S3631 Series Vector Network Analyzer

User Manual

Saluki Technology Inc.

The document applies to the vector network analyzer below:

- S3631C Vector Network Analyzer (300kHz-3GHz).
- S3631D Vector Network Analyzer (300kHz-8GHz).

Preface

Thanks for choosing S3631 Vector Network Analyzer produced by Saluki Technology Inc.

We devote ourselves to meeting your demands, providing the user high-quality measuring instrument and the best after-sales service. We persist with "superior quality and considerate service", and are committed to offering satisfactory products and service for our clients.

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Saluki Technology

Document Authorization

The information contained in this document is subject to change without notice. The power to interpret the contents of and terms used in this document rests with Saluki.

Product Quality Assurance

The warranty period of the product is 36 months from the date of delivery. The instrument manufacturer will repair or replace damaged parts according to the actual situation within the warranty period. The user should return the product to the manufacturer and prepay mailing costs. The manufacturer will return the product and such costs to the user after maintenance.

Product Quality Certificate

The product meets the indicator requirements of the document at the time of delivery. Calibration and measurement are completed by the measuring organization with qualifications specified by the state, and relevant data are provided for reference.

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Content

1. Precautions

1. 1. Notices

- Carefully read through the following safety instructions before putting the Analyzer into operation.
- The Analyzer must be used only by skilled and specialized staff or thoroughly trained personnel with the required skills and knowledge of safety precautions.
- S3631 is for INDOOR USE only.
- Determine the grid voltage to fit the equipment requirements of the input voltage before putting the Analyzer into operation.
- Never use damaged or aging power cord, and do not overhaul the power cord.
- Never place the power cord near heat sources.
- The instrument must waterproof strictly and be avoided the fierce collision when moved. Do not hold the front panel, it may damage the keyboard and input connector.
- Immediately stop using when it comes to abnormal phenomenon, such as equipment smoke and smell. Turn off the power switch, unplug the power cord and contact a professional service personnel.
- Unplug the power plug when it is not in use for a long time.
- Do not disassemble the equipment. Contact Technical Service personnel to maintenance when equipment failure.
- Any unit or individual without permission, is not allowed to change the structure of the equipment and safety design.

1. 2. Safety

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific WARNINGS elsewhere in this manual may impair the protection provided by the equipment. Such noncompliance would also violate safety standards of design, manufacture, and intended use of the instrument. Saluki Instruments assumes no liability for the customer's failure to comply with these precautions.

- Ground the Instrument

To avoid electric shock, the instrument chassis and cabinet must be grounded with the supplied power cable's grounding prong.

- Do not operate in an Explosive Atmosphere

Do not operate the instrument in the presence of inflammable gasses or fumes. Operation of any electrical instrument in such an environment clearly constitutes a safety hazard.

- Keep away from Live Circuits

Operators must not remove instrument covers. Component replacement and internal adjustments must be made by qualified VNA maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltage levels may remain even after the power cable has been disconnected. To avoid injuries, always disconnect the power and discharge circuits before touching them.

- DO NOT Service or Adjust the Instrument Alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

- DO NOT Substitute Parts or Modify the Instrument

To avoid the danger of introducing additional hazards, do not install substitute parts or perform unauthorized modifications to the instrument. Return the instrument to a Saluki Instruments Sales and Service Office for service and repair to ensure that safety

features are maintained in operational condition.

1. 3. Cleaning Notes

- Keep the instrument cleaning.
- Turn off the instrument and plug off Power Cable before cleaning.
- Clean the cover of instrument with a soft, dry cloth.
- DO NOT spray liquid against the instrument, it may damage the device.

1. 4. Instrument Software

- Update Pre-install software

Do NOT update Pre-install software, only when Saluki recommended. Read the chapter of Software Upgrade before install any software.

- DO NOT Modify or Reconfigure the Operating System

The Microsoft Windows operating system (Windows XP or Windows 7 Embedded) has been modified and optimized by Saluki to improve the performance of the VNA. Do NOT install a standard version of the Windows operating system on the VNA. Do NOT change advanced performance settings or group policies. Do NOT add or delete any hard disk drive partitions on the VNA. Do NOT change the settings of Standards and Formats in Regional Options and Languages from default setting (English).

- Install Antivirus Protection

The VNA does NOT have antivirus protection when shipped. Use of an antivirus program is strongly recommended if the user connect the VNA to the LAN (Internet).

In addition, the use of a firewall could help to protect the VNA from viruses.

- DO NOT Installing user application software

It is not recommended to install user application software, because some software may affect the speed of measurement, and even the normal operation of the instrument.

2. Overview

This chapter will introduce the appearance, UI and typical operations of S3631 VNA.

2. 1. Front Panel

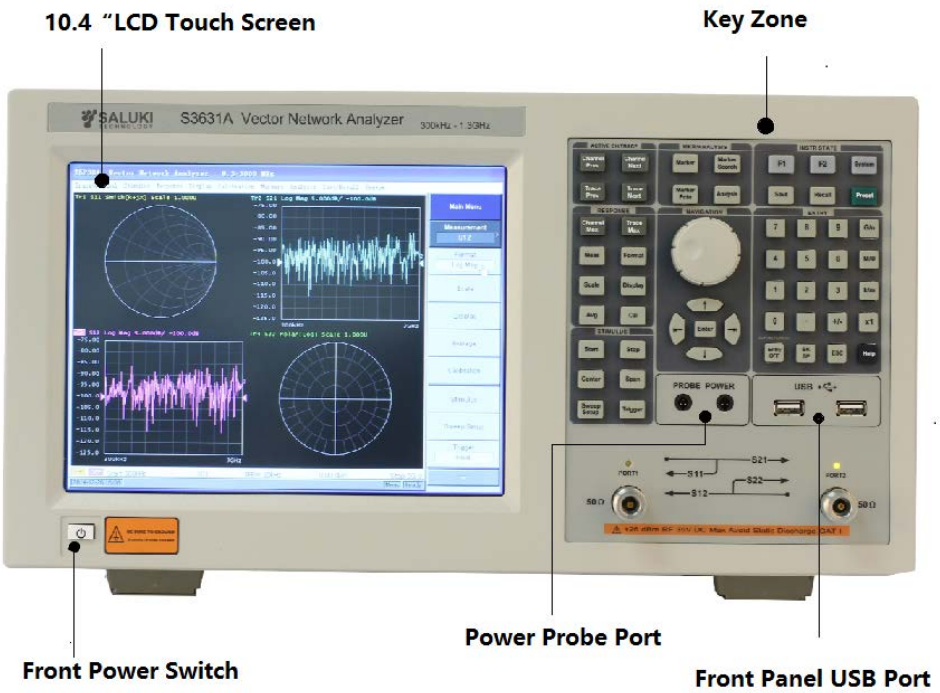


Figure 1: Front Panel

2. 1. 1. Front Panel Keyboard

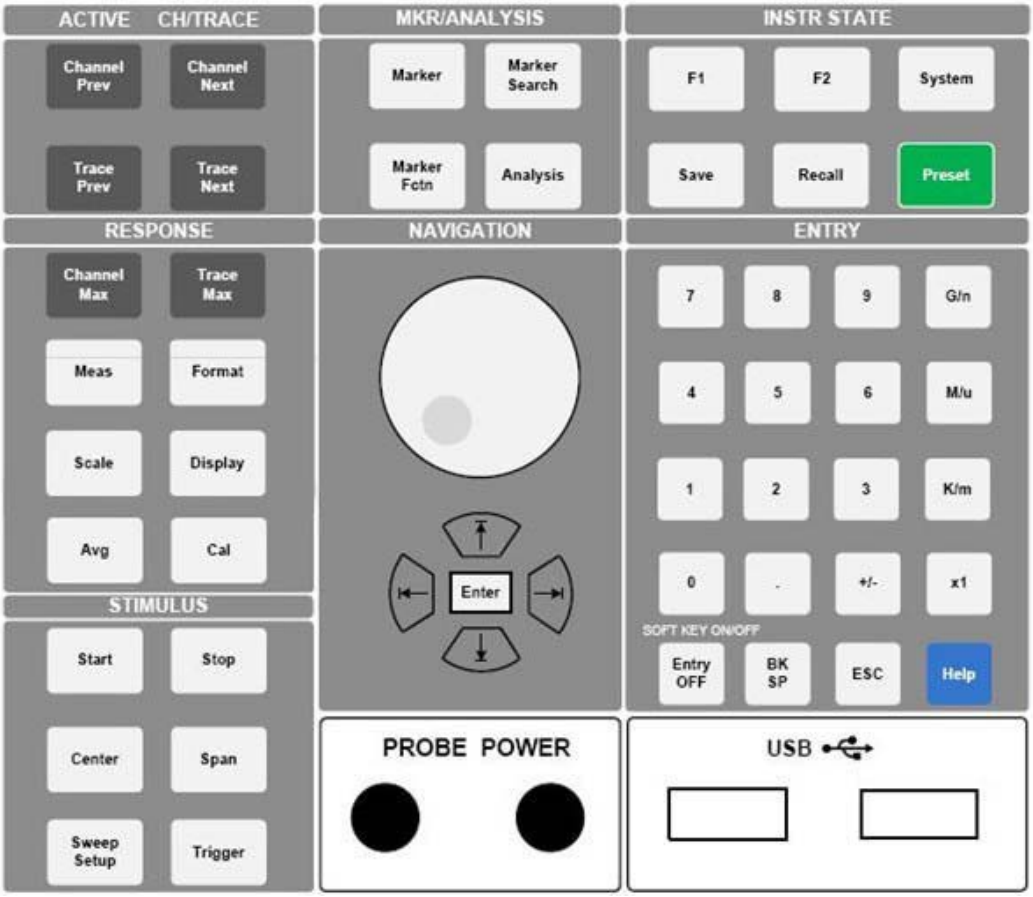


Figure 2: Front Panel Keyboard

2. 1. 1. 1. ACTIVE CH/TRACE Zone

A group of keys for selecting active channels and traces.

Key Name	Description
Channel Prev	Selects the previous channel as the active channel.
Channel Next	Selects the next channel as the active channel.
Trace Prev	Selects the previous trace as the active trace.
Trace Next	Selects the next trace as the active trace.

2. 1. 1. 2. MKR/ANALYSIS Zone

Key Name	Description
Marker	Displays the Marker Menu on the right side of the screen. User can add/edit/delete markers via the Marker Menu. Each trace can have max 15 normal markers and 1 reference marker.
Marker Search	Displays the Marker Search Menu on the right side of the screen, allows the user to move markers to a specific position (maximum, minimum, peak, and a point with a target value) on a trace. Parameters of max. 6 markers will be display on screen
Marker Fctn	Displays the Marker Function Menu on the right side of the screen. User can easily take the marker as a reference to move the trace.
Analysis	Displays the Analysis Menu on the right side of the screen, provides analysis functions like Fault Point Allocation, SRL, and Limit line

2. 1. 1. 3. INSTR STATE Zone

Key Name	Description
F1	Passive components measuring shortcuts
F2	Active components measuring shortcuts
SYSTEM	System settings, print, screenshot etc.
SAVE	Displays the Save Menu on the right side of the screen. Save the configurations, calibration data, and trace data to storage device.
RECALL	Displays the Recall Menu on the right side of the screen. Recall the configurations, calibration data, and trace data.
PRESET	Preset the instrument to default status.

2. 1. 1. 4. RESPONSE Zone

Key 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 be displayed. Double-click the channel window can also maximize the window. Even the inactive channels are not displayed, measurements of these channels are still going on.
Trace Max	Changes between normal and maximum display of the active trace 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 trace window is displayed over the entire area, with non-active windows not displayed. Double-click the trace window can also maximize the window. Even the inactive traces are not displayed, measurements of these traces are still going on.
Meas	Displays the Measurement Menu on the right side of the screen. Manipulating the Measurement Menu enables the user to specify the measurement parameters (types of S-parameters) for each trace.
Format	Displays the Format Menu on the right side of the screen. Manipulating the Format Menu Enables the user to specify the data format (data transformation and graph formats) for each trace.
Scale	Displays the Scale Menu on the right side of the screen. Manipulating the Scale Menu Enables the user to specify the scale for displaying a trace (magnitude per division, value of the reference line, etc.) for each trace. the user can also specify the electrical delay and phase offset for each trace.
Display	Displays the Display Menu on the right side of the screen. Manipulating the Display Menu Enables the user 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 on the right side of the screen. Manipulating the Average Menu Enables the user to set averaging, smoothing, and IF bandwidth.
Cal	Displays the Calibration Menu on the right side of the screen. Manipulating the Calibration Menu Enables the user to turn the calibration and error correction on/off and change definitions for calibration kits.

2. 1. 1. 5. STIMULUS Zone

Key Name	Description
Start	Displays the data entry bar for specifying the start frequency of the sweep range in the upper part of the screen.
Stop	Displays the data entry bar for specifying the stop frequency of the sweep range in the upper part of the screen.
Center	Displays the data entry bar for specifying the center frequency of the sweep range in the upper part of the screen.
Span	Displays the data entry bar for specifying the span width of the sweep range in the upper part of the screen.
Sweep Setup	Displays the Sweep Setup Menu on the right side of the screen. Manipulating the Sweep Setup Menu Enables the user to specify the output power level, sweep time, number of points, sweep type, etc.
Trigger	Displays the Trigger Menu on the right side of the screen. Manipulating the Trigger Menu Enables the user to specify the trigger mode and trigger source. Each channel can be set separately.

2. 1. 1. 6. Navigation Zone

Key Name	Description
 Knob (turned clockwise or counterclockwise)	Moves the soft-key selection (highlighted display) up or down. Increases or decreases the numeric value in the data entry area in step.
	Moves the soft-key selection (highlighted display) up or down. Increases or decreases the numeric value in the data entry area in large steps.
	Displays the soft-key menu one layer below. Moves the cursor (|) in the data entry area laterally back and forth. Use it together with the ENTRY Block keys to change data one character at a time.
 Press Knob or Enter key	Executes the function of the selected soft-key. Finishes the entry in the data entry area and moves the focus to the soft-key menu.

2. 1. 1. 7. Entry Zone

Key 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
G/n、M/u、k/m、x1	Adds a prefix to the numeric data typed by using the numeric key and +/- key and then enters that data. 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.
Entry Off	Turns the menu display on/off.
Bk Sp	Backspace key.
ESC	Quit the current operation.
Help	-

2. 1. 2. LCD Screen

S3631 is equipped with a 10.4-inch TFT color, touch LCD screen for displaying traces, scales, settings, soft-keys and other measurement related information. The touch screen LCD allows the user to manipulate soft-keys by touching the LCD screen directly.

2. 1. 3. Probe Power

DC power output. The 2 ports are used to power up the active DUT. The 2 ports need to be customized and need input (DC power, DC current) from user.

2. 1. 4. Front USB Port

Two USB (Universal Serial Bus) ports are provided that can be used for connecting to USB keyboard/mouse, USB storage or a printer.

2. 1. 5. Test Port

To be connected to DUT, cal kit.

2. 1. 6. Power Switch

Turn on/off the instrument.

2. 2. Rear Panel

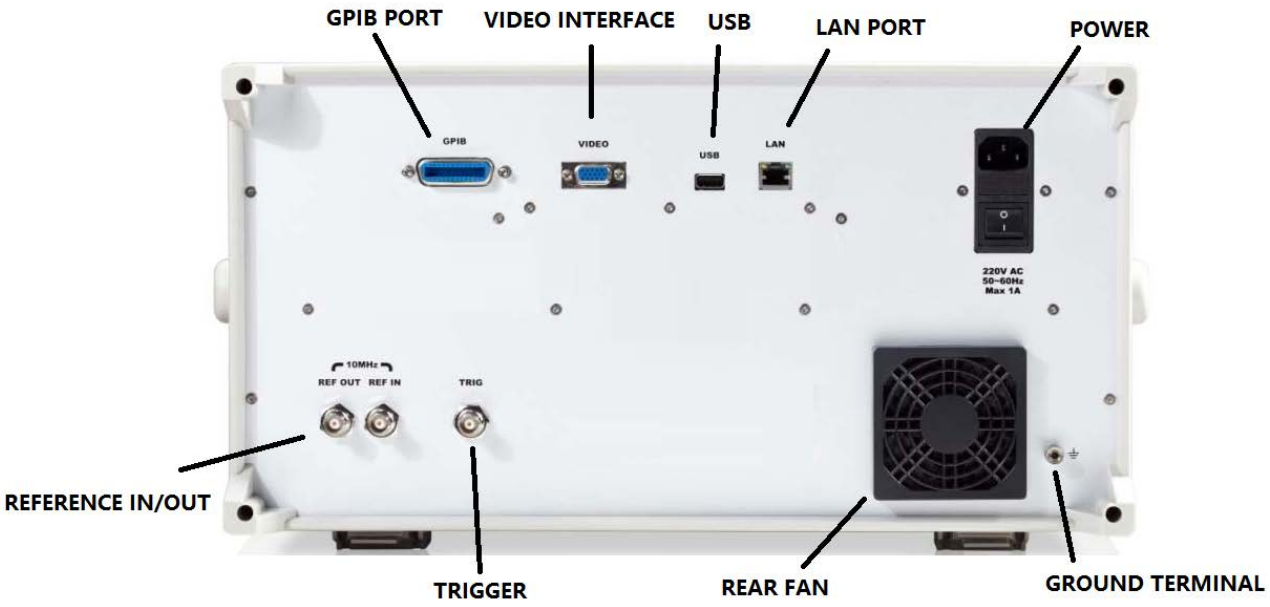


Figure 3: S3631 Rear Panel

2. 2. 1. GPIB Port

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

2. 2. 2. VIDEO Port

The video interface can be connected to an external color monitor (display device).

Connector type: 15-pin VGA connector, female

2. 2. 3. USB Port

One USB port is provided on the rear panel to connect to USB mouse/keyboard, USB storage or a printer

2. 2. 4. Ethernet Port

Connect S3631 to LAN (Local Area Network). Connecting this instrument to LAN enables user to access the hard disk drive of this instrument from an external PC.

2. 2. 5. Power Port and Switch

Power cable is provided as standard accessory of the instrument. Connect the female end of the power cable to the power port. Keep the switch off ("O") before connect the instrument to power source. When power is stabled connected, turn the switch on ("|").

2. 2. 6. Reference OUT/IN

Ref In port is used to connected to an eternal reference signal. With a high-quality reference signal, user can make a more accurate and stable measurement.

Ref out port can output a 10MHz signal for other devices.

2. 2. 7. Trigger

This BNC female connector allows external trigger to be applied.

2. 2. 8. Ground Terminal

Connect S3631 to a proper ground.

2. 3. UI

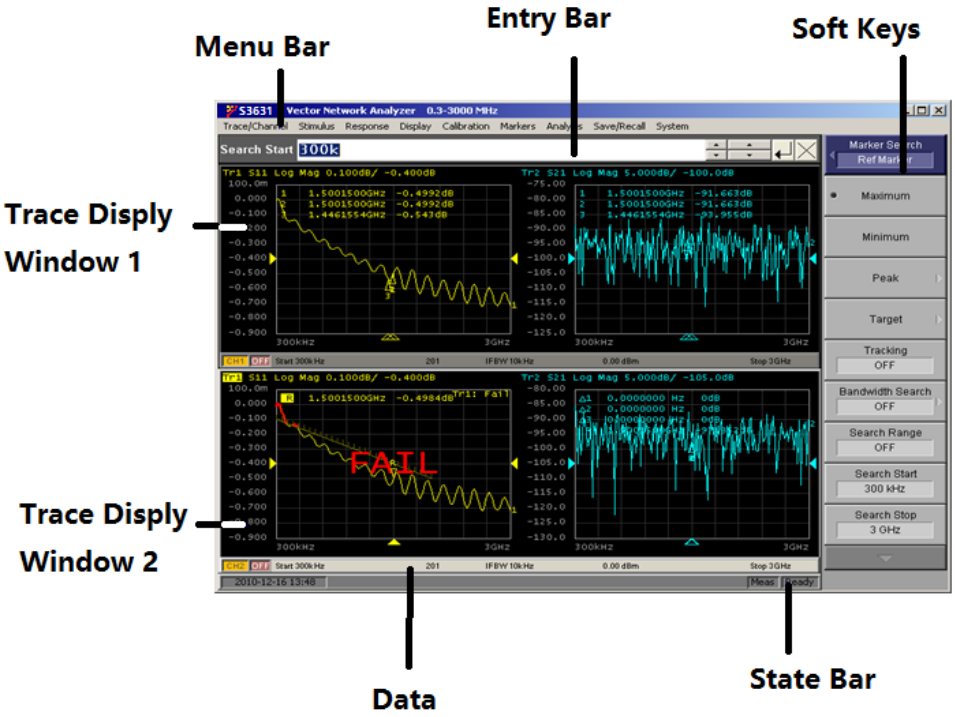


Figure 4: S3631 UI

2. 3. 1. Trace Display

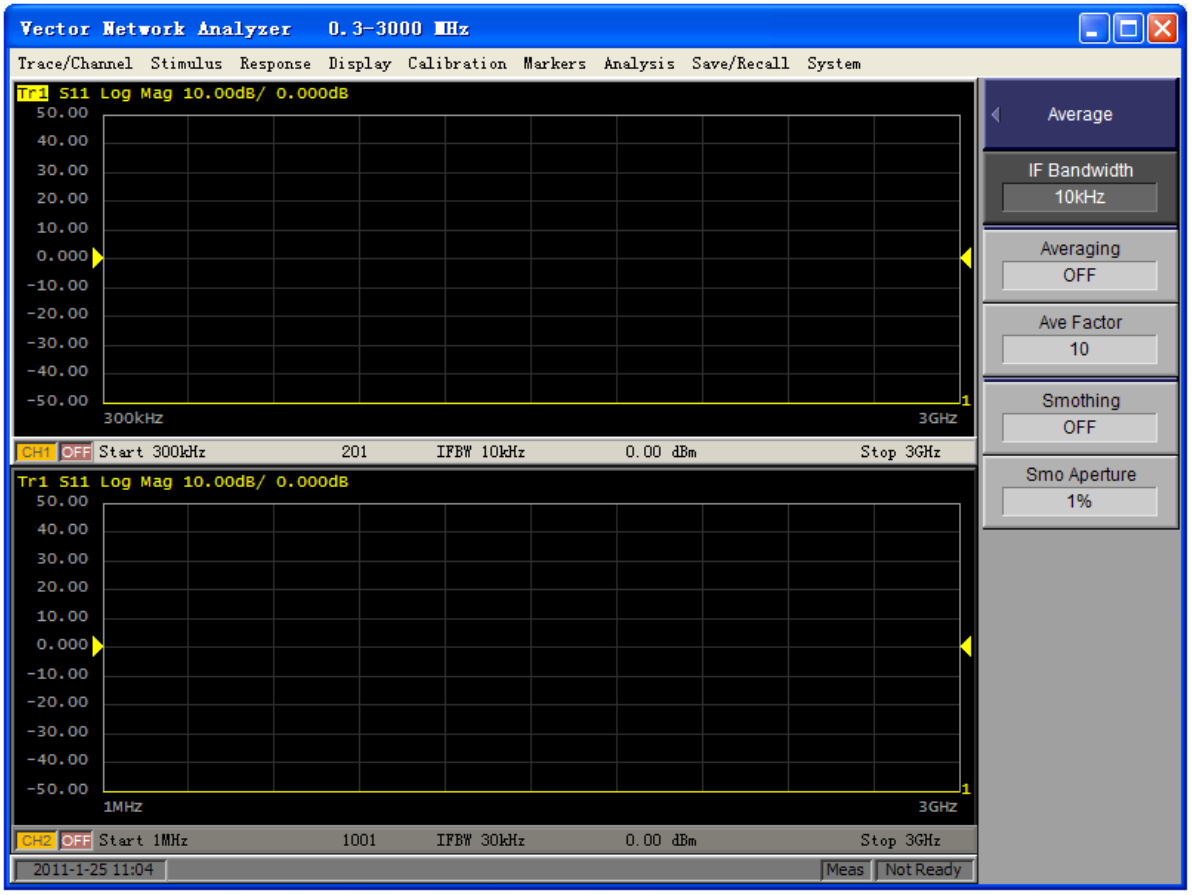


Figure 5: Trace Display

Windows for displaying 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, the channel is the active channel (the channel for which setup is being performed). In above figure, Channel 1 (the upper window) is the active channel. To make a channel active, use Channel Next or Channel Prev key. Clicking inside a channel window will also make the channel active.

2. 3. 2. Entry Bar

Used to enter numeric data into the S3631. Press a hardkey or soft-key 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 the user to enter letters and symbols by using the front panel keys or mouse is displayed instead.

Figure 6: Entry Bar

- Description

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

- Data Entry Area

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

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

- 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.

- Enter Button

After typing numeric values in the data entry area by using the keyboard or the numeric keys in the ENTRY Block on the front panel, press this button to finish the entry. Use the mouse to manipulate this button.

- Cancel Button

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

2. 3. 3. State Bar

Displays the measurement status of the S3631.

