ADVANTEST CORPORATION

R3860

RF Component Analyzer

Operation Manual

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CAUTIONS ON USING THE R3860

1. SAFETY PRECAUTIONS

The R3860 Component Analyzer has Microsoft Windows NT pre-installed.

The measuring function of the R3860 is dependent on the Windows environment. Do not alter the Windows operating environment in any way other than described in this manual.

Furthermore, the R3860 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 the R3860 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, "R3860 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.
3. Application software:

   When executing application programs on R3860, some operations may differ due to the Windows environment.

2. Limitations Imposed when Using Windows NT

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Certificate of Conformity

This is to certify, that

RF Component Analyzer

R3860

instrument, type, designation

complies with the provisions of the EMC Directive 89/336/EEC in accordance with EN61326 and Low Voltage Directive 73/23/EEC in accordance with EN61010.

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3860.00

PREFACE

This manual provides the information necessary to check functionality, operate and program the R3860 RF Component 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 Settings • Measurement Port, Frequency, and other Measurement Conditions • Trace Settings • Window Settings • 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 4-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. REFERENCE • Menu Index • Function Explanations	Lists menus and explains functions for each menu item.
9. USING THE EXTENSION FUNCTION • Saving Measurement Data • Saving Picture Image Data • Limit Test	Explains how to save measurement data.
10. Device Power Supply (Option 15)	Describes the functions of the device power supply (option 15).
11. REMOTE PROGRAMMING	Explains how to set up the GPIB. Also lists programming commands and shows programming examples.
12. PERFORMANCE VERIFICATION	The analyzer performance test methods are described.
13. 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 the R3860 RF Component Analyzer, standard accessories, operating environment, and safety precautions. Read this chapter before operating the analyzer.

1.1 Product Description

This R3860 RF Component Analyzer is capable of evaluating the performance of RF components for the frequency range of 300 kHz to 8 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 10 μs / point can significantly reduce test costs.

- Multi-ports

  This analyzer can be equipped with a maximum of 4 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.

- 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.

- 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

  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.

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-25	1	For Ethernet cable
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1.3 Options and Accessories

There are 2 to 4 test port options available.

An analyzer equipped with 3 ports can test unbalanced input devices and balanced output devices. An analyzer equipped with 4 ports can test balanced input and output devices.

The electronic-type output attenuator has a long life span and is capable of performing high-speed measurements. Therefore, it can be effectively used to test amplifiers. The second signal source is used as a local signal source when mixers are used for measuring.

Options	
OPT10	Electronic-type output attenuator
OPT11	The second signal source
OPT12	2-ports test set
OPT13	3-ports test set
OPT14	4-ports test set

Accessories
Rack-mount kit
Extension cable for the front panel
Multi-port test set (R3968)

1.4 Operating Environment

- Operating Environment

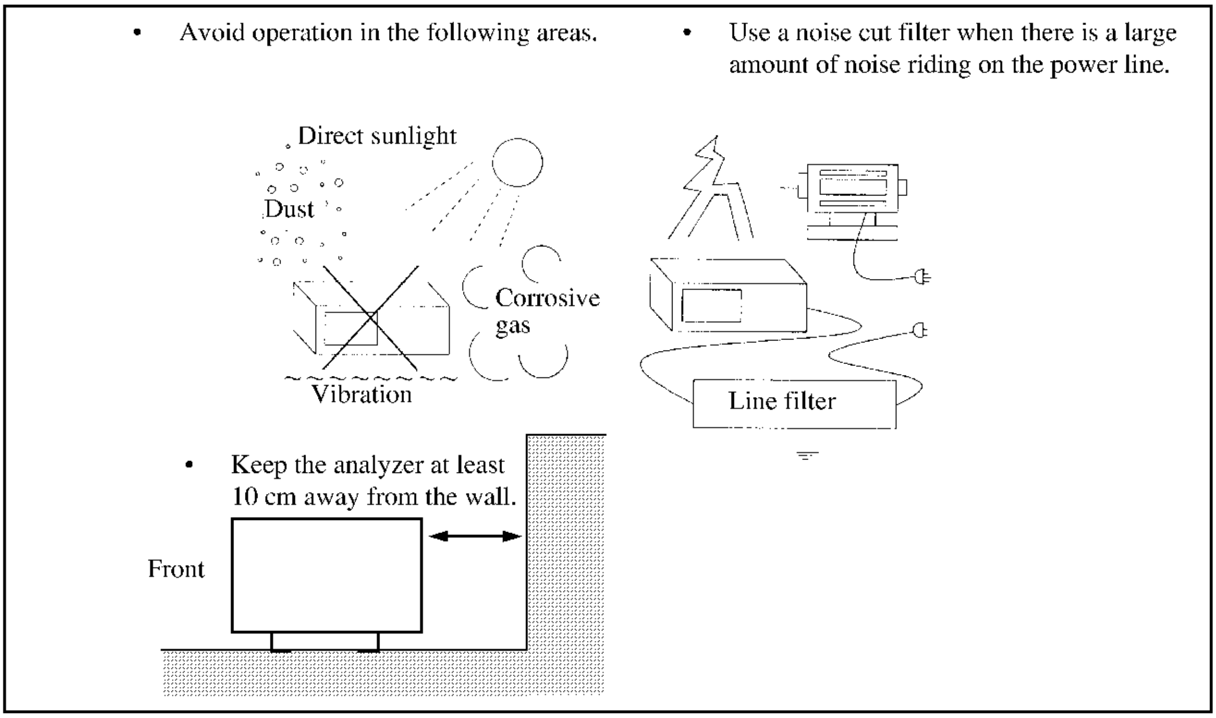


Figure 1-1 Operating Environment

The R3860 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 the R3860 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 the R3860 temperature has reached the room temperature level, and warm up the R3860 for 30 minutes.
- Installation position
  The R3860 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 the R3860 according to the power requirement.***
The R3860 might be damaged in the case not following the power requirement.

The power requirement of the R3860 is shown in the following.
Use the power supply by which the power requirement of the R3860 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 the R3860 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.***
    - ***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.***

A separately-sold plug for overseas use is available. For more information, contact the Advantest service department.

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 the R3860 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 the R3860 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 the R3860 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.

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

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

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, a +3 dBm signal is output to the test ports..***

2. Removing of case

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

   The R3860 has a high temperature part and a high pressure part.

3. When abnormality occurs

   When smoke rises from the R3860, smell nastily, or rear unusual sound feel, turn off the power switch. Pull out power cable from the outlet. And contact to our company.

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

4. Warm up

   After the R3860 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 the R3860 use.

   Therefore, electromagnetic interference is generated to the television or the radio by an improper installation and use of the R3860.

   If the power of the R3860 is turned off, and the electromagnetic interference is reduced, then the R3860 is the cause it.

   Prevent electromagnetic interference by the following procedure.

   - Change the direction of antenna of the television or the radio.
   - Place the R3860 the other side of the television or the radio.
   - Place the R3860 away from the television or the radio.
   - Use another line of power source for the television or the radio than the R3860.

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 1-2).
Floor in the work area:	Installation of a conductive mat, the use of conductive shoes, and grounding (see Figure 1-3).
Benchboard:	Installation of a conductive mat and grounding (see Figure 1-4).

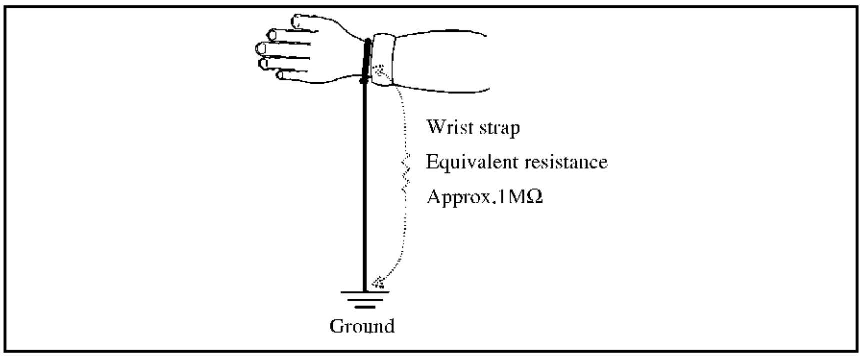


Figure 1-2 Countermeasures for Static Electricity of Human Bodies

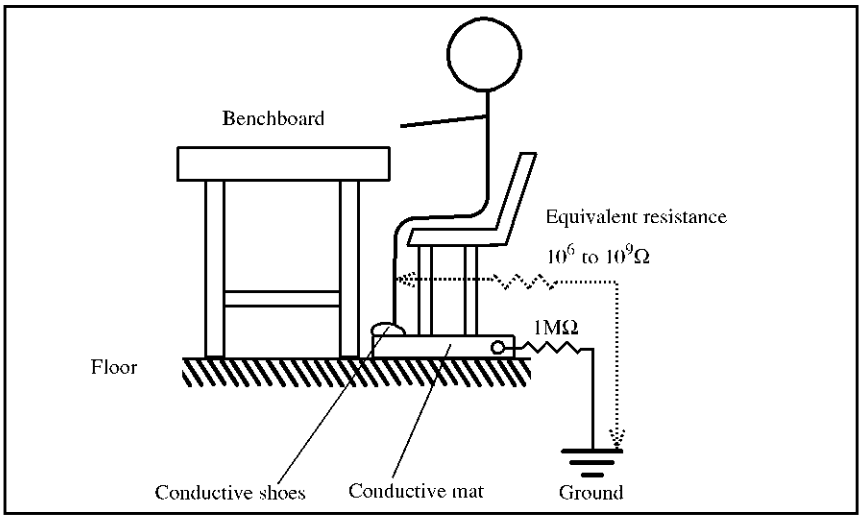


Figure 1-3 Countermeasures for Static Electricity of Work Site Floor

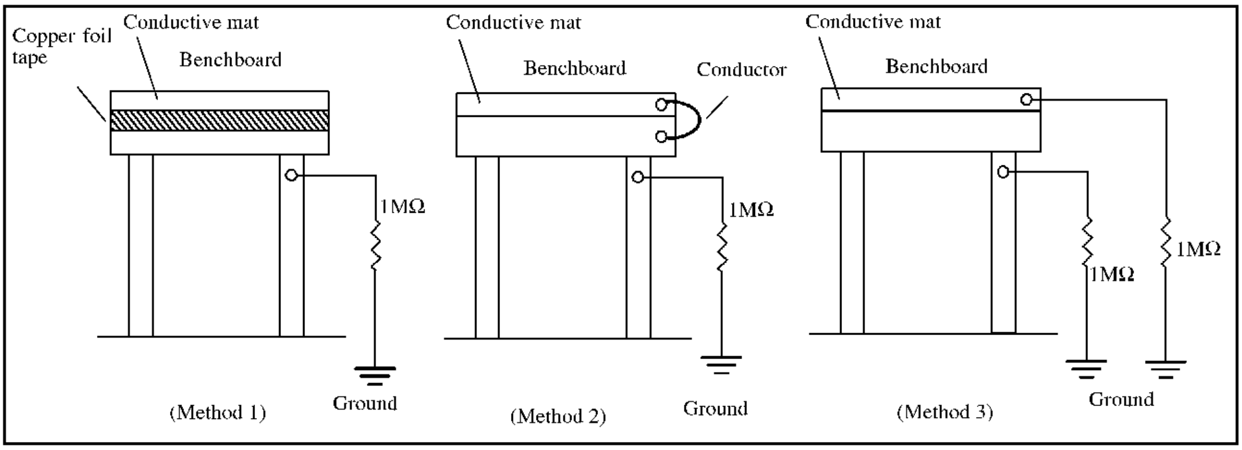


Figure 1-4 Countermeasures for Static Electricity of Work Bench

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.

   When the analyzer is used without connecting to a network, use the following settings (Defaults as the factory settings).

   IP address: 192.168.0.1

   Subnet mask: 255.255.255.0

   Default gateway: 127.0.0.1

   After setting the above parameters, press the ALT key, Control key, and Shift key simultaneously to display the "Windows security" dialog box, select "Shutdown," to restart the analyzer.

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.

    Pressing a key on the front panel or pressing the touch screen close the message.

11. Dialog Boxes

    Saving a file and opening a file can be performed using a dialog box displayed by pressing the file menu. File-related dialog boxes do not disappear while executing the preset.

    The following dialog boxes are file-related.

    Load Setting Dialog Box
    Save Setting Dialog Box
    Delete File Dialog Box
    Save S-Parameter Dialog Box
    Save Trace Dialog Box
    Save Bitmap Data Dialog Box
    Execute Dialog Box
    Print 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.

1.10 Precautions for Attaching and Detaching the Panel

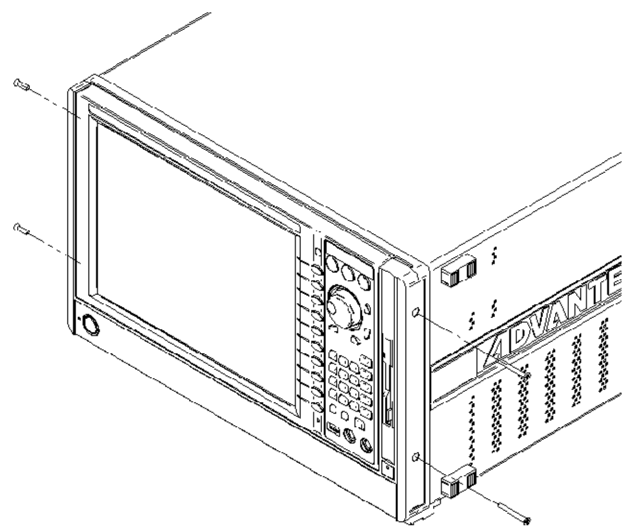
The front panel can be detached from the main unit.

The analyzer can be used with the detached front panel.

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 the R3860.

Table 1-2 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 1-5)

Use the Ethernet cable with the supplied ferrite core (ESD-SR-25) assembled as shown in Figure 1-5.

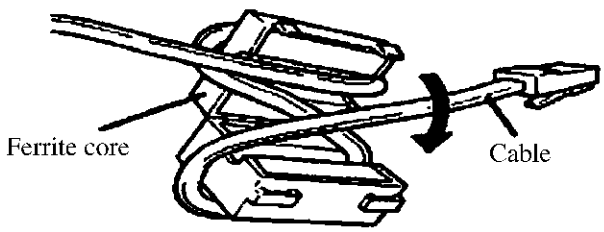


Figure 1-5 Ferrite Core Assembly

1.12 Cleaning, Storage and Transportation

1. Cleaning
   Wipe the dirt of the R3860 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 the R3860.
   - Do not use an organic solvent (for example, benzene and acetone, etc.) which changes plastics in quality.
2. Storage
   Storage temperature of the R3860 is from -20°C to +60°C. Do not store it out of this temperature range.
   The cases in which the R3860 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 the R3860, pack it equally to the first packing material or any more.

Packing procedure

1. Wrap the R3860 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

The R3860 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)

2. OPERATION

2.1 Explanation of Panel Surface

2.1.1 Front Panel

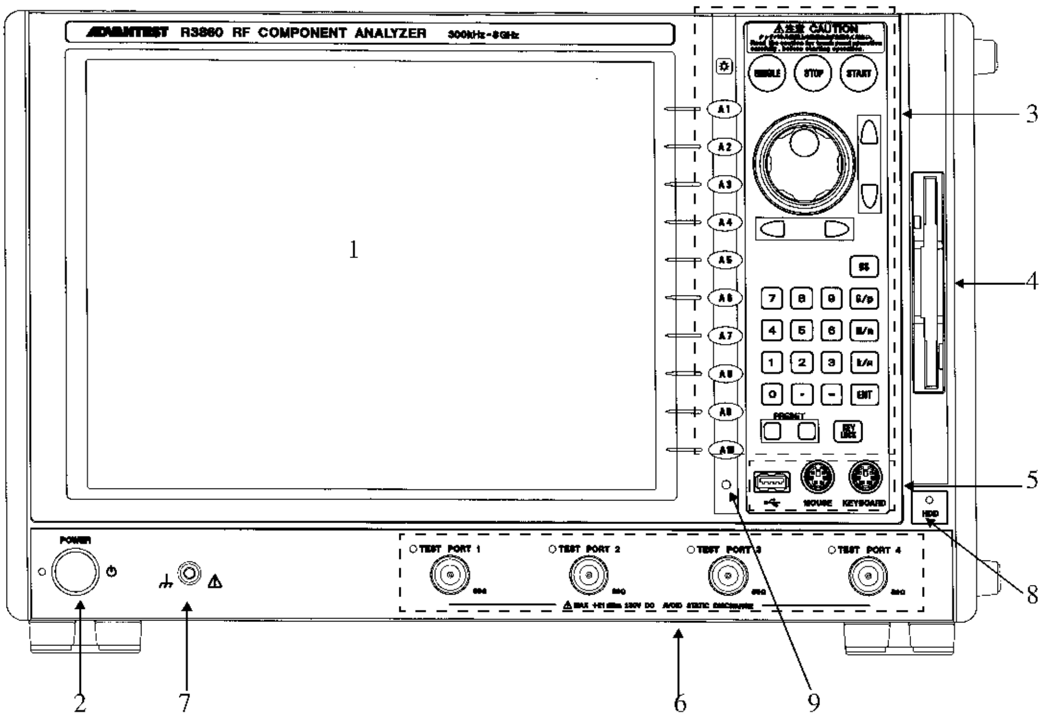


Figure 2-1 Front Panel

1. Touch panel display: Displays measurement data, setting conditions, and other information. Setting conditions can also be changed using the touch panel function.

2. Power switch: Power ON/OFF switch. Power is turned OFF after system shutdown when OFF is selected.

3. Entry key block: Key switch block for changing settings.

4. Floppy disk drive: 3.5-inch floppy disk drive.

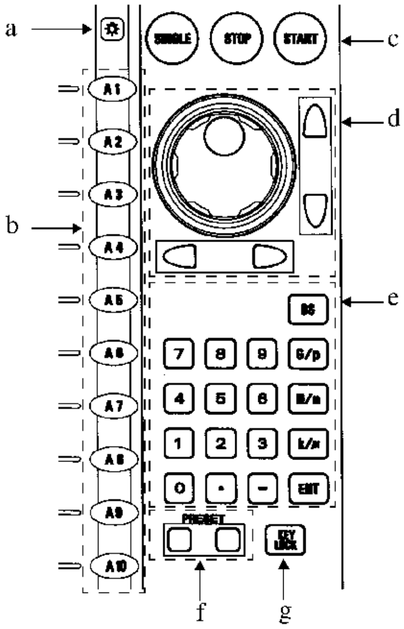
5. I/F connector block: I/F connector block for the keyboard and mouse.

6. Test port block: Test port connector block for measurements.

7. Grounding terminal: Grounding terminal for wrist strap connection to prevent static electricity shocks. It is connected to the chassis ground of the analyzer.

8. HDD access lamp: Lights when the hard disk drive (HDD) is accessed.
9. 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.

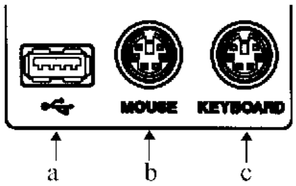
k/μ: Unit key - KHz for frequency data; μsec for time data.

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. USB connector: USB connector for accessories.

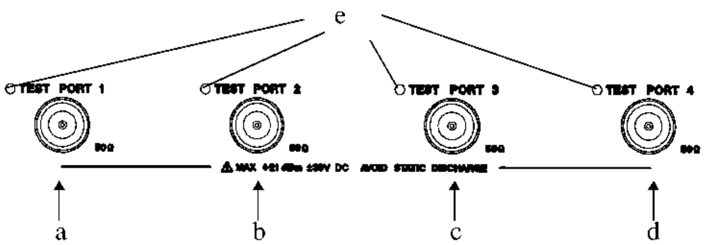
b. Mouse connector: Mouse connector. Connect the mouse before turning the power ON.

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

c. Keyboard connector: Keyboard connector. The keyboard can be used even if it is connected after power ON.

NOTE: Do not operate the front panel while pressing any keys on the keyboard.

- 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 (OPT 13 and 14 only)

d. Test port 4: Test port 4 input connector (OPT 14 only)

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

2.1.2 Rear Panel

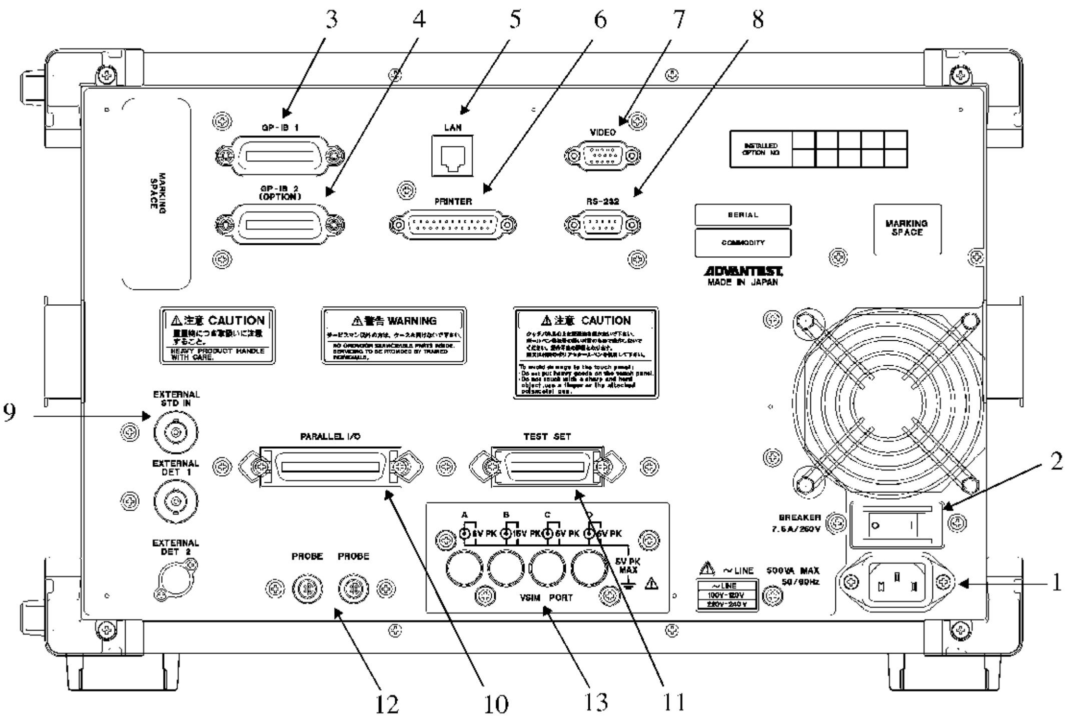


Figure 2-2 Rear Panel

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 (option 15): 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.

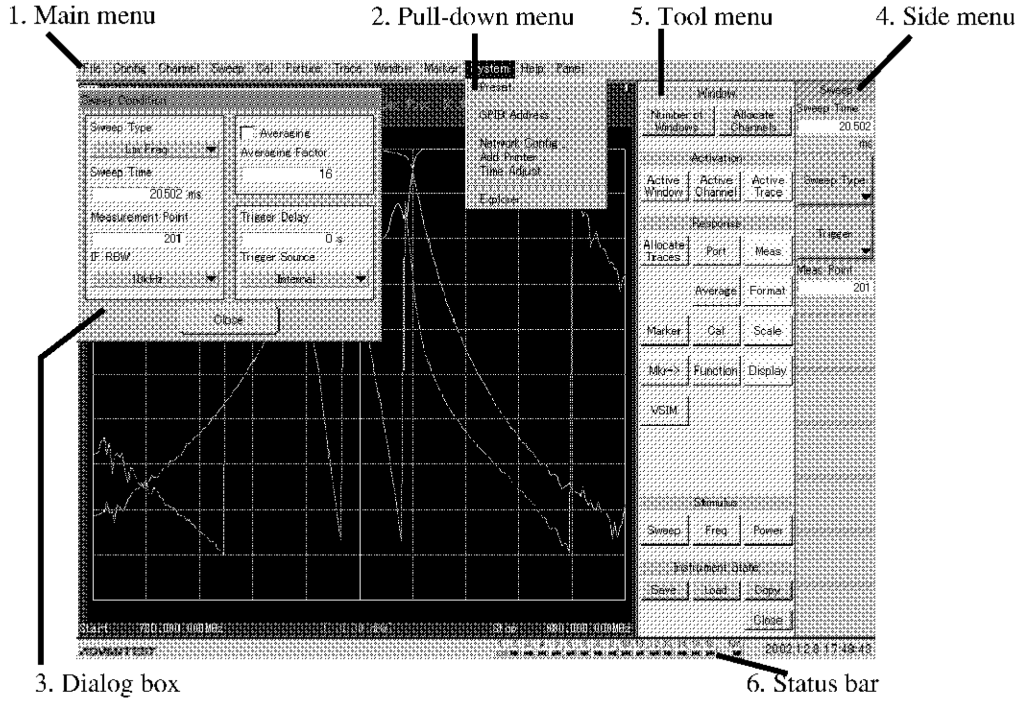


Figure 2-3 Operation Menus

1.	Main menu:	All functions can be operated from this menu. Clicking on the menu displays the pull-down menu.
2.	Pull-down menu:	A downward arrow on the menu indicates that it is a pull-down menu. Clicking on a menu with a downward arrow displays a pull-down menu.
3.	Tool menu:	Changes command execution of the side menu.
4.	Side menu:	>> on the menu indicates that it is the side menu. Clicking on a menu with >> displays the side menu.
5.	Dialog box:	... on a menu indicates that it is a dialog box. Clicking on a menu with ... displays a dialog box.
6.	Status bar:	Indicates the operating status of the unit.

2.2.2 Windows

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

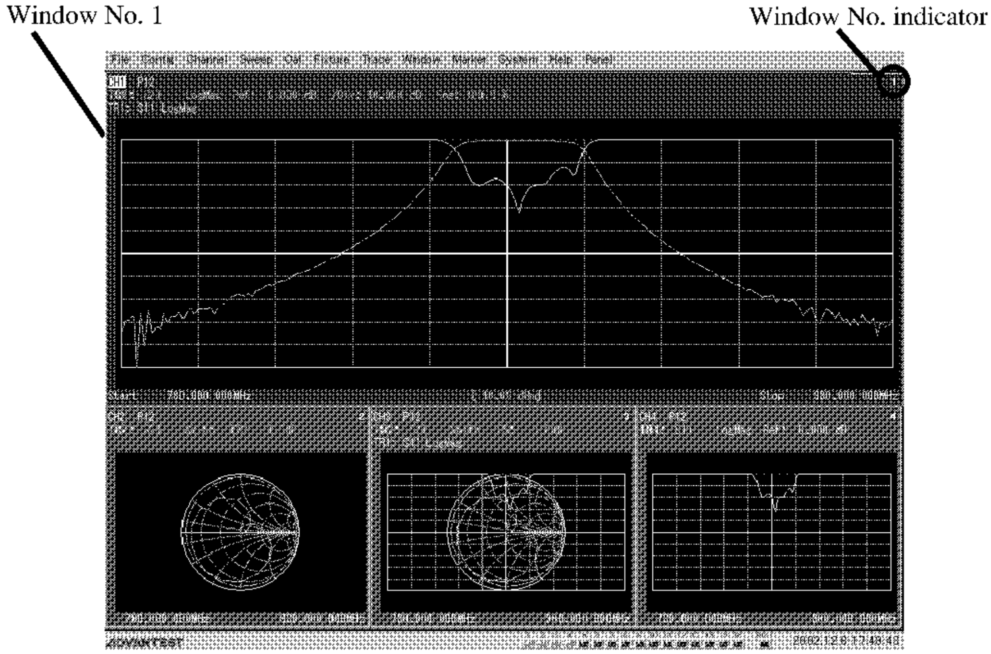
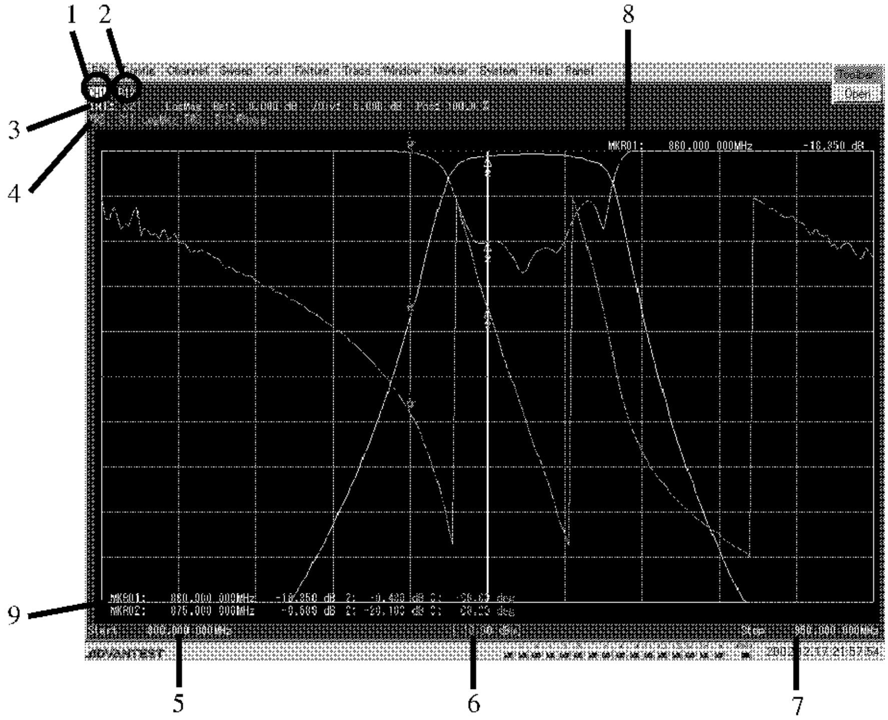


Figure 2-4 Window

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



1. Channel: Displays a channel number. Clicking it displays the Allocate CH side menu.
2. Measurement port: Displays the measurement port setting. Clicking it displays the Port side menu.
3. Active trace: Displays active trace information. Clicking it displays the Trace side menu.
4. Non-active trace: Displays non-active trace numbers. Clicking it changes to the active trace and displays the Active Trace side menu. Non-active trace annotation numbers are sorted in ascending order.
5. Start Frequency: Displays the start frequency. Clicking it displays the Frequency side menu.
6. Output power: Displays output power. Clicking it displays the Power side menu.
7. Stop Frequency: Displays the stop frequency. Clicking it displays the Frequency side menu.
8. Marker: Displays the active marker value. Clicking it displays the Marker side menu.
9. Marker list: Displays the marker list. Clicking it displays the Marker side menu.

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.

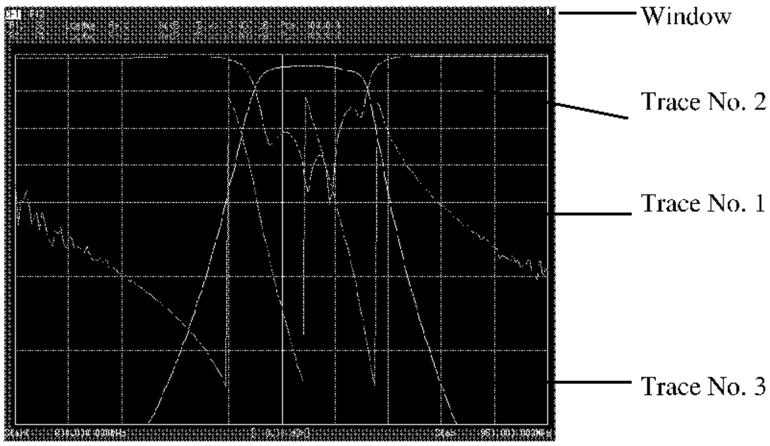


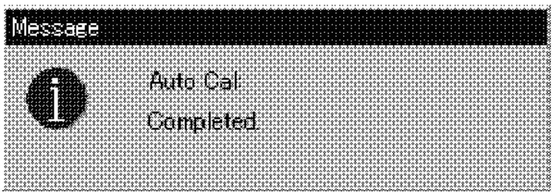
Figure 2-5 Trace

2.2.4 Messages

The unit displays the operating status in message boxes.

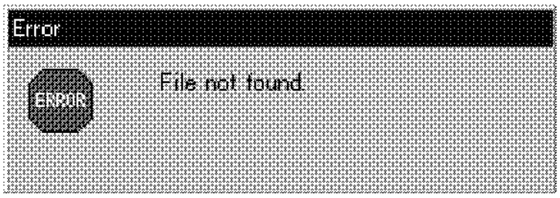
Displayed message boxes prompt the user to execute other operations or click on the window to clear the message box.

1. Message: Indicates normal operating status.



2. Warning: Indicates forced override of the operating status when operation outside the operating conditions of the unit is attempted.

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



See the Message List in the appendix for explanations of warning and error messages.

2.3 Measurement Channels and Windows

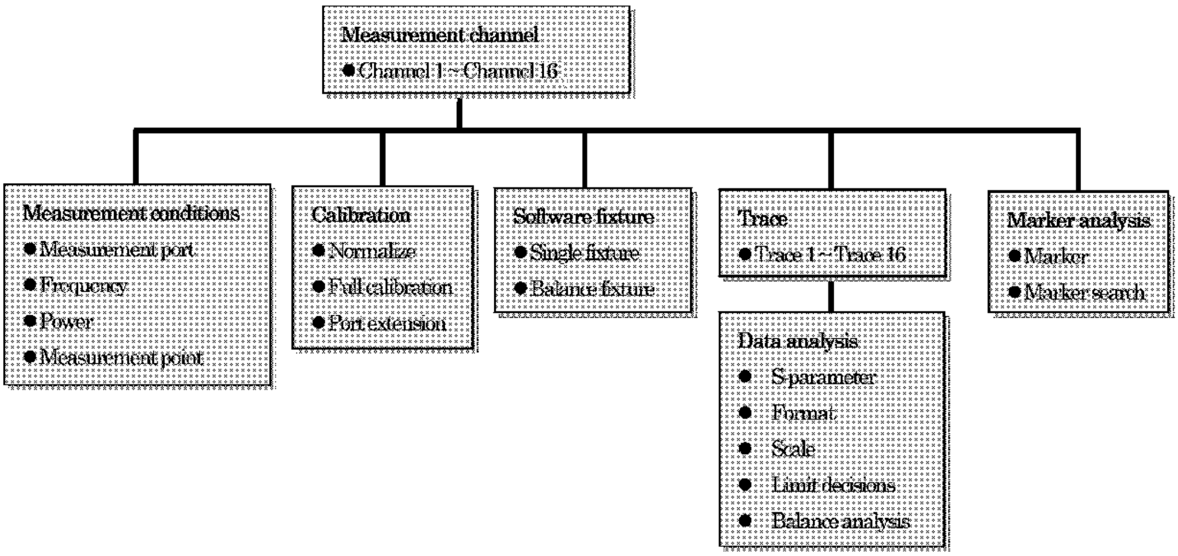
The unit uses a concept of measurement channels and windows. Measurements are executed using measurement channels, and measurement results are displayed in windows.

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.



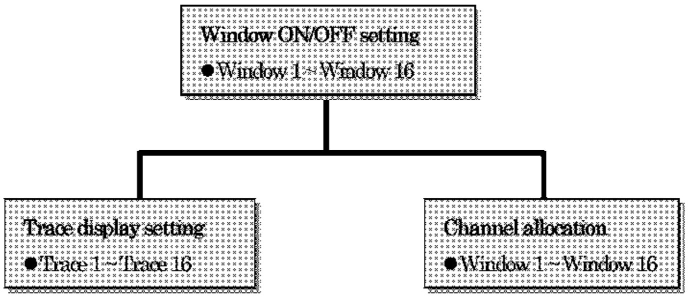
2.3.2 Windows

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.

All functions can be operated from the main menu using dialog boxes and the side menu.

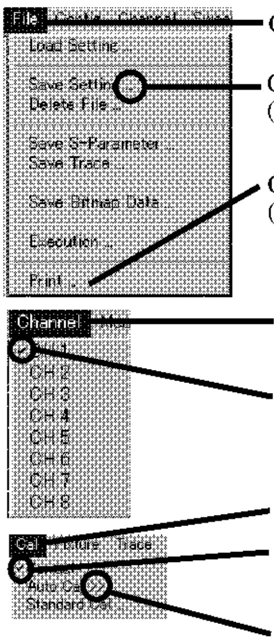
Frequently used functions can be easily operated from the tool menu using the side menu.

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 five operation formats in the pull-down menu.

1. Directly execute the clicked menu function.
2. Select from the multiple menus displayed. A check mark is displayed in the selected menu.
3. Toggle between ON/OFF. A check mark is displayed for ON.
4. Display a dialog box. ... is included at the end of the menu.
5. Display the side menu. >> is included at the end of the menu.



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

Clicking ***Save Setting...*** displays the Save dialog box.
(As in four, above.)

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

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

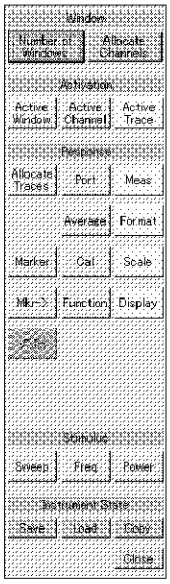
Clicking ***CH1*** selects CH1.
(As in two, above.)

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

Clicking ***Correct*** toggles between ON/OFF.
(As in three, above.)

Clicking ***Auto Cal >>*** displays the Auto Cal side menu.
(As in five, above.)

2. Tool Menu

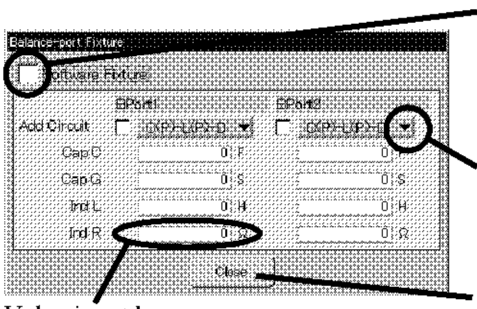


Clicking the menu displays frequently used functions in the side menu. Inclusion of frequently used functions allows ease of operation.

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 the box toggles Software Fixture between ON/OFF.
A check mark is displayed for ON.
(Two cases)

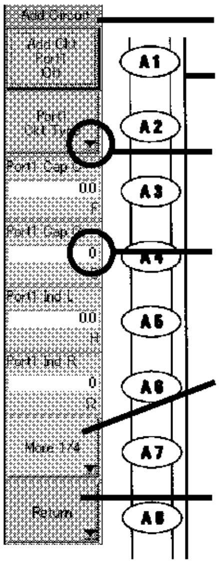
Pull-down menu
Clicking the ***C(P)-L(P)-D*▼** displays the pull-down menu.
(Three cases)

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

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

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.

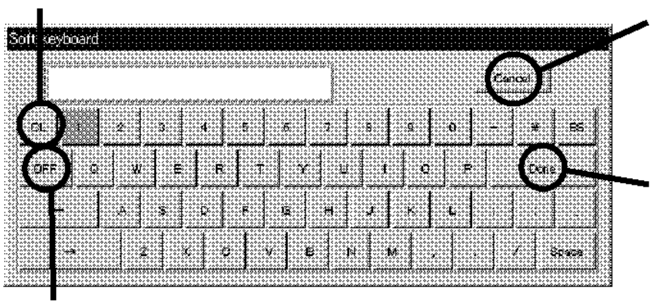
Return menu
Clicking the menu or pressing the application key displays the menu in the directory immediately above.

5. Software keyboard

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

   1. Moving the cursor in vertical directions.
      Use the step buttons. Pressing the △ step button moves the cursor upward. Pressing the ▽ step button moves the cursor downward.
   2. Moving the cursor in horizontal directions.
      Use the data knob. Rotating the data knob clockwise moves the cursor to right. Rotating the data knob counterclockwise moves the cursor to left.
   3. Confirming the character input.
      Press **ENTER.**
   4. Turning off the software keyboard.
      Selecting ***Done*** or ***Cancel*** on the software keyboard closes the software keyboard display.

Clear key
Erases all the entered characters.



Cancel key
Cancels the entered characters and closes the software keyboard.

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

Caps Lock ON/Off key
Switches between capital and lowercase letters.

2.4.2 Simple Measurement Example

This section explains operation of the tool menu for measurement of an 800 MHz 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.***

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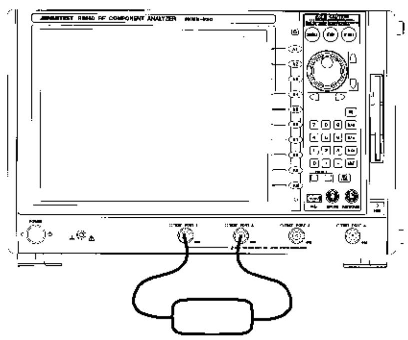
4. Connect Test port 1 and Test port 2 to the filter as shown in the diagram below.



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 ***Freq*** on the tool menu to display the Frequency side menu.
8. Press ***Start Freq*, 8, 0, 0, M/n, *Stop Freq*, 9, 0, 0** and **M/n** to set the Start Frequency to 800 MHz and the Stop Frequency to 900 MHz.

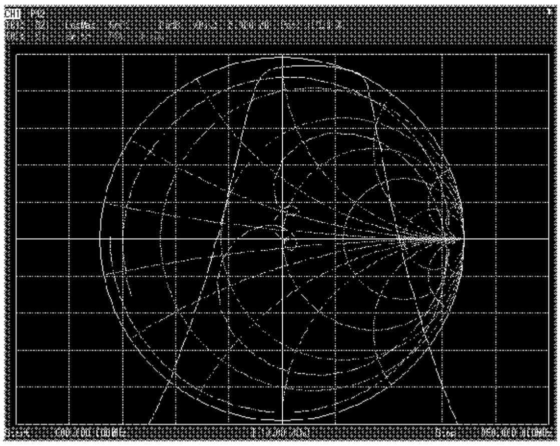
Trace and scale settings

9. Press ***Meas*** in the tool menu and then ***S21*** in the side menu to set Trace 1 to S-Parameter: S21.
10. Press ***Scale*** in the tool menu and then ***/Div*, *5*** and **ENT** in the side menu to set the scale of Trace 1 to 5 dB.

11. Press ***Activate Trace*** in the tool menu and then ***Trace 2*** in the side menu to set Trace 2 to Active Trace.

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

13. Press ***Format*** in the tool menu and then ***Smith*** in the side menu to set the format of Trace 2 to a Smith Chart.



Window 2 settings

14. Press ***Number of Windows*** in the tool menu to display the Window side menu.

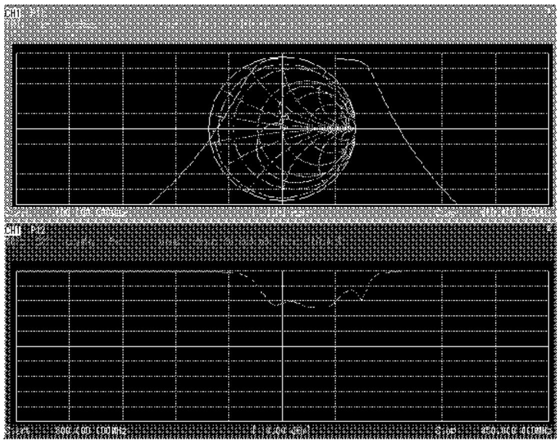
15. Press ***Window 2 Off*** to switch the menu to ON and display Window 2.

16. Press ***Allocate Traces*** in the tool menu to display the Allocate Tr side menu.

17. Press ***Trace 1 On***. The menu is switched to OFF and Trace 1 disappears from Window 2.

18. Press ***Trace 3 Off***. The menu is switched to ON and display Trace 3 in Window 2.

19. Press ***Meas*** in the tool menu and then ***S22*** in the side menu to set Trace 3 to S-Parameter: S22.



Power OFF

20. 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, the display screen can be selected for each measurement channel, which allows optimum multi-channel measurement.

3.1 Channel Settings

Click ***Allocate Channels*** in the tool menu to display the Allocate CH side menu.

Assign channels to windows. Channel numbers, which are the same as window numbers, are set by default. Any channel numbers from 1 to 16 can be assigned to windows 1 to 16.

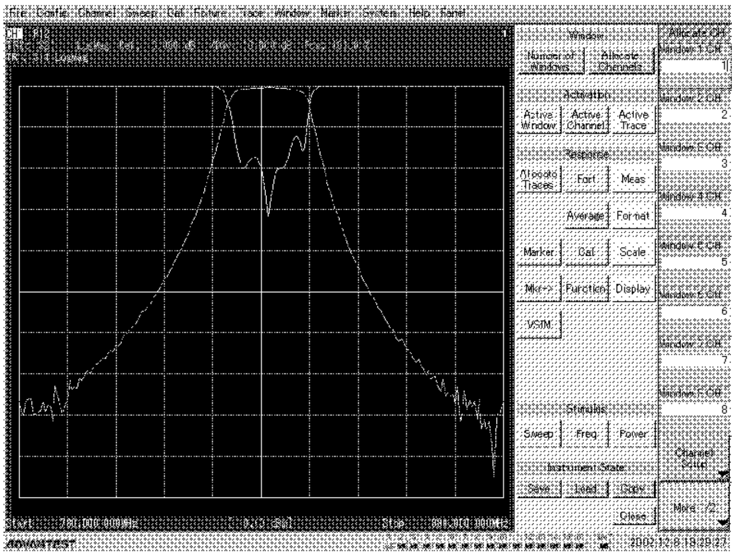


Figure 3-1 Allocate CH Side Menu

Click ***Active Channel*** in the tool menu to display the Active CH side menu.

Set an active channel. If the window assigned to a channel in the Active CH side menu is displayed, the active window is changed according to the active channel setting. 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.

