and ***S24***.
    The Trace parameter is set to S24.

    The displayed S24 is the crosstalk from Test Port 4 to Test Port 2. Confirm the value using a marker.

    <Confirm> -110 dB or lower at 300 kHz - 700 MHz
    -120 dB or lower at 700 MHz - 4 GHz
    -110 dB or lower at 4 GHz - 8 GHz
    -105 dB or lower at 8 GHz - 16 GHz
    -100 dB or lower at 16 GHz - 20 GHz

    If the external power amplifier connection port is added.
    -100 dB or lower at 300 kHz - 700 MHz
    -105 dB or lower at 700 MHz - 4 GHz
    -100 dB or lower at 4 GHz - 8 GHz
    -95 dB or lower at 8 GHz - 16 GHz
    -90 dB or lower at 16 GHz - 20 GHz

    In the 6-port type
    -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

For 6-port type

18. Disconnect the Short Standard from Test Port 4, and connect it to Test Port 5.

19. Press ***Meas, Measure More*** and ***S25***.
    The Trace parameter is set to S25.

    The displayed S25 is the crosstalk from Test Port 5 to Test Port 2. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

20. Disconnect the Short Standard from Test Port 5, and connect it to Test Port 6.

21. Press ***Meas, Measure More*** and ***S26***.
    The Trace parameter is set to S26.

    The displayed S26 is the crosstalk from Test Port 6 to Test Port 2. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

Test Port 3 Crosstalk (For 3-port type, 4-port type and 6-port type)

22. Connect the Load Standard to Test Port 3 and the Short Standard to Test Port 1.

23. Press ***Meas***, ***Measure More*** and ***S31***.
    The Trace parameter is set to S31.

    The displayed S31 is the crosstalk from Test Port 1 to Test Port 3. Confirm the value using a marker.

    <Confirm> -110 dB or lower at 300 kHz - 700 MHz
    -120 dB or lower at 700 MHz - 4 GHz
    -110 dB or lower at 4 GHz - 8 GHz
    -105 dB or lower at 8 GHz - 16 GHz
    -100 dB or lower at 16 GHz - 20 GHz

    If the external power amplifier connection port is added.
    -100 dB or lower at 300 kHz - 700 MHz
    -105 dB or lower at 700 MHz - 4 GHz
    -100 dB or lower at 4 GHz - 8 GHz
    -95 dB or lower at 8 GHz - 16 GHz
    -90 dB or lower at 16 GHz - 20 GHz

    In the 6-port type
    -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

24. Disconnect the Short Standard from Test Port 1, and connect it to Test Port 2.
25. Press ***Meas***, ***Measure More*** and ***S32***.
    The Trace parameter is set to S32.

    The displayed S32 is the crosstalk from Test Port 2 to Test Port 3. Confirm the value using a marker.

    <Confirm> -110 dB or lower at 300 kHz - 700 MHz
    -120 dB or lower at 700 MHz - 4 GHz
    -110 dB or lower at 4 GHz - 8 GHz
    -105 dB or lower at 8 GHz - 16 GHz
    -100 dB or lower at 16 GHz - 20 GHz

    If the external power amplifier connection port is added.
    -100 dB or lower at 300 kHz - 700 MHz
    -105 dB or lower at 700 MHz - 4 GHz
    -100 dB or lower at 4 GHz - 8 GHz
    -95 dB or lower at 8 GHz - 16 GHz
    -90 dB or lower at 16 GHz - 20 GHz

    In the 6-port type
    -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

For 4-port type and 6-port type

26. Disconnect the Short Standard from Test Port 2, and connect it to Test Port 4.
27. Press ***Meas***, ***Measure More*** and ***S34***.
    The Trace parameter is set to S34.

    The displayed S34 is the crosstalk from Test Port 4 to Test Port 3. Confirm the value using a marker.

    <Confirm> -110 dB or lower at 300 kHz - 700 MHz
    -120 dB or lower at 700 MHz - 4 GHz
    -110 dB or lower at 4 GHz - 8 GHz
    -105 dB or lower at 8 GHz - 16 GHz
    -100 dB or lower at 16 GHz - 20 GHz

    If the external power amplifier connection port is added.
    -100 dB or lower at 300 kHz - 700 MHz
    -105 dB or lower at 700 MHz - 4 GHz
    -100 dB or lower at 4 GHz - 8 GHz
    -95 dB or lower at 8 GHz - 16 GHz
    -90 dB or lower at 16 GHz - 20 GHz

    In the 6-port type
    -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

For 6-port type

28. Disconnect the Short Standard from Test Port 4, and connect it to Test Port 5.

29. Press ***Meas, Measure More*** and ***S35***.
The Trace parameter is set to S35.

    The displayed S35 is the crosstalk from Test Port 5 to Test Port 3. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

30. Disconnect the Short Standard from Test Port 5, and connect it to Test Port 6.

31. Press ***Meas, Measure More*** and ***S36***.
The Trace parameter is set to S36.

    The displayed S36 is the crosstalk from Test Port 6 to Test Port 3. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

Test Port 4 Crosstalk (For 4-port type and 6-port type)

32. Connect the Load Standard to Test Port 4 and the Short Standard to Test Port 1.

33. Press ***Meas***, ***Measure More*** and ***S41***.
The Trace parameter is set to S41.

    The displayed S41 is the crosstalk from Test Port 1 to Test Port 4. Confirm the value using a marker.

    <Confirm> -110 dB or lower at 300 kHz - 700 MHz
    -120 dB or lower at 700 MHz - 4 GHz
    -110 dB or lower at 4 GHz - 8 GHz
    -105 dB or lower at 8 GHz - 16 GHz
    -100 dB or lower at 16 GHz - 20 GHz

    If the external power amplifier connection port is added.
    -100 dB or lower at 300 kHz - 700 MHz
    -105 dB or lower at 700 MHz - 4 GHz
    -100 dB or lower at 4 GHz - 8 GHz
    -95 dB or lower at 8 GHz - 16 GHz
    -90 dB or lower at 16 GHz - 20 GHz

    In the 6-port type
    -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

34. Disconnect the Short Standard from Test Port 1, and connect it to Test Port 2.

35. Press ***Meas***, ***Measure More*** and ***S42***.
    The Trace parameter is set to S42.

    The displayed S42 is the crosstalk from Test Port 2 to Test Port 4. Confirm the value using a marker.

    <Confirm> -110 dB or lower at 300 kHz - 700 MHz
    -120 dB or lower at 700 MHz - 4 GHz
    -110 dB or lower at 4 GHz - 8 GHz
    -105 dB or lower at 8 GHz - 16 GHz
    -100 dB or lower at 16 GHz - 20 GHz

    If the external power amplifier connection port is added.
    -100 dB or lower at 300 kHz - 700 MHz
    -105 dB or lower at 700 MHz - 4 GHz
    -100 dB or lower at 4 GHz - 8 GHz
    -95 dB or lower at 8 GHz - 16 GHz
    -90 dB or lower at 16 GHz - 20 GHz

    In the 6-port type
    -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

36. Disconnect the Short Standard from Test Port 2, and connect it to Test Port 3.

37. Press ***Meas***, ***Measure More*** and ***S43***.
    The Trace parameter is set to S43.

    The displayed S43 is the crosstalk from Test Port 3 to Test Port 4. Confirm the value using a marker.

    <Confirm> -110 dB or lower at 300 kHz - 700 MHz
    -120 dB or lower at 700 MHz - 4 GHz
    -110 dB or lower at 4 GHz - 8 GHz
    -105 dB or lower at 8 GHz - 16 GHz
    -100 dB or lower at 16 GHz - 20 GHz

    If the external power amplifier connection port is added.
    -100 dB or lower at 300 kHz - 700 MHz
    -105 dB or lower at 700 MHz - 4 GHz
    -100 dB or lower at 4 GHz - 8 GHz
    -95 dB or lower at 8 GHz - 16 GHz
    -90 dB or lower at 16 GHz - 20 GHz

    In the 6-port type
    -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

For 6-port type

38. Disconnect the Short Standard from Test Port 3, and connect it to Test Port 5.

39. Press ***Meas, Measure More*** and ***S45***.
    The Trace parameter is set to S45.

    The displayed S45 is the crosstalk from Test Port 5 to Test Port 4. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

40. Disconnect the Short Standard from Test Port 5, and connect it to Test Port 6.

41. Press ***Meas, Measure More*** and ***S46***.
    The Trace parameter is set to S46.

    The displayed S46 is the crosstalk from Test Port 6 to Test Port 4. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

Test Port 5 Crosstalk (For 6-port type)

42. Connect the Load Standard to Test Port 5 and the Short Standard to Test Port 1.

43. Press ***Meas, Measure More*** and ***S51***.
    The Trace parameter is set to S51.

    The displayed S51 is the crosstalk from Test Port 1 to Test Port 5. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

44. Disconnect the Short Standard from Test Port 1, and connect it to Test Port 2.

45. Press ***Meas, Measure More*** and ***S52***.
    The Trace parameter is set to S52.

    The displayed S52 is the crosstalk from Test Port 2 to Test Port 5. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

46. Disconnect the Short Standard from Test Port 2, and connect it to Test Port 3.

47. Press ***Meas, Measure More*** and ***S53***.
    The Trace parameter is set to S53.

    The displayed S53 is the crosstalk from Test Port 3 to Test Port 5. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

48. Disconnect the Short Standard from Test Port 3, and connect it to Test Port 4.

49. Press ***Meas, Measure More*** and ***S54***.
    The Trace parameter is set to S54.

    The displayed S54 is the crosstalk from Test Port 4 to Test Port 5. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

50. Disconnect the Short Standard from Test Port 4, and connect it to Test Port 6.

51. Press ***Meas, Measure More*** and ***S56***.
    The Trace parameter is set to S56.

    The displayed S56 is the crosstalk from Test Port 6 to Test Port 5. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

Test Port 6 Crosstalk (For 6-port type)

52. Connect the Load Standard to Test Port 6 and the Short Standard to Test Port 1.

53. Press ***Meas, Measure More*** and ***S61***.
    The Trace parameter is set to S61.

    The displayed S61 is the crosstalk from Test Port 1 to Test Port 6. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

54. Disconnect the Short Standard from Test Port 1, and connect it to Test Port 2.

55. Press ***Meas, Measure More*** and ***S62***.
    The Trace parameter is set to S62.

    The displayed S62 is the crosstalk from Test Port 2 to Test Port 6. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

56. Disconnect the Short Standard from Test Port 2, and connect it to Test Port 3.

57. Press ***Meas, Measure More*** and ***S63***.
    The Trace parameter is set to S63.

    The displayed S63 is the crosstalk from Test Port 3 to Test Port 6. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

58. Disconnect the Short Standard from Test Port 3, and connect it to Test Port 4.

59. Press ***Meas, Measure More*** and ***S64***.
    The Trace parameter is set to S64.

    The displayed S64 is the crosstalk from Test Port 4 to Test Port 6. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

60. Disconnect the Short Standard from Test Port 4, and connect it to Test Port 5.

61. Press ***Meas, Measure More*** and ***S65***.
    The Trace parameter is set to S65.

    The displayed S65 is the crosstalk from Test Port 5 to Test Port 6. Confirm the value using a marker.