READY	Instrument normal
NOT READY	Instrument unnormal

2. 3. 4. Softkey Zone

A group of keys on the screen called by the soft-keys and menu bars. the user can manipulate these keys by using the NAVIGATION zone keys on the front panel, the mouse, or the keyboard. User can also use the touch screen instead of keyboard or mouse.

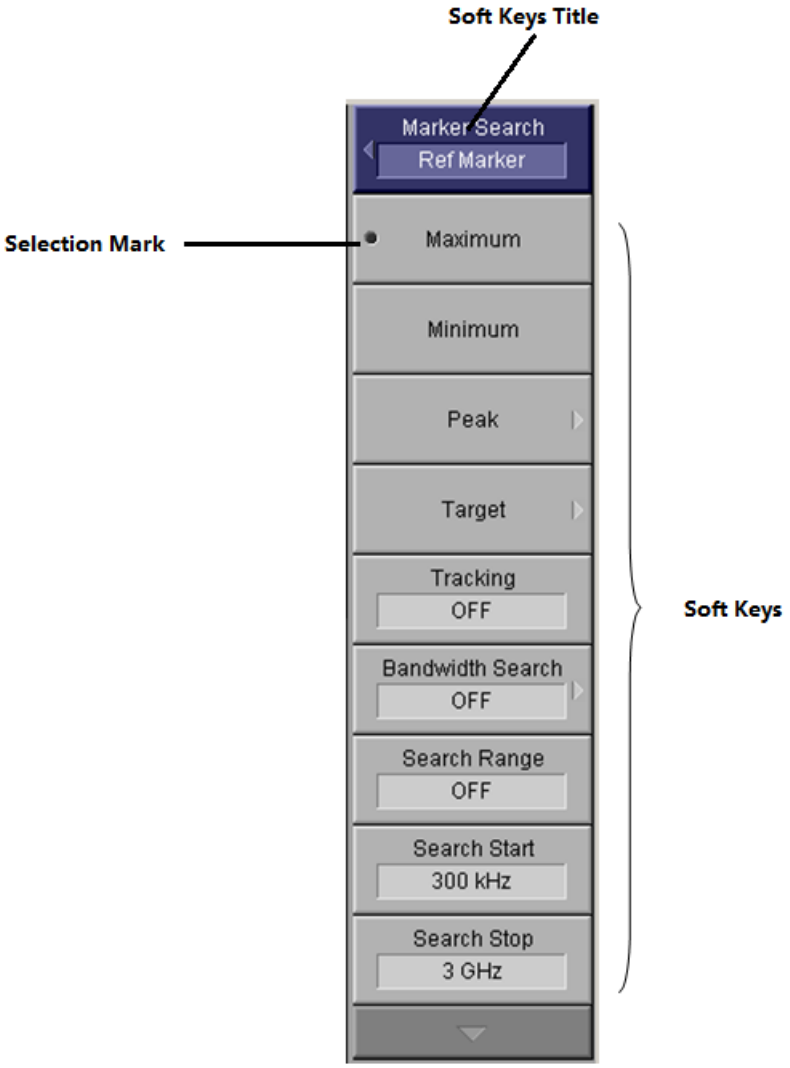


Figure 7: Soft Keys Zone

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

2. 4. Three Methods of Operation

The user can operate the S3631 using one of three operating methods: using keys on the front panel, using a mouse and keyboard, and using the touch screen.

2. 5. Basic Measurement Procedures

To better understanding how to use the S3631, this section describes the basic measurement procedure using the S3631.

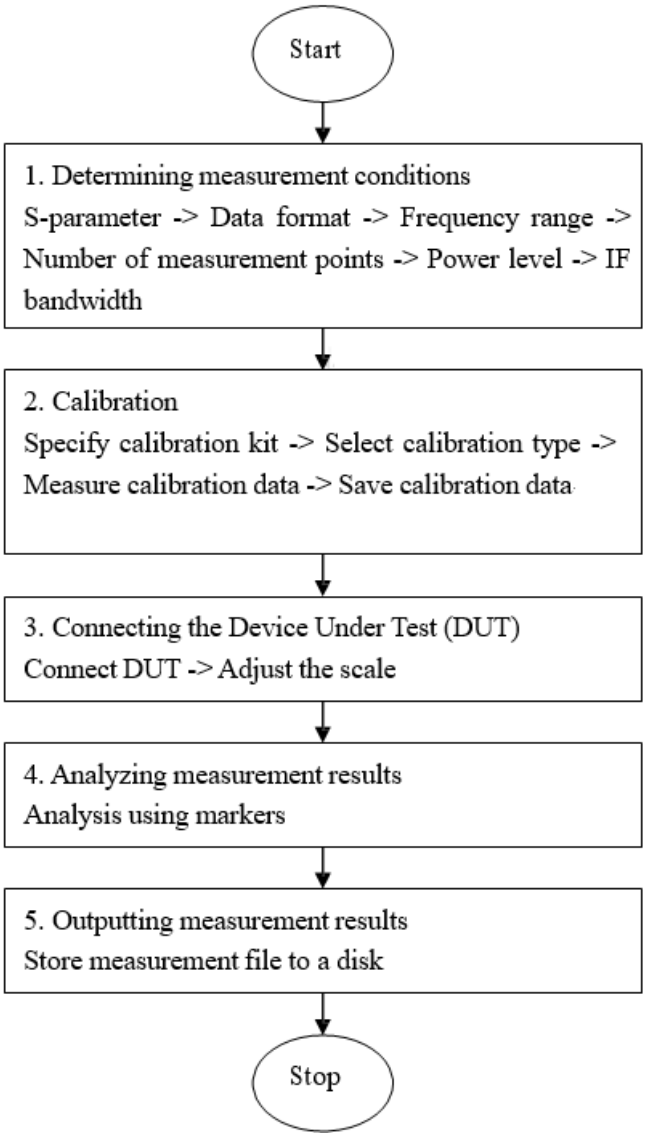


Figure 8:Basic Measurement Flow

3. Setting Measurement Conditions

3. 1. Initializing Parameters

1. Press Preset on the front panel or Execute the :SYST:PRES command
2. Press OK

3. 2. Setting the System Z0

The procedure for setting the system characteristic impedance (Z0) is as follows:

1. Press Cal key, or Cal on the front panel.
2. Click System Z0, then input the system Z0.
3. Press Enter.

3. 3. Setting Channels and Traces

3. 3. 1. Setting Channel Display Windows (Layout of Channels)

The procedure for setting the window layout is as follows:

1. Press Display key or on the front panel.
2. Press Allocate Channels key.
3. Press the desired soft-key to select the window layout shown below.

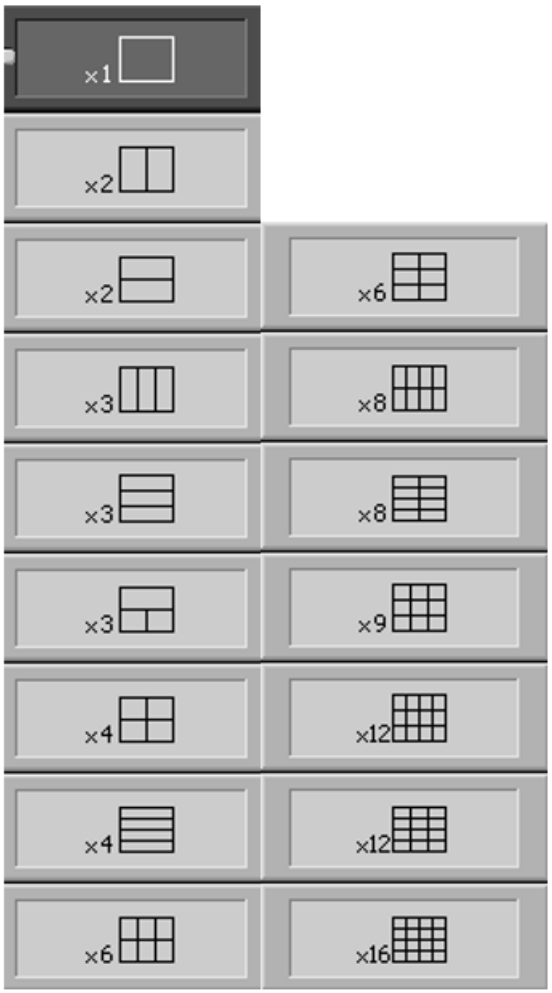


Figure 9: Channel Windows Layout

3. 3. 2. Setting Trace Display

1. Setting the number of traces the procedure for setting the number of traces is as follows:

1) Press Channel Next or Channel Prev to select the channel for which the user want to set the number of traces.

2) Press Display.

3) Click Number of Traces key.

4) Press the desired soft-key to set the number of traces.

2. Setting trace layout (graph layout)

The procedure for setting the graph layout is as follows:

1) Press Channel Next or Channel Prev to select the channel for which the user want to set the graph layout.

2) Press Display

3) Click Allocate Traces.

4) Press the desired soft-key to select the graph layout shown below.

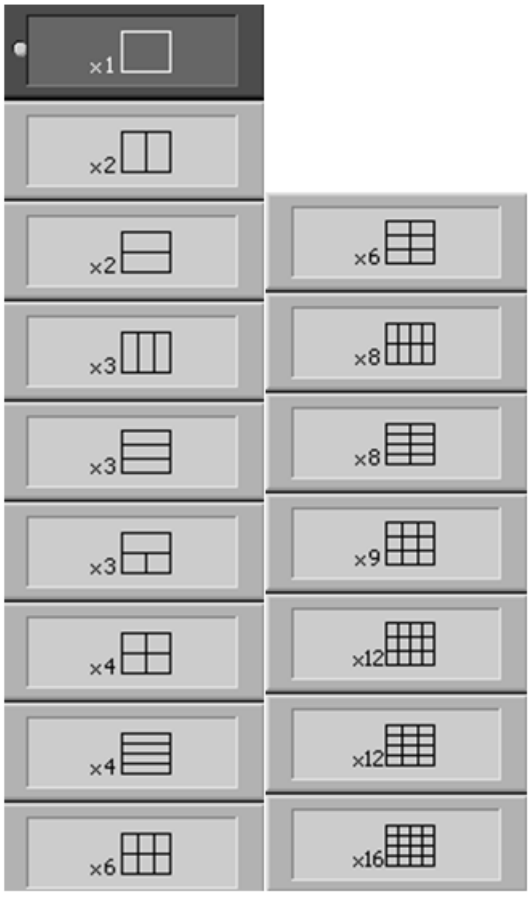


Figure 10: Trace Graph Layout

3. 3. 3. Active channel

The active channel is the one whose settings can currently be changed. The window frame of the active channel is displayed brighter than the window frames of the other channels. To change the settings specific to a certain channel, the user must first activate the channel.

To change the active channel, use the following hardkeys:

Hardkey	Function
Channel Next	Change the active channel to the next channel with the larger channel number.
Channel Prev	Change the active channel to the previous channel with the smaller channel number.

3. 3. 4. Active Trace

The active trace is the one whose settings can currently be changed. The trace name on the screen (for example, Tr3) of the current active trace is highlighted. To change the settings specific to a certain trace, the user must first activate the trace.

To select the active trace, use the following hardkeys:

Hardkey	Function
Trace Next	Change the active trace to the next trace with the larger race number.
Trace Prev	Change the active trace to the previous trace with the smaller trace number.

3. 4. Setting Stimulus Conditions

3. 4. 1. Setting the Sweep Type

Theusercan select the sweep type from the following four types.

SoftKey	Description
Linear	Sweeps frequencies in linear scale.
Log	Sweeps frequencies in logarithmic scale.
Segment	Performs a sweep with linear sweep conditions (segments) combined. For more information, refer to Performing a Segment-by-Segment Sweep (segment sweep).
Power	Sweeps power levels in linear scale.

The procedure for selecting the sweep type is as follows:

1. Press Channel Next / Channel Prev keys to select the channel for which the user want to set the sweep type.
2. Press Sweep Setup.
3. Click Sweep Type.
4. Press the desired soft-key to select the sweep type.

3. 4. 2. Setting the Sweep Range

1. Setting the Sweep Range with the Lowest and Highest Values

   1) Press Channel Next / Channel Prev keys to select the channel whose sweep range will be set.

   2) Press Start , then input the lowest value.

   3) Press Stop , then input the highest value.

2. Setting the Sweep Range with the Center Value and a Span

   1) Press Channel Next / Channel Prev keys to select the channel whose sweep range will be set.

   2) Press Center , then input the center value.

   3) Press Span , then input the span value.

3. Setting the Sweep Range Using the Marker

   1) In the channel window whose range must be set, place the active marker The marker on a trace that can be repositioned either by front panel controls or by programming commands on the active trace to a position that corresponds to the new range (to the lowest, highest, or center value).

   2) Press Marker Fctn key.

   3) Click the soft-key that corresponds to each value.

SoftKey	Function
Marker → Start	Sets the lowest value to the stimulus value of the active marker on the currently active trace.

Marker → Stop	Sets the highest value to the stimulus value of the active marker on the currently active trace.
Marker → Center	Sets the center value to the stimulus value of the active marker on the currently active trace.

3. 4. 3. Enable/Disable Stimulus Signal Output

The user can turn on/off the stimulus signal output, but this will prevent the user from performing measurement. Therefore, the user will not normally use this feature. This is mainly used to turn the output back to on after it has been turned off by the power trip feature.

Follow these steps to turn the stimulus signal output on/off:

1. Press [Sweep Setup] key.
2. Click Power > RF Out (Each press toggles between on/off).

3. 4. 4. Setting CW frequency of power sweep

The procedure for setting the fixed frequency (CW frequency) at the power sweep is as follows:

1. Press [Channel Next]/[Channel Prev] keys to select the desired channel.
2. Press [Sweep Setup] key.
3. Click Power -> CW Freq, then enter the fixed frequency.

3. 4. 5. Setting power level of frequency sweep

The procedure for setting power level is as follows:

1. Press [Channel Next]/[Channel Prev] keys to select the desired channel.
2. Press [Sweep Setup] key.
3. Click Power
4. Click Power in submenu
5. Enter the power level

The user can use the power slope feature to correct the attenuation of a power level so that it is simply proportional to the frequency (attenuation due to cables and so on),which improves the accuracy of the level actually applied to the DUT.

1. Turning power slope feature on/off

1. Press [Channel Next]/[Channel Prev] keys to select the desired channel.
2. Press [Sweep Setup] key.
3. Click Power > Slope [OFF] (Slope [ON]). Each press toggles between on/off.

2. Setting correction coefficient

1. Press [Channel Next]/[Channel Prev] keys to select the desired channel.
2. Press [Sweep Setup] key.
3. Click Power > Slope Data [xxx dB/GHz] ("xxx" represents the current set value.).
4. Enter the correction coefficient using the ENTRY block keys on the front panel.

3. 4. 6. Setting the number of points

The number of points is the number of data items collected in one sweep. It can be set to any number from 2 to 10001 for each channel independently.

1. To obtain a higher trace resolution against the stimulus value, choose a larger value for number of points.
2. To obtain higher throughput, keep the number of points to a smaller value within an allowable trace resolution.
3. To obtain higher measurement accuracy after calibration, perform calibration using the same number of points as in actual measurements.

The procedure for setting the number of points is as follows:

1. Press Channel Next / Channel Prev keys to select the desired channel.
2. Press Sweep Setup key.
3. Click Points, then input the desired number of points.

3. 4. 7. Setting the Sweep Time

The sweep time is always kept to the shortest time possible with the current measurement conditions. There is no need to set.

3. 5. Selecting Measurement Parameters

3. 5. 1. S- Parameters

S-parameters (scattering parameters) are used to evaluate how signals are reflected by and transferred through the DUT. An S-parameter is defined by the ratio of two complex numbers and contains information on the magnitude and phase of the signal. S-parameters are typically expressed as follows:

- S out-in
- Out: port number of the DUT from which the signal is output
- In: port number of the DUT to which the signal is input

For example, S-parameter S21 is the ratio of the output signal of port 2 on the DUT with the input signal of port 1 on the DUT, both expressed in complex numbers.

Operating Procedure:

4. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to select the trace for which measurement parameters will be set up.
5. Press Meas.
6. Click a soft-key that corresponds to the desired measurement parameter, such as S11, S21, S12, S22.

Note: There are only S11,S21 parameters for S3631A.

3. 6. Selecting a Data Format

The S3631 allows the user to display measured S-parameters by using the following data formats. The data format can be preset to factory settings using the Preset option.

- Rectangular display formats
- Polar format
- Smith chart format

3. 6. 1. Rectangular display formats

Rectangular display formats draw traces by assigning stimulus values (linear scale) to the X-axis and response values to the Y-axis. Eight different formats are available depending on the selection of data for the Y-axis. Eight formats include Log Mag, SWR, Phase, Expand Phase, Group Dalay, Lin Mag, Real, Imag.

Type	Y-axis Data Type	Y-axis Unit	Application Examples
Log mag	Magnitude	dB	Return loss measurement Insertion loss measurement (or gain measurement)
SWR	$\frac{1+\rho}{1-\rho}$ (ρ: reflection coefficient)	(Abstract number)	Measurement of standing wave ratio
Phase	Phase (displayed in range from -180° to +180°)	Degrees (°)	Measurement of deviation from linear phase
Expanded phase	Phase (can be displayed above +180° and below -180°)	Degrees (°)	Measurement of deviation from linear phase
Group delay	Signal transfer delays within the DUT	Seconds (s)	Group delay measurement
Lin mag	Magnitude	(Abstract number)	Reflection coefficient measurement
Real	Real part of measured complex parameter	(Abstract number)	
Imag	Imaginary part of measured complex parameter	(Abstract number)	

3. 6. 2. Polar format

In the polar format, traces are drawn by expressing the magnitude as a displacement from the origin (linear) and phase in an angle counterclockwise from the positive X-axis. This data format does not have a stimulus axis, so frequencies must be read by using the marker. The polar format allows users to select one of the following three:

- Linear magnitude and phase (°)
- Log magnitude and phase (°)
- Real and imaginary parts

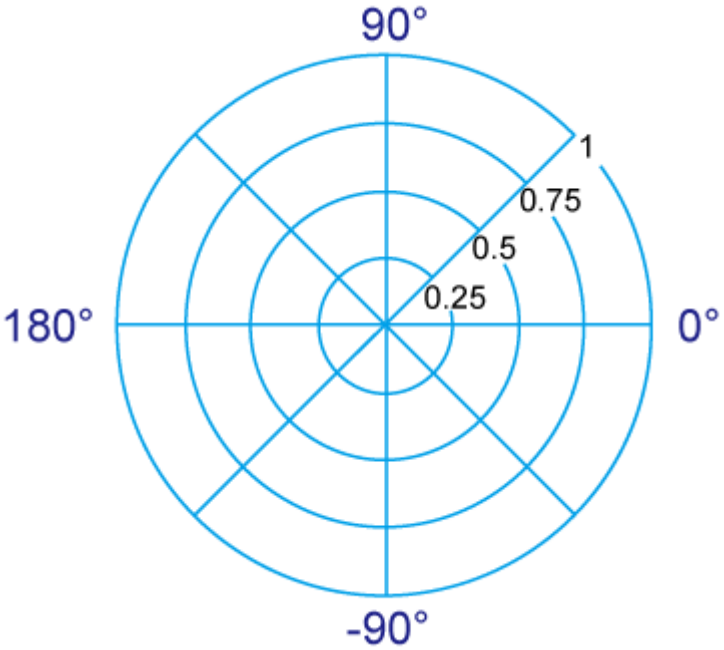


Figure 11: Polar Format

3. 6. 3. Smith chart format

The Smith chart format is used to display impedances based on reflection measurement data of the DUT. In this format, traces are plotted at the same spots as in the polar format. The Smith chart format allows users to select one of the following five data groups for displaying the marker response values.

- Linear magnitude and phase (°)
- Log magnitude and phase (°)
- Real and imaginary parts
- Resistance (ohm), Reactance (ohm), and inductance (H) or capacitance (F)
- Conductance (S), susceptance (S), and capacitance (F) or inductance (H)

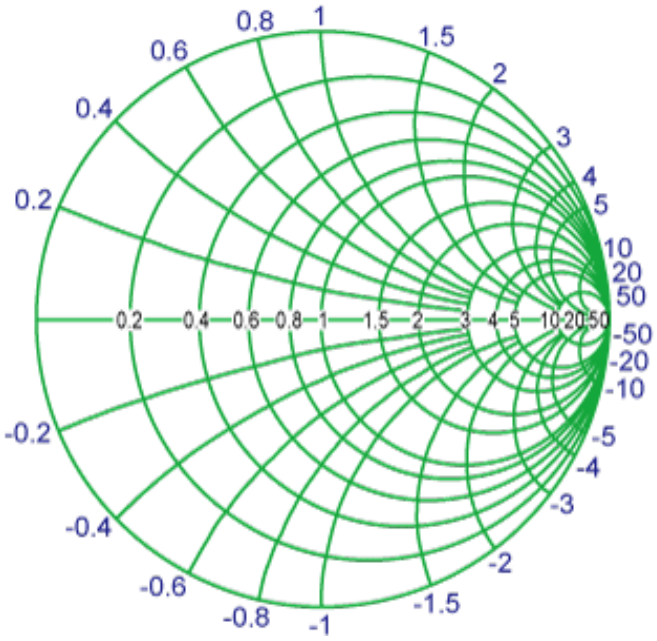


Figure 12: Smith Chart Format

3. 7. Setting the Scales

3. 7. 1. Auto scale

The auto scale function is used to tailor each scale (scale/division and the reference line value) automatically in such a way that traces will appear at the proper size on the screen for easy observation.

1. Single Trace Auto Scale
   1) Follow the procedure below to perform the auto scale function on a specific trace.
   2) Press Channel Next / Channel Prev and Trace Next / Trace Prev keys to select the trace for which the auto scale function will be performed.
   3) Press Scale .
   4) Click Auto Scale.
2. Auto Scale on All Traces
   1) Press Scale
   2) Click Auto Scale All

3. 7. 2. Manual scale adjustment on a rectangular display format

For a rectangular display format, four parameters are used to manually adjust the scales.

Adjustable feature	Description
Divisions	Defines the number of divisions on the Y-axis. An even number from 4 to 30 must be used. Once set, it is commonly applied to all traces displayed in any rectangular format within that channel.
Scale/Division (Scale/Div)	Defines the number of increments per division on the Y-axis. The value applies only to the active trace.
Reference position	Defines the position of the reference line. The position must be specified using the number assigned to each division on the Y-axis starting at 0 (the least significant) running up to the number of divisions being used (the most significant). The position applies only to the active trace.
Reference line value (Reference Value)	Defines the value corresponding to the reference line. It must be set using the unit on the Y-axis. The reference line value applies only to the active trace.

Manually setting scales on a rectangular display format:

1. Press Channel Next / Channel Prev keys and Trace Next / Trace Prev keys to select the trace for which scale features will be adjusted.
2. Press Scale key.
3. Select the soft-key that corresponds to the particular feature that needs to be adjusted.

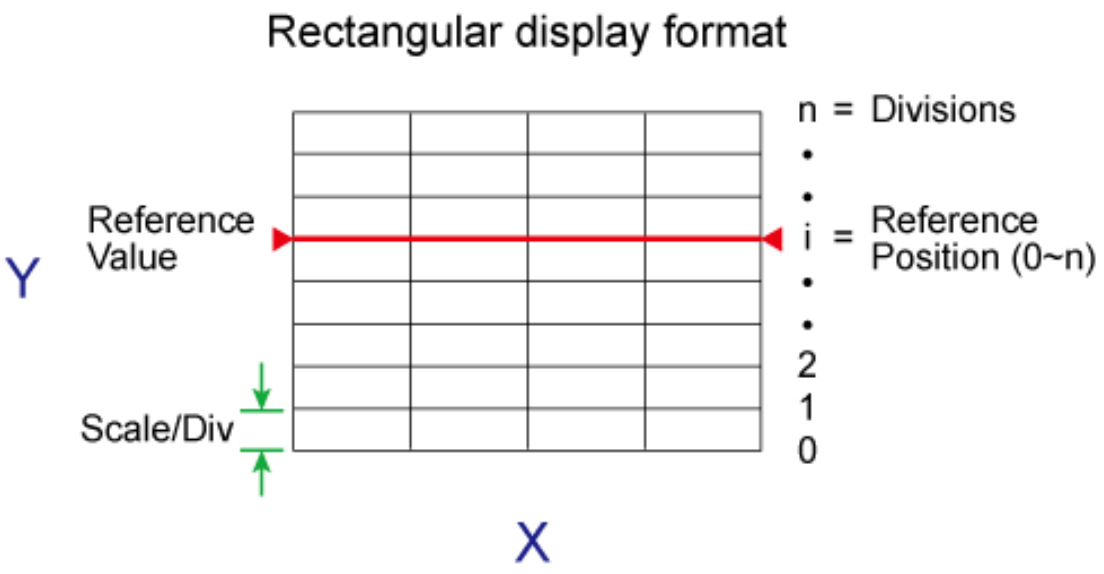


Figure 13: Manual scale adjustment on a rectangular display format

Softkey	Function
Divisions	Defines the number of divisions on the Y-axis.
Scale/Div	Defines the number of increments per division on the Y-axis.
Reference Position	Defines the position of the reference line.
Reference Value	Defines the value corresponding to the reference line.

