Quick Start

Quick Start helps you to understand the E5061B operation quickly.

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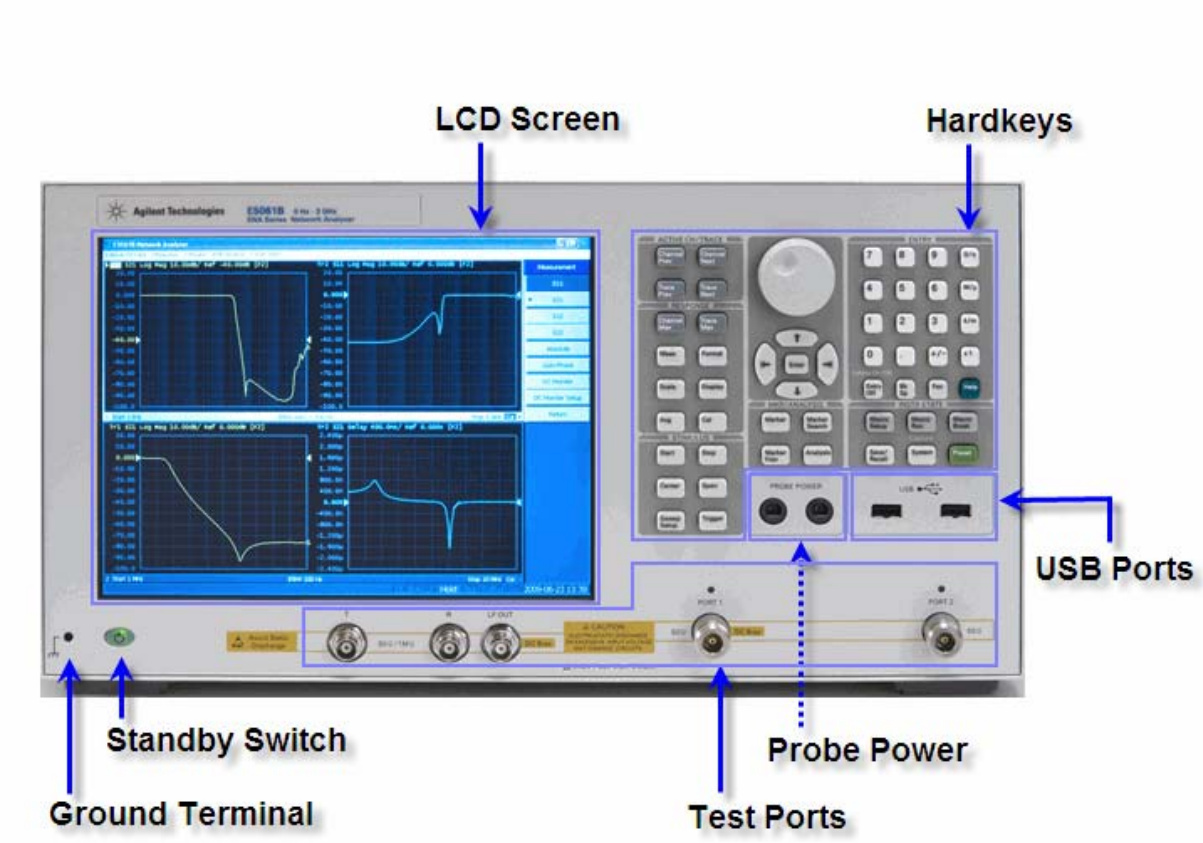
Overview

Front Panel: Names and Functions of Parts



Ground Terminal

Ground terminal is provided with the E5061B and is connected to the chassis of the E5061B. You can connect a banana-type plug to this terminal for grounding.

Hardkeys

ACTIVE CH/TRACE Block

A group of keys for selecting active channels and traces. For more on the concepts of channels and traces, see Setting Channels and Traces.

Hardkey Name	Description
Channel Next	Selects the next channel as the active channel. (Each time the key is pressed, the active channel steps up from the current channel to the channel with one number larger than the current channel number). A channel must be active before you can define such parameters as the sweep range. To change the

	settings of a channel, use this key to first make the channel active.
Channel Prev	Selects the previous channel as the active channel. (Each time the key is pressed,the active channel steps down from the current channel to the channel with one number smaller than the current channel number).
Trace Next	Selects the next trace as the active trace. (Each time the key is pressed, the active trace steps up from the current trace to the trace with one number larger than the current trace number). A trace must be active before you can define measurement parameters and other settings. To change the settings of a trace, use this key to first make the trace active.
Trace Prev	Selects the previous trace as the active trace. (Each time the key is pressed, active trace steps down from the current trace to the trace with one number smaller than the current trace number).

ENTRY Block

A group of keys used for entering numeric data is provided on the front panel of the E5061B.

Hardkey Name	Description
0, 1, 2, 3 ….. 9 , . Keys (numeric keys)	Type numeric characters or a decimal point at the position of the cursor in the data entry area.
+/-	**+/-** alternately changes the sign (+, -) of a numeric value in the data entry area.
G/n, M/u, k/m, x1	Adds a prefix to the numeric data typed by using the numeric key and **+/-** key. One of the two prefixes written on the surface of the key is automatically selected depending on the parameter to be entered. **x1** is entered without a prefix.
Softkey On/Off , Entry Off	Turns off the data entry bar if it is displayed. If the dialog box is displayed, it cancels the entry and closes the dialog box. If the data entry bar and dialog box are not displayed, it turns the softkey menu display on/off.
Bk Sp	Backspace key.
Foc	Changes the selection (focus) among the objects to be

	manipulated by the **NAVIGATION** Block keys and **ENTRY** Block keys. The objects to be manipulated by the **NAVIGATION** Block keys and **ENTRY** Block keys include softkey menus, data entry areas, tables (e.g., segment tables, limit tables, and marker tables), and dialog boxes. When two or more of these objects are displayed on the screen and need selecting, use this key to change the selection (focus) among the objects to be manipulated. When a softkey menu is selected, the menu name area at the top of the menu is displayed in blue. When a data entry area is selected, the data entry bar is displayed in blue. When a table is selected, the frame of the table window is displayed in light gray. While a dialog box is displayed, the focus is fixed on the dialog box and cannot be changed.
Help	Displays help for E5061B.

INSTR STATE Block

A group of keys related to the macro function, store and call function, control/management function, and presetting of the E5061B (returning it to the preset state).

Hardkey Name	Description
Macro Setup	Displays the Macro Setup Menu in Softkey Menu Bar. Manipulating the Macro Setup Menu enables you to start up the VBA editor or to create, call, or store a VBA project.
Macro Run	Executes a VBA procedure called "main" that has a VBA module named Module1.
Macro Break	Stops the VBA procedure being executed.
Save/Recall	Displays the Save/Recall Menu in Softkey Menu Bar. Manipulating the Save/Recall Menu enables you to store the setup conditions to or read from the storage devices, calibration data, and trace data of the analyzer.
Capture/System	First, temporarily saves the data for the image displayed on the LCD screen the moment this key is pressed to the internal memory (clipboard). Immediately after that, displays the System Menu in Softkey Menu Bar. Manipulating the System Menu enables you to define the setup for the limit test and then execute it, or to define the setup for the control and management of the analyzer. Using the **Dump Screen Image** option enables you to store the image data in the clipboard to a file on the storage devices. Also, using the **Print** option in the System menu enables you to print the image data in the clipboard to a

	printer.
Preset	Displays the Preset Menu in Softkey Menu Bar. Clicking **OK** in the Preset Menu enables you to return the analyzer to the initial setup state, called the preset setup.

MKR/ANALYSIS Block

A group of keys used for analyzing the measurement results by using the markers and etc.

Hardkey Name	Description
Marker	Displays the Marker Menu in Softkey Menu Bar. Manipulating the Marker Menu enables you to turn the markers on/off and move them by entering stimulus values. You can place up to 10 markers on each trace.
Marker Search	Displays the Marker Search Menu in Softkey Menu Bar. Manipulating the Marker Search Menu enables you to move a marker to a specific point (maximum, minimum, peak, and a point with a target value) on a trace. You can also find the bandwidth parameters (up to six) and display them.
Marker Fctn	Displays the Marker Function Menu in Softkey Menu Bar. Manipulating the Marker Function Menu enables you to not only specify the marker sweep range and the coupling of markers on a channel but also to display statistics data on traces.
Analysis	Displays the Analysis Menu in Softkey Menu Bar. Manipulating the Analysis Menu enables you to use the analytical function of the fault location, the SRL, and each limit test.

NAVIGATION Block (No Label on Front Panel)

The keys and Rotary knob in the **NAVIGATION** Block are used to navigate between softkey menus, tables (limit table, segment table, etc.), or selected (highlighted) areas in a dialog box as well as to change a numeric value in the data entry area by stepping up or down. When selecting one of two or more objects (softkey menus, data entry areas, etc.) to manipulate with the **NAVIGATION** Block keys displayed on the screen, first press the **Foc** (Focus) key in the ENTRY Block to select the object to be manipulated (placing focus on the object) and then manipulate the **NAVIGATION** Block keys (knob) to move among selected (highlighted) objects or change numeric values.

The following descriptions show how the **NAVIGATION** Block keys work both when the focus is on a softkey menu and when the focus is on the data entry area. For more on tables and dialog boxes manipulation, refer to the manipulation procedure for each of these functions.

- **When the focus is on a softkey menu (softkey menu is selected)**
- **When the focus is on the data entry area (data entry area is selected)**

RESPONSE Block

A group of keys used mainly for setting up response measurements on the E5061B.

Hardkey Name	Description
Channel Max	Changes between normal and maximum display of the active channel window. In normal display, all of the defined channel windows (both active and non-active) are displayed in split views on the screen. In maximum display, only the active channel window is displayed over the entire area, with non-active windows not displayed. To maximize the active channel, double-click the channel window frame. Measurements are also carried out on the non-active channels that are not displayed.
Trace Max	Changes between normal and maximum display of the active trace window. In normal display, all of the defined trace windows (both active and non-active) are displayed in split views on the screen. In maximum display, only the active trace is displayed over the entire channel window, with non-active traces not displayed. To maximize the trace, double-click anywhere in the channel window. Measurements are also carried out on the non-active traces that are not displayed.
Meas	Displays the Measurement Menu in Softkey Menu Bar. Manipulating the Measurement Menu enables you to specify the measurement parameters (types of S-parameters) for each trace.
Format	Displays the Format Menu in Softkey Menu Bar. Manipulating the Format Menu enables you to specify the data format (data transformation and graph formats) for each trace.
Scale	Displays the Scale Menu in Softkey Menu Bar. Manipulating the Scale Menu enables you to specify the scale for displaying a trace (magnitude per division, value of the reference line, etc.) for each trace. You can also specify the electrical delay and phase offset for each trace.
Display	Displays the Display Menu in Softkey Menu Bar. Manipulating the Display Menu enables you to specify the number of channels and the channel window array, the number and arrangement of

	traces, the setup for data math, etc.
Avg	Displays the Average Menu in Softkey Menu Bar. Manipulating the Average Menu enables you to define the averaging, smoothing, and IF bandwidth.
Cal	Displays the Calibration Menu in Softkey Menu Bar. Manipulating the Calibration Menu enables you to turn the calibration and error correction on/off and change definitions for calibration kits.

STIMULUS Block

A group of keys for defining the stimulus values (signal sources and triggers).

Hardkey Name	Description
Start	Displays the data entry bar for specifying the start value of the sweep range in the upper part of the screen. (It also displays the Stimulus Menu for specifying the sweep range in Softkey Menu Bar.)
Stop	Displays the data entry bar for specifying the stop value of the sweep range in the upper part of the screen. (It also displays the Stimulus Menu in the same way as **Start**.)
Center	Displays the data entry bar for specifying the center value of the sweep range in the upper part of the screen. (It also displays the Stimulus Menu in the same way as **Start**.)
Span	Displays the data entry bar for specifying the span value of the sweep range in the upper part of the screen. (It also displays the Stimulus Menu in the same way as **Start**.)
Sweep Setup	Displays the Sweep Setup Menu in Softkey Menu Bar. Manipulating the Sweep Setup Menu enables you to specify the signal source power level, sweep time, number of points, sweep type, etc.
Trigger	Displays the Trigger Menu in Softkey Menu Bar. Manipulating the Trigger Menu enables you to specify the trigger mode and trigger source. You can specify the trigger mode for each channel.

LCD Screen

The E5061B is equipped with a 10.4-inch TFT color, touch-sensitive LCD screen for displaying traces, scales, settings, softkeys and other measurement related information. The touch screen LCD allows you to

manipulate softkeys by touching the LCD screen directly with a finger. For more on the LCD screen, see Screen Area: Names and Functions of Parts.

CAUTION Do not press the surface of the LCD screen with a sharp object (e.g., nail, pen, or screwdriver). Pressing the surface with a sharp-pointed object will damage the LCD screen surface or cause the screen to fail.

NOTE Valid pixels are 99.998 % and more. Below 0.002 % of fixed points of black, blue, green or red are not regarded as failure.

Probe Power

The E5061B Option 3L5 comes with two ports that can be used to provide power to external probes. See the Data sheet for the voltage and maximum current.

NOTE Other E5061B options do not have probe power ports.

Standby Switch

This switch can turn on/off the E5061B. The color on the button shows the status as shown below:

Indicator Color	Description
Green	Normal power on status.
Orange	Standby status.
Red	Illegal power on status.

To turn off the power of the E5061B, be sure to follow the steps described below:

1. First, press this standby switch or send a shutdown command from the external controller to activate the shutdown process (the processing of software and hardware necessary to turn off the power supply). This will put the E5061B into the standby state.
2. Next, if necessary, turn off power supply to the Power Cable Receptacle (to LINE) on the rear panel.

   CAUTION Under normal use, never directly interrupt the power supply to the power cable receptacle on the rear panel when the power supply is on. Always keep the Line Switch (Always ON) at (|). Never turn it off (O).

   If you directly interrupt the power supply to the power cable receptacle when the power supply is on, or turn off the Line Switch (Always ON), the shutdown process will not work. This

could damage the software and hardware of the E5061B and lead to device failure.

Turning on the power supply after a faulty shutdown may cause the system to start up in a condition called "safe mode." If this occurs, first shut down the system to set it to the standby state and then turn on the power supply again to start up the system in normal mode.

Test Ports

Port 1 and Port 2

Port 1 and Port 2 are for S-parameter measurement. Port 1 can apply DC Bias. While signals are being output from a test port, the yellow LED above the test port is lit.

LF Out, R and T Ports

LF Out, R and T Ports are for Gain-Phase measurement. LF Out is a source port and it can apply DC Bias on measurement signal. The R and T ports are receiver ports. The input impedance for R and T ports can be selected from 50 Ω or 1 MΩ.

LF Out can be used for DC voltage source during S parameter measurement.

NOTE Only E5061B Option 3L5 has LF Out, R and T Ports. Other E5061B options do not have these ports.

CAUTION Do not apply the exceeded DC voltage or current to the test port.

CAUTION When you use the probe which has a pin on the connector, place the plastic ring to avoid connector from damage.

The test ports comply with Installation Category I of IEC 61010-1.

USB Ports

Two USB (Universal Serial Bus) Ports are provided that can be used for connecting to ECal (Electronic Calibration) module, USB keyboard, USB mouse, USB memory or a printer. Connecting a designated ECal module to this port enables ECal measurements to be taken. Connecting a compatible printer to this port enables screen information on the E5061B to be printed. See Using USB for more detail.

Rear Panel: Names and Functions of Parts

24 Bit (Handler) I/O Port

The terminal to which an automatic machine (handler) used on a production line is connected. See 24 Bit (Handler) I/O Port.

Connector type: 36-pin Ribbon (Centronics) connector

Certificate of Authenticity Label

The label shows the licence information of the Windows Operating System

Ethernet Port

A terminal for connecting the E5061B to a LAN (Local Area Network). Connecting this instrument to a LAN enables you to access the hard disk drive of this instrument from an external PC or to control this instrument by using SICL-LAN or telnet.

Specification	Value
Connector type	8-pin RJ-45 connector
Base standard	10Base-T/100Base-TX/1000Base-T

External Monitor Output Port (VIDEO)

A terminal to which an external color monitor (display device) can be connected. By connecting a color monitor to this terminal, the same information shown on the LCD screen of the main body can be displayed on an external color monitor.

Connector type: 15-pin VGA connector, female

External Trigger (EXT TRIG)

Input

A connector to which external trigger signals are input. This connector detects the downward transition from the HIGH state in TTL signals as the trigger signal. To use this connector to generate a trigger, you must set the trigger source to the "external" side. The connector type is BNC, female.

Output

The External Trigger Output Port can output the pulse with the specified polarity and position either before or after the measurement of each point. The connector type is BNC, female.

Parameter	Typical Value	Condition
HIGH Level Output Voltage	5 V	I_{out}=-50µA

LOW Level Output Voltage	0 V	I_{out}=50µA

NOTE The External Trigger Output Port can safely handle a maximum output current of 50 mA.

GPIB Port

The connection of an external controller through General Purpose Interface Bus (GPIB) connector allows you to configure an automatic measurement system.

This GPIB port is used only for controlling the E5061B from an external controller. Use USB/GPIB interface to control other devices from the E5061B. You cannot control other devices from the E5061B through this GPIB port.

Hard Disk Drive (HDD)

Built in hard disk drive.

Reference Signal Ports (10MHz)

The specification for the signals is specified in the data sheet.