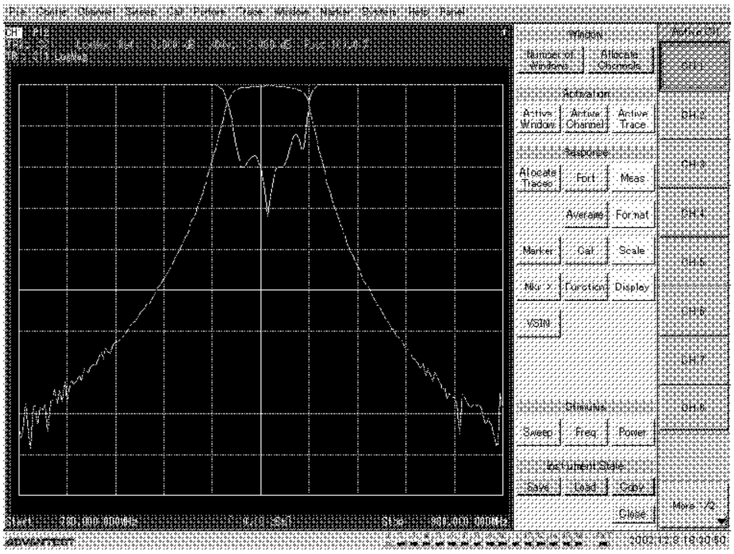


Figure 3-2 Active CH Side Menu

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***, ***Sweep***, and ***Freq*** in the tool menu.

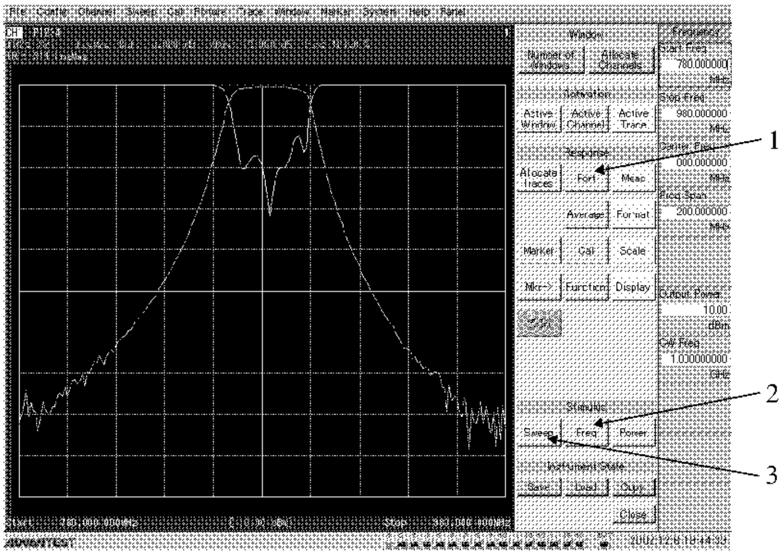


Figure 3-3 Measurement Conditions settings

1. ***Port*** — Sets a measurement port in the Port side menu. When ***None*** is selected, no measurement is performed.

2. ***Freq*** — Sets the start frequency, stop frequency, center frequency, and frequency span in the Frequency side menu.

3. ***Sweep*** — Sets the sweep time, sweep mode, trigger mode, and the number of measurement points in the Sweep side 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***, ***Format***, and ***Allocate Traces*** in the tool menu.

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

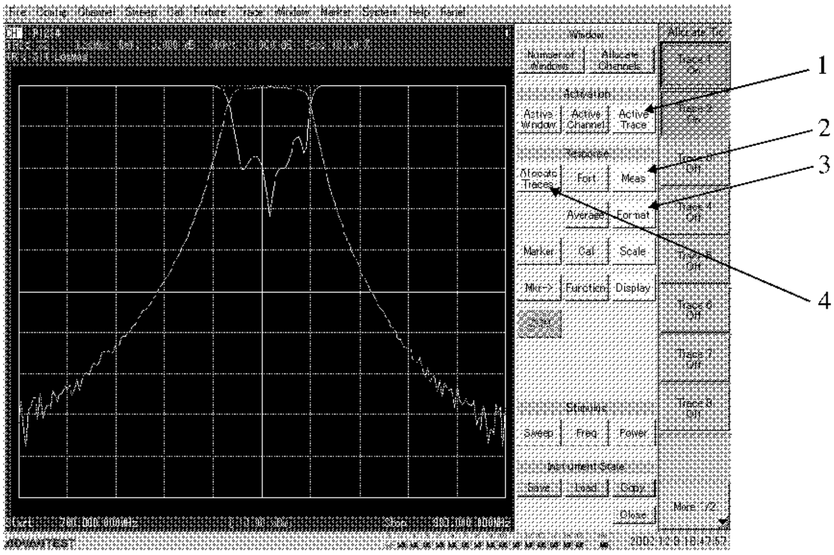


Figure 3-4 Trace Settings

1. ***Active Trace*** — Sets the trace selected in the Active Trace side menu as the active 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.
4. ***Allocate Traces*** — Selects the selected trace display ON or OFF in the Allocate Tr side menu.

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 ***Display*** in the tool menu to display the Display 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***	Performs four basic mathematical calculations between trace data and trace memory data and displays results as trace data.

3.4 Window Settings

Click ***Number of Windows*** in the tool menu to display the Window side menu.

The areas, which display the traces set in part 3.3, are called windows, of which there are 16. The measurement channel to be displayed can be set for each window.

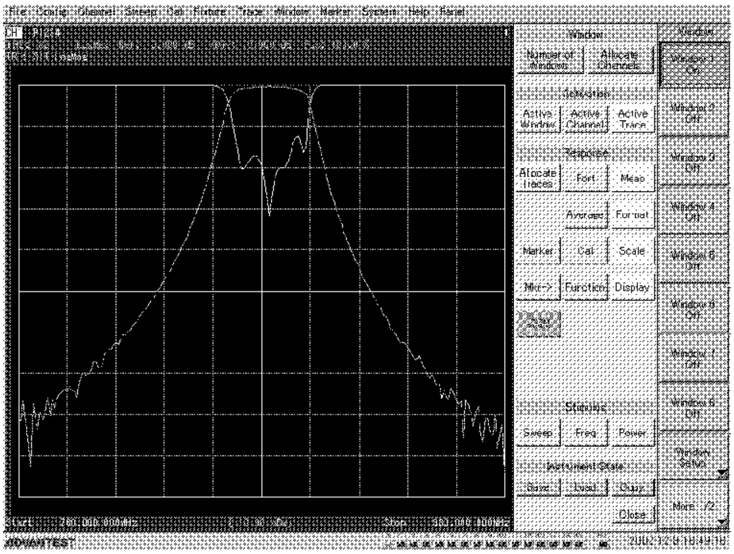


Figure 3-5 Window Side Menu

Click the ***Window Setup*** in the Window side menu to display the Window Setup side menu.

1. ***Display Mode*** — Selects the window display mode in the Display Mode side menu. Multiple windows can be displayed or windows can be overlaid.

2. ***Screen Layout*** — Selects a window display area on the screen in the Scrn Layout side menu. Half or full screen display can be selected. The display allocation can also be selected.

3.4.1 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.

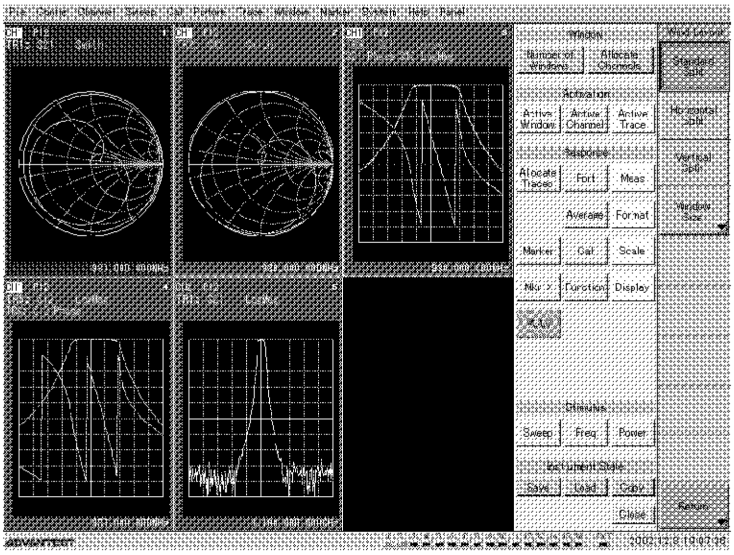
Select ***Number of Windows*** in the tool menu. Then, select ***Window Setup*** and ***Window Layout*** in the side menu.

1. ***Standard Split***	Displays all windows equally. The Column and Size (%) settings are ignored.
2. ***Horizontal Split***	Splits the display horizontally into the number of windows specified in Column.
3. ***Vertical Split***	Splits the display vertically into the number of windows specified in Column.
4. ***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.
5. ***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.

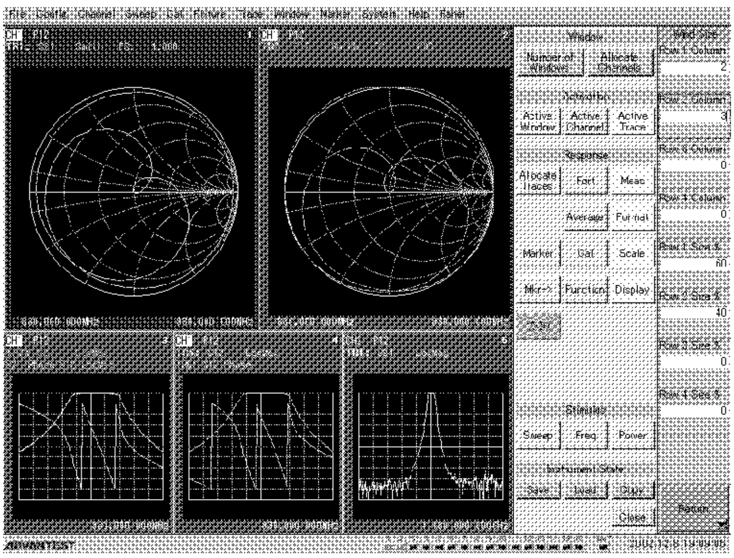
1. Standard split

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



2. Horizontal split

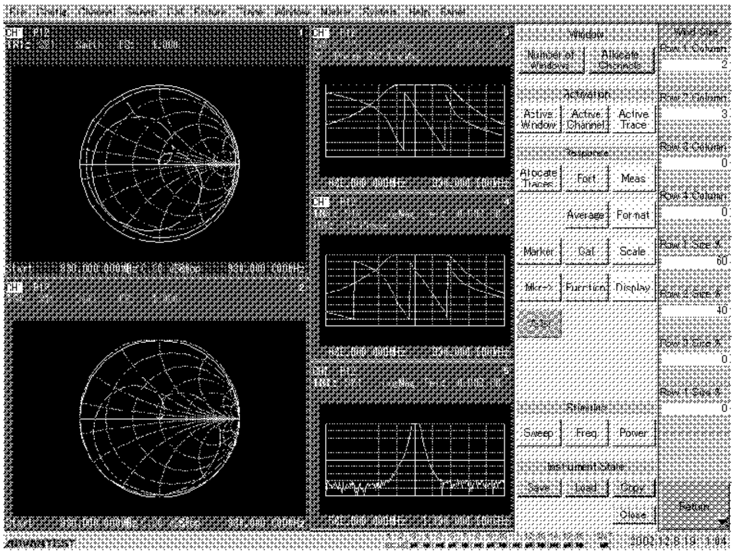
   The display is split horizontally into 2 rows. The first row is set to have 2 windows and the second row is set to have 3 windows.
   Size distributions are 60% for the first row and 40% for the second row.



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.

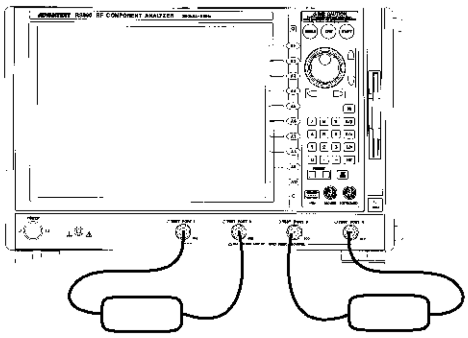


3.5 Measurement Example

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

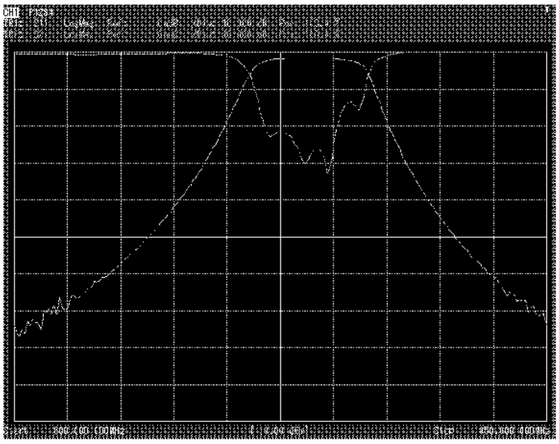
The procedures outlined below begin with the model in initialized status.

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.



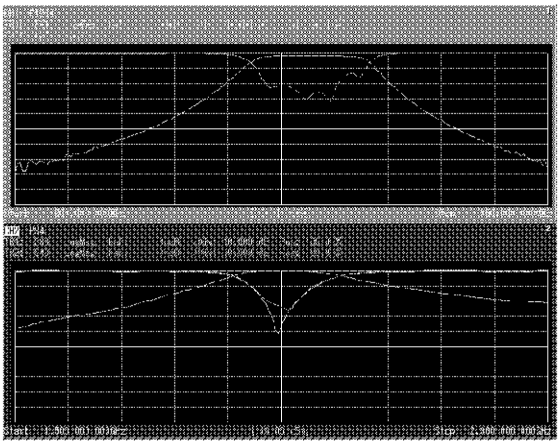
Measurement Channel 1 Settings

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. Click ***Freq*** in the tool menu to display the Frequency side menu.
4. Press ***Start Frequency*, 8, 0, 0, M/n, *Stop Frequency*, 9, 0, 0** and **M/n** to set the Start Frequency to 800 MHz and the Stop Frequency to 900 MHz.
5. Click ***Active Trace*** in the tool menu to display the Active Trace side menu.
6. Press ***Trace* 2** to display Trace 2. Trace 1 is set to S11 and Trace 2 is set to S21 in initialized status.
7. 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.
8. The above operation measures the reflection characteristics (S11 and S22) and transmission characteristics (S21) of the 800 MHz band filter.



Measurement Channel 2 Settings

9. Click ***Number of Windows*** in the tool menu to display the Window side menu.
10. Click ***Window 2 Off*** to set ***Window 2 ON*** and 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.
11. Click ***Active Channel*** in the tool menu to display the Active CH side menu.
    Measurement channel 2 is assigned to window 2 by default.
12. Click ***Port*** in the tool menu to display the Port side menu.
13. Click ***P34*** to set the measurement port to the 2-port of Port 3-Port 4.
14. Click ***Freq*** in the tool menu to display the Frequency side menu.
15. Press ***Start Frequency*, 1, 8, 0, 0, M/n,** ***Stop Frequency*, 2, 0, 0, 0** and **M/n** to set the Start Frequency to 1800 MHz and the Stop Frequency to 2000 MHz.
16. Click ***Active Trace*** in the tool menu to display the Active Trace side menu.
17. 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.
18. Click ***Active Trace*** in the tool menu to display the Active Trace side menu.
19. 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.
20. 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, and 4-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 4.6, "Calibration Kit Selection."

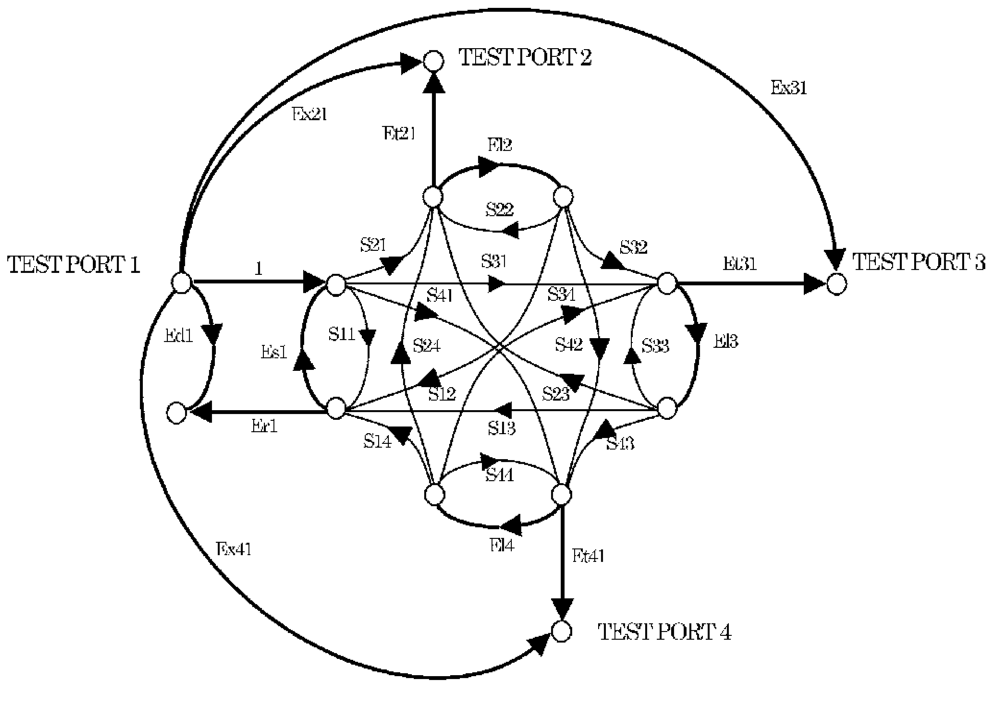
4.1 4-Port Full Calibration

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 only with OPT 14 (built-in 4-port test set).

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.

4.2 3-Port Full Calibration

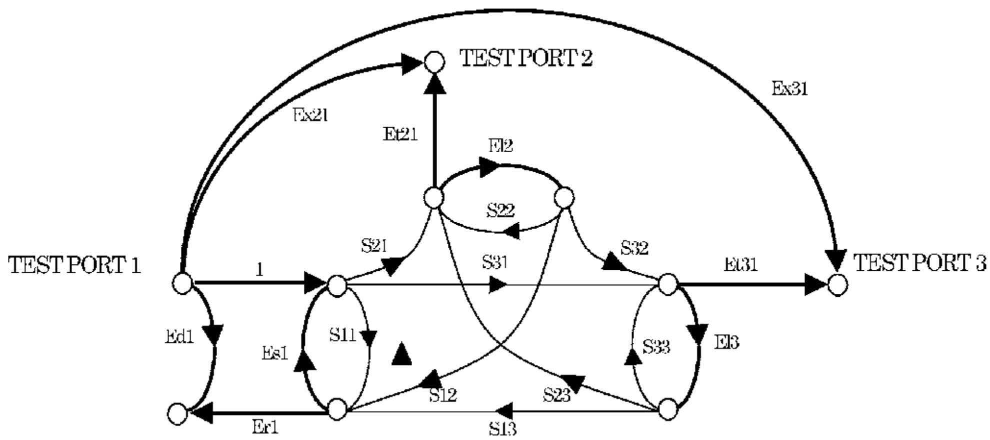
In measurement of 3-port devices, directivity, source match, load match, frequency tracking, and isolation errors are calibrated, and nine completely compensated S-parameters are measured.

This calibration method can be executed with Port 1-Port 2-Port 3 in OPT 13 (built-in 3-port test set).

This method can be executed in OPT14 (built-in 4-port test set) 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.

4.3 2-Port Full Calibration

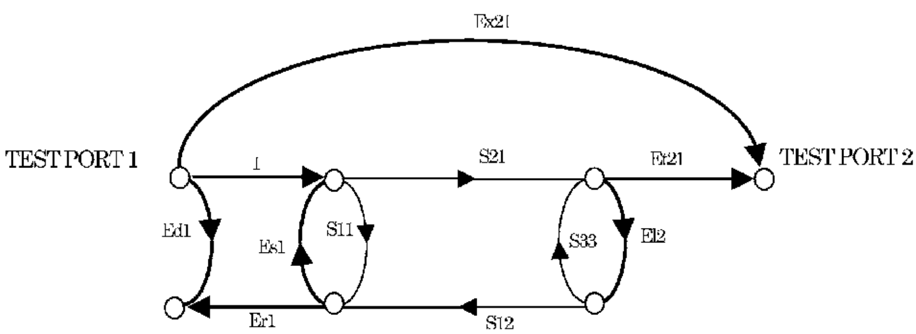
In measurement of 2-port devices, directivity, source match, load match, frequency tracking, and isolation errors are calibrated, and four completely compensated S-parameters are measured.

This calibration method can be executed with Port 1-Port 2, Port 1-Port 3, and Port 2-Port 3 in OPT 13 (built-in 3-port test set).

This method can be executed in OPT14 (built-in 4-port test set) 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.

4.4 1-Port Full Calibration

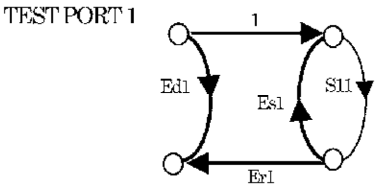
In measurement of 1-port devices, directivity, source match, load match, frequency tracking, and isolation errors are calibrated, and one completely compensated S-parameter is measured.

This calibration method can be executed with Port 1 or Port 2 in OPT 12 (built-in 2-port test set).

This calibration method can be executed with Port 1, Port 2, or Port 3 in OPT 13 (built-in 3-port test set).

This method can be executed Port 1, Port 2, Port 3, or Port 4 in OPT14 (built-in 4-port test set).

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

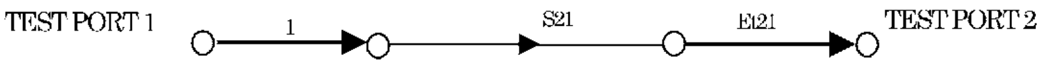
Note: Numbers of error items indicate the port numbers.

4.5 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.

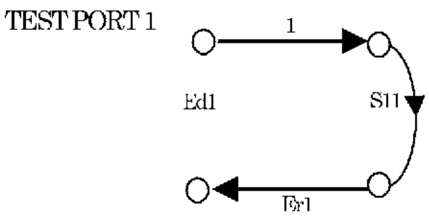
1. Either of the following calibration standards is required.
   - Thru Standard (for transmission characteristics)
   - Open Standard or Short Standard (for reflection characteristics)
2. An error model of transmission characteristics is shown as a signal flow graph (using Port 1-Port 2).



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

4.6 Calibration Kit Selection

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

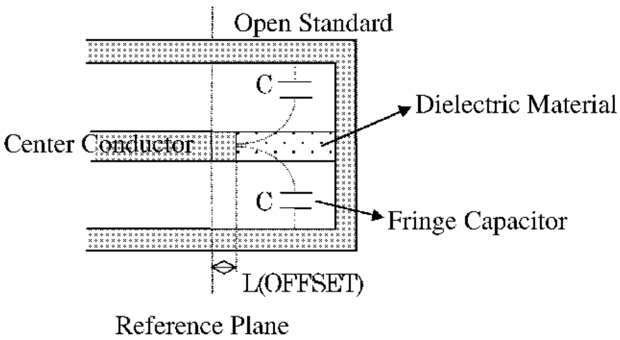
It is physically impossible to fabricate an ideal calibration kit. Values varying from ideal values exist in actual calibration kits.

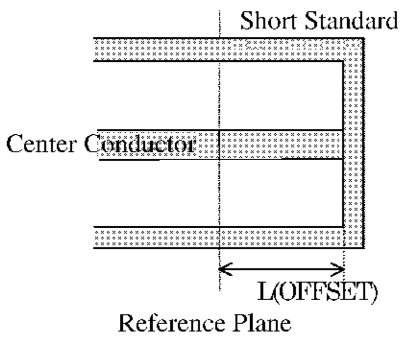
Calibration is executed based on these values which vary from ideal values.

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

4.6.1 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.

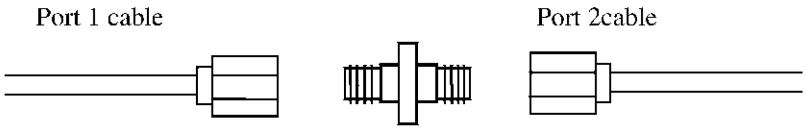
In the Short Standard, an offset value from the center conductor to the ground surface is assigned.

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

4.6.2 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.



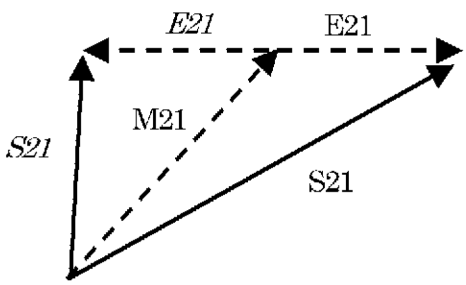
Thru Standard

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

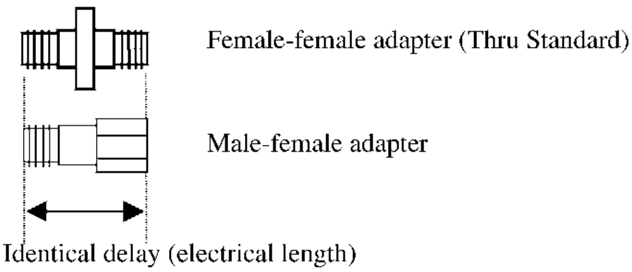
There are two methods for compensating for the delay (electrical length) of the Thru Standard.

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

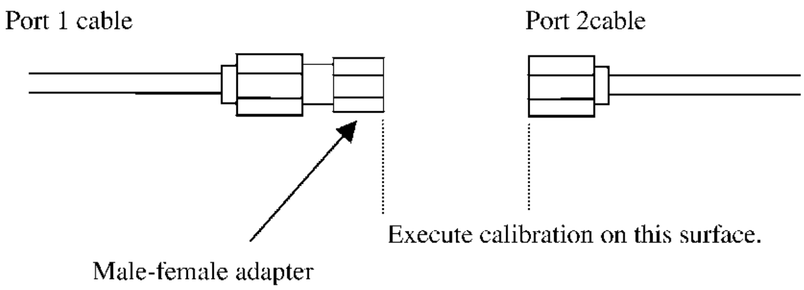
   In selecting the calibration kit, select User define kit and set the delay (electrical length) of the Thru adapter. The automatically assigned delay (electrical length) will be compensated for and the error will be determined when calibration is executed.

2. Method using conversion adapters

   Use of a female-male adapters with identical delay (electrical length) physically compensates for delay (electrical length). Use female-male adapters as shown in the diagram below.

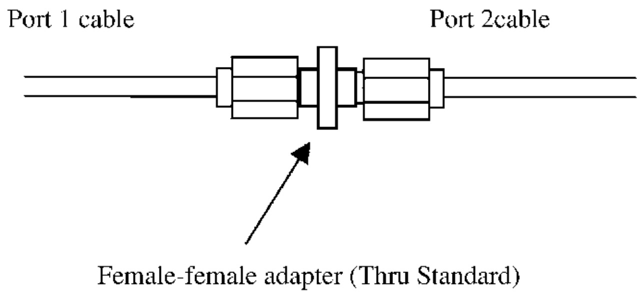


- Connect a male-female adapter to the tip of actual test port (cable tip) for execution of the Open Standard, Short Standard, and Load Standard. Execute calibration with the adapter tip.

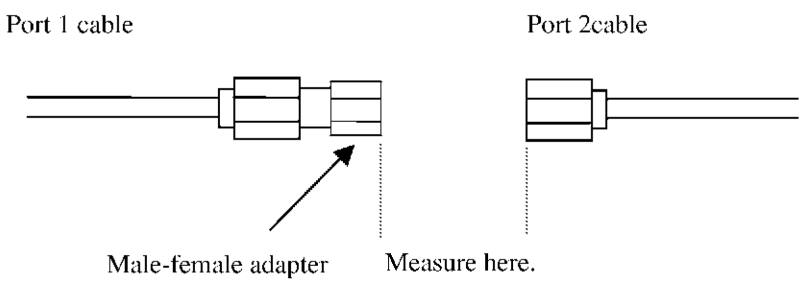


- Execution of the Thru Standard

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



- Execution of measurement



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

4.6.3 User-defined Calibration Kit

When using a calibration kit other than the standard calibration kit of this unit, select User define to allow alteration of the calibration kit's values.

- Open Standard Settings

  Set the fringe capacitor (floating capacity) value and offset value.

  The fringe capacitor is a function of the frequency. Set the values of C0, C1, C2, and C3 in the following formula.

  Fringe capacitor $C = C0\ 10^{-15}\ F + C1\ 10^{-27}\ F / Hz + C2\ 10^{-36}\ F / Hz^2 + C3\ 10^{-45}\ F / Hz^3$

  Set the offset value to the Delay.

  Delay = L/C L = Physical length
  C = Speed of light

- Short Standard Setting Values

  Set the offset value to the Delay.

- Load Standard Setting Values

  Models of the Load Standard are shown in Figure 4-1 and Figure 4-2.

  Set Terminal impedance Z1, Transmission path characteristics impedance Z0, Delay T, and resistance R/s ([Ω/sec]@1 GHz) per unit length as the conductor loss.

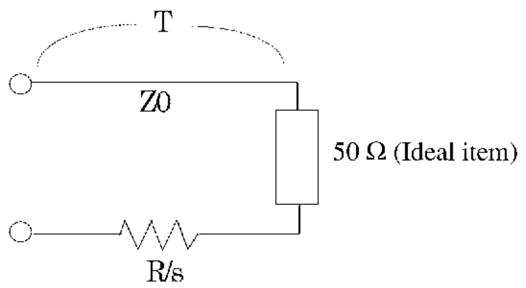


Figure 4-1 Load Standard Model 1

Reference: Delay T of the transmission path and impedance Z0 are expressed as inductor L in different models.

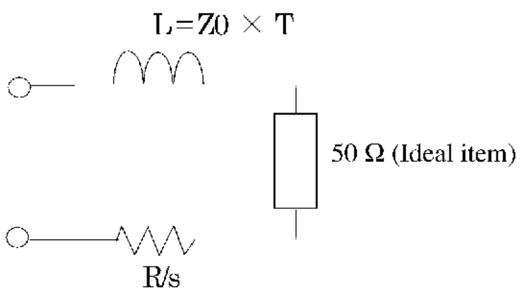


Figure 4-2 Load Standard Model 2

- Thru Standard Setting Values

  A model of the Thru Standard is shown in Figure 4-3.

  Set Delay T of the transmission path, impedance Z0, and resistance R/s ([Ω/sec]@1GHz) per unit length.

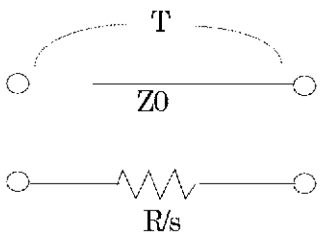
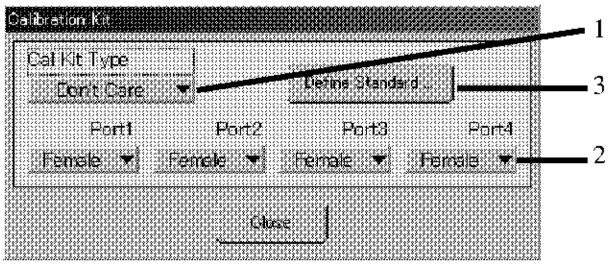


Figure 4-3 Thru Standard Model

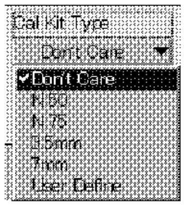
4.6.4 Calibration Kit Setting Methods

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.

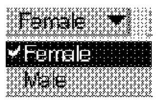


1. ***Cal Kit Type*** : Displays a pull-down menu for selecting the type of Calibration Kit.



Don't Care : Ideal calibration kit without compensation values
N50 : N-type 50Ω calibration kit
N75 : N-type 75Ω calibration kit
3.5 mm : 3.5 mm-type 50Ω calibration kit
7 mm : 7 mm-type 50Ω calibration kit
User Define: User-defined calibration kit

2. ***Port*** : Displays a pull-down menu for selecting the polarity of the test port.
   Valid for N50, N75, 3.5 mm.



CAUTION: ***This is the polarity of the test port. It is not the polarity of the calibration kit.***

---

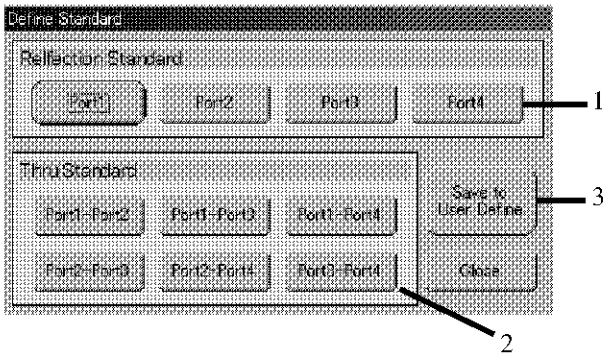
3. ***Define Standard*** : Displays a dialog box for setting a user-defined calibration kit.
   Refer to 4.6.5, "User-defined Calibration Kit Setting Methods."

4.6.5 User-defined Calibration Kit Setting Methods

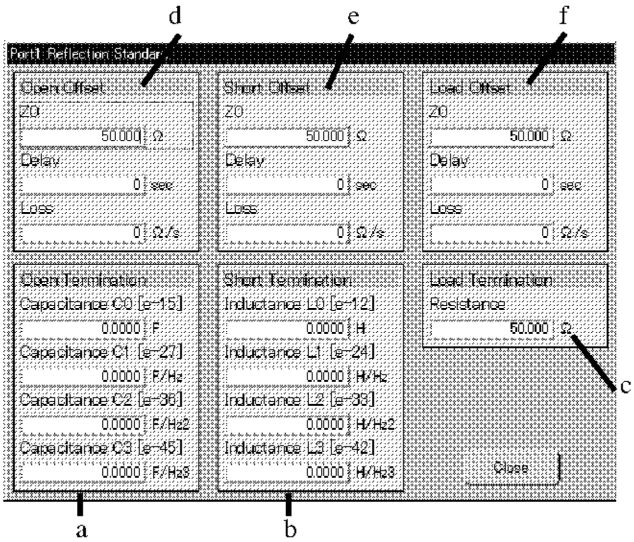
Click ***Cal*** in the tool menu to display the Calibration side menu.

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

Click ***Define Standard*** in the dialog box to display the Define Reflection Standard dialog box.



1. ***Reflection Standard*** : Displays the Port Reflection Standard dialog box.



(a) Sets the fringe capacitor value of the Open Standard.

(b) Sets the inductance value of the Short Standard.

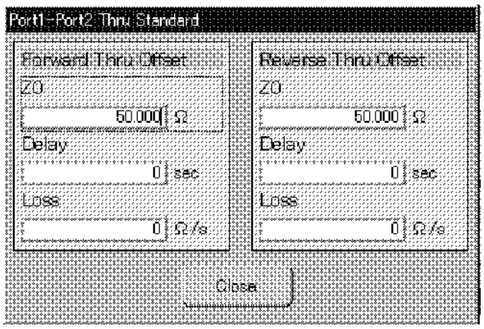
(c) Sets the impedance value of the Load Standard.

(d) Sets the Delay, Loss and Offset impedance Z0 values of the Open Standard.

(e) Sets the Delay, Loss and Offset impedance Z0 values of the Short Standard.

(f) Sets the Delay, Loss and Offset impedance Z0 values of the Load Standard.

2. ***Thru Standard*** : Displays the Port - Port Thru Standard dialog box.
Sets the Delay, Loss and Offset impedance Z0 values of the Load Standard.



3. ***Save to User Define*** : Click this key to save the values set in steps 1 and 2.

4.7 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.

4.7.1 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, Port 1, Male, Port 2, Male, Port 3, Male, Port 4*** 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 2 and Port 3 with the Thru Standard, and click ***P2-P3 Thru.***
21. Connect Port 1 and Port 3 with the Thru Standard, and click ***P1-P3 Thru.***

22. Connect Port 1 and Port 4 with the Thru Standard, and click ***P1-P4 Thru.***
23. Click ***Omit Isolation.*** Isolation calibration is omitted here.
24. Click ***Done.***

The above procedure completes 4-port full calibration.

4.7.2 4-Port Full Calibration (Automatic Calibration)

1. Click ***Cal*** in the tool menu to display the Calibration side menu.
2. Click ***Auto Cal*** and ***4port Auto Cal*** to display the 4-port auto calibration Kit side menu.
3. Connect Port 1 and Port 2 to the Automatic Calibration Kit (R17050), and click ***Aquire P1-P2.***
4. Connect Port 1 and Port 4 to the Automatic Calibration Kit (R17050), and click ***Aquire P1-P4.***
5. Connect Port 1 and Port 3 to the Automatic Calibration Kit (R17050), and click ***Aquire P1-P3.***
6. Connect Port 2 and Port 3 to the Automatic Calibration Kit (R17050), and click ***Aquire P2-P3.***
7. Click ***Done.***

The above procedure completes 4-port full calibration.

4.7.3 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, Port 1, Male, Port 2, Male, Port 3*** 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. Click More 2/3 to display page 3 of three pages.
16. Connect Port 1 and Port 2 with the Thru Standard, and click ***P1-P2 Thru.***
17. Connect Port 1 and Port 3 with the Thru Standard, and click ***P1-P3 Thru.***
18. Connect Port 2 and Port 3 with the Thru Standard, and click ***P2-P3 Thru.***
19. Click ***Omit Isolation.*** Isolation calibration is omitted here.
20. Click ***Done.***

The above procedure completes 3-port full calibration.

4.7.4 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. Click ***Calibration, Auto Cal, 3port Auto Cal*** and ***P1-P2-P3*** to display the 3-port Auto Calibration side menu.
3. Connect Port 1 and Port 2 to the Automatic Calibration Kit (R17050), and click Acquire P1-P2.
4. Connect Port 1 and Port 3 to the Automatic Calibration Kit (R17050), and click Acquire P1-P3.
5. Connect Port 2 and Port 3 to the Automatic Calibration Kit (R17050), and click Acquire P2-P3.
6. Click Done.

The above procedure completes 3-port full calibration.

4.7.5 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, Port 1, Male, Port 2*** 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.

4.7.6 2-Port Full Calibration (Port 1-Port 2, Automatic Calibration)

1. Click ***Cal*** in the tool menu to display the Calibration side menu.
2. Click ***Auto Cal*** and ***2port Auto Cal*** to display the 2-port auto calibration side menu.
3. Connect Port 1 and Port 2 to the Automatic Calibration Kit (R17050), and click ***P1-P2 Auto Cal Done.***

The above procedure completes 2-port full calibration.

4.7.7 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, Port 1*** 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.

4.7.8 1-Port Full Calibration (Port 1, Automatic Calibration)

1. Click ***Cal*** in the tool menu to display the Calibration side menu.
2. Click ***Auto Cal*** and ***1port Auto Cal*** to display the 1-port auto calibration side menu.
3. Connect Port 1 to the Automatic Calibration Kit (R17050), and click ***Port1 Auto Cal Done***.

The above procedure completes 1-port full calibration.

4.7.9 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.

4.7.10 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.

4.7.11 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.

4.8 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) $\times$ 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

4.8.1 How to Set the Port Extension

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

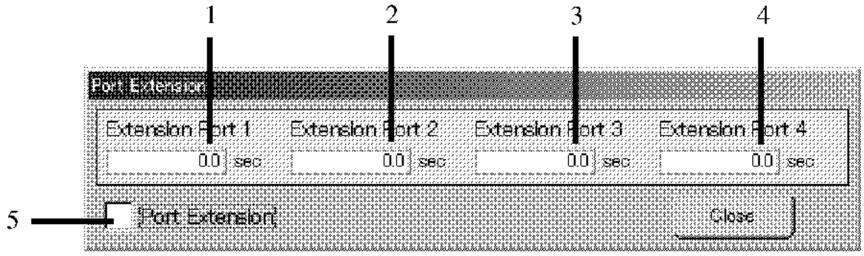


Figure 4-4 Port Extension Dialog Box

1.	***Extension Port 1***	: Sets the Port 1 extension value in time.
2.	***Extension Port 2***	: Sets the Port 2 extension value in time.
3.	***Extension Port 3***	: Sets the Port 3 extension value in time.
4.	***Extension Port 4***	: Sets the Port 4 extension value in time.
5.	***Port Extension***	: Sets the port extension function to ON or OFF.

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

Select *Cal* in the main menu. Then, select ***Electrical Delay*** to display the dialog box.

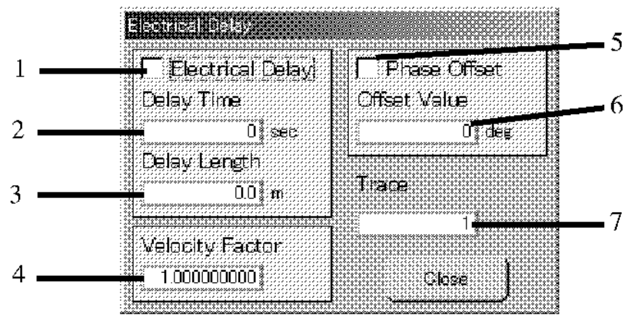


Figure 4-5 Electrical Delay Dialog Box

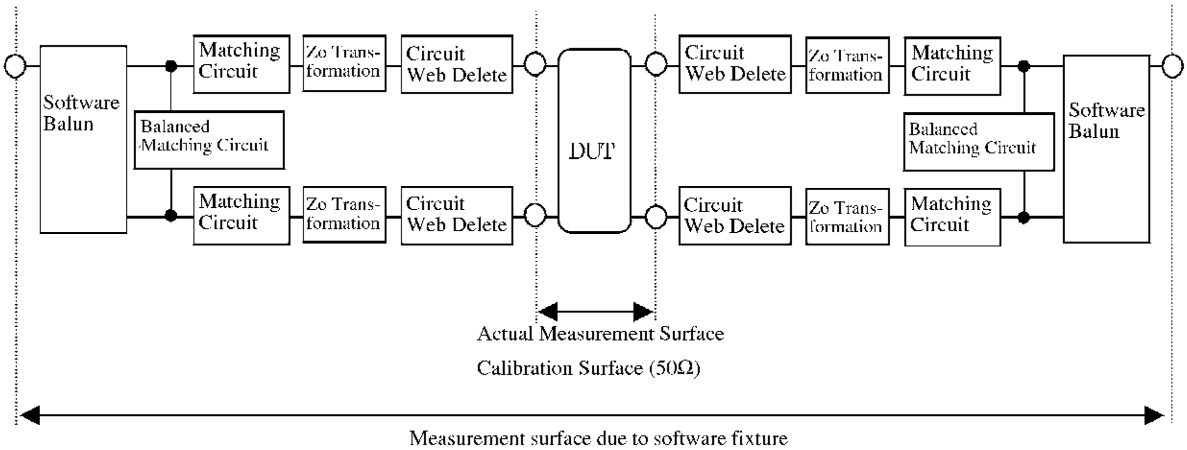
1.	***Electrical Delay***	: Sets the electrical delay correction function to ON or OFF.
2.	***Delay Time***	: Sets electrical delay correction values in time. Can be set for individual traces.
3.	***Delay Length***	: Sets electrical delay correction values in distance. Can be set for individual traces.
4.	***Velocity Factor***	: Sets the velocity factor.
5.	***Phase Offset***	: Sets the phase offset function to ON or OFF.
6.	***Offset Value***	: Sets phase offset values. Can be set for individual traces.
7.	***Trace***	: Selects trace numbers.

5. SOFTWARE FIXTURE

This feature transforms and analyzes items measured at 50Ω impedance to an optional impedance with an impedance transformation 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.

OPT13 (built-in 3-port test set) and OPT14 (built-in 4-port test set) used in combination allow easy analysis of balanced components and floating components in a manner similar to 2-port unbalanced components.

[Measurement Flow]



5.1 Circuit Web Delete Function

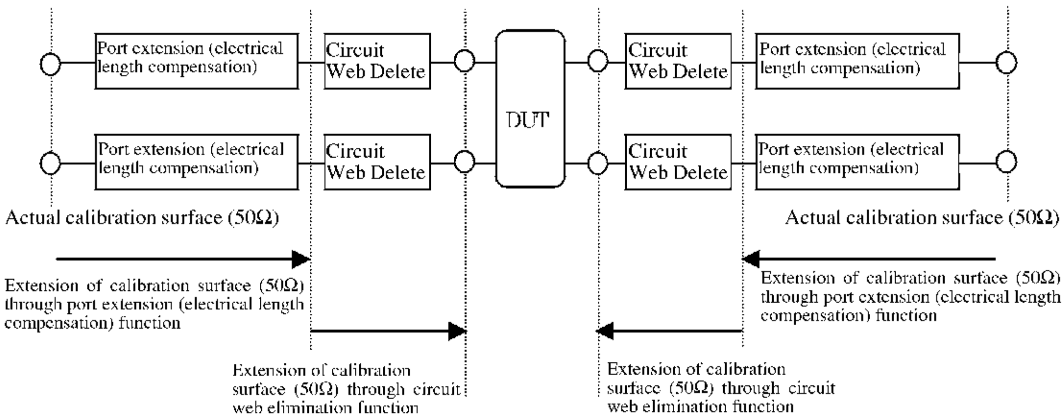
A known 2-port circuit web is deleted for each measurement port before measurement.

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.