3. 7. 3. Manual scale adjustment on the Smith chart/polar format

Manual scale adjustment on the Smith chart format or the polar format is done by using the displacement (Scale/Div of the outermost circle).

1. Press Channel Next / Channel Prev keys and Trace Next / Trace Prev keys to select the trace for which the scale will be adjusted
2. Press Scale key
3. Click Scale/Div, then input the displacement of the outermost circle.

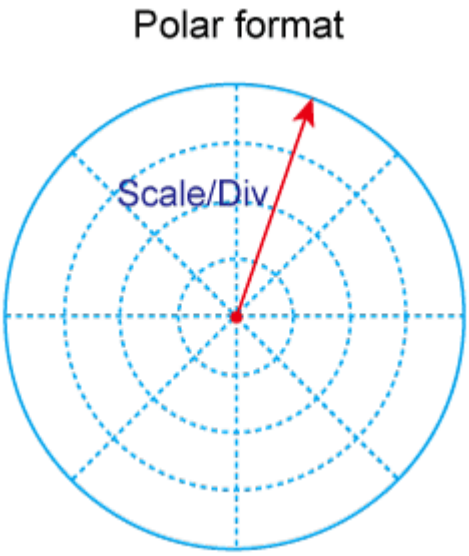


Figure 14: Polar Format

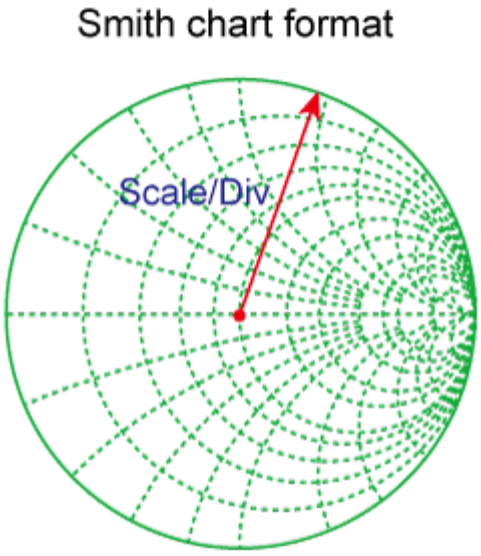


Figure 15： Smith Chart Format

3. 7. 4. Other data settings

1. Electric Delay

   1) Press Channel Next, Channel Prev keys and Trace Next, Trace Prev keys to select the trace for which the scale will be adjusted.

   2) Press Scale key.

   3) Click Electric Delay, then input the displacement of the outermost circle.

2. Phase Offset

   1) Press Channel Next, Channel Prev keys and Trace Next, Trace Prev keys to select the trace for which the scale will be adjusted.

   2) Press Scale key.

3) Click Phase Offset, then input the displacement of the outermost circle.

3. 8. Setting Window Displays

3. 8. 1. Maximizing a channel window

When using multiple channels, it is possible to maximize a specific channel window on the screen. When multiple traces are displayed in a channel window, it is also possible to maximize a specific trace displayed within that channel window.

1. Press Channel Next (or Channel Prev) to select the channel whose window will be maximized.
2. Press Channel Max to maximize the channel window.
3. Press Channel Max one more time to reduce the window to its previous size.

3. 8. 2. Maximizing a trace display

1. Press Channel Next (or Channel Prev) to select the channel to which the trace belongs.
2. Press Trace Next (or Trace Prev) to select the trace whose display will be maximized.
3. Press Trace Trace Max the trace display.
3. Press Trace Max one more time to reduce the display to its previous size.

3. 8. 3. Comparing Traces/Performing Data Math

Each of the traces for which measured data is displayed is provided with an additional trace, called a memory trace, that temporarily stores measured data. the user can use the memory trace to compare traces on the screen or to perform complex data math between the memory trace and measured data.

Performing Data Math Operations:

1. Press Channel Next / Channel Prev keys and Trace Next / Trace Prev keys to select the trace for which the scale will be adjusted.
2. Press Display key.
3. Click Data -> Mem to store the measured data in memory.
4. Click Data Math. Select the data math operation to perform.

Value	Description
Data/Mem	Divides the measured data by the data in the memory trace. This function can be used to evaluate the ratio of two traces (e.g., evaluating gain or attenuation).
Data * Memory	Multiplies the measured data by a memory trace.
Data – Memory	Subtracts a memory trace from the measured data. This function can be used, for example, to subtract a vector error that has been measured and stored (e.g., directivity) from data subsequently measured on a device.
Data + Memory	Adds the measured data and the data in the memory trace.
OFF	Turn off data math function.

5. Click Display.
6. Select the type of data to display on the screen.

Softkey	Function
Data	Display only data trace on the screen
Mem	Displays only memory trace stored by Data->Mem operation on the screen.
Data&Mem	Displays data trace and memory trace on the screen. the user can now easily compare the data trace and memory trace on the screen.
OFF	Trace is not displayed

3. 8. 4. Labeling a window (Title)

It is possible to assign a unique name to a channel and display it on the screen. This feature is useful in saving and/or printing measurement result for future reference. Labeling a window:

1. Press Channel Next, Channel Prev keys and Trace Next / Trace Prev keys to select the trace for which the scale will be adjusted.
2. Press Display key.
3. Click Edit Title Label,then the title label input dialog box appears.
4. Press Enter.
5. Click Title Label to turn on the title display. The title will appear within a frame at the top of the channel window.

3. 8. 5. Turn off the information update function of screen

1. Press Display.
2. Click Update.

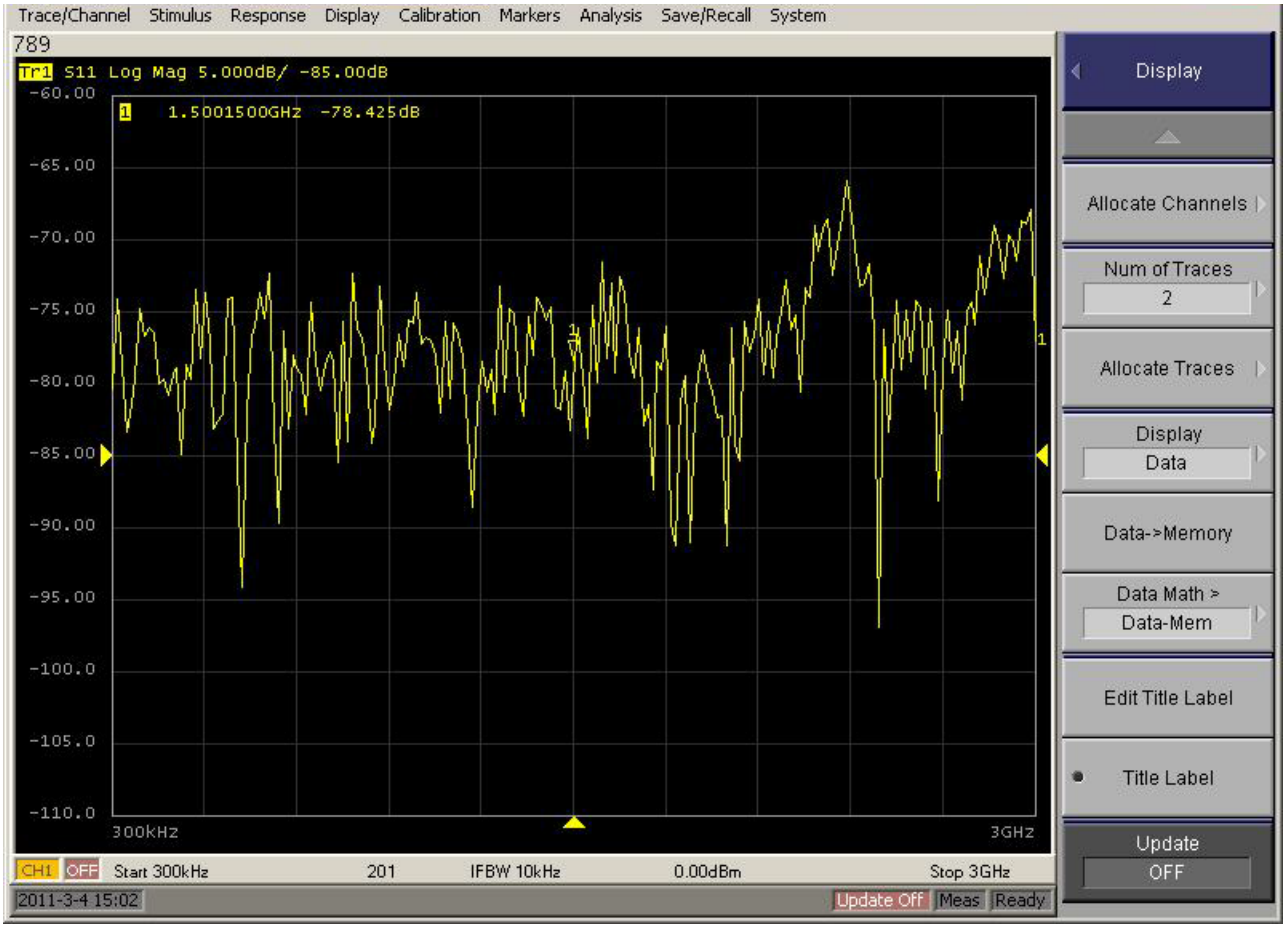


Figure 16 : Turn off the information update

4. Calibration

4. 1. Calibration Types and Characteristics

Calibration Method	Standard (s) Used	Corrected Error Factor	Measurement Parameters
No calibration	None	None	All parameters
Response Calibration	* OPEN or SHORT * LOAD	Following 2 error terms: * Reflection Tracking (Er) * Directivity (Ed)	S11(Reflection characteristics at 1 port)
	* THRU * LOAD	Following 2 error terms: * Transmission Tracking (Et) * Isolation (Ex)	S21 (1 direction transmission characteristics at 2 ports)
1-Port Calibration	* OPEN * SHORT * LOAD	Following 3 error terms: * Directivity (Ed) * Source Match (Es) * Reflection Tracking (Er)	S11 (Reflection characteristics at 1 port)
Enhanced Response Calibration	* OPEN * SHORT * LOAD * THRU	Following 5 error terms: * Directivity (Ed1) * Isolation (Ex21) * Source Match (Es1) * Transmission Tracking (Et21) * Reflection Tracking (Er1)	S11, S21 (1 direction transmission/Reflection characteristics at 2 ports)
Full 2-Port Calibration	* OPEN * SHORT * LOAD * THRU	Following 12 error terms: * Directivity (Ed1,Ed2) * Isolation (Ex21,Ex12) * Source Match (Es1,Es2) * Load Match (El12,El21) * Transmission Tracking(Et21,Et12) * Reflection Tracking (Er1,Er2)	S11,S21,S12,S22 (All S-parameters at 2 ports)

4. 2. Checking Calibration Status

4. 2. 1. Execution Status of Error Correction for Each Channel

The user can check the execution status of error correction for each channel with the error correction status.

The error correction status is indicated in the channel status bar in the lower part of the window by the symbols in the below table.

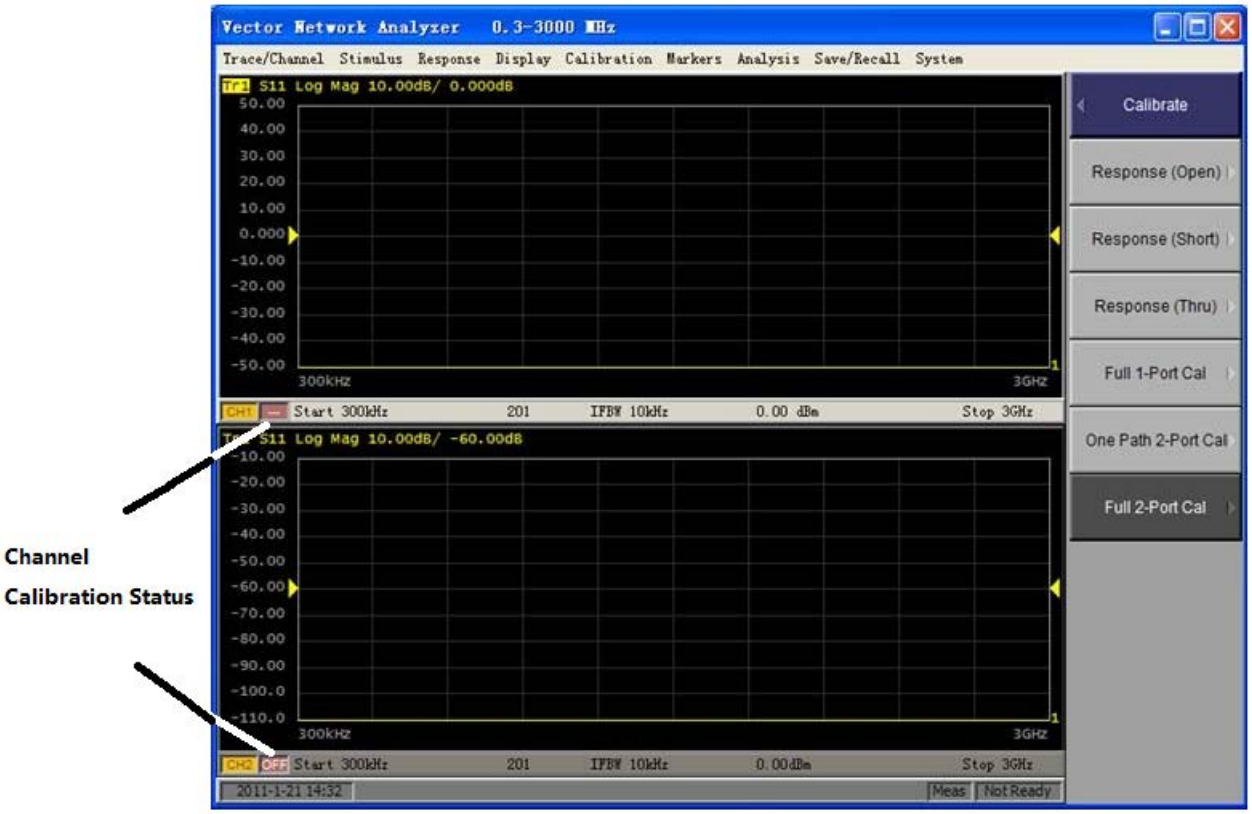


Figure 17:Calibration Status

4. 2. 2. Execution Status of Error Correction for Each Trace

The user can check the status of the error correction actually executed for each trace with the trace status area.

For a trace for which error correction is executed, the applied calibration type is indicated in the trace status area by the symbols in the table below.

Symbol	Calibration Type
RO	Open response calibration
RS	Short response calibration
RT	Thru response calibration
F1	Enhanced response calibration
OP	1-port calibration
F2	Full 2-port calibration/2-port TRL calibration

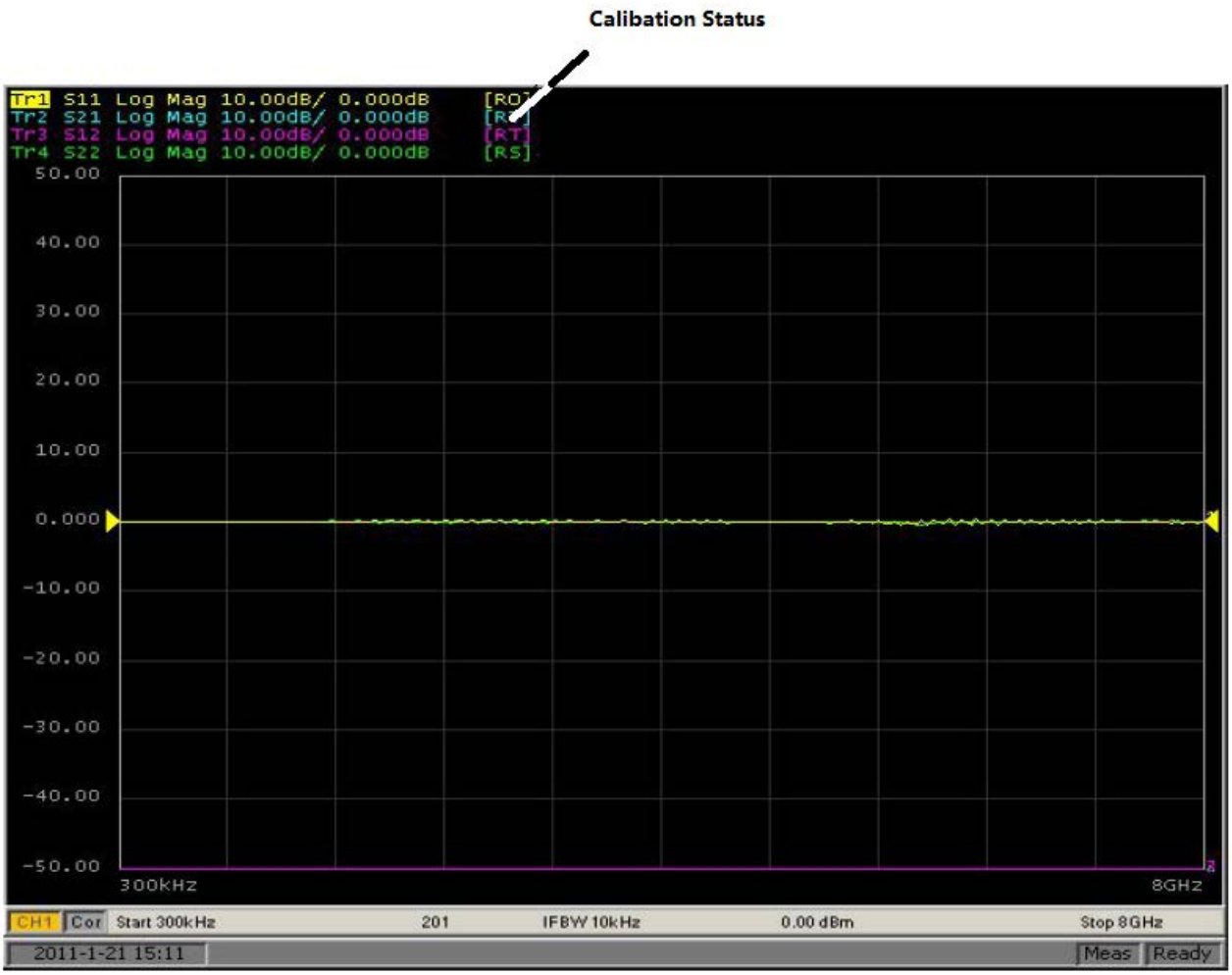


Figure 18: Execution Status of Error Correction for Each Trace

4. 3. Calibration process

4. 3. 1. Selecting Calibration Kit

Before executing calibration, the user need to select a calibration kit.

If the user use a calibration kit other than a predefined one, the user need to define it. If the connector type of the standard of the calibration kit the user use has polarity (the distinction between male and female), the user need to change the standard class definition of the calibration kit depending on the standard the user actually use. For more information, see Modifying Calibration Kit Definition.

- Operating Procedure:

1. Press Channel Next / Channel Prev keys to select the channel for which the user want to select the calibration kit.
2. Press Cal Key.
3. Click Cal Kit, then select the calibration kit.

4. 3. 2. OPEN/SHORT Response Calibration (reflection test)

In OPEN or SHORT response calibration, calibration data are measured by connecting an OPEN or SHORT standard, respectively, to the desired test port. For frequency response, these calibrations effectively eliminate the reflection tracking error from the test setup reflection test using that port.

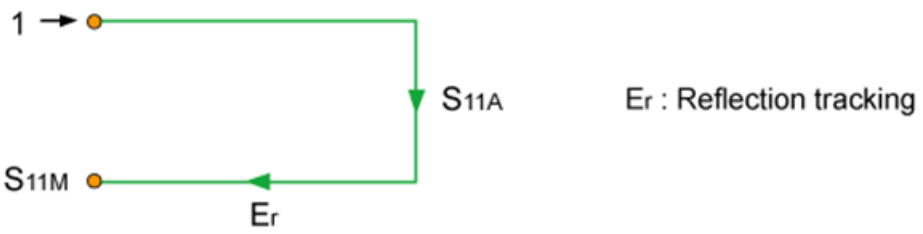


Figure 19: 1-port error model (Open/Short response)

It is also possible to carry out isolation calibration with a LOAD standard during OPEN/SHORT response calibration. An isolation calibration will eliminate the directivity error from the test setup in a reflection test using that port:

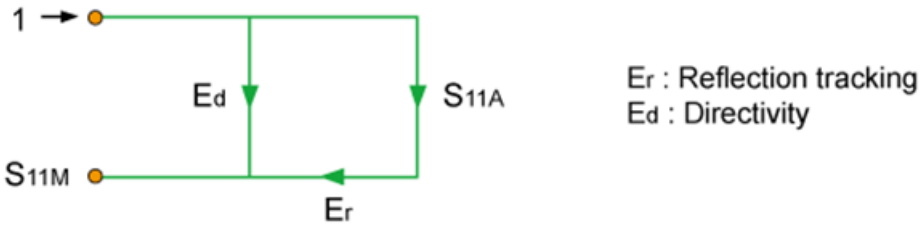


Figure 20:1-port error model (OPEN/SHORT response + isolation)

Operating Procedure:

1. Press Channel Next/Channel Prev keys to select the channel for which the user want to select the calibration kit.
2. Press Cal.
3. Click Cal Kit to select Calibration Kit.
4. Click Calibrate.
5. Click Response (Open)/Response(Short).
6. Connect a calibration standard (OPEN or SHORT) to the selected test port (connector to which the DUT is to be connected).
7. Click Open or Short to start the calibration measurement.
8. If an isolation calibration must be performed using a LOAD standard, follow the Operating procedure :
9. Connect a LOAD standard to the selected test port (connector to which the DUT is to be connected).
10. Click Load (Optional) to start the measurement on the LOAD standard.
11. Click Done to terminate the response calibration (and the LOAD isolation calibration) process. Upon pressing this key, calibration coefficients will be calculated and saved. The error correction function will also be automatically Enabled.

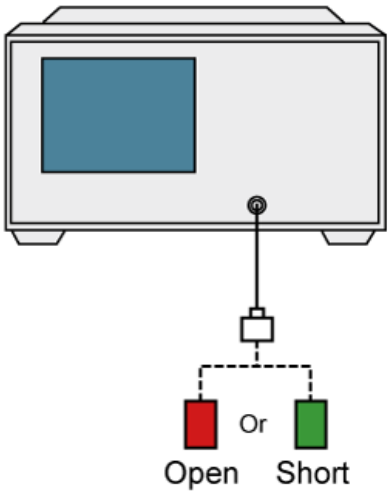


Figure 21:Connecting standards in OPEN/SHORT Response calibration

4. 3. 3. THRU Response Calibration (transmission test)

In THRU response calibration, calibration data are measured by connecting a THRU standard to the desired test port. This calibration effectively eliminates the frequency response transmission tracking error from the test setup in a transmission test using that port.

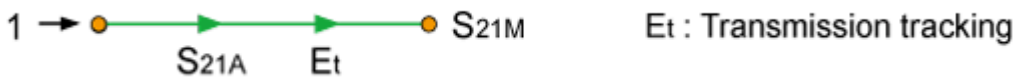


Figure 22:2-Port error model (THRU response)

It is also possible to carry out an isolation calibration using a LOAD standard in the process of THRU response calibration. An isolation calibration will eliminate isolation error (crosstalk error) from the test setup in a transmission test using that port.

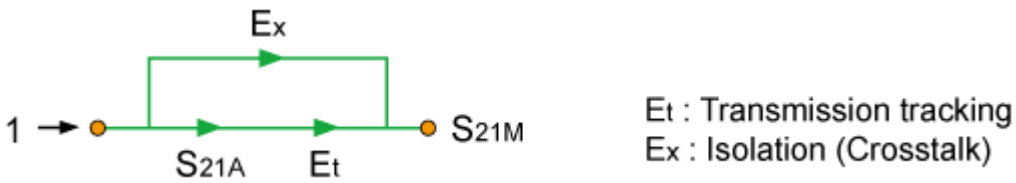
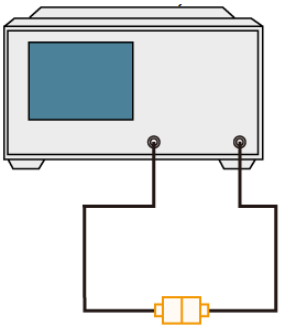


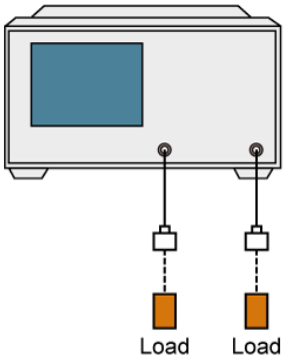
Figure 23: 2-port error model (THRU response + isolation)

Operation Procedure:

1. Press Channel Next/Channel Prev keys to select the channel for which the user want to select the calibration kit.
2. Press Cal.
3. Click Cal Kit to select Calibration Kit.
4. Click Calibrate.
5. Click Response (Thru).
6. Click Select Ports.
7. Select the test ports (and corresponding S parameters) upon which a THRU response calibration is to be performed.
8. Make a between the selected test ports (between the connectors to which the DUT will be connected)



9. Click Thru to start the calibration measurement
10. If an isolation calibration must be performed using a LOAD standard, follow the procedure below.
    - Connect a LOAD standard to each of the two selected test ports (connectors to which the DUT is to be connected).