    <Confirm> -90 dB or lower at 300 kHz - 700 MHz
    -100 dB or lower at 700 MHz - 4 GHz
    -90 dB or lower at 4 GHz - 8 GHz
    -85 dB or lower at 8 GHz - 16 GHz
    -80 dB or lower at 16 GHz - 20 GHz

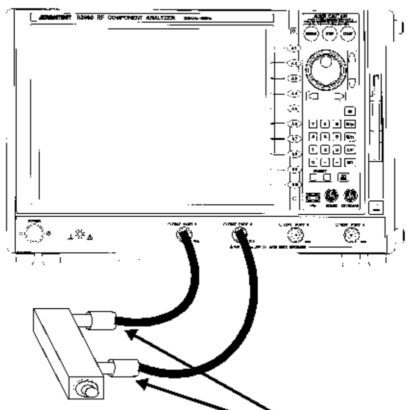
15.9 Dynamic Level Accuracy

Measurements of the analyzer are expressed as vector data, so the dynamic level accuracy of phase characteristics is assured by magnitude characteristics satisfying standards. As a result, this section explains the method for confirming the dynamic level accuracy of magnitude characteristics.

Testing Procedure

Dynamic Level Accuracy of Test Port 1

1. Connect a 3 dB fixed attenuator and a step attenuator to Test Port 1 and Test Port 2 using RF Cables as shown in the following diagram.



Step Attenuator 3 dB Fixed Attenuator

Figure 15-8 Dynamic Level Accuracy

2. Press ***Center*, 5, 0, M/n, *Span*, 0, ENT, *Output Power*, 1, 0, ENT, *IF RBW*** and **100 Hz**.
   This operation sets Center Frequency to 50 MHz, Frequency Span to 0 Hz, Output power to 10 dBm (1 dBm for 20-GHz type), and RBW to 100 Hz.
3. Press ***Meas*, *Measure More*** and ***S12***.
   The Trace parameter is set to S12.
4. Set the step attenuator to 20 dB.
5. Press ***Cal, Standard Cal*** and ***Normalize Open/Thru***.
   This operation executes Thru Normalize.
6. Set the step attenuator to 0 dB.
7. Acquire the Trace data using a marker.

8. Repeat steps 6 and 7 in accordance with the following table.

Step Attenuator Setting	Dynamic Level Accuracy Standard Value
0 dB	±0.2 dB (300 kHz to 4.0 GHz) ±0.4 dB (4.0 GHz to 8 GHz) ±0.4 dB (8 GHz to 20 GHz)
10 dB	±0.05 dB
20 dB	Standard
30 dB	±0.05 dB
40 dB	±0.05 dB
50 dB	±0.05 dB
60 dB	±0.10 dB

<Confirm> Confirm that dynamic level accuracy is within the standard values of the above table for the various step attenuator setting values.

The dynamic level accuracy = (the S12 read value) - (the step attenuator value)

CAUTION: ***Use a value calibrated from a 20 dB standard as the step attenuator value. When 19.95 dB is calibrated as the difference from 20 dB at a setting of 0 dB, the step attenuator value is 19.95 dB.***

9. Press ***Center*, 3** and **G/p**.
   The frequency is set to 3 GHz.

10. Repeat steps 4 through 8 to confirm dynamic level accuracy at 3 GHz.

11. Press ***Center*, 8** and **G/p**.
    The frequency is set to 8 GHz.

12. Repeat steps 4 through 8 to confirm dynamic level accuracy at 8 GHz.

Dynamic Level Accuracy of Test Port 2

13. Press ***Meas***, ***Measure More*** and ***S21***.
    The Trace parameter is set to S21.

14. Repeat steps 4 through 12 to confirm the dynamic level accuracy.

Dynamic Level Accuracy of Test Port 3 (For 3-port type, 4-port type and 6-port type)

15. Disconnect the RF cable from Test Port 2, and connect it to Test Port 3.

16. Press ***Meas***, ***Measure More*** and ***S31***.
    The Trace parameter is set to S31.

17. Repeat steps 4 through 12 to confirm the dynamic level accuracy.

Dynamic Level Accuracy of Test Port 4 (For 4-port type and 6-port type)

18. Disconnect the RF cable from Test Port 3, and connect it to Test Port 4.
19. Press ***Meas***, ***Measure More*** and ***S41***.
    The Trace parameter is set to S41.
20. Repeat steps 4 through 12 to confirm the dynamic level accuracy.

Dynamic Level Accuracy of Test Port 5 (For 6-port type)

21. Disconnect the RF cable from Test Port 4, and connect it to Test Port 5.
22. Press ***Meas, Measure More*** and ***S51***.
    The Trace parameter is set to S51.
23. Repeat steps 4 through 12 to confirm the dynamic level accuracy.

Dynamic Level Accuracy of Test Port 6 (For 6-port type)

24. Disconnect the RF cable from Test Port 5, and connect it to Test Port 6.
25. Press ***Meas, Measure More*** and ***S61***.
    The Trace parameter is set to S61.
26. Repeat steps 4 through 12 to confirm the dynamic level accuracy.

15.10 Attenuation Accuracy (Expanded Power Function)

15.10.1 Specifications

Reference Level:	Attenuation	0 dB
	Attenuation	20 dB: ±4 dB
	Attenuation	40 dB: ±5 dB(8-GHz type)
		40d B: ±4 dB(20-GHz type)
	Attenuation	60 dB: ±6 dB(8-GHz type)
		60 dB: ±4 dB(20-GHz type)

15.10.2 Instruments Required

- RF cable (SMA(m)/SMA(m) 50Ω)
  Recommended model : A01253-060
- Adopter (N(m)/SMA(f)) quantity=2
  Recommended model : HRM-554S

15.10.3 Testing Procedure

For a 8-GHz type:

1. Connect the RF cable and conversion connector (for OPT 12 or 13, only the RF cable is used) from TEST PORT 1 to TEST PORT 2 as shown in Figure 15-9.

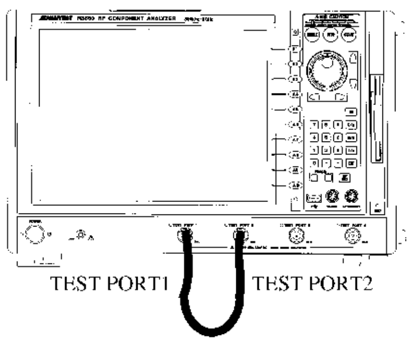


Figure 15-9 Connections for Attenuation Accuracy Measurements

2. Press ***Port***, ***More 1/2*** and ***P2***.
   The measurement port is set to P2.

3. Press ***Config***, ***Service Menu***, ***Absolute Meas*** and ***A***.
   The measurement parameter is set to A.

4. Press ***Att***, ***Output Power***, **-**, **1** and **ENT**.
   The output level is set to -1 dBm.

5. Press ***Scale***, ***/Div***, **2**, **ENT**, ***Ref Position***, **5**, **0** and **ENT**.
   The scale is set to 10 dB/ and the reference position is set to 50 %.

6. Press ***Avg***, ***IF RBW***, ***More 1/4***, ***More 2/4*** and ***100Hz***.
   The RBW is set to 100 Hz.

7. Press ***Marker***.
   The marker is displayed.

8. Press ***Cal***, ***Standard Cal*** and ***Normalize Open/Thru***.
   The normalization is performed.

9. Ensure that the normalization is complete and Correct is set to ON.

10. Press ***Att***, ***Port 1 ATT***, **2**, **0** and **ENT**.
    The attenuator is set to 20 dB.

11. Press ***Scale***, ***Ref Val/Full***, **-**, **2**, **0** and **ENT**.
    The reference is set to -20 dB.

12. Press ***Marker Search***, ***Search Mode*** and ***Max Search***.
    Confirm the marker value.

    <Confirm> -20 dB ± 4 dB or less

13. Press ***Min Search***.
    Confirm the marker value.

    <Confirm> -20 dB ± 4 dB or less

14. Press ***Att***, ***Port 1 ATT***, **4**, **0** and **ENT**.
    The attenuator is set to 40 dB.

15. Press ***Scale***, ***Ref Val/Full***, **-**, **4**, **0** and **ENT**.
    The reference is set to -40 dB.

16. Press ***Marker Search*** and ***Max Search***.
    Confirm the marker value.

    <Confirm> -40 dB ± 5 dB or less

17. Press ***Min Search***.
    Confirm the marker value.

    <Confirm> -40 dB ± 5 dB or less

18. Press ***Att***, ***Port 1 ATT***, **6**, **0** and **ENT**.
    The attenuator is set to 60 dB.

19. Press ***Scale***, ***Ref Val/Full***, **-**, **6**, **0** and **ENT**.
    The reference is set to -60 dB.

20. Press ***Marker Search*** and ***Max Search***.
    Confirm the marker value.

    <Confirm> -60 dB ± 6 dB or less

21. Press ***Min Search***.
    Confirm the marker value.

    <Confirm> -60 dB ± 6 dB or less

For a 20-GHz type:

The following shows a test procedure in a 4-port type analyzer with the first signal source:

1. Open all test ports.
2. Press ***AVG***, ***IF RBW***, **1**, **0**, **0** and **ENT**.

   The RBW is set to 100 Hz.
3. Press ***Config***, ***Service Menu***, ***Absolute Meas*** and ***A***.

   The measurement parameter is set to A.
4. Press ***Att***, ***Output Power***, **-**, **1**, **0** and **ENT**.

   The output level is set to - 10 dBm.
   For other models, set the output power as follows:

2-port type, 1ST SG	-7 dBm
3/4-port type, 1ST SG	-10 dBm
2ND SG	+3 dBm

5. Press ***Scal***, ***/Div***, ***10***, ***ENT***, ***Ref Position***, **5**, **0** and **ENT**.

   The scale is set to 10 dB per division and the reference position is set to 50%.
6. Press ***Cal***, ***Standard Cal*** and ***Normalize Open/Thru***.

   The trace waveform is normalized.
7. Press ***Marker***.

   The marker is displayed.
8. Press ***Att***, ***Output Power***, **-**, **3**, **0** and **ENT**.

   The output level is set to - 30 dBm.
   For other models, set the output power as follows:

2-port type, 1ST SG	-27 dBm
3/4-port type, 1ST SG	-30 dBm
2ND SG	-17 dBm

9. Press ***Marker Search***, ***Search Mode*** and ***Max Search***.

   Check the marker value.

   <Confirm> -20 dB ± 4 dB or less
10. Press ***Marker Search***, ***Search Mode*** and ***Min Search***.

    Check the marker value.

    <Confirm> -20 dB ± 4 dB or less

11. Press ***Att***, ***Output Power***, **-**, **5**, **0** and **ENT**.

    The output level is set to - 50 dBm.
    For other models, set the output power as follows:

2-port type, 1ST SG	-47 dBm
3/4-port type, 1ST SG	-50 dBm
2ND SG	-37 dBm

12. Press ***Marker Search***, ***Search Mode*** and ***Max Search***.

    Check the marker value.

    <Confirm> -40 dB ± 4 dB or less

13. Press ***Marker Search***, ***Search Mode*** and ***Min Search***.

    Check the marker value.

    <Confirm> -40 dB ± 4 dB or less

14. Press ***Att***, ***Output Power***, **-**, **7**, **0** and **ENT**.

    The output level is set to - 70 dBm.
    For other models, set the output power as follows:

2-port type, 1ST SG	-67 dBm
3/4-port type, 1ST SG	-70 dBm
2ND SG	-57 dBm

15. Press ***Marker Search***, ***Search Mode*** and ***Max Search***.

    Check the marker value.

    <Confirm> -60 dB ± 4 dB or less

16. Press ***Marker Search***, ***Search Mode*** and ***Min Search***.

    Check the marker value.