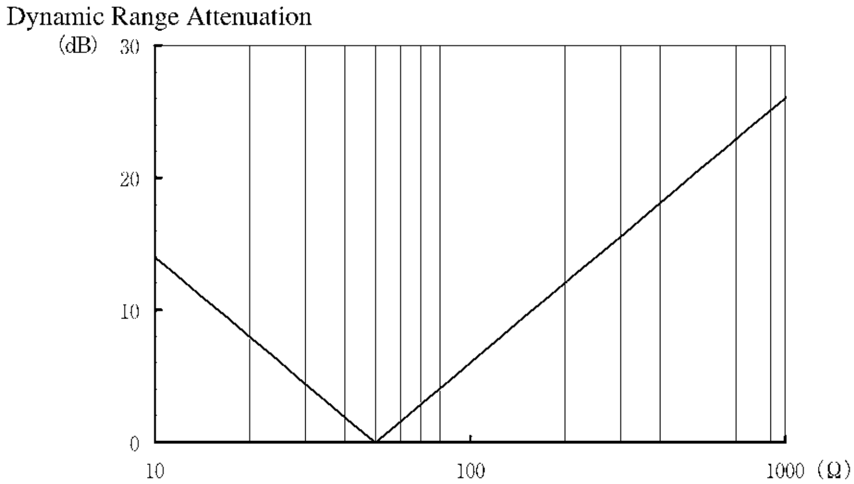


Figure 5-1 Impedance after Transformation

- 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.

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

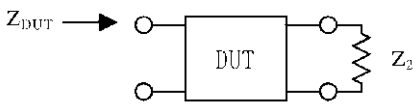
As shown above, the S-parameters are defined as components of a matrix, and the various parameters can be individually calculated the simple circuit calculations.

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.

$$S11 = \frac{Z_{DUT} - Z_1}{Z_{DUT} + Z_1}$$



2. Transmission Parameter S21

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

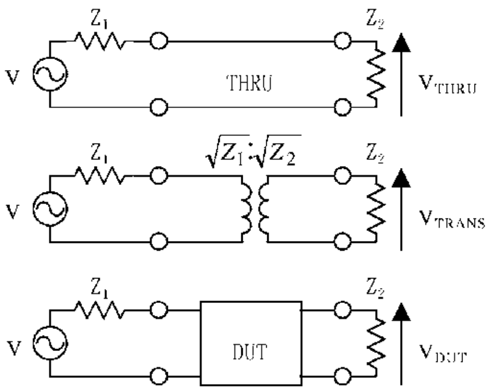
   The voltage arising in the duty when the signal source and duty are directly connected is: V_{THRU}

   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.

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

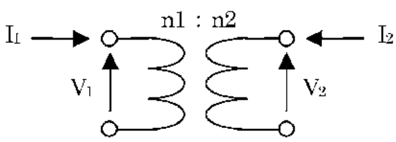


   In particular, when Z1 = Z2, then $V_{TRANS} = V_{THRU}$, and the formula holds.

   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.

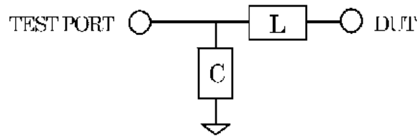
There are the following two methods for setting the matching circuit.

- Setting through combination of a capacitor and inductor

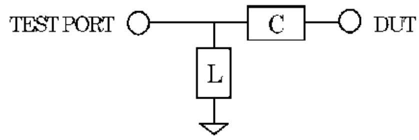
  Capacitance C and Inductance L can be set to optional values. Additionally, conductance component G of the capacitor and resistance component R of the inductor can also be set.

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

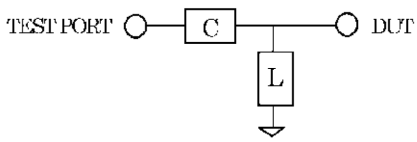
1. parallel C – series L (C(P)-L(S)-D)



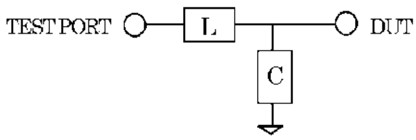
2. parallel L – series C (L(P)-C(S)-D)



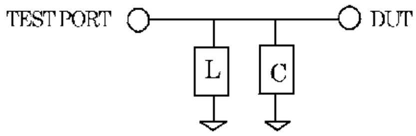
3. series C – parallel L (C(S)-L(P)-D)



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



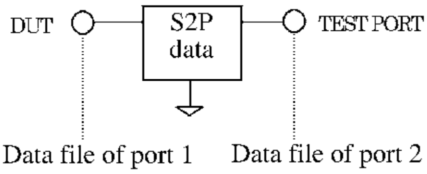
5. parallel L – parallel C (L(P)-C(P)-D)



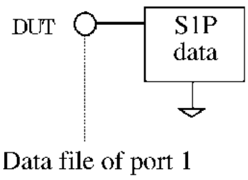
- Setting using an S-parameter file

  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.***

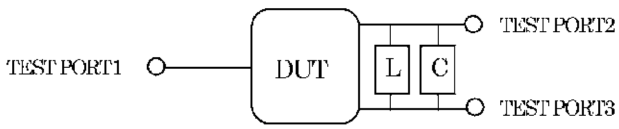
5.4 Balance Matching Circuit Function

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.

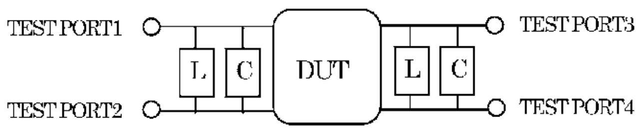
- 3-port devices (OPT13 or 14 required)

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



- 4-port devices (OPT14 required)

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



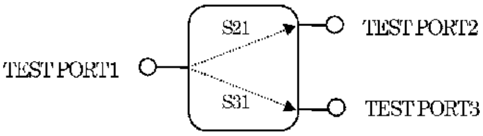
5.5 Balance Measurement Function

This function measures the balance (Blance-parameter) between the magnitude and phase of the transmission characteristics.

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

The definition of balance is as follows.

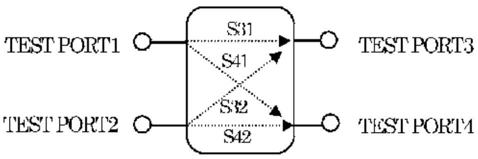
- 3-port devices (OPT11 or 14 required)



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 (OPT 14 required)



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 1 (B12) = -(S13-S14)/(S23-S24)

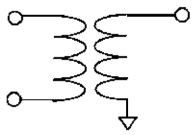
Balance between test port 2 and test port 1 (B21) = -(S23-S24)/(S13-S14)

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

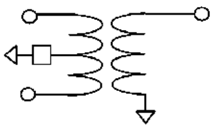
Floating balun



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.

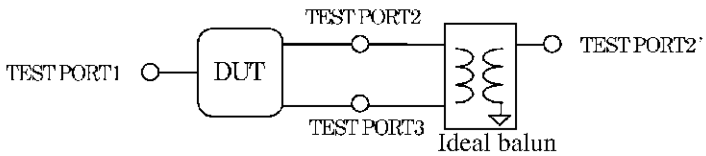
2. Differential balun

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.

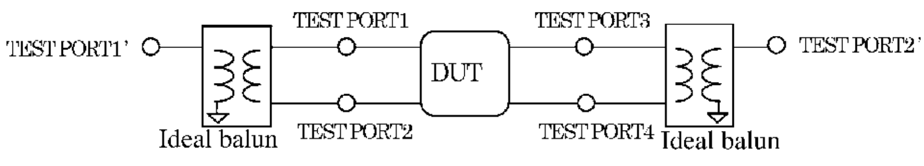
- 3-port devices (OPT13 or 14 required)



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 (OPT 14 required)



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.

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.

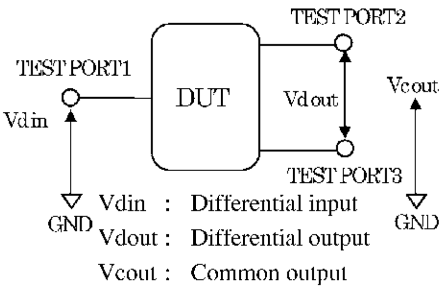
Alphabetic characters	d:	Differential
	c:	Common
Numeric characters	1:	Indicates Test port 1 for 3-port devices, and Balance port 1 formed from Test port 1 and Test port 2 for 4-port devices.
	2:	Indicates Balance port 2 formed from Test port 2 and Test port 3 for 3-port devices, and Balance port 2 formed 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 (OPT13 or 14 required)

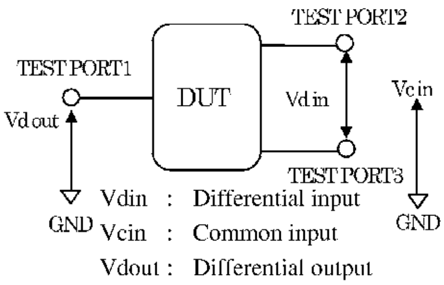
  Test port 1 is an unbalanced port, so there is no distinction between common and differential. Measurement is differential.

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



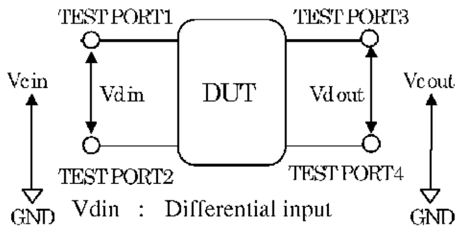
Differential/differential input reflection characteristics: Sdd11
Differential/differential forward transmission characteristics: Sdd21
Differential/common forward transmission characteristics: Scd21

  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

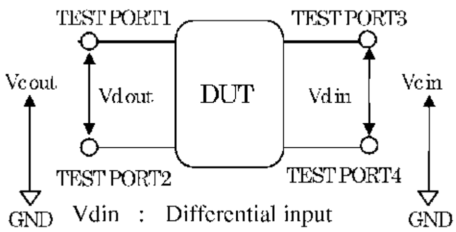
- 4-port devices (OPT14 required)
  1. Forward (Test port 1 and Test port 2 are the inputs, and Test port 3 and Test port 4 are the outputs)



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)

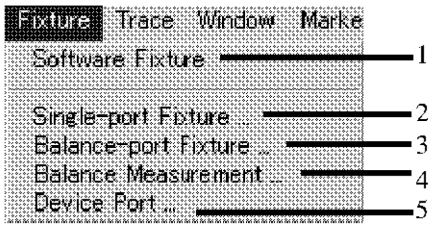


Vdin : Differential input
Vcin : Common input
Vdout : Differential output
Vcout : Common output

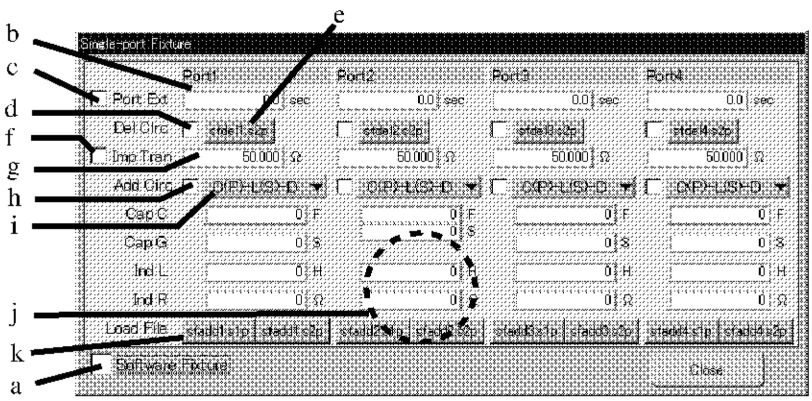
Differential/differential input reflection characteristics: Sdd11
Differential/common input reflection characteristics: Scd11
Common/common input reflection characteristics: Scc11
Common/differential input reflection characteristics: Sdc11
Differential/differential forward transmission characteristics: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

5.8 Operation Methods

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



1. ***Software Fixture*** : Sets ON/OFF for the entire software fixture function. A check mark at the beginning of the menu indicates ON.
2. ***Single-port Fixture*** : Displays the Single-port Fixture dialog box for setting the port extension function, circuit web delete function, impedance transformation 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) Sets ON/OFF of the circuit web delete function by test port.

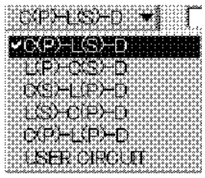
(e) Loads the user-defined circuit file for use in the circuit web delete function by test port.

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

(g) Sets impedance transformation values by test port.

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

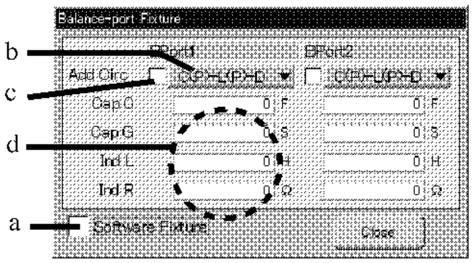
(i) Sets the type of matching circuit by test port.



(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.

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



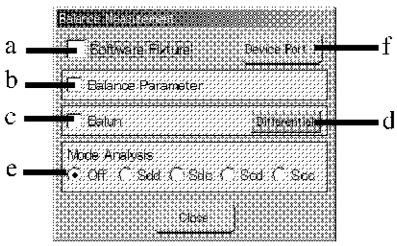
(a) Sets ON/OFF for the entire software fixture function.

(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.

4. ***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.

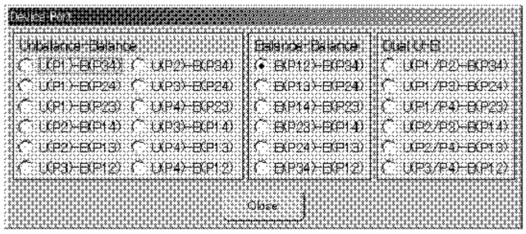
(c) Sets ON/OFF for the Software balun function.

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

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

(f) Displays the Device Port dialog box.

5. ***Device Port*** : Displays the Device Port dialog box.



- 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)

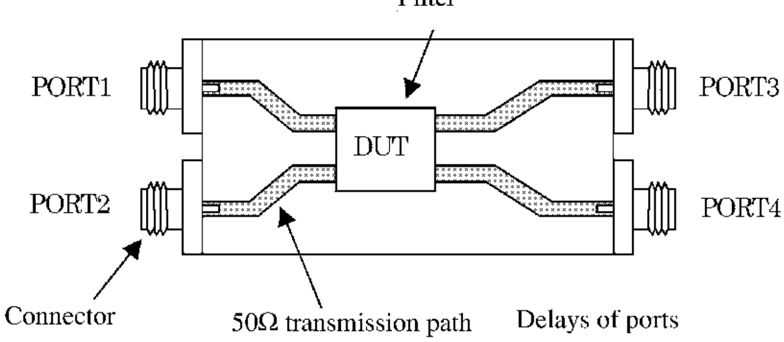
5.9 Measurement Example

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.

OPT14 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 Extension*** 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 transformation settings

The device in this measurement example is a 50(device. Therefore, set the impedance of ports to 50(. Impedance transformation is not necessary for 50(, 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 Transform*** box to activate impedance transformation.
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.
9. Click ***Close*** to close the Balance measurement dialog box.

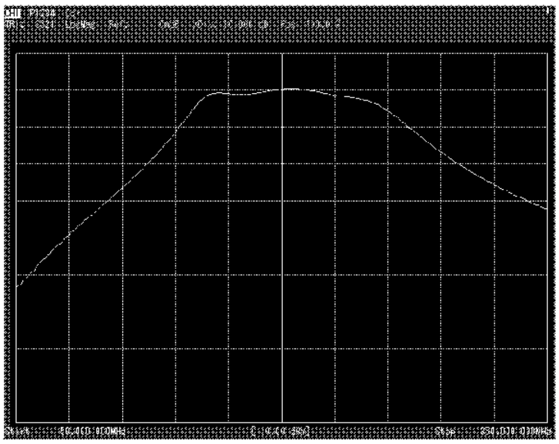
The basic settings of the software fixture function have been completed, but execution of the following software fixture function is necessary for execution of the function (measurement).

Software fixture function execution

Execute the software fixture function and measure transmission characteristics SS21.

10. Click ***Fixture*** and ***Software Fixture*** in the main menu to activate the Software fixture function.
11. Click ***Trace*** in the tool menu to display the Trace side menu.
12. Click ***Trace Parameter*** and ***SS21***.

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



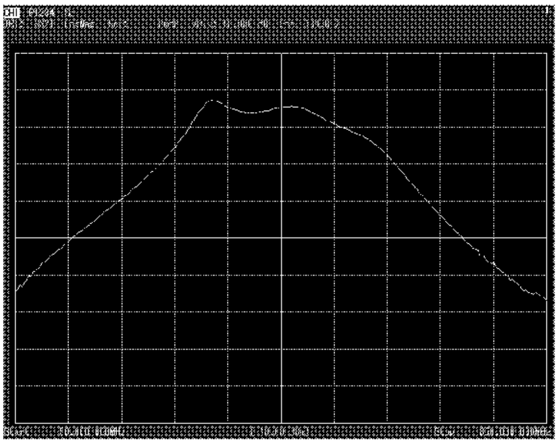
Matching circuit function settings

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.

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

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

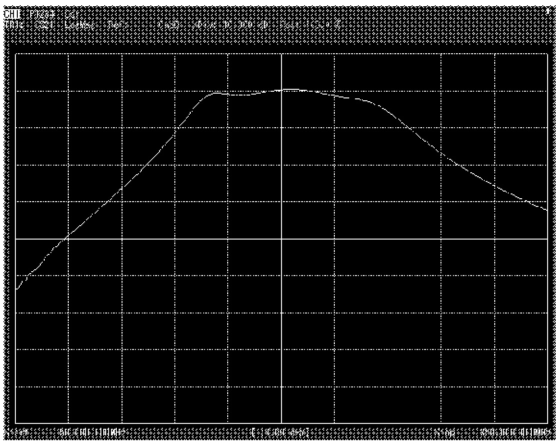


Circuit web delete function settings

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.

18. Click ***Delete Circuit sfdel4.s2p*** to load user-defined circuit file "sfdel4.s2p."
19. Click the ***sfdel4.s2p*** box to activate the circuit web delete function.
20. 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.

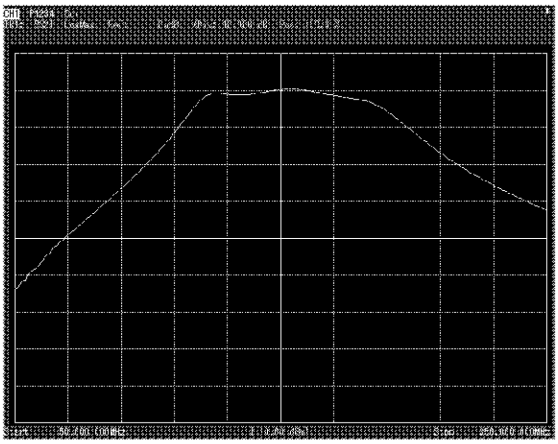


Floating balun settings

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

21. Click ***Fixture*** and ***Balance Measurement*** in the main menu to open the Balance measurement dialog box.
22. Click ***Differential*** to change the setting to ***Floating.***
23. 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.



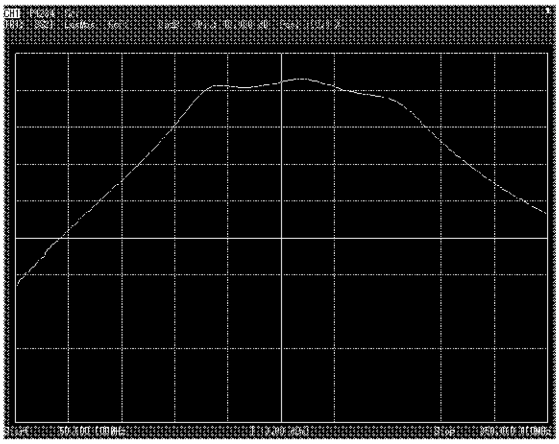
(Reference)
When an unbalanced type of filter is measured, a clear difference appears between the floating balun and the differential balun.

Balance matching circuit settings.

Add a 1.5 pF capacitor as the balance matching circuit between Port 3 and Port 4 (Balance Port 2).

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

It can be seen that matching is obtained and path loss is decreased.

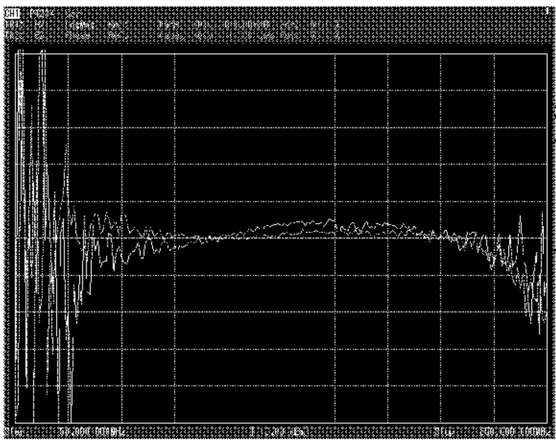


Balance measurement

Measure the balance between Port 1 and Port 2.

28. Click ***Fixture*** and ***Balance Measurement*** in the main menu to open the Balance measurement dialog box.
29. Click the ***Balance Parameter*** box to activate balance measurement.
30. Click ***Close*** to close the Balance measurement dialog box.
31. Click ***Trace*** in the tool menu to display the Trace side menu.
32. Click ***Trace Parameter*** and ***B21*** to set to balance B21.
    Also set the trace to B21 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

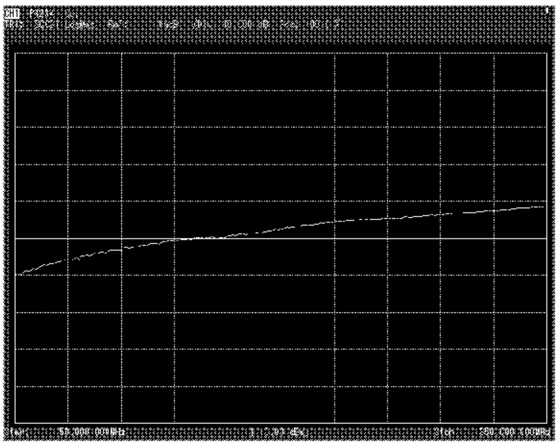
Trace 1	B21 LogMag	
	Ref.Posion	50%
	Ref.Value	0 dB
	/Div	0.1 dB
Trace 2	B21 Phase	
	Ref.Posion	50%
	Ref.Value	0 deg
	/Div	1 deg

Mode Analysis Execution

Discriminate and measure the common components and differential components.

33. Click ***Fixture*** and ***Balance Measurement*** in the main menu to open the Balance measurement dialog box.
34. Click ***Mode Analysis Scc*** to activate common input-common output measurement.
35. Click ***Trace*** in the tool menu to display the Trace side menu.
36. Click ***Trace Parameter*** and ***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.

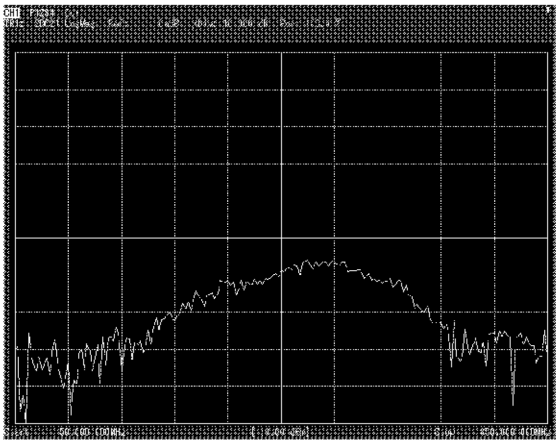


Setting conditions

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

37. Click ***Mode Analysis Sdc*** to activate common input-differential output measurement.
38. Click ***Trace Parameter*** and ***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.

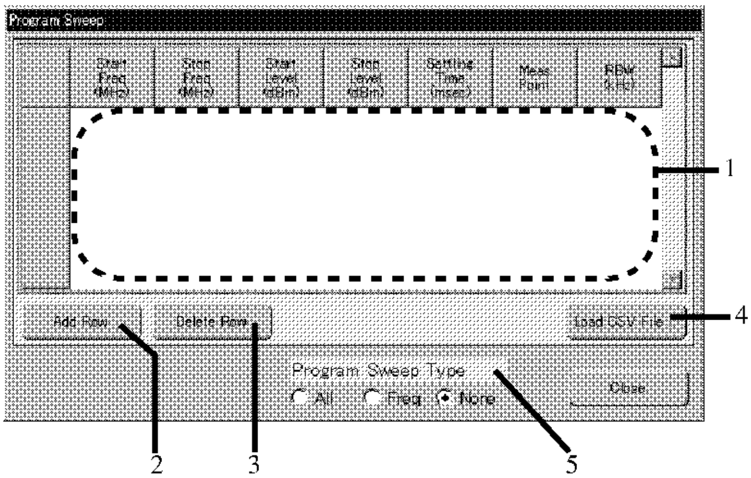


6. PROGRAM SWEEP

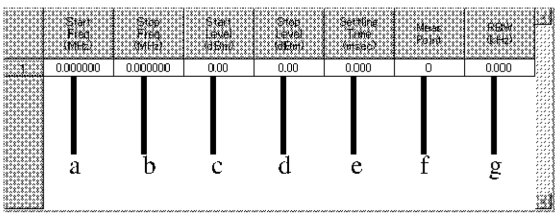
Program Sweep divides the measurement range into segments, and allows optional settings for the measurement points of frequency, RBW, and power by segment. Optimum measurement conditions for measurement items can be set, so measurement accuracy can be raised and measurement time can be reduced.

6.1 Program Sweep Editing

Click ***Sweep*** 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. Segment Display Area
2. ***Add Row*** : Adds a segment.
   Clicking displays Segment 1 in the Segment Display Area. Input the items to set the segment.



(a) Start frequency of the segment
(b) Stop frequency of the segment
(c) Start level of the segment
(d) Stop level of the segment
(e) Start waiting time of the segment
(f) Number of points in the segment
(g) RBW of the segment

3. ***Delete Row*** : Deletes a segment.
   Clicking deletes the segment with the highest number.

4. ***Load CSV File*** : Loads the segment data from the CSV file.

   Describe the CSV file write for each line by entering the seven items of Start frequency (MHz), Stop frequency (MHz), Start level (dBm), Stop level (dBm), Start waiting time (ms), number of points, and RBW (KHz) separated by commas.

   Lines not conforming to the above write format are ignored.

   Items exceeding the maximum number of segments are ignored.

5. ***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.

   Frequency:
   Activates only the frequencies and points specified by the segment.

   None: Does not execute program sweep.

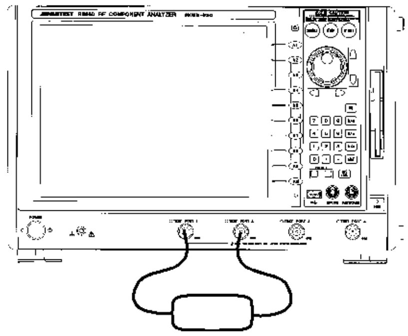
6.2 Measurement Example

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 ***Sweep*** in the tool menu and then click ***Sweep Type*** and ***Edit Prgm Swp*** side menu to display the Program Sweep dialog box.
6. Click ***Add Row*** in the dialog box to display Segment 1.
   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. Click the Start Freq (MHz) cell of Segment 1, and input **7, 0, 0** and **ENT**.
8. Click the Stop Freq (MHz) cell of Segment 1, and input **8, 0, 0** and **ENT**.
9. Click the Meas Point cell of Segment 1, and input **1, 0, 0** and **ENT**.
10. Click the RBW (KHz) cell of Segment 1, and input **1, 0** and **ENT**.

Segment 2 settings

11. Click ***Add Row*** in the dialog box to display Segment 2.
    Set a start frequency of 860 MHz and stop frequency of 900 MHz to measure the interference range 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. Click the Start Freq (MHz) cell of Segment 2, and input **8, 6, 0** and **ENT**.
13. Click the Stop Freq (MHz) cell of Segment 2, and input **9, 0, 0** and **ENT**.
14. Click the Meas Point cell of Segment 2, and input **2, 0, 0** and **ENT**.
15. Click the RBW (KHz) cell of Segment 2, and input **1, 0** and **ENT**.

Segment 3 settings

16. Click ***Add Row*** in the dialog box to display Segment 3.
    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. Click the Start Freq (MHz) cell of Segment 3, and input **1, 6, 0, 0** and **ENT**.
18. Click the Stop Freq (MHz) cell of Segment 3, and input **1, 8, 0, 0** and **ENT**.
19. Click the Meas Point cell of Segment 3, and input **1, 0, 0** and **ENT**.
20. Click the RBW (KHz) cell of Segment 3, and input **1, 0, 0** and **ENT**.

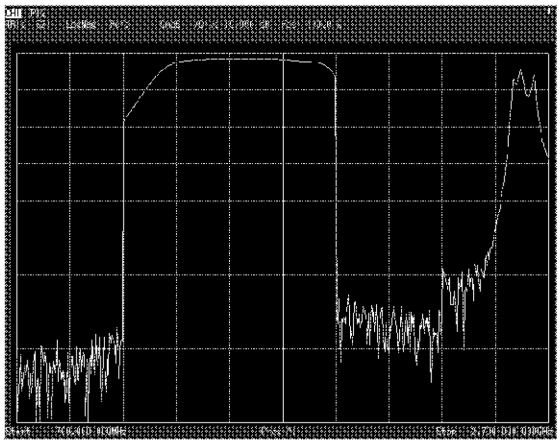
Segment 4 settings

21. Click ***Add Row*** in the dialog box to display Segment 4.
    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. Click the Start Freq (MHz) cell of Segment 4, and input **2, 4, 0, 0** and **ENT**.
23. Click the Stop Freq (MHz) cell of Segment 4, and input **2, 7, 0, 0** and **ENT**.
24. Click the Meas Point cell of Segment 4, and input **1, 0, 0** and **ENT**.
25. Click the RBW (KHz) cell of Segment 4, and input **4, 0, 0** and **ENT**.

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.

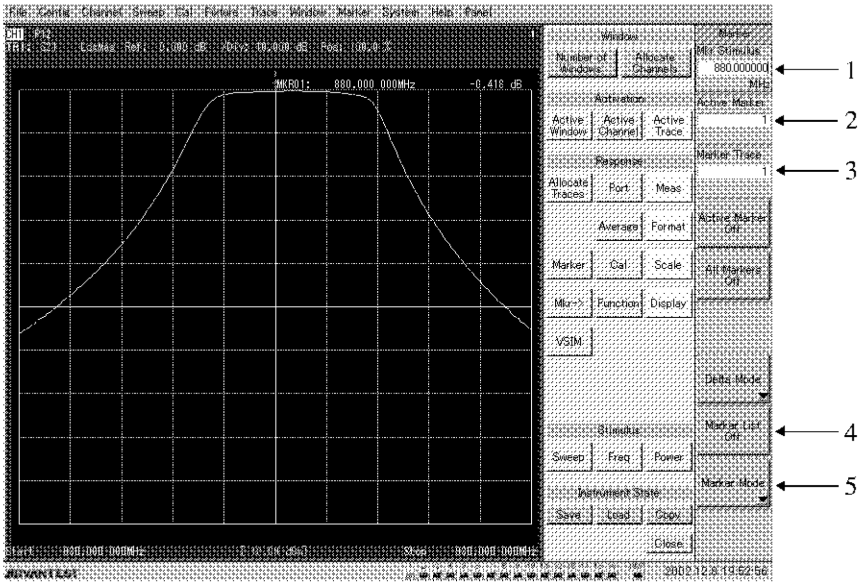


7. MARKER FUNCTION

Measurement data can be read by using markers. For each measurement channel, 10 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.
Markers are set in the active channel.



1. Setting the marker frequency

   Click ***Mkr Stimulus*** to specify the active marker frequency (or the power value for the power sweep).

2. Setting an active marker

   Click ***Active Marker*** to specify an active marker. The encoder and up-down keys are used to activate displayed markers. To display a new active marker, specify a marker number by using the value input keys.

3. 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.

4. Displaying the marker list

   Click ***Marker List Off*** to set ***Marker List On*** and display all the marker data in a list. Clicking ***Marker Mode***, ***Marker List Upper***, or ***Marker List Lower*** changes the display position.

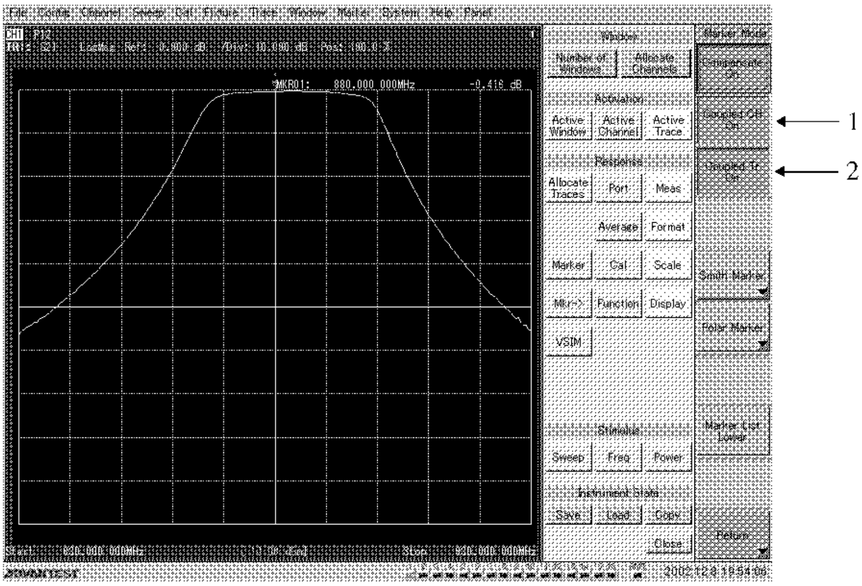
5. Setting a marker mode

   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 8.2.3.11, "Marker."

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



1. Coupling function between channels

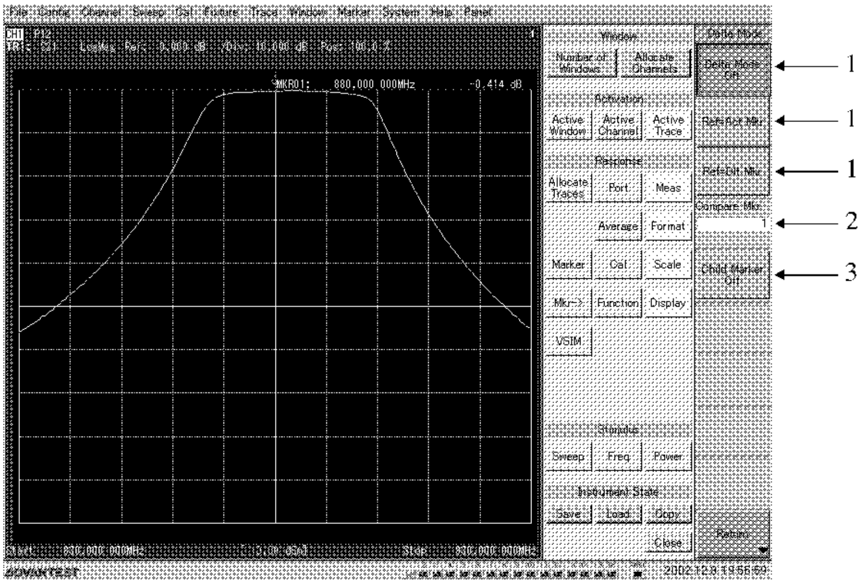
   Clicking the ***Coupled CH Off*** to set ***Coupled CH On*** couples markers to active channel markers. The ON or OFF setting is common for all channels. Channels to be coupled with active channels can be specified separately. For more information on the coupling function, refer to 8.2.2.8, "Marker."

2. Coupling function between traces

   Clicking the ***Coupled Tr Off*** to set ***Coupled Tr On*** displays the markers on all currently displayed active channel traces. Each channel can be set to ON or OFF. All channels can be set to ON or OFF in a dialog box. For more information on the coupling function, refer to 8.2.2.8, "Marker."

7.3 Delta Mode

Select ***Marker*** 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.

   Ref=Act Mkr : Sets Active Marker as the reference marker and finds the difference with the marker number set in ***Compare Mkr***.

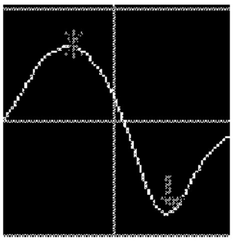
   Ref=Dlt Mkr : Sets the reference marker as a child marker and obtains the difference with the active marker. If the child marker is not displayed when setting, the child marker is displayed. The child marker disappears by setting the Delta Mode to Off or clicking ***Child Marker Off***.

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 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.

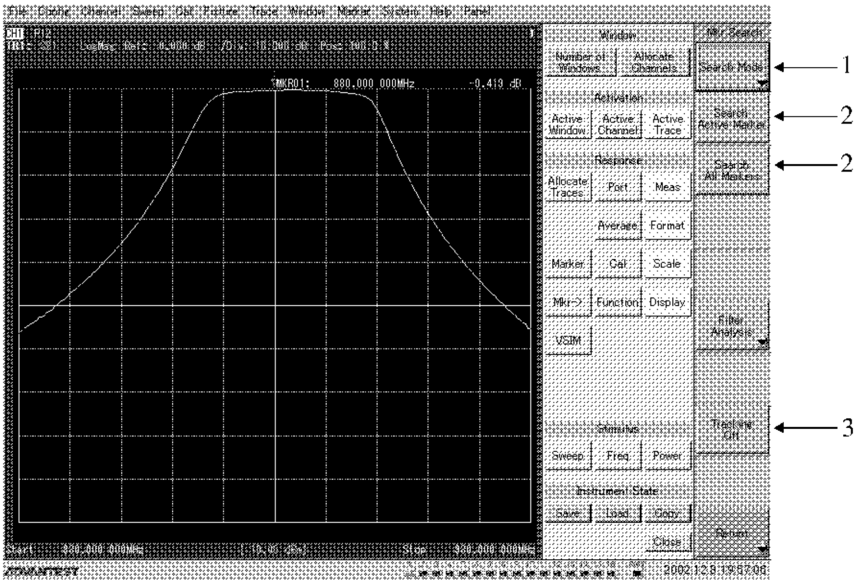


Active Marker(▽) and Child marker(*).

7.4 Marker Search

Select ***Marker*** in the tool menu. Select ***Mkr->*** and ***Marker Search*** as selections appear to display the Mkr 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 8.2.3.14, "Mkr->."

2. Executing a search

   Click ***Search Active 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.

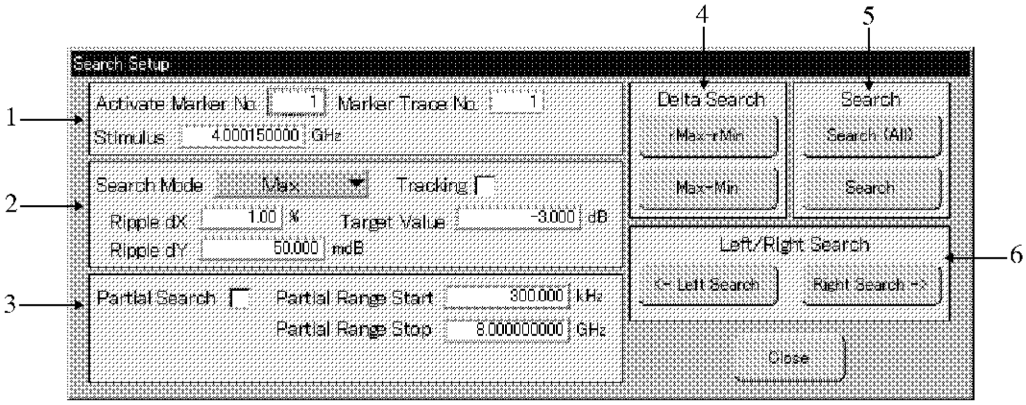
3. Executing a continuous search

   Click ***Tracking Off*** to set ***Tracking On*** and execute a search on completion of each sweep.

7.5 Search Setup

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

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



1. Active Marker Setup

   Sets the Activate Marker No., Marker Trace No., and Stimulus for the selected active marker. *1

   *1: Stimulus displayed in the menu or dialog does not follow during a search.

2. Search Mode

   Sets the active marker search related settings. Each item can be set independently for every marker. The settings include Search mode, Tracking, Target Value, Ripple dX, and Ripple dY. For further details on Search Mode, refer to 8.2.3.14, "Mkr->."

3. Partial Search

   Sets the Partial Search mode.
   Each item can be set for individual markers.

Partial Search:	Sets Partial Search to ON or OFF. Checking the box sets Partial Search to ON.
Partial Range Start:	Specifies the partial range analysis start point.
Partial Range Stop:	Specifies the partial range analysis stop point.

4. Delta Search

   Sets the search mode and delta mode combined analysis.

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.

5. 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.

6. Left/Right Search

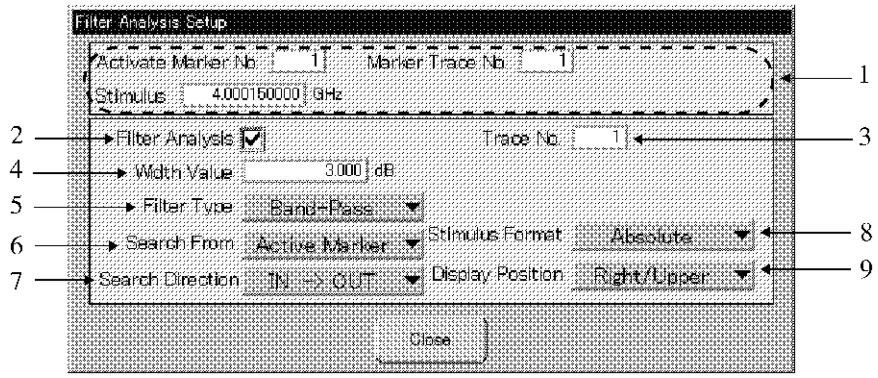
   Searches for data to the left and right of the active marker.

   Left Search: Searches for data to the left of the active marker.

   Right Search: Searches for data to the right of the active marker.

7.6 Filter Analysis

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



1. Active Marker Setup

   Sets Activate Marker No., Marker Trace No., and Stimulus. *1

   *1: Stimulus displayed in the menu or dialog does not follow during a search.

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. Trace No.

   Specifies the trace number to analyze.

4. Width Value

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

5. 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>.

6. Search from

   Sets the search reference point.

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

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

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

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

7. Search Direction

   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.

8. Stimulus Format

   Selects the bandwidth display format.

   Absolute: Displays the bandwidth by using the absolute value.

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

9. Display Position

   Used to specify the position to display analysis results.

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

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

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

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

The above stated settings can also be specified by clicking ***Mkr->*** in the tool menu and then ***Marker Search*** and ***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 3 dB below the minimum loss point in the range and C/F' is the bandwidth center frequency.

  Q = C.F' / B.W'

  The Shaping Factor is found by using the following equation where; B.W' is the bandwidth 3 dB below the minimum loss point in the range and B.W" is the bandwidth 60 dB below t the minimum loss point.