Input (REF IN)

The reference signal input connector is used for phase-locking the measurement signal from the E5061B to the external frequency reference signal. Inputting reference signal to this connector improves the accuracy and frequency stability of the measurement signal from the E5061B. When the frequency reference signal is input to this connector, the measurement signal from the E5061B is automatically phase-locked to the reference signal. When an input signal is not present, the frequency reference signal inside the E5061B is automatically used. The ExtRef on the instrument status bar is displayed in blue when the system is phase-locked to the external reference signal and in gray when not phase-locked.

When using Option 1E5 (high stability time base), connect this connector to the REF OVEN by using the BNC(m)-BNC(m) cable included with the option.

Output (REF OUT)

A connector for outputting the internal frequency reference signal from the E5061B. By connecting this output connector to the external reference signal input connector of another device, the device can be phase-locked to the internal reference signal of the E5061B and used under this condition.

High Stability Frequency Reference Output (REF OVEN, OPT 1E5)

When Option 1E5 (high stability time base) is installed, the reference signal is output from this connector. Connect this connector to the REF IN by using the BNC(m)-BNC(m) adapter included with the option.

Line Switch (Always ON)

Always keep this switch on (|).

CAUTION Do not use this switch to turn off (O) the mains. Doing so may cause the analyzer to fail. For more information, see the description of the Standby Switch.

Power Cable Receptacle (to LINE)

The receptacle (outlet) to which the power cable is connected.

NOTE To connect the device to a power source (outlet), use the supplied three-prong power cable with a ground conductor. The plug attached to the power cable (on the power outlet side or device side of the cable) serves as the disconnecting device (device that cuts off power supply) of the E5061B. When the power supply must be cut off to avoid such danger as electric shock, pull out the power cable plug (on the power outlet side or device side of the cable). For the procedure for turning off the main in normal use, see the description in Standby Switch.

For more on the power supply, see the Installation Guide.

Serial Number Plate

The label showing the product number, serial number and the installed option number. The accessary and system rack options are not listed on this label. (CFGxxx or ATOxxx in the first line is Agilent Use Only.)

Test Set I/F Port

This interface is reserved and currently not available.

USB Interface Port (USBTMC)

Through this port, you can control the E5061B from external controllers. For more information on the measurement system using the USB port, see the USB Remote Control System.

Specification	Value
Connector type	Universal serial bus (USB), type B (4 contact positions), Female (jack)
Compliance Standards	USBTMC-USB488 and USB2.0

USB Ports

Four USB (Universal Serial Bus) ports are provided that can be used for connecting to ECal (Electronic Calibration) module, USB keyboard, USB mouse, USB memory or a printer. Connecting a designated ECal module to this port enables ECal measurements to be obtained. Connecting a

compatible printer to this port enables screen information on the E5061B to be printed. See Using USB for more detail.

Screen Area

Screen Area: Names and Functions of Parts

Click on the name or area for details of the topic.

- Menu Bar
- Data Entry Bar
- Softkey Menu Bar
- Instrument Status Bar
- Channel Window
- **Windows XP Status Bar** - Windows XP Status Bar may or may not appear, depending on the Windows license. Under the same

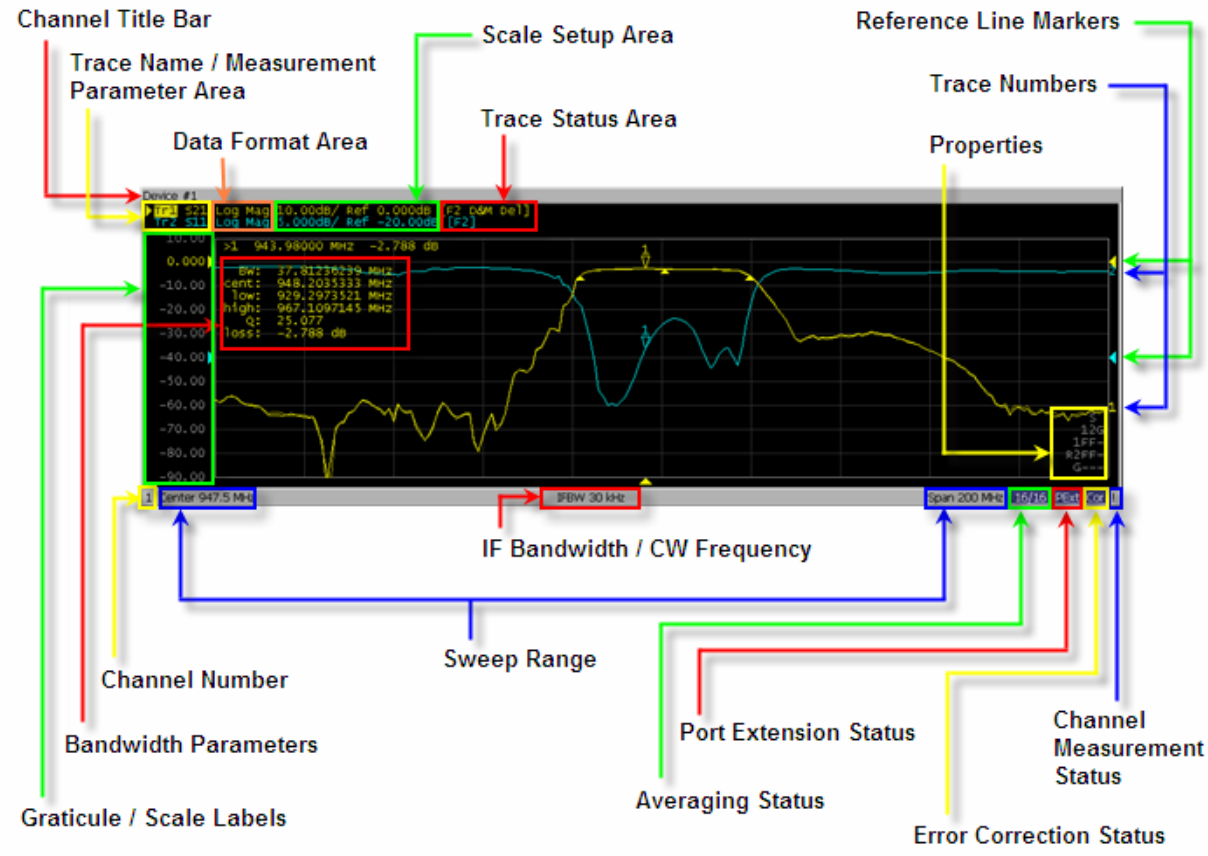
condition, either Windows resize buttons or E5061B resize button will appear. For more information, refer to Windows License.

Channel Window

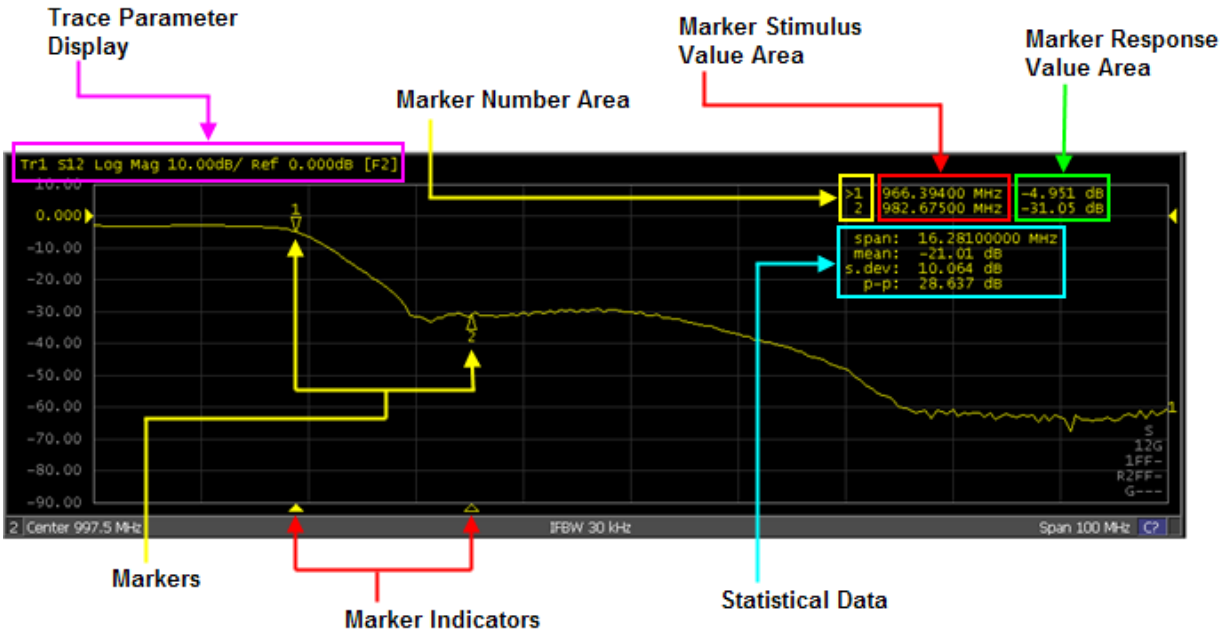
Window for displaying the traces. Because a channel corresponds to a window, it is called a channel window. When the outer frame of a channel window is displayed in light gray, it shows that the channel is an active channel (the channel for which setup is being performed). In the following figure, Channel 1 (the upper window) is the active channel. To make a channel active, use **Channel Next** or **Channel Prev**. Clicking inside a channel window will also make the channel active.

Channel 1 Window and Channel 2 Window describes different measurement parameters available in the channel measurement window. The measurement parameters described in the Channel 1 and 2 Window correspond to the same channel measurement window and are displayed in separate windows for ease of read.

Channel 1 Window



Channel 2 Window



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Bandwidth Parameters

Turning on the bandwidth search function displays the bandwidth parameters here.

Channel Number

Indicates the channel number.

Channel Status Bar

The status of each channel is displayed here.

Averaging Status

Displays the averaging factor and averaging count when averaging is turned on.

n/m (displayed in blue)	Averaging: ON (m: averaging factor; n: averaging count)
(not displayed)	Averaging: OFF

Channel Measurement Status

Displays the update status of traces on the channel.

!	Measurement in progress. When the sweep time exceeds 1.5 seconds, ↑ is displayed at the point on the trace.
#	Invalid traces. The measurement conditions have changed,

	but the traces on the channel currently displayed have not been updated to match the new conditions.
(No display)	The measurement has not been executed.

Error Correction Status

Displays the execution status of error correction on the channel.

IF Bandwidth/CW Frequency

Indicates the IF bandwidth when the sweep type is linear/log frequency or the CW frequency when the sweep type is power.

Port Extension Status

Shows whether the port extension and impedance port extension (Option 005 only) or is turned ON or OFF. port extension and impedance port extension can be truned on both at the same time.

PExt (displayed in blue)	Port extension: ON
ZExt (displayed in blue)	Z port extension: ON
(not displayed)	Port extension: OFF

Sweep Range

Indicates the sweep range by using the start/stop or center/span.

Channel Title Bar

You can assign a title to each channel and have the title displayed on the bar.

Data Format

The data format of each trace is displayed here.

See Also: Trace Parameter Display

Graticule Labels

Y-axis divisions in the rectangular display format. When traces in the rectangular display format are overlaid, the Y-axis divisions for the active trace are displayed. The value of the reference line (the division line between ▶ and ◀) is entered numerically by opening the data entry bar using the keys: **Scale** > **Reference Value**. You can change values of the reference line at one-division intervals by placing the mouse pointer in the

area of the graticule label (the pointer changes from  to ), moving the pointer vertically with the left mouse button pressed, and then releasing the button at the desired location.

Marker Indicators

Indicates the positions of markers on the stimulus axis.

▲	Active marker indicator
△	Non-active marker indicator

You can also move a marker to the desired position by placing the mouse pointer on the marker indicator or position of the marker itself (the pointer changes from  to ), moving the indicator vertically with the left mouse button pressed, and then releasing the button at the desired location.

Marker Numbers

Displayed marker number is listed. For the active marker (the one for which setup and analysis are being performed), > is displayed at the left of the marker number. For the reference marker, is displayed instead of the marker number.

Marker Response Values

The marker response value for each marker (the measurement value at the marker point) is displayed here. Two (or three) response values are displayed for data in Smith chart or polar display format.

Markers

The markers used for reading values on a trace. Up to 10 markers can be displayed for each trace.

	Active marker (the one for which setup and analysis are being performed)
	Non-active marker

Here, "n" denotes a marker number. For the reference marker, however, nothing is displayed at the location of n. Clicking the marker or one of the Marker Indicators makes the marker active.

Marker Stimulus Values

The marker stimulus value for each marker (the frequency/power level at the marker point) is displayed here.

Properties

Displays the status of the obtained calibration coefficients on the channel.

Reference Line Indicators

The indicators that indicate the position of the reference line for the Y-axis scale in the rectangular display format. One indicator is to the right and the other is to the left of the scale (▶and ◀). To enter a numeric value for the position of the reference line, open the data entry bar using the keys: **Scale** > **Reference Position**. You can also move the position of the reference line by placing the mouse pointer on either of the two reference line indicators (the pointer changes from  to  .), moving the indicator vertically with the left mouse button kept pressed, and then releasing the button at the desired location (i.e., a drag-and-drop operation).

Scale Settings

The scale setting for each trace is displayed here. This example shows that "10.00dB/" corresponds to 10 dB per division. "Ref 0.000dB" shows that the value of the reference line is 0 dB.

See Also: Trace Parameter Display

Statistics Data

Turning on the statistics data function displays statistics data here.

Trace Name/Measurement Parameter

The names of the traces, such as Tr1, on the channel and their measurement parameters are displayed here. ▶ to the right of the trace name indicates the active trace (the trace for which setup is being performed). To make a trace active, use **Trace Next** or **Trace Prev**. Clicking the line where the trace name is placed (the mouse pointer changes from  to ) also makes a trace active.

See Also: Trace Parameter Display

Trace Number

In the rectangular display format, the trace number is displayed in the same color as the trace at the right end of each trace.

Trace Status Area

The setup for each trace is displayed here.

See Also: Trace Parameter Display

Trace status display

Classification	Contents inside [ ]	Meaning

Error correction	**RO**	Error correction: ON (OPEN (n) response calibration)
	RS	Error correction: ON (SHORT (n) response calibration)
	RT	Error correction: ON (THRU (n) response calibration)
	ER	Error correction: ON (Enhanced response calibration)
	F1	Error correction: ON (1-port calibration)
	F2	Error correction: ON (Full 2-port calibration)
	Zcor	Error correction: ON Impedance Calibration
Fixture Compensation (Opt 005)	**Zcomp**	Fixture Compenation ON
Turning on / off traces	Nothing	Data trace: ON, Memory trace: OFF
	M	Data trace: OFF, Memory trace: ON
	D&M	Data trace: ON, Memory trace: ON
	off	Data trace: OFF, Memory trace: OFF
Performing data math **When a memory trace is ON, see the contents inside ()**	**D+M** (**D+M&M**)	Execution of Data+Mem math
	D- M (**D-M&M**)	Execution of Data- Mem math
	D*M (**D*M&M**)	Execution of Data*Mem math
	D/M (**D/M&M**)	Execution of Data/Mem math
Electrical delay	**Del**	A numeric value other than 0 (zero) is specified as the electrical delay or phase offset.
Smoothing	**Smo**	Smoothing: ON
Gating	**Gat**	Gating: ON
Fault location	**FL(RT)**	Fault location: ON, Reflection type: Round Trip

	FL(OW)	Fault location: ON, Reflection type: One Way
SRL	**SRL(xxxΩ)**	SRL: ON (xxx is average cable impedance value)
Parameter conversion	**Zr**	Conversion: ON (Impedance: Reflection measurement)
	Zt	Conversion: ON (Impedance: Transmission measurement)
	Ztsh	Conversion: ON (Impedance: Transmission-Shunt measurement)
	Yr	Conversion: ON (Admittance: Reflection measurement)
	Yt	Conversion: ON (Admittance: Transmission measurement)
	Ytsh	Conversion: ON (Admittance: Transmission-Shunt measurement)
	1/S	Conversion: ON (Inverse S-parameter)
	Conj	Conversion: ON (Conjugation)
Reference Tracking	**PTrk**	Peak Track
	FTrk	Frequency Track
Equation Editor	**Equ**	Equation Editor: ON

Trace Parameter Display

As mentioned above, measurement parameters are displayed at the upper-left of the trace window. However, there is difference in parameter display for network measurement and impedance measurement.

Network Measurement

When network measurement is selected, for example, S11, the following parameters are displayed at the upper-left of the trace window:

Trace number	Measurement Parameter	Format	Scale/Div	Reference value

Impedance Measurement (Option 005)

When impedance measurement is selected, the measurement parameter and format is replaced with Z-parameter and measurement method. Hence, the following parameters are displayed:

Trace number	Impedance (Z)-Parameter	Method	Scale/Div	Reference value

Y-Axis (Log)

Regardless of the measurement parameter, when Log scale is selected at Y-Axis, the following parameters change.

If Linear scale is selected:

Scale/Div	Reference value

If Log scale is selected:

Top xx.xxx	Bottom xx.xxx

Example

Below are examples of several scenarios.