    <Confirm> -60 dB ± 4 dB or less

15.11 Output Voltage Accuracy (VSIM Function)

15.11.1 Specifications

Accuracy: ±(0.15% of setting +3 mV)

15.11.2 Instruments Required

- Digital Multimeter
  Recommended model : R6581
- Digital Multimeter input cable
  Recommended model : A01035

15.11.3 Testing Procedure

1. Press ***VSIM***, ***VSIM ON/OFF*** (ON), ***VS CH State***, ***CH A ON/OFF*** (ON), and ***Return***.
   CH A on the VSIM is set to ON.
2. Press ***V Source*** (VS CH A), ***V Source ON/OFF*** (ON), ***Output***, and **6**, **ENT**.
   A 6 V voltage is output to CH A.
3. Set the digital multimeter to the voltage measurement mode. Measure the output voltage on channel A on the VSIM as shown in Figure 15-10.

NOTE: When measuring, take great care not to damage the core of the BNC connector.

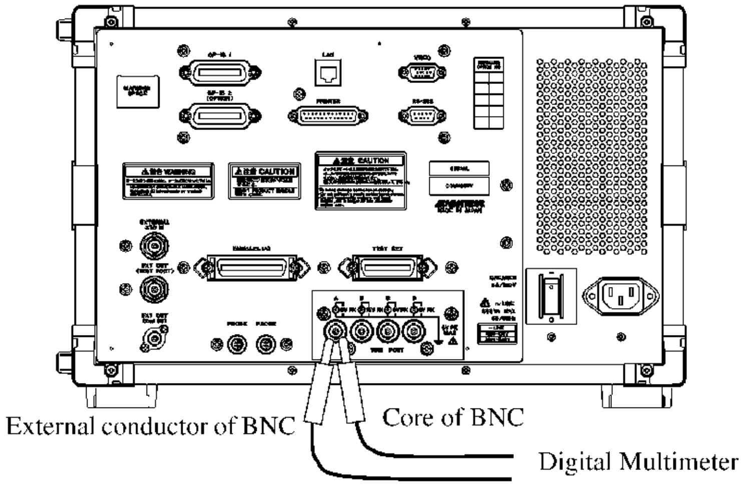


Figure 15-10 Output Voltage Accuracy Measurement on Channel A on the VSIM

4. Ensure that the measured value is within the specification range.

   Specification range: 6 V ±0.012 V

5. Repeat steps 1 to 4 for other voltage levels and channels to ensure that the output voltage accuracy is within the specification range.

15.12 Current Measurement Accuracy (VSIM Function)

15.12.1 Specifications

Channel	Range	Accuracy
A	200 μA 1 mA 50 mA 500 mA	±(0.15% of reading +400 nA +5 nA×Vo/1 V) ±(0.15% of reading +1000 nA +25 nA×Vo/1 V) ±(0.15% of reading +40 μA +1 μA×Vo/1 V) ±(0.15% of reading +400 μA +10 μA×Vo/1 V)
B	200 μA 1 mA 50 mA 120 mA	±(0.15% of reading +400 nA +5 nA×Vo/1 V) ±(0.15% of reading +2000 nA +25 nA×Vo/1 V) ±(0.15% of reading +80 μA +1 μA×Vo/1 V) ±(0.15% of reading +200 μA+2.5 μA×Vo/1 V)
C/D	200 μA 1 mA 30 mA	±(0.15% of reading +800 nA +5 nA×Vo/1 V) ±(0.15% of reading +4000 nA +25 nA×Vo/1 V) ±(0.15% of reading +180 μA +1 μA×Vo/1 V)

15.12.2 Instruments Required

- Digital Multimeter
  Recommended model : R6581
- Digital Multimeter input cable
  Recommended model : A01035

15.12.3 Testing Procedure

1. Press ***I Measure*** (IM CH A), ***I Measure ON/OFF*** (ON), and ***Return***.
   The current measurement function is set to ON.
2. Press ***Display***, ***CH A ON/OFF*** (ON), and ***Return***.
   The current measurement value of CH A is displayed on the screen.
3. Press ***I Measure*** (IM CH A), ***200μA***, and ***Return***.
   The current measurement range of 200 μA is set to CH A.
4. Press ***V source*** (VS CH A), ***Current Limit***, **1**, **9**, **0**, **k/μ**, ***Output***, **1**, and **ENT**.
   The current limit of CH A is set to 190 μA and the output voltage is set to 1 V.
5. Set the digital multimeter to the current measurement mode. Measure the current on channel A on the VSIM as shown in Figure 15-11. While the digital multimeter probe is connected, record the current measured value of CH A on the screen.

NOTE:

1. ***When measuring, the limit error is displayed on the screen. Ignore the limit error.***
2. ***Take great care not to damage the core of the BNC connector.***

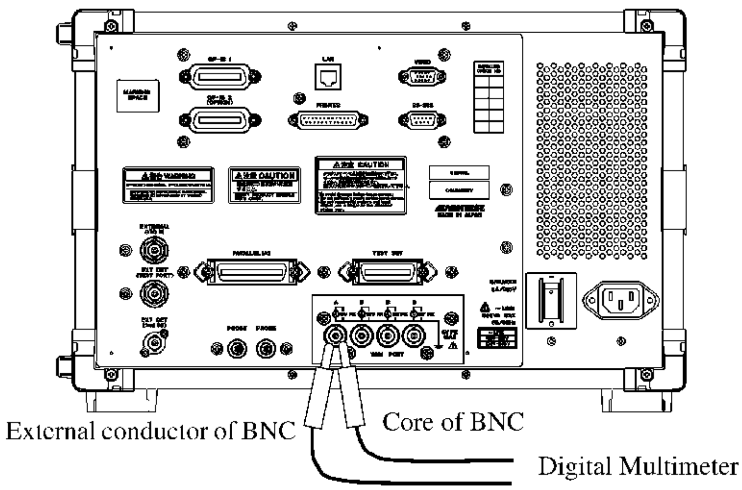


Figure 15-11 Current Accuracy Measurement on Channel A on the VSIM

6. Calculate an error from the measured current value of CHA.

   Example: When the measured current value on CH A = 189.99 μA

   189.99 μA×0.0015+0.4 μA+0.005 μA = 0.690 μA

7. Ensure that the read value on the digital multimeter is within 189.99 μA±0.690 μA.

8. Repeat steps 1 to 7 for other current measurement ranges and channels to ensure that the current measurement accuracy is within the specification range.

16. SPECIFICATIONS

The items in which 8-GHz type is specified apply to the R3860A 8-GHz type and the R3768.
The items in which 20-GHz type is specified apply to the R3860A 20-GHz type and the R3770.

When measured in RBW 10 Hz with eight-time averaging after executing Isolation Calibration (typical value).

System dynamic range	8 GHz type 300 kHz to 700 MHz: -123 dB 700 MHz to 3.8 GHz: -125 dB 3.8 GHz to 6.0 GHz: -124 dB 6.0 GHz to 8.0 GHz: -123 dB 8 GHz type (If the external power amplifier connection port is added) 300 kHz to 700 MHz: -113 dB 700 MHz to 3.8 GHz: -110 dB 3.8 GHz to 6.0 GHz: -114 dB 6.0 GHz to 8.0 GHz: -113 dB 8 GHz 6-port type 300 kHz to 700 MHz: -103 dB 700 MHz to 3.8 GHz: -105 dB 3.8 GHz to 6.0 GHz: -104 dB 6.0 GHz to 8.0 GHz: -103 dB 20 GHz 2-port type 300 kHz to 700 MHz: -123 dB 700 MHz to 3.8 GHz: -125 dB 3.8 GHz to 6.0 GHz: -125 dB 6.0 GHz to 8.0 GHz: -125 dB 8.0 GHz to 20 GHz: -117 dB 20 GHz 3/4-port type 300 kHz to 700 MHz: -123 dB 700 MHz to 3.8 GHz: -125 dB 3.0 GHz to 8.0 GHz: -125 dB 6.0 GHz to 8.0 GHz: -125 dB 8.0 GHz to 20 GHz: -113 dB 20 GHz type (If the external power amplifier connection port is added) 300 kHz to 700 MHz: -113 dB 700 MHz to 3.8 GHz: -110 dB 3.0 GHz to 8.0 GHz: -115 dB 6.0 GHz to 8.0 GHz: -115 dB 8.0 GHz to 20 GHz: -103 dB 20 GHz 6-port type 300 kHz to 700 MHz: -103 dB 700 MHz to 3.8 GHz: -105 dB 3.0 GHz to 8.0 GHz: -105 dB 6.0 GHz to 8.0 GHz: -105 dB 8.0 GHz to 20 GHz: -93 dB

When executed the full-calibration using the 3.5 mm calibration kit (central value).

Load match	40 dB (300 kHz to 1 GHz) 39 dB (1 GHz to 3 GHz) 35 dB (3 GHz to 4 GHz) 34 dB (4 GHz to 6 GHz) 30 dB (6 GHz to 8 GHz) 28 dB (8 GHz to 20 GHz)
Source match	40 dB (300 kHz to 1 GHz) 37 dB (1 GHz to 2 GHz) 36 dB (2 GHz to 3 GHz) 32 dB (3 GHz to 4 GHz) 31 dB (4 GHz to 6 GHz) 27 dB (6 GHz to 8 GHz) 23 dB (8 GHz to 20 GHz)
Directivity	40 dB (300 kHz to 3 GHz) 36 dB (3 GHz to 6 GHz) 31 dB (6 GHz to 8 GHz) 31 dB (8 GHz to 20 GHz)
Reflection tracking	0.006 dB (300 kHz to 3 GHz) 0.008 dB (3 GHz to 6 GHz) 0.012 dB (6 GHz to 8 GHz) 0.012 dB (8 GHz to 20 GHz)
Transmission tracking	0.017 dB (300 kHz to 1 GHz) 0.012 dB (1 GHz to 2 GHz) 0.027 dB (2 GHz to 3 GHz) 0.059 dB (3 GHz to 6 GHz) 0.089 dB (6 GHz to 8 GHz) 0.176 dB (8 GHz to 20 GHz)

When executed the full-calibration using the N type calibration kit (central value).

Load match	40 dB (300 kHz to 1 GHz) 39 dB (1 GHz to 2 GHz) 33 dB (2 GHz to 4 GHz) 29 dB (4 GHz to 8 GHz)
Source match	40 dB (300 kHz to 1 GHz) 35 dB (1 GHz to 2 GHz) 30 dB (2 GHz to 3 GHz) 29 dB (3 GHz to 4 GHz) 26 dB (4 GHz to 6 GHz) 25 dB (6 GHz to 8 GHz)
Directivity	40 dB (300 kHz to 2 GHz) 34 dB (2 GHz to 4 GHz) 30 dB (4 GHz to 8 GHz)
Reflection tracking	0.011 dB (300 kHz to 2 GHz) 0.014 dB (2 GHz to 4 GHz) 0.019 dB (4 GHz to 6 GHz) 0.020 dB (6 GHz to 8 GHz)
Transmission tracking	0.017 dB (300 kHz to 1 GHz) 0.014 dB (1 GHz to 2 GHz) 0.051 dB (2 GHz to 3 GHz) 0.056 dB (3 GHz to 4 GHz) 0.105 dB (4 GHz to 6 GHz) 0.119 dB (6 GHz to 8 GHz)

1. Measurement Function

Measurement channels	2/3/4-port type: 16 channels 6-port type: 8 channels
Display windows	16 windows
Tracing	16 traces/channel (up to 16 traces can be displayed at the same time)
Measurement parameters	2-port type: S11, S21, S12, S22 3-port type: S11, S22, S33, S21, S12, S31, S13, S23, S32 4-port type: S11, S22, S33, S44, S21, S31, S41, S12, S32 S42, S13, S23, S43, S14, S24, S34 6-port type: S11, S22, S33, S44, S55, S66, S12, S13, S14 S15, S16, S21, S23, S24, S25, S26, S31, S32 S34, S35, S36, S41, S42, S43, S45, S46, S51 S52, S53, S54, S56, S61, S62, S63, S64, S65 These parameters can be converted into impedance (Z) or admittance (Y) by using the parameter conversion function.
Measurement format	
Orthogonal coordinate display	Amplitude (linear and logarithmic), phase, group delay, VSWR, and complex number (real number and imaginary number)
Smith chart	Linear and logarithmic amplitude, phase, and complex number (real number and imaginary number) can be read by using the marker. R+jX, G+jB
Polar coordinate display	Linear and logarithmic amplitude, phase, and complex number (real number and imaginary number) can be read by using the marker.