  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

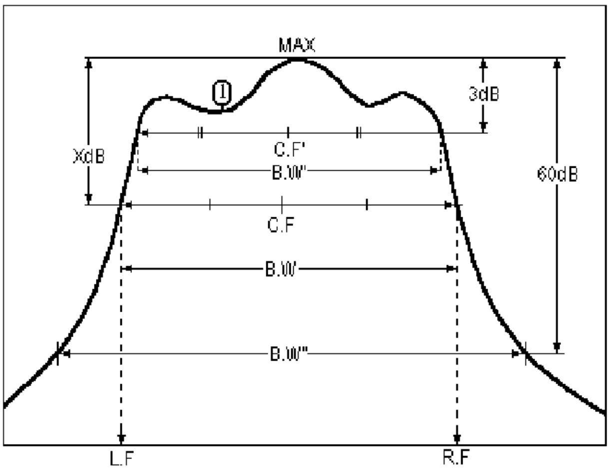


Figure 7-1 Band-Pass Filter and MAX Reference

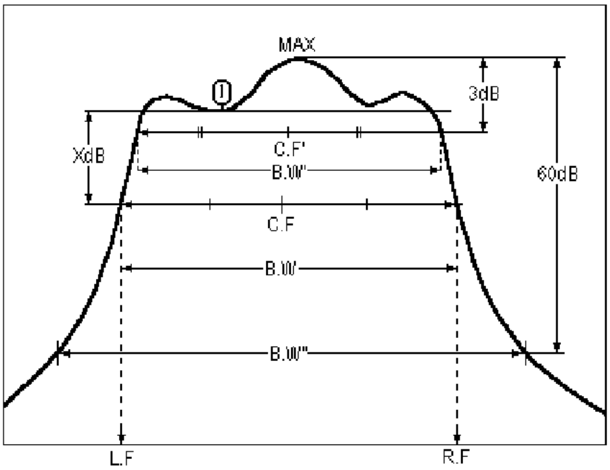


Figure 7-2 Band-Pass Filter and Active Marker Reference

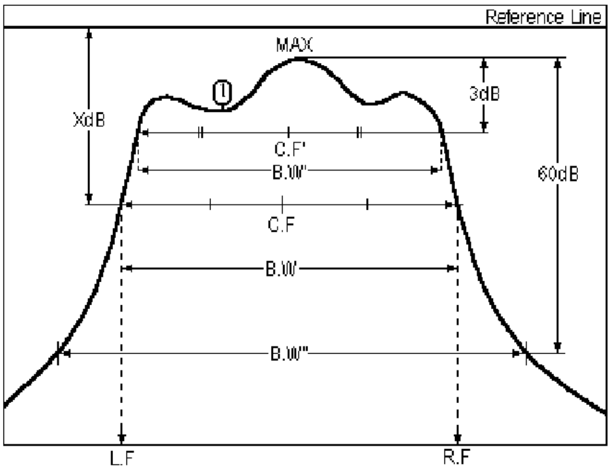


Figure 7-3 Band-Pass Filter and Reference Line Reference

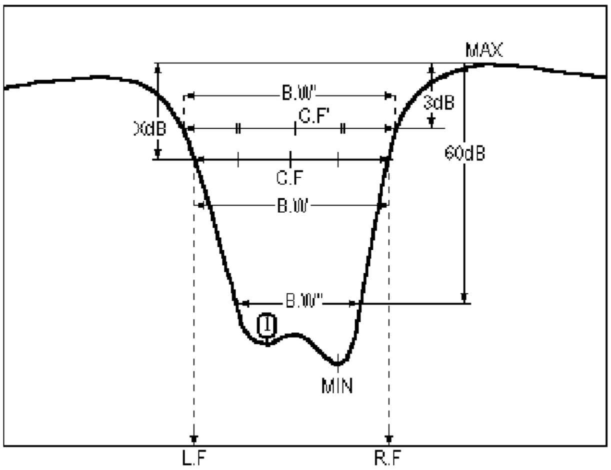


Figure 7-4 Notch Filter and MAX Reference

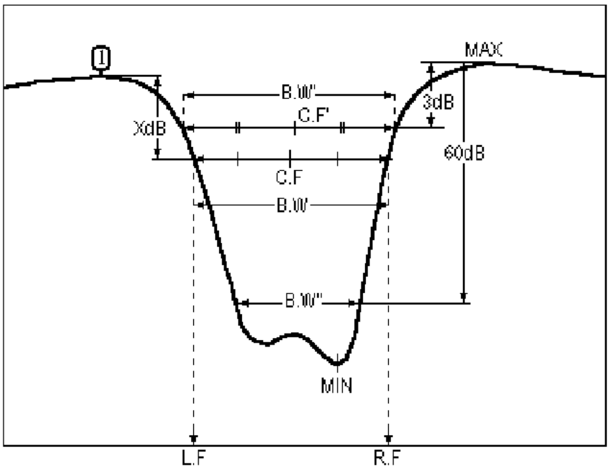


Figure 7-5 Notch Filter and Active Marker Reference

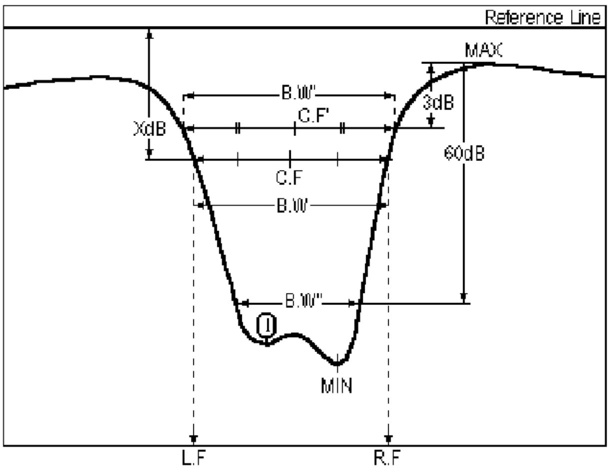


Figure 7-6 Notch Filter and Reference Line Reference

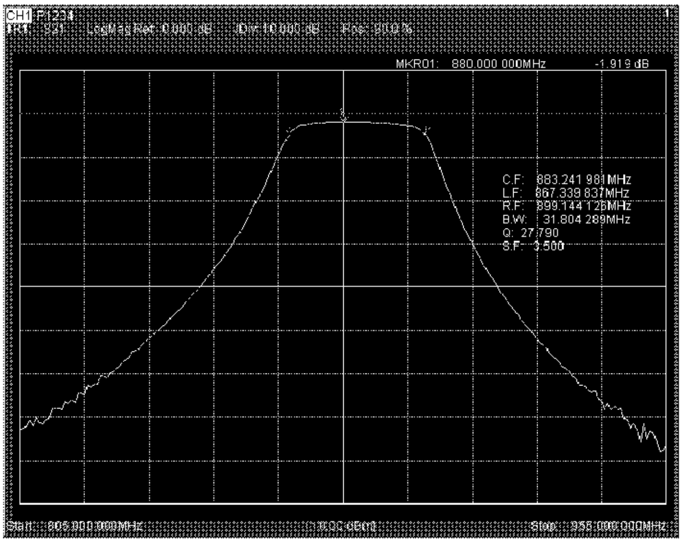


Figure 7-7 Filter Analysis Performed Sample

8. REFERENCE

This section explains the functions of the main menu, dialog boxes, side menus, and tool menus.

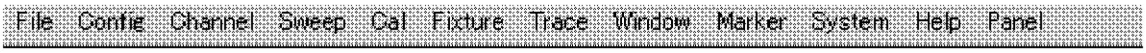
8.1 Menu Index

Use this menu index as an index for Section 8.

8.2 Function Explanations

8.2.1 Main Menu

The functions of this analyzer are divided by group, with the following menus in the main menu.



File	Executes save, reuse, print, and application software.
Config	Sets the operating status of measurement channels (sixteen channels). Abbreviation for configuration.
Channel	Sets the active measurement channel (active channel).
Sweep	Sets the measurement conditions of the active channel.
Cal	Executes calibration of the active channel. Abbreviation for calibration.
Fixture	Sets and executes the software fixture function of the active channel.
Trace	Sets the analysis and display scale of measurement data of the active channel.
Window	Sets the display window of the measurement data.
Marker	Sets the marker function of the active channel.
System	Sets the system function.
Help	Help function.
Panel	Sets the tool menu display and side menu display to ON or OFF.

Selecting menus displays pull-down menus. This section explains the pull-down menus for various menus.

1. File pull-down menu

   Executes save, reuse, print, and application software.

Load Setting	Displays the Load dialog box.
Save Setting	Displays the Save dialog box.
Define Save Option	Displays the Define Save Option dialog box.
Delete File	Displays the Delete dialog box.
Save S-parameter	Displays the Save S-parameter dialog box.
Save Trace	Displays the Save Trace dialog box.
Save Bitmap Data	Saves the displayed picture image in a file.
Save Bitmap Data	Displays the Save dialog box.
Execution	Displays the Execution dialog box.
Print	Displays the Print dialog box.

2. Configuration pull-down menu

   Sets the operational status of measurement channels (sixteen channels).

Instrument Configuration	Displays the Instrument Configuration dialog box.
PIO Setting	Displays the PIO dialog box.
Test Set Setting	Displays the Test set dialog box.

3. Channel pull-down menu

   Sets the active measurement channel and assigns it to the active window. A check mark is added to a measurement channel set as active.

CH n	Sets a channel to the active channel.

   NOTE: "n" indicates a channel number.

4. Sweep pull-down menu

   Sets the measurement conditions.

Measure Port	Displays the Measurement Port dialog box.
Frequency	Displays the Frequency dialog box.
Power	Displays the Power dialog box.
Sweep Condition	Displays the Sweep Condition dialog box.
Edit Program Sweep	Displays the Edit Program Sweep dialog box.

5. Calibration pull-down menu

   Executes calibration.

Correct	Toggles between Correct ON/OFF.
Auto Cal	Displays the Auto Cal side menu.
Port Extension	Displays the Port Extension dialog box.
Electrical Delay	Displays the Electrical Delay dialog box.

6. Fixture pull-down menu

   Sets and executes the software fixture function.

Software Fixture	Toggles between Software fixture ON/OFF.
Single-port Fixture	Displays the Single-port Fixture dialog box.
Balance-port Fixture	Displays the Balance-port Fixture dialog box.
Balance Measurement	Displays the Balance Measurement dialog box.
Device Port	Displays the Device Port dialog box.

7. Trace pull-down menu

   Sets the analysis and display scale of measurement data.

Trace	Displays the Trace dialog box.
Memory	Displays the Memory dialog box.
Scale	Displays the Scale dialog box.
Auto Scale	Executes Auto Scale for all traces.
Limit Test	Displays the Limit Test dialog box.
Judgement Trace	Displays the Judgement Trace dialog box.
Edit Limit Line	Displays the Limit Line Editor dialog box.

8. Window pull-down menu

   Sets the display window.

Window Trace	Displays the Window Trace dialog box.
Window No	Displays the Window dialog box.
Window Layout	Displays the Window Layout dialog box.

Screen Layout Displays the Screen Layout dialog box.

9. Marker pull-down menu
   Sets the marker function.
   Selecting this menu displays another sub pull-down menu.
   Marker Setup Displays the Marker Setup sub pull-down menu.
   Analysis Marker Displays the Analysis Marker sub pull-down menu.

   Marker Setup sub pull-down menu
   Sets the basic functions of markers.
   Marker Setup Displays the Marker Setup dialog box.
   Coupled Ch Displays the Marker Coupled Channel dialog box.

   Analysis Marker sub pull-down menu
   Sets the marker analysis functions.
   Delta Marker Displays the Delta Marker dialog box.
   Search Setup Displays the Search Setup dialog box.
   Partial Search Displays the Partial dialog box.
   Filter Analysis Displays the Filter Analysis Setup dialog box.

10. System pull-down menu
    Sets the system function.
    Preset Initializes the analyzer.
    GPIB Address Displays the GPIB Address dialog box.
    Network Config Displays the Network Config dialog box.
    Add Printer Displays the Printer Install dialog box.
    Time Adjust Displays the Time Adjust dialog box.
    Explorer Displays the file operating environment (Explorer).

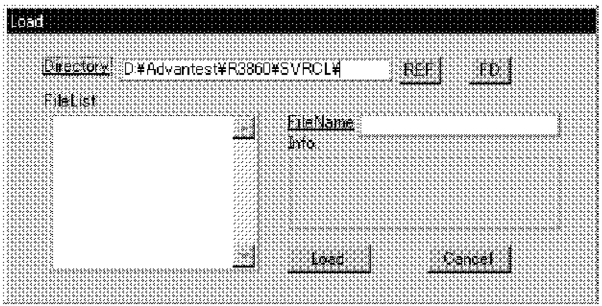
11. Panel pull-down menu
    Sets the menu display to ON or OFF. Displays " √ " for the menu set to ON.
    Tool Menu Displays the tool menu.
    Side Menu Displays the side menu.

8.2.2 Dialog Boxes

This section explains dialog boxes displayed by the main menu or side menus.

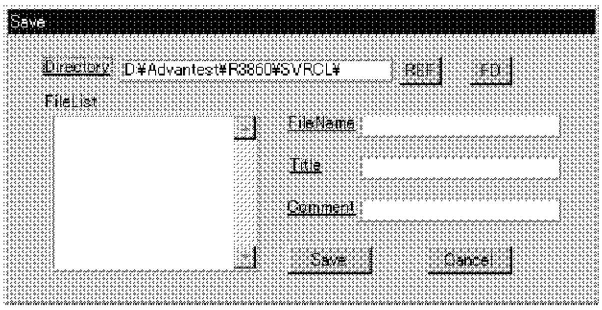
8.2.2.1 File

1. 1. Load dialog box
   Loads and reuses saved files of the analyzer's setting conditions.
   Operation of ***File*** and ***Load Setting*** in the main menu displays this dialog box.



REF	:	Displays the contents of the standard directory in the file list.
FD	:	Displays the contents of the floppy disk in the file list.
File List	:	Displays the file list.
File Name	:	Inputs the file name.
Info.	:	Displays the selected file information.
Load	:	Performs load, reuse, and execute.
Cancel	:	Cancels settings.

2. Save dialog box
   Saves the analyzer's setting conditions to a file.
   Operation of ***File*** and ***Save Setting*** in the main menu displays this dialog box.



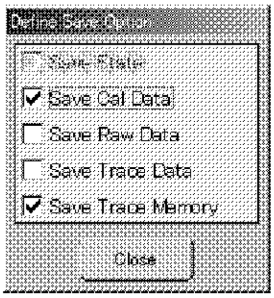
REF	:	Displays the contents of the standard directory in the file list.
FD	:	Displays the contents of the floppy disk in the file list.
File List	:	Displays the file list.
File Name	:	Inputs the file name.

Title : Inputs the title of the file.
Comment : Inputs file comments.
Save : Executes save.
Cancel : Cancels settings.

3. Define Save Option dialog box

   Saves the measurement condition settings by using Save Setting.

   Select File in the main menu. Then, select Define Save Option to display the dialog box.

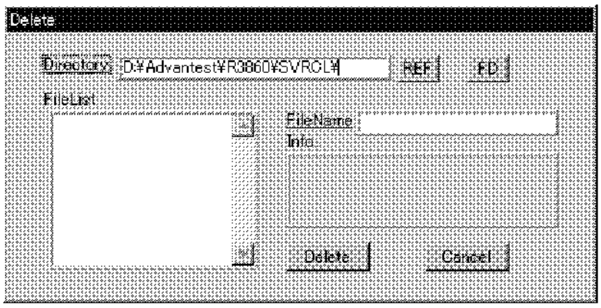


Save Cal Data : Selecting this item saves the calculated data when Save Setting is executed.
Save Raw Data : Selecting this item saves the raw measurement data when Save Setting is executed.
In this case, executing Load Setting sets the sweep condition to stop.
Save Trace Data: Selecting this item saves the before format trace data.
In this case, executing Load Setting sets the sweep condition to stop.
Save Trace Memory:
Selecting this item saves the trace memory.

4. Delete dialog box

   Deletes the setting conditions file of the analyzer.

   Operation of ***File*** and ***Delete File*** in the main menu displays this dialog box.



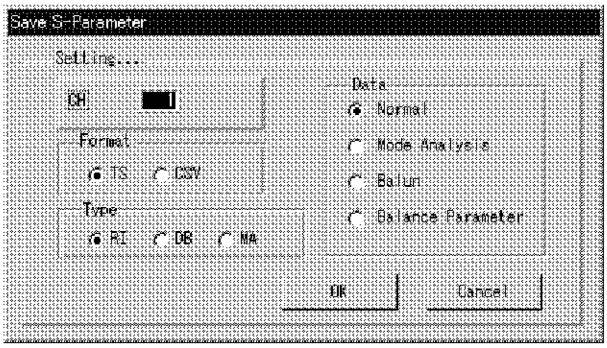
REF : Displays the contents of the standard directory in the file list.
FD : Displays the contents of the floppy disk in the file list.
File List : Displays the file list.
File Name : Inputs the file name.
Info. : Displays the selected file information.
Delete : Executes deletion.

Cancel : Cancels settings.

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.

- TS : Specifies TS format.
- CSV : Specifies CSV format.

Type : Selects the data type.

- RI : Real/Imaginary
- DB : dB/Degree
- MA : Linear/Degree

Data : Selects the data.

- Normal : S-parameters
- Mode Analysis : Mode analysis results
- Balun : Balun transformation results
- Balance Parameter : Balance parameters

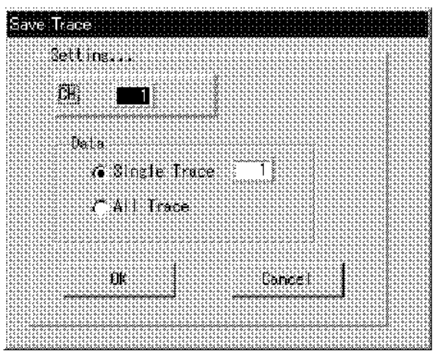
OK : Displays the dialog box for saving to a file.

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 Trace : Saves the specified trace.

All Trace : Saves all valid traces.

OK : Displays the dialog box for saving to a file.

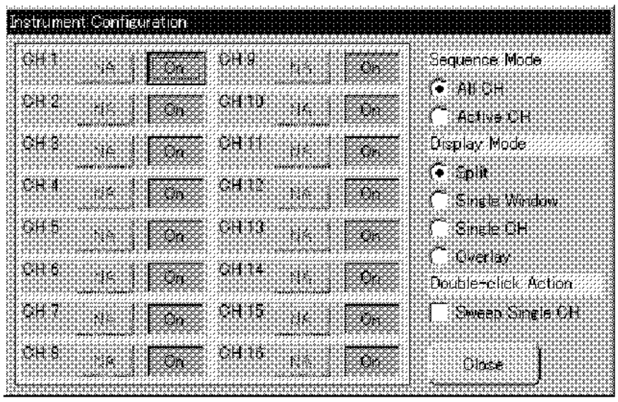
Cancel : Cancels settings.

8.2.2.2 Config

1. Instrument Configuration dialog box

   Sets the operating status of the analyzer.

   Operation of ***Config*** and ***Instrument Configuration*** in the main menu displays this dialog box.



CH No. On/Off : Selects execute measurement/suspend for measurement channels when the measurement sequence is all channels.

On : Executes measurement.

Off : Suspends measurement.

Sequence Mode : Sets the measurement sequence of measurement channels.

All CH : Measures all channels in channel number sequence.

Active CH: Measures only active channels.

Display Mode : Sets the measurement channel display mode.

Split : Splits the screen and displays all windows.

Single Window : Displays only the active window.

Single CH: Displays only the active channel.

Overlay : Displays and overlaps all windows.

Double-click Action : Sets the operation to be performed by double-clicking.

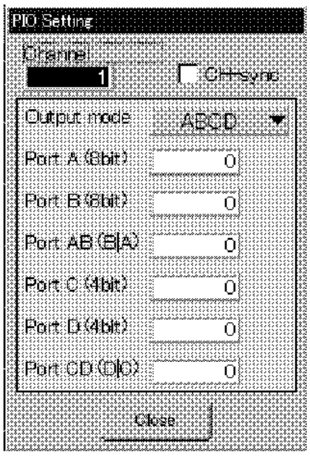
ON : Sets Display Mode to Single Window and Sequence Mode to Active CH.

OFF : Sets Display Mode to Single Window. Sequence Mode is unchanged.

2. PIO dialog box

   Sets parallel I/O.

   Operation of ***Config*** and ***PIO Setting*** in the main menu displays this dialog box.



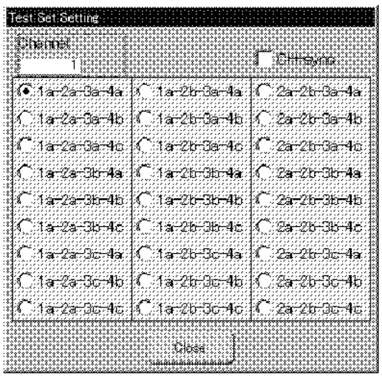
Channel	:	Selects the channel for channel synchronization setting.
CH-sync	:	Selects the channel synchronization setting. Synchronization setting outputs the set data by measured channel.
Output Mode	:	Sets the output mode.

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.

3. Test set dialog box

   Controls the R3968 Test Set.

   Operation of ***Config*** and ***Test Set Setting*** in the main menu displays this dialog box.



Channel	:	Selects the channel for channel synchronization setting.
CH-sync	:	Selects the channel synchronization setting. Synchronization setting toggles the set port by measured channel.
Port Connection	:	Sets the ports of the R3968 Test Set.

1a-2a-3a-4a	:	Sets the R3968 to Port 1a, Port 2a, Port 3a, and Port 4a.

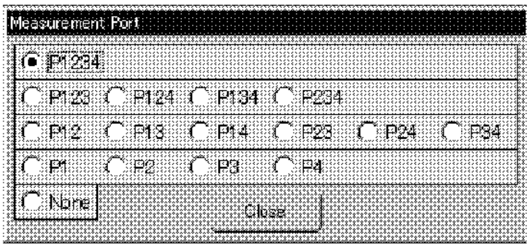
1a-2a-3a-4b	:	Sets the R3968 to Port 1a, Port 2a, Port 3a, and Port 4b.
1a-2a-3a-4c	:	Sets the R3968 to Port 1a, Port 2a, Port 3a, and Port 4c.
1a-2a-3b-4a	:	Sets the R3968 to Port 1a, Port 2a, Port 3b, and Port 4a.
1a-2a-3b-4b	:	Sets the R3968 to Port 1a, Port 2a, Port 3b, and Port 4b.
1a-2a-3b-4c	:	Sets the R3968 to Port 1a, Port 2a, Port 3b, and Port 4c.
1a-2a-3c-4a	:	Sets the R3968 to Port 1a, Port 2a, Port 3c, and Port 4a.
1a-2a-3c-4b	:	Sets the R3968 to Port 1a, Port 2a, Port 3c, and Port 4b.
1a-2a-3c-4c	:	Sets the R3968 to Port 1a, Port 2a, Port 3c, and Port 4c.
1a-2b-3a-4a	:	Sets the R3968 to Port 1a, Port 2b, Port 3a, and Port 4a.
1a-2b-3a-4b	:	Sets the R3968 to Port 1a, Port 2b, Port 3a, and Port 4b.
1a-2b-3a-4c	:	Sets the R3968 to Port 1a, Port 2b, Port 3a, and Port 4c.
1a-2b-3b-4a	:	Sets the R3968 to Port 1a, Port 2b, Port 3b, and Port 4a.
1a-2b-3b-4b	:	Sets the R3968 to Port 1a, Port 2b, Port 3b, and Port 4b.
1a-2b-3b-4c	:	Sets the R3968 to Port 1a, Port 2b, Port 3b, and Port 4c.
1a-2b-3c-4a	:	Sets the R3968 to Port 1a, Port 2b, Port 3c, and Port 4a.
1a-2b-3c-4b	:	Sets the R3968 to Port 1a, Port 2b, Port 3c, and Port 4b.
1a-2b-3c-4c	:	Sets the R3968 to Port 1a, Port 2b, Port 3c, and Port 4c.
2a-2b-3a-4a	:	Sets the R3968 to Port 2a, Port 2b, Port 3a, and Port 4a.
2a-2b-3a-4b	:	Sets the R3968 to Port 2a, Port 2b, Port 3a, and Port 4b.
2a-2b-3a-4c	:	Sets the R3968 to Port 2a, Port 2b, Port 3a, and Port 4c.
2a-2b-3b-4a	:	Sets the R3968 to Port 2a, Port 2b, Port 3b, and Port 4a.
2a-2b-3b-4b	:	Sets the R3968 to Port 2a, Port 2b, Port 3b, and Port 4b.
2a-2b-3b-4c	:	Sets the R3968 to Port 2a, Port 2b, Port 3b, and Port 4c.
2a-2b-3c-4a	:	Sets the R3968 to Port 2a, Port 2b, Port 3c, and Port 4a.
2a-2b-3c-4b	:	Sets the R3968 to Port 2a, Port 2b, Port 3c, and Port 4b.
2a-2b-3c-4c	:	Sets the R3968 to Port 2a, Port 2b, Port 3c, and Port 4c.

8.2.2.3 Sweep

1. Measurement Port dialog box

   Sets the measurement port.

   Operation of ***Sweep*** and ***Measurement Port*** in the main menu displays this dialog box.

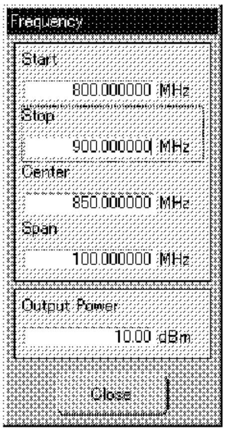


P1234 : Sets 4-port measurement of Port 1, Port 2, Port 3, and Port 4.
P123 : Sets 3-port measurement of Port 1, Port 2, and Port 3.
P124 : Sets 3-port measurement of Port 1, Port 2, and Port 4.
P134 : Sets 3-port measurement of Port 1, Port 3, and Port 4.
P234 : Sets 3-port measurement of Port 2, Port 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.

2. Frequency dialog box

   Sets the frequency.

   Operation of ***Sweep*** and ***Frequency*** in the main menu displays this dialog box.

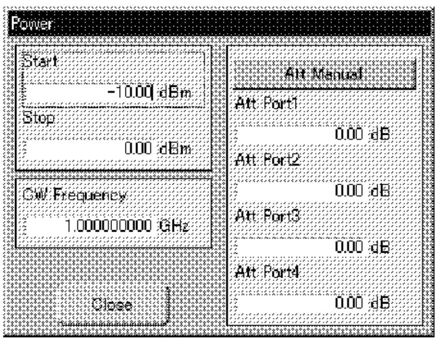


Start : Sets the start frequency.
Stop : Sets the stop frequency.
Center : Sets the center frequency.
Span : Sets the span frequency.
Output Power : Sets the output power.

3. Power dialog box

   Sets the output power for level sweep.

   Operation of ***Sweep*** and ***Power*** in the main menu displays this dialog box.



Start : Sets the start power for level sweep.
Stop : Sets the stop power for level sweep.
CW Frequency : Sets the CW frequency for level sweep.
Att Auto/Manual: 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.

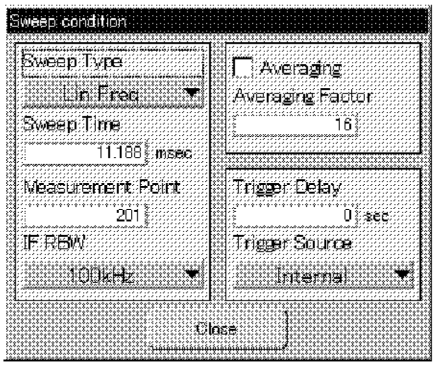
Manual : Manually sets attenuator values for each port.

Port1 Att : Sets an attenuator value for Port 1.
Port2 Att : Sets an attenuator value for Port 2.
Port3 Att : Sets an attenuator value for Port 3.
Port4 Att : Sets an attenuator value for Port 4.

4. Sweep Condition dialog box

   Sets the sweep conditions.

   Operation of ***Sweep*** and ***Sweep Condition*** in the main menu displays this dialog box.



Sweep type : Sets the sweep mode.
- Lin Freq : Sets the sweep mode to linear frequency sweep.
- Log Freq : Sets the sweep mode to log frequency sweep.
- Power : Sets the sweep mode to level sweep.
- Prog Freq: Sets only the frequency to program sweep.
- Prog All : Sets all items to program sweep.

Sweep time : Sets the sweep time.

Measurement Point:
Sets the number of measurement points.

IF RBW : Sets IF RBW.

Averaging : Sets averaging ON/OFF.

Averaging Factor: Sets the averaging factor.

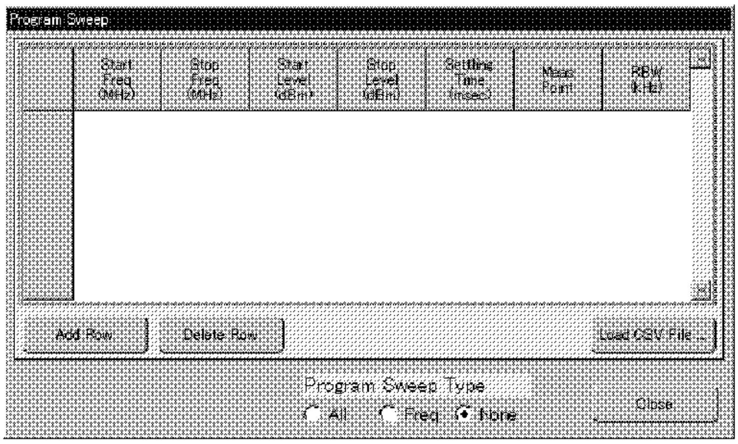
Trigger Delay : Sets the trigger delay time.

Trigger Source : Selects the trigger source.
- Internal : Sets the trigger source to internal trigger.
- External : Sets the trigger source to external trigger.
- Bus : *TRG, GET becomes the trigger.
- Hold : Suspends detection.

5. Edit Program Sweep dialog box

   Sets program sweep.

   Operation of ***Sweep*** and ***Edit Program Sweep*** in the main menu displays this dialog box.



Start Freq (MHz) : Sets the start frequency of the segment.

Stop Freq (MHz) : Sets the stop frequency of the segment.

Start Level : Sets the start level of the segment.

Stop Level : Sets the stop level of the segment.

Settling Time : Sets the settling time of the segment.

Meas Point : Sets the number of measurement points of the segment.

RBW (KHz) : Sets the IF RBW of the segment.

Add Row : Adds a segment.

Delete Row : Deletes a segment.

Load CSV File : Loads the settings from a CSV file.
Refer to 6 "PROGRAM SWEEP" for the write format.

Program Sweep Type : Confirms the edited content of the segment, and sets the type of program sweep.

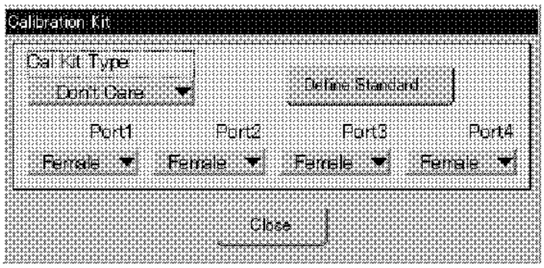
- All : All items execute valid program sweep.
- Freq : Only frequencies and the number of points execute valid program sweep.
- None : Program sweep is not executed.

8.2.2.4 Cal

1. Calibration Kit dialog box

   Sets the calibration kit.

   Operation of ***Cal*** and ***Standard Cal*** in the main menu displays the side menu, then click ***Cal Kit*** to display 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.
N50	:	Selects an N-type 50(calibration kit, and sets the compensation values.
N75	:	Selects an N-type 75(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 Define	:	Selects a user-defined calibration kit, and sets the compensation values.

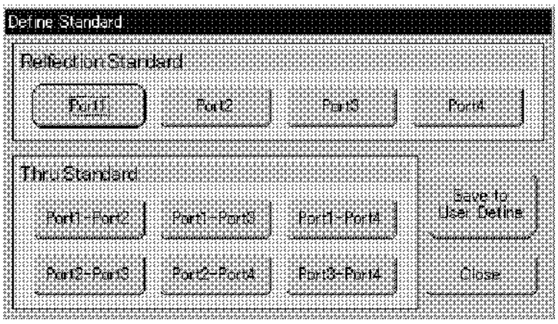
Port Female/Male: Specifies the polarity of the Test port.

Define Standard : Displays the Define Standard dialog box.

2. Define Standard dialog box

   Sets the user-defined calibration kit.

   Operation of ***Define Standard*** in the Calibration Kit dialog box displays this dialog box.

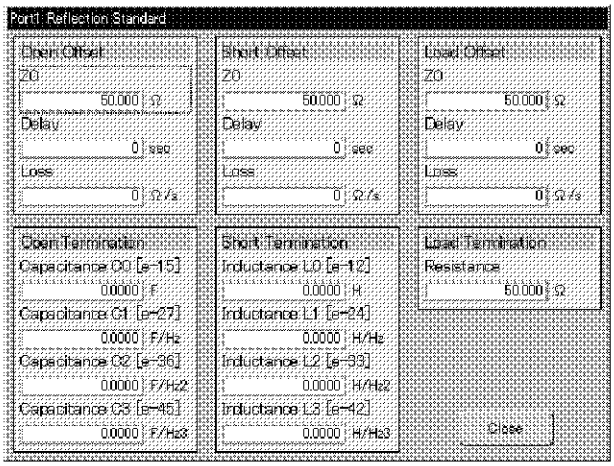


Reflection Standard	:	Displays the Reflection Standard dialog box.
Thru Standard	:	Displays the Thru Standard dialog box.
Save to User Define	:	Activates and saves the set compensation values.

3. Reflection Standard dialog box

   Sets the OPEN, SHORT, and LOAD standards.

   Operation of ***Reflection Standard Port No.*** in the Define Standard dialog box displays this dialog box.



Open Offset

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

Short Offset

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

Load Offset

Z0 : Inputs the offset impedance of the Load Standard.

Delay : Inputs the delay of the Load Standard.

Loss : Inputs the loss of the Load 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 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.

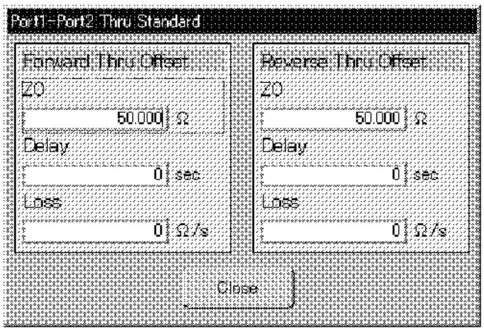
Load Termination

Resistance : Inputs the impedance of the Load Standard.

4. Thru Standard dialog box

   Sets the Thru Standard.

   Operation of ***Port - Port Thru*** in the Define Standard dialog box displays this dialog box.



Forward Thru Offset : Sets the forward compensation values.

Z0 : Inputs the offset impedance of the Thru Standard.

Delay : Inputs the delay of the Thru Standard.

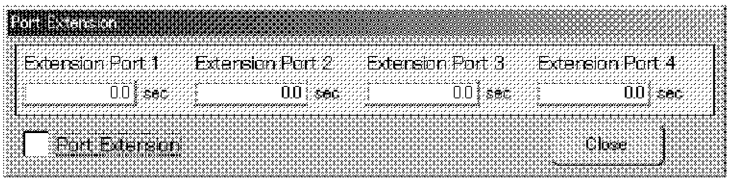
Loss : Inputs the loss of the Thru Standard.

Reverse Thru Offset : Sets the reverse compensation values.

5. Port Extension dialog box

   Sets port extensions.

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

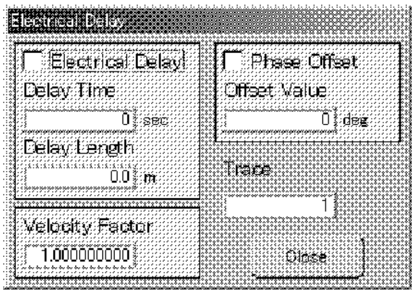


Extension Port 1 : Sets Port 1 extension value in time.
Extension Port 2 : Sets Port 2 extension value in time.
Extension Port 3 : Sets Port 3 extension value in time.
Extension Port 4 : Sets Port 4 extension value in time.
Port Extension : Sets the port extension function to ON or OFF.

6. Electrical Delay dialog box

   Sets the electrical delay correction value and offsetting phase value.

   Select ***Cal*** in the main menu. Then, select ***Electrical Delay*** to display the dialog box.



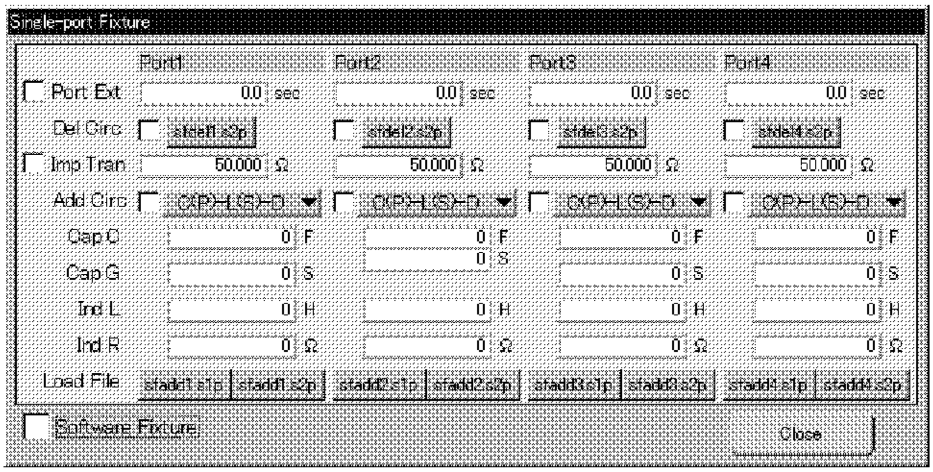
Electrical Delay : Sets the electrical delay correction function to ON or OFF.
Delay Time : Sets the electrical delay correction value in time.
Delay Length : Sets the electrical delay correction value in distance.
Velocity Factor : Sets the velocity factor.
Phase Offset : Sets the phase offset function to ON or OFF.
Offset Value : Sets the offsetting phase value.
Trace : Selects trace numbers.

8.2.2.5 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 : Sets ON/OFF of the circuit web delete function.

Imp Tran : 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.

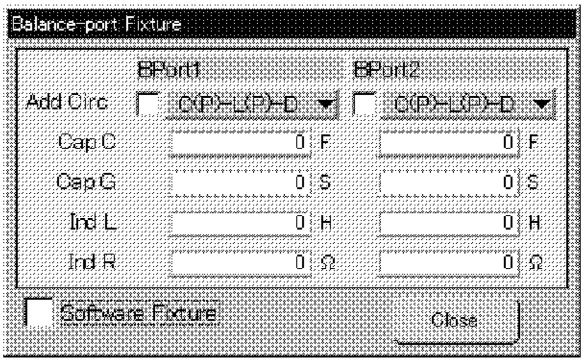
Load User File : Loads user-defined file.

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.

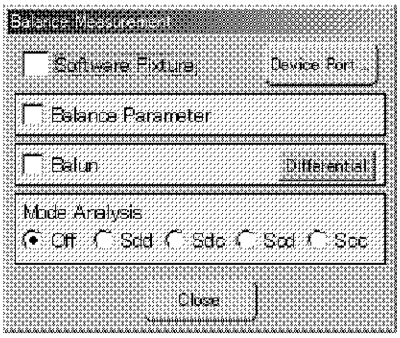


Software Fixture	:	Sets ON/OFF of the software fixture function.
Add Circ	:	Sets ON/OFF of the balancing circuit function and the type of balancing circuit. C(P)-L(P)-D : Sets the device type to parallel C - parallel L.
Cap C	:	Sets the value of Capacitance C.
Cap G	:	Sets the value of Capacitance G.
Ind L	:	Sets the value of Inductance L.
Ind R	:	Sets the value of Inductance R.

3. Balance Measurement dialog box

   Sets the balance measurement.

   Operation of ***Fixture*** and ***Balance Measurement*** in the main menu displays this dialog box.



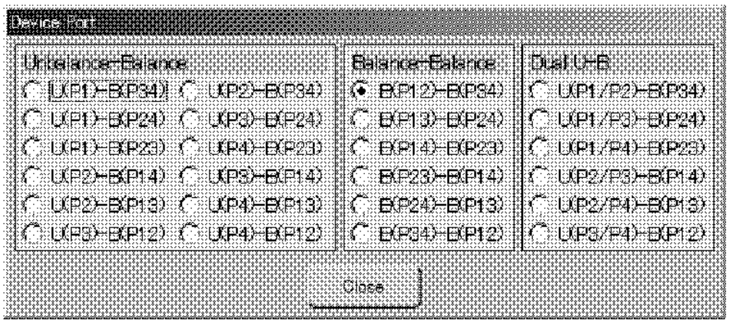
Software Fixture	:	Sets ON/OFF of the software fixture function.
Device Port	:	Displays the Device Port dialog box.
Balance Parameter	:	Sets the balance measurement.
Balun	:	Sets the balun function. Differential : Sets the differential balun function. Floating : Sets the floating balun function.
Mode Analysis	:	Sets the mode analysis. Off : Sets mode analysis to OFF.

Sdd	:	Sets to differential input - differential output mode.
Sdc	:	Sets to common input - differential output mode.
Scd	:	Sets to differential input - common output mode.
Scc	:	Sets to common input - common output mode.

4. Device Port dialog box

   Sets balance measurements balance port combinations.

   Select ***Fixture*** in the main menu. Then, select ***Device Port*** to display the dialog box.



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.

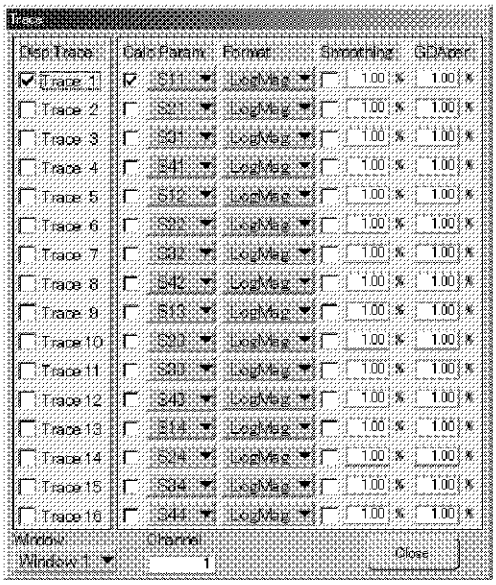
U(P3/P4)-B(P12) : Sets Ports 3 and 4 to unbalance ports, and sets Ports 1 and 2 to balance ports.

8.2.2.6 Trace

1. Trace dialog box

   Sets the traces.

   Operation of ***Trace*** and ***Trace*** in the main menu displays this dialog box.



Disp Trace : Sets the specified trace display to ON or OFF.

Calc : Sets the specified trace measurement ON or OFF.

Param : Sets the designated S-parameters.

- S11 - S44 : Sets to the S-parameters.

Format : Sets to the designated format.

- LogMag : Sets to Log magnitude format.
- Phase : Sets to the phase format.
- Delay : Sets to the group delay format.
- Smith : Sets to the Smith chart (Z) format.
- I- Smith : Sets to the Smith chart (Y) format.
- Polar : Sets to the polar coordinates format.
- LinMag : Sets to the linear magnitude format.
- SWR : Sets to the SWR (standing wave ratio) format.
- U-Phase : Sets to the continuous phase format.
- Real : Sets to the real number format.
- Imag : Sets to the imaginary number format.

Smoothing : Sets smoothing ON/OFF and the smoothing aperture.

GDAper : Sets the group delay aperture.

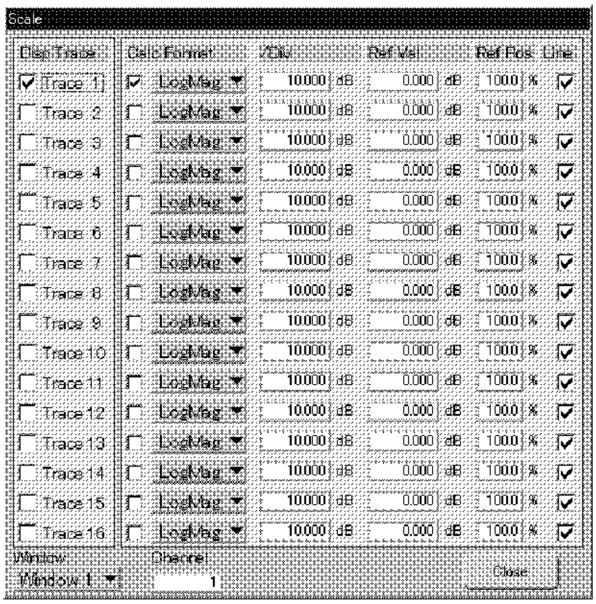
Window : Selects the active window.

Channel : Sets the measurement channel to be displayed in the active window.

2. Scale dialog box

   Sets the scale.

   Operation of ***Trace*** and ***Scale*** in the main menu displays this dialog box.



Disp Trace	:	Sets the specified trace display to ON or OFF.
Calc	:	Sets the specified trace measurement ON or OFF.
Format	:	Sets the format of the specified trace.

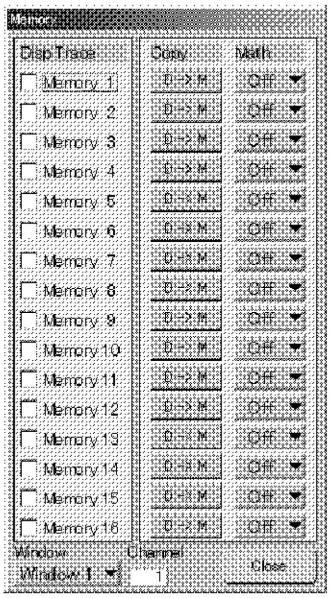
LogMag	:	Sets to the Log magnitude format.
Phase	:	Sets to the phase format.
Delay	:	Sets to the group delay format.
Smith	:	Sets to the Smith chart (Z) format.
I- Smith	:	Sets to the Smith chart (Y) format.
Polar	:	Sets to the polar coordinates format.
LinMag	:	Sets to the linear magnitude format.
SWR	:	Sets to the SWR (standing wave ratio) format.
U-Phase	:	Sets to the continuous phase format.
Real	:	Sets to the real number format.
Imag	:	Sets to the imaginary number format.

/Div	:	Sets the graduated scale of rectangular coordinates.
Ref Value	:	Sets the reference line value of rectangular coordinates.
Ref Pos	:	Sets the reference line position of rectangular coordinates.
Line	:	Sets reference line ON/OFF for rectangular coordinates.
Window	:	Selects the active window.
Channel	:	Sets the measurement channel to be displayed in the active window.

3. Memory dialog box

   Sets the trace memory.

   Select ***Trace*** in the main menu. Then, select ***Memory*** to display the dialog box.



Disp Trace : Sets the specified trace memory window display to ON or OFF.

Copy : Copies the specified trace data to a trace memory section.

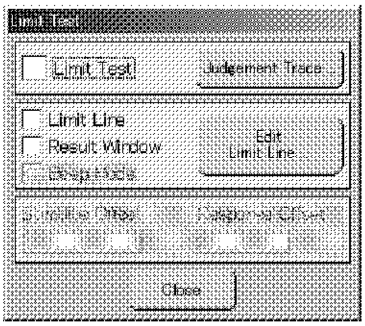
Math : Sets four basic mathematical calculations between the specified trace data and trace memory data.

- Off : No calculation is performed.
- D/M : Divides the trace data by the trace memory data, and displays the result as trace data.
- D-M : Subtracts the trace memory data from the trace data, and displays the result as trace data.
- D*M : Multiplies the trace data and trace memory data, and displays the result as trace data.
- D+M : Adds the trace data and trace memory data, and displays the result as trace data.

Window : Sets active windows.

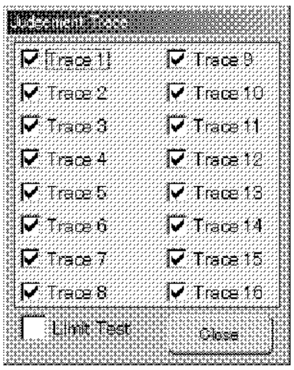
Channel : Sets measurement channels to display in active windows.

4. Limit Test dialog box
   Sets limit test functions.
   Select ***Trace*** in the main menu. Then, select ***Limit Test*** to display the dialog box.