    - Click Isolation (Optional) to start the calibration measurement.
11. Click Done to terminate the response calibration (and the LOAD isolation calibration) process. Upon pressing this key, calibration coefficients will be calculated and saved. The error correction function will also be automatically Enabled.

4. 3. 4. 1-Port Calibration (reflection test)

In 1-port calibration, calibration data are measured by connecting an OPEN standard, a SHORT standard, and a LOAD standard to the desired test port. This calibration effectively eliminates the frequency response reflection tracking error, directivity error, and source match error from the test setup in a reflection test using that port.

Figure 24：1-Port error model (1-port calibration)

1. Press Channel Next/Channel Prev keys to select the channel for which the user want to select the calibration kit.
2. Press Cal.
3. Click Cal Kit to select Calibration Kit.
4. Click Calibrate.
5. Click 1-Port Cal.
6. Click Select Port to select a test port (and corresponding S parameter) on which 1-port calibration will be performed.

7. Connect an OPEN calibration standard to the selected test port (connector to which the DUT is to be connected).
8. Click Open to start the calibration measurement.

If the user select the calibration kit which has different calibration definitions for each gender, (m) and (f) in the name (label) of the standard displayed in the soft-key indicate male (m) and female (f) for the analyzer's connector, respectively.

9. Connect a SHORT calibration standard to the selected test port (connector to which the DUT is to be connected).
10. Click Short to start the calibration measurement.
11. Connect a LOAD calibration standard to the selected test port (connector to which the DUT is to be connected).
12. Click Load to start the calibration measurement.
13. Click Done to terminate the 1-port calibration process. Upon pressing this key, calibration coefficients will be calculated and saved. The error correction function will also be automatically Enabled.

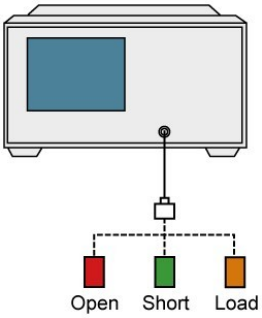


Figure 25:Connecting the standard for 1-port calibration

4. 3. 5. One Path 2-Port Calibration

Operating Procedure:

1. Press Channel Next/Channel Prev keys to select the channel for which the user want to select the calibration kit.
2. Press Cal.
3. Click Cal Kit to select Calibration Kit.
4. Click Calibrate.
5. Click One Path 2-Port Cal.
6. Click Select Port to select a test port (and corresponding S parameter) on which 1-port calibration will be performed.
7. Connect an OPEN calibration standard to the selected test port (connector to which the DUT is to be connected).
8. Click Open to start the calibration measurement.

If the user select the calibration kit which has different calibration definitions for each gender, (m) and (f) in the name (label) of the standard displayed in the soft-key indicate male (m) and female (f) for the analyzer's connector, respectively.

9. Connect a SHORT calibration standard to the selected test port (connector to which the DUT is to be connected).
10. Click Short to start the calibration measurement.
11. Connect a LOAD calibration standard to the selected test port (connector to which the DUT is to be connected).
12. Make a between the selected test ports (between the connectors to which the DUT will be connected).
13. Click Thru to start the calibration measurement.
14. Click Done to terminate the One Path 2-Port Calibration process. Upon pressing this key, calibration coefficients will be calculated and saved. The error correction function will also be automatically Enabled.

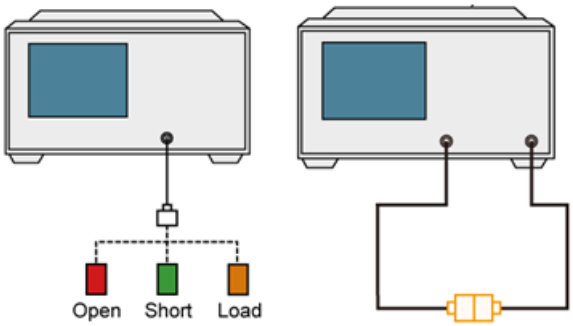


Figure 26: One Path 2-Port Calibration

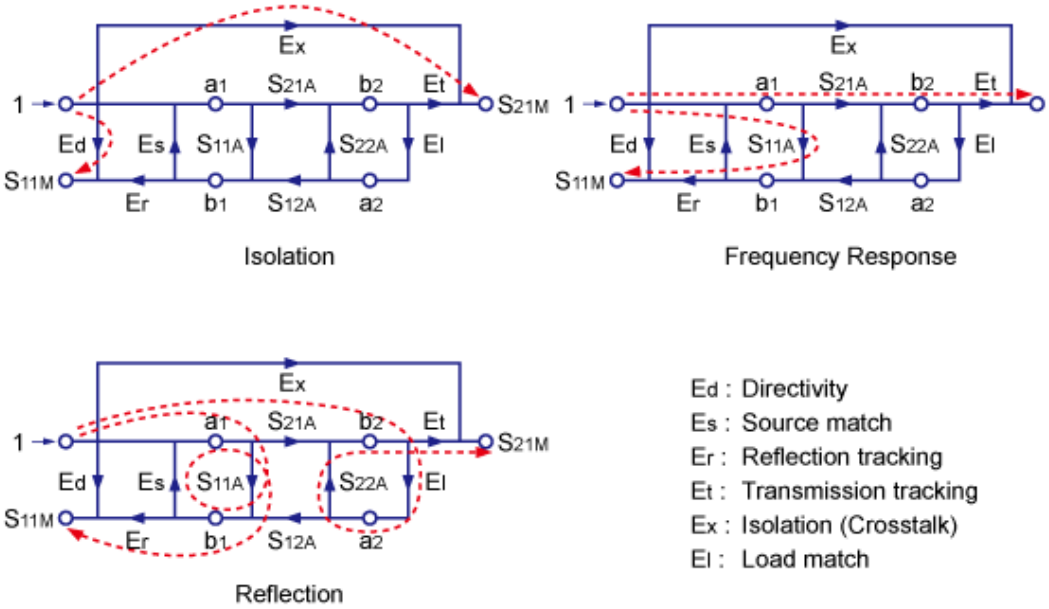


Figure 27:F-2 Calibration (12 error terms)

Operating Procedure:

1. Press Channel Next/Channel Prev keys to select the channel for which the user want to select the calibration kit.
2. Press Cal.
3. Click Cal Kit to select Calibration Kit.
4. Click Calibrate.
5. Click One Full 2-Port Cal.
6. Connect the calibration standard to test port x (the connector to which the DUT is to be connected). Upon pressing this key, calibration coefficients will be calculated and saved. The error correction function will also be automatically Enabled.
7. Click Port 1 Open/Short/Load to start the calibration measurement (x denotes the test port to which the standard is connected).
8. Repeat the above procedure for port y.
9. Make a THRU connection between ports x and y (between the connectors to which the DUT is to be connected).
10. Click Thru to start the calibration measurement (x and y denote the test ports between which the THRU connection is being made).
11. Click Done to terminate the One Path 2-Port Calibration process.

Upon pressing this key, calibration coefficients will be calculated and saved. The error correction function will also be automatically Enabled.

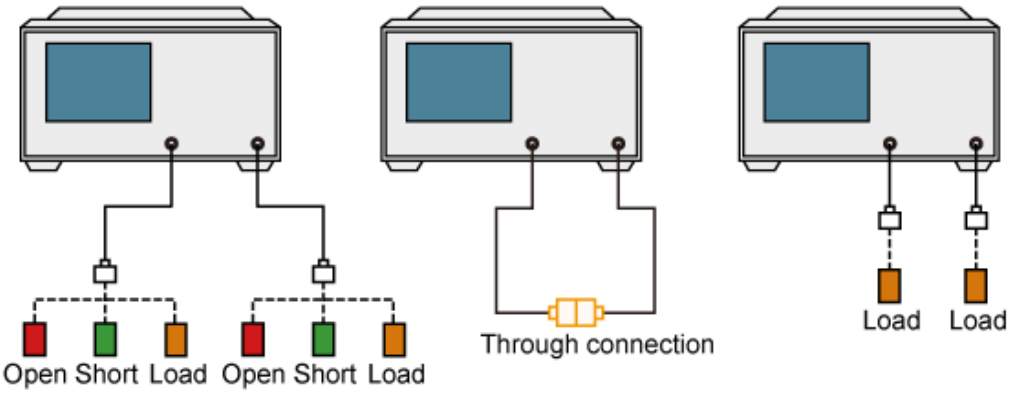


Figure 28：Full 2-Port Calibration

5. Trigger

The trigger source generates a cue signal that initiates a measurement process. Four types of trigger sources are available.

Trigger Sources	Function
Internal (Internal)	Uses a consecutive signal generated by the firmware as a trigger source. Triggers are sent immediately following the completion of each measurement.
External (External)	Uses the external trigger input terminal (BNC) or Handler I/O (Pin No. 18) as a trigger source.
Manual (Manual)	A trigger is generated by pressing Trigger > Trigger.
Bus (Bus)	A trigger is generated through GPIB/LAN/USB.

Operating Procedure:

1. Press Trigger .
2. Click Trigger Source.
3. Click the soft-key that corresponds to the desired trigger source.

5. 1. Selecting a Trigger Mode

Follow the procedure below to select a trigger mode.

1. Press Channel Next/Channel Prev keys to select the channel for which the trigger mode will be set.
2. Press Trigger.
3. Press the soft-key that corresponds to the desired trigger mode. Repeat the procedure until each channel is set for its trigger mode.

Hold	Sets active channel trigger mode to hold sweep mode
Single	Sets active channel trigger mode to single sweep mode
Continuous	Sets active channel trigger mode to continuous sweep mode
Hold All Channels	Sets all channel trigger modes to hold sweep mode
Continuous All Channels	Sets trigger modes of all displayed channels (Display > Allocate Channels) to continuous sweep mode

5. 2. Generating the Trigger

Next, it is necessary to generate a trigger by using the trigger source selected in Selecting a Trigger Source.

1. Pressing Trigger .
2. Click Restart during a sweep forces the analyzer to abort the sweep.

6. Data Analysis

6. 1. Analyzing Data on the Trace Using the Marker

6. 2. Marker Functions

The marker can be used in the following ways:

- Reading a measured value as numerical data (as an absolute value or a relative value from the reference point)
- Moving the marker to a specific point on the trace (marker search)
- Analyzing trace data to determine a specific parameter
- Using the value of the marker to change the stimulus (sweep range) and scale (value of the reference line)

The S3631 is capable of displaying up to 16 markers including the reference marker on each trace. Each marker has a stimulus value (the value on the X-axis in rectangular display format) and a response value (the value on the Y-axis in rectangular display format). The Smith chart and polar formats each have two marker response values (log amplitude and phase).

6. 2. 1. Reading Marker Values on Trace

The user can read the value of a marker displayed on the trace.

In rectangular display format, the marker response value is always in the same data format as that of the Y-axis. On the contrary, one format for the marker response values (two values: main and auxiliary) can be selected from among several types. The selection is performed in the data format.

Softkey for selecting data format	Marker response value	
	Main	Auxiliary
Smith - Lin/Phase	Linear amplitude	Phase
Smith - Log/Phase	Log amplitude	Phase
Smith - Real/Imag	Real component	Imaginary component
Smith - R + jX	Resistance	Reactance
Smith - G + jB	Conductance	Susceptance
Polar - Lin/Phase	Log amplitude	Phase
Polar - Log/Phase	Real component	Imaginary component
Polar - Real/Imag	Real component	Imaginary component

6. 2. 2. Marker Operation

6. 2. 2. 1. Add Marker

Add marker on the trace.

1. Press Channel Next / Channel Prev keys to activate the channel on which a marker is used.
2. Press Trace Next / Trace Prev to activate the trace on which a marker is used.
3. Press Marker.

4. Click Add Marker.
5. Enter the frequency value, and click enter.

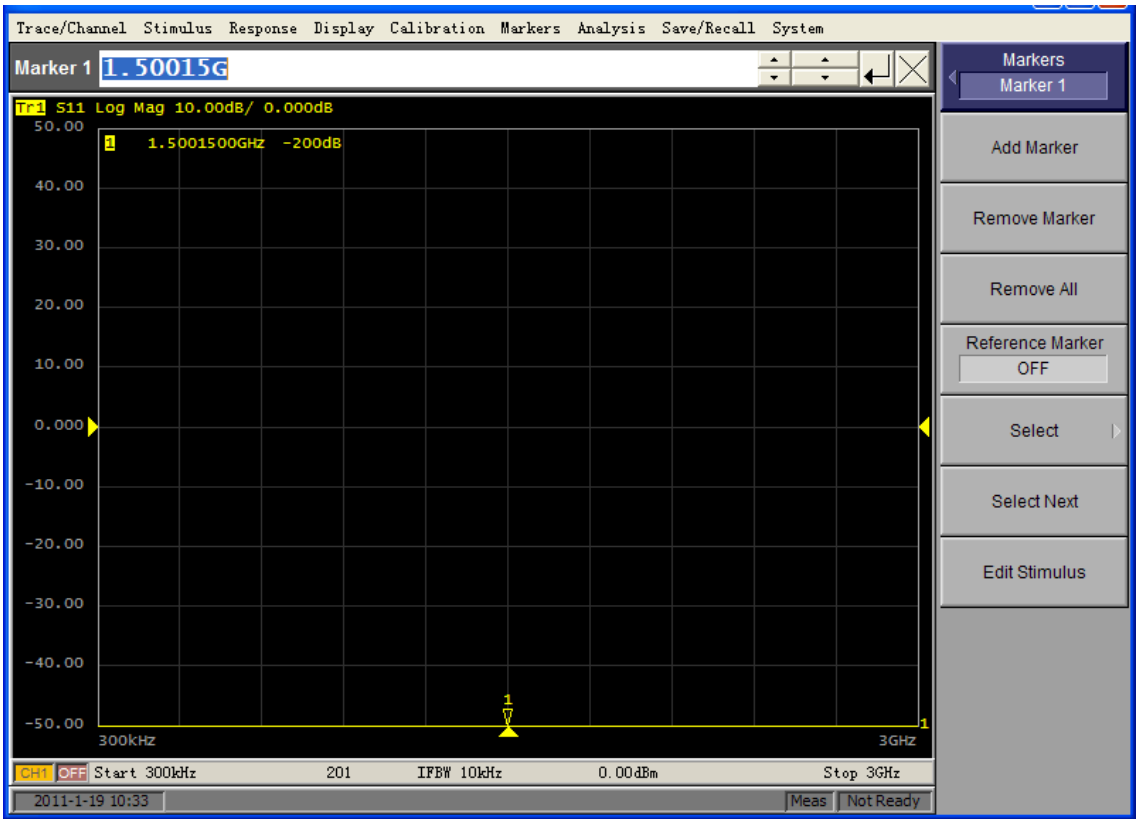


Figure 29：Add marker dialog

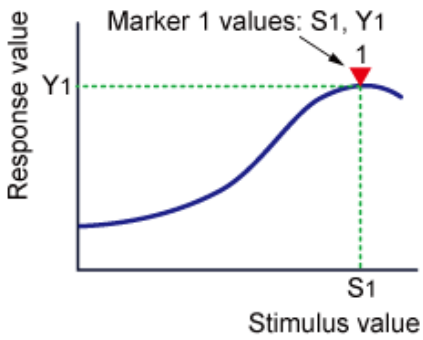
6. 2. 2. 2. Remove Marker

Operating Procedure:

1. Press Channel Next / Channel Prev keys to activate the channel on which a marker is used.
2. Press Trace Next / Trace Prev to activate the trace on which a marker is used.
3. Press Marker.
4. Click Remove Marker

6. 2. 2. 3. Reference Marker

The user can convert the marker reading into a relative value from the reference point.



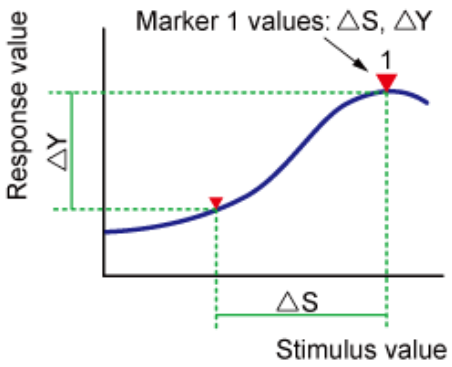


Figure 30 Reference Marker

Operating Procedure:

1. Press Marker.
2. Click Reference Marker [ON/OFF].

6. 2. 2. 4. Select and Edit Marker

Operating Procedure:

1. Press Channel Next / Channel Prev keys to activate the channel on which a marker is used.
2. Press Trace Next / Trace Prev to activate the trace on which a marker is used.
3. Press Marker.
4. Click Select, then click the marker is needed to edit. (Marker1, …, Marker15, Reference Marker)
5. Enter the stimulus value, and press Enter.

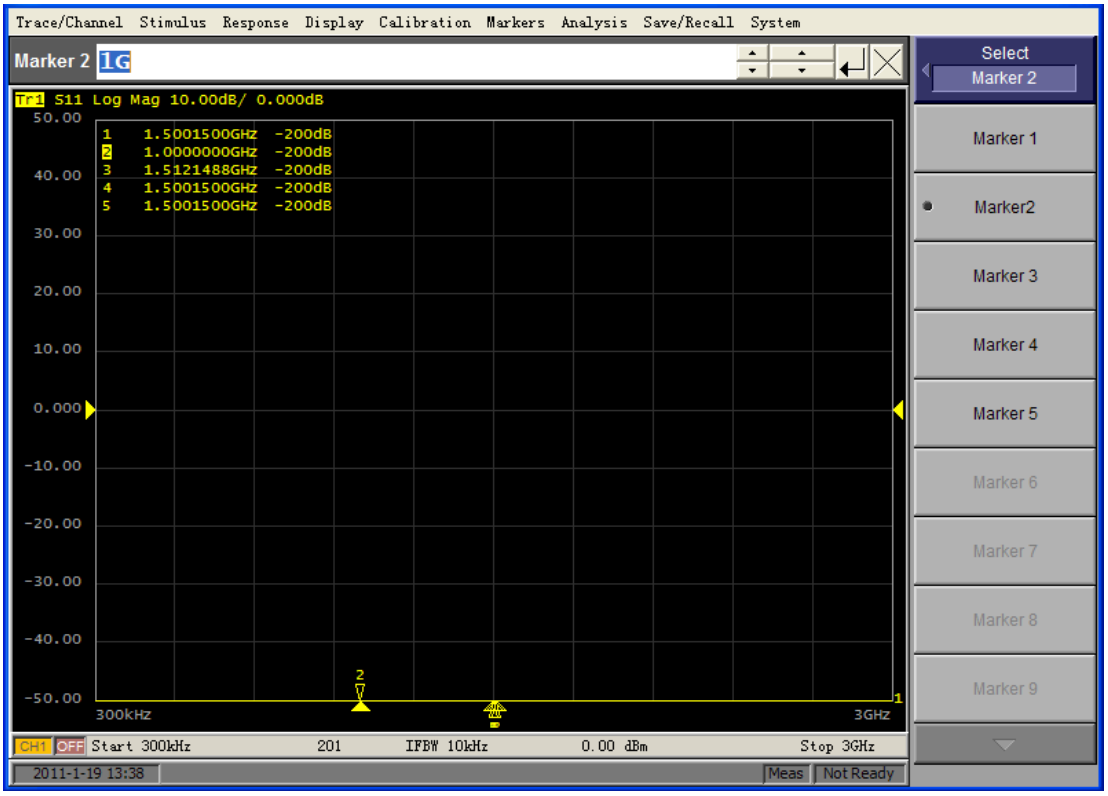


Figure 31: Select and Edit Marker

6. 2. 3. Marker Search

The user can search for a position that matches your specified criteria by using the Marker Search feature. Marker Search allows the user to search for a position that matches any of the following criteria.

1. Maximum value
2. Minimum value
3. Target (a point that has a target measurement value)
   - Target nearest to marker position

- Target on left-hand side nearest to marker position
- Target on right-hand side nearest to marker position

4. Peak
   - Maximum peak (for a positive peak), minimum peak (for a negative peak)
   - Peak on left-hand side nearest to marker position
   - Peak on right-hand side nearest to marker position

6. 2. 3. 1. Moving markers max

Operating Procedure:

1. Press Channel Next / Channel Prev keys to activate the channel on which a marker is used.
2. Press Trace Next / Trace Prev to activate the trace on which marker search is used.
3. Press Marker Search .
4. Click Maximum.

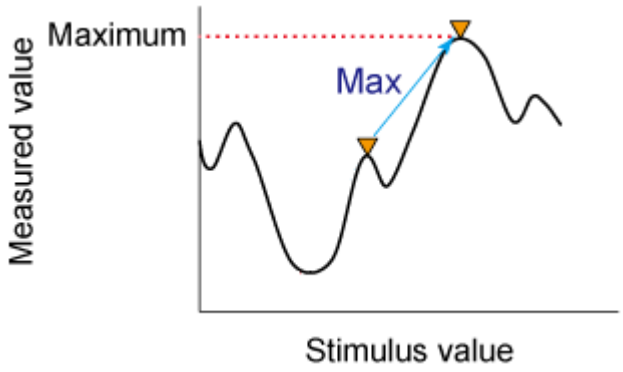


Figure 32:Marker search for maximum

6. 2. 3. 2. Moving markers min

Operating Procedure:

1. Press Channel Next / Channel Prev keys to activate the channel on which a marker is used.
2. Press Trace Next / Trace Prev to activate the trace on which marker search is used.
3. Press Marker Search .
4. Click Maximum.

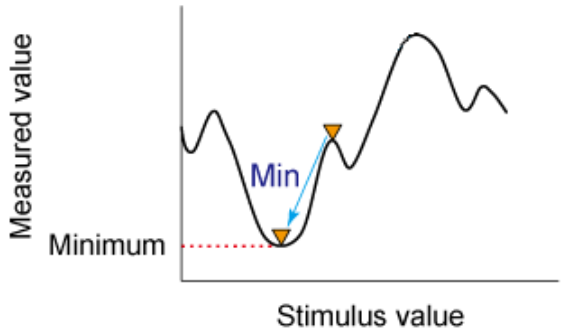


Figure 33: Marker search for minimum

ATTENTION: When the data format is in Smith chart or polar format, execute the search only for the main response value.

6. 2. 3. 3. Searching for the target value (target search)

The target search is a function that searches for a target that matches the pre-defined target value and transition type(s) (positive, negative, or both positive and negative) and then moves the marker to that target.

Target Transition	Description
Positive	When the value of the target is larger than the measured value that immediately precedes it (on the left side)
Negative	When the value of the target is smaller than the measured value that precedes immediately it (on the left side)
Both	Both Positive and Negative

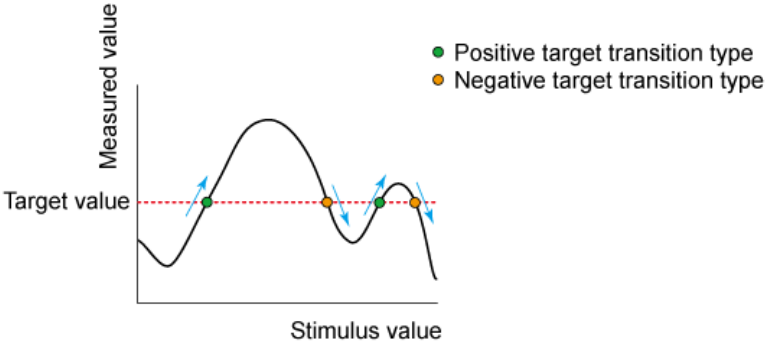


Figure 34 Target Transition

The following three methods are available for executing the target search:

Search Type	Description
Target search	The marker moves to the peak with maximum response value if the peak polarity is Positive or Both or to the peak with minimum response value if the peak polarity is Negative.
Search left	Executes the search from the current marker position to the smaller stimulus values and moves the marker to first target encountered.
Search right	Executes the search from the current marker position to the larger stimulus values and moves the marker to first target encountered.