2. Signal Source Characteristics

Frequency	
Range	8-GHz type: 300 kHz to 8.0 GHz 20-GHz type: 300 kHz to 20 GHz
Setting resolution	1 Hz
Accuracy	±10 ppm (23°C ±5°C)
Temperature stability	±15 ppm (5°C to 40°C, typical)
Aging rate	±3 ppm (year, typical)

Output power	In the 2, 3 and 4-port types, the output power is specified at all test ports. In the 6-port type, the output power is specified at test ports 3 and 4.
Range	8 GHz 2-port type -9 dBm to +11 dBm (300 kHz to 0.5 GHz) -7 dBm to +13 dBm (0.5 GHz to 4.0 GHz) -10 dBm to +10 dBm (4.0 GHz to 6.0 GHz) -12 dBm to +8 dBm (6.0 GHz to 8.0 GHz) 8 GHz 2-port type, output power expansion (electronic output attenuator) -74 dBm to +6 dBm (300 kHz to 0.5 GHz) -72 dBm to +8 dBm (0.5 GHz to 4.0 GHz) -75 dBm to +5 dBm (4.0 GHz to 6.0 GHz) -77 dBm to +3 dBm (6.0 GHz to 8.0 GHz) 8 GHz 3/4/6-port type, external power amplifier connection port -9 dBm to +11 dBm (300 kHz to 0.5 GHz) -7 dBm to +13 dBm (0.5 GHz to 4.0 GHz) -12 dBm to +8 dBm (4.0 GHz to 6.0 GHz) -14 dBm to +6 dBm (6.0 GHz to 8.0 GHz) 8 GHz 3/4-port type, external power amplifier connection port, output power expansion (electronic output attenuator) -74 dBm to +6 dBm (300 kHz to 0.5 GHz) -72 dBm to +8 dBm (0.5 GHz to 4.0 GHz) -77 dBm to +3 dBm (4.0 GHz to 6.0 GHz) -79 dBm to +1 dBm (6.0 GHz to 8.0 GHz) 20 GHz 2-port type -10 dBm to +10 dBm (300 kHz to 4.0 GHz) -13 dBm to +7 dBm (4.0 GHz to 6.0 GHz) -15 dBm to +5 dBm (6.0 GHz to 8.0 GHz) -19 dBm to +1 dBm (8.0 GHz to 11 GHz) -20 dBm to 0 dBm (11 GHz to 15 GHz) -22 dBm to -2 dBm (15 GHz to 20 GHz) 20 GHz 2-port type, output power expansion (mechanical output attenuator) -71 dBm to +9 dBm (300 kHz to 4.0 GHz) -75 dBm to +5 dBm (4.0 GHz to 6.0 GHz) -77 dBm to +3 dBm (6.0 GHz to 8.0 GHz) -81 dBm to -1 dBm (8.0 GHz to 11 GHz) -82 dBm to -2 dBm (11 GHz to 15 GHz) -86 dBm to -6 dBm (15 GHz to 20 GHz) 20 GHz 3/4/6-port type, external power amplifier connection port -12 dBm to +8 dBm (300 kHz to 4.0 GHz) -15 dBm to +5 dBm (4.0 GHz to 6.0 GHz) -17 dBm to +3 dBm (6.0 GHz to 8.0 GHz) -22 dBm to -2 dBm (8.0 GHz to 11 GHz) -23 dBm to -3 dBm (11 GHz to 15 GHz) -25 dBm to -5 dBm (15 GHz to 20 GHz)

	20 GHz 3/4-port type, external power amplifier connection port, output power expansion (mechanical output attenuator) -73 dBm to +7 dBm (300 kHz to 4.0 GHz) -77 dBm to +3 dBm (4.0 GHz to 6.0 GHz) -79 dBm to +1 dBm (6.0 GHz to 8.0 GHz) -84 dBm to -4 dBm (8.0 GHz to 11 GHz) -85 dBm to -5 dBm (11 GHz to 15 GHz) -89 dBm to -9 dBm (15 GHz to 20 GHz)
	The second signal source 8-GHz type -5 dBm to +15 dBm (300 kHz to 0.5 GHz) -2 dBm to +18 dBm (0.5 GHz to 4.0 GHz) -3 dBm to +17 dBm (4.0 GHz to 6.0 GHz) -4 dBm to +16 dBm (6.0 GHz to 8.0 GHz)
	The second signal source 8-GHz type, output power expansion (electronic output attenuator) -70 dBm to +10 dBm (300 kHz to 0.5 GHz) -67 dBm to +13 dBm (0.5 GHz to 4.0 GHz) -68 dBm to +12 dBm (4.0 GHz to 6.0 GHz) -69 dBm to +11 dBm (6.0 GHz to 8.0 GHz)
	The second signal source 20-GHz type -6 dBm to +14 dBm (300 kHz to 2.0 GHz) -7 dBm to +13 dBm (2.0 GHz to 4.0 GHz) -8 dBm to +12 dBm (4.0 GHz to 6.0 GHz) -9 dBm to +11 dBm (6.0 GHz to 8.0 GHz) -12 dBm to +8 dBm (8.0 GHz to 20 GHz)
	The second signal source 20-GHz type, output power expansion (mechanical output attenuator) -67 dBm to +13 dBm (300 kHz to 2.0 GHz) -68 dBm to +12 dBm (2.0 GHz to 4.0 GHz) -70 dBm to +10 dBm (4.0 GHz to 6.0 GHz) -71 dBm to +9 dBm (6.0 GHz to 8.0 GHz) -74 dBm to +6 dBm (8.0 GHz to 15 GHz) -76 dBm to +4 dBm (15 GHz to 20 GHz)
Resolution	0.01 dB
Accuracy	±0.5 dB (50 MHz, 0 dBm, 23°C ±5°C, specified in TEST PORT1)
	For a 20-GHz type, when a mechanical output attenuator is added. ±0.8 dB (50 MHz, 0 dBm, 23°C ±5°C, specified in TEST PORT1)
	In the 6-port type ±0.5 dB (50 MHz, 0 dBm, 23°C ±5°C, specified in TEST PORT3)

Flatness	For an 8-GHz type 2.0 dBp-p (23°C±5°C, 0 dBm at TEST PORT1 and 2ND SG port) For a 20-GHz type 2.0 dBp-p (23°C±5°C, first signal source: maximum output power at 15 GHz to 20 GHz at TEST PORT1, second signal source: 0 dBm at 2ND SG port) For a 20-GHz type, when a mechanical output attenuator is added. 2.5 dBp-p (23°C±5°C, first signal source: maximum output power at 15 GHz to 20 GHz at TEST PORT1, second signal source: 0 dBm at 2ND SG port) In the 6-port type For an 8-GHz type 2.0 dBp-p (23°C±5°C, 0 dBm at TEST PORT3) For a 20-GHz type 2.0 dBp-p (23°C±5°C, maximum output power at 15 GHz to 20 GHz at TEST PORT3)
Linearity	±0.7 dB (23°C ±5°C, specified in the ATT = 0 dB setting when an output attenuator is added)
Attenuation accuracy	When an electronic or mechanical output attenuator is added. (With reference to 23°C ±5°C and ATTENUATION=0 dB) ATTENUATION=20 dB (ATT FIX) ±4 dB ATTENUATION=40 dB (ATT FIX) ±5 dB (8-GHz type) ±4 dB (20-GHz type) ATTENUATION=60 dB (ATT FIX) ±6 dB (8-GHz type) ±4 dB (20-GHz type)
Sweep function	
Sweep type	Linear sweep, logarithmic sweep, program sweep, or power sweep
Sweep time	5 μs/1 point (RBW 400 kHz)
Number of points	3 to 1601 points
Sweep trigger	Continuous, single, hold, or external trigger

3. Receiver Characteristics

Resolution bandwidth	400 kHz, 200 kHz, 150 kHz, 100 kHz 100 kHz to 10 Hz (variable in 1, 1.5, 2, 3, 4, 5, and 7 steps)
Stability	
Trace noise	0.0025 dBrms (300 kHz to 10 MHz, RBW 1 kHz, typical) 0.0025 dBrms (10 MHz to 990 MHz, RBW 100 kHz, typical) 0.005 dBrms (990 MHz to 1.98 GHz, RBW 100 kHz, typical) 0.010 dBrms (1.98 GHz to 3.96 GHz, RBW 100 kHz, typical) 0.020 dBrms (3.96 GHz to 8.0 GHz, RBW 100 kHz, typical) 0.040 dBrms (8 GHz to 15.84 GHz, RBW 100 kHz, typical) 0.080 dBrms (15.84 GHz to 20 GHz, RBW 100 kHz, typical) If the external power amplifier connection port is added or in the 6-port type 0.0025 dBrms (300 kHz to 10 MHz, RBW 1 kHz, typical) 0.004 dBrms (10 MHz to 990 MHz, RBW 100 kHz, typical) 0.007 dBrms (990 MHz to 1.98 GHz, RBW 100 kHz, typical) 0.010 dBrms (1.98 GHz to 3.96 GHz, RBW 100 kHz, typical) 0.020 dBrms (3.96 GHz to 8.0 GHz, RBW 100 kHz, typical) 0.040 dBrms (8 GHz to 15.84 GHz, RBW 100 kHz, typical) 0.080 dBrms (15.84 GHz to 20 GHz, RBW 100 kHz, typical)
Temperature stability	0.01 dB/°C (300 kHz to 2.6 GHz, typical) 0.02 dB/°C (2.6 GHz to 8.0 GHz, typical) 0.03 dB/°C (8.0 GHz to 20 GHz, typical)
Aging stability	0.005 dB/week (typical)
Amplitude characteristics	
Amplitude resolution	0.001 dB
Dynamic accuracy	With respect to an input range of the maximum input to -20 dB ±0.20 dB (0 to -10 dB, 300 kHz to 4 GHz) ±0.30 dB (0 to -10 dB, 4 GHz to 8 GHz) ±0.40 dB (0 to -10 dB, 8 GHz to 20 GHz) ±0.05 dB (-10 to -50 dB) ±0.10 dB (-50 to -60 dB) ±0.40 dB (-60 to -70 dB) ±1.00 dB (-70 to -90 dB)
Phase characteristics	
Phase resolution	0.01°
Dynamic accuracy	With respect to an input range of the maximum input to -20 dB ±2.0° (0 to -10 dB, 300 kHz to 4 GHz) ±3.0° (0 to -10 dB, 4 GHz to 8 GHz) ±4.0° (0 to -10 dB, 8 GHz to 20 GHz) ±0.3° (-10 to -50 dB) ±0.4° (-50 to -60 dB) ±1.5° (-60 to -70 dB) ±4.0° (-70 to -80 dB) ±8.0° (-80 to -90 dB)

Group delay characteristics	Obtained by using the following equation and phase characteristics. $\Delta\phi$ / (360 × Δf) $\Delta\phi$: Phase difference Δf: Frequency difference (aperture frequency)
Group delay time resolution	1 pS
Aperture frequency	Can be set the set frequency range from [100/ (Measurement point -1)] × 2% to 50%.
Accuracy	Phase accuracy/ (360 × Aperture frequency (Hz))