Limit Test : Sets the limit test function to ON or OFF.
Limit Line : Sets the limit line display to ON or OFF.
Result Window : Sets the limit test result display to ON or OFF.
Judgement Trace : Displays the Judgement Trace dialog box.
Edit Limit Line : Displays the Limit Line Editor dialog box.

5. Judgement Trace dialog box
   Sets traces to test limits.
   Select ***Trace*** in the main menu. Then, select ***Judgement Trace*** to display the dialog box.

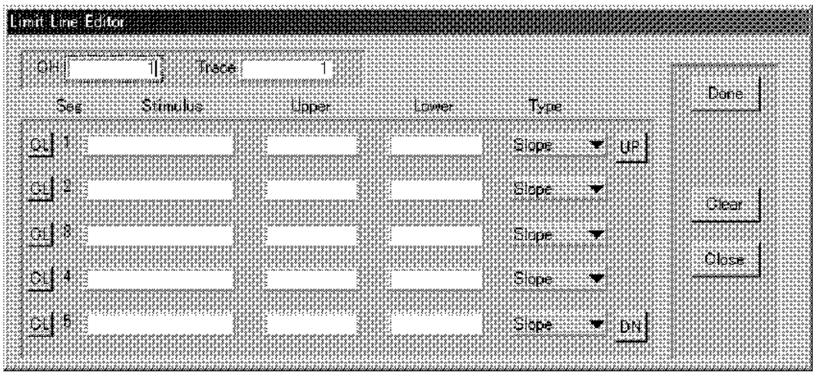


Trace No. : Sets whether or not to perform the limit test for each trace.
  ON : Performs the limit test.
  OFF : Performs no limit test.
  The relevant trace is handled as pass.
Limit Test : Sets the limit test function to ON or OFF.

6. Limit Line Editor dialog box

   Edits limit lines.

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



CH : Specifies setting channels.

Trace : Specifies setting traces.

CL : Clears specified segment contents.

Stimulus : Sets the specified segment stimulus value.

Upper : Sets the specified segment test upper limit.

Lower : Sets the specified segment test lower limit.

Type : Sets the specified segment line type.

- Point : Performs an independent test at the stimulus point. The upper limit is ∨ and the lower limit is ∧ in the display.
- Slope : Connected to the next segment start point limit value with an inclined line. If the segment is the last one, a horizontal line is drawn to the stimulus maximum point.
- Flat : A horizontal line is drawn to the next segment start point. The limit value stays constant to the next segment start point. If the segment is the last one, a horizontal line is drawn to the stimulus maximum point.

UP : Moves the segment editing range upward.

DN : Moves the segment editing range downward.

Done : Completes the editing and defines the limit line.

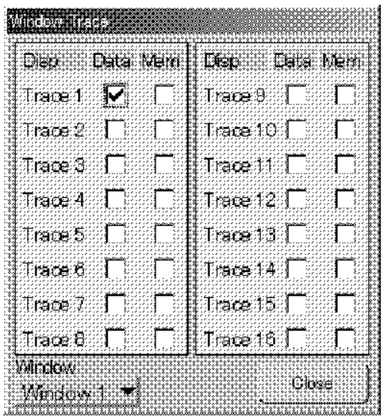
Clear : Clears all segment contents.

8.2.2.7 Window

1. Window Trace dialog box

   Sets the trace to be displayed in the window.

   Select ***Window*** in the main menu. Then, select ***Window Trace*** to display the dialog box.

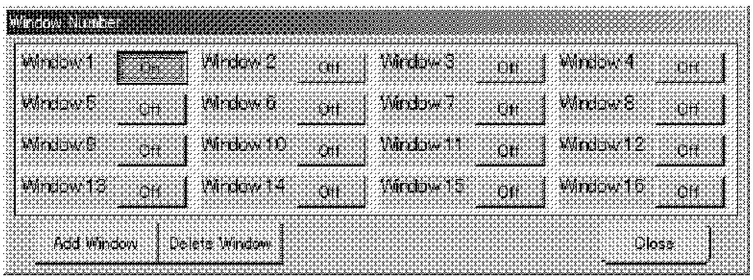


Data	:	Specifies the trace data to display in the active window.
Mem	:	Specifies the trace memory data to display in the active window.
Window	:	Specifies the active window.

2. Window Number dialog box

   Sets windows to display.

   Select ***Window*** in the main menu. Then, select ***Window No.*** to display the dialog box.

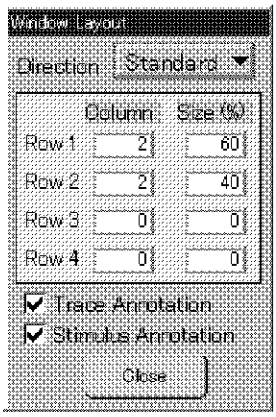


Window n On/Off	:	Sets the window display to ON or OFF.
Add Window	:	Displays an additional window.
Delete Window	:	Deletes an active window.

3. Window Layout dialog box

Sets windows display layouts.

Select ***Window*** in the main menu. Then, select ***Window Layout*** to display the dialog box.



Direction : Specifies window layouts.

Standard : Displays all windows evenly. In this case, Column and Size(%) specifications are ignored.

Horizontal : Displays windows on horizontally split screen as specified in Column.

Vertical : Displays windows on vertically split screen as specified in Column.

Row n Column : Specifies numbers of windows to be displayed in each rows and columns.

Row n Size(%) : Specifies size distributions for rows (columns) in percentages.

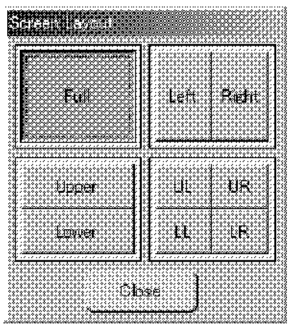
Trace Annotation : Sets the trace annotation display to ON or OFF.

Stimulus Annotation : Sets the stimulus annotation display to ON or OFF.

4. Screen Layout dialog box

Sets the screen area for displaying windows.

Select ***Window*** in the main menu. Then, select ***Screen Layout*** to display the dialog box.



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.
UL : Uses the upper left quarter as the windows display.
LL : Uses the lower left quarter as the windows display.
UR : Uses the upper right quarter as the windows display.
LR : Uses the lower right quarter as the windows display.

8.2.2.8 Marker

1. Marker Setup dialog box

   Performs the basic settings of the marker.

   Operation of ***Marker, Marker Setup*** and ***Marker Setup*** in the main menu displays this dialog box.

Activate Marker : Specifies the active marker. If the specified marker is not displayed, set the marker to active marker from the display specification.

Marker List On/Off : Sets the marker list display to ON or OFF.

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.

Smith Marker : Sets the Smith chart marker display format.

- Linear : Displays linear amplitude and phase.
- Log : Displays log amplitude and phase.
- Re/Im : Displays complex numbers.
- R+jX : Displays complex number impedance.
- G+jB : Displays complex number admittance.

Polar Marker : Sets the Polar coordinate marker display format.

- Linear : Displays linear amplitude and phase.

Log : Displays log amplitude and phase.

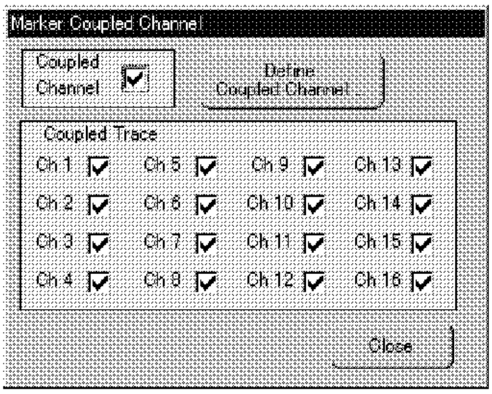
Re/Im : Displays complex numbers.

All Marker Off : Sets all marker displays to OFF.

2. Marker Coupled Channel dialog box

   Couples trace and channel interval markers.

   Operation of ***Marker, Marker Setup*** and ***Coupled Ch*** in the main menu displays this dialog box.



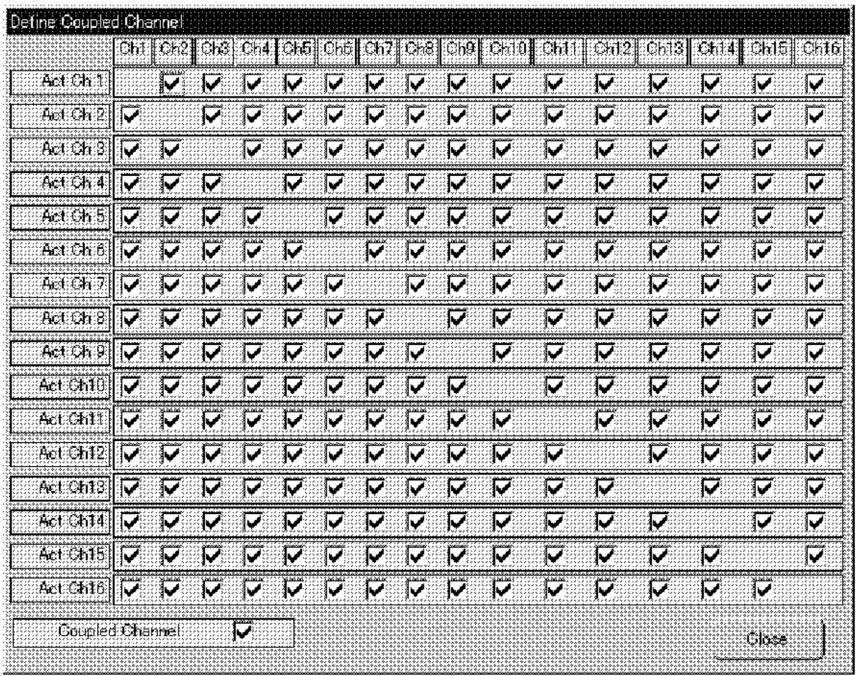
Coupled Channel : Used to set the marker coupling function between channels to ON or OFF. When selected (checked), the active marker selected at the time will be the subject for coupling.

Coupled Trace : 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.

Define Coupled Channel : Displays the Define Coupled Channel dialog box.

3. Define Coupled Channel dialog box

   Selects marker-coupling channels.



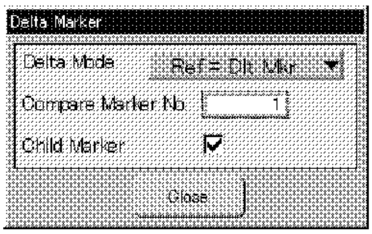
Act Ch 1 to 16 : Selects channels for each channel to couple with when the channel is set to active. Marker couples are performed between selected (checked) channels. However, if the sweep conditions differ between channels (power sweep and frequency sweep), no channel coupling is performed.

Coupled Channel : 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.

4. Delta Marker dialog box

   Performs the basic settings of the delta marker.

   Operation of ***Marker, Analysis Marker*** and ***Delta Marker*** in the main menu displays this dialog box.



Delta Mode : Sets the analysis mode for performing a delta analysis.

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.

Ref=Dlt Mkr : Sets child marker as the reference marker and finds the difference with the active marker. If the active marker is not displayed at the time the child marker is set, the child marker will be displayed. The child marker display disappears by setting the Delta Mode to OFF or by removing the check from the child marker check box.

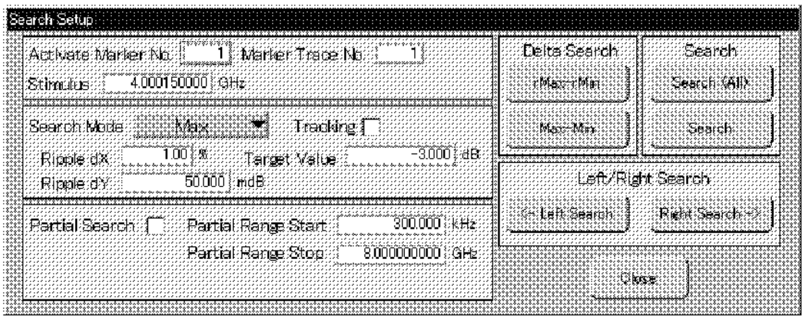
Compare Marker No. : Specifies the comparison marker for when Ref=Act Mkr is set in Delta Mode. Only the displaying marker number can be set.

Child Marker : Select to display the child marker box when 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.

5. Search Setup dialog box

   Performs the basic settings of the search marker.

   Operation of ***Marker, Analysis Marker*** and ***Search Setup*** in the main menu displays this dialog box.



Active Marker Setup : Sets the Activate Marker No., Marker Trace No., and Stimulus for the selected active marker. *1

*1: Stimulus displayed in the menu or dialog does not follow during a search.

Search Mode : Sets the active marker search related settings. Each item can be set independently for every marker. The settings include Search mode, Tracking, Target Value, Ripple dx, and Ripple dy. For further details on Search Mode, refer to 8.2.3.14 "Mkr->."

Partial Search : Sets the Partial Search mode.
Each item can be set for individual markers.

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

Partial Search Start:
Specifies the partial range analysis start point.

Partial Search Stop:
Specifies the partial range analysis stop point.

Delta Search : Sets the search mode and delta mode combined analysis.

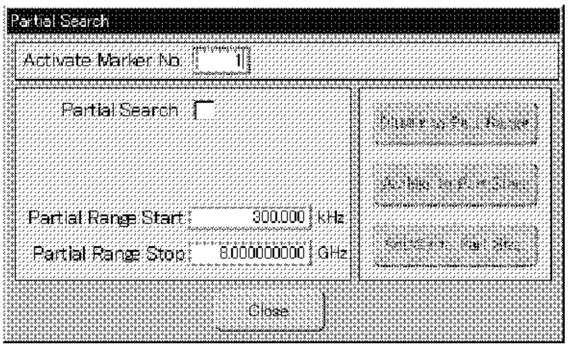
rMax-rMin : Finds the greatest maxima value and smallest minima value, and validates delta mode to find the difference of two.

		Max-Min	:	Finds the maximum and minimum values, and validates delta mode to find the difference of two.
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.
Left/Right Search	:	Searches for data to the left and right of the active marker.		
		Left Search	:	Searches for data to the left of the active marker.
		Right Search	:	Searches for data to the right of the active marker.

6. Partial Search dialog box

Specifies the partial search settings of the marker.

Operation of ***Marker, Analysis Marker*** and ***Partial Search*** in the main menu displays this dialog box.



Activate Marker No. : Selects the active marker. The selected marker will be the subject for operations.

Partial Search : Sets the partial analysis mode to ON or OFF. Selecting the function (check the box) sets the analysis mode to ON.

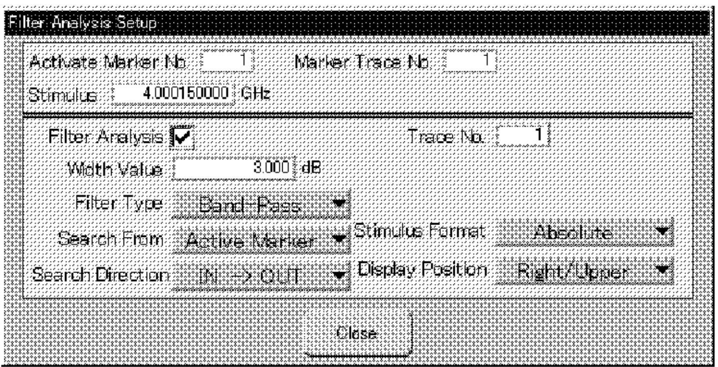
Partial Range Start : Specifies the partial range analysis start point.

Partial Range Stop : Specifies the partial range analysis stop point.

7. Filter Analysis Setup dialog box

Specifies the filter analysis settings.

Operation of ***Marker, Analysis Marker*** and ***Filter Analysis*** in the main menu displays this dialog box.



Active Marker Setup : Sets Activate Marker No., Marker Trace No., and Stimulus. *1

*1: Stimulus displayed in the menu or dialog does not follow during a search.

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>.

Trace No. : Specifies the trace number to analyze.

Width Value : Specifies the bandwidth to analyze in the value of level decay (dB) from the reference point.

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.

- Active Marker: Sets the active marker as the search reference point.
- Max Value : Sets the maximum value as the search reference point.
- Reference Line: Sets the reference line as the search reference point.

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

Search Direction : 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.

Stimulus Format : Selects the bandwidth display format.

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

Display Position : Used to specify the position to display analysis results.

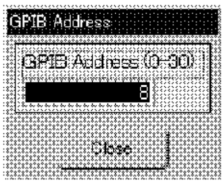
- Right/Upper : Displays results in the upper right part of the screen.
- Right/Lower : Displays results in the lower right part of the screen.
- Left/Upper : Displays results in the upper left part of the screen.
- Left/Lower : Displays results in the lower left part of the screen.

8.2.2.9 System

1. GPIB dialog box

   Sets the GPIB address.

   Operation of ***System*** and ***GPIB Address*** in the main menu displays this dialog box.

2. Network Config dialog box

   Refer to Section A.3 "Network Settings."

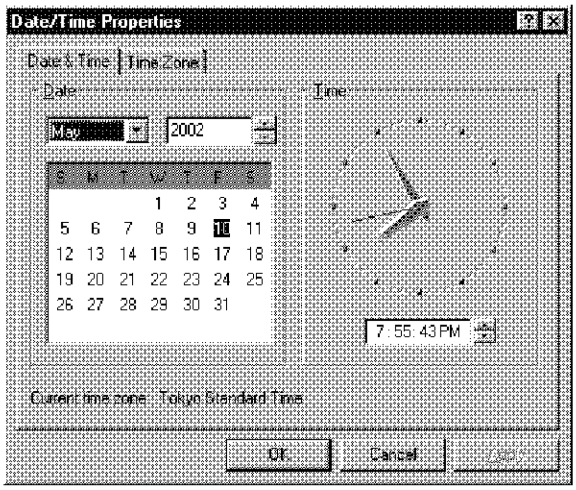
3. Add Printer dialog box

   Refer to Section A.4 "Printer Installation Method."

4. Time Adjust dialog box

   Sets the time adjustment.

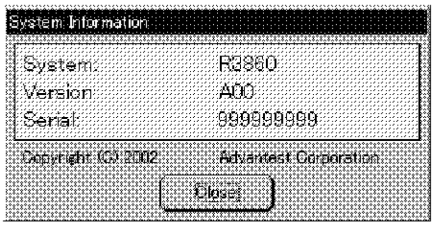
   Operation of ***System*** and ***Time Adjust*** in the main menu displays this dialog box.



5. Explorer dialog box
   Opens Explorer.

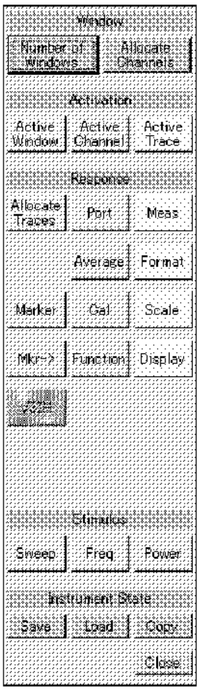
8.2.2.10 Help

1. Version dialog box
   Displays the version information of the analyzer.
   Operation of ***Help*** and ***Version*** in the main menu displays this dialog box.



8.2.3 Side Menus

This section explains side menus displayed from the tool menu.



8.2.3.1 Number of Windows

1. Window menu

   Window n On/Off : Sets a window to ON or OFF.

   Window Setup : Displays the Window Setup menu.

   NOTE: "n" indicates a window number.

2. Window Setup menu

   Display Mode : Displays the Display Mode menu.

   Screen Layout : Displays the Scrn Layout menu.

   Window Layout : Displays the Window Layout menu.

   Double-Clk All CH/Single CH: Sets the operation to be performed when a window is double-clicked.

   All CH : Sets Display Mode to Single Window.
   Sequence Mode is unchanged.

   Single CH: Sets Display Mode to Single Window.
   Sequence Mode is set to Active CH.

   Window Label : Displays the Softkeyboard dialog box used to set window titles. Each title is displayed at the top of each window.

Disp Label On/Off	: Sets the window title display to ON or OFF. On : Displays the set window title. Off : Displays no window title.
Status Label	: Displays the Softkeyboard dialog box used to set a status title. Each title is displayed at the bottom of each window.

3. Display Mode menu

Disp Mode Split	: Displays all the measurement channels, for which measurement ports are set, in multiple windows.
Disp Mode Single Wind	: Displays only the measurement channel displayed in the active window.
Disp Mode Single CH	: Displays only the active measurement channel.
Disp Mode Overlay	: Displays all the measurement channels, for which measurement ports are set, in overlaid windows.
Trace Annot On/Off	: Sets the trace annotation display to ON or OFF.
Stim Annot On/Off	: Sets the stimulus annotation display to ON or OFF.

4. Scrn Layout 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.

5. Wind Layout menu

Standard Split	: Displays all windows evenly. The Column and Size % settings are ignored.
Horizontal Split	: Splits the display horizontally into the number of windows specified in Column.
Vertical Split	: Splits the display vertically into the number of windows specified in Column.
Window Size	: Displays the Wind Size menu.

6. Wind Size menu

Row n Column	: Specifies the number of windows aligned in the nth row.
Row n Size %	: Specifies the nth row display size.

8.2.3.2 Allocate Channels

1. Allocate CH menu

   Assigns a measurement channel to a window.

   Window n CH : Specifies a channel number to be assigned to a window.

   Channel Setup : Displays the CH Setup menu.

   NOTE: "n" indicates a window number.

2. Channel Setup menu

   Sets measurement channel operations.

   Sequence All CH : Measures all channels in order of channel number.

   Sequence Active CH : Measures only the active channel.

   Sequence CH : Displays the Sequence CH menu.

3. Sequence CH menu

   Sets whether the measurements for channels are executed or suspended.
   All channels cannot be suspended at the same time.

   CH n On/Off : Selects whether measurements are performed (ON) or stopped (OFF) for each channel.

   NOTE: "n" indicates a channel number.

8.2.3.3 Active Window

1. Active Window menu

   Specifies an active window. If the specified window is not displayed, display the window and then set it to the active window.

   Window n : Sets a window to the active window.

   NOTE: "n" indicates a window number.

8.2.3.4 Active Channel

1. Active Channel menu

   Specifies an active channel. If the window, to which the active channel is assigned, is displayed, that window is set to the active window.

   CH n : Sets a channel to the active channel.

   NOTE: "n" indicates a channel number.

8.2.3.5 Active Trace

1. Active Trace menu

   Specifies an active trace. If the specified trace is not displayed, display the trance and then set it to the active trace.

   Trace n : Sets a trace to the active trace.

   NOTE: "n" indicates a trace number.

8.2.3.6 Allocate Traces

1. Allocate Trace menu

   Sets the trace display in the active window to ON or OFF.

   Trace n On/Off : Sets a trace to ON or OFF.

   NOTE: "n" indicates a trace number.

8.2.3.7 Port

1. Port menu

   Sets measurement ports.

   (1/2 page)

   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.
   None : Does not execute measurement.

   (2/2 page)

   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.

8.2.3.8 Meas

1. Measure menu

   Sets an active trace measurement parameter.

S11 to S44	:	Sets the S parameter.
Balance Trace	:	Displays the Balance Trace menu.

2. Balance Trace menu

Balance Parameter	:	Displays the Balance Param menu.
Balun	:	Displays the Balun menu.
Mode Analysis	:	Displays the Mode Analysis menu.

3. Balance Param menu

B12 to B23b	:	Sets the S parameter after the balun setting. Sets a balance parameter. For more information on the balance parameter, refer to Section 5.5, "Balance Measurement Function."

4. Balun menu

SS11 to SS22b	:	Sets the S parameter after the balun setting. For more information on the balun setting, refer to Section 5.6, "Software Balun Function."

5. Mode Analysis menu

Sdd11 to Scc22b	:	Sets the mixed S parameter. For more information on the mixed S parameter, refer to Section 5.7, "Mode Analysis Function."

8.2.3.9 Average

1. Averaging menu

Averaging On/Off	:	Sets averaging to ON or OFF.
Averaging Factor	:	Sets the averaging factor.
IF RBW	:	Displays the IF RBW menu.

2. IF RBW menu

   Sets the IF RBW menu.

8.2.3.10 Format

1. Format 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.
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.
U-Phase	: Sets to the continuous phase format.
Smoothing	: Displays the Smoothing menu.

2. Smoothing menu

Smoothing On/Off	: Sets smoothing to ON or OFF.
Smo Aperture	: Sets the smoothing aperture.
Dly Aperture	: Sets the group delay aperture.

8.2.3.11 Marker

1. Marker menu

Mkr Stimulus	: Sets the frequency of the active marker.
Active Marker	: Specifies the active marker. If not displayed, set to the active marker after display.
Marker Trace	: Specifies the trace for displaying the marker.
Active Marker Off	: Turns the active marker OFF.
All Marker Off	: Turns all markers OFF.
Delta Mode	: Displays the Delta Mode menu.
Marker List On/Off	: Selects Marker List ON or OFF.
Marker Mode	: Displays the Marker Mode menu.

2. Delta Mode 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.
Ref=Dlt Mkr	: Sets child marker as the reference marker and finds the difference with the active marker. If the active 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.

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 OFF 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 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 channel marker is the subject for coupling.
- Off : The active channel marker is not the subject for coupling.

Smith Marker : Displays the Smith Marker menu.

Polar Marker : Displays the Polar Marker menu.

Marker List Upper/Lower : Selects marker list display positions.
- Upper : Displays the marker list in the upper left of the screen.
- Lower : Displays the marker list in the lower left of the screen.

4. Smith Marker menu

Sets the Smith chart marker display format.

Linear : Displays linear amplitude and phase.

Log : Displays log amplitude and phase.

Re/Im : Displays complex numbers.

R+jX : Displays complex number impedance.

G+jB : Displays complex number admittance.

5. Polar Marker menu

Sets the Polar coordinates marker display format.

Linear : Displays linear amplitude and phase.

Log : Displays log amplitude and phase.

Re/Im : Displays complex numbers.

8.2.3.12 Cal

1. Calibration menu

Correct On/Off	:	Selects calibration ON/OFF.
Auto Cal	:	Displays the Auto Cal menu.
Standard Cal	:	Displays the Standard Cal menu.
Clear Cal Data	:	Deletes calibration data.
Port Extension	:	Displays the Port Ext menu.
Electrical Delay	:	Displays the Elec Delay menu.

2. Auto Cal 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	:	Displays the Auto C4 menu. (Executes 4-port Auto Calibration if the R17051 is connected.)
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 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 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.
P1 - P4 Auto Cal	:	Executes 2-port Auto Calibration for Port 1 - Port 4.
P2 - P3 Auto Cal	:	Executes 2-port Auto Calibration for Port 2 - Port 3.
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 menu

P1 - P2 - P3	:	Displays Auto C3(P123) menu. (Executes 3-port Auto Calibration if the R17051 is connected.)
P1 - P2 - P4	:	Displays Auto C3(P124) menu. (Executes 3-port Auto Calibration if the R17051 is connected.)
P1 - P3 - P4	:	Displays Auto C3(P134) menu. (Executes 3-port Auto Calibration if the R17051 is connected.)
P2 - P3 - P4	:	Displays Auto C3(P234) menu. (Executes 3-port Auto Calibration if the R17051 is connected.)

6. Auto C3(P123) menu

Acquire P1 - P2	:	Acquires the compensation factor of Port 1 - Port 2.
Acquire P1 - P3	:	Acquires the compensation factor of Port 1 - Port 3.
Acquire P2 - P3	:	Acquires the compensation factor of Port 2 - Port 3.
Done	:	Executes P123 3-port Auto Calibration.

7. Auto C3(P124) menu

Acquire P1 - P2	:	Acquires the compensation factor of Port 1 - Port 2.
Acquire P1 - P4	:	Acquires the compensation factor of Port 1 - Port 4.
Acquire P2 - P4	:	Acquires the compensation factor of Port 2 - Port 4.
Done	:	Executes P124 3-port Auto Calibration.

8. Auto C3(P134) menu

Acquire P1 - P3	:	Acquires the compensation factor of Port 1 - Port 3.
Acquire P1 - P4	:	Acquires the compensation factor of Port 1 - Port 4.
Acquire P3 - P4	:	Acquires the compensation factor of Port 3 - Port 4.
Done	:	Executes P134 3-port Auto Calibration.

9. Auto C3(P234) menu

Acquire P2 - P3	:	Acquires the compensation factor of Port 2 - Port 3.
Acquire P2 - P4	:	Acquires the compensation factor of Port 2 - Port 4.
Acquire P3 - P4	:	Acquires the compensation factor of Port 3 - Port 4.
Done	:	Executes P234 3-port Auto Calibration.

10. Auto C4 menu

Acquire P1 - P2	:	Acquires the compensation factor of Port 1 - Port 2.
Acquire P1 - P4	:	Acquires the compensation factor of Port 1 - Port 4.
Acquire P1 - P3	:	Acquires the compensation factor of Port 1 - Port 3.
Acquire P2 - P3	:	Acquires the compensation factor of Port 2 - Port 3.
Done	:	Executes 4-port Auto Calibration.

11. Auto Cal Verify 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.

12. Verify C1 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.

13. Verify C2 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.

14. Verify C3 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.

15. Verify C4 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.
Clear Result	:	Deletes the verification results display.

16. Cal Setup menu

Avg Factor Spec/Auto : Selects an averaging factor setting mode.

Spec : Executes averaging for the number set in Avg Factor.

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.

Avg Factor : Sets averaging factor for calibration execution.

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.

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.

17. Standard Cal 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.
    - ***Cal Kit*** : Displays the Cal Kit dialog box.
18. C1 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.
19. C1(Pn) menu
    - ***Port n Open*** : Acquires the Open compensation factor of Port n.
    - ***Port n Short*** : Acquires the Short compensation factor of Port n.
    - ***Port n Load*** : Acquires the Load compensation factor of Port n.
    - ***Done*** : Executes 1-Port Cal.

NOTE: "n" indicates a port number.

20. C2 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.
    - ***P1 - P4*** : Displays the C2(P14) menu of Port 1 - Port 4.
    - ***P2 - P3*** : Displays the C2(P23) menu of Port 2 - Port 3.
    - ***P2 - P4*** : Displays the C2(P24) menu of Port 2 - Port 4.
    - ***P3 - P4*** : Displays the C2(P34) menu of Port 3 - Port 4.
21. C2(Pnm) menu
    - ***Port n Open*** : Acquires the Open compensation factor of Port n.
    - ***Port n Short*** : Acquires the Short compensation factor of Port n.
    - ***Port n Load*** : Acquires the Load compensation factor of Port n.
    - ***Port m Open*** : Acquires the Open compensation factor of Port m.
    - ***Port m Short*** : Acquires the Short compensation factor of Port m.
    - ***Port m Load*** : Acquires the Load compensation factor of Port m.
    - ***Pn - Pm Thru*** : Acquires the Thru compensation factor of Port n - Port m.

Omit Isolation : Omits isolation compensation.
Pn - Pm Isolation : Acquires the Isolation compensation factor of Port n - Port m.
Done : Executes 2-Port Cal.

NOTE: "n" and "m" indicate port numbers.

22. C3 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.

23. C3(Pnmj) menu
(Page 1 of 3)
Port n Open : Acquires the Open compensation factor of Port n.
Port n Short : Acquires the Short compensation factor of Port n.
Port n Load : Acquires the Load compensation factor of Port n.
Port m Open : Acquires the Open compensation factor of Port m.
Port m Short : Acquires the Short compensation factor of Port m.
Port m Load : Acquires the Load compensation factor of Port m.
Done : Executes 3-Port Cal.
(Page 2 of 3)
Port j Open : Acquires the Open compensation factor of Port j.
Port j Short : Acquires the Short compensation factor of Port j.
Port j Load : Acquires the Load compensation factor of Port j.
Pn - Pm Thru : Acquires the Thru compensation factor of Port n - Port m.
Pn - Pj Thru : Acquires the Thru compensation factor of Port n - Port j.
Pm - Pj Thru : Acquires the Thru compensation factor of Port m - Port j.
Omit Isolation : Omits isolation compensation.
Done : Executes 3-Port Cal.
(Page 3 of 3)
Pn -Pm Isolation : Acquires the Isolation compensation factor of Port n - Port m.
Pn -Pj Isolation : Acquires the Isolation compensation factor of Port n - Port j.
Pm -Pj Isolation : Acquires the Isolation compensation factor of Port m - Port j.
Omit Isolation : Omits isolation compensation.
Done : Executes 3-Port Cal.

NOTE: "n", "m" and "j" indicate port numbers.

24. C4 menu
(Page 1 of 4)
Port 1 Open : Acquires the Open compensation factor of Port 1.
Port 1 Short : Acquires the Short compensation factor of Port 1.

Port 1 Load : Acquires the Load compensation factor of Port 1.
Port 2 Open : Acquires the Open compensation factor of Port 2.
Port 2 Short : Acquires the Short compensation factor of Port 2.
Port 2 Load : Acquires the Load compensation factor of Port 2.
Done : Executes 4-Port Cal.

(Page 2 of 4)

Port 3 Open : Acquires the Open compensation factor of Port 3.
Port 3 Short : Acquires the Short compensation factor of Port 3.
Port 3 Load : Acquires the Load compensation factor of Port 3.
Port 4 Open : Acquires the Open compensation factor of Port 4.
Port 4 Short : Acquires the Short compensation factor of Port 4.
Port 4 Load : Acquires the Load compensation factor of Port 4.
Done : Executes 4-Port Cal.

(Page 3 of 4)

P1 - P2 Thru : Acquires the Thru compensation factor of Port 1 - Port 2.
P2 - P3 Thru : Acquires the Thru compensation factor of Port 2 - Port 3.
P1 - P3 Thru : Acquires the Thru compensation factor of Port 1 - Port 3.
P1 - P4 Thru : Acquires the Thru compensation factor of Port 1 - Port 4.
Omit Isolation : Omits isolation compensation.
Done : Executes 4-Port Cal.

(Page 4 of 4)

P1 - P2 Isolation : Acquires the Isolation compensation factor of Port 1 - Port 2.
P1 - P3 Isolation : Acquires the Isolation compensation factor of Port 1 - Port 3.
P1 - P4 Isolation : Acquires the Isolation compensation factor of Port 1 - Port 4.
P2 - P4 Isolation : Acquires the Isolation compensation factor of Port 2 - Port 4.
P2 - P3 Isolation : Acquires the Isolation compensation factor of Port 2 - Port 3.
P3 - P4 Isolation : Acquires the Isolation compensation factor of Port 3 - Port 4.
Omit Isolation : Omits isolation compensation.
Done : Executes 4-Port Cal.

25. Port Ext menu

Port Ext 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.
Marker to Extension : Changes the port extension value according to the frequency where the active marker is positioned as well as the phase.

26. Elec Delay 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 Ofs On/Off : Sets the phase offset function to ON or OFF.

Phase Ofs : Sets the phase offset value.

27. Verify Setup menu

Result On/Off : Selects the result display after the verification to ON or OFF.
- On : Displays the verification results regardless of the results.
- Off : Displays the verification results only when they exceed the limit.

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.

Jdg 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.

8.2.3.13 Scale

1. Scale menu

/Div : Sets the graduated scale of rectangular coordinates.

Ref Value/Full Scale : Sets the reference line of rectangular coordinates or the scale value of polar coordinates.

Ref Position : Sets the reference line position of rectangular coordinates.

Auto Scale : Executes automatic setting of the scale.

Ref Line On/Off : Sets ON/OFF of the reference line of rectangular coordinates.

8.2.3.14 Mkr->

1. Marker To 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.
Partial Search	: Displays the Partial Search menu.
Marker Search	: Displays the Mkr Search menu.

2. Partial Search menu

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.

3. Mkr Search menu

Search Mode	: Displays the Search Mode menu.
Search Active Marker	: Searches for an active marker.
Search All Markers	: Searches for all markers in a valid search mode (not set to OFF).
Filter Analysis	: Displays the Filter Analysis menu.
Tracking Off	: No search is performed for each sweep.

4. Search Mode menu

Sets the active marker search related settings. The settings can be specified for each marker separately.

Search Off	: Sets the search mode to OFF.
Max	: Searches a maximum value. *1
Min	: Searches a minimum value. *1
Target	: Displays the Target Search menu.
Ripple	: Displays the Ripple Search menu.

5. Target Search menu

Target	: Searches for a value specified by Target Value. *1
0 deg	: Performs a 0-degree search. *2
180 deg	: Performs a 180-degree search. *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.

6. Ripple Search menu

Ripple Max	: Searches for the value of the greatest maxima. *1
Ripple Min	: Searches for the value of the smallest minima. *1

*1: LogMag data is referred in the Smith or Polar Format.

*2: Phase data is referred in the Phase or uPhase Format.

rMax-rMin : Obtains the values of the greatest maxima value and the smallest minima and enables the delta mode to find the difference between the two.

Max-Min : Obtains the maximum and minimum values and enables the delta mode to find the difference between the two.

Ripple dx : Sets the horizontal axis screening sensibility for Ripple Max or Ripple Min function.

Ripple dy : Sets the vertical axis screening sensibility for Ripple Max or Ripple Min function.

7. Filter Analysis menu

Width Value : Specifies the bandwidth to analyze in the value of level decay (dB) from the reference point.

Filter Type Band/Notch : Specifies the filter type.

- Band : Executes the band-pass filter analysis.
- Notch : Executes the notch filter analysis.

Search From : Displays the Search From menu.

Disp 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.

Filter Analy 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>.

Display Position : Displays the Disp Position menu.

8. Search From 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.

9. Disp Position 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.

8.2.3.15 Function

1. Function menu

Software Fixture	:	Displays the Soft Fixture menu.
Limit Test	:	Displays the Limit Test menu.
Parallel I/O	:	Displays the Parallel I/O menu.
Multiport Test Set	:	Displays the R3968(Quick) menu.
Service Menu	:	Displays the Service Menu menu. This is a maintenance menu which can be used only by a customer service engineer.

2. Soft Fixture menu

Software 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.
Transform Impedance	:	Displays the Trans Impd menu.
Add Circuit	:	Displays the Add Circuit menu.
Balance Meas	:	Displays the Balance Meas menu.
Add Balance Ckt	:	Displays the Balance Ckt menu.

3. Port Ext menu

Port Ext On/Off	:	Selects ON/OFF of the port extension function.
Ext Port1	:	Sets the port extension function of Port 1.
Ext Port2	:	Sets the port extension function of Port 2.
Ext Port3	:	Sets the port extension function of Port 3.
Ext Port4	:	Sets the port extension function of Port 4.
Marker to Extension	:	Changes the port extension value according to the frequency where the active marker is positioned as well as the phase.

4. Delete Circuit menu

Delete Ckt Port1 On/Off	:	Sets the circuit web function of Port 1 to ON or OFF.
Delete Ckt Port2 On/Off	:	Sets the circuit web function of Port 2 to ON or OFF.

Delete Ckt Port3 On/Off	:	Sets the circuit web function of Port 3 to ON or OFF.
Delete Ckt Port4 On/Off	:	Sets the circuit web function of Port 4 to ON or OFF.
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.

5. Trans Impd menu

Trans Impd On/Off	:	Selects ON/OFF of the impedance transformation function.
Port1 Impd	:	Sets the impedance of Port 1.
Port2 Impd	:	Sets the impedance of Port 2.
Port3 Impd	:	Sets the impedance of Port 3.
Port4 Impd	:	Sets the impedance of Port 4.

6. Add Circuit 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.

7. P n Ckt Type 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 Ckt	:	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.

8. Balance Meas menu

Balance Parameter On/Off	:	Selects ON/OFF of the Balance parameter function.
Balun On/Off	:	Selects ON/OFF of the balun function.
Balun Type Differential/Floating	:	Selects floating balun/differential balun.
Mix-mode On/Off	:	Selects ON/OFF of the mixed-mode analysis function.
Mix-mode Sdd	:	Sets to Sdd mode (differential input-differential output).
Mix-mode Sdc	:	Sets to Sdc mode (common input-differential output).

Mix-mode Scd : Sets to Scd mode (differential input-common output).

Mix-mode Scc : Sets to Scc mode (common input-common output).

Device Port : Displays the Device Port menu.

9. Device Port menu

4P Device B(P12)-B(P34) : Sets Ports 1 and 2 for balance input, and Ports 3 and 4 for balance output.

4P Device U(P1)-B(P34) : Sets Port 1 for unbalance input, and Ports 3 and 4 for balance output.

4P Device U(P2)-B(P34) : Sets Port 2 for unbalance input, and Ports 3 and 4 for balance output.

4P Device U(P1/P2)-B(P34) : Sets Ports 1 and 2 for unbalance ports, and Ports 3 and 4 for balance ports.

Device Port More : Displays the Device Port dialog box.

10. Balance Ckt 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.

11. Limit Test 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.

Rslt Window On/Off : Sets the limit test result window display to ON or OFF.

12. Judge Trace menu

Trace n On/Off : Sets whether or not to perform the limit test for each trace.

On : Performs no limit test.

Off : Not performs the limit test.
The relevant trace is handled as Pass.

NOTE: "n" indicates a trace number.

13. Parallel I/O menu

Sets Parallel I/O.

Output Mode : Displays the Output Mode menu.

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.

CH-Sync On/Off : Selects the channel synchronization setting.
Synchronization setting outputs the set data by measured channel.

14. Output Mode menu
Sets the PIO output mode.

ABCD : Sets Ports A, B, C, and D as output ports.
ABD : Sets Ports A, B, and D as output ports, and Port C as an input port.
ABC : Sets Ports A, B, and C as output ports, and Port D as an input port.
AB : Sets Ports A and B as output ports, and Ports C and D as input ports.

15. R3968(Multiport Test Set) Menu
Sets the R3968 measurement path.

(Page 1 of 4)
1a-2a-3a-4a : Sets the R3968 to Port 1a, Port 2a, Port 3a, and Port 4a.
1a-2a-3b-4b : Sets the R3968 to Port 1a, Port 2a, Port 3b, and Port 4b.
1a-2a-3c-4c : Sets the R3968 to Port 1a, Port 2a, Port 3c, and Port 4c.
1a-2b-3a-4a : Sets the R3968 to Port 1a, Port 2b, Port 3a, and Port 4a.
1a-2b-3b-4b : Sets the R3968 to Port 1a, Port 2b, Port 3b, and Port 4b.
1a-2b-3c-4c : Sets the R3968 to Port 1a, Port 2b, Port 3c, and Port 4c.
2a-2b-3a-4a : Sets the R3968 to Port 2a, Port 2b, Port 3a, and Port 4a.
CH-Sync On/Off : Selects ON or OFF for Channel Synchronization path.

(Page 2 of 4)
1a-2a-3a-4a : Sets the R3968 to Port 1a, Port 2a, Port 3a, and Port 4a.
1a-2a-3a-4b : Sets the R3968 to Port 1a, Port 2a, Port 3a, and Port 4b.
1a-2a-3a-4c : Sets the R3968 to Port 1a, Port 2a, Port 3a, and Port 4c.
1a-2a-3b-4a : Sets the R3968 to Port 1a, Port 2a, Port 3b, and Port 4a.
1a-2a-3b-4b : Sets the R3968 to Port 1a, Port 2a, Port 3b, and Port 4b.
1a-2a-3b-4c : Sets the R3968 to Port 1a, Port 2a, Port 3b, and Port 4c.
1a-2a-3c-4a : Sets the R3968 to Port 1a, Port 2a, Port 3c, and Port 4a.
1a-2a-3c-4b : Sets the R3968 to Port 1a, Port 2a, Port 3c, and Port 4b.
1a-2a-3c-4c : Sets the R3968 to Port 1a, Port 2a, Port 3c, and Port 4c.

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1a-2b-3a-4a : Sets the R3968 to Port 1a, Port 2b, Port 3a, and Port 4a.
1a-2b-3a-4b : Sets the R3968 to Port 1a, Port 2b, Port 3a, and Port 4b.
1a-2b-3a-4c : Sets the R3968 to Port 1a, Port 2b, Port 3a, and Port 4c.
1a-2b-3b-4a : Sets the R3968 to Port 1a, Port 2b, Port 3b, and Port 4a.
1a-2b-3b-4b : Sets the R3968 to Port 1a, Port 2b, Port 3b, and Port 4b.
1a-2b-3b-4c : Sets the R3968 to Port 1a, Port 2b, Port 3b, and Port 4c.
1a-2b-3c-4a : Sets the R3968 to Port 1a, Port 2b, Port 3c, and Port 4a.
1a-2b-3c-4b : Sets the R3968 to Port 1a, Port 2b, Port 3c, and Port 4b.
1a-2b-3c-4c : Sets the R3968 to Port 1a, Port 2b, Port 3c, and Port 4c.

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2a-2b-3a-4a : Sets the R3968 to Port 2a, Port 2b, Port 3a, and Port 4a.

2a-2b-3a-4b : Sets the R3968 to Port 2a, Port 2b, Port 3a, and Port 4b.
2a-2b-3a-4c : Sets the R3968 to Port 2a, Port 2b, Port 3a, and Port 4c.
2a-2b-3b-4a : Sets the R3968 to Port 2a, Port 2b, Port 3b, and Port 4a.
2a-2b-3b-4b : Sets the R3968 to Port 2a, Port 2b, Port 3b, and Port 4b.
2a-2b-3b-4c : Sets the R3968 to Port 2a, Port 2b, Port 3b, and Port 4c.
2a-2b-3c-4a : Sets the R3968 to Port 2a, Port 2b, Port 3c, and Port 4a.
2a-2b-3c-4b : Sets the R3968 to Port 2a, Port 2b, Port 3c, and Port 4b.
2a-2b-3c-4c : Sets the R3968 to Port 2a, Port 2b, Port 3c, and Port 4c.

8.2.3.16 Display

1. Display 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 On/Off : Sets four basic mathematical calculations between trace data and trace memory data to ON or OFF. The Trace Math cannot be set to ON 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.