Network Measurement (with Linear Y-Axis):

Network Measurement (with Log Y-Axis):

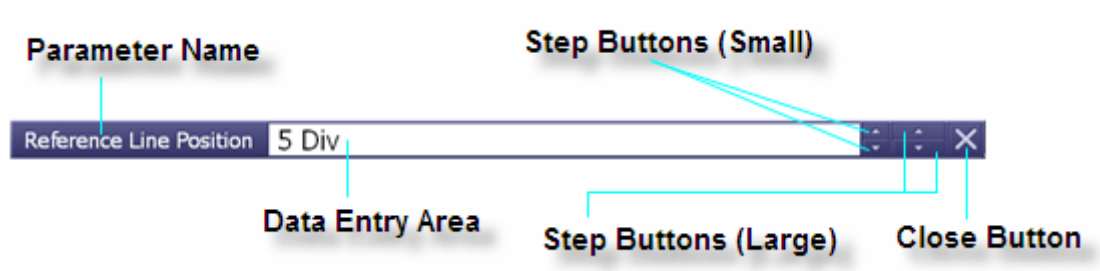
Z Measurement (with Linear Y-Axis):

Z Measurement (with Log Y-Axis):

Data Entry Bar

Used to enter numeric data into the E5061B. Press a hardkey or softkey to enter data, and the data entry bar will appear at the top of the screen. To assign a title to a channel window, an entry bar that allows you to enter letters and symbols by using the front panel keys or mouse is displayed.

Data entry bar



NOTE To manipulate the data entry bar by using the front panel keys, the data entry bar must be selected as the object to manipulate (with the focus placed on it). When the focus is placed on the data entry bar, the entire bar is displayed in blue. Pressing or clicking **Foc** Key in the ENTRY Block enables you to move the focus to the desired object.

Close Button

Closes the data entry area (turns off the display). Use mouse to manipulate this button.

Data Entry Area

When the data entry bar is displayed for the first time, the current settings are displayed on it. You can change numeric values by typing from the keyboard or in the ENTRY block on the front panel.

You can hide the frequency information in order to ensure its confidentiality or for other reasons. For detailed information, see Hiding Softkey's Frequency Information.

Parameter Name

Displays the name of the parameter for which data will be entered.

Step Button (Small)

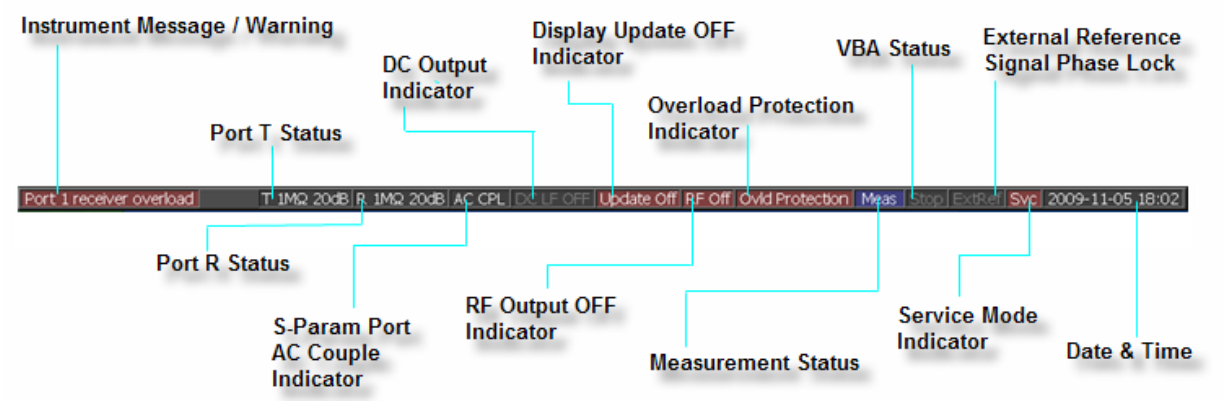
Increases or decreases the numeric value in the data entry area in small steps. Use the mouse to manipulate this button.

Step Button (Large)

Increases or decreases the numeric value in the data entry area in large steps. Use the mouse to manipulate this button.

Instrument Status Bar

The instrument status bar displays the status of the entire instrument.



Date and Time

Displays the date and time generated by the internal clock. The display format is as follows:

YYYY-MM-DD HH:MM

Where:

YYYY: Year (AD)
MM: Month
DD: Day
HH: MM: Time (0:00 to 23:59)

NOTE You can turn the date and time display on/off by: **System** > **Misc Setup** > **Clock Setup** > **Show Clock.**

Display Update OFF Indicator

When information update display on the LCD screen is turned off, this indicator is displayed.

DC Output Indicator

Displays the output port (LF or P1[Port 1]) and status (ON or OFF) for DC output.

External Reference Signal Phase Lock

When the frequency reference signal is input to the Reference Signal Input (REF IN) on the rear panel and the measurement signal of the E5061B is phase-locked to the reference signal, ExtRef is displayed in blue.

Value	Description
ExtRef (displayed in blue)	Measurement signal is phase-locked to the external reference signal.
ExtRef (displayed in	Measurement signal is not phase-locked to the

gray)	external reference signal.

NOTE Even when the High Stability Frequency Reference Output (REF OVEN) and Reference Signal Input (REF IN) are connected, phase-locking may not occur immediately after power-on in a low-temperature environment. (The "ExtRef" display remains gray, not blue.) In such a case, wait a few minutes until the instrument has warmed up and the "ExtRef" display turns blue.

Instrument Message/Warning

Displays instrument messages and warnings. Instrument messages are displayed in gray and warnings in red.

Measurement Status

Displays the measurement status of the E5061B.

Value	Description
Setup	Setup for measurement in progress
Hold	Measurement on hold (idling)
Init	Measurement being initialized
Man	The trigger source is set to "Manual" and waiting for trigger.
Ext	The trigger source is set to "External" and waiting for trigger.
Bus	The trigger source is set to "Bus" and waiting for trigger.
Meas	A measurement is in progress.

Overload Protection Indicator

Displays when the overload is detected.

Port R Status

Displays the current settings of input impedance and attenuator for Port R.

Port T Status

Displays the current settings of input impedance and attenuator for Port T.

RF Output OFF Indicator

When RF signal output is turned off, this indicator is displayed.

Service Mode Indicator

Indicates the service mode status. The service mode indicator is displayed when E5061B enters the following state.

Value	Description
SVC (displayed	The E5061B is in service mode, which is used for self-diagnosis and repair of the E5061B or 8 term calibration

in blue)	mode. Therefore, measurement performance will not be guaranteed according to the specifications. If, under normal use, the system remains in the service mode and does not return to normal operating mode, there is a possibility that the instrument is out of order.
SVC (displayed in red)	An abnormal condition has been detected inside the E5061B. The unit may be damaged. Notify the Customer Contact listed at the end of this manual or the distributor from whom the unit was purchased.

S-Param Port AC Couple Indicator

This indicator is displayed when the S-param port couple status is AC.

VBA Status

Displays the state of the execution of the VBA program in the E5061B.

Value	Description
Run	A VBA program is currently running.
Stop	A VBA program has stopped.

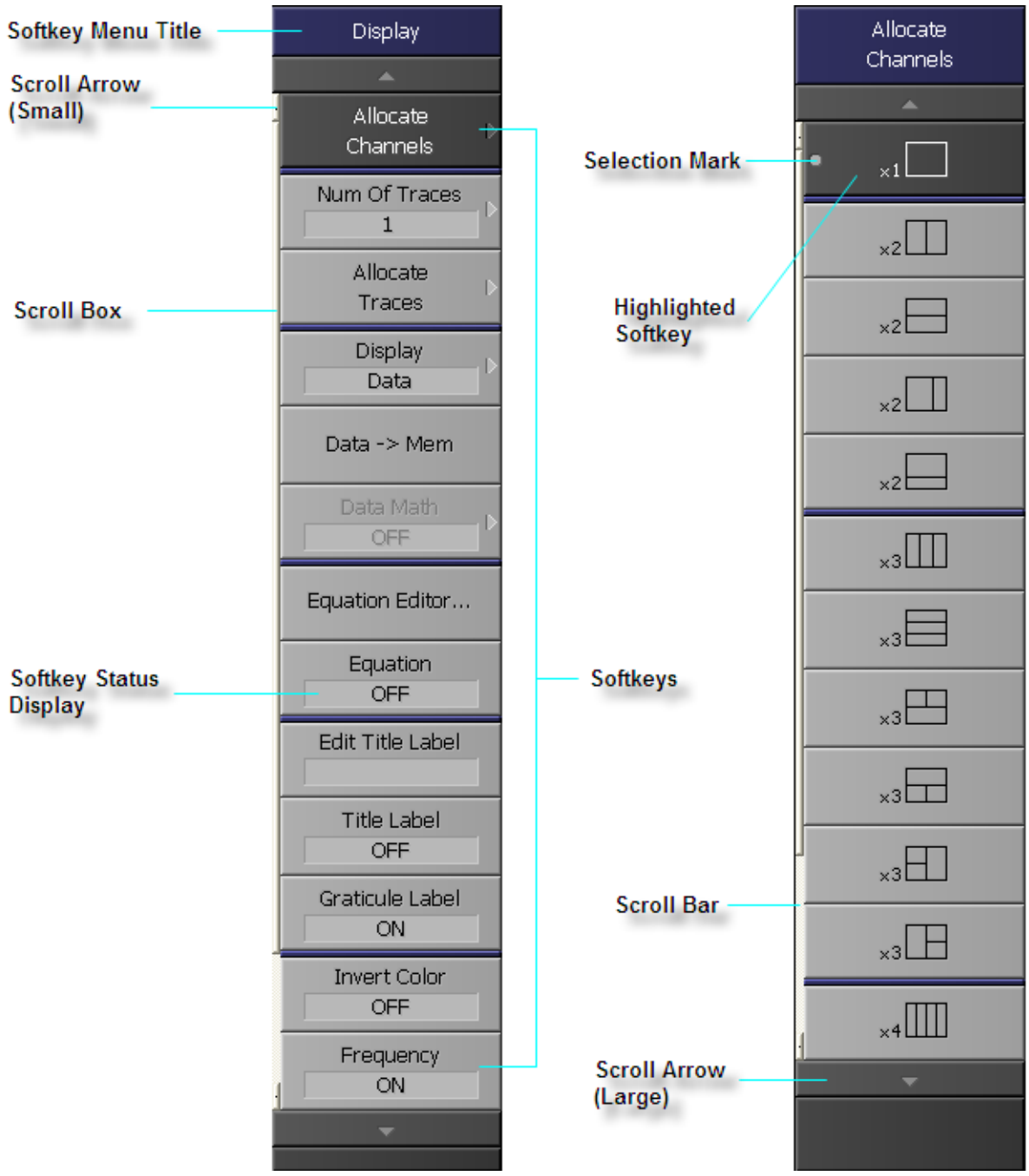
Menu Bar

By using the mouse and keyboard to manipulate the menu bar, you can perform interface operations that are equivalent to those of the keys in the **ACTIVE CH/TRACE** Block, **RESPONSE** Block, **STIMULUS** Block, **MKR/ANALYSIS** Block, and **INSTR STATE** Block on the front panel of the E5061B. The menus on the menu bar correspond to the key blocks, and their submenus to the hardkeys inside the key blocks.

Softkey Menu Bar

A group of keys on the screen called by the softkeys and menu bars. You can manipulate these keys by using the **NAVIGATION** Block keys on the front panel, the mouse, or the keyboard. You can perform manipulations by directly touching the screen with your finger instead of using a mouse.

Softkey Menu Bar



NOTE To manipulate a menu bar, it has to be selected as the object to manipulate (with the focus placed on it). When the focus is placed on a menu bar, the menu title area at the top is displayed in blue. Pressing or clicking on **Foc** Key in the ENTRY Block enables you to move the focus to the desired object.

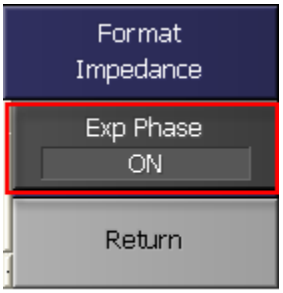
E5061B Option 005

With E5061B Option 005, **Impedance Analysis Menu** under the **Measurement** menu is activated. Else, this button is grayed out or disabled.

e5061b083

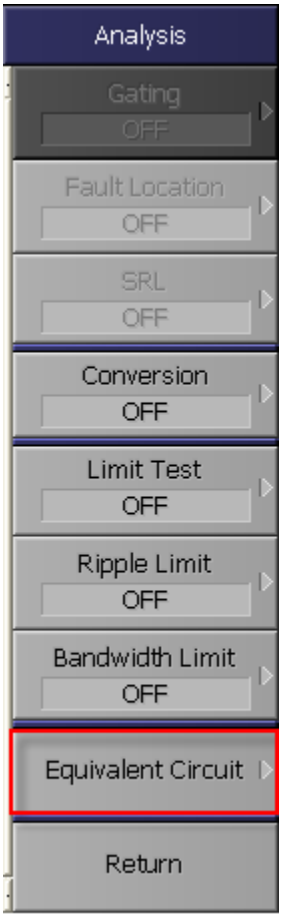
Selecting Impedance measurement, **|Z|** for an active trace changes:

- **Format** menu display. The only available Format option is **Expand Phase**.



e5061b084

- **Analysis** menu display. The **Equivalent Circuit** button is enabled. Else, this button is grayed out or disabled.



e5061b085

All Other E5061B Options Except for Option 3L5

For all other E5061B options except for E5061B Option 3L5, limited buttons as available under the **Measurement** menu, as shown below. Other buttons such as **Gain-Phase**, **Gain-Phase Setup**, **DC Monitor Setup** and **Impedance Analysis Menu** are not available:

e5061b086

Highlighted Softkey

Pressing and **Enter** key on the front panel or pressing **Enter** key on the keyboard causes the highlighted (selected) softkey to be executed. You can change which softkey in the menu is highlighted by turning or pressing on the front panel or by pressing on the keyboard. Pressing the key on the front panel or the key on the keyboard brings up the upper level softkey menu, and pressing the key on the front panel or the key on the keyboard brings up the lower level softkey menu.

Scroll Arrow (Large)

When the softkeys in a menu overflow the screen, use this key to enable you to scroll the menu page by page. Both upward and downward scroll arrows are available. Use the mouse to manipulate these buttons.

Scroll Arrow (Small)

Using this button, you can scroll the menu one softkey at a time. Both upward and downward scroll arrows are available. Use the mouse to manipulate these buttons.

Scroll Bar

When the softkeys in a menu overflow the screen, clicking on the blank part of the scroll bar enables you to scroll the softkey menu up or down.

Scroll Box

You can scroll the softkey menu up or down by using the mouse to select and drag the scroll box (pressing the button on the object to be moved and then releasing the button at the desired location). The length and position of the scroll box indicate the length and position of the currently displayed part of the softkey menu relative to the entire menu.

Selection Mark

Shows which softkey function is currently selected.

Softkeys

These are the actual keys you would use to perform setup. A ▶ displayed to the right of a softkey indicates that pressing that softkey displays the lower layer of softkeys.

Softkey Menu Title

The title of the softkey menu is displayed here. Double-clicking on this part of the menu bar displays the top layer of softkeys.

Softkey Status Display

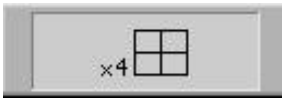
Displays a softkey's setup status.

You can hide the frequency information in order to ensure its confidentiality or for other reasons. See Hiding Softkey's Frequency Information.

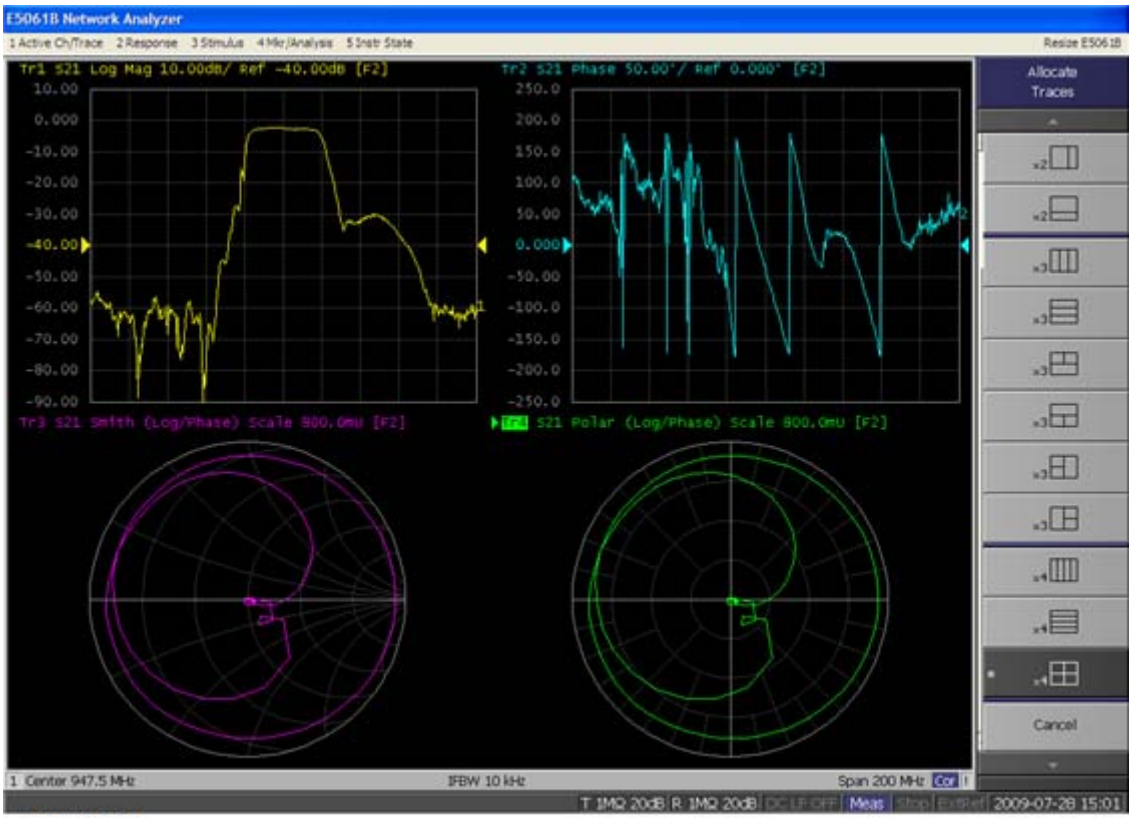
Three Methods of Operation

You can operate the E5061B using one of three operating methods: using keys on the front panel, using a mouse and keyboard, and using the touch screen. This section illustrates these three operating methods through the example in which the channel window layout is set to four-channel display as shown in the following figure.