4. Test Port Characteristics

Load match	With no system correction 14 dB (300 kHz to 1 MHz) 20 dB (1 MHz to 1.0 GHz) 18 dB (1.0 GHz to 4.0 GHz) 12 dB (4.0 GHz to 8.0 GHz) 10 dB (8 GHz to 20 GHz)
Source match	With no system correction 16 dB (300 kHz to 2.6 GHz) 14 dB (2.6 GHz to 4.0 GHz) 12 dB (4.0 GHz to 8.0 GHz) 8 dB (8 GHz to 20 GHz) If the external power amplifier connection port is added 16 dB (300 kHz to 2.6 GHz) 13 dB (2.6 GHz to 4.0 GHz) 9 dB (4.0 GHz to 8.0 GHz) 6 dB (8 GHz to 20 GHz) In the 6-port type 12 dB (300 kHz to 2.6 GHz) 12 dB (2.6 GHz to 4.0 GHz) 10 dB (4.0 GHz to 8.0 GHz) 7 dB (8 GHz to 20 GHz)

Directivity	With no system correction 13 dB (300 kHz to 500 MHz) 23 dB (500 MHz to 1.2 GHz) 20 dB (1.2 GHz to 4.5 GHz) 12 dB (4.5 GHz to 18 GHz) 8 dB (18 GHz to 20 GHz) If the external power amplifier connection port is added 13 dB (300 kHz to 500 MHz) 23 dB (500 MHz to 1.2 GHz) 18 dB (1.2 GHz to 4.5 GHz) 9 dB (4.5 GHz to 18 GHz) 8 dB (18 GHz to 20 GHz) In the 6-port type 13 dB (300 kHz to 500 MHz) 22 dB (500 MHz to 1.2 GHz) 20 dB (1.2 GHz to 4.5 GHz) 12 dB (4.5 GHz to 18 GHz) 8 dB (18 GHz to 20 GHz)
Crosstalk	When maximum output power 110 dB (300 kHz to 700 MHz) 120 dB (700 MHz to 4 GHz) 110 dB (4 GHz to 8 GHz) 105 dB (8 GHz to 16 GHz) 100 dB (16 GHz to 20 GHz) If the external power amplifier connection port is added 100 dB (300 kHz to 700 MHz) 105 dB (700 MHz to 4 GHz) 100 dB (4 GHz to 8 GHz) 95 dB (8 GHz to 16 GHz) 90 dB (16 GHz to 20 GHz) In the 6-port type 90 dB (300 kHz to 700 MHz) 100 dB (700 MHz to 4 GHz) 90 dB (4 GHz to 8 GHz) 85 dB (8 GHz to 16 GHz) 80 dB (16 GHz to 20 GHz)
Maximum input level	+10 dBm (8-GHz type) +1 dBm (20-GHz type)

Noise level	300 kHz to 10 MHz RBW 1 kHz, 10 MHz or more RBW 100 kHz Difference from the maximum input level. From the maximum input level: 8-GHz type -85 dB (300 kHz to 700 MHz) -90 dB (700 MHz to 8 GHz) 20-GHz type -78 dB (300 kHz to 700 MHz) -90 dB (700 MHz to 7.92 GHz) -75 dB (7.92 GHz to 20 GHz) If the external power amplifier connection port is added or in the 6-port type 8 GHz type -80 dB (300 kHz to 700 MHz) -85 dB (700 MHz to 8 GHz) 20 GHz type -73 dB (300 kHz to 700 MHz) -85 dB (700 MHz to 7.92 GHz) -70 dB (7.92 GHz to 20 GHz)
Input damage level	+21 dBm, 16 Vdc When the EXT AMP connection port option is added R/A/B IN: +13 dBm, 0 Vdc EXT AMP IN: +30 dBm, 16 Vdc
Test port connector	8-GHz type: N-type connector (female) 20-GHz type: 3.5-mm connector (male) *1

*1: A 3.5-mm cable and the following cables can be connected to the test port connector of the 20-GHz-type analyzer:
(No other cables can be used.)
HUBER+SUHNER products: SF4PDVAP35600
SF4PBDVAP35600
SF4PEADVAP35600

5. VSIM Characteristics

Accuracy at 23°C to 5°C is guaranteed for a period of one year after calibration

DC voltage				
Range	ch A/C/D : -1.000 V to +6.000 V ch B : -1.000 V to +15.000 V			
Resolution	1 mV			
Accuracy	ch A/B/C/D : ±(0.17% of setting +5 mV)			
Current Measure				
Range	ch	Setting	Range	Resolution
	A	200 µA 1 mA 50 mA 500 mA	0 to ±200.00 µA 0 to ±1.00000 mA 0 to ±50.000 mA -100.00 to +500.00 mA	10 nA 50 nA 2 µA 20 µA
	B	200 µA 1 mA 50 mA 120 mA	0 to ±200.00 µA 0 to ±1.00000 mA 0 to ±50.000 mA -100.00 to ±120.00 mA	10 nA 50 nA 2 µA 5 µA
	C/D	200 µA 1 mA 30 mA	0 to ±200.00 µA 0 to ±1.00000 mA 0 to ±30.000 mA	10 nA 50 nA 2 µA
Accuracy	ch	Setting	Accuracy	
	A	200 µA 1 mA 50 mA 500 mA	±(0.18% of reading +500 nA+15 nA×Vo/1 V) ±(0.18% of reading +1500 nA+75 nA×Vo/1 V) ±(0.18% of reading +60 µA+3.4 µA×Vo/1 V) ±(0.18% of reading +600 µA+34 µA×Vo/1 V)	
	B	200 µA 1 mA 50 mA 120 mA	±(0.18% of reading +700 nA+15 nA×Vo/1 V) ±(0.18% of reading +3000 nA+75 nA×Vo/1 V) ±(0.18% of reading +140 µA+3.4 µA×Vo/1 V) ±(0.18% of reading +350 µA+8.5 µA×Vo/1 V)	
	C/D	200 µA 1 mA 30 mA	±(0.18% of reading +2000 nA+15 nA×Vo/1 V) ±(0.18% of reading +9000 nA+75 nA×Vo/1 V) ±(0.18% of reading +520 µA+3 µA×Vo/1 V)	

Vo: Output voltage (ch A/C/D : -1 V to +6 V, ch B: -1 V to +15 V)

6. Other Functions

Display section	
Display	12.1-inch SVGA TFT color LCD
Backlight	Brightness half-life 40,000 hours (typical)
Error compensation	Normalization, 1-port calibration, 2-port calibration, 3-port calibration (3/4/6-port type only), 4-port calibration (4/6-port type only), 5-port calibration (6-port type only), 6-port calibration (6-port type only) Averaging, smoothing Electrical length correction, phase offset correction
Marker function	16 multimarkers Δ marker function, search function, marker → function
Limit line function	Can be set at a maximum of 32 segments PASS/FAIL display function Beep function
Save/load function	Saves to the FDD or HDD.
Program execution environment	Executable programs written in Visual Basic or other languages are available.
FDD Function	Compliant with MS-DOS FAT format Available in two modes (DD 720 KB and HD 1.4 MB)

7. External Device Connections

External display signals	15-pin D-SUB connector (SVGA)
GP-IB	Compliant with IEEE488.1 and IEEE488.2
Parallel port	TTL level Output port (8 bits × 2 ports) I/O port (4 bits × 2 ports)
Serial port	Accessory serial I/O
Printer port	Compliant with IEEE-1284-1994
LAN port	10Base-T
Keyboard	PS/2 101 or 106 keyboard
Mouse	PS/2 mouse
External reference frequency input	1 MHz, 2 MHz, 5 MHz, 10 MHz (±10 ppm) 0 dBm (50 Ω) or more
Probe power	±15 V ±0.5 V, 300 mA (150 mA, two output systems)

8. General specification

Operating environment	Temperature range +5 to +40°C Relative humidity 80% or less (no condensation)
Storage environment	-20°C to +60°C
Power source	100 VAC to 120 VAC, 50 Hz/60 Hz 220 VAC to 240 VAC, 50 Hz/60 Hz (Auto-switching between 100 VAC and 200 VAC systems)
External dimensions	R3860A: About 424 mm (width) × about 266 mm (height) × about 532 mm (depth) R3770/R3768: About 424 mm (width) × about 266 mm (height) × about 450 mm (depth)
Mass	R3860A: About 36 kg or less R3770/R3768: About 28 kg or less
Power consumption	500 VA or less
Accessories	Operation manual, power cable, special touch screen panel pen, ferrite core, system recovery disk

APPENDIX

A.1 Message List

This appendix explains warning messages and error messages that are displayed while the analyzer is being operated.

- Confirmation message

Message	Explanation
Settings of CH* will be changed in mixer mode.	The setting of the target channel is changed in the mixer measurement mode. Select OK after checking.
Mixer mode of CH* will be canceled.	The mixer measurement mode of the target channel is canceled. Select OK after checking.
File already exists. overwrite ?	Confirms file overwrite. Select Yes to overwrite, and No to not overwrite.
Delete file * ?	Confirms file deletion. Select Yes to delete, and No to not delete.

- Warning Messages

Message	Explanation
Data out of range.	Data was altered to within the range because the input data exceeded the allowable range.
Balance settings canceled.	Balance settings canceled due to change of the settings.
Calibration canceled.	Calibration canceled due to change of the settings.
Collection aborted.	Calibration aborted due to change of the settings during calibration.
Changeless correction applied.	Applied alternative calibration data (changeless correction value) because the calibration required for the software fixture is not executed.
Segment is empty.	Clear All or Del Seg is executed to clear the empty segment in either the Program Sweep Editor or the Limit Line Editor.

- Error Messages

Hardware

Message	Explanation
FAN No. STOP!	A cooling fan has stopped. There are four cooling fans. Fan Nos. 1 through 3 are side fans; Fan No. 4 is the rear fan. <Required Action> Turn the power of the analyzer OFF, and consult with Advantest or an authorized service agency.
Rch Overload Ach Overload Bch Overload Cch Overload Dch Overload	Input overload in R channel. Input overload in A channel. Input overload in B channel. Input overload in C channel. Input overload in D channel. <Required Action> Confirm the input signal level.
Synthe(R)Unlock Synthe(S)Unlock Source Unlevel	The internal reference frequency lock (local side) is open. The internal reference frequency lock (source side) is open. The signal source level is too low. <Required Action> Contact Advantest Sales Office or a local representative.
Option required.	Cannot be executed because optional functions are not installed. <Required Action> Contact Advantest Sales Office or a local representative.
MCU board not found A/D board (1) not found A/D board (2) not found VSIM board not found	This is a hardware error. <Required Action> Contact Advantest Sales Office or a local representative.

- Error Messages

  Files

Message	Explanation
File not found.	Loaded file not found. <Required Action> Confirm the file name and re-execute.
File not loaded.	File not loaded. <Required Action> Confirm the file type and re-execute.
Full calibration required.	Save S-parameter executed without full calibration. <Required Action> Perform full calibration and re-execute.
No balance measurements.	Save S-parameter balance executed without balance settings. <Required Action> Perform the balance settings and re-execute.
File read/write error	Error occurred during file I/O. <Required Action> Confirm remaining disk capacity or that the disk is not write protected.
Permission denied.	File operation prohibited. <Required Action> Confirm drive name, file name, or directory name.
No such file or directory.	File or directory does not exist. <Required Action> Confirm file name or directory name.
No space left on device.	No remaining space. <Required Action> Delete unnecessary files.
Bad file name.	Improper file name. <Required Action> Change the file name.
Bad data format.	Improper file format. <Required Action> Confirm the file save format or extension.