8.2.3.17 Sweep

1. Sweep menu

Sweep Time : Sets the sweep time.
Sweep Type : Displays the Sweep Type menu.
Trigger : Displays the Trigger menu.
Meas Point : Sets the number of measurement points.

2. Sweep Type menu

Lin Freq : Sets the linear frequency sweep.
Log Freq : Sets the log frequency sweep.
Power : Sets the power sweep.
Prgm Swp Freq : Sets the program sweep (the frequency and the number of points).
Prgm Swp All : Sets the program sweep (all items).
Edit Prgm Swp : Displays the Edit Program Sweep dialog box.

3. Trigger 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.

8.2.3.18 Freq

1. Frequency menu

Start Frequency	:	Sets the start frequency.
Stop Frequency	:	Sets the stop frequency.
Center Frequency	:	Sets the center frequency.
Freq Span	:	Sets the span frequency.
Output Power	:	Sets the output power.
CW Freq	:	Sets the CW frequency of the power sweep.

8.2.3.19 Power

1. Power menu

Start Power	:	Sets the start power for the power sweep.
Stop Power	:	Sets the stop power for the power sweep.
Attenuator	:	Displays the Attenuator menu. (Option 10)
Output Power	:	Sets the output power.
CW Freq	:	Sets the CW frequency for the power sweep.

2. Attenuator menu (Option 10)

Sets a built-in attenuator.

Output Power	:	Sets output power.
Att Mode Auto/Manual	:	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. Manual : Manually sets attenuator values for each port.
Att Port1	:	Sets an attenuator value for Port 1.
Att Port2	:	Sets an attenuator value for Port 2.
Att Port3	:	Sets an attenuator value forof Port 3.
Att Port4	:	Sets an attenuator value for Port 4.

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.

8.2.3.20 Save

1. Save menu

   Saves the analyzer's setting conditions to a file.

   Save File : Displays the Save dialog box.

   Define Save Option : Displays the Save Option menu.

   Delete File : Displays the Delete dialog box.

   Save S-Param : Displays the Save S-Parameter dialog box.

   Save Trace : Displays the Save Trace dialog box.

2. Save Option menu

   Sets measurement conditions of the analyzer.

   Cal Data On/Off : Sets the calibration data saving to ON or OFF. Saves the calibration data when ON is selected.
   However, additional information such as executable conditions are not saved. If the setting is changed after the data is loaded, the calibration data may not be validated.

   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.

8.2.3.21 Load

Displays the Load dialog box. Loads and opens the analyzer's setting conditions file.

8.2.3.22 Copy

1. Copy menu

   Save Bitmap Data : Saves a displayed picture image in a file.

9. USING THE EXTENSION FUNCTION

9.1 Saving Measurement Data

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

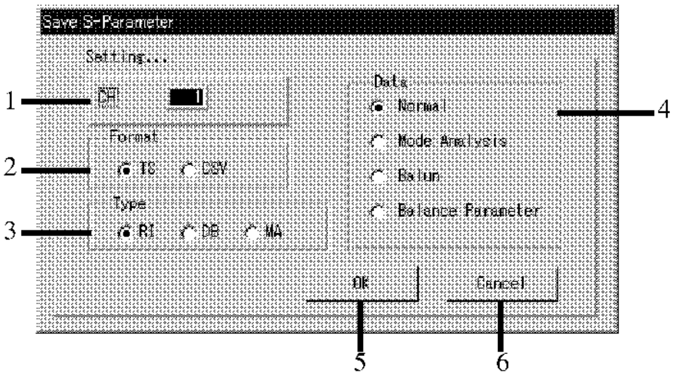
The two save methods allow saving of all measured S-parameters or specified measurement data only.

9.1.1 Save All S-parameters

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

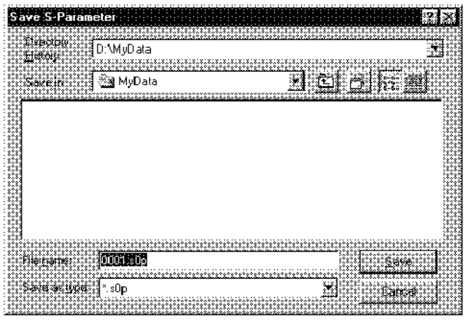
Display the File pull-down menu from the main menu, and click ***Save S-Parameter*** to display the Save S-Parameter dialog box.

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
   - ***Mode Analysis***: S-parameters after mode analysis
   - ***Balun***: S-parameters after balun transformation
   - ***Balance Parameter***: Balance parameters

5. ***OK*** : Displays the dialog box for specifying the file name and executing the save.
In the initialized status, D:\MyData is specified in the save area.



6. ***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(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

- 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

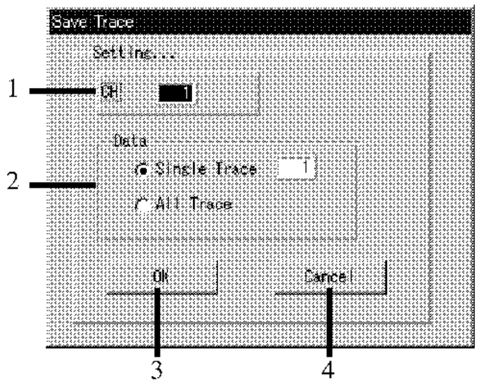
  T.S files have line feeds (LF) for devices with three or more ports. CSV files represent all data as a single line (with no line feeds).

9.1.2 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.

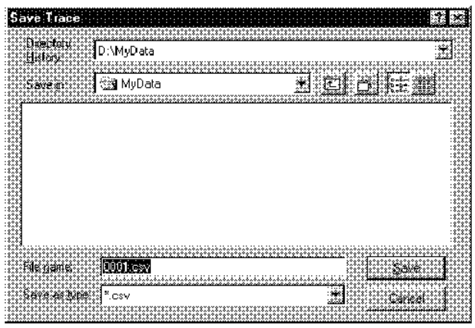
The file extension of the saved file is "csv." Data is arrayed in the order of measurement frequency and measurement data.



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.
   In the initialized status, D:\MyData is specified in the save area.

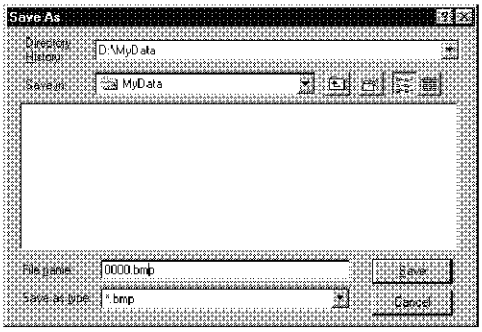


4. ***CANCEL*** : Cancels the settings and closes the dialog box.

9.2 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 Bitmap Data*** 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)

9.3 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.

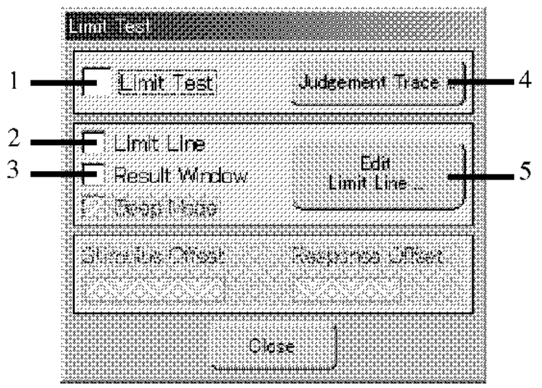
- The PASS or FAIL result is displayed in each window.
- The overall PASS or FAIL result is displayed in the limit test result window in full size.
- When the result is FAIL, the corresponding Limit Status Register bit is set.
- The waveform data in a failed range is displayed in red.

CAUTION:

1. ***The limit evaluation is performed at the sweep completion.***
   The evaluation result remains unrevised until the next time the sweep is performed.
2. ***No limit evaluation is performed for traces with Smith or Polar display format.***

9.3.1 How to Set the Limit Test function

Select ***Trace*** in the main menu. Then, select ***Limit Test*** to display the dialog box.



1. ***Limit Test*** : Sets the limit test function to On or Off.

   On : The limit evaluation is performed at the sweep completion. Limit evaluation results (PASS or FAIL) are displayed in each window.

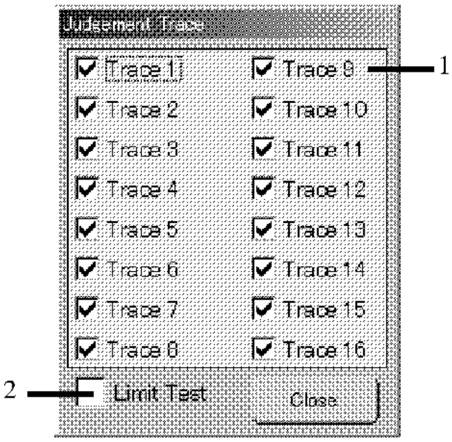
   Off : No limit evaluation is performed. Limit evaluation results are deleted.

2. ***Limit Line*** : Sets the limit line display to On or Off.
3. ***Result Window*** : Sets the limit test result window display to On or Off.
4. ***Judgement Trace*** : Displays the Judgement Trace dialog box.

5. ***Edit Limit Line*** : Displays the Limit Line Editor dialog box.

9.3.2 Judgement Trace Dialog Box

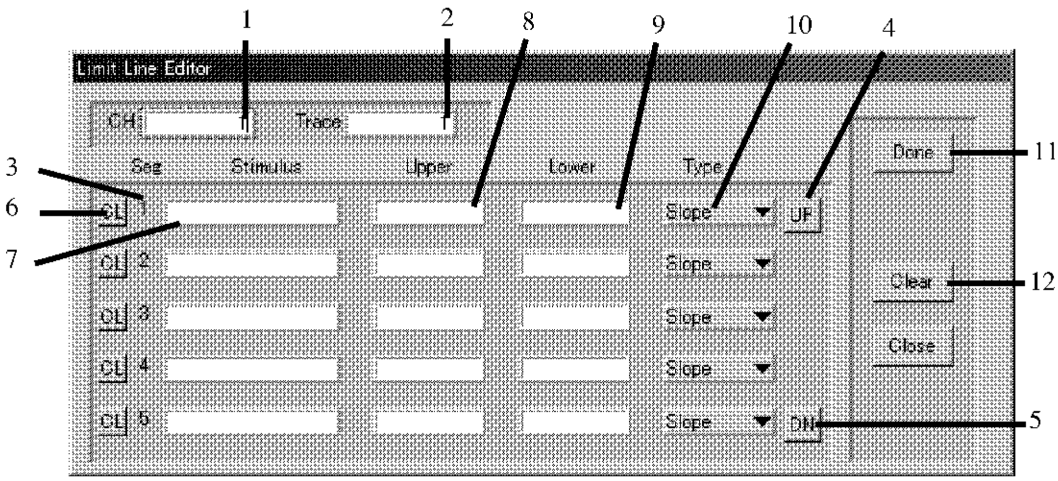
Select ***Trace*** in the main menu. Then, select ***Judgement Trace*** to display the dialog box.



1. ***Trace No.*** : Sets whether or not to perform the limit test for each trace.
   On : Performs the limit test.
   Off : Performs no limit test. The corresponding trace is considered a PASS.
2. ***Limit Test*** : Sets the limit test function to On or Off.

9.3.3 Limit Line Editor Dialog Box

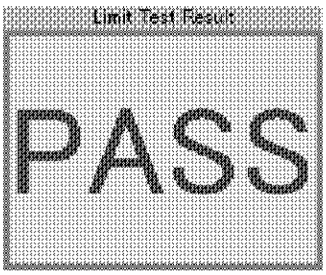
Edits limit lines.
Select ***Trace*** in the main menu. Then, select ***Edit Limit Line*** to display the dialog box.

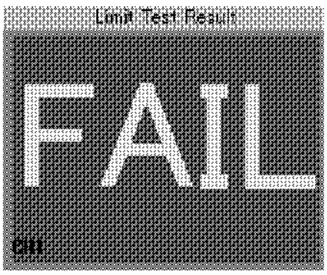


1. ***CH*** : Specifies the setting channel.
2. ***Trace*** : Specifies the setting trace.
3. ***Seg*** : Segment numbers. A maximum of 32 numbers (1~ 32) can be set.
4. ***UP*** : Moves the segment edit range upward.
5. ***DN*** : Moves the segment edit range downward.
6. ***CL*** : Clears specified segment contents.
7. ***Stimulus*** : Sets the specified segment stimulus value.
8. ***Upper*** : Sets the specified segment test upper limit.
9. ***Lower*** : Sets the specified segment test lower limit.
10. ***Type*** : Sets the specified segment line type.
    - ***Point*** : Performs an independent test at the stimulus point. The upper limit is ∨ and the lower limit is ∧ in the display.
    - ***Slope*** : Connected to the next segment start point limit value with an inclined line. If the segment is the last one, a horizontal line is drawn to the stimulus maximum point.
    - ***Flat*** : A horizontal line is drawn to the next segment start point. The limit value stays constant to the next segment start point. If the segment is the last one, a horizontal line is drawn to the stimulus maximum point.
11. ***Done*** : Completes the editing and defines the limit line.
12. ***Clear*** : Clears all segment contents.

9.3.4 Limit Test Result Window

Displays all channels and traces overall limit test result in easy to view size.





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.

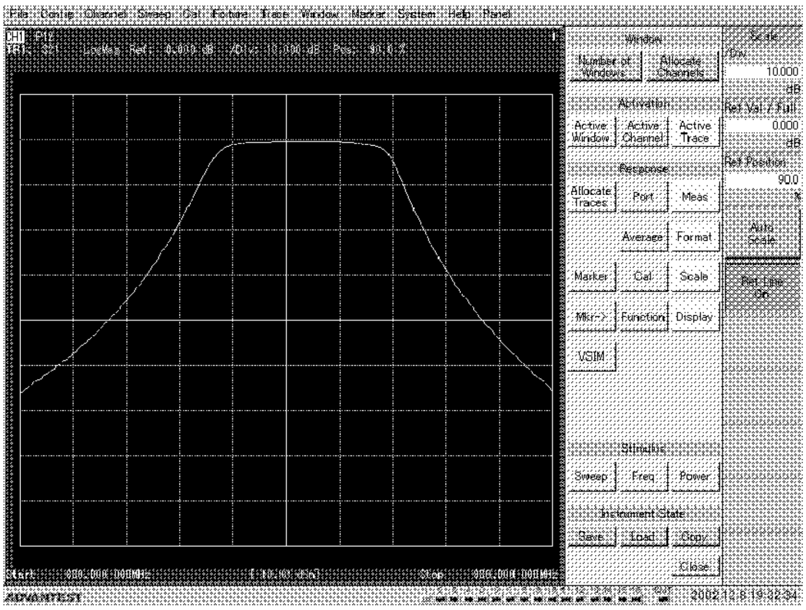
9.3.5 Measurement Sample

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*, *Freq*, *Center Freq*, 8, 8, 0, M/n, *Freq Span*, 1, 0, 0, M/n, *Active Trace*, *Trace* 1, *Meas*, *S21*, *Format*, *LogMag*, *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 ***Function*** in the side bar, and select ***Limit Test*** and ***Edit Limit Line*** as they appear in selections. The Limit Line Editor dialog box displays.

3. Edit limit lines.

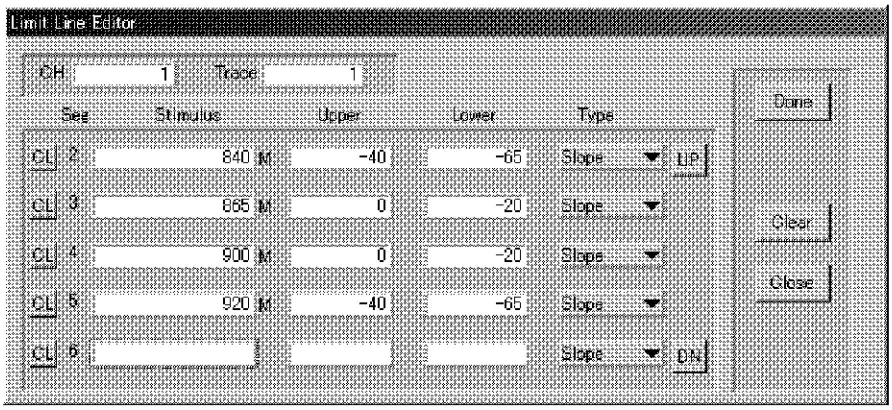
   For this example, set following limit lines.

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.

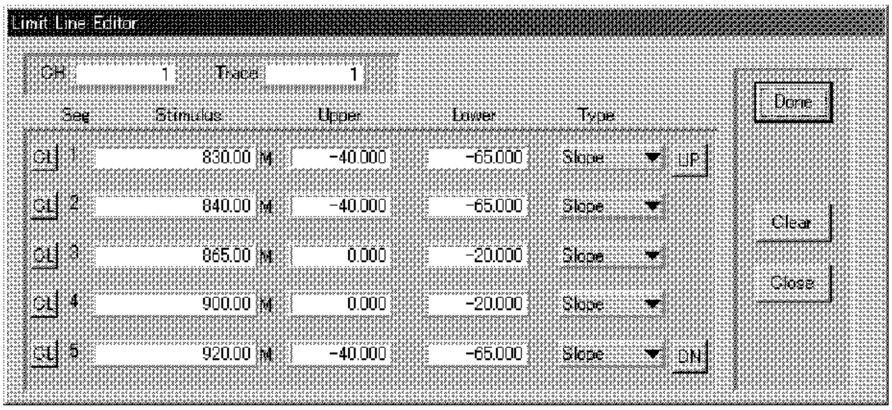
1. Select Seg 1 column for Stimulus and input **8**, **3**, **0**, and **M/n**.
2. Next Seg 1 column, for Upper is selected automatically. Input **-**, **4**, **0**, and **ENT**.
3. Input **-**, **6**, **5**, and **ENT** when the next column is selected. For Type, select ***Slope***.

Follow same procedures to set segments 2 ~ 5.



4. Confirm limit line settings.

   When all segments are set, select ***Done*** to finalize settings.



   The above completes limit line editing.

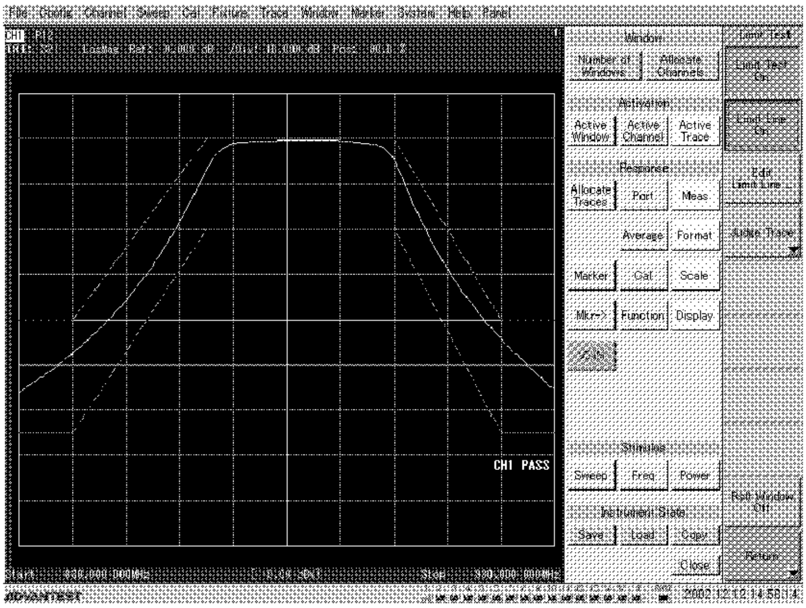
   Select ***Close*** to close the Limit Line Editor dialog box.

5. Validate the limit test.

   Select ***Limit Test On*** in the side bar.

6. Validate the limit line display.

   Select ***Limit Line On*** in the side bar.
   Following display appears.


CH1 PASS
Active Window
Active Channel
Active Trace
Allocate Traces
Port
Meas
Average
Format
Marker
Cal
Scale
Function
Display
Sweep
Freq
Power
Save
Load
Copy
Close
Edit Limit Line

10. Device Power Supply (Option 15)

10.1 Overview

The device power supply (Voltage Source & Current (I) Measurement. Hereafter called VSIM.) corresponds to the R3860 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 R3860 rear panel.

10.2 Functions

- Voltage output functions from four independent channels.
- A maximum of 16 settings, which correspond to 16 R3860 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 10-1 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 10-2 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

10.3 Menu

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

10.3.1 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.

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.

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 10-1 Output voltage range.
   Current Limit : Sets output current limit values. For more information on the setting ranges of each channel, refer to Table 10-1 Output voltage range.

4. I Meas 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.

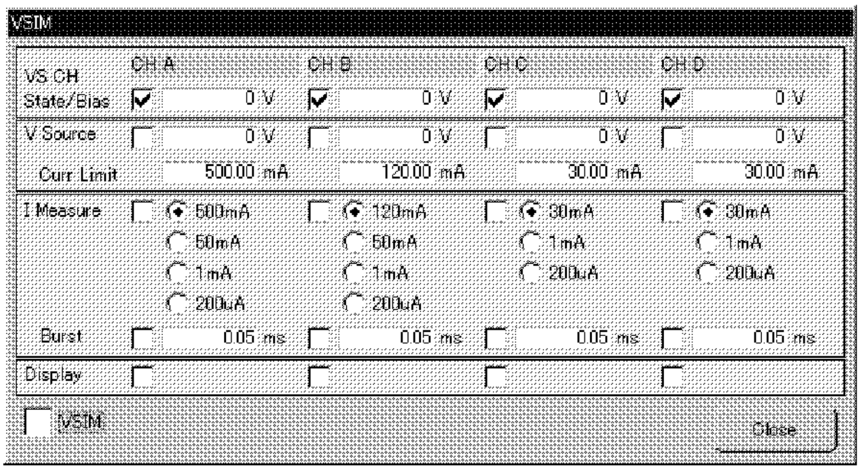
CH B On/Off : Sets the display of the channel B result to ON or OFF.

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.

10.3.2 VSIM Dialog Box

Sets the VSIM function conditions for each channel.
The dialog box is displayed by selecting Confg 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.

Curr 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.

10.4 Example Settings

This section shows examples of the switch control voltage settings used to measure the EGSM/DCS dual band FEM (Front End Module). (The measurement requires the R3968 multi-port test set as well as the optional functions.)
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 10-3 EGSM/DCS Dual Band FEM Control

	Control 1	Control 2	R3860 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 CHA
Control 2 : VSIM CHB

Sending the EGSM

1. Activate measurement channel 1 (CH1).
2. Select ***VSIM*** in the ***Config*** 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 10-1 according to the settings in Table 10-3.
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.

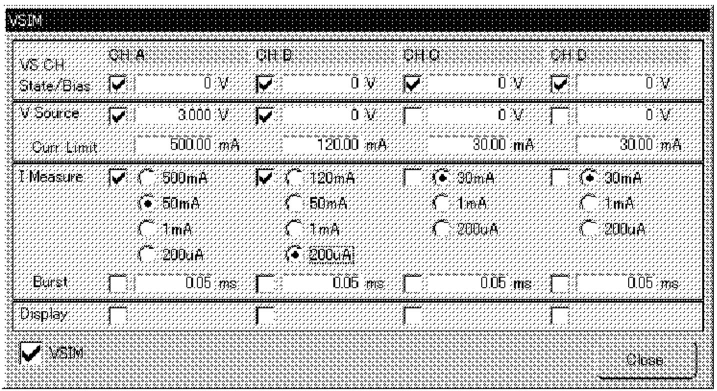


Figure 10-1 Sending the EGSM

Sending the DCS

1. Activate measurement channel 2 (CH2).
2. Set channels A and B as shown in Figure 10-2 according to the settings in Table 10-3.
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 .

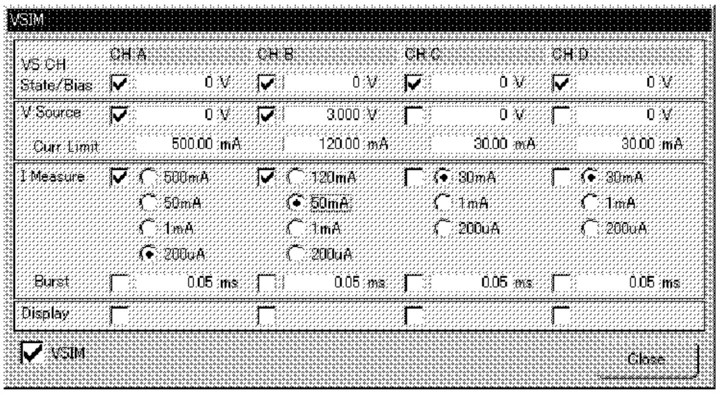


Figure 10-2 Sending the DCS

Receiving the EGSM

1. Activate measurement channel 3 (CH3).
2. Set channels A and B as shown in Figure 10-3 according to the settings in Table 10-3.
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.

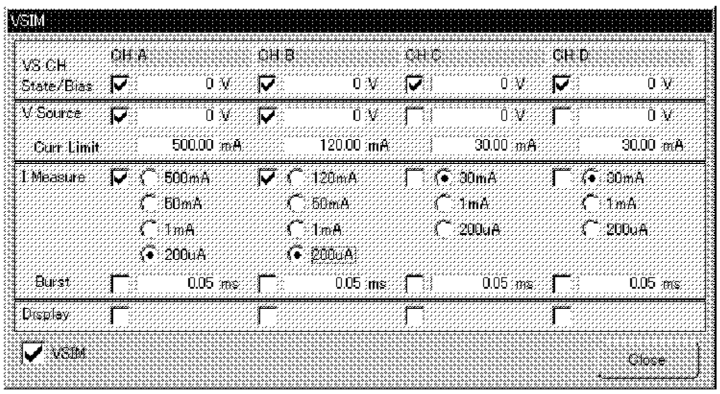


Figure 10-3 Receiving the EGSM

Receiving the DCS

1. Activate measurement channel 4 (CH4).

2. Set channels A and B as shown in Figure 10-4 according to the settings in Table 10-3.

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.

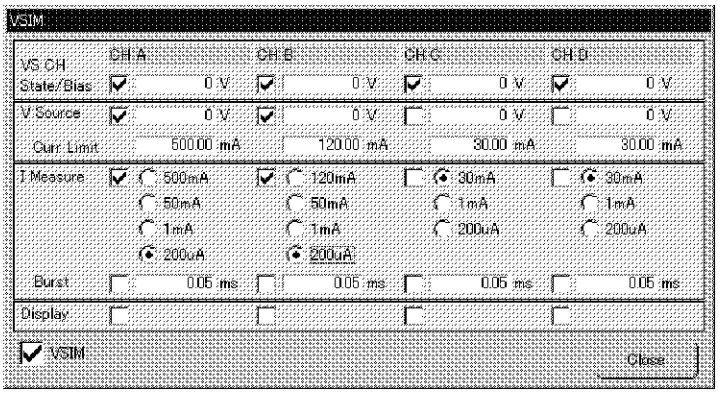
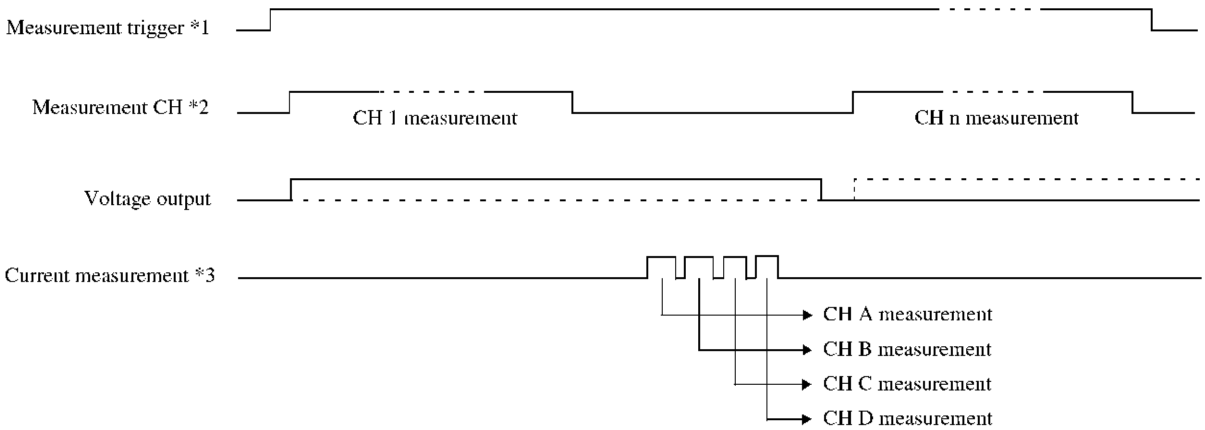


Figure 10-4 Receiving the DCS

10.5 Timing Chart

<VSIM voltage settings and current measurement timing>



* 1: R3860 internal measurement trigger.
* 2: Network analyzer measurement channel
* 3: The current is measured in channels A, B, C, and D, in order.

10.6 GPIB Command

For more information on GPIB commands, refer to Chapter 11, "REMOTE PROGRAMMING."

<table>
<tr><th>Function</th><th>Command</th><th>Parameter
(Summary Content)</th><th>Query</th></tr>
<tr><td>ON/OFF</td><td>[SOURce:]VSIM:STATe</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>
<tr><td>Current measurement function</td><td></td><td></td><td></td></tr>
<tr><td>ON/OFF</td><td>SENSe:CURRent<ch>:
STATe<vsim></td><td><bool></td><td>0|1</td></tr>
<tr><td>Measurement range</td><td>SENSe:CURRent<ch>:
RANGe<vsim></td><td><real></td><td><real></td></tr>
<tr><td>Burst measurement
ON/OFF</td><td>SENSe:CURRent<ch>:
BURSt<vsim></td><td><bool></td><td>0|1</td></tr>
<tr><td>Burst measurement time</td><td>SENSe:CURRent<ch>:
TIME<vsim></td><td><real></td><td><real></td></tr>
<tr><td>Current measurement
value output</td><td>FETCh<ch>:CURRent<vsim>?</td><td>×</td><td><real></td></tr>
<tr><td>Measurement error output</td><td>SENSe:CURRent<ch>:
CONDition<vsim>?</td><td>×</td><td><int>
= Error code
(from lower bits)
LimitA, B, C, D,
OscillatorA, B, C, D,
OverloadA, B, C, D,
Overheat</td></tr>
<tr><td>Result display</td><td></td><td></td><td></td></tr>
<tr><td>ON/OFF</td><td>DISPlay<ch>:WINDow:
VSIM<vsim></td><td><bool></td><td>0|1</td></tr>
</table>

<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.

10.7 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.

11. REMOTE PROGRAMMING

11.1 GPIB Command Index

Use this GPIB Command Index as an index for Section 11.7.2. Common Commands.

11.2 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 analyzer also has a built-in control function, enabling easy configuration of small GPIB systems.

The following describes the method of control using the GPIB remote control functions.

11.2.1 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.

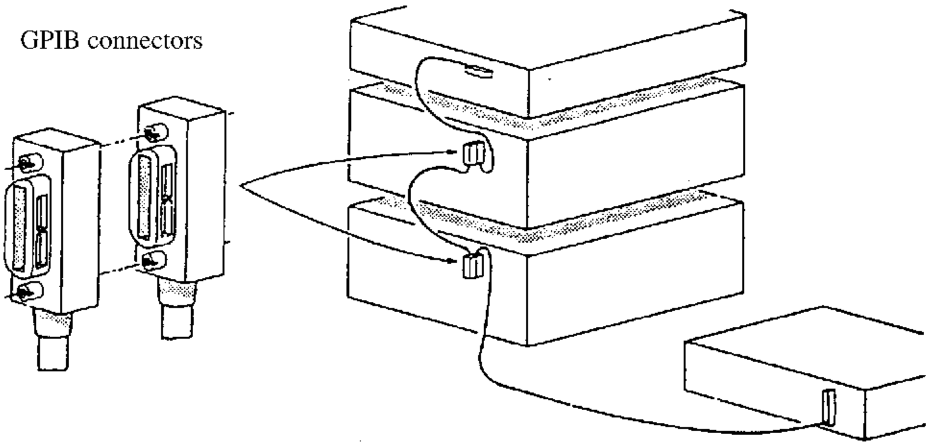
  The controller controls the entire system by sending interface messages or device messages to each measuring instrument. The functions of the messages are:

  - Interface message: Control of the GPIB bus
  - Device message: Control of the measuring instrument

11.2.2 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. The GP-IB 2 connector (option) is a dedicated connector for a controller.

2. Setting GPIB address

   GPIB addresses can be set in the GPIB Address dialog box, which is accessed by selecting GPIB Address in the System menu.

11.3 GPIB Bus Functions

11.3.1 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

11.3.2 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.

11.3.2.1 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. If the analyzer is specified as an active controller at that time, control of the GPIB bus will be removed from the analyzer and transferred to the system controller.

11.3.2.2 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 2.3.8), it ignores all key inputting.

11.3.2.3 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.

11.3.2.4 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 "11.6 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.

11.3.2.5 Device C7lear (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.)

11.3.2.6 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.

11.3.2.7 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.

11.3.2.8 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

11.3.2.9 Take Control (TCT)

If the analyzer receives the TCT message when it is specified as a talker, it becomes the active controller through "pass control". On receiving the IFC message, the analyzer returns to the addressable mode.

11.3.3 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.

11.3.3.1 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

11.3.3.2 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.

Purser

The purser 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 purser 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 purser is cleared.

Any of the following four methods can be used to clear the purser:

- 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 purser 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

11.4 Command Syntax

11.4.1 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.

11.4.1.1 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 "11.4.1.2 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

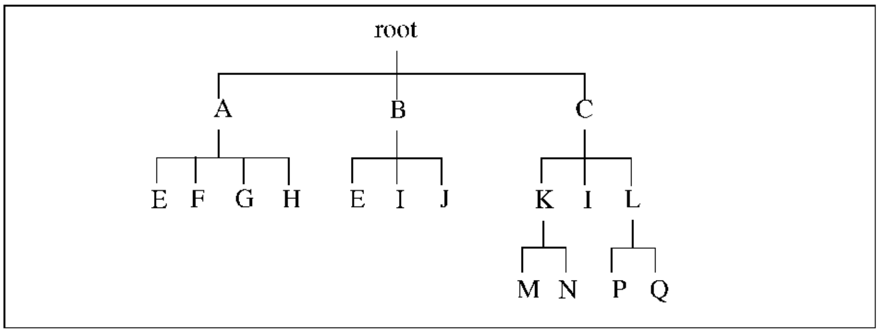
   The current path should be changed in accordance with the following rules:

   - 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.

11.4.1.2 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

     [Symbol] → Number ⇒

   - Fixed-point type : NR2 format

     [Symbol] → Number ⇒ . → Number ⇒

   - Floating-point type : NR3 format

     [Symbol] → Number ⇒ . → Number ⇒ E or e → Symbol → Number ⇒

   NOTE: ***" ⇒ " indicates repetition. Symbols 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
[SENCe:]CORRection:CKIT:DEFine:STANdard:ODELay
[SENCe:]CORRection:CKIT:DEFine:STANdard:SDELay
[SENCe:]CORRection:CKIT:DEFine:STANdard:LDELay
[SENCe:]CORRection:CKIT:DEFine:STANdard:TFDELay
[SENCe:]CORRection:CKIT:DEFine:STANdard:TRDELay
[SOURce:]SWEep:TIME
TRIGger[:SEQuence]:DELay</td></tr>
<tr><td>OHM</td><td>[SENCe:]CORRection:CKIT:DEFine:STANdard:OIMPedance
[SENCe:]CORRection:CKIT:DEFine:STANdard:SIMPedance
[SENCe:]CORRection:CKIT:DEFine:STANdard:LIMPedance
[SENCe:]CORRection:CKIT:DEFine:STANdard:TFIMPedance
[SENCe:]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.

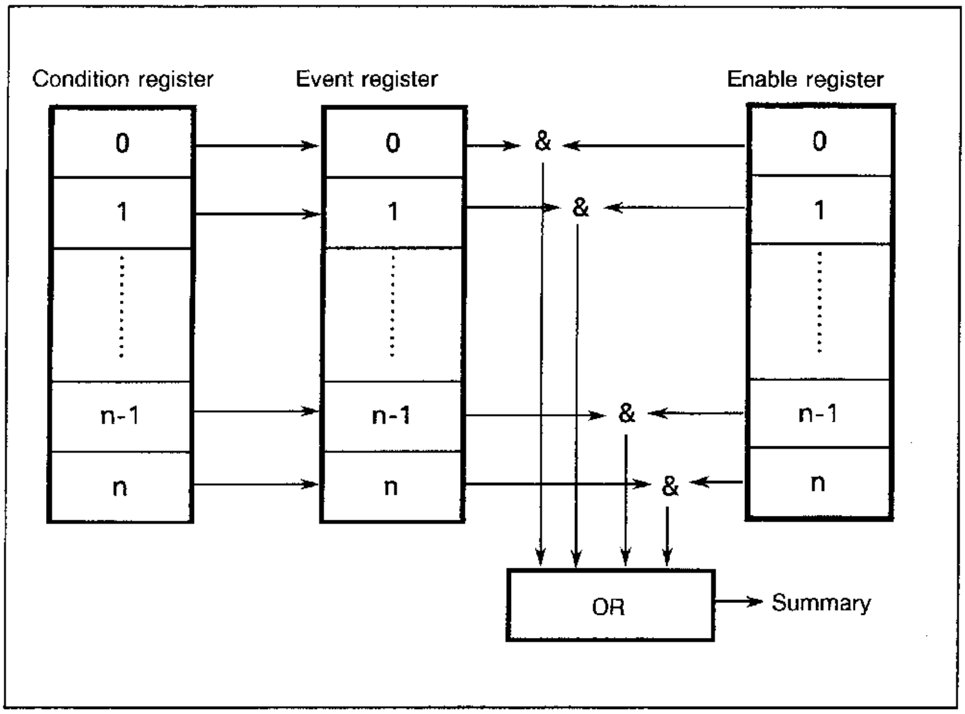
*: If HZ or OHM is used as the unit, the command will be executed using th suffix 1E6 (equivalent to MA).

11.5 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 R3860 system 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 spectrum analyzer are shown in Figure 11-1.

The status registers are shown in detail in Figure 11-2.

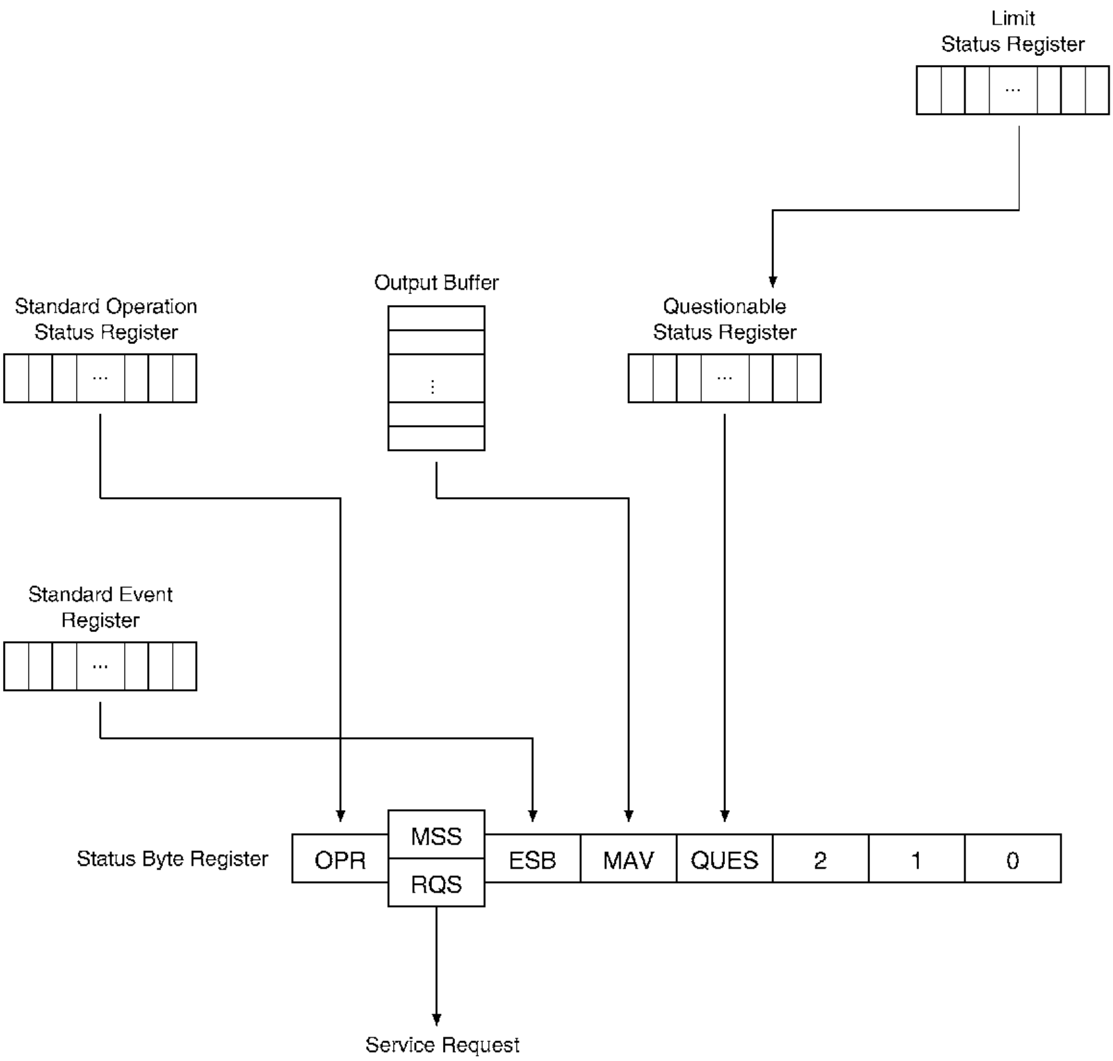


Figure 11-1 Arrangement of the Three Status Registers

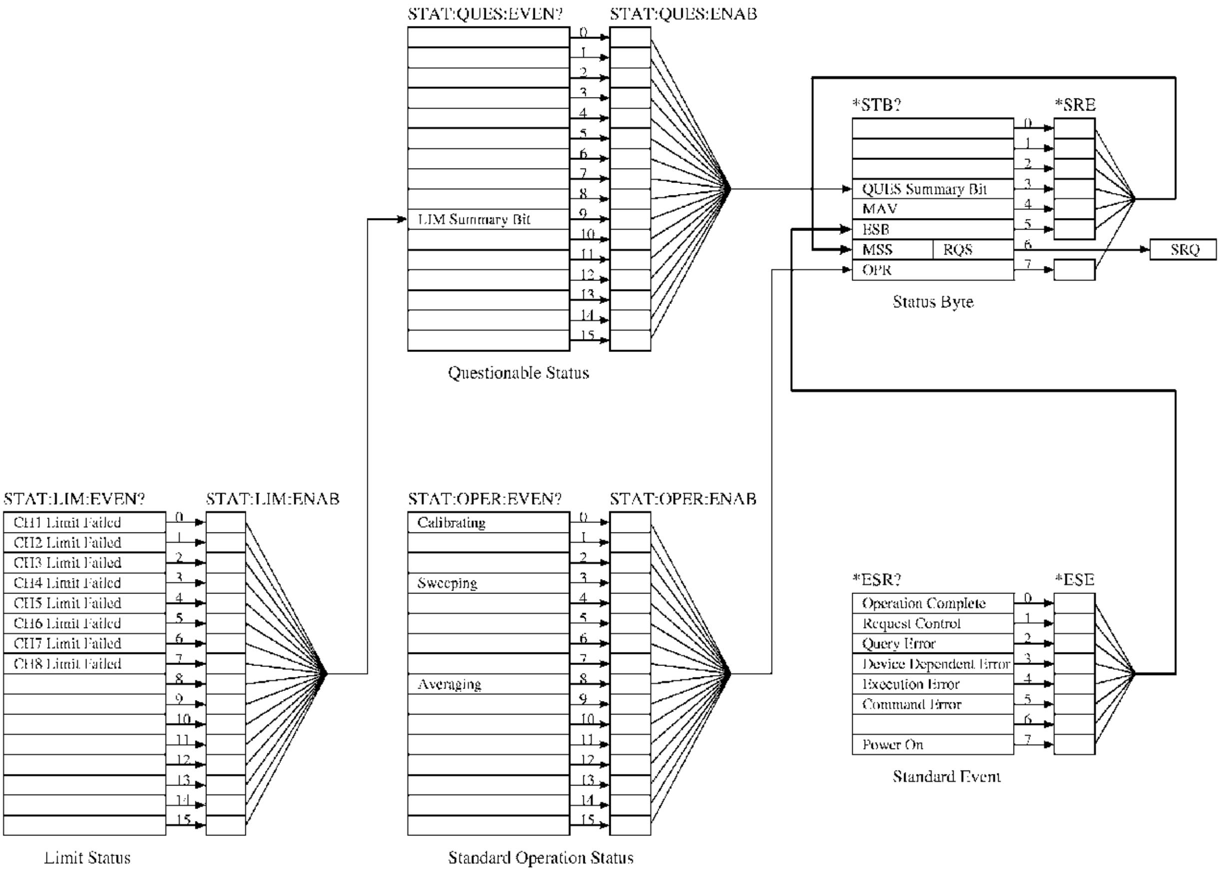


Figure 11-2 Details of the Three Status Registers

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 11-3.