In the next section and those following it, a series of operations is expressed as follows:

Display > **Allocate Traces** > 

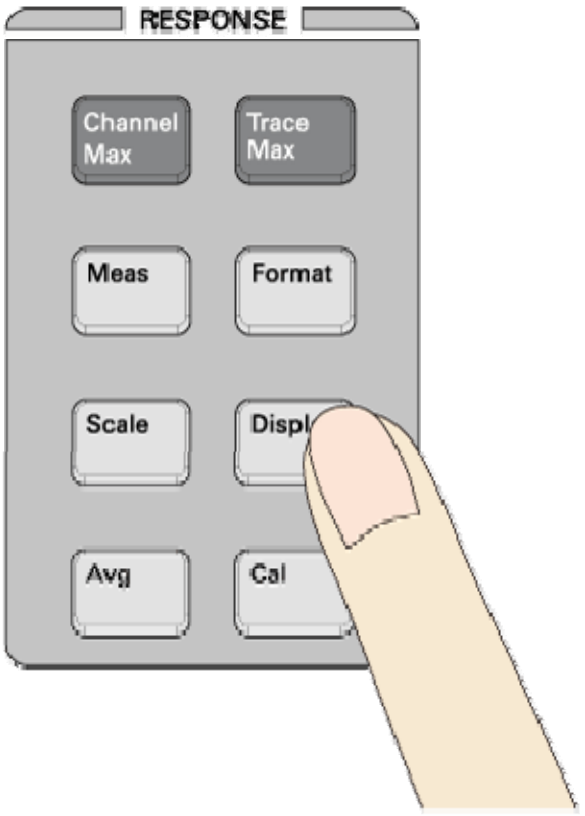
Four-Trace Display



e5061b076

Operating Method Using Keys

1. Press the **DISPLAY** key in the **RESPONSE** Block.



e5071c307

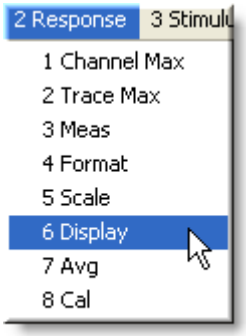
2. Press or key to move the cursor to the **Allocate Traces**, then press **Enter** or ( ) key.

e5071c002

3. Press or key to move the cursor to  , then press **Enter** key.

Operation Method Using a Mouse

1. From the **Response** menu, press **Display** key.

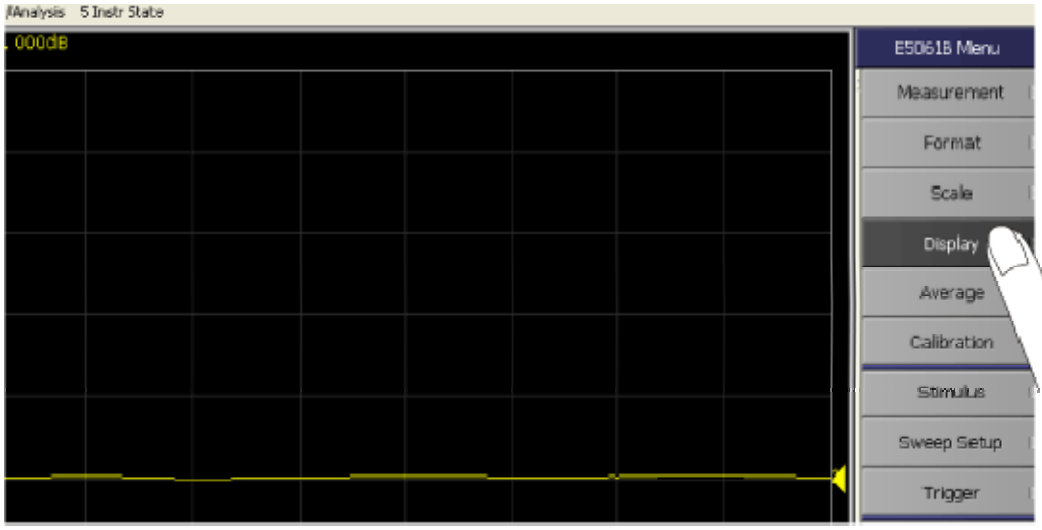


e5071c051

2. Click **Allocate Traces**.
3. Click 

Operation Method Using the Touch Screen

1. Press **Display** key after presetting the E5061B (Executing **Preset** key).



e5061b078

2. Click/Press **Allocate Traces.**
3. Click/Press any desired setting.

S-Parameter Measurement

S-Parameter Measurement

- Basic Measurement Procedure
- Measurement Example of a Bandpass Filter

Basic Measurement Procedures

This section describes the basic measurement procedure using the E5061B and presents an example of the transmission measurement of a bandpass filter, for better understanding of how to use the E5061B.

Basic Measurement Flow

1. **Determining measurement conditions**
   - Initializing Parameters
   - Select:
     - Measurement Parameter
     - Data format
     - Sweep Type and range
     - Power level
     - IF bandwidth
2. **Calibration**
   - Select calibration kit
   - Make a calibration
3. **Connecting the Device Under Test (DUT)**
   - Connect DUT
   - Adjust the scale
4. **Analyzing measurement results**
   - Analysis using markers
5. **Outputting measurement results**
   - Store measurement result into a file

Measurement Example of a Bandpass Filter

This section describes how to measure the transmission characteristics of a 947.5 MHz bandpass filter. The measurement conditions for this measurement example are those suitable for a 947.5 MHz bandpass filter. To measure another device under test (DUT), change the measurement conditions to suit the particular DUT.

STEP 1. Determining Measurement Conditions

1. Preset the E5061B.

   Preset > **OK**

2. Set the S-parameter to S21.

   Meas > **S21**

   NOTE When measuring the reverse transmission characteristics, set the S-parameter to S12.

3. Set the data format to the log magnitude format

   Format > **Log Mag**

4. Set the center frequency to the bandpass filter center frequency. Next, specify the span frequency, which is set to 200 MHz in this measurement example.

   Center > **9** > **4** > **7** > **.** > **5** > **M/m**
   Span > **2** > **0** > **0** > **M/m**

   NOTE When entering the frequency unit using the keyboard, type "G" for GHz, "M" for MHz, and "k" for kHz.

5. Specify the number of measurement points per sweep. The number of measurement points in this measurement example is set to 401.

   Sweep Setup > **Points** > **4** > **0** > **1** > **x1**

6. Specify the power level of the signal source. The power level in this measurement example is set to -10 dBm.

   Sweep Setup > **Power** > **+/-** > **1** > **0** > **x1**

7. Specify the IF bandwidth of the receiver as necessary. In this measurement example, the IF bandwidth is set to 10 kHz because of the need to lower the noise floor.

   Avg > **IF Bandwidth** > **1** > **0** > **k/m**

STEP 2. Calibration

To turn the error correction ON, set the calibration type to the full 2-port calibration and measure the calibration data.

For details about calibration, see Calibration.

1. Select the calibration kit suitable for the measurement cable. In this measurement example, Calibration Kit 85032F is selected.

   Cal > **Cal Kit** > **85032F**

2. Set the calibration type to the full 2-port calibration using the test port 1 and 2.

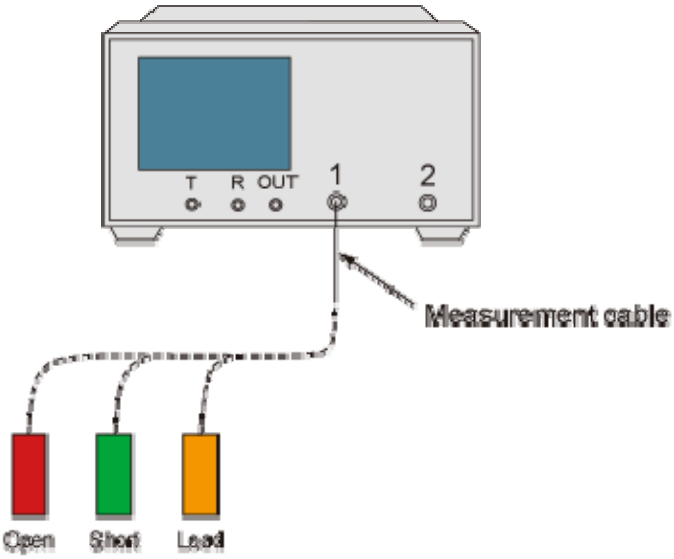
   Cal > **Calibrate** > **2-Port Cal**

3. Connect the OPEN standard (included in the calibration kit) to the other end of the measurement cable that is connected to the test port 1 as shown in the following figure, and measure the open calibration data at the test port 1. After measuring the open calibration data, a checkmark  is displayed to the left of the **Port 1 Open** menu.

   Cal > **Calibrate** > **2-Port Cal** > **Reflection** > **Port1 Open**

   In the same way, measure the calibration data for the SHORT/LOAD standards at the test port 1.

   Connecting the OPEN/SHORT/LOAD standards

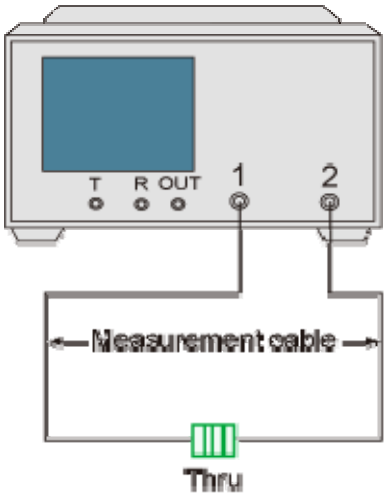


e5061b-842

4. In the same way as described above, measure the calibration data for the OPEN/SHORT/LOAD standards at the test port 2.
5. Connect the measurement cables as shown in the figure below, and measure the thru calibration. After measuring the thru calibration data, a checkmark is displayed to the left of the **Port 1-2 Thru** button.

Cal > **Calibrate** > **2-Port Cal** > **Transmission** > **Port 1-2 Thru**

Making the through calibration



e5061b-844

6. Set the full 2-port calibration measurement to DONE. The calibration factor is calculated based on the calibration data acquired, and the error correction is turned ON.

Cal > **Calibrate** > **2-Port Cal** > **Done**

7. Select the type in which the data is to be saved before saving the calibration factor (calculated based on the calibration data).

Save/Recall > **Save Type** > **State & Cal**

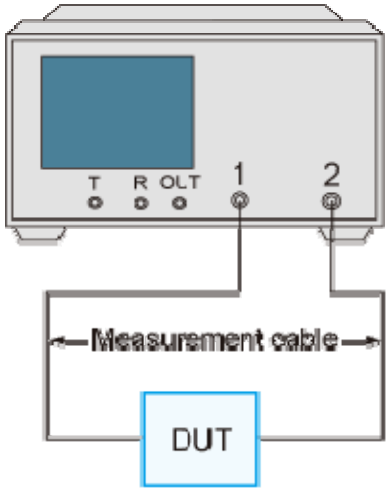
8. Store the calibration file to the disk of the E5061B. The symbol "X" appearing in the operations below represent the assigned numbers to be used when the file is saved.

Save/Recall > **Save State** > **State 0X**

STEP 3. Connecting the Device Under Test (DUT)

1. Connect to the DUT to the E5061B. (See the below figure)

Connecting the DUT



e5061b044

2. Set the appropriate scale by executing the auto scale. (See the below figure)

Scale > **Auto Scale**

You can also adjust the scale by entering arbitrary values in the **Scale/Div** button, **Reference Position** button, and **Reference Value**.

S21 trace after executing the auto scale

STEP 4. Analyzing Measurement Results

This section describes how to use the marker function to read out important parameters for the transmission measurement of the bandpass filter (insertion loss, -3 dB bandwidth).

Measuring the Insertion Loss

1. Display a marker.

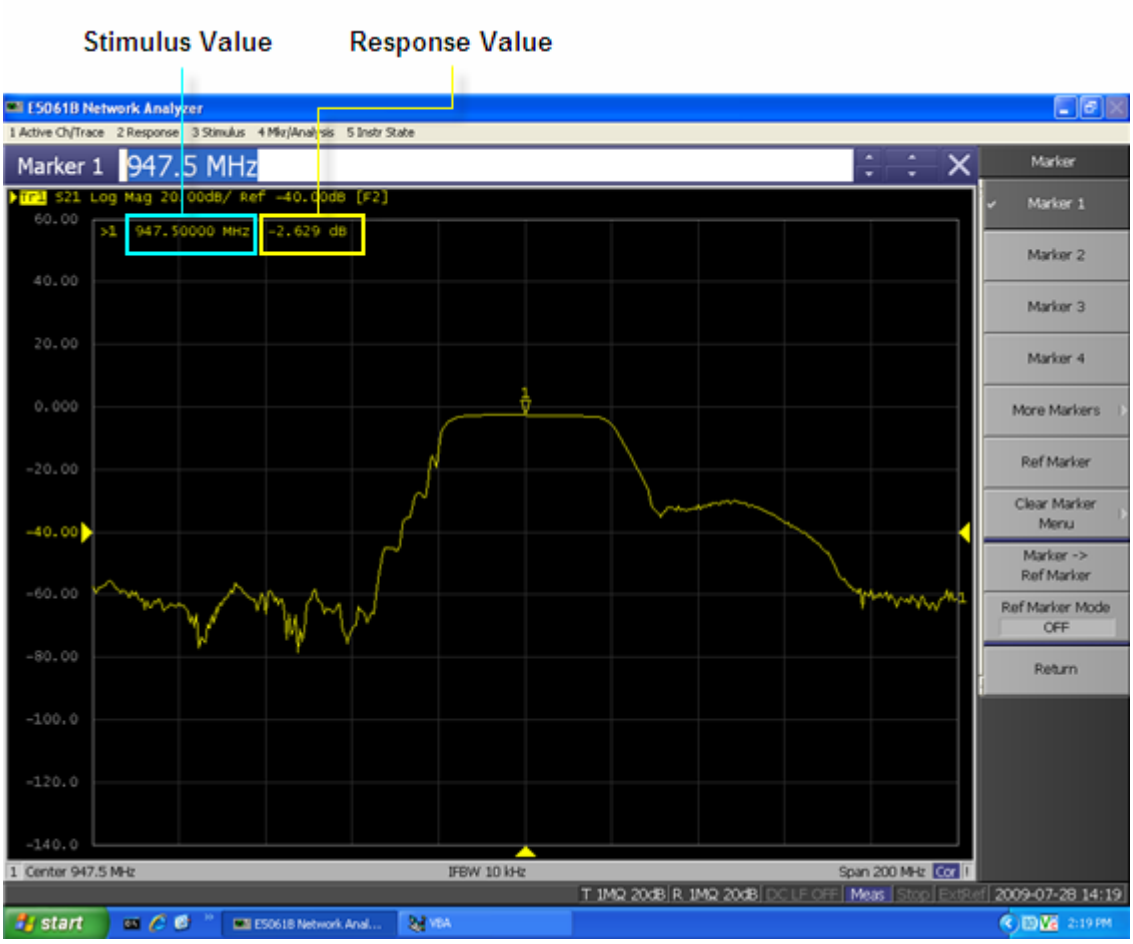
   Marker > **Marker 1**

2. Using one of the following methods to move the marker to the center frequency of the bandpass filter.

- On the entry bar, press **9**> **4** > **7** > **.** > **5** > **M/m**
- Turn the rotary knob on the front panel to set it to the center frequency (947.5 MHz).

3. Read the marker value displayed as shown in the figure below. In this example, the response value denotes the insertion loss.

Measuring an Insertion Loss



Measuring the -3 dB Bandwidth

Using the marker bandwidth search function, the bandwidth, center frequency between two cutoff frequency points, Q value, and insertion loss are all read out. These parameters are described in the following table.

NOTE If the two cutoff frequency points are not found, all data items except the insertion loss revert to zero.

Parameter	Description
BW (Bandwidth)	Stimulus width between two cutoff frequency points (low and high)
cent (Center Frequency)	Center point between cutoff frequency points (low and high)
low (Left-side Cutoff Frequency)	The lower frequency of the two cutoff frequency points
high (Right-side Cutoff	The higher frequency of the two cutoff

Frequency)	frequency points
Q (Q Value)	Q = cent/BW
loss (Insertion Loss)	The measured value of the active marker.

1. Display a marker.

   Marker > **Marker 1**

2. Using one of the following methods to move the marker to the center frequency of the bandpass filter.

- On the entry bar, press **9** > **4** > **7** > **.** > **5** > **M/m**
- Turn the rotary knob  on the front panel to set it to the center frequency (947.5 MHz).

3. Specify the bandwidth definition value that defines the pass band of the filter. In this measurement example, it is set to -3 dB.