Operation

Message	Explanation
Invalid measurement port.	Operation executed for a test port without settings. <Required Action> Confirm the test ports with settings and re-execute.
Invalid measurement parameter.	Invalid operation executed for the parameter settings. <Required Action> Confirm the settings and re-execute.
No correction data.	CORRECT ON executed without calibration data. <Required Action> Execute calibration.
External Standard In	An external reference frequency is input.
Standard not completely acquired.	Done executed without fully acquiring standards in calibration. <Required Action> Re-execute calibration.
Cannot access to CH* in mixer mode.	Cannot access the channel which is being used for the mixer measurement mode. <Required Action> Use other channels. Otherwise, cancel the mixer measurement.
Mixer Meas: Start (Auto) frequency out of range.	The start frequency of mixer measurement is out of the set range. <Required Action> Change to the appropriate frequency value of mixer measurement.
Mixer Meas: Stop (Auto) frequency out of range.	The stop frequency of mixer measurement is out of the set range. <Required Action> Change to the appropriate frequency value of mixer measurement.
Segment is full.	Ins Seg is executed, even though all segments (32 segments) are already inserted, in either the Program Sweep Editor or the Limit Line Editor. <Required Action> Execute Clear All or Del Seg to delete unnecessary segments.
File read/write error.	File read/write error occurred in either the Save S-para or the Save Trace. <Required Action> Check the state (space and the write enable) of the location in which the file is written.
Cal-box not found.	Auto Cal menu was executed without connecting the Cal-box (R17050, R17051, R17052, etc.). <Required Action> Connect the Cal-box.

Auto Calibration

Message	Explanation
Auto Cal: Out of frequency range.	Frequency set outside the range of Auto Cal. <Required Action> Set the frequency setting within the range of Auto Cal.
Auto Cal: SIO open error.	Serial IO communication cannot be effected. <Required Action> Consult with Advantest or an authorized service agency.
Auto Cal: cal-box communication error.	Error occurred in communication with Auto Cal. <Required Action> Confirm that the control cable of the auto calibration kit and the analyzer are connected, and re-execute. Consult with Advantest or an authorized service agency if the same error message is displayed again.
Auto Cal: read/write error.	Error occurred during file I/O. <Required Action> Consult with Advantest or an authorized service agency.
Auto Cal: Calibration Mode unmatched.	Done executed without acquiring Cal data required between ports during 3-port Cal or 4-port Cal. <Required Action> Re-execute auto calibration.
Auto Cal: Port connection error.	Auto Cal RF port and test port are not connected. <Required Action> Re-execute auto calibration after confirming connection of the Auto Cal RF port and test port of the analyzer.
Auto Cal: Can't Verify when CORRECT OFF.	Verification executed in CORRECT OFF status. <Required Action> Change to CORRECT ON and re-execute verification.
Auto Cal: Caution! Please check verification results.	Verification results exceeded allowable values. <Required Action> Confirm the proper allowable values and re-execute calibration. Consult with Advantest or an authorized service agency if the same error message is displayed again.
Auto Cal: Can't verify when cal mode not matched.	Calibration and verification types do not match. <Required Action> Confirm the calibration type and re-execute verification.
Auto Cal: Error	Auto calibration aborted. <Required Action> Consult with Advantest or an authorized service agency.
Auto Cal: Cal-box not found.	Auto Cal was executed without connecting the Auto Calibration kit. <Required Action> Connect the Auto Calibration kit.

Message	Explanation
Auto Cal:cal-box type mismatched.	The 6-port or 5-port full calibration is executed by connecting automatic calibration kits except for the R17051A and R17052A. <Required Action> Connect the R17051A or R17052A (USB type 4-port automatic calibration kit) and perform the calibration.

A.2 R3860A/R3770/R3768 System Recovery Procedure

This analyzer employs Microsoft Windows NT embedded or Windows XP embedded to allow execution of measurement functions using Windows applications.

The system files necessary for operation of this analyzer are saved in the C drive.

The analyzer may fail to operate properly if any of the system files used by the analyzer are damaged for any reason.

In this event, the "System Recovery Disk" included with the analyzer can be used to restore the content of the C drive to its original state.

CAUTION: ***Execution of recovery completely erases the existing contents of the C drive. Consequently, any network and printer settings made after the purchase will be erased.***
System recovery is not possible for the analyzer when the disk partition information is damaged or the disk device is broken.
Do not remove the floppy disk when the floppy disk drive access light is on. The floppy disk may become damaged.

Recovery Procedure

1. Turn OFF the power of the analyzer.
2. Insert the floppy disk labeled "System Recovery Disk" into the floppy disk drive.
3. Turn ON the power of the analyzer.
   Launch the Recovery Software.
4. Select **Continue** to execute recovery, and press **ENT**.
   The recovery starts.
   The Reboot dialog box will be displayed when recovery has been completed.
5. Eject the "System Recovery Disk" floppy disk from the floppy disk drive.
6. Select **Reboot** and press **ENT** to reboot the analyzer.
   When system recovery is complete, restart the analyzer. Firmware will operate.

A.3 Network Settings

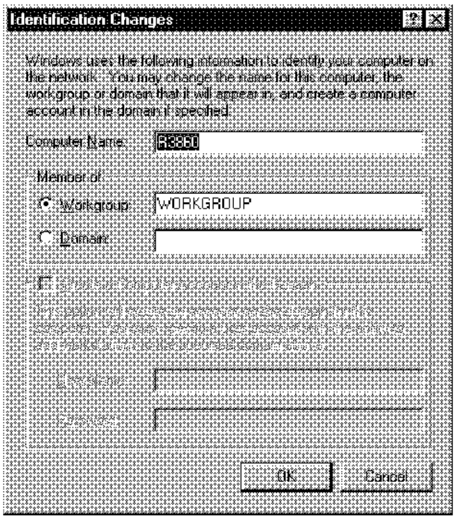
Connecting this analyzer to a network allows sharing of files and folders with computers on the network. This appendix explains the method for setting up a network.

NOTE: ***Set the measurement to the HOLD status before setting the network.***

- If Windows NT Embedded is installed in this instrument.

Setup Procedure

1. Click ***Config*** and ***Network Setup*** in the main menu to display the Network dialog box.
2. Click the ID tab and then click Change to display the Change ID dialog box.



3. Input the Computer Name and Work Group.

CAUTION: ***"Domain" cannot be used.***

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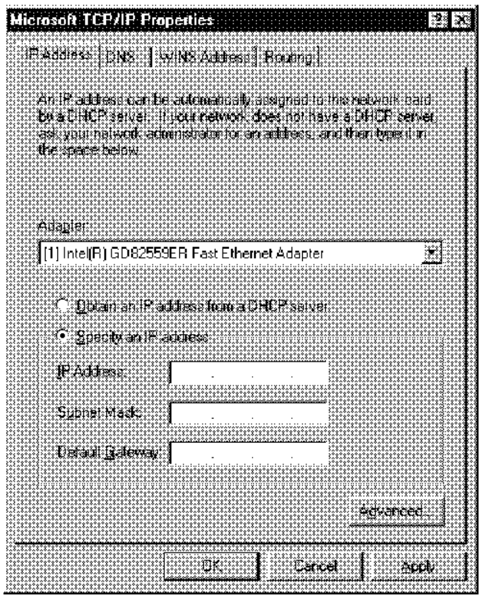
4. Click OK to close the dialog box.
5. Click the Protocol tab.
6. Select TCP/IP Protocol and click Property to display the TCP/IP Property dialog box.

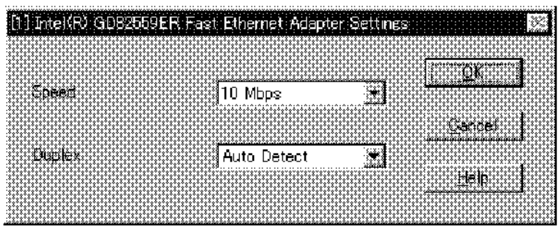


To Specify the IP Address:

7. Select Specify IP Address.
8. Input the IP Address, Subnet Mask, and Default Gateway.

When Using a DHCP Server:

9. Select Obtain IP Address from DHCP Server.
10. Click OK to close the dialog box.
11. Click the Adapter tab.
12. Select ... Ethernet Adapter and click Property to display the ... Ethernet Adapter Settings dialog box.



13. Set Speed and Duplex appropriately as necessary.
14. Click OK to close the dialog box.

15. The dialog box for launching restart will be displayed.
    Click Yes.

CAUTION:

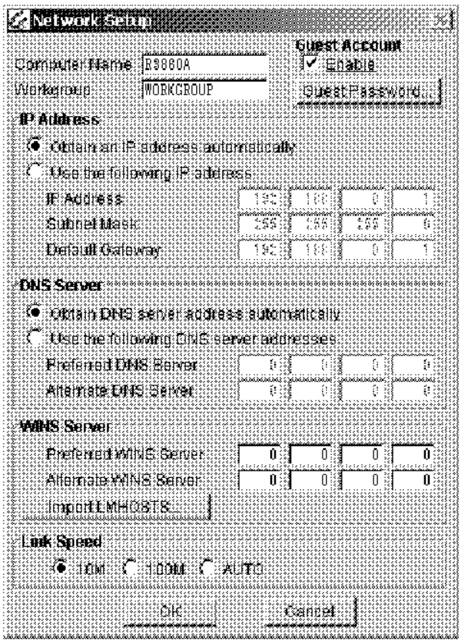
1. ***The analyzer will not launch normally if Obtain IP Address from DHCP Server is selected when the DHCP server is not on a network.***
2. ***Do not Delete items using the Service, Protocol, and Adapter tabs. Deleted items cannot be restored.***
3. ***Do not Add items using the Service and Protocol tabs. Doing so may cause the analyzer to launch improperly.***

- If Windows XP Embedded is installed in this instrument.

  Describes each item in the network setting dialog box.

  Click ***Config*** and ***Network Setup*** in the main menu.

  The network dialog box appears.



[Guest Account]

It is necessary to setup a guest account in order to access this instrument from a remote PC through a network and share files. Because the guest account is disabled when this instrument is shipped from the factory, the guest account must be setup before files can be shared.

[Enable]

If this box is checked, the Guest Account is enabled. **[Guest Password]** can only be entered when this box is checked.

[Guest Password...]

Opens the password entry dialog box that allows a new password to be entered. The currently set password is not displayed. Enter a new password. The new password is displayed. Press the **Enter** key. The new password is set. If the **Enter** key is pressed without entering a password, no password is set.

[Computer Name]
The name of the computer, in which this software is installed, on the network is displayed.
If this item is changed, the change is applied after the computer restarts.

[Workgroup]
The Windows work group of this instrument is displayed.
If this item is changed, the change is applied after the computer restarts.

[IP Address]

[Obtain an IP address automatically]
Select when obtaining the IP address from the DHCP server.

[Use the following IP address]
Select when manually specifying the IP address.

[IP Address]
Displays the current setting just after the IP Address dialog box appears.

[Subnet Mask]
Displays the current setting just after the Subnet Mask dialog box appears.

[Default Gateway]
Displays the current setting just after the Default Gateway dialog box appears.

[DNS Server]

[Obtain DNS server address automatically]
Select when obtaining the DNS server information from the DHCP server.

[Use the following DNS server address]
Select when manually setting the DNS server.

[Preferred DNS Server]
Displays the current setting just after the Preferred DNS Server address dialog box appears.

[Alternate DNS Server]
Displays the current setting just after the Alternate DNS Server address dialog box appears.

[WINS Server]
Sets the server, which dynamically maps the IP address to the computer name.

[Preferred WINS Server]
Sets the IP address of the Preferred WINS Server.