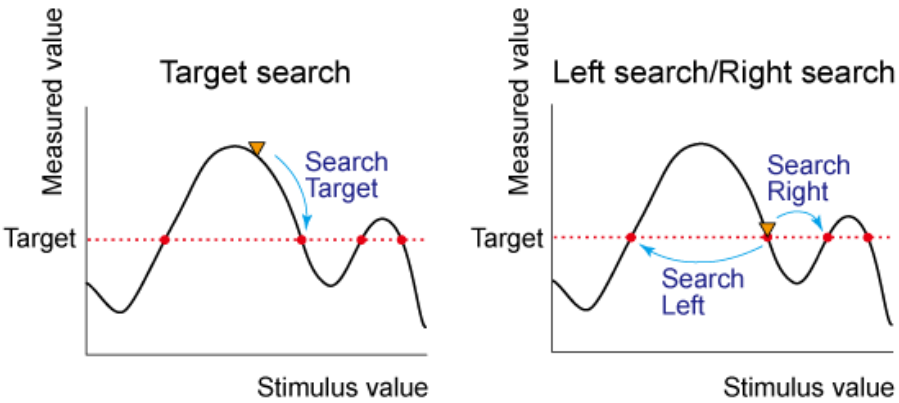


Figure 35 Type of target search

Operating Procedure:

1. Press Channel Next / Channel Prev keys to activate the channel on which a marker is used.
2. Press Trace Next / Trace Prev to activate the trace on which marker search is used.
3. Press Marker Search .
4. Click Target Search > Target Transition.
5. Click Target Value, enter the target value and press Enter .
6. Click Target Value/Search Target Left/Search Target Right to do the search

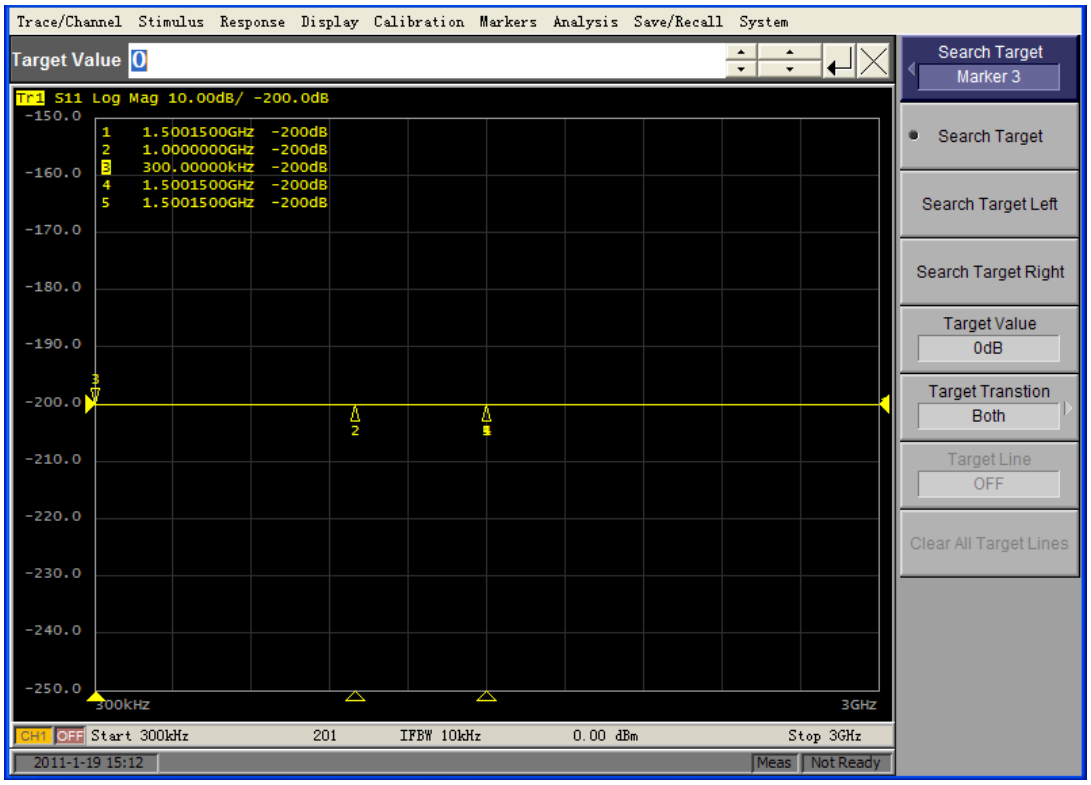


Figure 36 Target Value

6. 2. 3. 4. Searching for the peak

The peak search function Enables the user to move the marker to the peak on the trace. Definition of the peak

A peak is a measurement point whose value is greater or smaller than the adjoining measurement points on its right and left sides. Peaks are classified into the following two types depending on the difference in magnitude from the measurement points on either side of it.

Peak Polarity	Description
Positive peak	A peak whose measured value is greater than those of the measurement points on either side of it (peak polarity: positive)
Negative peak	A peak whose measured value is smaller than those of the measuring points on either side of it (peak polarity: negative)
Both	Both positive peak and negative peak

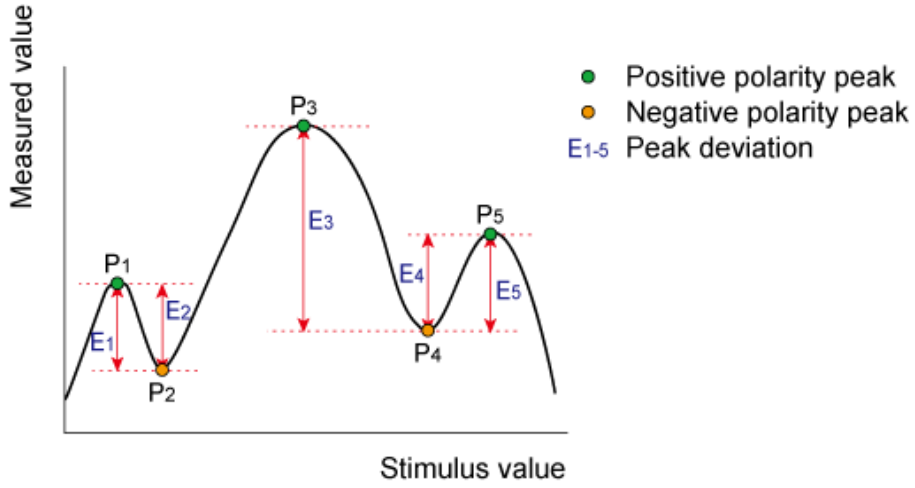


Figure 37 Peak Polarity

Executing a Peak Search

The following three methods are available for executing the peak search:

Search Type	Description
Peak search (Search Peak)	Moves the marker to the maximum peak when peak polarity is Positive or Both. Moves the marker to the minimum peak when peak polarity is Negative.
Left search (Search Left)	Executes the search from current marker position to the smaller stimulus values and moves the marker to first peak encountered.
Right search (Search Right)	Execute the search from current marker position to the larger stimulus values and moves the marker to first peak encountered.

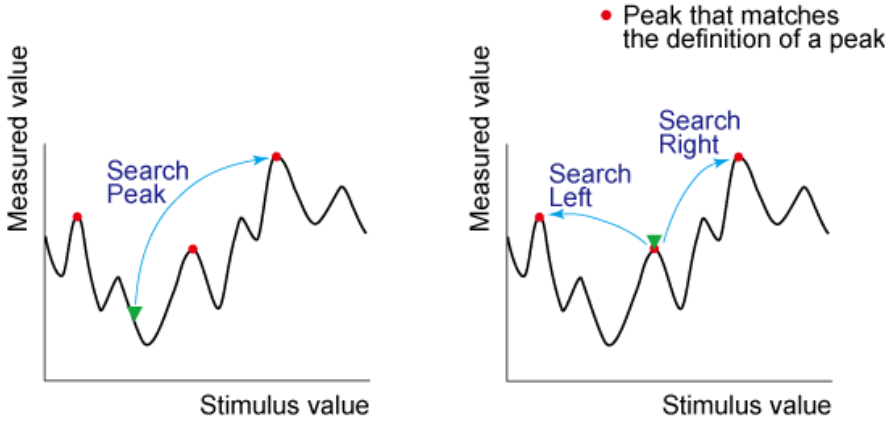


Figure 38 Type of Peak Search

Operating Procedure:

1. Activate the marker using for the peak search.
2. Press Marker Search .
3. Click Peak > Peak Excursion.
4. Enter the lower limit for the peak excursion value. This sets the peak search to be executed based on the definitions of the newly set lower limit for the peak excursion value and the currently set peak polarity.
5. Click Peak Polarity.
6. Select a peak polarity. This sets the peak search to be executed based on the definitions of the currently set lower limit for the

peak excursion value and the newly set peak polarity.

7. Click the corresponding soft-key to move the marker to the peak.
8. When the data format is in Smith chart or polar format, execute the search for the main response value of the two marker response values

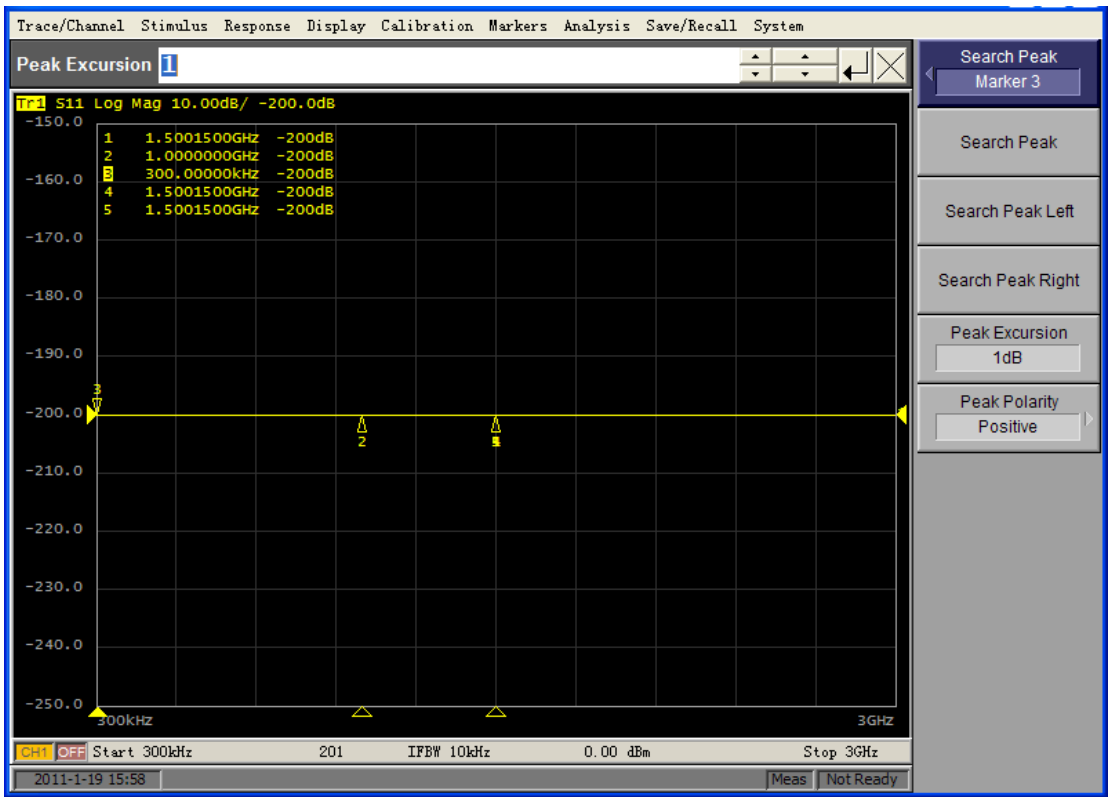


Figure 39 Peak Excursion

6. 2. 3. 5. Automatically Executing a Search (Search Tracking)

Search tracking is a function that sets a search to be repeated every time a sweep is done even if the execution key for the search (maximum, minimum, peak, and target) is not pressed. This function facilitates observation of measurement results such as the maximum value of traces (e.g., the insertion loss of a band pass filter).

Performing Search Tracking

1. Press Channel Next / Channel Prev keys to activate the channel on which a marker is used.
2. Press Trace Next / Trace Prev to activate the trace on which marker search is used.
3. Press Marker Search.
4. Click Tracking and turn the search tracking function ON/OFF.

6. 2. 3. 6. Bandwidth Search

The bandwidth search/ notch search is a function for determining the bandwidth of the trace, center frequency, cut-off points (on the higher frequency and the lower frequency sides), Q, and insertion loss, based on the position of the active marker. The definitions of the parameters determined through the bandwidth search are shown in below.

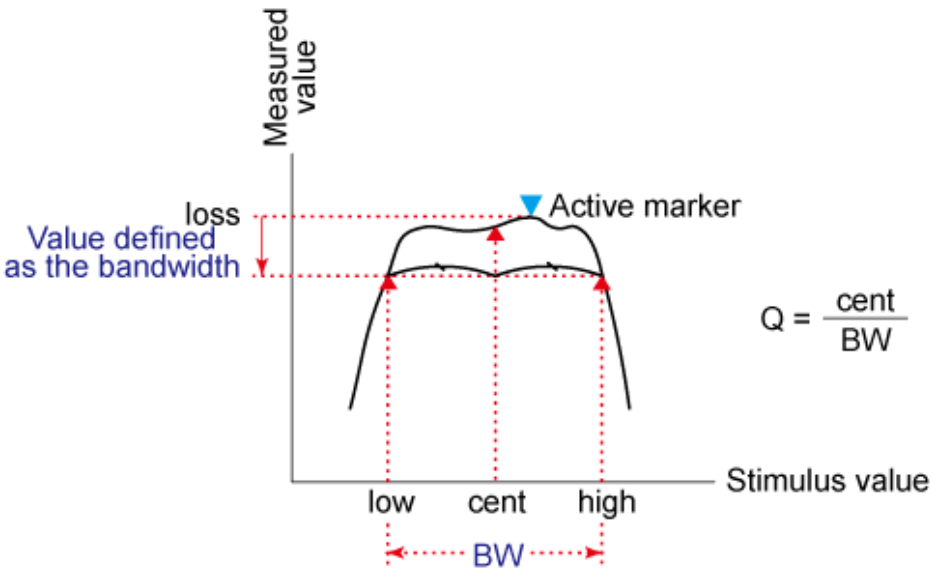


Figure 40 Value defined as the bandwidth

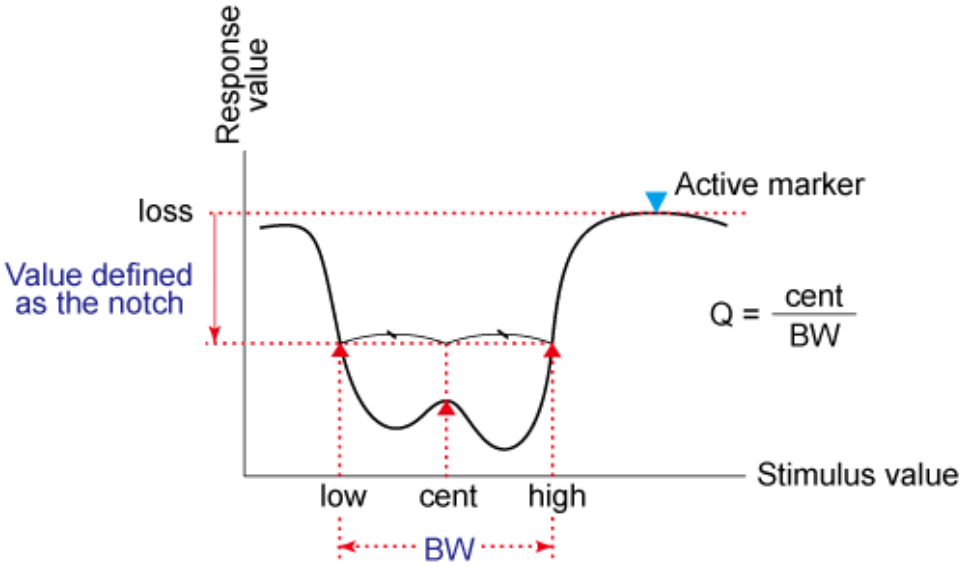


Figure 41 Value defined as the notch

Bandwidth Parameter	Definition
Insertion loss (loss)	The measured value of the position of the active marker at the time the bandwidth search is executed.
Lower frequency cut-off point (low)	Lowest frequency of two measurement points, both separated by the defined bandwidth value from the active marker position.
Higher frequency cut-off point (high)	Highest frequency of two measurement points, both separated by the defined bandwidth value from the active marker position.
Center frequency (cent)	Frequency at the midpoint between the lower frequency cut-off and higher frequency cut-off points.(high+low)/2
Bandwidth (BW)	The difference in frequency between the higher frequency cut-off and lower frequency cut-off points. (high-low)
Q	Value obtained by dividing the center frequency by the bandwidth.(cent/BW)

Executing a Bandwidth Search:

1. Press Channel Next / Channel Prev and Trace Next / Trace Prev keys to activate the trace on which the bandwidth search is executed. The response value of this active marker itself is the insertion loss in the bandwidth search (loss).
2. Press Marker Search.
3. Click Bandwidth Search.
4. Click Bandwidth Value and enter the defined bandwidth value in the entry area that appears.
5. Click Bandwidth to turn on the bandwidth search. In the upper left of the trace display, six bandwidth parameters are displayed.

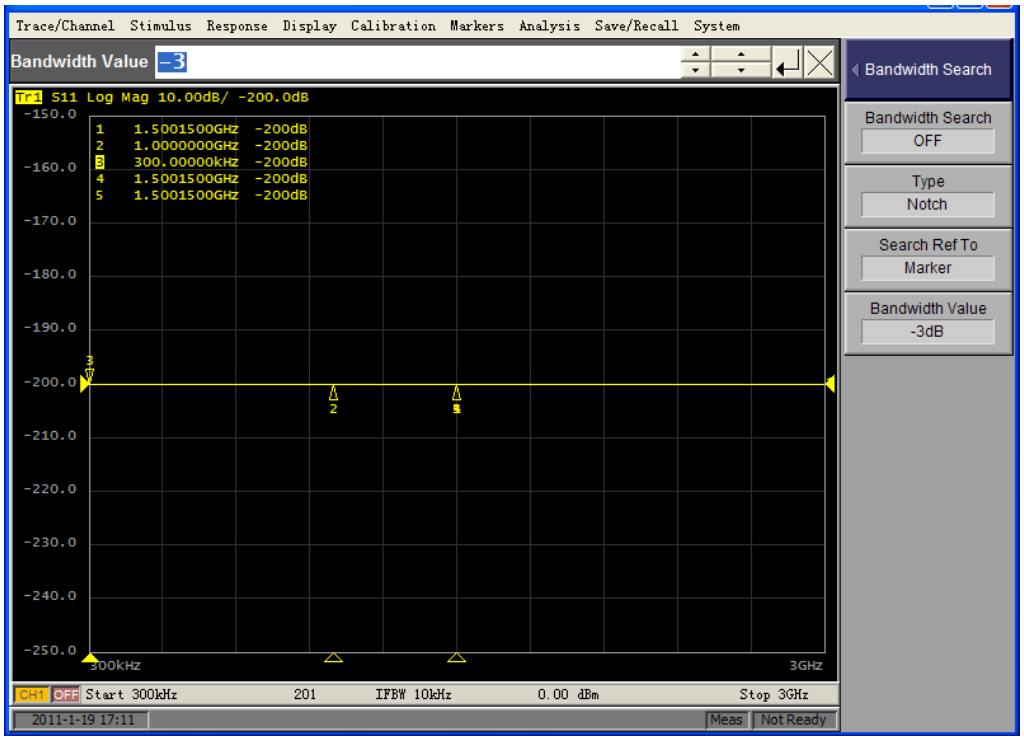


Figure 42 Bandwidth search (Data entry dialog)

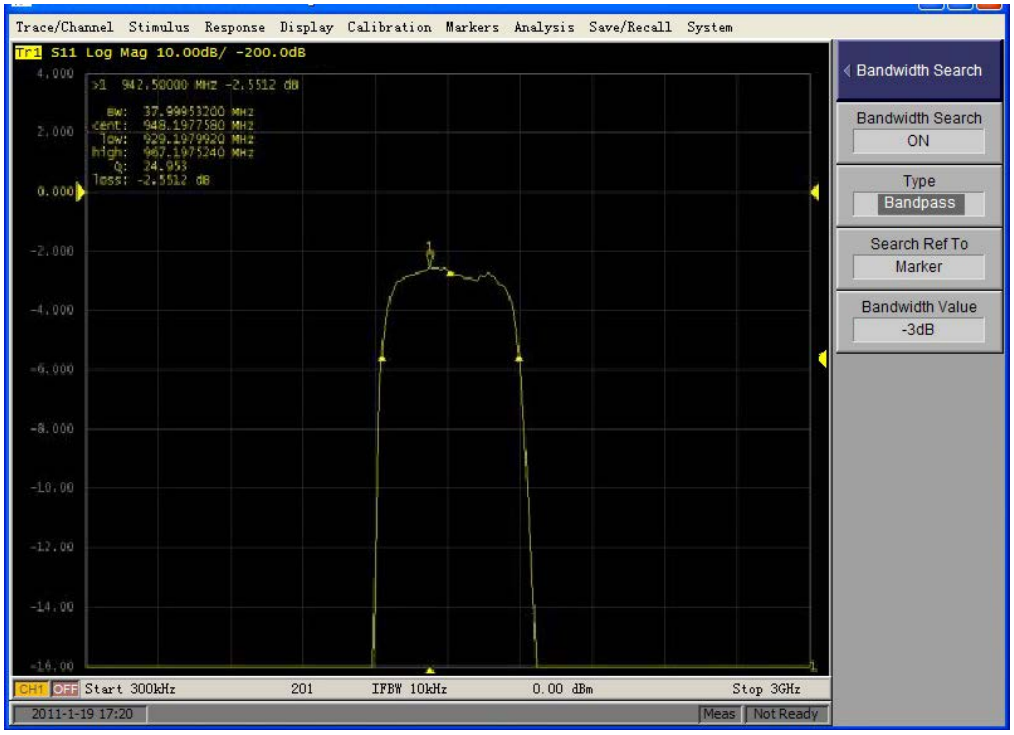


Figure 43 Bandwidth search results

6. 2. 3. 7. Setting Search Range

The Marker Search feature allows the user to set part of the sweep range as the search target (Partial Search feature) as well as the entire search range. For the Partial Search feature, the user can select whether to couple traces in the channel. The Marker Statistics value is calculated by using the search range.

Procedure to Set Search Range:

1. Press Channel Next / Channel Prev and Trace Next / Trace Prev keys to activate the trace on which the bandwidth search is executed. The response value of this active marker itself is the insertion loss in the bandwidth search (loss).
2. Press Marker Search.
3. Click Search Range to turn ON the Partial Search feature.
4. Click Search Start, then enter the start value (lower limit) of the search range.
5. Click Search Stop, then enter the stop value (upper limit) of the search range.
6. Click Search Range to turn ON the Partial Search feature.
7. Click Couple to toggle ON/OFF trace coupling within the search range.

6. 2. 3. 8. Setting up Markers for Each Trace/Setting up Markers for Coupled Operation between Traces

Makers can be set up and moved either in coupled operation for all traces in a channel or independently for each trace.

1. Press Channel Next / Channel Prev and Trace Next / Trace Prev keys to activate the trace on which the bandwidth search is executed. The response value of this active marker itself is the insertion loss in the bandwidth search (loss).
2. Press Marker Search.
3. Click Couple to turn the marker coupling on or off.

6. 2. 4. Marker Function

6. 2. 4. 1. Marker Transfer Settings

1. Setting the Sweep Range Using the Marker
   1) In the channel window whose range must be set, place the active marker on the active trace to a position that corresponds to the new range (to the lowest, highest, or center value).
   2) Press Marker Fctn .
   3) Click the soft-key that corresponds to each value.

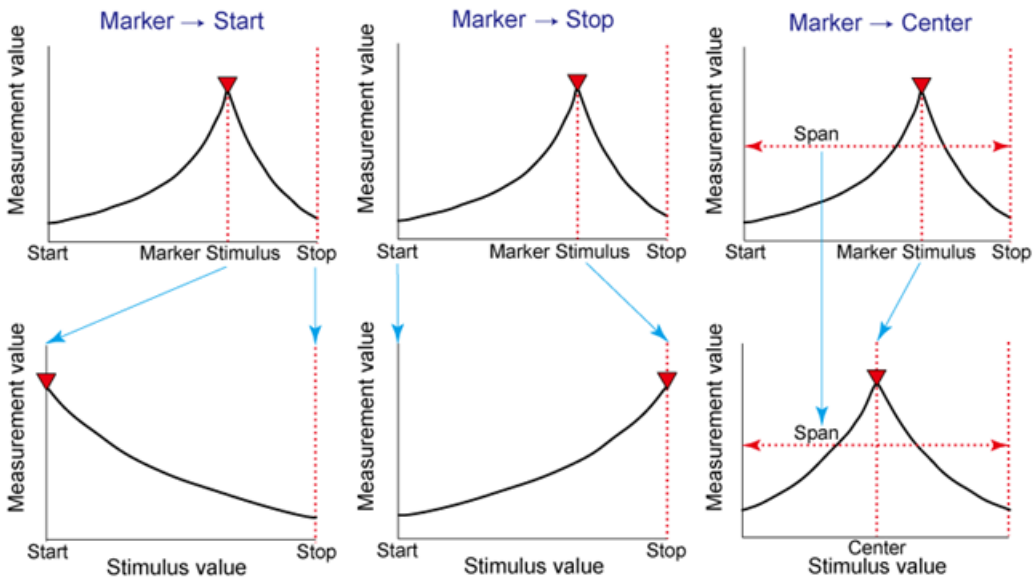


Figure 44 Marker

If the reference marker is on and the stimulus value of the active marker is expressed by a value relative to the reference marker, the absolute stimulus value will be used to set the new sweep rang.