   Marker Search > **Bandwidth Value** > **+/-** > **3** > **x 1**

4. Set the bandwidth search function ON.

   Marker Search > **Bandwidth**

5. The bandwidth data items (BW, cent, low, high, Q, loss) is displayed. (See the following figure.)

Measuring the -3 dB Bandwidth

STEP 5. Outputting Measurement Results (Save)

You can save not only the internal data but also the measurement results such as trace data and display screens to the disk.

Saving the Trace Data(in CSV format)

You can save the trace data to the disk of the E5061B in CSV file format (extension: .csv). Since the CSV-formatted data to be saved is a text file, you can analyze the data using Microsoft Excel.

Follow the step below to save the trace data:

Save/Recall > **Save Trace Data**

Saving the Display Screen

You can save the screen displayed on the E5061B to the disk of the E5061B in Windows bitmap file format (extension: .bmp) or Portable Network Graphics format (extension: .png).

Follow the step below to save the display screen:

System > **Dump Screen Image**

NOTE The image on the LCD display memorized in the volatile memory (clipboard) (the image on the LCD display when the **Capture/System** key is pressed) is saved.

Impedance Measurement (Option 005)

Impedance Measurement

- Basic Measurement Procedure
- Measurement Method
- Measurement Example of a Capacitor (Port 1 Reflection)
- Measurement Example of a Crystal (Port 1-2 Series)
- Measurement Example of a Capacitor (Port 1-2 Shunt)
- Measurement Example of a Ceramic Resonator (Gain-Phase/Series-Through)
- Measurement Example of a Capacitor (Gain-Phase/Shunt-Through)

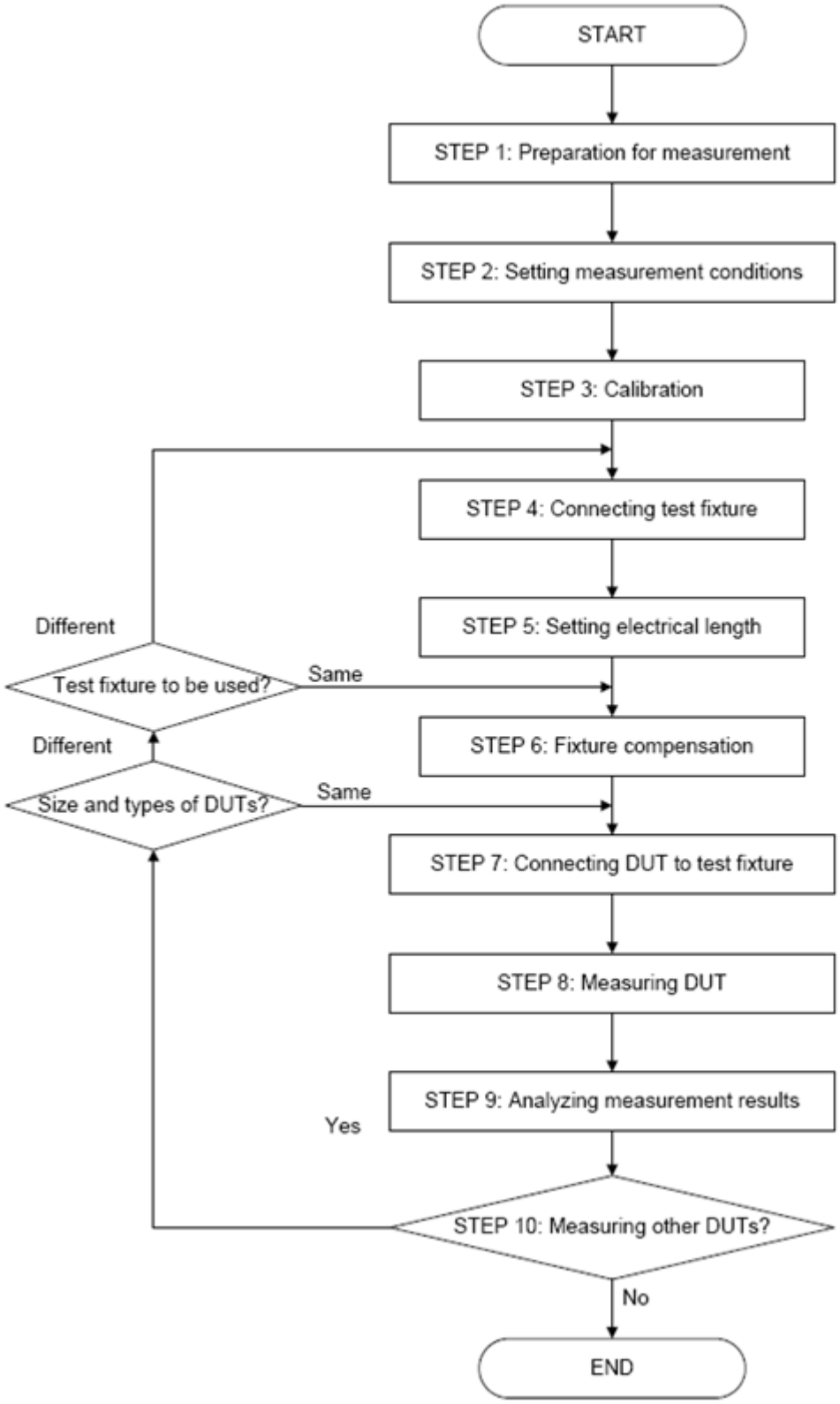
Basic Measurement Procedure

- Procedure for Port 1 Reflection
- Procedure for Port 1-2 Shunt/Series and GP Shunt/Series

Other topics about Impedance Measurement Quick Start

Procedure for Port 1 Reflection

The basic procedure for Port 1 Reflection method is shown in the flow chart below:



STEP 1:Preparation for measurement

STEP 2: Setting measurement conditions

STEP 3: Calibration

STEP 4: Connecting test fixture

STEP 5: Setting electrical length

STEP 6: Fixture compensation

STEP 7: Connecting DUT to test fixture

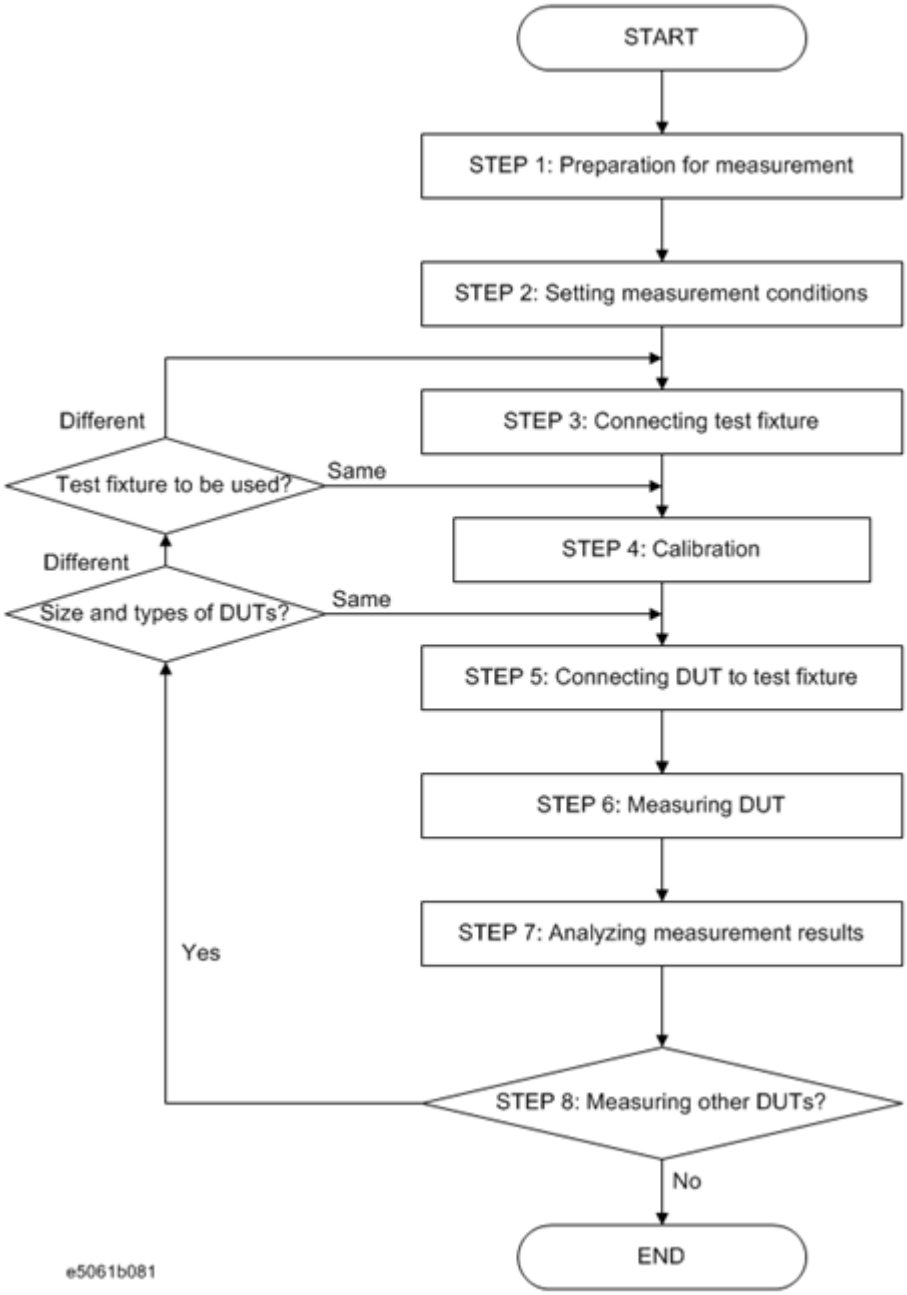
STEP 8: Measuring DUT

STEP 9: Analyzing measurement results

STEP 10: Measuring other DUTs

Procedure for Port 1-2 Shunt/Series and GP Shunt/Series

The basic procedure for Port 1-2 Shunt/Series and GP Shunt/Series method is shown in the flow chart below:



STEP 1:Preparation for measurement

STEP 2: Setting measurement conditions

STEP 3: Connecting test fixture

STEP 4: Calibration

STEP 5: Connecting DUT to test fixture

STEP 6: Measuring DUT

STEP 7: Analyzing measurement results

STEP 8: Measuring other DUTs

Measurement Method

- Available Methods
- Measurement DUT Impedance Range for Each Method
- Configuration for Each Method

Other topics about Impedance Measurement Quick Start

Available Methods

This section describes the impedance measurement method. Five methods shown in the following table can be used to make an impedance measurement. For the connection for each method, see Preparation for Measurement.

When you select Impedance (**Meas** > **Impedance Analysis Menu**) as the Measurement type, the measurement method is made available (**Meas** > **Impedance Analysis Menu** >**Method**).

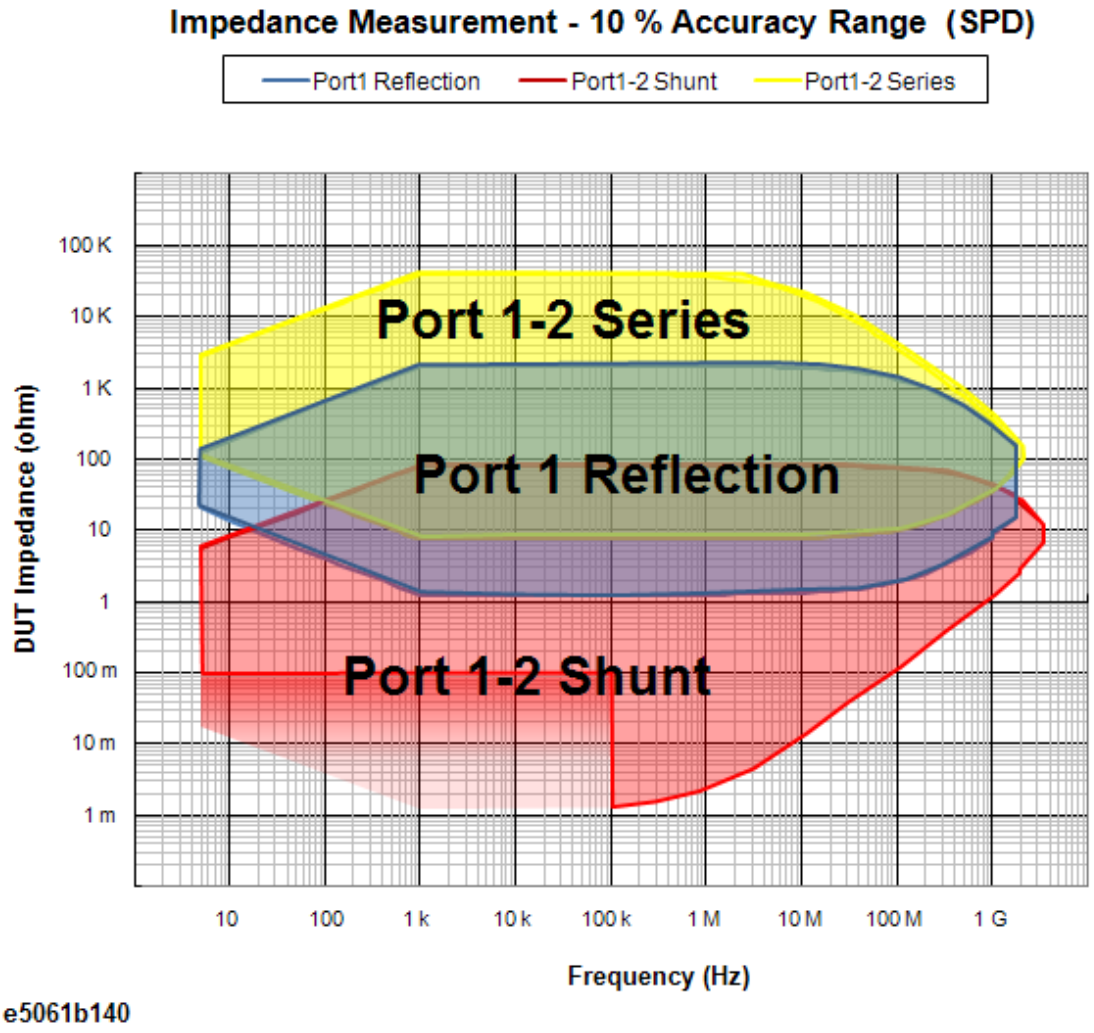
The characteristics of the measurement method is as described in the following table:

Method	Port 1 (or 2) Reflection	Port 1-2 Series	Port 1-2 Shunt	GP Series	GP Shunt
Measurement DUT Impedance Range	Low to middle impedance	Middle to high impedance in the high frequency range Not applicable to grounded DUTs	Very low impedance in the high frequency range	Middle to high impedance in the low frequency range	Very low impedance in the low frequency range
Formula	Zdut = 50 x (1+S11)/(1-S11)	Zdut = 50 x 2 x (1-S21)/S21	Zdut = 50 x S21/(2 x (1-S21))	Zdut = 50 x (1-S21)/S21	Zdut = 50 x S21/(2 x (1-S21))

Measurement DUT Impedance Range for Each Method

The following figures show the 10% accuracy range for each method. You can select the appropriate method according to your DUT impedance.

Ports 1 and 2



Conditions of 10 % measurement accuracy range

The following table shows the condition where the 10% measurement accuracy range shown above is specified.