[Alternate WINS Server]
Sets the IP address of the Alternate WINS Server.

[Import LMHOSTS...]
Displays the dialog box to import the LMHOSTS file (*).
Specify the created text file and press the ***Select*** button.

(*): The LMHOSTS file is a local text file that maps the computer name to the IP address of the host computer, which is not connected to the local sub-network.

[Link Speed]
Selects the link rate of the LAN port.

A.4 Printer Installation Method

A.4.1 Obtaining the Printer Driver

This instrument uses a Windows NT or Windows XP printer driver.

Use the printer driver which is supplied with the OS installed in this instrument.

NOTE: ***The following example is described assuming that Windows XP is installed in this instrument.***

CAUTION: ***Set the measurement to the Hold status before installing the printer driver.***

A.4.2 Installing the Printer Driver

Install the printer driver according to the attached installation procedure.

If the printer driver is provided on the CD-ROM, place the CD-ROM drive in an PC attached to the network and install the printer driver from there.

"Standard TCP/IP Port" is not supported in this instrument.

A.4.3 Printer Setting

Set the printer in the displayed Printers and Faxes window after selecting ***Config*** from the main menu and ***Add Printer...*** from the pull-down menu.

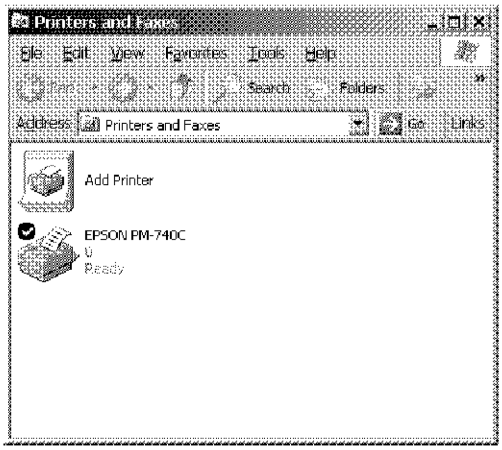
(The displayed window title differs depending on the installed OS.)

A.4.4 Deleting the Printer Driver

The printer driver is installed in the system folder of this instrument.

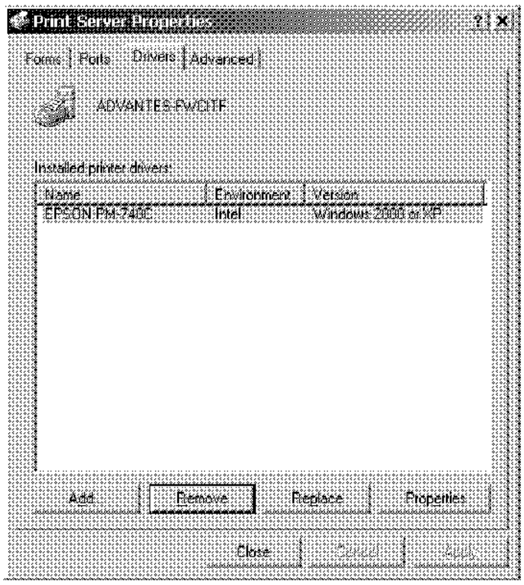
Therefore the printer driver might not be installed if there is insufficient space in the system folder to install the printer driver. In this case, install the printer driver after deleting any unused printer drivers according to the following procedure.

1. Select ***Add Printer...*** in the ***Config*** pull-down menu to open the Printers and Faxes window.



2. Select the printer driver to be deleted, touch ***File*** to select ***Delete*** from the pull-down menu, touch the ***Yes*** button in the displayed dialog box, and delete the printer driver from the available printers.

3. Touch the ***File*** menu in the Printers and Faxes window, select ***Server Properties*** from the pull-down menu, and then the Print Server Properties dialog box appears.



4. Touch the ***Drivers*** tab in the Print Server Properties dialog box to display the printer driver installed in this instrument. Touch the printer driver to be deleted in the displayed printer drivers and touch the ***Remove*** button. After this, touch the ***Yes*** button when prompted to complete the operation of the printer driver deletion.

A.5 Panel Keys and Corresponding Keyboard Keys

The table below shows the panel keys and the corresponding keyboard keys.

Panel key		Keyboard
Application Keys	A1 to A10	F1 to F10
Program Keys	SINGLE	Shift + F2
	STOP	Shift + F3
	START	Shift + F4
Encoder, Up and down keys	◁ ▷	←, →
	△	Page Up
	▽	Page Down
	Encoder	↑, ↓
Unit input keys	0 to 9	0 to 9
	. (Point)	.
	- (Minus)	-
	k/μ	Shift + F7
	M/n	Shift + F6
	G/p	Shift + F5
	BS	Back space
	ENT	Enter
Reset Keys	PRESET (R) + PRESET (L)	Shift + F8
Task manager start key	PRESET (R) + Back Light Key (Keep pressing for five seconds or longer.)	Ctrl + Alt + Delete

A.6 Parallel I/O Port

1. Outline

The parallel I/O port is the input/output port to communicate with a handler or peripherals.

Use always the shield cable for the connection.

The parallel I/O connector on the back panel is used for communication.

Figure A-2 shows the internal pin assignment and signals of the connector.

These I/O ports are controlled by GPIB commands and panel operations.

- Input/output port

  There are two output ports and two input/output ports, as follows:

  Port only for output: A port ; 8-bit width
B port ; 8-bit width

  Input/output port: C port ; 4-bit width
D port ; 4-bit width

- Port C status output, port D status output

  Shows the settings of the input of the input/output ports C and D. It is low when C or D port is set to input, it is high when it is set to output.

- Write strobe output for output port

  By generating a negative pulse on the write strobe output, it shows a data is output to some port. Figure below shows the timing chart of the write strobe output and data output. Pulse width is 10 μs or more.

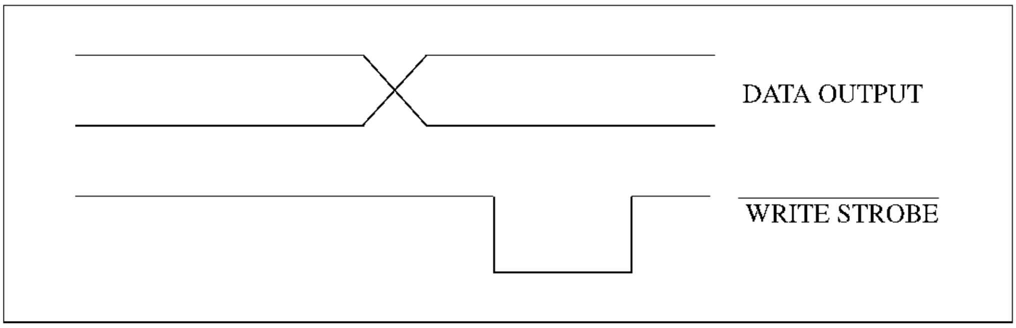


Figure A-1 Timing Chart of WRITE STROBE

- INPUT 1

  By entering a negative pulse on the INPUT 1, the OUTPUT 1 and 2 are set to LOW. The pulse width of the input signal to be entered in the INPUT 1 should be more than 1 μs.

- OUTPUT 1 and 2

  These two signal lines are the latch output terminals set to LOW when a negative pulse is entered on the INPUT 1.

- PASS/FAIL output

  Generates LOW when the result of the limit test is PASS and HIGH when the result is FAIL. This function is available only when the limit test function is ON.

- Write strobe output for PASS/FAIL output

  When the limit test result is output to the PASS/FAIL output line, generates a negative pulse. Pulse width is 10 μs or more.

- SWEEP END

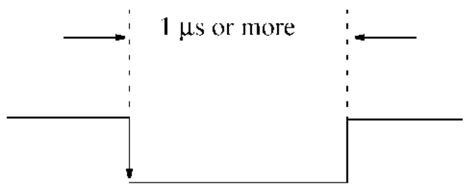
  When this analyzer finishes the sweeping, generates a negative pulse with a width of 10 μs. Pulse width is 10 μs or more.

- +5 V output

  +5 V output is provided for the external device. The maximum current to be supplied is 100 mA. A protection element is equipped on this line to shut off the over-current.

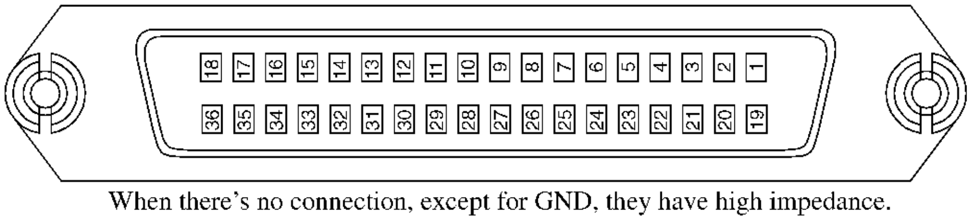
- EXT TRIG input

  By entering a negative pulse on this line, it is possible to trigger the sweep of measurement. The pulse width should be at least 1 μs. The sweeping starts at the trailing edge of the pulse. When this signal line is used, the trigger mode should be set to external source.



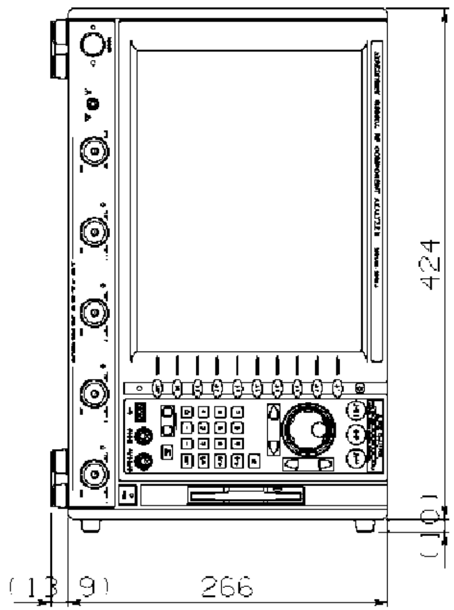
2. Parallel I/O connector pin assignment and signal standard