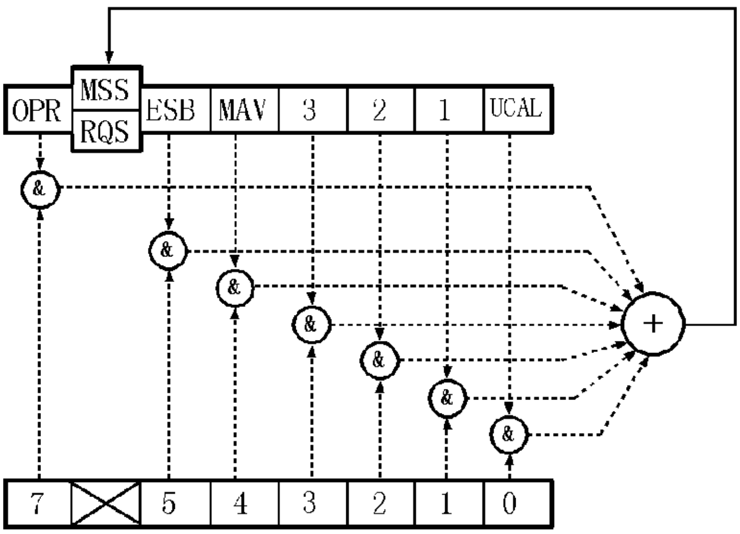


Figure 11-3 Structure of the Status Byte Register

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	Will be set to 1 when channel 1 waveform is defined as FAIL.
1	CH2 Limit Failed	Will be set to 1 when channel 2 waveform is defined as FAIL.
2	CH3 Limit Failed	Will be set to 1 when channel 3 waveform is defined as FAIL.
3	CH4 Limit Failed	Will be set to 1 when channel 4 waveform is defined as FAIL.
4	CH5 Limit Failed	Will be set to 1 when channel 5 waveform is defined as FAIL.
5	CH6 Limit Failed	Will be set to 1 when channel 6 waveform is defined as FAIL.
6	CH7 Limit Failed	Will be set to 1 when channel 7 waveform is defined as FAIL.
7	CH8 Limit Failed	Will be set to 1 when channel 8 waveform is defined as FAIL.

11.6 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.

11.6.1 Trigger Model

The following shows the model of the trigger system for the analyzer.

Switching on power

:ABORt → Idle state — See section 11.6.2.
*RST

↓ ↑

Trigger waiting state — See section 11.6.3.

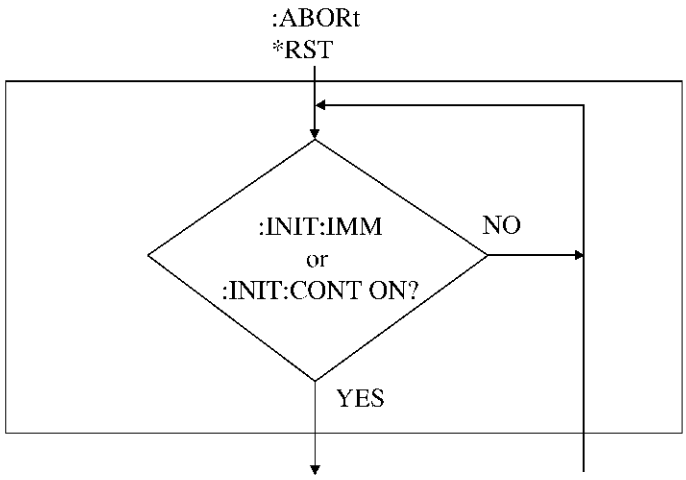
↓ ↑

Measuring state — See section 11.6.4.

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.

11.6.2 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:

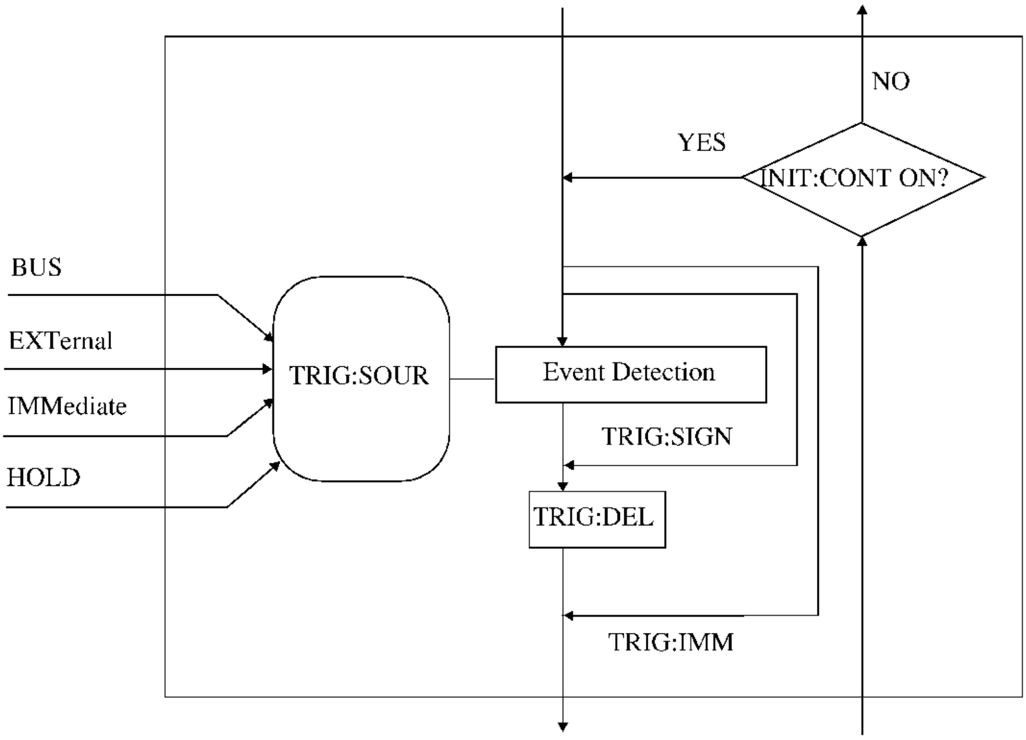


The trigger system does not leave this state until INITiate [:IMMediate] or INITiate:CONTinuous ON. Either of these conditions changes the trigger system to the trigger waiting state.

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.

11.6.3 Trigger Waiting State

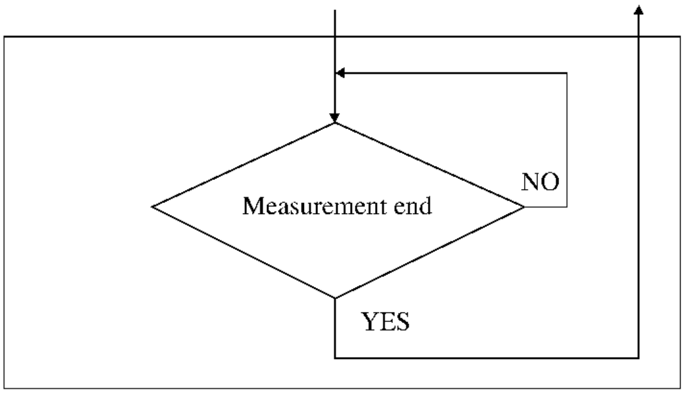


The above is a flowchart of the trigger waiting state of the analyzer. The TRIGger:SOURce command sets the trigger source, and the event detection detects a trigger factor. When the analyzer is triggered and leaves the event detection state, it enters the next state after the time specified by the TRIGger:DELay 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.

11.6.4 Measuring State



The analyzer performs measurement in this state. When the analyzer enters the measuring state, it performs sweeping and acquires measurement data.

11.7 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.
System Command	:	Is used for system-related information.
GP-IB Command	:	Is used for GP-IB control.

11.7.1 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, 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.***
<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***	
x	:	***Not available***	

11.7.2 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.

  The status byte (which was set by the REQUEST command in the Built-in BASIC) cannot be cleared by "* CLS". "* CLS" can be used to clear the status byte register whenever its contents are not zero. If you first execute "* CLS" and then execute "REQUEST 0" from BASIC when using the REQUEST command.

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 queryCommand / 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 queryCommand / 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 queryQuery
- 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 11-1 Table Standard Event Register Assignmen

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 purser 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 queryQuery
   - 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 queryQuery
   - Query — *IDN?
   - IDNT?
   - Response type — "<manufacturer>,<model>,<serial number>,<firmware level>"

     <manufacturer> = ADVANTEST

     <model> = Model name

     <serial number> = Serial number

     <firmware level> = 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 queryQuery
   - 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 queryCommand / 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. *PCB
    - Function: Setting of the GPIB address used to return the right of control
    - Presence of command and queryCommand
    - Command: *PCB <primary>[,<secondary>]
    - Parameter: <primary>
      <secondary>
    - Description: The *PCB command sets the address of the external controller to which the analyzer is connected.
12. *PMC
    - Function: Deletion of all macro definitions
    - Presence of command and queryCommand
    - 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.

13. *RCL

- Function: Recalls the device settings
- Presence of command and queryCommand

  Command: *RCL {<int> | POFF}

  Parameter: <int> = register number
  POFF = Settings before the power-off
- Description: The *RCL command recalls the analyser settings from the specified internal register. If the register number 0 or POFF (or RECLPOFF) is used, this command recalls the settings before the power-off.

14. *RST

- Function: Resetting of devices
- Presence of command and queryCommand
- 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).

15. *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).

16. *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.

17. *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 11-2 Standard Event Register Assignments

bit		
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

18. *TRG
    - Function　　Triggering device
    - Presence of command and queryCommand
    - 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 "11.6 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.
19. *TST?
    - Function　　Query of self test result
    - Presence of command and queryQuery
    - 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. For the analyzer, answers other than "0" are not returned in response to "*TST?".
20. *WAI
    - Function　　Waiting for end of all operations being performed
    - Presence of command and queryCommand
    - 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.

11.7.3 File Commands

Function	Command	Parameter (Summary Content)	Query
Reuse			
Loading a file	FILE:LOAD	<str> = "File name"	×
Register recall	REGister:RECall	<int> = "File No.":0 to 9999	×
Save			
Storing a file	FILE:STORe	<str> = "File name"	×
Saving a register	REGister:SAVE	<int> = "File No.":0 to 9999	×
Save option			
Cal Data	FILE:STATe: CORRection	<bool>	1|0
Raw Data	FILE:STATe:RAW	<bool>	0|1
Trace Data	FILE:STATe:DATA	<bool>	0|1
Trace Memory	FILE:STATe:MEMory	<bool>	1|0

11.7.4 Configuration Commands

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|SPL|OV ER
Test set			
Path	ROUTe:PATH<ch>: SELect	<int> = See *1	<int> = See *1
Synchronizing Channels	ROUTe:PATH<ch>: SYNChronize	<bool>	0|1
Cal data save	REGister:SAVE: CORRection	<int> = File number: 0 - 9999	×
Cal data recall	REGister:RECall: CORRection	<int> = File number: 0 - 9999	×
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>
Channel synchronous	[SYSTem:] COMMunicate<ch>: PARallel<ch>: SYNChronize	<bool>	0|1

*1: Test set path settings

Setting Value	Path	Setting Value	Path
0	Port1a - Port2a - Port3a - Port4a	8464	Port1a - Port2b - Port3b - Port4c
4096	Port1a - Port2a - Port3a - Port4b	528	Port1a - Port2b - Port3c - Port4a
8192	Port1a - Port2a - Port3a - Port4c	4624	Port1a - Port2b - Port3c - Port4b
256	Port1a - Port2a - Port3b - Port4a	8720	Port1a - Port2b - Port3c - Port4c
4352	Port1a - Port2a - Port3b - Port4b	20	Port2a - Port2b - Port3a - Port4a
8448	Port1a - Port2a - Port3b - Port4c	4116	Port2a - Port2b - Port3a - Port4b
512	Port1a - Port2a - Port3c - Port4a	8212	Port2a - Port2b - Port3a - Port4c
4608	Port1a - Port2a - Port3c - Port4b	276	Port2a - Port2b - Port3b - Port4a
8704	Port1a - Port2a - Port3c - Port4c	4372	Port2a - Port2b - Port3b - Port4b
16	Port1a - Port2b - Port3a - Port4a	8468	Port2a - Port2b - Port3b - Port4c
4112	Port1a - Port2b - Port3a - Port4b	532	Port2a - Port2b - Port3c - Port4a
8208	Port1a - Port2b - Port3a - Port4c	4628	Port2a - Port2b - Port3c - Port4b
272	Port1a - Port2b - Port3b - Port4a	8724	Port2a - Port2b - Port3c - Port4c
4368	Port1a - Port2b - Port3b - Port4b		

11.7.5 Channel Commands

Function	Command	Parameter (Summary Content)	Query
Channel			
Attach Channel	DISPlay:WINDow<win> :ATTach	<ch>	<ch>
Active Channel	DISPlay:ACTivate	<ch>	<ch>

11.7.6 Sweep Commands

Function	Command	Parameter (Summary Content)	Query
Test port	[SENSe:]FUNCtion <ch>:POWer	P1|P2|P3|P4|P12|P13|P14|P23|P24|P34|P123|P124|P134|P234|P1234|NONE = See *2	P1|P2|P3|P4|P12|P13|P14|P23|P24|P34|P123|P124|P134|P234|P1234|NONE = See *2
Frequency			
Start	[SOURce:]FREQuency <ch>:STARt	<real>	<real>
Stop	[SOURce:]FREQuency <ch>:STOP	<real>	<real>
Center	[SOURce:]FREQuency <ch>:CENTer	<real>	<real>
Span	[SOURce:]FREQuency <ch>:SPAN	<real>	<real>
CW	[SOURce:]FREQuency <ch>:CW	<real>	<real>
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 (Option 10)			
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>

<table>
<tr><th>Function</th><th>Command</th><th>Parameter (Summary Content)</th><th>Query</th></tr>
<tr><td>Sweep type</td><td></td><td></td><td></td></tr>
<tr><td>Frequency sweep</td><td>[SOURce:]FREQuency <ch>:MODE</td><td>SWEep</td><td>SWE|CW
= SWE: Linear/Log sweep
= CW: Others</td></tr>
<tr><td>Power sweep</td><td>[SOURce:]POWer <ch>:MODE</td><td>SWEep</td><td>SWE|FIX
= SWE: Power sweep
= FIX: Others</td></tr>
<tr><td>Program sweep</td><td>[SOURce:]PSWeep<ch> :MODE</td><td>FREQuency|ALL|NONE
= FREQ:Frequency
= ALL:All items
= NONE:Others</td><td>FREQ|ALL|NONE</td></tr>
<tr><td>Linear/Log</td><td>[SOURce:]SWEep<ch> :SPACing</td><td>LINear|LOGarithmic
= LIN:Linear frequency
= LOG:Log frequency</td><td>LIN|LOG</td></tr>
<tr><td>Trigger</td><td></td><td></td><td></td></tr>
<tr><td>Trigger</td><td>TRIGger[:SEQuence] [:IMMediate]</td><td>-</td><td>×</td></tr>
<tr><td>Trigger</td><td>TRIGger[:SEQuence]: SIGNal</td><td>-</td><td>×</td></tr>
<tr><td>Delay</td><td>TRIGger<ch> [:SEQuence]:DELay</td><td><real></td><td><real></td></tr>
<tr><td>Source</td><td>TRIGger[:SEQuence]: SOURce</td><td>IMMediate|EXTernal|BUS|HOLD</td><td>IMM|EXT|BUS|HOLD</td></tr>
<tr><td>Continuous sweep</td><td>INITiate:CONTinuous</td><td><bool></td><td>0|1</td></tr>
<tr><td>Single sweep</td><td>INITiate[:IMMediate]</td><td>-</td><td>×</td></tr>
<tr><td>Program sweep\</td><td></td><td></td><td></td></tr>
<tr><td>Frequency</td><td>[SOURce:]PSWeep <ch>:FREQuency<seg></td><td><real>[,<real>]</td><td><real>,<real></td></tr>
<tr><td>Power</td><td>[SOURce:]PSWeep <ch>:POWer<seg></td><td><real>[,<real>]</td><td><real>,<real></td></tr>
<tr><td>RBW</td><td>[SOURce:]PSWeep <ch>:BANDwidth<seg></td><td><real></td><td><real></td></tr>
<tr><td>Point</td><td>[SOURce:]PSWeep <ch>:POINt<seg></td><td><int></td><td><int></td></tr>
<tr><td>Settling time</td><td>[SOURce:]PSWeep <ch>:SETTling<seg></td><td><real></td><td><real></td></tr>
<tr><td>Segment clear</td><td>[SOURce:]PSWeep <ch>:CLEar<seg></td><td>-</td><td>×</td></tr>
</table>

<table>
<tr><th>Function</th><th>Command</th><th>Parameter (Summary Content)</th><th>Query</th></tr>
<tr><td>All clear</td><td>[SOURce:]PSWeep
<ch>:CLEar:ALL</td><td>-</td><td>×</td></tr>
<tr><td>Averaging</td><td></td><td></td><td></td></tr>
<tr><td>ON/OFF</td><td>[SENSe:]AVERaging
<ch>[:STATe]</td><td><bool></td><td>0|1</td></tr>
<tr><td>Count</td><td>[SENSe:]AVERaging
<ch>:COUNt</td><td><int></td><td><int></td></tr>
</table>

11.7.7 Cal Commands

<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>Cal data clear</td><td>[SENSe:]CORRection
<ch>:COLLect:DELete</td><td>-</td><td>×</td></tr>
<tr><td>Standard Cal</td><td></td><td></td><td></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
= See *2</td><td>P1|P2|P3|P4|P12|P13|P1
4|P23|P24|P34|P123|
P124|P134|P234|P1234|
NONE
= See *2</td></tr>
<tr><td>Standards</td><td>[SENSe:]CORRection
<ch>:COLLect[:ACQuire]</td><td>STANdard{1-25}
= 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</td><td>P1|P2|P3|P4|P12|P13|P14|P23|P24|
P34|P123|P124|P134|P234|P1234
= 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>
<tr><td>Averaging factor (count)</td><td>[SENSe:]CORRection
<ch>:AUTO:AVERaging:
COUNt</td><td><int></td><td><int></td></tr>
</table>

Function	Command	Parameter (Summary Content)	Query
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-defined	<int> =0: Don't care =1: N50Ω =2: N75Ω =3: 3.5mm =4: 7mm =5: User-defined
Port polarity	[SENSe:]CORRection <ch>:CKIT:TERMinal <port>	FEMale|MALE	FEM|MALE

11.7.7 Cal Commands

Function	Command	Parameter (Summary Content)	Query
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>
Offset impedance	[SENSe:]CORRection <ch>:CKIT:DEFine: STANdard<port>: LIMPedance	<real>	<real>

Function	Command	Parameter (Summary Content)	Query
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	-	×

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 → Extension	MARKer<ch>:LET	PEXTension	×

*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.
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.
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-Port4T hru
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
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.

11.7.8 Fixture Commands

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 web delete	CALCulate<ch>:TRANsform: SFIXture:DEVice<port>: SMATching	<bool>	0|1
Impedance transformation	CALCulate<ch>:TRANsform: SFIXture:DEVice:STATe	<bool>	0|1
Impedance value	CALCulate<ch>:TRANsform: SFIXture:DEVice<port>: IMPedance	<bool>	<real>
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

<table>
<tr><th>Function</th><th>Command</th><th>Parameter (Summary Content)</th><th>Query</th></tr>
<tr><td>Capacitance value</td><td>CALCulate<ch>:TRANsform:
SFIXture:BALance<bport>:
CAPacitance</td><td><real></td><td><real></td></tr>
<tr><td>Conductance value</td><td>CALCulate<ch>:TRANsform:
SFIXture:BALance<bport>:
GCAPacitance</td><td><real></td><td><real></td></tr>
<tr><td>Inductance value</td><td>CALCulate<ch>:TRANsform:
SFIXture:BALance<bport>:
INDuctance</td><td><real></td><td><real></td></tr>
<tr><td>Resistor value</td><td>CALCulate<ch>:TRANsform:
SFIXture:BALance<bport>:
RINDuctance</td><td><real></td><td><real></td></tr>
<tr><td>Balance measurement</td><td></td><td></td><td></td></tr>
<tr><td>Balance parameter</td><td>CALCulate<ch>:TRANsform:
SFIXture:BPARameter</td><td><bool></td><td>0|1</td></tr>
<tr><td>Balance transformation</td><td>CALCulate<ch>:TRANsform:
SFIXture:BALun</td><td><bool></td><td>0|1</td></tr>
<tr><td>Balun type</td><td>CALCulate<ch>:TRANsform:
SFIXture:BALun:TYPE</td><td>FLOating|DIFFerential</td><td>FLO|DIFF</td></tr>
<tr><td>Mixed 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>Balance type</td><td>CALCulate<ch>:TRANsform:
SFIXture:DEVice:
SPECification</td><td>B12B34|U1B34|U2B34</td><td>B12B34|U1B34|
U2B34</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>
</table>

11.7.9 Trace Commands

<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>0|1</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</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</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>
<tr><td>Scale</td><td></td><td></td><td></td></tr>
<tr><td>Auto scale</td><td>DISPlay<ch>[:WINDow]:
Y<tr>:SCALe:AUTO
ONCE</td><td>ONCE</td><td>×</td></tr>
<tr><td>/div</td><td>DISPlay<ch>[:WINDow]:
Y<tr>:SCALe:PDIVision</td><td><real></td><td><real></td></tr>
<tr><td>Reference level</td><td>DISPlay<ch>[:WINDow]:
Y<tr>:SCALe:RLEVel</td><td><real></td><td><real></td></tr>
<tr><td>Reference position</td><td>DISPlay<ch>[:WINDow]:
Y<tr>:SCALe:RPOSition</td><td><real></td><td><real></td></tr>
<tr><td>Reference line ON/OFF</td><td>DISPlay<ch>[:WINDow]:
Y<tr>:RLINe</td><td><bool></td><td>0|1</td></tr>
</table>

Function	Command	Parameter (Summary Content)	Query
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>
Trace memory			
Display ON/OFF	DISPlay:WINDow<win>: 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
Limit line ON/OFF	DISPlay<ch>:LIMit:LINE	<bool>	0|1
Test trace ON/OFF	DISPlay<ch>:LIMit: TRACe<tr>:STATe	<bool>	1|0
Result window display ON/OFF	DISPlay:LIMit:SUMMary: WINDow	<bool>	0|1
Segment edit	DISPlay<ch>:LIMit<tr>: SEGMent<seg>	<real>,<real>,<real>,{SLINe| FLINe|SPOint} =Stimulus,Upper,Lower,Type	<real>,<real>,{SLIN|FLIN| SPO},0,0
All segment clear	DISPlay<ch>:LIMit<tr>: CLEar	-	×
Test result output	DISPlay<ch>:LIMit: RESult?	×	OFF|PASS|FAIL
Test result summary output	DISPlay:LIMit:SUMMary?	×	OFF|PASS|FAIL

11.7.10 Window Commands

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>	1|0
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>
Annotation display			
Trace annotation	DISPlay:ANNotation:TRACe	<bool>	1|0
Stimulus annotation	DISPlay:ANNotation:STIMulus	<bool>	1|0

11.7.11 Marker Commands

<table>
<tr><th>Function</th><th>Command</th><th>Parameter (Summary Content)</th><th>Query</th></tr>
<tr><td>Marker</td><td></td><td></td><td></td></tr>
<tr><td>Activate</td><td>MARKer<ch>:
ACTivate[:NUMBer]</td><td><int>[<real>]
= Marker No., Frequency
(Power during Power sweep)</td><td><int>,<real></td></tr>
<tr><td>Frequency setting</td><td>MARKer<ch>:
ACTivate:STIMulus</td><td><real></td><td><real></td></tr>
<tr><td>Trace specify</td><td>MARKer<ch>:
ACTivate:TRACe</td><td><int></td><td><int></td></tr>
<tr><td>ON/OFF</td><td>MARKer<ch>:
ACTivate:STATe</td><td><bool></td><td>0|1</td></tr>
<tr><td>All marker OFF</td><td>MARKer<ch>:AOFF</td><td>-</td><td>×</td></tr>
<tr><td>Compensate ON/OFF</td><td>MARKer<ch>:
COMPensate</td><td><bool></td><td>0|1</td></tr>
<tr><td>Polar marker</td><td>MARKer<ch>:POLar</td><td>MLINear|MLOGarithmic|
RIMaginary</td><td>MLIN|MLOG|RIM</td></tr>
<tr><td>Smith marker</td><td>MARKer<ch>:SMITh</td><td>MLINear|MLOGarithmic|
RIMaginary|IMPedance|
ADMittance</td><td>MLIN|MLOG|RIM|IMP|
ADM</td></tr>
<tr><td>Marker list</td><td>MARKer<ch>:LIST</td><td><bool></td><td>0|1</td></tr>
<tr><td>List display position</td><td>MARKer<ch>:LIST:
DISPlay</td><td>LOWer|UPPer</td><td>LOW|UPP</td></tr>
<tr><td>Channel definition</td><td>MARKer<ch>:COUPle:
CHANnel<ch>:DEFine</td><td><bool></td><td>0|1</td></tr>
<tr><td>Delta mode</td><td></td><td></td><td></td></tr>
<tr><td>Mode</td><td>MARKer<ch>:DELTa
[:MODE]</td><td>OFF|CHILd|COMPare</td><td>OFF|CHIL|COMP</td></tr>
<tr><td>Compare marker</td><td>MARKer<ch>:DELTa:
COMPare</td><td><int>,<real></td><td><int>,<real></td></tr>
<tr><td>Marker To</td><td>MARKer<ch>:LET</td><td>STARt|STOP|CENTer|SPAN|
RLEVel</td><td>STAR|STOP|CENT|
SPAN|RLEV</td></tr>
<tr><td>Search</td><td></td><td></td><td></td></tr>
<tr><td>Search</td><td>MARKer<ch>:
SEARch[:MODE]</td><td>MAX|MIN|TARGet|RIPPle</td><td>MAX|MIN|TARG|RIPP</td></tr>
<tr><td>Ripple Search</td><td>MARKer<ch>:SEARch
:RIPPle[:MODE]</td><td>MAX|MIN|BOTH|PPEak</td><td>MAX|MIN|BOTH|PPE</td></tr>
<tr><td>Ripple Sensitivity</td><td>MARKer<ch>:SEARch
:RIPPle{:DX|:DY}</td><td><real></td><td><real></td></tr>
</table>

11.7.11 Marker Commands

Function	Command	Parameter (Summary Content)	Query
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
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

*5: Marker data output

Response format = <stimulus>, <data 1>, <data 2>, <data 3>, and <status>

<stimulus> : Marker position stimulus value.

<data 1> : Marker position response value. If it is a polar coordinate, it is real.

<data 2> : If it is a polar coordinate, it is imaginary.

<data 3> : In case of a polar coordinate, it is derived figure or capacity figure.

<status> : Normal when 0. Error when other than 0.

When there is no valid data available, an invalid value (+1.0e38) is entered.

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>

Function	Command	Parameter (Summary Content)	Query
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
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>
Marker couple			
Couple channel	MARKer:COUPle: CHANnel[:STATe]	<bool>	0|1
Couple trace	MARKer:COUPle: TRACe[:STATe]	<bool>	0|1

*6: 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 entered.

11.7.12 System Command

Function	Command	Parameter (Summary Content)	Query
Reset	SYSTem:PRESet	-	×
Built-in Correction			
Source Correction	[SOURce:]CORRection <ch>:GAIN:STATe	<bool>	1|0
Input Correction	[SENSe:]CORRection <ch>:GPHase:STATe	<bool>	1|0

11.7.13 GPIB Dedicated Commands

Function	Command	Parameter (Summary Content)	Query
Data Output			
	FORMat:DATA	REAL,{32|64}	REAL,{32|64}
		ASCii,{0|8-22}	ASC,{0|8-22}
	FORMat:BORDer	SWAPped|NORMal	SWAP|NORM
	TRACe|:DATA|?	<int> =Refer to *6	<int> =Refer to *6
Error Request	SYSTem:ERRor?	×	<int>,<str>
	SYSTem:ERRor:ALL?	×	<int>,<str>, ...
Standard operation status	STATus:OPERation:ENABle <int>	<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 11.5 "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.

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		
S12	(Channel No. - 1) × 1024 + 148		
S22	(Channel No. - 1) × 1024 + 149		
S32	(Channel No. - 1) × 1024 + 150		
S42	(Channel No. - 1) × 1024 + 151		
S13	(Channel No. - 1) × 1024 + 152		
S23	(Channel No. - 1) × 1024 + 153		
S33	(Channel No. - 1) × 1024 + 154		
S43	(Channel No. - 1) × 1024 + 155		
S14	(Channel No. - 1) × 1024 + 156		
S24	(Channel No. - 1) × 1024 + 157		
S34	(Channel No. - 1) × 1024 + 158		
S44	(Channel No. - 1) × 1024 + 159		

Data	No.	Expression	Remarks
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		
S12	(Channel No. - 1) × 1024 + 212		
S22	(Channel No. - 1) × 1024 + 213		
S32	(Channel No. - 1) × 1024 + 214		
S42	(Channel No. - 1) × 1024 + 215		
S13	(Channel No. - 1) × 1024 + 216		
S23	(Channel No. - 1) × 1024 + 217		
S33	(Channel No. - 1) × 1024 + 218		
S43	(Channel No. - 1) × 1024 + 219		
S14	(Channel No. - 1) × 1024 + 220		
S24	(Channel No. - 1) × 1024 + 221		
S34	(Channel No. - 1) × 1024 + 222		
S44	(Channel No. - 1) × 1024 + 223		
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		
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 : Es4	(Channel No. - 1) × 1024 + 263		
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		

Data	No.	Expression	Remarks
Load Match Port 1: El1	(Channel No. - 1) × 1024 + 268	Complex Number	Undefined when no error factor exists
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		
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		
Tracking S23: Et23	(Channel No. - 1) × 1024 + 279		
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		
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		
Isolation S43: Ex43	(Channel No. - 1) × 1024 + 294		
Isolation S34: Ex34	(Channel No. - 1) × 1024 + 295		
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		

Data	No.	Expression	Remarks
Normalize: S12 Normalize: S22 Normalize: S32 Normalize: S42 Normalize: S13 Normalize: S23 Normalize: S33 Normalize: S43 Normalize: S14 Normalize: S24 Normalize: S34 Normalize: S44	(Channel No. - 1) × 1024 + 300 (Channel No. - 1) × 1024 + 301 (Channel No. - 1) × 1024 + 302 (Channel No. - 1) × 1024 + 303 (Channel No. - 1) × 1024 + 304 (Channel No. - 1) × 1024 + 305 (Channel No. - 1) × 1024 + 306 (Channel No. - 1) × 1024 + 307 (Channel No. - 1) × 1024 + 308 (Channel No. - 1) × 1024 + 309 (Channel No. - 1) × 1024 + 310 (Channel No. - 1) × 1024 + 311	Complex Number	Undefined when no error factor exists
Balance Parameter 2 × 2 Matrix 4-Port 3-Port	313 Output in the order of B12, B21, B34, B43. Output in the order of B23, B32, Invalid, Invalid.	Complex Number (Matrix)	Undefined when balance parameters are not being executed.
Balance Transformation Data 2 × 2 Matrix	314 Output in the order of SS11, SS12, SS21, SS22.	Complex Number (Matrix)	Undefined when balance transformation is not being executed.
Mixed Parameter 2 × 2 Matrix	315 When Sdd:Output in the order of Sdd11, Sdd12, Sdd21, Sdd22. When Sdc:Output in the order of Sdc11, Sdc12, Sdc21, Sdc22. When Scd:Output in the order of Scd11, Scd12, Scd21, Scd22. When Scc:Output in the order of Scc11, Scc12, Scc21, Scc22.	Complex Number (Matrix)	Undefined when mixed mode is not being executed.

Data	No.	Expression	Remarks
All Parameters	318	Complex Number (Matrix)	Undefined when full calibration is not being executed.
2-Port: 2 × 2 Matrix			
Port1-Port2	Output in the order of S11, S12, S21, S22.		
Port1-Port3	Output in the order of S11, S13, S31, S33.		
Port1-Port4	Output in the order of S11, S14, S41, S44.		
Port2-Port3	Output in the order of S22, S23, S32, S33.		
Port2-Port4	Output in the order of S22, S24, S42, S44.		
Port3-Port4	Output in the order of S33, S34, S43, S44.		
3-Port: 3 × 3 Matrix			
Port1-Port2-Port3	Output in the order of S11, S12, S13, S21, S22, S23, S31, S32, S33.		
Port1-Port2-Port4	Output in the order of S11, S12, S14, S21, S22, S24, S41, S42, S44.		
Port1-Port3-Port4	Output in the order of S11, S13, S14, S31, S33, S34, S41, S43, S44.		
Port2-Port3-Port4	Output in the order of S22, S23, S24, S32, S33, S34, S42, S43, S44.		
4-Port: 4 × 4 Matrix	Output in the order of S11, S12, S13, S14, S21, S22, S23, S24, S31, S32, S33, S34, S41, S42, S43, S44.		
Frequency	384	Real Number	
Output Power	385	Real Number	

12. 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.

12.1 Before Testing

12.1.1 Warm-up

Let the analyzer warm up for at least 30 minutes after power ON before executing performance testing.

12.1.2 Setup of Measurement Equipment

Prepare measurement equipment for the test items as shown in the following table.

Table 12-1 Measurement Equipment Required for Performance Testing (1 of 2)

Test Item	Measurement Equipment		Remarks
Frequency Accuracy and Range	• Counter Frequency: 300 kHz to 8.0 GHz Display: 7 lines or more Accuracy: 0.1 ppm or less	R5372 (-18 GHz) or R5373 (-26 GHz) (ADVANTEST products)	Refer to Section 12.2.
	• RF Cable: BNC-BNC, N-N type		
I/O Level Accuracy and Flatness	• Power Meter Frequency: 300 kHz to 8 GHz Power Range: -21 dBm to +17 dBm	NRVS (R&S) (Equipment calibrated using national standards)	Refer to Section 12.3.
	• Power Sensor Frequency: 300 kHz to 8 GHz Power Range: -21 dBm to +17 dBm	NRV-Z51 (R&S) (DC -18 GHz)	
Output Level Linearity	• Power Meter Frequency: 300 kHz to 8 GHz Power Range: -21 dBm to +17 dBm	NRVS (R&S) (Equipment calibrated using national standards)	Refer to Section 12.4.
	• Power Meter Frequency: 300 kHz to 3.8 GHz 300 kHz to 8 GHz Power Range: -21 dBm to +17 dBm	NRV-Z51 (R&S) (DC -18 GHz)	
Directivity	• Calibration Kit	Model 9617A3 (DC-18 GHz, N-type connector)	Refer to Section 12.5.
Load Match of Test Port	• Calibration Kit • Directivity Bridge	Model 9617A3 (DC-18 GHz, N-type connector)	Refer to Section 12.6.

Table 12-1 Measurement Equipment Required for Performance Testing (2 of 2)

Test Item	Measurement Equipment		Remarks
Crosstalk	• Calibration Kit	Model 9617A3 (DC-18 GHz, N-type connector)	Refer to Section 12.8.
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 12.9.
	• 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 (OPT10)	• RF Cable (SMA(m)/SMA(m) 50Ω)		
	• Transformer Connectors (N(m)/SMA (f)) x 2		

12.1.3 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

12.2 Frequency Accuracy and Range

Testing Procedure

1. Connect Test Port 1 to the counter as shown in the following diagram.

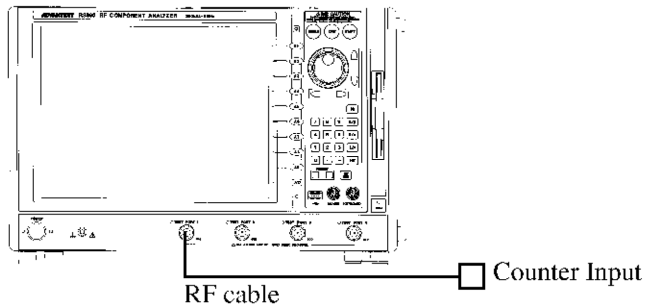


Figure 12-1 Frequency Accuracy and Range

2. Press ***Sweep, Center Frequency,*** **3, 0, 0, k/μ,** ***Frequency Span,*** **0** and **ENT.**
   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 Frequency,*** **3** and **G/p.**
   The Center Frequency is set to 3 GHz.

   <Confirm> Frequency range read by the counter = 2.99997 GHz - 3.00003 GHz

4. Press ***Center Frequency,*** **8** and **G/p.**
   The Center Frequency is set to 8 GHz.

   <Confirm> Frequency range read by the counter = 7.99992 GHz - 8.00008 GHz

12.3 Output Level Accuracy and Flatness

Testing Procedure

1. Connect the power sensor to Test Port 1 as shown in the following diagram.

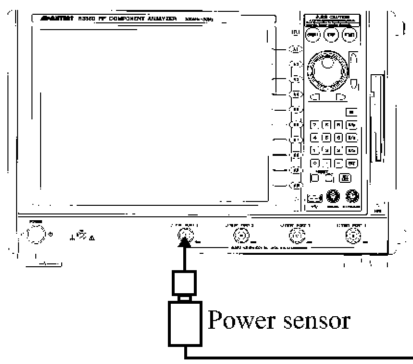


Figure 12-2 Output Level Accuracy and Flatness

2. Press ***Sweep, Center Frequency*****, 5, 0, M/n,** ***Frequency Span*****, 0, ENT,** ***Output power*****, 0** and **ENT**.
   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

3. Press ***Center Frequency*****, 3, 0, 0** and **k/µ**.
   The Center Frequency is set to 300 kHz.

   Record the read value of the power meter.

4. Press ***Center Frequency*****, 1, 0** and **M/n**.
   The Center Frequency is set to 10 MHz.

   Record the read value of the power meter.

5. Press ***Center Frequency*****, 1, 0, 0** and **M/n**.
   The Center Frequency is set to 100 MHz.

   Record the read value of the power meter.

6. Press ***Center Frequency*****, 5, 0, 0** and **M/n**.
   The Center Frequency is set to 500 MHz.

   Record the read value of the power meter.

7. In the same manner, use an optional number of frequencies to record the read values of the power meter up to 8 GHz.

   <Confirm> Difference between the minimum and maximum recorded read values of the power meter is within 2 dB

12.4 Output Level Linearity

Testing Procedure

1. Perform ZERO Calibration on the power meter.
2. Connect the power sensor to Test Port 1 as shown in the following diagram.

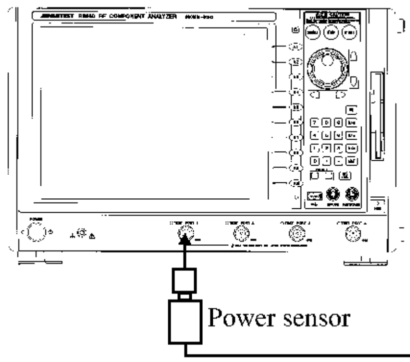


Figure 12-3 Output Level Linearity

3. Press ***Sweep, Center Frequency,*** **5, 0, M/n,** ***Frequency Span,*** **0, ENT,** ***Output power,*** **-, 3** and **ENT**.
   This operation sets Center Frequency to 50 MHz, Frequency Span to 0 Hz, and Output power to -3 dBm.

   Record the read value of the power meter. This value serves as the standard for linearity.

4. Press ***Output power,*** **1** and **ENT**.
   The Output Power is set to +1 dBm.

5. Subtract the standard 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 standard values = -3.23 dBm and +1 dBm, and the setting value = +0.81 dBm,
   Linearity = (+0.81 dBm - (-3.23dBm)) - (+1 dBm - (-3 dBm))= 0.04 dB

6. In the same manner, use an optional number of Output Power settings to confirm linearity.

7. Change to an optional number of Center Frequency to confirm linearity.

   <Confirm> For OPT12 and 13

   300 kHz to 15 MHz
   ±0.4 dB (-8 dBm to +2 dBm, -3 dBm Standard)
   ±0.8 dB (-13 dBm to +7 dBm, -3 dBm Standard)

   15 MHzto 8 GHz
   ±0.2 dB (-8 dBm to +2 dBm, -3 dBm Standard)
   ±0.4 dB (-13 dBm to +7 dBm, -3 dBm Standard)

For OPT14

300 kHz to 15 MHz
±0.4 dB (-8 dBm to +2 dBm, -3 dBm Standard)
±0.8 dB (-13 dBm to +5 dBm, -3 dBm Standard)

15 MHzto 8 GHz
±0.2 dB (-8 dBm to +2 dBm, -3 dBm Standard)
±0.4 dB (-13 dBm to +5 dBm, -3 dBm Standard)

12.5 Directivity

Testing Procedure

1. Connect the Short Standard to Test Port 1 as shown in the following diagram.

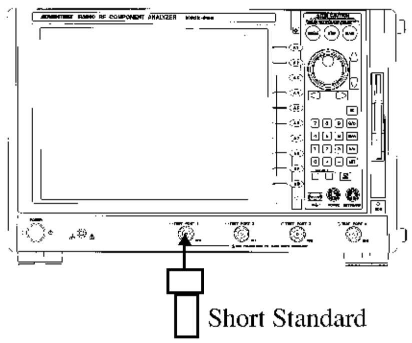


Figure 12-4 Directivity

2. Press ***Sweep, Start Frequency,*** **3, 0, 0, k/µ,** ***Stop Frequency,*** **8** and **G/p.**
   Start Frequency is set to 300 KHz, and Stop Frequency is set to 8 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> -28 dB or lower at 300 KHz - 40 MHz
   -30 dB or lower at 40 MHz - 2.6 GHz
   -26 dB or lower at 2.6 GHz - 3.8 GHz
   -22 dB or lower at 3.8 GHz - 8 GHz

5. Press ***Trace, Trace parameter*** 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> -28 dB or lower at 300 KHz - 40 MHz
   -30 dB or lower at 40 MHz - 2.6 GHz
   -26 dB or lower at 2.6 GHz - 3.8 GHz
   -22 dB or lower at 3.8 GHz - 8 GHz

For OPT13 and 14

8. Press ***Trace, Trace parameter*** 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> -28 dB or lower at 300 KHz - 40 MHz
    -30 dB or lower at 40 MHz - 2.6 GHz
    -26 dB or lower at 2.6 GHz - 3.8 GHz
    -22 dB or lower at 3.8 GHz - 8 GHz

For OPT14

11. Press ***Trace, Trace parameter*** 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> -28 dB or lower at 300 KHz - 40 MHz
    -30 dB or lower at 40 MHz - 2.6 GHz
    -26 dB or lower at 2.6 GHz - 3.8 GHz
    -22 dB or lower at 3.8 GHz - 8 GHz

12.6 Load Match

Testing Procedure

1. Connect the RF Cable to Test Port 2 as shown in the following diagram.

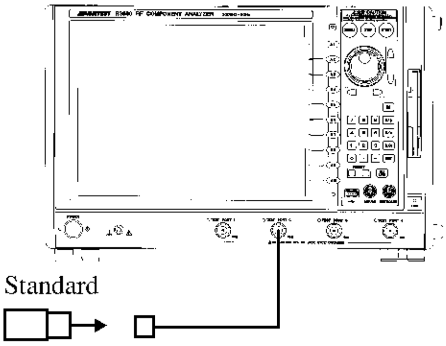


Figure 12-5 Load Match

2. Press ***Sweep, Start Frequency,* 3, 0, 0, k/µ, *Stop Frequency,* 8, G/p, *Trace, Trace parameter*** and ***S22***.
   This operation sets Start Frequency to 300 kHz, Stop Frequency to 8 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.

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> -16 dB or lower at 300 KHz - 40 MHz
   -20 dB or lower at 40 MHz - 2.6 GHz
   -16 dB or lower at 2.6 GHz - 3.8 GHz
   -14 dB or lower at 3.8 GHz - 8 GHz

6. Press ***Trace, Trace parameter*** 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.

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> -16 dB or lower at 300 KHz - 40 MHz
   -20 dB or lower at 40 MHz - 2.6 GHz
   -16 dB or lower at 2.6 GHz - 3.8 GHz
   -14 dB or lower at 3.8 GHz - 8 GHz

For OPT13 and 14

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> -16 dB or lower at 300 KHz - 40 MHz
    -20 dB or lower at 40 MHz - 2.6 GHz
    -16 dB or lower at 2.6 GHz - 3.8 GHz
    -14 dB or lower at 3.8 GHz - 8 GHz

For OPT14

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> -16 dB or lower at 300 KHz - 40 MHz
    -20 dB or lower at 40 MHz - 2.6 GHz
    -16 dB or lower at 2.6 GHz - 3.8 GHz
    -14 dB or lower at 3.8 GHz - 8 GHz

12.7 Noise Level

Testing Procedure

1. Connect the Load Standard to Test Port 1 as shown in the following diagram.

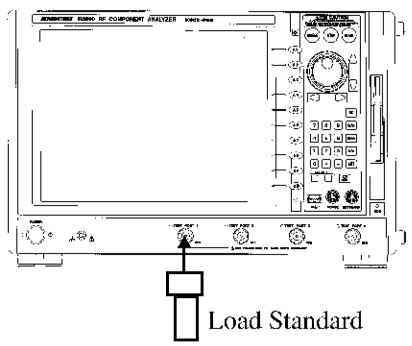


Figure 12-6 Noise Level

2. Press ***Sweep, Start Frequency,* 3, 0, 0, k/μ, *Stop Frequency,* 1, 5, M/n, *Output Power,* -, 1, 0, ENT, *Measurement Point,* 1, 6, 0, 1, ENT, *IF RBW*** and **10 KHz**.
This operation sets Start Frequency to 300 KHz, Stop Frequency to 15 MHz, Output power to -10 dBm, Measurement Point to 1601, and RBW to 10 KHz.

3. Press ***Trace, Trace Setup, Smoothing off, Smoothing Aperture,* 2, 0** and **ENT**.
This operation sets Smoothing to ON and a Smoothing Aperture of 20%.

4. Press ***Channel, Channel Setup, Service Menu, Maintenance 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 - 15 MHz. Confirm the value using a marker.