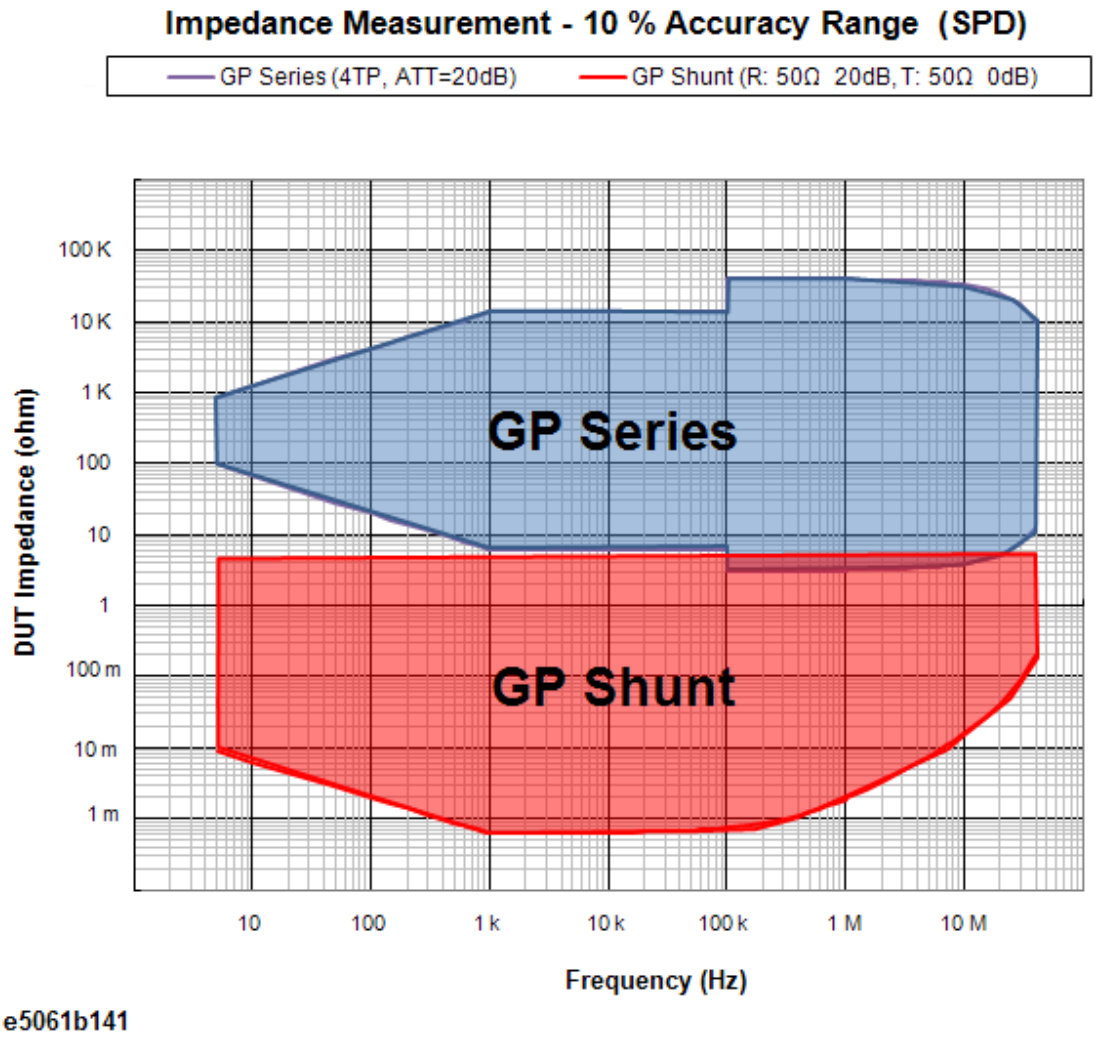
Method	Frequency	Calibration	IFBW	Source Power	Note
Port 1-2 Series	5 Hz to 3 GHz	Full 2-port calibration at measurement terminals of fixture or Full 2-port calibration + Open/Short/L	See the following table Measurement Frequency: < 200 Hz IF BW: ≤ (1/5 × Measurement	-20 to 0 dBm	

<table>
<tr><td></td><td rowspan="2"></td><td>oad fixture compensation
Note</td><td rowspan="2"><table><tr><td></td><td>Frequency) Hz</td></tr><tr><td>≥ 200 Hz</td><td>≤ 40 Hz</td></tr></table></td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>Port 1 Reflecti on</td><td>Open/Short/L oad calibration at 7 mm terminal of the 16201A.
Calibration kit: 16195B or 85031B</td></tr>
<tr><td>Port 1-2 Shunt</td><td>100 kHz to 3 GHz</td><td>Full 2-port calibration at measurement terminals of fixture
or
Full 2-port calibration + Open/Short/L oad fixture compensation
Note</td><td>10 Hz</td><td>10 dBm</td><td>Measurem ent error in the short calibration is included. (10 pH residual inductance of short standard is included.)
A ferrite core is required to measure DUTs with 100 mΩ or below at ≤100 KHz.</td></tr>
</table>

Temperature Condition

- 23±5 °C at calibration
- (calibration temperature) ±1 °C at measurement

Gain-Phase Ports



Conditions of 10 % measurement accuracy range

The following table shows the condition where the 10% measurement accuracy range shown above is specified.

Method	Frequency	Calibration	Receiver Setup	IFBW	Source Power	Note
GP Series	5 Hz to 30 MHz	Open/Short/Load calibration at measurement terminals of fixture Fixture: 16047E or	Rch: Zin=50 Ω, Att=20 dB Tch: Zin=50 Ω, Att=2	See the following table Meas. Frequency: < 200 Hz IF BW: ≤ (1/5 × Measurement	-20 to 0 dBm	Only with the response-thru calibration at the terminals of fixture, the measure

<table>
<tr>
<td></td>
<td></td>
<td>16034E/G/H

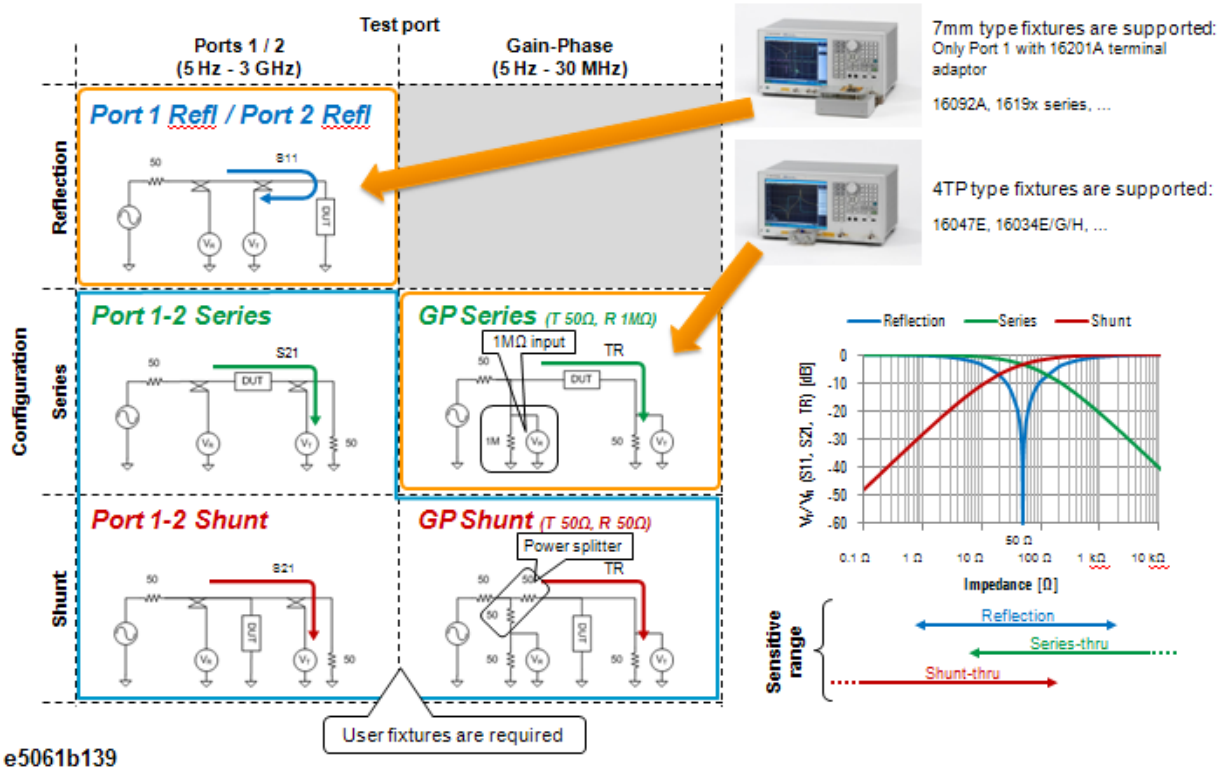
Load Standard: Agilent PN 5012-8646 (THT) or 0699-2829 (SMD)</td>
<td>0 dB</td>
<td><table><tr><td></td><td>Frequency) Hz</td></tr><tr><td>≥ 200 Hz</td><td>≤ 40 Hz</td></tr></table></td>
<td></td>
<td>ment accuracy may be degraded due to a parasitic capacitance of receiver port at RF range (≥1 MHz)</td>
</tr>
<tr>
<td>GP Shunt</td>
<td></td>
<td>Open/Short /Load calibration at measurement terminals of fixture
(Source=-10 dBm at calibration)
Note</td>
<td>Rch: Zin=50 Ω , Att=20 dB
Tch: Zin=50 Ω , Att=0 dB</td>
<td>See the following table<table><tr><th>Meas. Frequency</th><th>IF BW</th></tr><tr><td>< 50 Hz</td><td>≤ (1/5 × Measurement Frequency) Hz</td></tr><tr><td>≥50 Hz</td><td>≤ 40 Hz</td></tr></table></td>
<td>10 dBm</td>
<td>Measurement error in the short calibration is included (10 pH residual inductance of short standard is included.)
Maximum DUT impedance is 5 Ω in this condition in order to avoid a receiver saturation</td>
</tr>
</table>

Temperature Condition

- 23±5 °C at calibration
- (calibration temperature) ±1 °C at measurement

Configuration for Each Method

The following figure shows the configuration for each method.


Test port
Ports 1 / 2
(5 Hz - 3 GHz)
Gain-Phase
(5 Hz - 30 MHz)
Configuration
Reflection
Series
Shunt
Port 1 Refl / Port 2 Refl
Port 1-2 Series
GP Series (T 50Ω, R 1MΩ)
Port 1-2 Shunt
GP Shunt (T 50Ω, R 50Ω)
1MΩ input
Power splitter
TR
DUT
S11
S21
S21
User fixtures are required
7mm type fixtures are supported:
Only Port 1 with 16201A terminal adaptor
16092A, 1619x series, ...
4TP type fixtures are supported:
16047E, 16034E/G/H, ...
Reflection
Series
Shunt
Impedance [Ω]
Sensitive range
Reflection
Series-thru
Shunt-thru
e5061b139

Measurement Example of a Capacitor (Port 1 / Reflection)

This section describes how to measure a Capacitor. In this example, apart from E5061B option 005, 16201A terminal adapter and 16196A test fixture are used. The measurement is performed with 10 pF capacitor, hence, to measure another device under test (DUT), change the measurement conditions to suit accordingly. Prior to the measurement, ensure that the 16201A terminal adapter is connected to the E5061B network analyzer. See Connecting Terminal Adapter.

STEP 1. Setting Measurement Conditions

1. Preset the E5061B.

   Preset > **OK**

2. Set the trace display settings.

   Display > **Num of Traces** > **2**

   Display > **Allocate Traces** > **x2**

3. Set the measurement port to S-Parameter.

   Meas > **Measurement Port** > **S-Parameter**

4. Set the measurement method to Port 1 Reflection.

   Meas > **Impedance Analysis Menu** > **Method** > **Port 1 Refl**

5. Set the measurement type of each trace.

   Select Trace 1 as the active trace. **Meas** > **Impedance Analysis Menu** > **|Z|**

   Select Trace 2 as the active trace. **Meas** > **Impedance Analysis Menu** > **θz**

6. Set the format of the measurement of each trace.

   Select Trace 1 as the active trace. **Format** > **Exp Phase** > **OFF**

   Select Trace 2 as the active trace. **Format** > **Exp Phase** > **OFF**

7. Set the sweep setup power.

   Sweep Setup > **Power** > **-10dBm**

8. Set the sweep type.

   Sweep Setup > **Sweep Type** > **Log Freq**

9. Set the frequency bandwidth.

Avg > **IF Bandwidth** > **100 Hz**

STEP 2. Calibration

Once the measurement condition is set, impedance calibration should be performed. The 16195B calibration kit is required to perform the calibration.

1. Connect the E4991-60022 OPEN standard to the 16201A terminal adapter (which is connected to Port 1 of E5061B).

   Cal > **Cal Kit** > **16195B**

   Cal > **Calibrate** > **Impedance Calibration** > **Open**

   Once the open calibration is completed, a checkmark  is displayed to the left of the **Open** menu.

2. Remove the OPEN standard and connect the E4991-60021 SHORT standard to the terminal adapter.

   Cal > **Calibrate** > **Impedance Calibration** > **Short**

   Once the short calibration is completed, a checkmark  is displayed to the left of the **Short** menu.

3. In the same way, measure the calibration data for LOAD standard and LOW LOSS C standard. Use 04287-60021 50 Ω termination LOAD standard and 04287-60022 LOW LOSS Capacitor standard.

   Cal > **Calibrate** > **Impedance Calibration** > **Load**

   Cal > **Calibrate** > **Impedance Calibration** > **Low-Loss C**

   Once the calibrations are completed, a checkmark  is displayed to the left of the **Load** and **Low-Loss C** menu.

4. Set the calibration to DONE to save the performed calibration.

STEP 3. Fixture Compensation

As 16196A test fixture is used in this measurement example, fixture compensation should be performed to reduce possible errors induced by the test fixture. Ensure that the insulator assembly used is appropriate with the DUT. Refer to 16196A Test Fixture Operation and Service Manual to learn more about the fixture.

1. Connect the 16196A test fixture to the terminal adapter and set the electrical length:
   a. Turn the adapter's 7-mm connector in the counterclockwise direction when viewed from above and screw the connection sleeve in fully.

   b. Align the text fixture with the adapter's mount post and 7-mm connector and set it gently in place.
   c. Turn the adapter's 7-mm connector counterclockwise, connecting the bottom of the test fixture with the connector.
   d. **Cal** > **Fixture Compen** > **Fixture** > **16196A**
2. Set the open state by using the open state supplied.
   a. Using the Tweezers, place the open plate on top of the insulator assembly.
   b. Set the open plate with the protruding surface down.
   c. Fit the cap in place with the mark toward the front, and turn it to the right until it is locked.
   d. **Cal** > **Fixture Compen** > **Compensate** > **Open**
   e. Once the open compensation is completed, a checkmark  is displayed to the left of the **Open** menu.
3. Set the short state by using the open state supplied.
   a. Remove the cap. Remove the open plate used to measure the open compensation data.
   b. Place the short plate on the insulator assembly with tweezers. Place the rod-shaped protrusion of the short plate downward, and insert it into the DUT insertion hole.
   c. Fit the cap in place with the mark toward the front, and turn it to the right until it is locked.
   d. **Cal** > **Fixture Compen** > **Compensate** > **Short**
   e. Once the short calibration is completed, a checkmark  is displayed to the left of the **Short** menu.
4. Set the compensation to DONE to save the performed fixture compensation. Now, the fixture compensation should be automatically turned ON (**Cal** > **Fixture Compen** > **ON**).

STEP 4. Connecting Device Under Test (DUT)

1. Remove the cap.
2. Insert the DUT into the insulator hole with tweezers. Use a magnifying glass to check that the DUT is inserted deeply enough into the insulator hole for it to contact the bottom electrode.
3. Fit the cap in place with the mark toward the front, and turn it to the right until it is locked.
4. Set the log scale for Trace 1

   Select Trace 1 as the active trace. **Scale** > **Y-Axis** > **Log**

5. Set the appropriate scale for both traces by executing the auto scale.

Scale > **Auto Scale All**

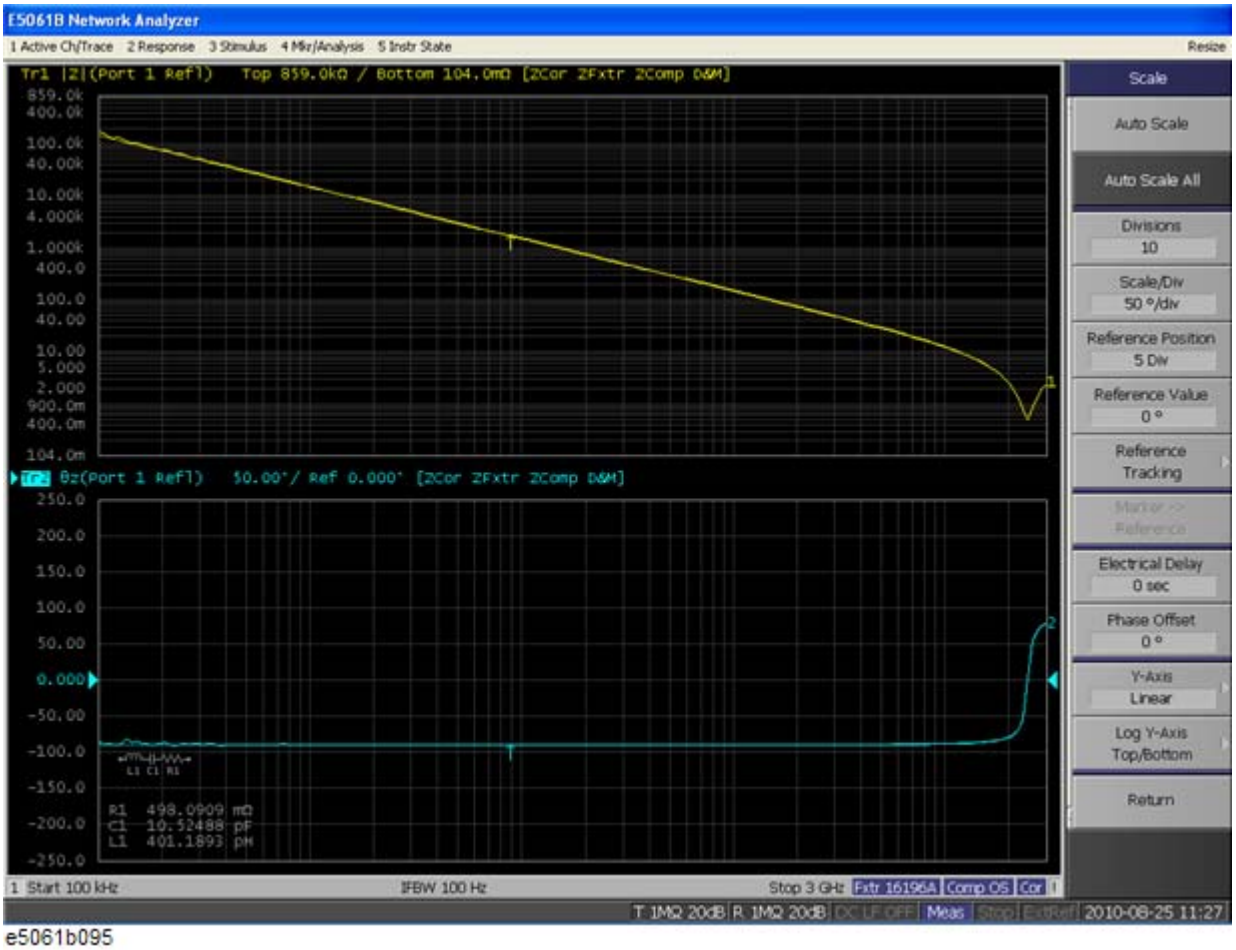
STEP 5. Analyzing Measurement Results

This section describes how to use Equivalent Circuit function to analyze the measurement.