2. Setting the Reference Using the Marker
   1) In the channel window whose range must be set, place the active marker on the active trace to a position that corresponds to the new range (to the lowest, highest, or center value).
   2) Press Marker Fctn
   3) Click Marker->Reference.
3. Setting the Delay Using the Marker
   1) In the trace whose reference must be set, place the active marker on the active trace to a position that corresponds to the new reference.
   2) Press Marker Fctn .
   3) Click Marker->Delay (Scale>Electrical Delay).

6. 2. 4. 2. Marker Couple

Makers can be set up and moved either in coupled operation for all traces in a channel or independently for each trace.

1. Press Channel Next / Channel Prev keys to activate the channel on which the marker couple will be set.

2. Press Marker Fctn .
3. Click Couple to turn the marker coupling on or off.

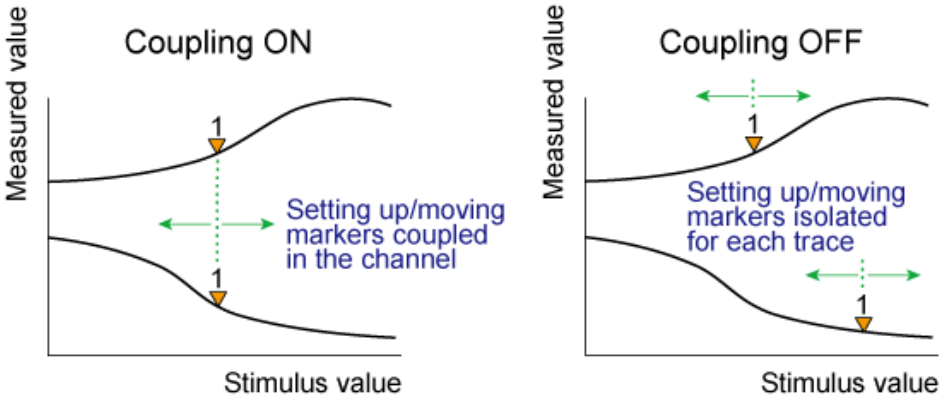


Figure 45 Marker Couple

6. 2. 4. 3. Listing all Marker Values in all Displayed Channels

The user can list all of the marker values in all of the displayed channels on the screen. Turning On the Marker Table Display

1. Press Marker Fctn .
2. Click Marker Table to turn on the marker table display.

6. 2. 4. 4. Marker Statistics Data

The user can easily determine the statistics data for a trace (mean, standard deviation, and peak-to-peak). The definitions for the statistics data elements are shown below.

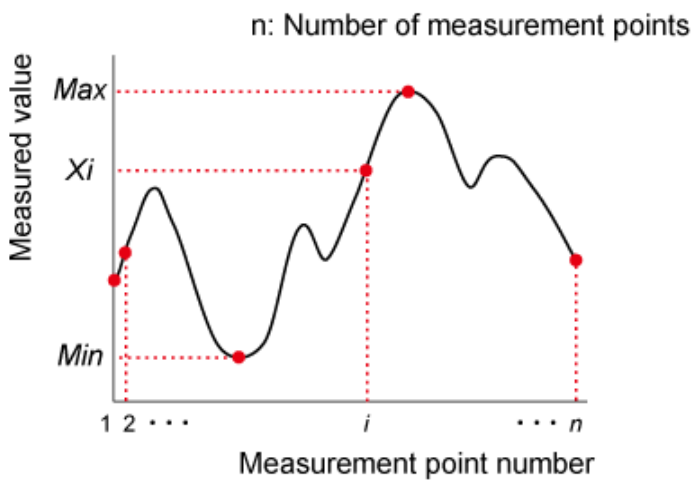


Figure 46 Marker Statistics

Statistics data element	Definition
Mean (mean)	$\frac{\sum_{i=1}^{n} x_i}{n}$ (n: number of points; xi: measured value at the i-th measurement point)

Statistics data element	Definition
Standard deviation (s. dev)	$\sqrt{\frac{\sum_{i=1}^{n}(x_i - \text{mean})^2}{n-1}}$ (n: number of points; xi: measured value at the i-th measurement point; mean: Mean)
Peak-to-peak (p - p)	Max-Min (Max: greatest measured value; Min: smallest measured value）

Displaying Statistical Data

1. Press Channel Next / Channel Prev and Trace Next / Trace Prev keys to activate the trace for which statistical data is required.
2. Press Marker Fctn key.
3. Click Statistics to turn on the display of statistics data.
4. Click Statistics Start and Statistics Stop to set the range of Statistics.

6. 2. 4. 5. Specifying Display Position of Marker Values

This section describes how to specify the marker value display position for each active trace.

Operational procedure:

1. Press Channel Next / Channel Prev keys to activate the channel for which the user want to set marker coupling.
2. Press Marker Fctn key.
3. Click Annotation Options.
4. Click Data X Pos to set the horizontal display position.
5. Click Data Y Pos to set the vertical display position.

6. 2. 4. 6. Aligning Marker Value Display

This section describes how to align maker value displays.

Value	Description
On (Align ON)	Displays marker values to align to the display position of trace 1.
Off (Align OFF)	Displays marker values in the display position defined for each trace.

6. 3. Limit Test

The limit test feature allows the user to set the limit line for each trace and then perform the pass/fail judgment for the measurement result.

The limit test is a function to perform pass/fail judgment based on the limit line the user set with the limit table.

In the limit test, if the upper limit or lower limit indicated by the limit line is not exceeded, the judgment result is pass; if it is exceeded, the judgment result is fail for all measurement points on the trace. Measurement points in a stimulus range with no limit line are judged as pass.

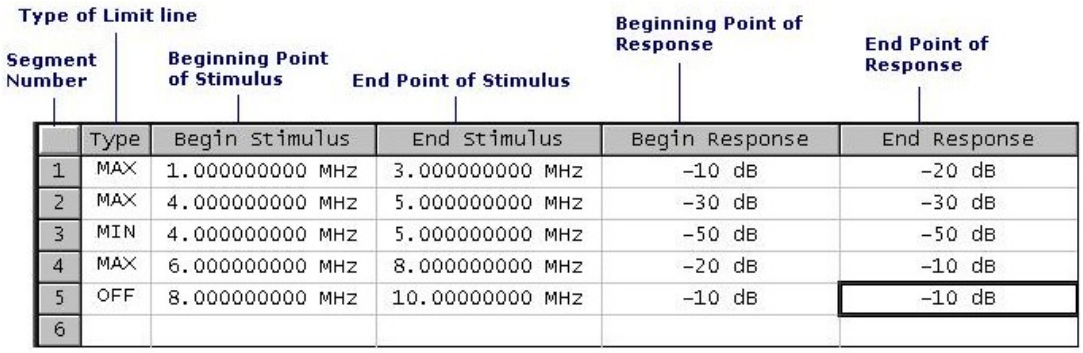
ATTENTION: The targets of the pass/fail judgment are measurement points only. Parts interpolated between measurement points

are not judged.

The user defines the limit line by specifying the stimulus value (Begin Stimulus) and response value (Begin Response) of the begin point, the stimulus value (End Stimulus) and response value (End Response) of the end point, and the type (lower limit/upper limit). For more information, refer to Defining the limit line.

When the limit test is on, measurement points that fail are displayed in red on the screen and the trace's pass/fail judgment result based on the results of individual measurement points (fail if one or more measurement points on the trace fail) is also displayed. the user can check the pass/fail judgment result for the channel (fail if one or more traces fail in any of the limit test, the ripple test or the bandwidth test within the channel) on the screen as well. For more information, refer to Displaying judgment result of limit test.

In addition to viewing the screen, the user can check the judgment result of the limit test by the following methods.



	Type	Begin Stimulus	End Stimulus	Begin Response	End Response
1	MAX	1.000000000 MHz	3.000000000 MHz	-10 dB	-20 dB
2	MAX	4.000000000 MHz	5.000000000 MHz	-30 dB	-30 dB
3	MIN	4.000000000 MHz	5.000000000 MHz	-50 dB	-50 dB
4	MAX	6.000000000 MHz	8.000000000 MHz	-20 dB	-10 dB
5	OFF	8.000000000 MHz	10.00000000 MHz	-10 dB	-10 dB
6					

Figure 47 Limit Table

segment parameter values shown below:

Segment Parameter	Description
Type	Select the type of segment from the following: OFF Segment not used for the limit test MIN Segment at which the minimum is specified MAX Segment at which the maximum is specified
Begin Stimulus	Specify starting point for stimulus value on the limit line
End Stimulus	Specify ending point for stimulus value on the limit line
Begin Response	Specify starting point for response value on the limit line
End Response	Specify ending point for response value on the limit line

ATTENTION:

- The user can define a limit line that is able to freely overlap the stimulus range of another limit line.

Defining one limit line having the same type as a second limit line whose stimulus range overlaps with the first one result in two or more limit values at the same measurement point. In this case, the limit value to be used in the limit test is defined as follows:

  - When two or more limit values whose type is set to maximum (MAX) exist, the smallest one is used as the maximum.
  - When two or more limit values whose type is set to minimum (MIN) exist, the largest one is used as the minimum.

- Even if the span of the sweep range on the S3631 is set to 0, enter the two parameters of Begin Stimulus and End Stimulus.
- When two or more response values are returned as a result of using the Smith or polar chart format, the first response value of the marker provides the object of the limit test.

Measurement points that fail are displayed in red on the screen. The judgment result of the trace is indicated by Pass or Fail displayed in the upper right part of the graph.

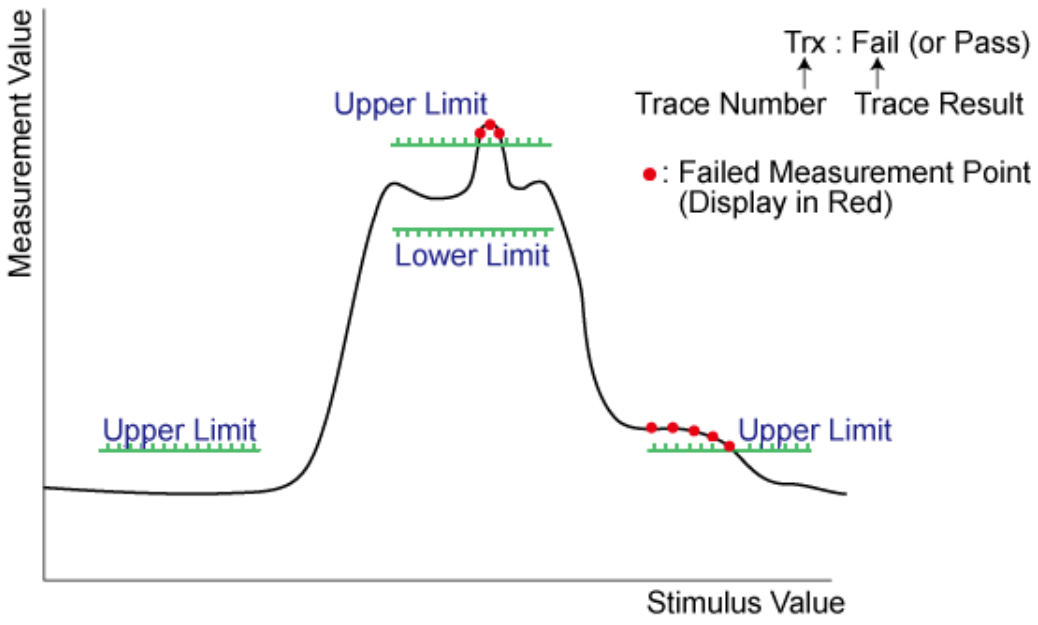


Figure 48 Limit Test

6. 3. 1. Defining Limit Line

To use the limit test, the user must first define the limit line. the user can define a limit table for each trace, and the user can define up to 100 limit lines (segments) in a limit table.

The following steps describe how to define a segment.

1. Press Channel Next / Channel Prev keys and Trace Next / Trace Prev keys to select the trace on which the limit test function will be used.
2. Press key to display the Analysis menu.
3. Click Limit Test to display the soft-keys associated with the limit test.
4. Click Edit Limit Line to display the limit table.
5. Click Add to add a segment to the limit table and then specify the segment parameter values shown below.

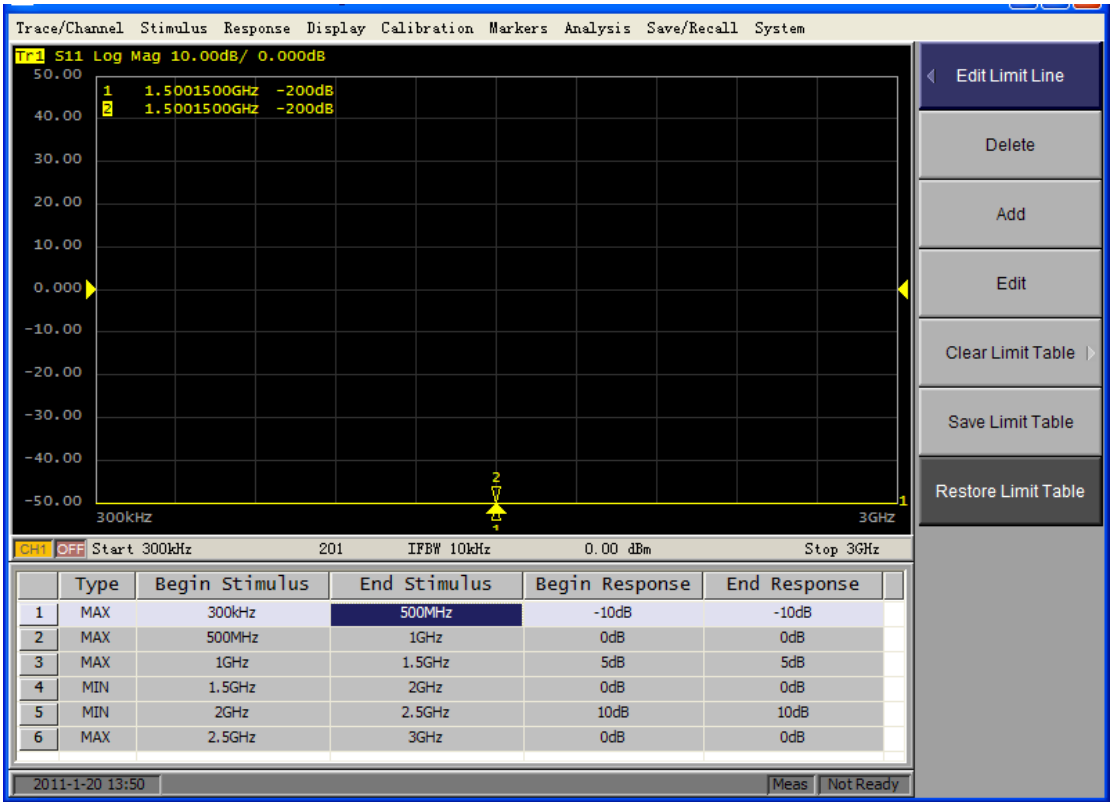


Figure 49 Edit Limit Table

Softkey	Function
Delete	Delete a segment
Add	Add a segment
Edit	Edit the segment
Clear Limit Table	Clear the limit table
Save Limit Table	Open the Save As dialog box. In this step, lim (extension: *.lim) is selected as the file type.
Restore Limit Table	Recall the limit table the user have saved.

6. 3. 2. Limit line offset

By adding a certain offset to the limit value, the user can adjust the limit line so that it conforms to the device output.

1. Press Channel Next, Channel Prev keys and Trace Next, Trace Prev keys to select the trace on which the limit test function will be used.
2. Press Analysis key to display the Analysis menu.
3. Click Limit Test to display the soft-keys for the limit test.
4. Click Limit Line Offsets to display the limit line offset function menu. The following functions correspond to each soft-key.

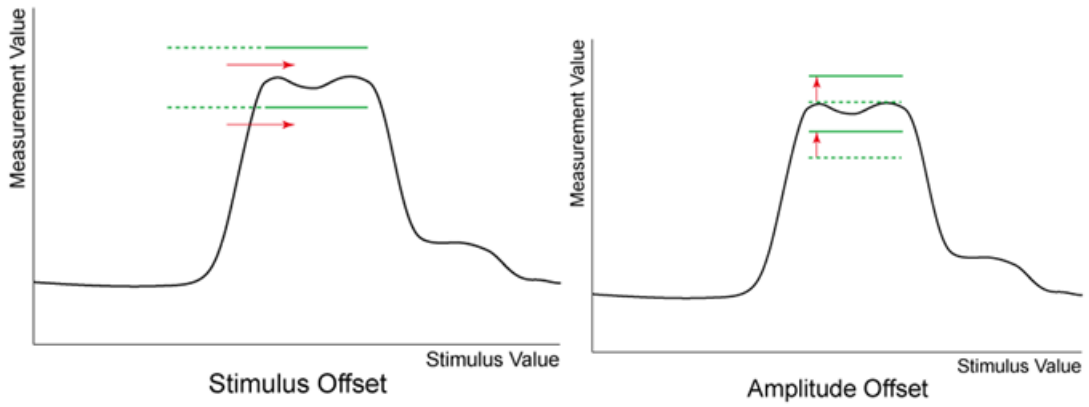


Figure 50 Stimulus Offset

Softkey	Function
Stimulus Offset	Adds a certain offset to the stimulus value of the entire segment in the limit table. (Stimulus offset)
Response Offset	Adds a certain offset to the response value of the entire segment in the limit table. (Amplitude offset)
Marker-> Response Ofs.	Adds the amplitude offset by the same amount as the retrieved value of the active marker. the user can confirm the current value set for the amplitude offset by pressing Amplitude Offset. (Marker amplitude offset)

6. 3. 3. Turning the limit test ON/OFF

The user can set the limit test ON/OFF for each trace individually.

1. Press Channel Next, Channel Prev keys and Trace Next, Trace Prev keys to select the trace on which the limit test function will be used.
2. Press Analysis key to display the Analysis menu.
3. Click Limit Test to display the Limit Test menu.
4. Click Fail Sign.
5. Click Limit Line.
6. Click Limit Test.

6. 4. Ripple Test

Independently of the limit test, the user can evaluate the measurement results on a pass/fail basis by setting a limit for the ripple. This function is called the ripple test. The ripple test is a function for evaluating the results on a pass/fail basis based on the ripple limit, which is set using the ripple limit table. the user can specify up to 12 frequency bands, which permits a test for each frequency band.

The ripple test judges the measurement as "Pass" when the ripple value specified with the ripple limit is not exceeded by any of the measurement points on the trace; otherwise, it judges the measurement as "Fail". For the measurement points in a stimulus range without a specified ripple limit, the test judges the measurement as "Pass".

Figure 51 Result of Ripple Test

6. 4. 1. Configuring Ripple Limit

The user must configure the ripple limit before the user can use the ripple test function. the user can specify a ripple limit table for each trace, where up to 12 ripple limit bands (frequency bands) can be configured.

Operating procedure:

1. Press Channel Next / Channel Prev keys and Trace Next / Trace Prev keys to select the trace on which the user want to apply the ripple test function.
2. Press Analysis to display the Analysis menu.
3. Click Ripple Limit to display the soft-keys for to the ripple test.
4. Click Edit Ripple Limit to display the ripple limit table shown below.

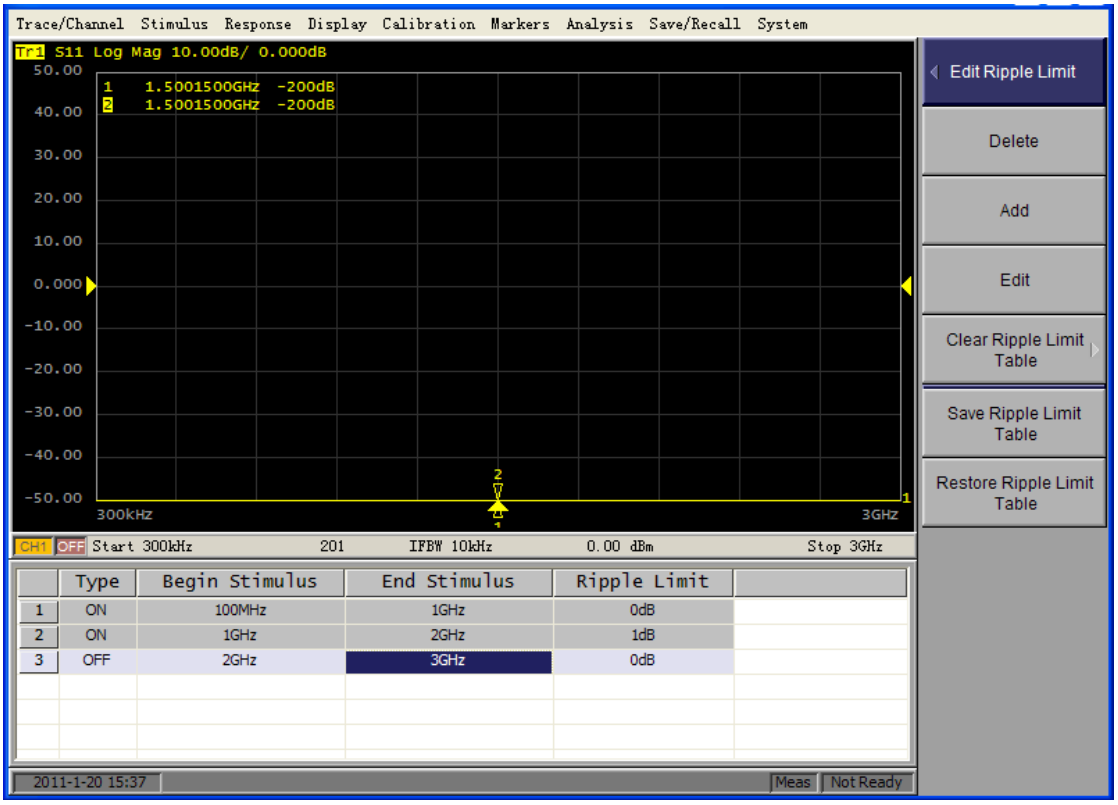


Figure 52 Ripple Test Edit Window

Softkey	Function
Delete	Delete a segment
Add	Add a segment
Edit	Edit the segment
Clear Ripple Limit Table	Clear the ripple limit table
Save Ripple Limit Table	Open the Save As dialog box. In this step, lim (extension: *.rlm) is selected as the file type.
Restore Ripple Limit Table	Recall the ripple limit table the user have saved.

6. 4. 2. Turning ON/OFF Ripple Test and Result Display

The user can set the limit test ON/OFF for each trace individually.

1. Press Channel Next / Channel Prev keys and Trace Next / Trace Prev keys to select the trace on which the user want to apply the ripple test function.
2. Press Analysis to display the Analysis menu.
3. Click Ripple Limit to display the soft-keys for the ripple test.

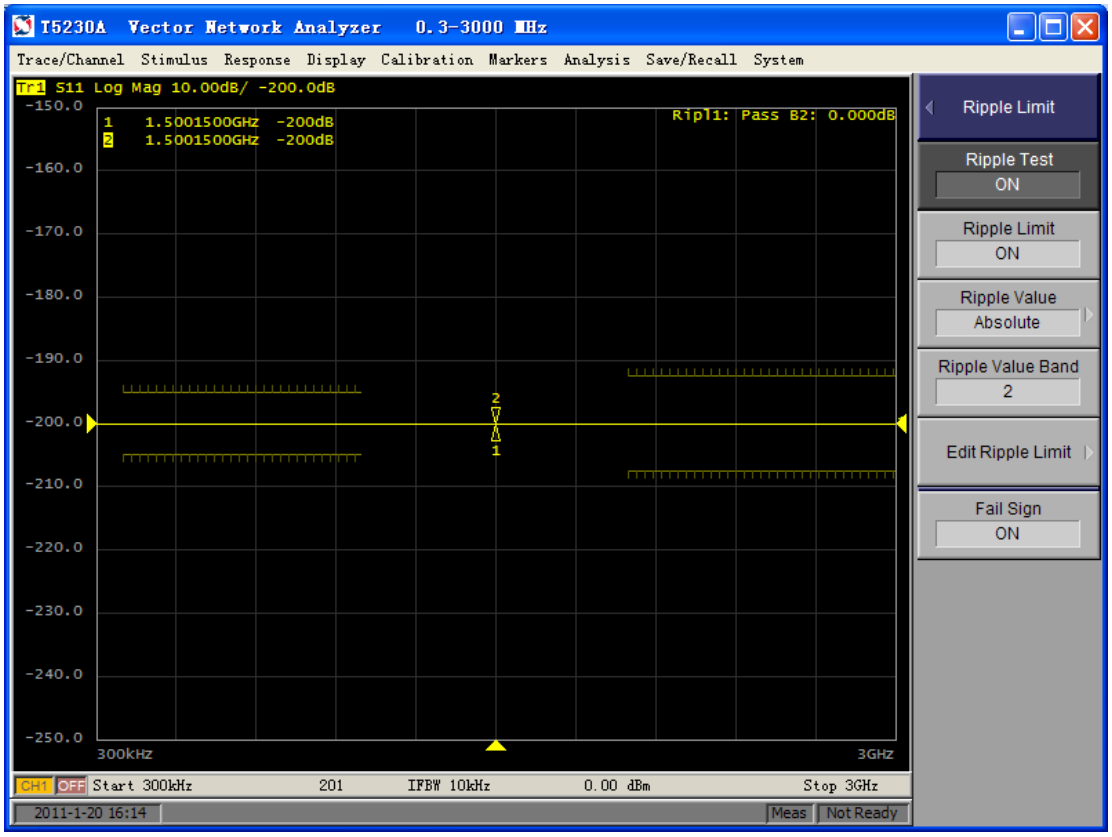


Figure 53 Ripple Limit (Softkeys)

Softkey	Function
Ripple Test	Sets the ripple test ON/OFF.
Ripple Limit	Sets the ripple limit line display ON/OFF.
Ripple Value	Sets how the ripple values are displayed. Available settings are off, absolute value (difference between maximum and minimum values within the band) display, and margin (difference between absolute value of ripple and ripple limit) display.
Ripple Value Band	Selects the band for which the user want to display the ripple value.
Edit Ripple Limit	Opens the ripple limit table for editing the ripple limit. To use the ripple test function, the user must first define the ripple limit.