   <Confirm> -77 dB or lower at 300 kHz - 15 MHz

5. Press ***Sweep, Start Frequency,* 1, 5, M/n, *Stop Frequency,* 8, G/p, *IF RBW*** and **100 kHz**.
This operation sets Start Frequency to 15 MHz, Stop Frequency to 8 GHz, and RBW to 100 kHz.

   The displayed data is the noise level of Test Port 1 at 15 MHz - 8 GHz. Confirm the value using a marker.

   <Confirm> -72 dB or lower at 15 MHz - 100 MHz
   -80 dB or lower at 100 MHz - 2.6 GHz
   -70 dB or lower at 2.6 GHz - 8.0 GHz

6. Disconnect the Load Standard from Test Port 1, and connect it to Test Port 2.

7. Press ***Sweep, Start Frequency,* 3, 0, 0, k/μ, *Stop Frequency,* 1, 5, M/n, *IF RBW*** and **10 kHz**.
This operation sets Start Frequency to 300 kHz, Stop Frequency to 15 MHz, and RBW to 10 kHz.

8. Press ***Channel, Channel Setup, Service Menu, Maintenance 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 - 15 MHz. Confirm the value using a marker.

   <Confirm> -77 dB or lower at 300 kHz - 15 MHz

9. Press ***Sweep, Start Frequency***, **1, 5, M/n,** ***Stop Frequency***, **8, G/p,** ***IF RBW*** and **100 kHz**.
   This operation sets Start Frequency to 15 MHz, Stop Frequency to 8 GHz, and RBW to 100 kHz.

   The displayed data is the noise level of Test Port 2 at 15 MHz - 8 GHz. Confirm the value using a marker.

   <Confirm> -72 dB or lower at 15 MHz - 100 MHz
   -80 dB or lower at 100 MHz - 2.6 GHz
   -70 dB or lower at 2.6 GHz - 8.0 GHz

For OPT13 and 14

10. Disconnect the Load Standard from Test Port 2, and connect it to Test Port 3.

11. Press ***Sweep, Start Frequency***, **3, 0, 0, k/µ,** ***Stop Frequency***, **1, 5, M/n,** ***IF RBW*** and **10 kHz**.
    This operation sets Start Frequency to 300 kHz, Stop Frequency to 15 MHz, and RBW to 10 kHz.

12. Press ***Channel, Channel Setup, Service Menu, Maintenance 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 - 15 MHz. Confirm the value using a marker.

    <Confirm> -77 dB or lower at 300 kHz - 15 MHz

13. Press ***Sweep, Start Frequency***, **1, 5, M/n,** ***Stop Frequency***, **8, G/p,** ***IF RBW*** and **100 kHz**.
    This operation sets Start Frequency to 15 MHz, Stop Frequency to 8 GHz, and RBW to 100 kHz.

    The displayed data is the noise level of Test Port 3 at 15 MHz - 8 GHz. Confirm the value using a marker.

    <Confirm> -72 dB or lower at 15 MHz - 100 MHz
    -80 dB or lower at 100 MHz - 2.6 GHz
    -70 dB or lower at 2.6 GHz - 8.0 GHz

For OPT14

14. Disconnect the Load Standard from Test Port 3, and connect it to Test Port 4.

15. Press ***Sweep, Start Frequency,*** **3, 0, 0, k/µ,** ***Stop Frequency,*** **1, 5, M/n,** ***IF RBW*** and **10 kHz**.
    This operation sets Start Frequency to 300 kHz, Stop Frequency to 15 MHz, and RBW to 10 kHz.

16. Press ***Channel, Channel Setup, 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 - 15 MHz. Confirm the value using a marker.

    <Confirm> -77 dB or lower at 300 kHz - 15 MHz

17. Press ***Sweep, Start Frequency,*** **1, 5, M/n,** ***Stop Frequency,*** **8, G/p,** ***IF RBW*** and **100 kHz**.
    This operation sets Start Frequency to 15 MHz, Stop Frequency to 8 GHz, and RBW to 100 kHz.

    The displayed data is the noise level of Test Port 4 at 15 MHz - 8 GHz. Confirm the value using a marker.

    <Confirm> -72 dB or lower at 15 MHz - 100 MHz
    -80 dB or lower at 100 MHz - 2.6 GHz
    -70 dB or lower at 2.6 GHz - 8.0 GHz

12.8 Crosstalk

Testing Procedure

1. Press ***Sweep, Start Frequency,* 3, 0, 0, k/μ, *Stop Frequency,* 8, G/p, *IF RBW,* 100 Hz, *Trace, Trace Setup, Smoothing off, Smoothing Aperture,* 0, ., 5** and **ENT**.
   This operation sets Start Frequency to 300 KHz, Stop Frequency to 8 GHz, RBW to 100 Hz, Smoothing to ON, and a Smoothing Aperture of 0.5%.

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.

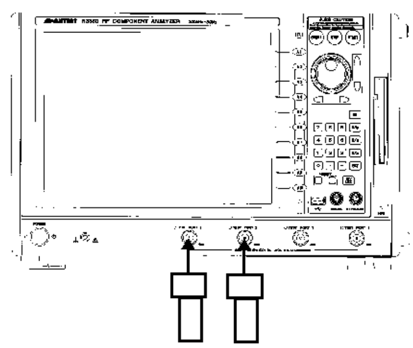


Figure 12-7 Crosstalk

3. Press ***Trace, Trace parameter*** 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> -90 dB or lower at 300 KHz - 40 MHz
   -100 dB or lower at 40 MHz - 2.6 GHz
   -90 dB or lower at 2.6 GHz - 3.8 GHz
   -80 dB or lower at 3.8 GHz - 5.0 GHz
   -70 dB or lower at 5.0 GHz - 8.0 GHz

For OPT13 and 14

4. Disconnect the Short Standard from Test Port 2, and connect it to Test Port 3.

5. Press ***Trace, Trace parameter*** 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> -90 dB or lower at 300 KHz - 40 MHz
-100 dB or lower at 40 MHz - 2.6 GHz
-90 dB or lower at 2.6 GHz - 3.8 GHz
-80 dB or lower at 3.8 GHz - 5.0 GHz
-70 dB or lower at 5.0 GHz - 8.0 GHz

For OPT14

6. Disconnect the Short Standard from Test Port 3, and connect it to Test Port 4.
7. Press ***Trace, Trace parameter*** 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> -90 dB or lower at 300 KHz - 40 MHz
   -100 dB or lower at 40 MHz - 2.6 GHz
   -90 dB or lower at 2.6 GHz - 3.8 GHz
   -80 dB or lower at 3.8 GHz - 5.0 GHz
   -70 dB or lower at 5.0 GHz - 8.0 GHz

Test Port 2 Crosstalk

8. Connect the Load Standard to Test Port 2 and the Short Standard to Test Port 1.
9. Press ***Trace, Trace parameter*** 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> -90 dB or lower at 300 KHz - 40 MHz
   -100 dB or lower at 40 MHz - 2.6 GHz
   -90 dB or lower at 2.6 GHz - 3.8 GHz
   -80 dB or lower at 3.8 GHz - 5.0 GHz
   -70 dB or lower at 5.0 GHz - 8.0 GHz

For OPT13 and 14

10. Disconnect the Short Standard from Test Port 1, and connect it to Test Port 3.
11. Press ***Trace, Trace parameter*** 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> -90 dB or lower at 300 KHz - 40 MHz
    -100 dB or lower at 40 MHz - 2.6 GHz
    -90 dB or lower at 2.6 GHz - 3.8 GHz
    -80 dB or lower at 3.8 GHz - 5.0 GHz
    -70 dB or lower at 5.0 GHz - 8.0 GHz

For OPT14

12. Disconnect the Short Standard from Test Port 3, and connect it to Test Port 4.

13. Press ***Trace, Trace parameter*** 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> -90 dB or lower at 300 KHz - 40 MHz
    -100 dB or lower at 40 MHz - 2.6 GHz
    -90 dB or lower at 2.6 GHz - 3.8 GHz
    -80 dB or lower at 3.8 GHz - 5.0 GHz
    -70 dB or lower at 5.0 GHz - 8.0 GHz

Test Port 3 Crosstalk (For OPT13 and 14)

14. Connect the Load Standard to Test Port 3 and the Short Standard to Test Port 1.

15. Press ***Trace, Trace parameter*** 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> -90 dB or lower at 300 KHz - 40 MHz
    -100 dB or lower at 40 MHz - 2.6 GHz
    -90 dB or lower at 2.6 GHz - 3.8 GHz
    -80 dB or lower at 3.8 GHz - 5.0 GHz
    -70 dB or lower at 5.0 GHz - 8.0 GHz

16. Disconnect the Short Standard from Test Port 1, and connect it to Test Port 2.

17. Press ***Trace, Trace parameter*** 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> -90 dB or lower at 300 KHz - 40 MHz
    -100 dB or lower at 40 MHz - 2.6 GHz
    -90 dB or lower at 2.6 GHz - 3.8 GHz
    -80 dB or lower at 3.8 GHz - 5.0 GHz
    -70 dB or lower at 5.0 GHz - 8.0 GHz

For OPT14

18. Disconnect the Short Standard from Test Port 2, and connect it to Test Port 4.

19. Press ***Trace, Trace parameter*** 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> -90 dB or lower at 300 KHz - 40 MHz
    -100 dB or lower at 40 MHz - 2.6 GHz
    -90 dB or lower at 2.6 GHz - 3.8 GHz
    -80 dB or lower at 3.8 GHz - 5.0 GHz
    -70 dB or lower at 5.0 GHz - 8.0 GHz

Test Port 4 Crosstalk (For OPT 14)

20. Connect the Load Standard to Test Port 4 and the Short Standard to Test Port 1.

21. Press ***Trace***, ***Trace parameter*** 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> -90 dB or lower at 300 KHz - 40 MHz
    -100 dB or lower at 40 MHz - 2.6 GHz
    -90 dB or lower at 2.6 GHz - 3.8 GHz
    -80 dB or lower at 3.8 GHz - 5.0 GHz
    -70 dB or lower at 5.0 GHz - 8.0 GHz

22. Disconnect the Short Standard from Test Port 1, and connect it to Test Port 2.

23. Press ***Trace***, ***Trace parameter*** 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> -90 dB or lower at 300 KHz - 40 MHz
    -100 dB or lower at 40 MHz - 2.6 GHz
    -90 dB or lower at 2.6 GHz - 3.8 GHz
    -80 dB or lower at 3.8 GHz - 5.0 GHz
    -70 dB or lower at 5.0 GHz - 8.0 GHz

24. Disconnect the Short Standard from Test Port 2, and connect it to Test Port 3.

25. Press ***Trace***, ***Trace parameter*** 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> -90 dB or lower at 300 KHz - 40 MHz
    -100 dB or lower at 40 MHz - 2.6 GHz
    -90 dB or lower at 2.6 GHz - 3.8 GHz
    -80 dB or lower at 3.8 GHz - 5.0 GHz
    -70 dB or lower at 5.0 GHz - 8.0 GHz

12.9 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.

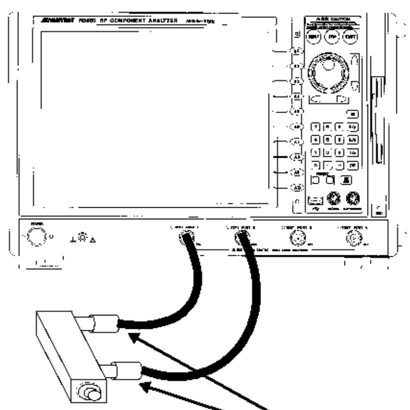


Figure 12-8 Dynamic Level Accuracy

2. Press ***Sweep, Center Frequency,* 5, 0, M/n,** ***Frequency Span,*** **0, ENT,** ***Output Power,*** **7, ENT,** ***IF RBW*** and **100 Hz.**
   This operation sets Center Frequency to 50 MHz, Frequency Span to 0 Hz, Output power to 7 dBm (5 dBm for OPT14), and RBW to 100 Hz.
3. Press ***Trace, Trace parameter*** 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 3.8 GHz) ±0.4 dB (3.8 GHz to 8 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 ***Sweep, Center Frequency,*** **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 ***Sweep, Center Frequency,*** **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 ***Trace, Trace parameter*** 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 OPT13 and 14)

15. Disconnect the RF cable from Test Port 2, and connect it to Test Port 3.

16. Press ***Trace, Trace parameter*** 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 OPT14)

18. Disconnect the RF cable from Test Port 3, and connect it to Test Port 4.
19. Press ***Trace, Trace parameter*** and ***S41***.
    The Trace parameter is set to S41.
20. Repeat steps 4 through 12 to confirm the dynamic level accuracy.

12.10 Attenuation Accuracy (OPT10)

12.10.1 Specifications

Reference Level:	Attenuation 0dB
	Attenuation 20dB: ±4dB
	Attenuation 40dB: ±5dB
	Attenuation 60dB: ±6dB

12.10.2 Instruments Required

- RF cable (SMA(m)/SMA(m) 50Ω)
  Recommended model : A01253-060
- Adopter (N(m)/SMA(f)) quantity=2
  Recommended model : HRM-554S

12.10.3 Testing Procedure

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 12-9.

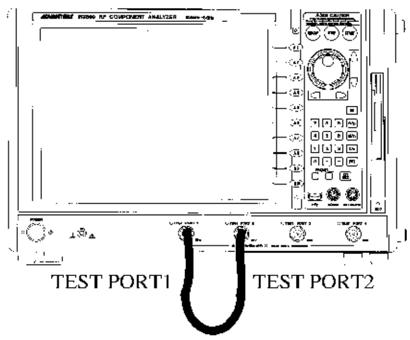


Figure 12-9 Connections for Attenuation Accuracy Measurements

2. Press ***Port***, ***More 1/2*** and ***P1***.
   The measurement port is set to P1.

3. Press ***Meas*** and ***S21***.
   The measurement parameter is set to S21.

4. Press ***Power***, ***Attenuator***, ***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 ***Average***, ***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 ***Power***, ***Attenuator***, ***Att Port 1***, **2**, **0** and **ENT**.
    The attenuator is set to 20 dB.

11. Press ***Scale***, ***Ref Val/Fill***, **-**, **2**, **0** and **ENT**.
    The reference is set to -20 dB.

12. Press ***Mkr->***, ***Marker Search***, ***Search Mode***, ***Max***, ***Return*** and ***Search Active Marker***.
    Confirm the marker value.

    <Confirm> -20 dB ± 4 dB or less

13. Press ***Search Mode***, ***Min***, ***Return*** and ***Search Active Marker***.
    Confirm the marker value.

    <Confirm> -20 dB ± 4 dB or less

14. Press ***Power***, ***Attenuator***, ***Att Port 1***, **4**, **0** and **ENT**.
    The attenuator is set to 40 dB.

15. Press ***Scale***, ***Ref Val/Fill***, **-**, **4**, **0** and **ENT**.
    The reference is set to -40 dB.

16. Press ***Mkr->***, ***Marker Search***, ***Search Mode***, ***Max***, ***Return*** and ***Search Active Marker***.
    Confirm the marker value.

    <Confirm> -40 dB ± 5 dB or less

17. Press ***Search Mode***, ***Min***, ***Return*** and ***Search Active Marker***.
    Confirm the marker value.

    <Confirm> -40 dB ± 5 dB or less

18. Press ***Power***, ***Attenuator***, ***Att Port 1***, **6**, **0** and **ENT**.
    The attenuator is set to 60 dB.

19. Press ***Scale***, ***Ref Val/Fill***, **-**, **6**, **0** and **ENT**.
    The reference is set to -60 dB.

20. Press ***Mkr->***, ***Marker Search***, ***Search Mode***, ***Max***, ***Return*** and ***Search Active Marker***.
    Confirm the marker value.

    <Confirm> -60 dB ± 6 dB or less

21. Press ***Search Mode***, ***Min***, ***Return*** and ***Search Active Marker***.
    Confirm the marker value.

    <Confirm> -60 dB ± 6 dB or less

13. SPECIFICATIONS

This chapter describes about the function of the R3860 and the performance/specification together.

1. Measurement Function

Measurement channels	8 channels
Display windows	16 windows
Trace	16 traces/channels (Up to 16 traces can be displayed simultaneously)
Measurement parameter	OPT12: S11, S21, S12, S22 OPT13: S11, S22, S33, S21, S12, S31, S13, S23, S32 OPT14: S11, S22, S33, S44, S21, S31, S41, S12, S32, S42, S13, S23, S43, S14, S24, S34 These parameters can be converted into impedance (Z) or admittance (Y).
Measurement format	
Rectangular display	The real part and the imaginary part of logarithmic/linear magnitude, phase, group-delay, VSWR or complex number.
Smith chart	Reading with marker is for logarithmic/linear magnitude & phase, real part + imaginary part, R + jX, G + jB.
Polar coordinates display	Reading with marker is for logarithmic/linear magnitude & phase, real part + imaginary part.

2. Signal Source Section

Frequency	
Range	300 kHz - 8.0 GHz
Setting resolution	1 Hz
Measurement resolution	±0.01 ppm
Accuracy	±10 ppm (23°C±5°C)
Stability against temperature changes	±15 ppm (5 to 40°C, Typical value)
Aging	±3 ppm (Year, Typical value)
Output power	
Range	OPT12, 13: +7 dBm to -13 dBm OPT14: +5 dBm to -13 dBm
Resolution	0.01 dB
Accuracy	±0.5 dB (50 MHz, 0 dBm, 23°C±5°C) Specified for test port 1
Flatness	2.0 dBp-p (23°C±5°C) Specified for test port 1
Linearity	OPT12, 13: 300 kHz to 15 MHz ±0.4 dB(-8 to +2 dBm, 0 dBm reference 23°C±5°C) ±0.8 dB(-13 to +7 dBm, 0 dBm reference 23°C±5°C) 15 MHz to 8GHz ±0.2 dB(-8 to +2 dBm, 0 dBm reference 23°C±5°C) ±0.4 dB(-13 to +7 dBm, 0 dBm reference 23°C±5°C) OPT14: 300 kHz to 15 MHz ±0.4 dB(-8 to +2 dBm, 0 dBm reference 23°C±5°C) ±0.8 dB(-13 to +5 dBm, 0 dBm reference 23°C±5°C) 15 MHz to 8GHz ±0.2 dB(-8 to +2 dBm, 0 dBm reference 23°C±5°C) ±0.4 dB(-13 to +5 dBm, 0 dBm reference 23°C±5°C)

Signal purity	
Harmonic spurious	-20 dBc (23°C±5°C when maximum output)
Non harmonic spurious	-30 dBc (23°C±5°C when maximum output)
Phase noise (10kHz off)	-106 dBc/Hz (300 kHz to 990 MHz, 23°C±5°C)
	-100 dBc/Hz (990 MHz to 1.98 GHz, 23°C±5°C)
	-94 dBc/Hz (1.98 MHz to 3.96 GHz, 23°C±5°C)
	-88 dBc/Hz (3.96 GHz to 8 GHz, 23°C±5°C)
Sweep function	
Sweep type	Linear, logarithmic, program or power sweep
Sweep time	10 µS / 1 point (RBW 400 kHz)
Measurement point	3 to 1601 points
Sweep trigger	Continuous, single, hold or external triggering

3. Characteristic of the Receiver Part

Resolution bandwidth	400 kHz, 200 kHz, 150 kHz, 100 kHz
	100 kHz to 10 Hz (changeable at 1, 1.5, 2, 3, 4, 5 and 7 steps)
Stability	
Trace noise	0.005 dBrms (300 kHz to 15 MHz, RBW 10 kHz, Typical value)
	0.005 dBrms (15 MHz to 990 MHz, RBW 100 kHz, Typical value)
	0.010 dBrms (990 MHz to 1.98 GHz, RBW 100 kHz, Typical value)
	0.020 dBrms (1.98 GHz to 3.96 GHz, RBW 100 kHz, Typical value)
	0.040 dBrms (3.96 GHz to 8.0 GHz, RBW 100 kHz, Typical value)
Stability against temperature changes	0.01 dB/°C (300 kHz to 2.6GHz, Typical value)
	0.02 dB/°C (2.6 GHz to 8.0 GHz, Typical value)
Aging stability	0.005 dB/week (Typical value)
Magnitude characteristic	
Magnitude resolution	0.001 dB
Frequency characteristic	±1.0 dB (23°C±5°C)
Dynamic accuracy	In reference to the value 20 dB below the allowable input level
	±0.20 dB (0 to -10 dB, 300 kHz to 3.8 GHz)
	±0.40 dB (0 to -10 dB, 3.8 GHz to 8.0 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 -90dB)

Phase characteristic	
Phase resolution	0.01°
Dynamic accuracy	In reference to the value 20 dB below the allowable input level ±2.0° (0 to -10 dB, 300 kHz to 3.8 GHz) ±4.0° (0 to -10 dB, 3.8 GHz to 8.0 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 characteristic	Can be obtained by the following equation. $\Delta\phi / (360 \times \Delta f)$ $\Delta\phi$: Phase difference Δf: Frequency difference (aperture frequency)
Group delay resolution	1 pS
Aperture frequency	Can be set in a range from $\frac{100}{\text{Measurement point -1}} \times 2\%$ to $\frac{100}{\text{Measurement point -1}} \times 50\%$
Accuracy	$\frac{\text{phase accuracy}}{360 \times \text{Aperture frequency (Hz)}}$

4. Test Port Characteristic

Load match	-16 dB (300 kHz to 40 MHz) -20 dB (40 MHz to 2.6 GHz) -16 dB (2.6 GHz to 3.8 GHz) -14 dB (3.8 GHz to 8.0 GHz)
Source match	-14 dB (300 kHz to 40 MHz) -18 dB (40 MHz to 2.6 GHz) -15 dB (2.6 GHz to 3.8 GHz) -12 dB (3.8 GHz to 8.0GHz)
Directivity	-28 dB (300 kHz to 40 MHz) -30 dB (40 MHz to 2.6 GHz) -26 dB (2.6 GHz to 3.8 GHz) -22 dB (3.8 GHz to 8.0 GHz)
Crosstalk	-90 dB (300 kHz to 40 MHz) -100 dB (40 MHz to 2.6 GHz) -90 dB (2.6 GHz to 3.8 GHz) -80 dB (3.8 GHz to 5.0 GHz) -70 dB (5.0 GHz to 8.0 GHz)
Maximum input level	+5 dBm
Noise level	From the maximum input level: For 300 kHz to 15 MHz RBW 10 kHz: -82 dB For 15 MHz to 8GHz RBW 100 kHz: -77 dB (15 MHz to 100 MHz) -85 dB (100 MHz to 2.6 GHz) -75 dB (2.6 GHz to 8.0 GHz)
Input head damage level	+21dBm, $30V_{dc}$
Tester port connector	N type (female)

5. Other Functions

Display Section	
Displaying device	12.1-inch SVGA TFT Color LCD
Back light	Intensity half-value period: 40,000 hours (Typical value)
Error compensation	Normalization, Normalization & Isolation, and 1-port calibration 2 ports calibration, 3 ports calibration (For OPT 13 and OPT 14 only) 4 ports calibration (OPT14 only) Averaging and smoothing Electrical length correction, Phase offset correction
Marker function	10 multi-marker ΔMarker function, Search function, Marker → function
Save/Recall function	Register format Save to HDD (2.1 GB) File format Save to floppy disk or HDD (2.1 GB)
Program Execution Environment	Operation is allowed for execution formats generated using Visual Basic and other languages.
FDD function	Compliant with MS-DOS FAT format in three modes (DD 720 KB, HD 1.2 MB or 1.4 MB) 2 mode handling (DD 720 KB, HD 1.2 MB/1.4 MB)

6. Connection to External Devices

Signal for external display	15 pins, D-SUB connector (VGA)
GP-IB	IEEE488.2 applicable
Parallel port	TLL level Output port (8 bits × 2 ports) Input/Output port (4 bits × 2 ports)
Serial port	Serial I/O port for the accessories
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) More than 0dBm (50Ω)
Probe power	±15 V ±0.5 V, 300 mA

7. General Specification

Operating environment	Temperature range +5 to +40°C Relative humidity under 80% (non-condensing)
Storing environment	-20 to +60°C
Power source	AC100 V to 120 V, 50 Hz / 60 Hz AC220 V to 240 V, 50 Hz / 60 Hz (Auto-switch between 100VAC and 200VAC type)
Outer dimensions	About 424mm (width) × 266mm (height) × 530mm (depth)
Mass	36kg or less
Power draw	500VA or less

APPENDIX

A.1 Message List

This appendix explains messages that are displayed while the analyzer is being operated.

- 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.

- 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.

- 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.

Auto Calibration

Message	Explanation
Auto Cal: Out of range.	Frequency set outside the range of Auto Cal. <Required Action> Set the frequency setting within the range of Auto Cal (40 MHz - 8 GHz).
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.

Message	Explanation
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.

A.2 R3860 System Recovery Procedure

This analyzer employs Microsoft Windows NT 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 "R3860 System Recovery Disk" included with the analyzer can be used to restore the content of the C drive to its original state.

CAUTION: ***Note: 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.***
Cancel the write protect status of the "System Recovery Disk" when executing recovery. 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

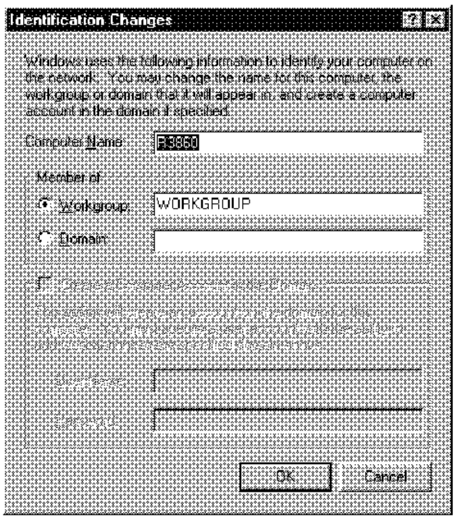
1. Turn OFF the power of the analyzer.
2. Insert the floppy disk labeled "R3860 System Recovery Disk 1" into the floppy disk drive.
3. Turn ON the power of the analyzer to load the Recovery Software from the floppy disk.
   The "Please Insert System Recovery Disk 2" message will be delayed.
4. Eject the "R3860 System Recovery Disk 1" floppy disk from the floppy disk drive.
5. Insert the floppy disk labeled "R3860 System Recovery Disk 2" into the floppy disk drive.
6. Press **ENT** to launch the Recovery Software.
7. Select **Continue** to execute recovery, and press **ENT** to display the dialog box for confirming continuation of recovery.
8. Select **Yes** and press **ENT** to begin recovery.
   The Reboot dialog box will be displayed when recovery has been completed.
9. Eject the "R3860 System Recovery Disk 2" floppy disk from the floppy disk drive.
10. 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.

Setup Procedure

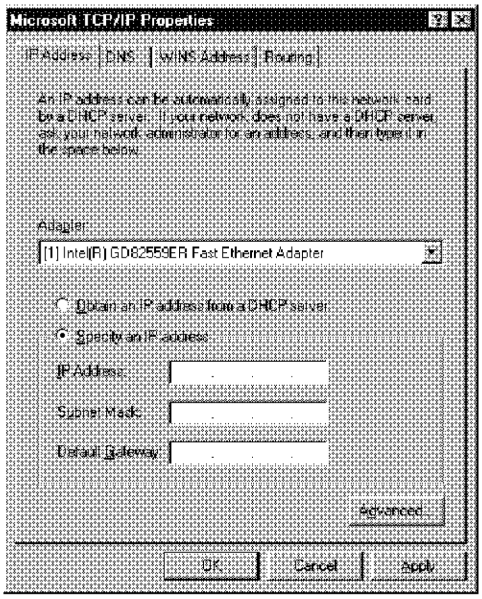
1. Click ***Sweep Cont*** in the tool menu to enter ***Sweep Hold*** status.
2. Click ***System*** and ***Network Config*** in the main menu to display the Network dialog box.
3. Click the ID tab and then click Change to display the Change ID dialog box.



4. Input the Computer Name and Work Group.

CAUTION: ***"Domain" cannot be used.***

5. Click OK to close the dialog box.
6. Click the Protocol tab.
7. Select TCP/IP Protocol and click Property to display the TCP/IP Property dialog box.

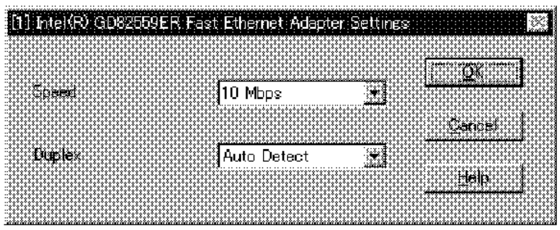


To Specify the IP Address:

8. Select Specify IP Address.
9. Input the IP Address, Subnet Mask, and Default Gateway.

When Using a DHCP Server:

10. Select Obtain IP Address from DHCP Server.
11. Click OK to close the dialog box.
12. Click the Adapter tab.
13. Select ... Ethernet Adapter and click Property to display the ... Ethernet Adapter Settings dialog box.



14. Set Speed and Duplex appropriately as necessary.
15. Click OK to close the dialog box.

16. 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.***

A.4 Printer Installation Method

A.4.1 Obtain the Printer Driver

This analyzer uses a WindowsNT printer driver.

Obtain a WindowsNT printer driver from accessories included for installing a printer or the Web site of a printer manufacturer.

CAUTION:

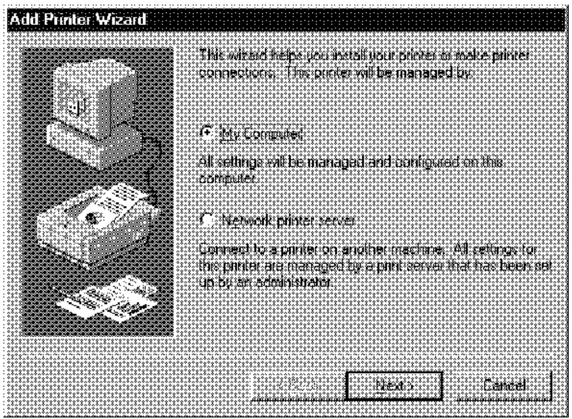
1. ***Put measurement in the Hold status before starting to install a printer.***
2. ***Use only a WindowsNT printer driver.***

A.4.2 Printer Installation Procedure

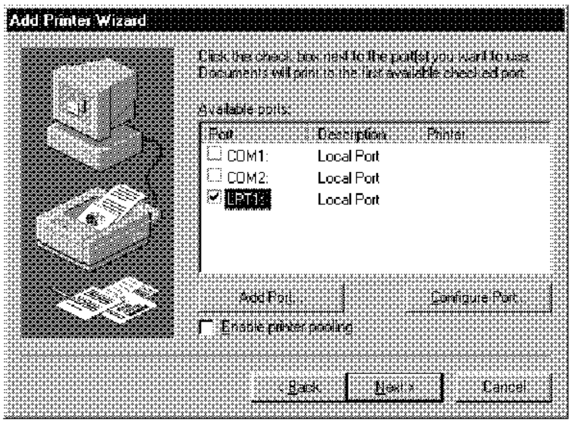
A printer directly connected to this analyzer with a printer cable is called a local printer. A printer connected to this analyzer through a network is called a network printer.

Local Printer Installation Procedure

1. Select ***System*** in the main menu.
2. Select ***Add Printer...*** in the ***System*** pull-down menu to display the Add Printer Wizard dialog box.

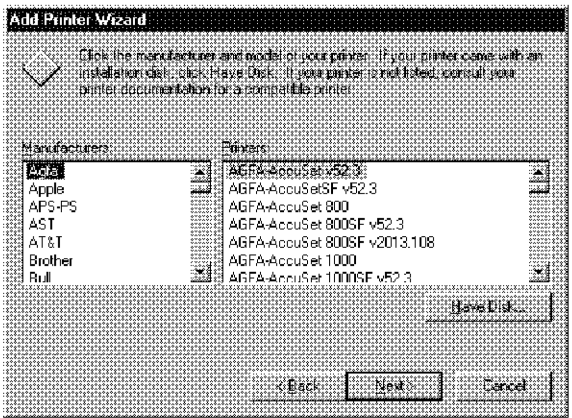


3. Select This Computer.
4. Click Next (N)>.
   The Add Printer Wizard dialog box then displays Useable Port (A).

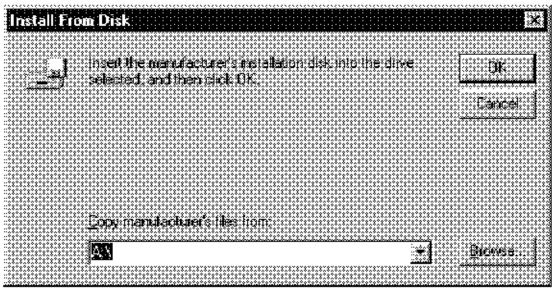


5. Read the message in the Add Printer Wizard dialog box, and select "LPT1" as Useable Port (A).

6. Click Next (N)> to display the Printer Wizard dialog box.



7. Read the message in the Printer Wizard dialog box, and click Use Disk (H) to display the Install from Floppy Disk dialog box.

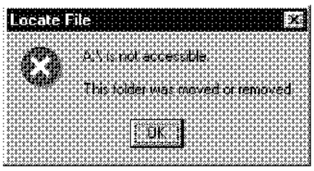


8. If the printer driver is provided in a floppy disk, insert this printer driver floppy disk into the floppy disk drive.

9. Click OK in the Install from Floppy Disk dialog box, and install in accordance with the installation procedure explained for the printer driver.

If the network of the analyzer is set, reference the printer driver through the network.

10. Click Reference (B) in the Install from Floppy Disk dialog box to select the printer driver through a network.
    The Locating File error dialog box will be displayed.



11. Click OK in the Locating File error dialog box to display the Locating File dialog box.

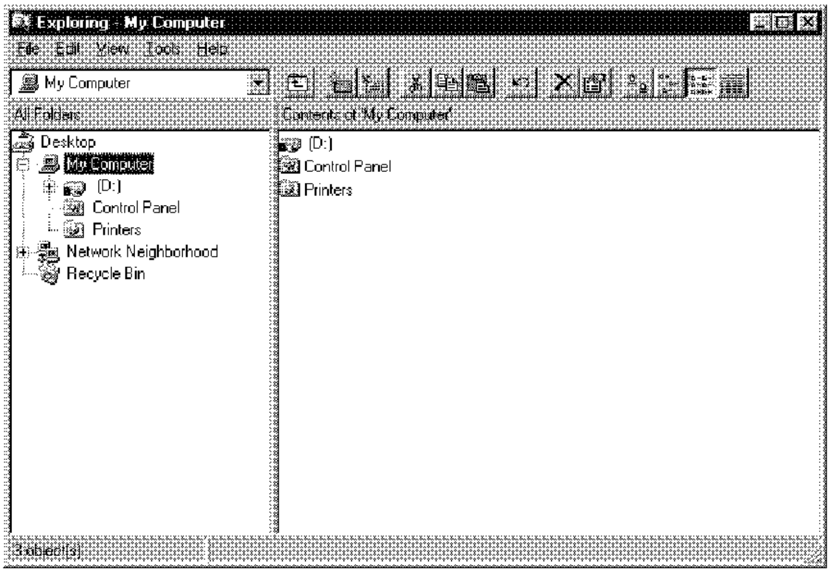
12. Select Network Computer.
13. Select the computer storing the printer driver to be installed.
14. Select the printer driver to be installed from the computer storing the printer driver to be installed.
15. Click Open (O).
16. Printer installation will be completed in accordance with the indications of the printer driver.

Network Printer Installation Procedure

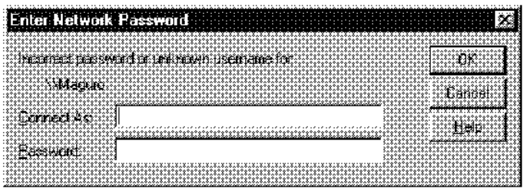
CAUTION: ***Make the settings for a network printer only after confirming that the analyzer is connected to a network.***

---

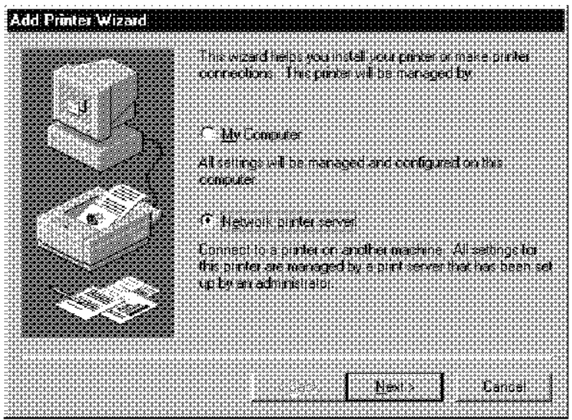
1. Select ***System*** in the main menu.
2. Select ***Explorer...*** in the ***System*** pull-down menu to display Explorer.



3. Click Network Computer.
4. Select the computer of the printer.
5. Input the user name and password to log in.

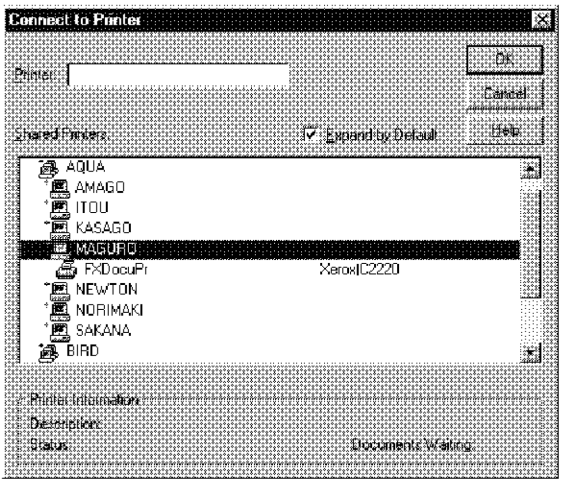


6. Select ***System*** in the main menu.
7. Select ***Add Printer...*** in the ***System*** pull-down menu to display the Add Printer Wizard dialog box.



8. Select Network Printer Server.

9. Click Next (N)> to display the Printer Connection dialog box.



10. Select the printer to be connected from the Share Printer display in the Printer Connection dialog box.

11. Click "OK" in the Printer Connection dialog box.

12. Printer installation will be completed in accordance with the indications of the printer driver.

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
	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 port is controlled with ENTER and OUTPUT commands.

- 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.

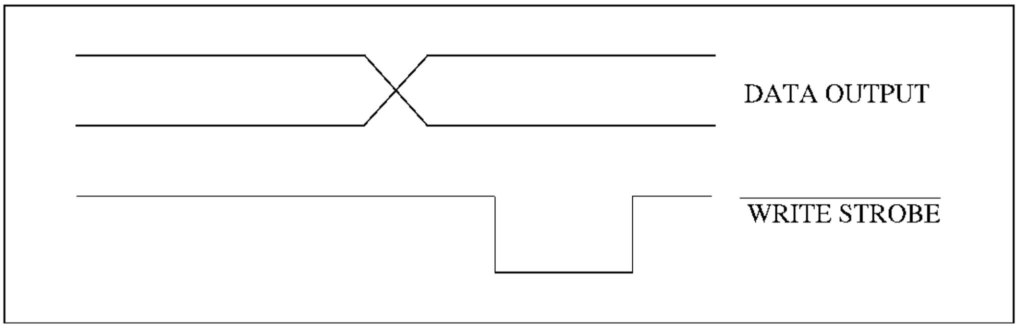


Figure A-1 Timing Chart of WRITE STROBE

- 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. It can be set to LOW or HIGH with the BASIC command (OUTPUT).

- 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.

- SWEEP END

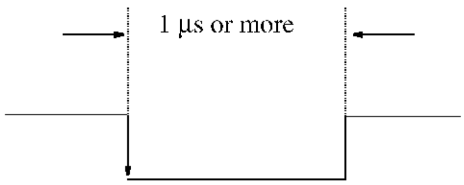
  When the R3860 finishes the sweeping, generates a negative pulse with a width of 10 μs.

- +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.

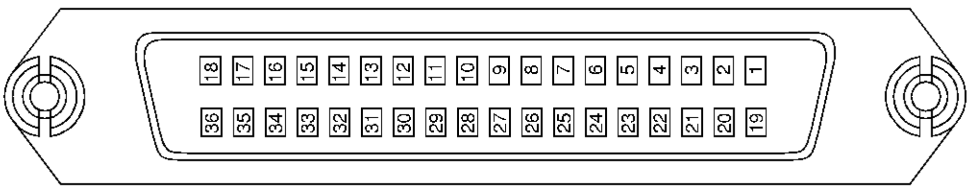
- EXT TRIG input

  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.



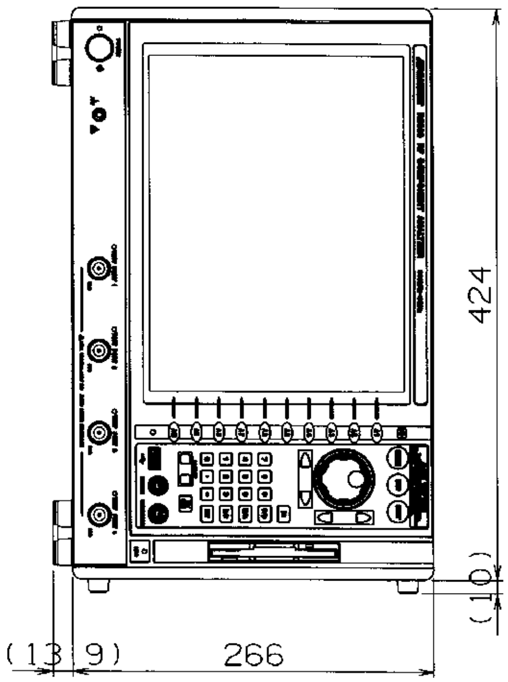
2. Parallel I/O connector pin assignment and signal standard

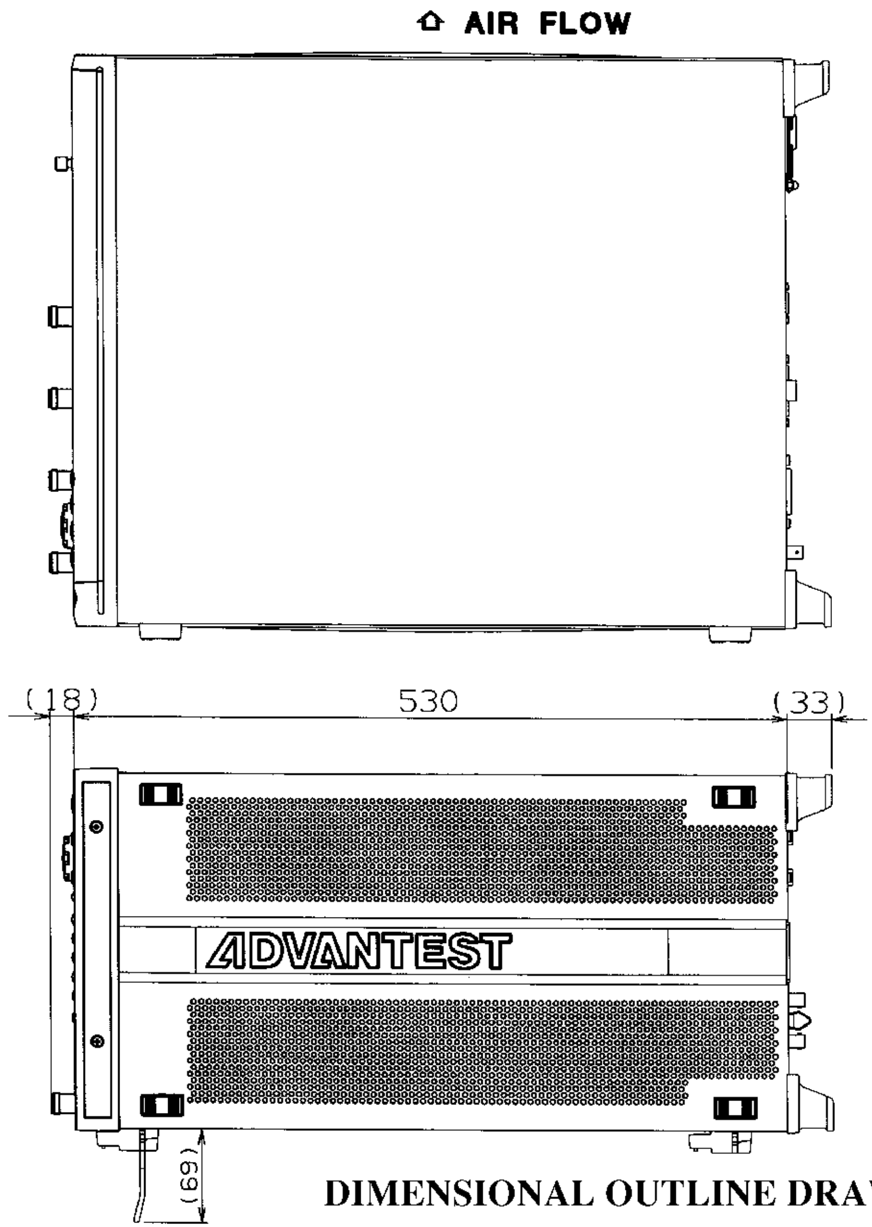
Pin No.	Signal name	Function
1	GND	Ground
2	INPUT 1	Negative logic pulse input of TTL level (width:1 μs or more)
3	OUTPUT 1	Negative logic latch output of TTL level
4	OUTPUT 2	Negative logic latch output of TTL level
5	Output port A0	Negative logic latch output of TTL level
6	Output port A1	Negative 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





DIMENSIONAL OUTLINE DRAWING

Unit : mm

CAUTION
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.

ALPHABETICAL INDEX

[Numerics]

[A]

[B]

[C]

[D]

[E]

[F]

[G]

[I]

[K]

[L]

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