1. **Analysis** > **Equivalent Circuit** > **Select Circuit** > **D**.
2. **Analysis** > **Equivalent Circuit** > **Calculate**. The calculated equivalent circuit parameters are displayed in each box of R1, C1 and L1.
3. **Analysis** > **Equivalent Circuit** > **Simulate** > **ON**.
4. **Analysis** > **Equivalent Circuit** > **Display** > **ON**.

Sample results as shown below:

DUT: 10 pF capacitor



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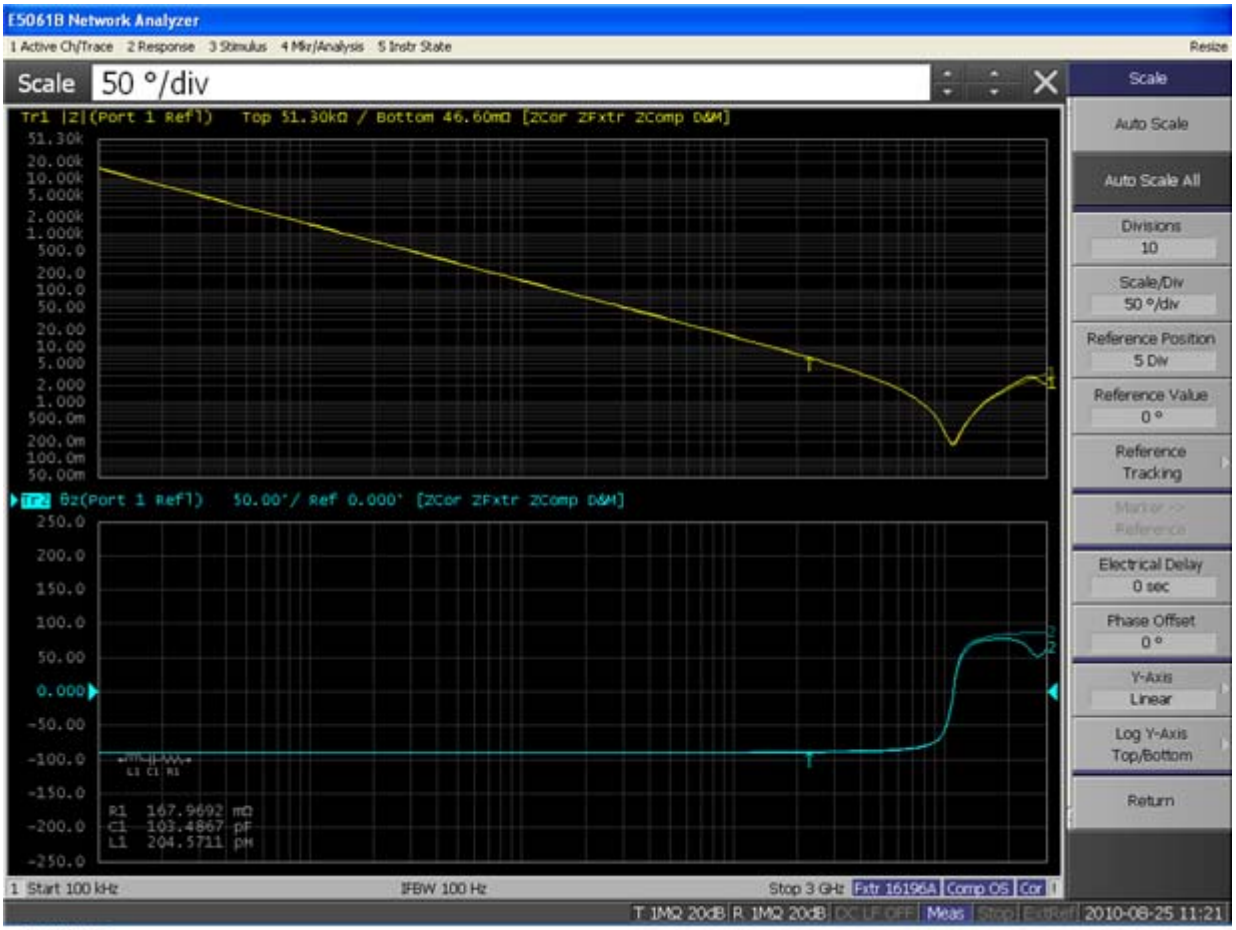
DUT: 100 pF capacitor


E5061B Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Resize
Scale 50 °/div
Tr1 |Z|(Port 1 Refl) Top 51.30kΩ / Bottom 46.60mΩ [ZCor ZFxtr ZComp D&M]
Tr2 θz(Port 1 Refl) 50.00°/ Ref 0.000° [ZCor ZFxtr ZComp D&M]
R1 167.9692 mΩ
C1 103.4867 pF
L1 204.5711 pH
1 Start 100 kHz
IFBW 100 Hz
Stop 3 GHz
Fxtr 16196A
Comp OS
Cor
T 1MΩ 20dB
R 1MΩ 20dB
DC LF OFF
Meas
Stop
ExtRef
2010-08-25 11:21
Scale
Auto Scale
Auto Scale All
Divisions 10
Scale/Div 50 °/div
Reference Position 5 Div
Reference Value 0 °
Reference Tracking
Marker => Reference
Electrical Delay 0 sec
Phase Offset 0 °
Y-Axis Linear
Log Y-Axis Top/Bottom
Return

e5061b096

Measurement Example of a Crystal (Port 1-2/Series-Through)

This section describes how to measure the frequency characteristics of a crystal by using the Series-Through method on Ports 1 and 2.

In this example, the following items are used.

Description	Product/Agilent Part Number	Note
Test Fixture	User Fixture	-
Shorting device	User Shorting device	-
Leaded Load	5012-8646	50 Ω leaded resister. Furnished with E5061B option 720.
DUT	Crystal	-
Cable and Adapter	Cables and adapters for Type-N or 3.5 mm	Connect your fixture to ports 1 and 2 of the E5061B

To measure another device under test (DUT), change the measurement conditions to suit the particular DUT.

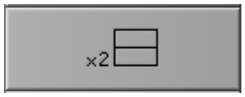
STEP 1. Determining Measurement Conditions

1. Preset the E5061B.

   Preset > **OK**

2. Set the number of traces at two and display each trace in one frame.

   Display > **Num of Traces** > **2**

   Display > **Allocate Traces** > **x2** 

3. Set the measurement port to S Parameter.

   Meas > **Measurement Port** > **S-Parameter**

4. Set the method to Port 1-2/Series-Through configuration.

   Meas > Impedance Analysis Menu > Method > Port 1-2 Series

5. Set the measurement parameter at |Z| for the trace 1 and θ type of each trace.

   Select Trace 1 as the active trace. **Meas** > **Impedance Analysis Menu** > **|Z|**

   Select Trace 2 as the active trace. **Meas** > **Impedance Analysis Menu** > **θz**

6. Specify the center and span frequencies to observe the frequency characteristic. In this example, the center is set at 32 MHz and span is set at 30 kHz

   Center > **3** > **2**> **M/μ**
   Span > **3** > **0** >**k/m**

   NOTE When entering the frequency unit using the keyboard, type "G" for GHz, "M" for MHz, and "k" for kHz.

5. Set the power level at 0 dBm (224 mV @ 50 Ω).

   Sweep Setup > **Power** > **0** > **x1**

6. Set the sweep type at Log.

   Sweep Setup > **Sweep Type** > **Lin Freq**

7. Set the IF Bandwidth at 100 Hz.

   Avg > **IF Bandwidth** > **1** > **0** > **0** > **x1**

STEP 2. Calibration

1. Select the calibration kit for leaded 50 Ω.

   Cal > **Cal Kit** > **Leaded 50ohm**

2. Connect the test fixture on the ports 1 and 2.
3. Set the open state of the test fixture.
4. Measure the calibration data for open.

   Cal > **Calibrate** > **Impedance Calibration** > **Open**

5. Set the short state of the test fixture.
6. Measure the calibration data for short.

   Short

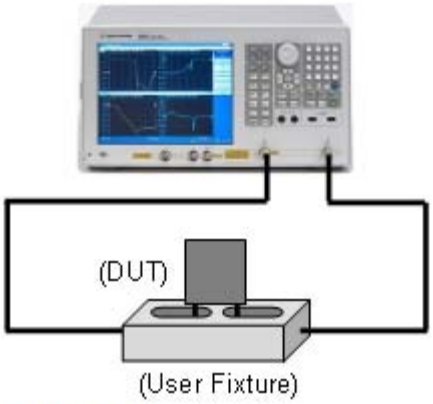
7. Set the load on the test fixture.
8. Measure the calibration data for load.

   Load

9. Finalize the calibration measurement. The calibration factor is calculated based on the calibration data acquired, and the error correction is turned ON. **Cor** is displayed at the bottom of the channel window.
10. **Done**

STEP 3. Connecting the Device Under Test (DUT)

1. Set the DUT on the fixture.



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2. Set the log scale for Trace 1.

   Select Trace 1 as the active trace. **Scale** > **Y-Axis** > **Log**
3. Set the appropriate scale for both traces by executing the auto scale.

   Scale > **Auto Scale All**

STEP 4. Analyzing Measurement Results

This section describes how to use the Equivalent circuit analysis.

Reading the values of resonant points

1. Display a marker.

   Marker > **Marker 1**
2. Search the minimum point.

   Marker Search > **Min**

Reading the values of anti-resonant points

1. Display the second marker.

   Marker > **Marker 2**
2. Search the maximum point.

   Marker Search > **Max**

Using Equivalent Circuit Analysis

1. Select the Equivalent circuit model.

   Analysis > **Equivalent Circuit** > **Select Circuit** > **E**.

2. Turn the Equivalent Circuit Display ON.

   Analysis > **Equivalent Circuit** > **Display**

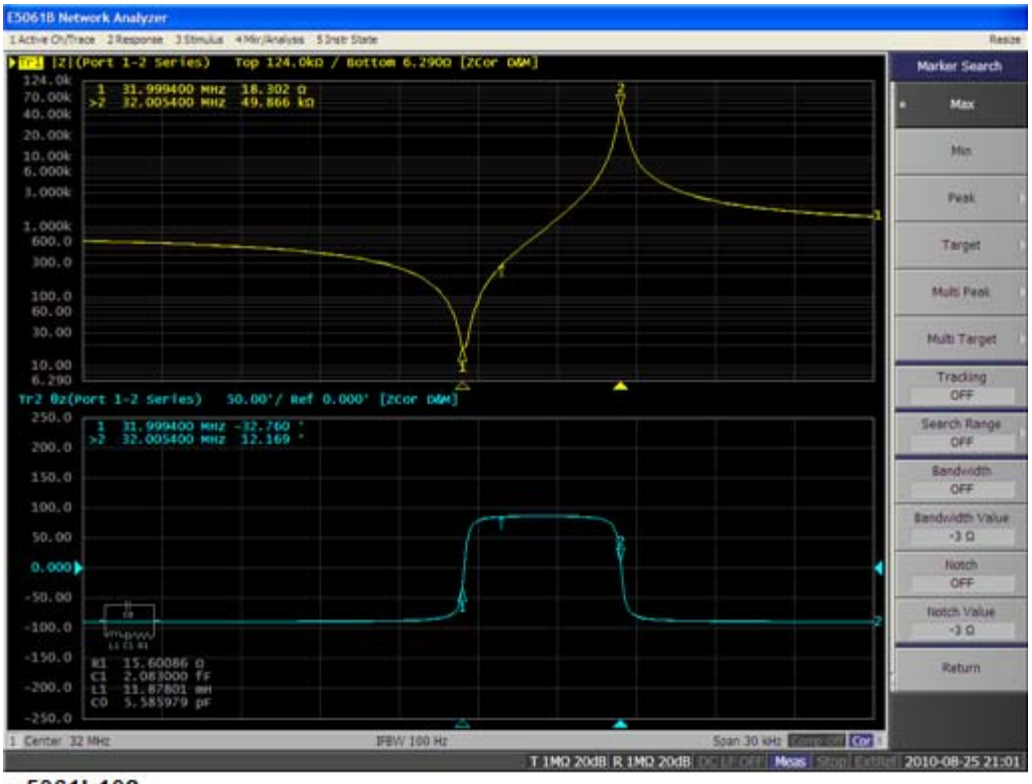
3. Calculate each parameter of the circuit model.

   Calculate. The calculated parameters are displayed in each box of R1, C1 and L1.

4. You can simulate the frequency characteristics by using the approximate value obtained from the above calculation.

   Analysis > **Equivalent Circuit** > **Simulate**

Measurement Result



e5061b108

Measurement Example of a Capacitor (Port 1-2 / Shunt-Through)

This section describes how to measure the frequency characteristics of a capacitor using the Series-Through method on ports 1 and 2.

In this example, the following items are used.

Description	Product / Agilent Part Number	Note
Test Fixture with DUT (Capacitor)	PC board user fixture	-
Test Fixture with Open or Short	PC board user fixture	-
Calibration Kit	85033E	Mechanical Calibration Kit, DC to 9 GHz, 3.5 mm
Cable and Adapter	Cables and adapters for Type-N or 3.5 mm	Connect your PC board to ports 1 and 2 of the E5061B

To measure another device under test (DUT), change the measurement conditions to suit the particular DUT.

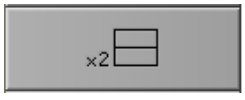
STEP 1. Determining Measurement Conditions

1. Preset the E5061B.

   Preset > **OK**

2. Set the number of traces at two and display each trace in one frame.

   Display > **Num of Traces** > **2**

   Display > **Allocate Traces** > **x2** 

3. Set the measurement port to Gain-Phase.

   Meas > **Measurement Port** > **S-Parameter**

4. Set the method to Port 1-2 Shunt-Through configuration.

   Meas > Impedance Analysis Menu > Method > Port 1-2 Shunt

5. Set the measurement parameter at |Z| for the trace 1 and θ type of each trace.

   Select Trace 1 as the active trace. **Meas** > **Impedance Analysis Menu** > **|Z|**

   Select Trace 2 as the active trace. **Meas** > **Impedance Analysis Menu** > **θz**

6. Specify the center and span frequencies to observe the frequency characteristic. In this example, the start is set at 100 kHz and stop is set at 1 GHz

   Start > **1** > **0** > **0** > **k/m**
   Stop > **1** > **G/n**

   NOTE When entering the frequency unit using the keyboard, type "G" for GHz, "M" for MHz, and "k" for kHz.

5. Set the power level at 0 dBm (224 mV @ 50 Ω).

   Sweep Setup > **Power** > **0** > **x1**

6. Set the sweep type at Log.

   Sweep Setup > **Sweep Type** > **Log Freq**

7. Set the IF Bandwidth at 100 Hz.

   Avg > **IF Bandwidth** > **1** > **0** > **0** > **x1**

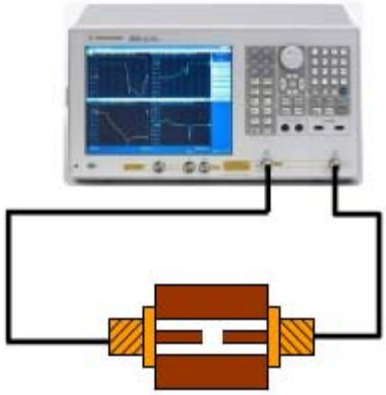
STEP 2. Calibration

1. Select the calibration kit for 85033E.

   Cal > **Cal Kit** > **85033E**

2. Connect the two 3.5 mm cables on both ports 1 and 2.
3. Perform Full 2-Port Calibration at the end of each cables.

4. Connect the fixture with open (or short) between the cables.



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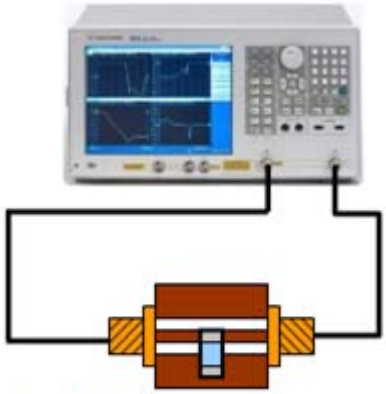
5. Perform Auto Port Extension.

STEP 3. Connecting the Device Under Test (DUT)

1. Connect the fixture with DUT between the cables instead of the fixture, with open (or short).



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2. Set the log scale for Trace 1.

   Select Trace 1 as the active trace. **Scale** > **Y-Axis** > **Log**

3. Set the appropriate scale for both traces by executing the auto scale.

   Scale > **Auto Scale All**

STEP 4. Analyzing Measurement Results

This section describes how to use the Equivalent circuit analysis.

Using Equivalent Circuit Analysis

1. Select the Equivalent circuit model.

   Analysis > **Equivalent Circuit** > **Select Circuit** > **E**.