4. Click Ripple Limit to turn on/off the ripple limit function.
5. Click Ripple Value set how the ripple values are displayed.
6. Click Fail Sign to show the result of ripple limit.

6. 5. Fixture Simulator

The Fixture Simulator is a function that uses software in the S3631 to simulate various measurement conditions based on the measurement results. The functions available in Fixture Simulator are as follows:

1. Port reference impedance conversion
2. Network de-embedding
3. Embedding

1. Port reference impedance conversion

1) Press Channel Next / Channel Prev keys to select the channel on which the user want to use fixture simulator function.

2) Press Analysis .

3) Click Fixture Simulator to enter the next menu. Click Fixture Simulator to turn ON/OFF the function.

4) Click Port Z Conversion, enter the next menu. Click Port Z Conversion to turn ON/OFF the function. Click Port1 Z0 to enter the Z0 data, click Port2 Z0 to enter the Z0 data.

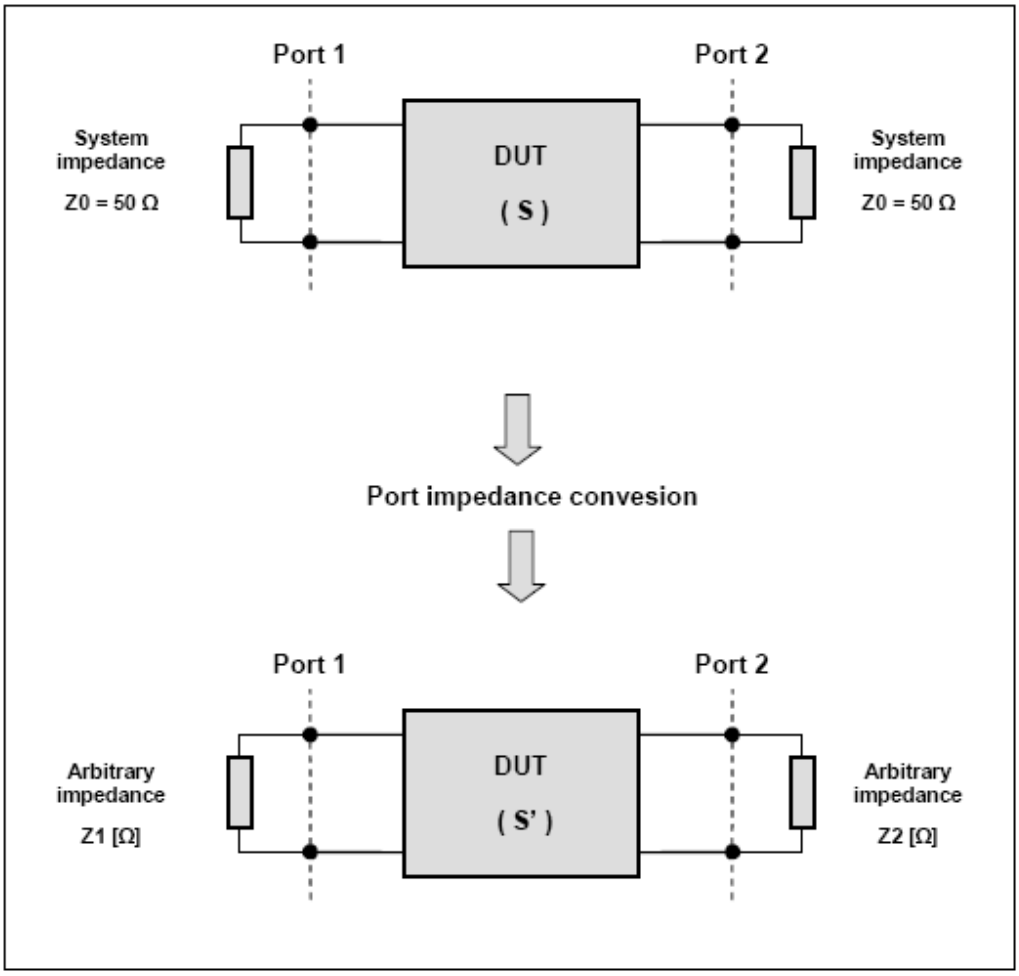


Figure 54 Port Z Conversion

2. Network de-embedding

Network de-embedding is a function for performing measurements, test port by test port, by removing the characteristics of an arbitrary network defined by a Touchstone data file.

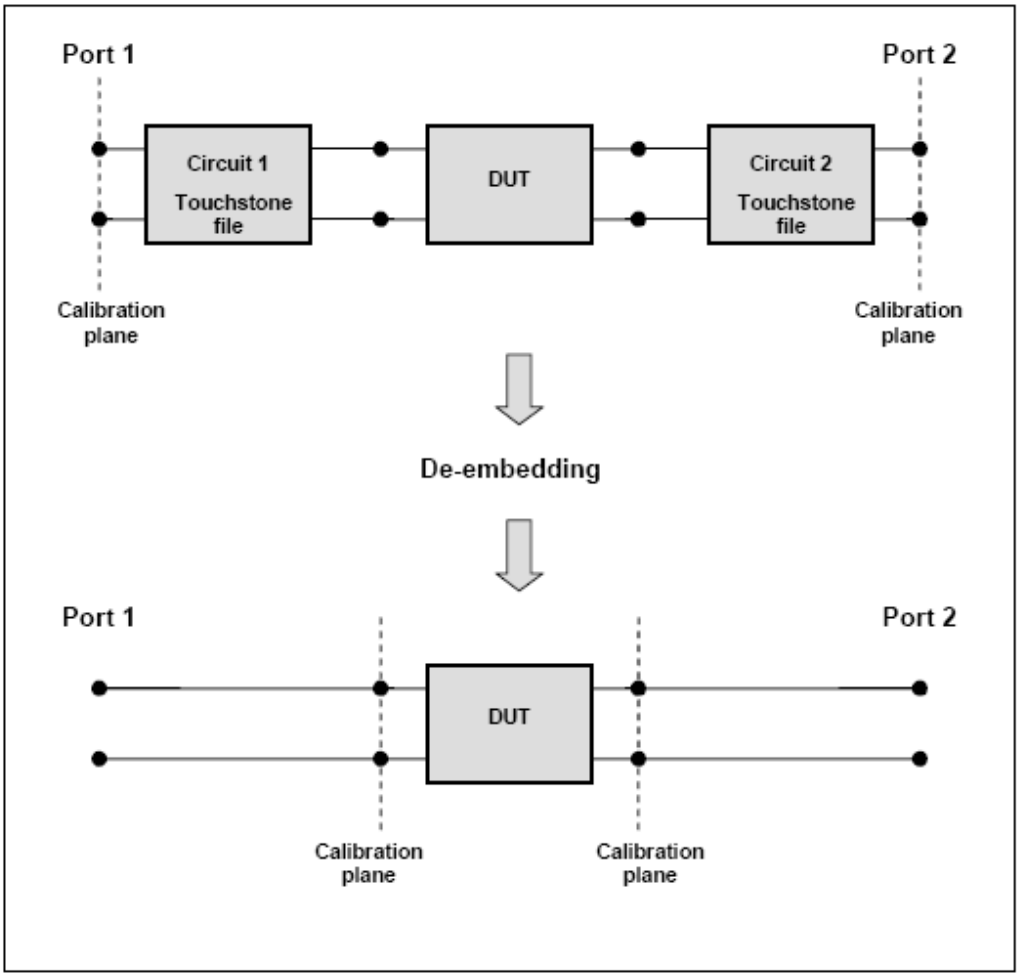


Figure 55 Network De-Embedding

1) Press Channel Next / Channel Prev keys to select the channel on which the user want to use fixture simulator function.

2) Press Analysis .

3) Click De-Embedding to enter the next menu.

4) Click Port1 S-parameters File to open S-parameters of simulation data file, click Port2 S-parameters File to open S-parameters of simulation data file.

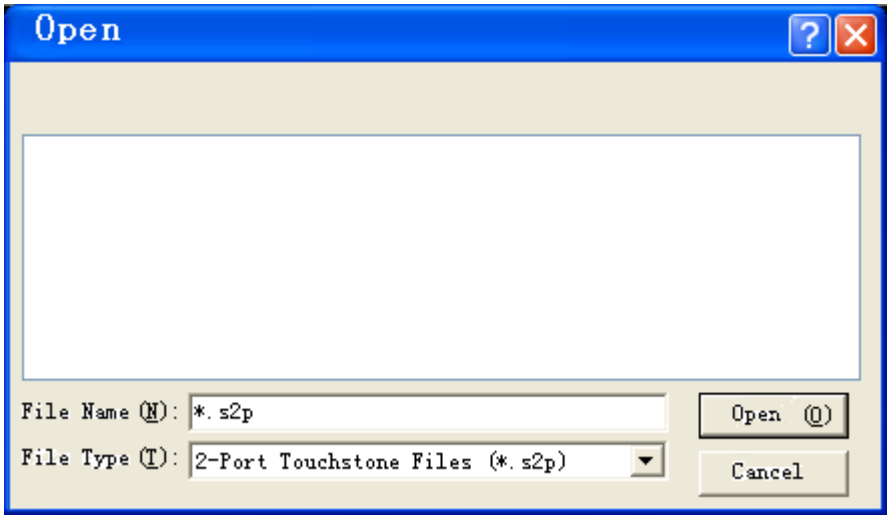


Figure 56 De-Embedding (S parameters of simulation data file)

5) Click Port1 to turn ON/OFF, click Port2 to turn ON/OFF.

3. Embedding

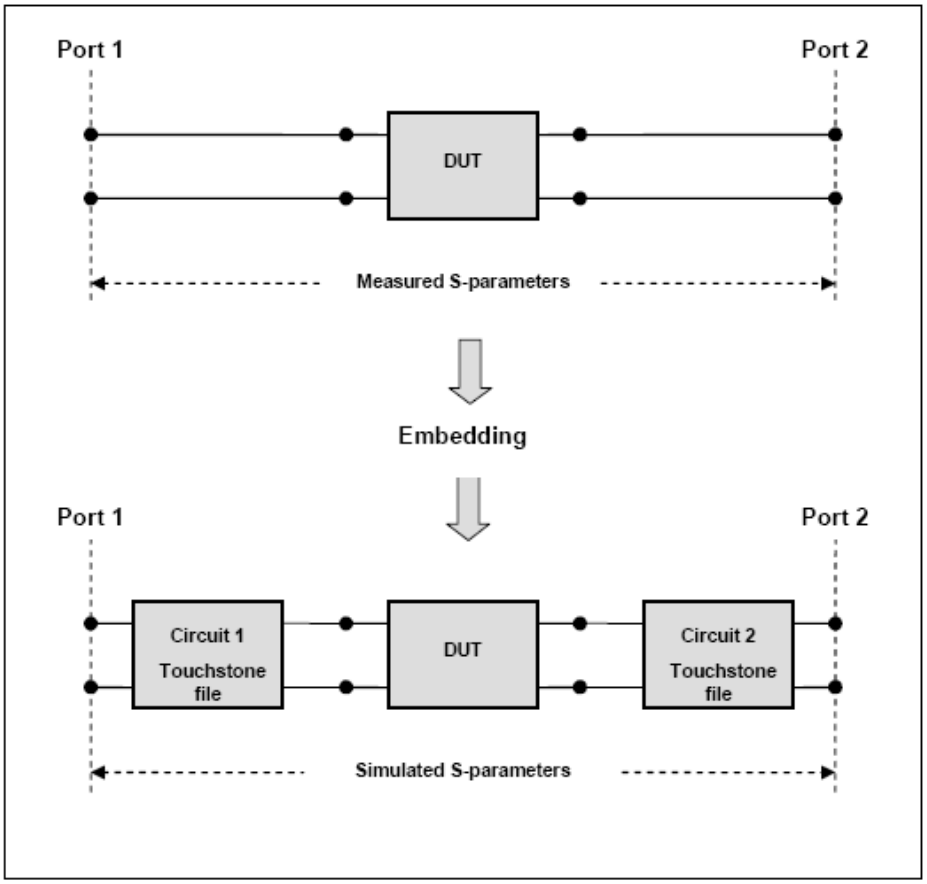


Figure 57 Embedding

6. 6. Time Domain

The S3631 provides the time domain function, which is used to mathematically transform waveforms in the frequency domain that can be measured with a general network analyzer to waveforms in the time domain.

The waveform in the frequency domain shows ripples due to mismatches, but it is difficult to estimate their locations. On the other

hand, from the waveform in the time domain, the user can determine the locations and magnitudes of mismatches.

Operating Procedure:

1. Press Channel Next / Channel Prev keys and Trace Next / Trace Prev keys to select the trace on which the user want to apply the time domain function.
2. Press Analysis to display the Analysis menu.
3. Click Time Domain to display the soft-keys for the time domain.
4. Click Time Domain to turn ON/OFF this function.
5. Click Start and Stop to set the time range, or Click center and span to set the time range.
6. Click Type to select the type, including Bandpass, Lowpass Step, Lowpass Impulse.
7. Click Window to select the shape of window, including Maximum, Normal, Minimum, Impluse Width, KiserBeta.

6. 7. Gating

Deletes unnecessary data in the time domain from original data in the time domain. For more information, refer to Deleting Unnecessary Data in Time Domain (gating). Measurement Flow:

Item	Description
1. Measurement in frequency domain	Executes measurement in frequency domain
2. Transformation to time domain	Enables transformation function and transforms measurement data to data in time domain
3. Setting the gate	Makes the following settings of the gate to select the necessary domain:Gate type, Gate shape, Gate range
4. Transformation back to frequency domain	Disables transformation function and displays response in frequency domain corresponding to the data selected with the gate

The following figure shows the change in the waveform at each step of the flow.

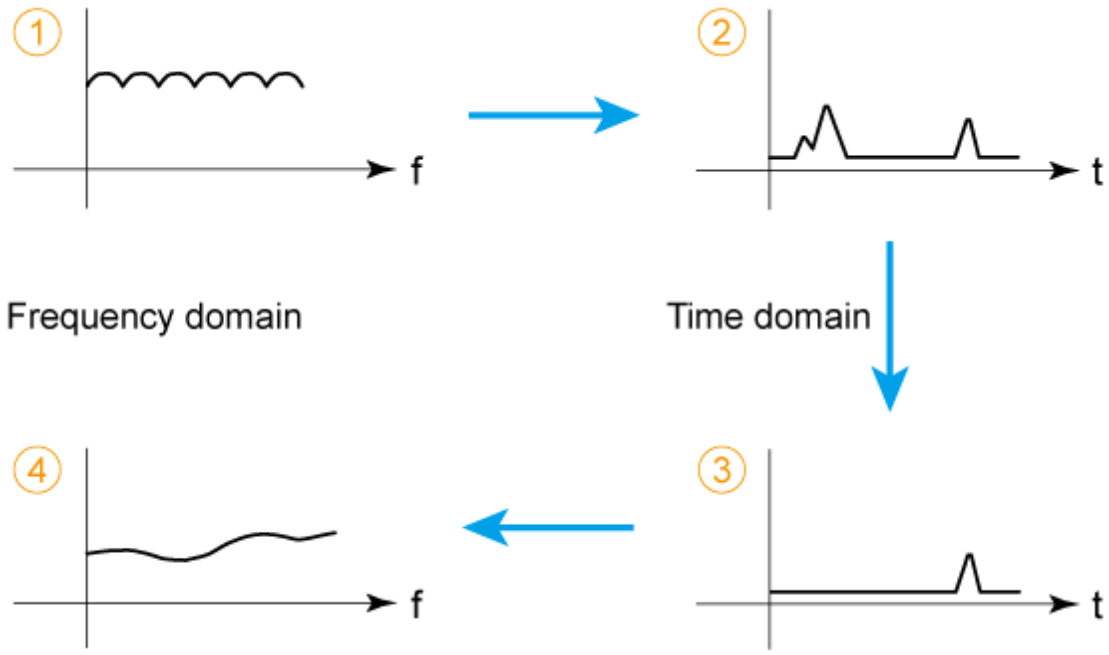


Figure 58 Change in the waveform at each step of the flow

1. Setting Gate Type

The S3631 lets the user choose from the following two gate types:

Gate type	Description
Band pass	Deletes response outside the gate range
Notch	Deletes response inside the gate range

Operating Procedure:

1) Press Channel Next, Channel Prev keys and Trace Next, Trace Prev keys to select the trace on which the user want to apply the gating function.
2) Press Analysis to display the Analysis menu.
3) Click gating to display the soft-keys for the gating.
4) Click Type to select the type, including Bandpass and Notch.

2. Setting Gate Shape

The gate is a filter whose shape looks like a band pass filter. There are several parameters that indicate the gate shape. The following figure shows the definition of the gate shape parameters.

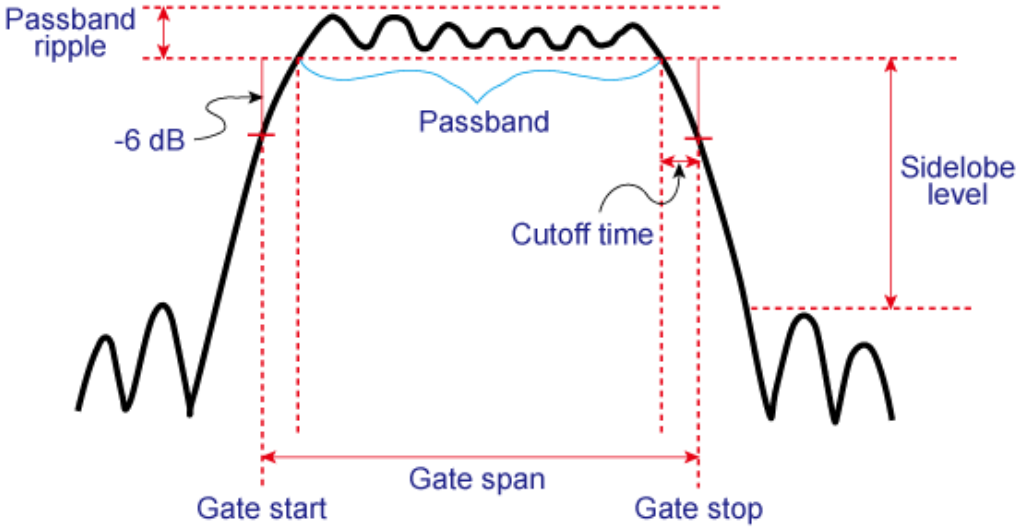


Figure 59 Gating (the definition of the gate shape parameters)

The following table compares the characteristics according to the gate shape.

Gate shape	Sidelobe level	Minimum gate span
Minimum	-48 dB	2.8/frequency span
Normal	-68 dB	5.6/frequency span
Wide	-57 dB	8.8/frequency span
Maximum	-70 dB	25.4/frequency span

Operating Procedure:

1) Press Channel Next / Channel Prev keys and Trace Next / Trace Prev keys to select the trace on which the user want to apply the gating function.

2) Press Analysis to display the Analysis menu.

3) Click gating to display the soft-keys for the gating.

4) Click Shape to select the shape of window.

3. Setting Gate Range

Specify the gate range in time. The ends of the range are defined as the - 6 dB attenuation points shown in the figure above. the user can set the gate range by specifying the start and stop times or the center and span. The S3631 has the following limitations on the gate range the user can set.

Lower limit: $-T_{span}$,

Upper limit: T_{span}

T_{span} is the measurement range expressed in time obtained in Measurement range.

Operating Procedure:

1) Press Channel Next / Channel Prev keys and Trace Next / Trace Prev keys to select the trace on which the user want to apply the gating function.

2) Press Analysis to display the Analysis menu.

3) Click gating to display the soft-keys for the gating.

4) Click Start and Stop to set the time range, or click center and span to set the time range.

4. Enabling Gating Function

Operating Procedure:

1) Press Channel Next / Channel Prev keys and Trace Next / Trace Prev keys to select the trace on which the user want to apply the gating function.

2) Press Analysis to display the Analysis menu.

3) Click gating to display the soft-keys for the gating.

4) Click Gating to turn ON/OFF the gating function.

6. 8. Performing Parameter Conversion of Measurement Results

1. The user can use the parameter conversion function to convert the measurement results of the S-parameter (Sab) to the following parameters.

   1) Equivalent impedance (Zr) and equivalent admittance (Yr) in reflection measurement

$$Z_r = Z_{0a} \times \frac{1 + S_{ab}}{1 - S_{ab}},\ Y_r = \frac{1}{Z_r}$$

   2) Equivalent impedance (Zt) and equivalent admittance (Yt) in transmission measurement

$$Z_t = \frac{2 \times \sqrt{Z_{0a} \times Z_{0b}}}{S_{ab}} - (Z_{0a} + Z_{0b}),\ Y_t = \frac{1}{Z_t}$$

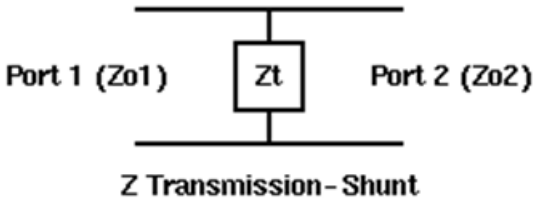
3) Inverse S-parameter (1/Sab)

where:

Z0a: Characteristic impedance of port a

Z0b: Characteristic impedance of port b

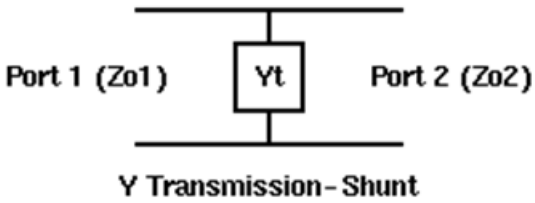
4) Z/Y Transmission Shunt



$$Zt = \frac{1}{Yt}$$

$$Yt = \frac{2\sqrt{Yo1 \cdot Yo2}}{S} - (Yo1 + Yo2)$$

$$Yo1 = \frac{1}{Zo1} \quad Yo2 = \frac{1}{Zo2}$$



5) Conjugation

Conjugation converts the measurement value to complex conjugate number.

When the fixture simulator function is ON and the port impedance function is ON, the value set in the port impedance conversion is used. In other cases, the system Z0 (preset value: 50 ohm) is used.

2. ON/OFF

Operating Procedure:

1) Press Channel Next / Channel Prev keys and Trace Next / Trace Prev keys to select the trace on which the user want to use the marker.

2) Press Analysis to display the Analysis menu.

3) Click Conversion.

4) Click Conversion to turn ON the conversion function.

3. Selecting Conversion Target Parameter

Operating Procedure:

1) Press Channel Next / Channel Prev keys and Trace Next / Trace Prev keys to select the trace on which the user want to use the marker.

2) Press Analysis to display the Analysis menu.

3) Click Conversion > Function.

4) Click the soft-key corresponding to the parameter to which the user want to convert the result.

7. Data Output

7. 1. Saving Data

7. 1. 1. Overview Save Type

The user can save the instrument state of the S3631 into a file on mass storage and then recall it later to reproduce that state. the user can select the stored data from the following four types.

Type	Stored data and usage
State only (State Only)	Saves the setting of the S3631 and reproduces the state when it was saved by recalling it later into the S3631.
State and calibration data (State & Cal)	Saves the setting of the S3631 and calibration data (calibration coefficient array) to reproduce the state when it was saved by recalling it later into the S3631. At this time, the user can perform error correction of measured values by using the recalled calibration data.
State and trace (State & Trace)	Saves the setting of the S3631 and traces (error-corrected data array and error-corrected memory array) to reproduce the state when it was saved by recalling it later into the S3631. At this time, the traces are also recalled and displayed on the screen.
State, calibration data, and traces (All)	Saves the setting of the S3631, calibration data, and traces to reproduce the state when it was saved by recalling it later into the S3631. At this time, the calibration data and traces are also recalled.