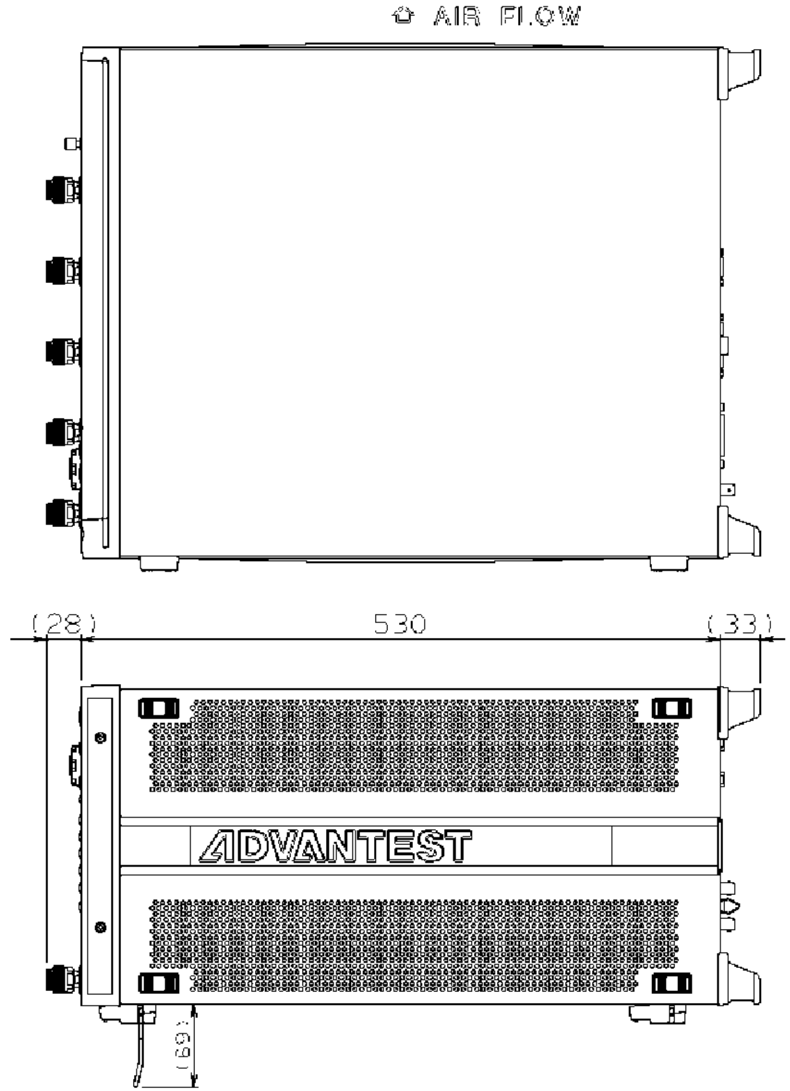
Pin No.	Signal name	Function
1	GND	Ground
2	INPUT 1	Negative logic pulse input of TTL level (width:1 µs or more)
3	OUTPUT 1	Negative logic latch output of TTL level
4	OUTPUT 2	Negative logic latch output of TTL level
5	Output port A0	Negative logic latch output of TTL level
6	Output port A1	Negative logic latch output of TTL level
7	Output port A2	Negative logic latch output of TTL level
8	Output port A3	Negative logic latch output of TTL level
9	Output port A4	Negative logic latch output of TTL level
10	Output port A5	Negative logic latch output of TTL level
11	Output port A6	Negative logic latch output of TTL level
12	Output port A7	Negative logic latch output of TTL level
13	Output port B0	Negative logic latch output of TTL level
14	Output port B1	Negative logic latch output of TTL level
15	Output port B2	Negative logic latch output of TTL level
16	Output port B3	Negative logic latch output of TTL level
17	Output port B4	Negative logic latch output of TTL level
18	EXT TRIG	EXTERNAL TRIGGER input (width : 1 µs or more), negative logic
19	Output port B5	Negative logic latch output of TTL level
20	Output port B6	Negative logic latch output of TTL level
21	Output port B7	Negative logic latch output of TTL level
22	Input/output port C0	Negative logic state input/latch output of TTL level
23	Input/output port C1	Negative logic state input/latch output of TTL level
24	Input/output port C2	Negative logic state input/latch output of TTL level
25	Input/output port C3	Negative logic state input/latch output of TTL level
26	Input/output port D0	Negative logic state input/latch output of TTL level
27	Input/output port D1	Negative logic state input/latch output of TTL level
28	Input/output port D2	Negative logic state input/latch output of TTL level
29	Input/output port D3	Negative logic state input/latch output of TTL level
30	Port C status	TTL level, Input mode: LOW, Output mode: HIGH
31	Port D status	TTL level, Input mode: LOW, Output mode: HIGH
32	Write strobe signal	TTL level, Negative logic, Pulse output
33	PASS/FAIL signal	TTL level, PASS: LOW, FAIL: HIGH, latch output
34	SWEEP END signal	TTL level , Negative logic, Pulse output (width:10 µs or more)
35	+5V	+5V±10%, 100mA MAX
36	Write strobe signal (PASS/FAIL)	TTL level, Negative logic, Pulse output



When there's no connection, except for GND, they have high impedance.

Figure A-2 Parallel I/O (36-pin) Connector Pin Assignment and Signal

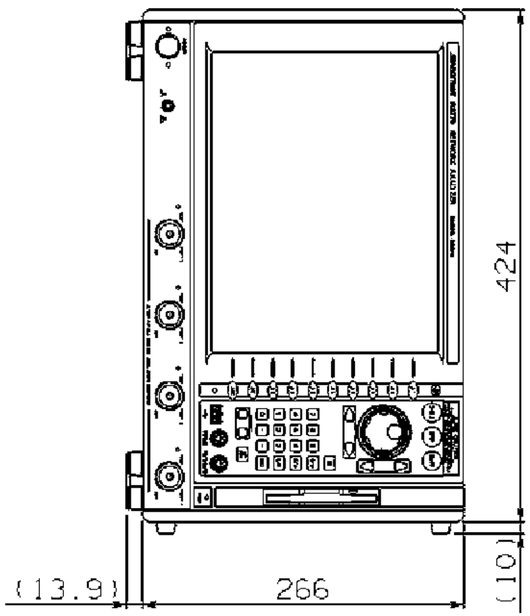


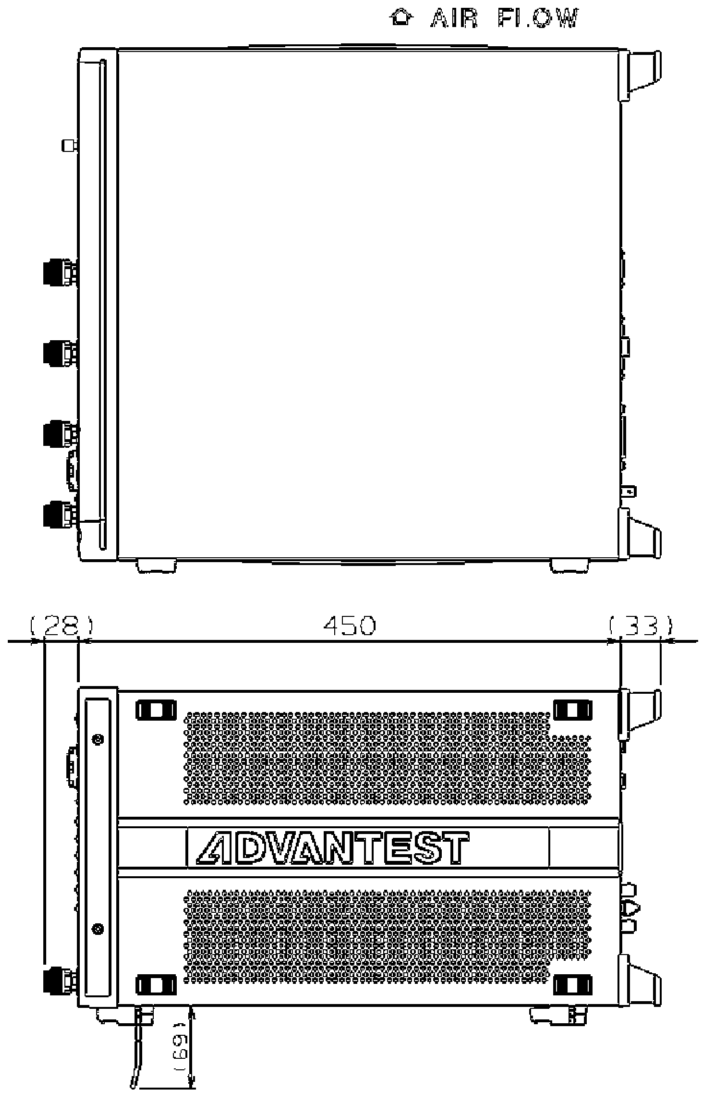


Unit : mm

NOTE
This drawing shows external dimensions of this instrument.
The difference in products and options used can cause a change in the appearance of the instrument.

R3860A DIMENSIONAL OUTLINE DRAWING





Unit : mm

NOTE
This drawing shows external dimensions of this instrument.
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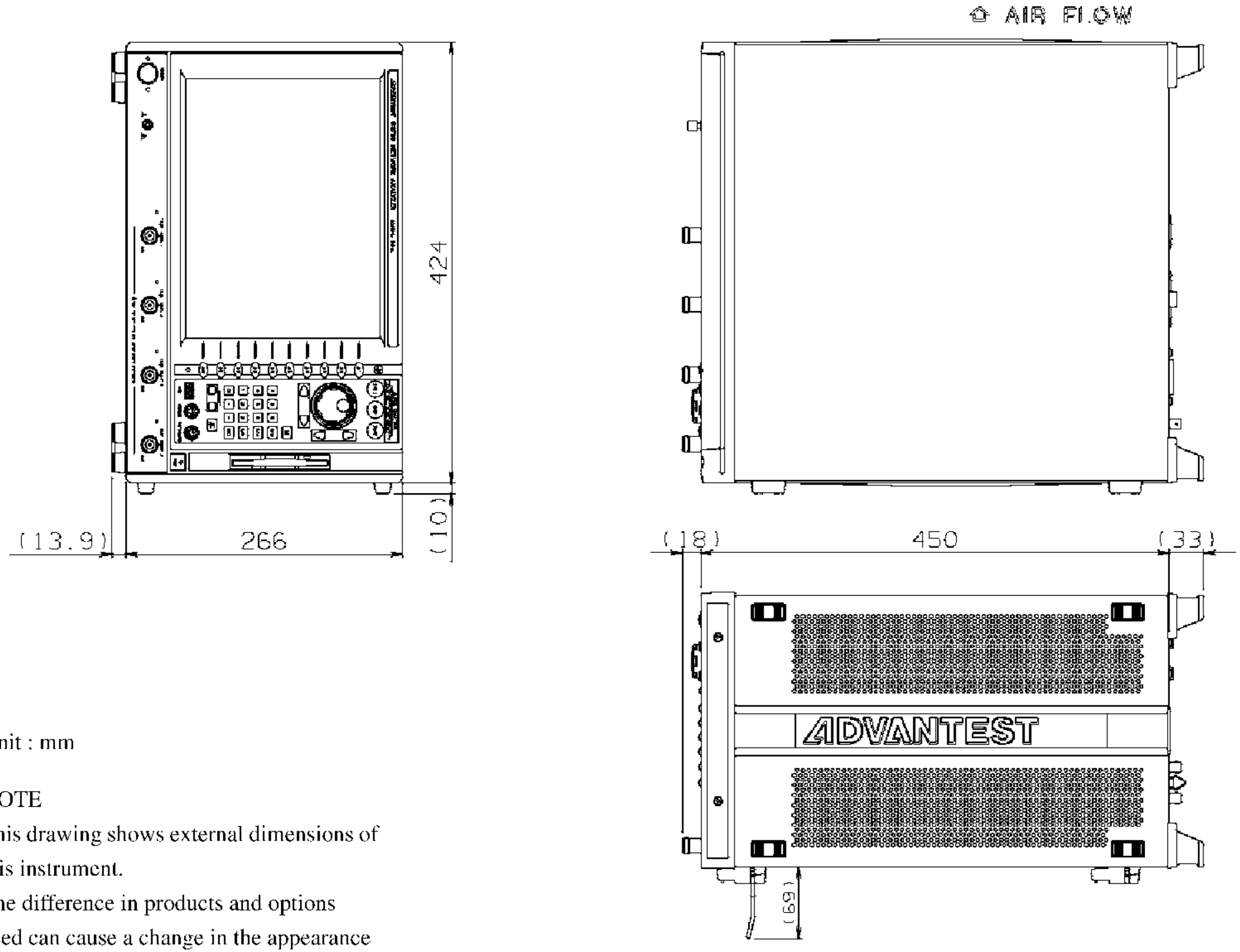
R3770 DIMENSIONAL OUTLINE DRAWING



Unit : mm

NOTE
This drawing shows external dimensions of this instrument.
The difference in products and options used can cause a change in the appearance of the instrument.

R3768 DIMENSIONAL OUTLINE DRAWING

ALPHABETICAL INDEX

[Symbol]

[Numerics]

[A]

[B]

[D]

[E]

[F]

[M]

[N]

[O]

[P]

[R]

[S]

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