2. Turn the Equivalent Circuit Display ON.

   Analysis > **Equivalent Circuit** > **Display**

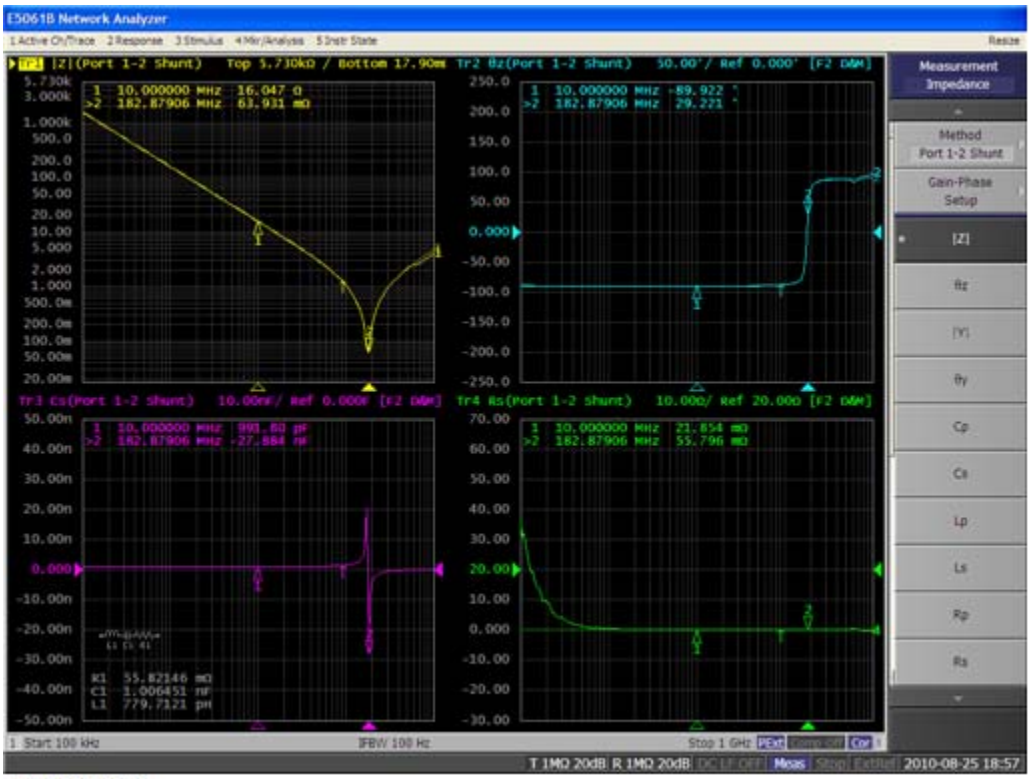
3. Calculate each parameter of the circuit model.

   Calculate. The calculated parameters are displayed in each box of R1, C1 and L1.

4. You can simulate the frequency characteristics by using the approximate value obtained from the above calculation.

   Analysis > **Equivalent Circuit** > **Simulate**

Measurement Result



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Measurement Example of a Ceramic Resonator (Gain-Phase / Series-Through)

This section describes how to measure the frequency characteristics of a ceramic resonator using the Series-Through method on Gain-Phase ports using Agilent test fixture. You can connect Agilent 4 terminal pair type fixture on the Gain-Phase ports.

In this example, the following items are used.

Description	Product / Agilent Part Number	Note
Test Fixture	Agilent 16047E	-
Shorting Bar	16047-00621	Furnished with the 16047E
Leaded Load	5012-8646	50 Ω leaded resister. Furnished with E5061B option 720.
DUT	Ceramic resonator	-

To measure another device under test (DUT), change the measurement conditions to suit the particular DUT.

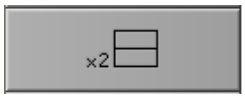
STEP 1. Determining Measurement Conditions

1. Preset the E5061B.

   Preset > **OK**

2. Set the number of traces at two and display each trace in one frame.

   Display > **Num of Traces** > **2**

   Display > **Allocate Traces** > **x2** 

3. Set the measurement port to Gain-Phase.

   Meas > **Measurement Port** > **Gain-Phase**

4. Set the method to Series-Through configuration.

   Meas > Impedance Analysis Menu > Method > GP Series T 50Ω, R 1MΩ

5. Set the measurement parameter at |Z| for the trace 1 and θ type of each trace.

Select Trace 1 as the active trace. **Meas** > **Impedance Analysis Menu** > **|Z|**

Select Trace 2 as the active trace. **Meas** > **Impedance Analysis Menu** > **θz**

6. Specify the center and span frequencies to observe the frequency characteristic. In this example, the center is set at 395 kHz and span is set at 40 kHz.

   Center > **3** > **9** > **5** > **k/m**
   Span > **4** > **0** > **k/m**

   NOTE When entering the frequency unit using the keyboard, type "G" for GHz, "M" for MHz, and "k" for kHz.

5. Set the power level at 0 dBm (224 mV @ 50 Ω).

   Sweep Setup > **Power** > **0** > **x1**

6. Set the sweep type at Linear.

   Sweep Setup > **Sweep Type** > **Lin Freq**

7. Set the IF bandwidth at AUTO.

   Avg > **IF BW Auto** .

8. Set the IFBW auto limit at 100 Hz.

   Avg > **IFBW Auto Limit** > **1** > **0** > **0** > **x1**

STEP 2. Calibration

1. Select the calibration kit for leaded 50 Ω.

   Cal > **Cal Kit** > **Leaded 50ohm**

2. Connect Agilent 16047E test fixture on the ports R, T and LF Out.
3. Set the open state of the 16047E.
   - Fasten the electrode securing screws at the HIGH and LOW sides without the DUT attached
4. Measure the calibration data for open.

   Cal > **Calibrate** > **Impedance Calibration** > **Open**

5. Set the short bar on the 16047E.

- Loosen the electrode securing screws so that the shorting bar is caught in the electrodes.
- Fasten the electrode securing screws.

6. Measure the calibration data for short.

   Short

7. Set the load on the 16047E.
   - Loosen the electrode securing screws so that the load (leaded register) device is caught in the electrodes.
   - Fasten the electrode securing screws.
8. Measure the calibration data for load.

   Load

9. Finalize the calibration measurement. The calibration factor is calculated based on the calibration data acquired, and the error correction is turned ON. **Cor** is displayed at the bottom of the channel window.

Done

STEP 3. Connecting the Device Under Test (DUT)

1. Set the ceramic resonator on the 16047E.
2. Set the log scale for Trace 1.

   Select Trace 1 as the active trace. **Scale** > **Y-Axis** > **Log**

3. Set the appropriate scale for both traces by executing the auto scale.

   Scale > **Auto Scale All**

STEP 4. Analyzing Measurement Results

This section describes how to use the marker function to read out the resonant point and the Equivalent circuit analysis.

Reading the values of resonant points

1. Display a marker.

   Marker > **Marker 1**

2. Search the minimum point.

   Marker Search > **Min**

Reading the values of anti-resonant points

1. Display a second marker.

   Marker > **Marker 2**

2. Search the maximum point.

   Marker Search > **Max**

Using Equivalent Circuit Analysis

1. Select the Equivalent circuit model.

   Analysis > **Equivalent Circuit** > **Select Circuit** > **E**.

2. Turn the Equivalent Circuit Display ON.

   Analysis > **Equivalent Circuit** > **Display**

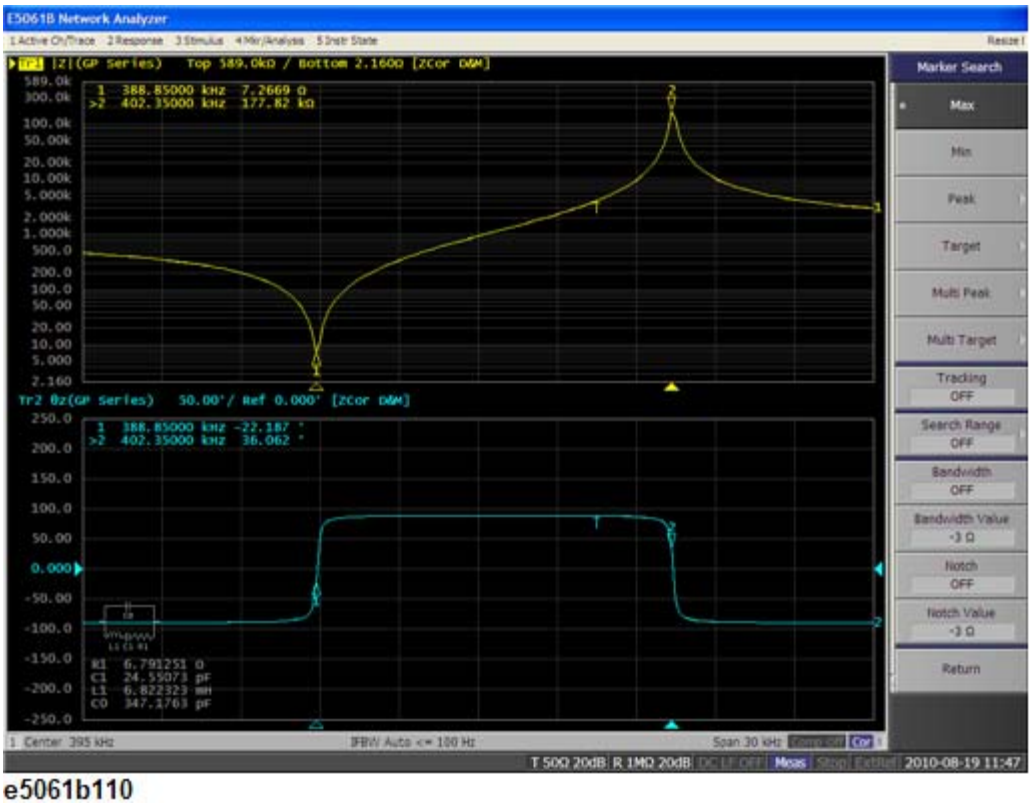
3. Calculate each parameter of the circuit model.

   Calculate. The calculated parameters are displayed in each box of R1, C1 and L1.

4. You can simulate the frequency characteristics by using the approximate value obtained from the above calculation.

   Analysis > **Equivalent Circuit** > **Simulate**

Measurement Result



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Measurement Example of a Capacitor (Gain-Phase/Shunt-Through)

This section describes how to measure the frequency characteristics of a capacitor by using the Shunt-Through method on Gain-Phase ports.

In this example, the following items are used.

Description	Product/Agilent Part Number	Note
PC Board with DUT	PC board user fixture	-
PC Board	PC board user fixture	-
Power Splitter	11617L	DC to 2 GHz Power Splitter with BNC connector.
DUT (Capacitor)	Capacitor	-
Cable and Adapter	Cables and adapters for BNC	Connect your PC board to LF Out/T and R connector of the E5061B.

To measure another device under test (DUT), change the measurement conditions to suit the particular DUT.

STEP 1. Determining Measurement Conditions

1. Preset the E5061B.

   Preset > **OK**

2. Set the number of traces at two and display each trace in one frame.

   Display > **Num of Traces** > **4**

   Display > **Allocate Traces** > **x4** 

3. Set the measurement port to Gain-Phase.

   Meas > **Measurement Port** > **Gain-Phase**

4. Set the method to Shunt-Through configuration.

   Meas > Impedance Analysis Menu > Method > GP Shunt T 50Ω, R 50Ω

5. Set the measurement parameter at |Z| for the trace 1 and θ type for each trace.

   Select Trace 1 as the active trace. **Meas** > **Impedance Analysis Menu** > **|Z|**.

   Select Trace 2 as the active trace, then click **θz**.

   Select Trace 3 as the active trace, then click **Cs**.

   Select Trace 4 as the active trace, then click **Rs**.

6. Specify the center and span frequencies to observe the frequency characteristic. In this example, the start is set at 5 Hz and stop is set at 30 MHz.

   Start > **5** > **x1**
   Stop > **3** > **0** > **M/μ**

   NOTE When entering the frequency unit using the keyboard, type "G" for GHz, "M" for MHz, and "k" for kHz.

5. Set the power level at -10 dBm (70.7 mV @ 50 Ω).

   Sweep Setup > **Power** > **-** > **1** > **0** > **x1**

6. Set the sweep type at Linear.

   Sweep Setup > **Sweep Type** > **Log Freq**

7. Set the IF bandwidth at AUTO.

   Avg > **IF BW Auto** .

8. Set the IFBW auto limit at 100 Hz.

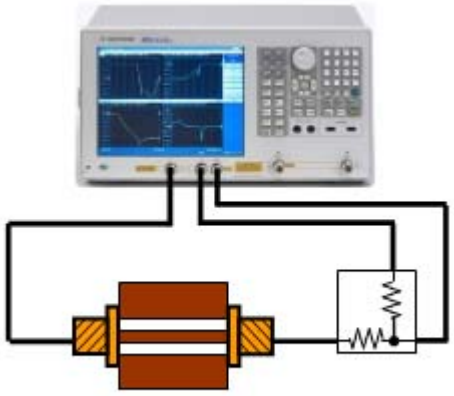
   Avg > **IFBW Auto Limit** > **1** > **0** > **0** > **x1**

STEP 2. Calibration

1. Select the calibration kit for leaded 50 Ω.

   Cal > **Cal Kit** > **Leaded 50ohm**

2. Connect the through fixture on the ports R, T and LF Out as shown below.



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3. Measure the response calibration data.

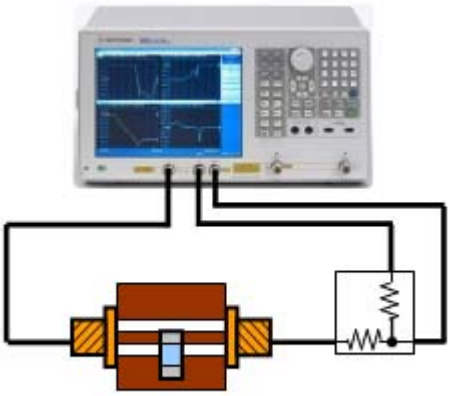
   Cal > **Calibrate** > **Response (Thru)** > **Thru**

4. Finalize the calibration measurement. The calibration factor is calculated based on the calibration data acquired, and the error correction is turned ON. **Cor** is displayed at the bottom of the channel window.

Done

STEP 3. Connecting the Device Under Test (DUT)

1. Set the PC board with DUT.



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2. Set the log scale for Trace 1.

   Select Trace 1 as the active trace. **Scale** > **Y-Axis** > **Log**

3. Set the appropriate scale for both traces by executing the auto scale.

   Scale > **Auto Scale All**

STEP 4. Analyzing Measurement Results

This section describes how to use the marker function to read out the resonant point and the Equivalent circuit analysis.

Using Equivalent Circuit Analysis

1. Select the Equivalent circuit model.

   Analysis > **Equivalent Circuit** > **Select Circuit** > **D**.

2. Turn ON the Equivalent Circuit Display option.

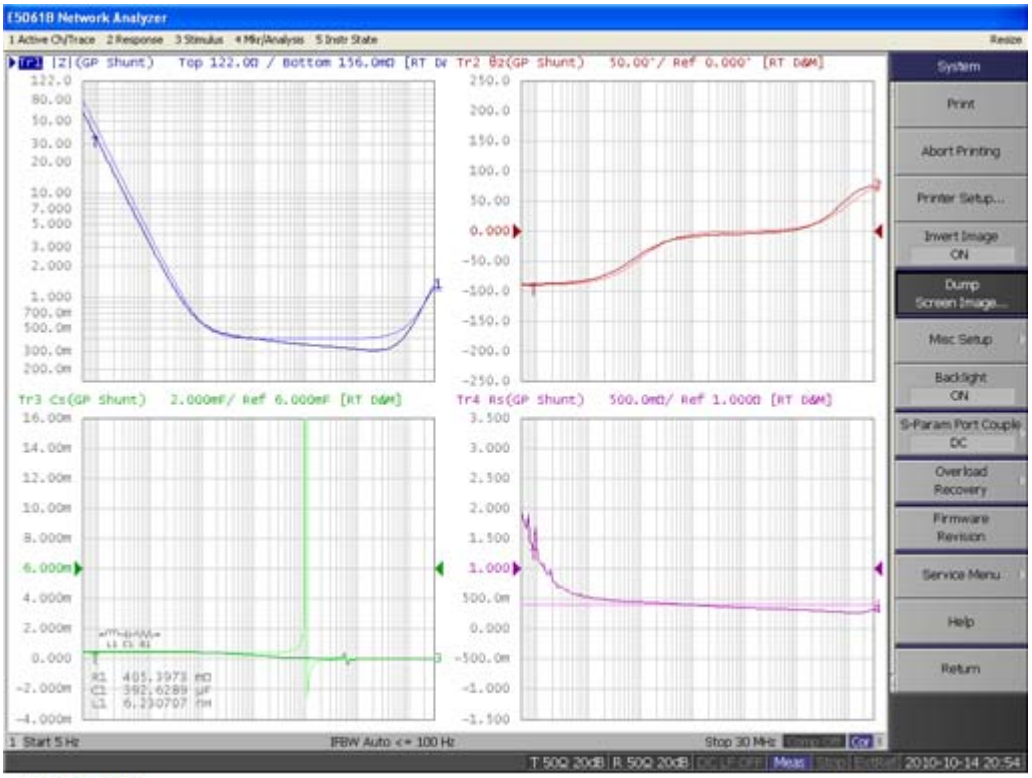
   Analysis > **Equivalent Circuit** > **Display**

3. Calculate each parameter of the circuit model.

   Calculate. The calculated parameters are displayed in each box of R1, C1 and L1.

4. You can simulate the frequency characteristics by using the approximate value obtained from the above calculation.

   Analysis > **Equivalent Circuit** > **Simulate**



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