7. 1. 2. Saving Instrument State

Operating steps:

1. Press Save key.
2. Click Save Type.
3. Press key or ESC key, Save
4. Click Save State.
5. Press , and Choose（State1~State10）, Press Enter key, or Click StateFile, Choose to save state file, Click save button.

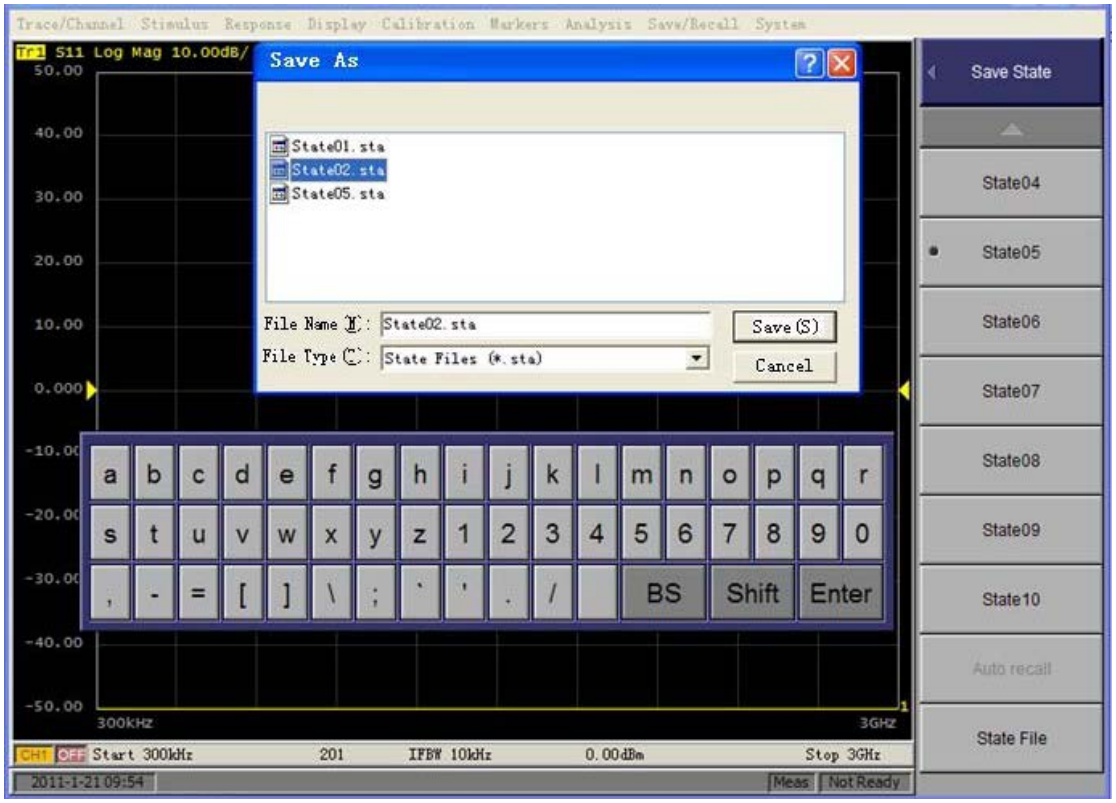


Figure 60 Save State (State Select)

7. 1. 3. Save Channel

The S3631 allows the user to save/recall the instrument state for each channel independently. This function allows the user to save the instrument state of the active channel independently into one of four registers (A to D, volatile memory) and to recall the instrument state from the register to restore it as the state of the currently active channel. As in the case of saving the entire state of the instrument into a file, the user can select items to be saved from four kinds.

Since the user can recall the instrument state for each channel that was saved with this function from a different channel that the one used to save it, this function is very useful for copying an instrument state between channels.

ATTENTION: Unlike when saving the entire instrument state, the instrument state for each channel is saved into volatile memory instead of a file, so if the user turn off the power, this state is lost.

Operating steps：

1. Press Channel Next or Channel Prev Key, to activate a channel whose state the user want to save.
2. Press Save Key.
3. Click Save Channel.
4. Click one of State A to State D to save the instrument state of the active channel to the specified register. For registers having saved data, the "●" symbol is displayed to the right of their soft-key label. If the user specify one of these, its content is overwritten.

7. 1. 4. Save Trace Data

The S3631 allows the user to save data for the active trace on the active channel to a CSV file (file extension *.csv) and to load the data into PC application software for further processing.

Procedure:

1. Press Channel Next or Channel Prev Key and Press Trace Next or Trace Prev Key to select the trace to be

saved.

2. Press Save Key.
3. Click Save Trace Data to open the Save As dialog box, Select the destination folder and input a file name，Click Save to save the file.

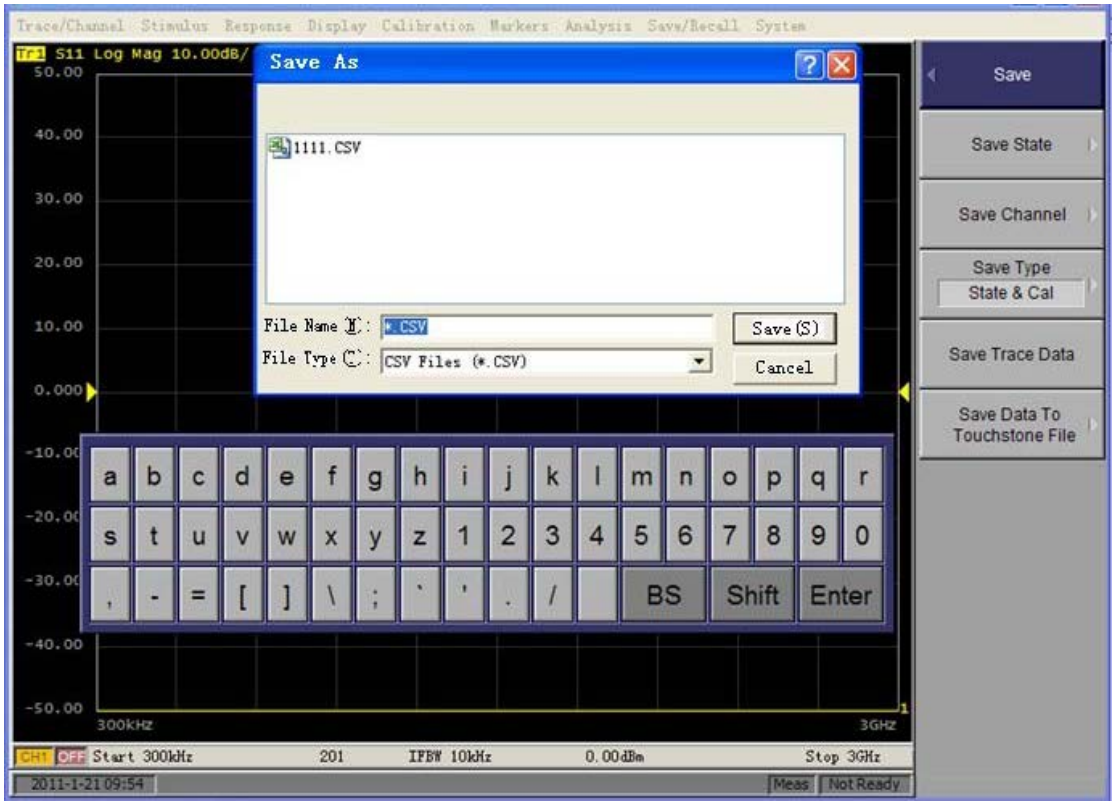


Figure 61 Save Trace Data

7. 2. Save Data in ToutchStone

The user can save data in "log magnitude - angle", "linear magnitude - angle", or "real number - imaginary number." File types are *.s1p or *.s2p。 The file type indicates the number of ports of the data structure that is output to the Touchstone file.

Operating Procedure:

1. Press Channel Next or Channel Prev Key and Press Trace Next or Trace Prev Key, to select the trace to be saved.
2. Press Save Key.
3. Click Save Data To Touchstone File.
4. Click Type, Choose file types, Click 1-Por（.s1p）, Choose s1p, Click2-Por（s2p）Choose s2p, Selected function button before “●”.
5. Press Key or ESC Key, Save Data To Touchstone File.
6. If choose file type is s1p, Need to choose port, Otherwise, don't need this step operation. Click Select Port, Each click once, On a 1, 2 switching.
7. Click Format, In Touchstone Format, choose file type. File type Shown below:

Softkey	Function

Real-Imaginary	Select "real - imaginary number" data format
Magnitude-Angle	Select "linear magnitude - angle" data format
dB-Angle	Select "log magnitude - angle" data format

8. Press Key or Save Key, Return Save Data To Touchstone File.
9. Click Save File, Open “save as” dialog box, Input to save the filename, Click save.

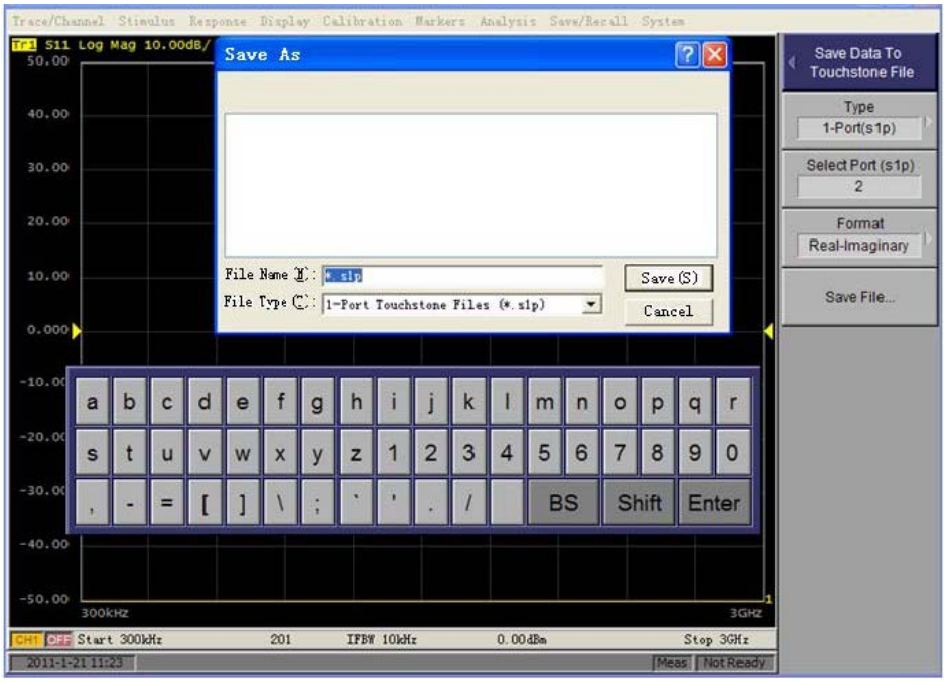


Figure 62 Save Data in ToutchStone

7. 3. Recall

7. 3. 1. Recall State

Operating Procedure:

1. Press Recall Key， Into Recall.
2. Click Recall State， Into Recall State.
3. Press Key，Choose State1~State10（Only the instrument has saved state can choose），Press Key，or Click State File， Choose the instrument saved State File
4. Click Open. Shown below：

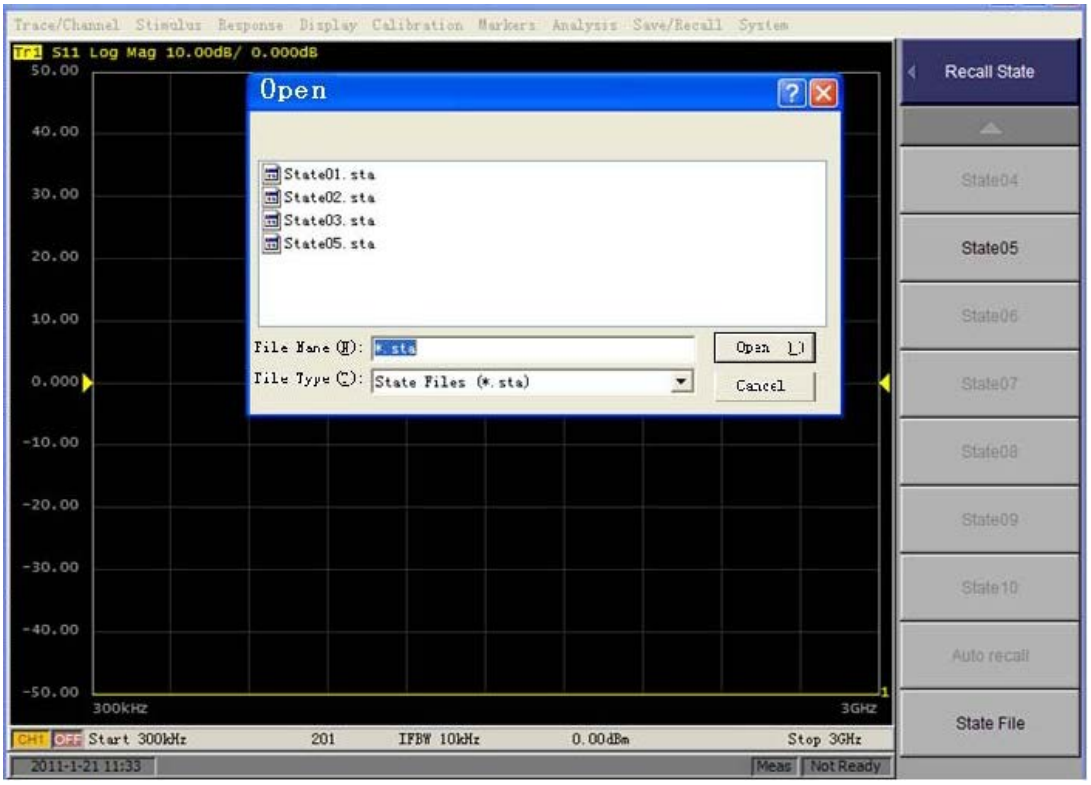


Figure 63 Recall State

7. 3. 2. Recall Channel

Operating Procedure:

1. Press Recall Key，Into Recall menu.
2. Click Recall Channel，Into Recall C menu.
3. Press ↑ ↓ Key，Click one of State A to State D to save the instrument state of the active channel to the specified register，Press Enter Key，Shown below：

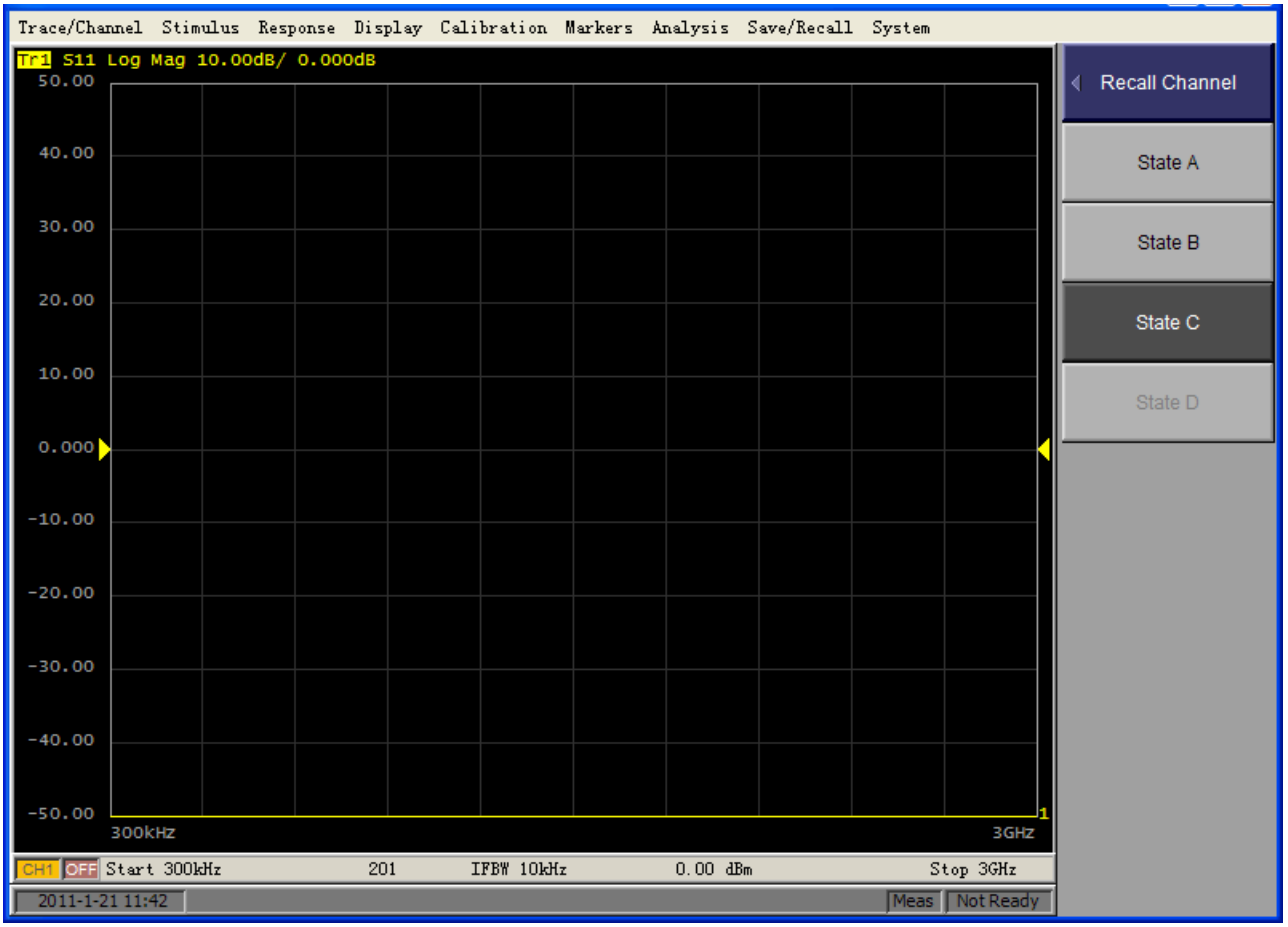


Figure 64 Recall Channel

7. 3. 3. Delete State

Operating Procedure:

1. Press Recall Key.
2. Click Delete State， Open Delete State File， Choose to Delete State File， Click Open， Shown below：

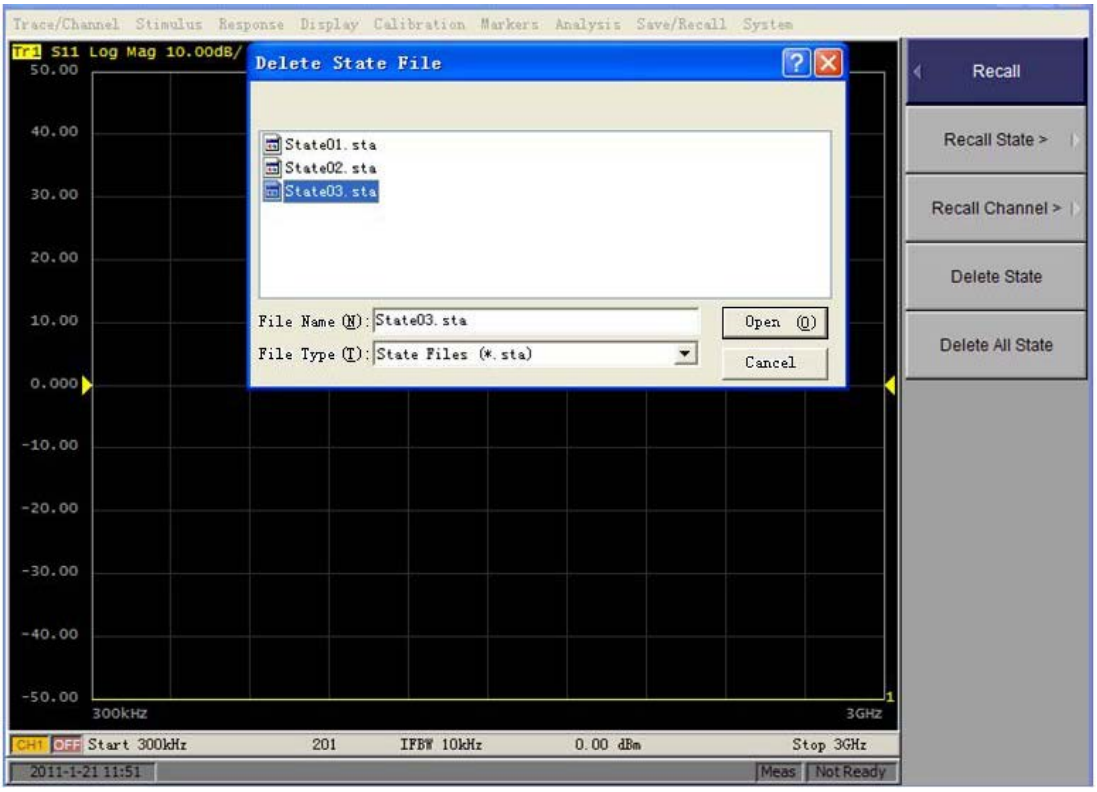


Figure 65 Delete State

7. 3. 4. Delete All State

Operating Procedure:

1. Press Recall Key.
2. Click Delete All State， Shown below：

Figure 66 Delete All State

8. Optimizing Measurements

8. 1. Expanding Dynamic Range

The dynamic range is the finite difference between the maximum input power level and the minimum measurement power level (noise floor) of the analyzer. In evaluating a characteristic accompanied by a large change in the amplitude (the pass band and stop band of a filter, for example), it is important to increase the dynamic range.

Lowering the noise floor of the receiver Enables the user to expand the dynamic range. The following methods can be used to lower the receiver noise floor.

1. Narrowing the IF bandwidth
2. Turning on Sweep Averaging

8. 1. 1. Narrowing the IF bandwidth

Narrowing the receiver IF bandwidth Enables the user to reduce the effect of random noise on measurements. Narrowing the IF bandwidth to 1/10 the original bandwidth causes the receiver noise floor to decrease by 10 dB.

To specify the IF bandwidth, follow the steps described below.

1. Press Channel Next or Channel Prev Key, to select a channel on which to specify the IF bandwidth.
2. Press Avg Key.
3. Click IF Bandwidth.
4. Change the IF bandwidth in the data entry area.

8. 1. 2. Turning on Sweep Averaging

Using sweep averaging also Enables the user to reduce the effects of random noise on measurements. Sweep averaging averages data from each point (vector quantity) based on the exponential average of a continuous sweep weighted by the averaging factor specified by the user. Sweep averaging is expressed in following equation.

$$A_n = \frac{S_n}{F} + \left(1 - \frac{1}{F}\right) \times A_{n-1}$$

Where:

1. A_n = Result of the calculation of sweep averaging for the nth sweep operation at the point in question (a vector quantity)
2. S_n = Measurement value obtained at the nth sweep operation at the point in question (a vector quantity)
3. F = Sweep averaging factor (an integer between 1 and 999)

Define the sweep averaging by following the steps below.

1. Press or Key， select the channel on which the user want to define the sweep averaging.
2. Press key。
3. Click Ave Factor
4. Change the averaging factor in the data entry area.。
5. Click Averaging to turn on/off the function.

8. 2. Reducing Trace Noise

Smoothing can be used to reduce noise that has relatively small peaks. By turning on smoothing, the value of each point on a trace is represented by the moving average over the values of several nearby points. The smoothing aperture (percentage of sweep span) defines the range of points to be included in the calculation of the moving average.

Set up the smoothing operation by following the steps below:

1. Press Channel Next or Channel Prev Key and Press Trace Next or Trace Prev Key，To activate the trace on which smoothing will be defined.
2. Press Avg Key.
3. Click Smo Aperture.
4. Change the Smoothing aperture (%) in the data entry area
5. Click Smoothing，Turn ON the Smoothing，Be Open Smoothing；Turn OFF the Smoothing，Be turn OFF the Smoothing.

8. 3. Improving Phase Measurement Accuracy

8. 3. 1. Electrical Delay

Electrical Delay is a function that adds or removes a pseudo-lossless transmission line with a variable length corresponding to the receiver input. Using this function Enables the user to improve the resolution in phase measurement and thereby measure deviation from the linear phase. the user can specify the electrical delay trace by trace. Depending on the media type, the calculation method of the electrical delay, which is required to correct the phase delay, differs.

Operating Procedure:

1. Press Channel Next or Channel Prev Key and Press Trace Next or Trace Prev Key，To activate the phase trace for which the user want to specify the Electrical Delay.
2. Press Scale Key.
3. Click Electrical Delay.
4. Change the electrical delay （Entry） in the data entry area.

8. 3. 2. Phase Offset

Phase offset is a function used to add or subtract a predetermined value relative to the frequency to and from the trace. Using this function Enables the user to simulate the phase offset occurring as a result of, say, adding a cable. The phase offset can be specified from -360° to +360°.

Operating Procedure:

1. Press Channel Next or Channel Prev Key and Press Trace Next or Trace Prev Key，To activate the phase trace for which the user want to specify the Phase Offset.
2. Press Scale Key.
3. Click Phase Offset, Change the Phase Offset(Entry) in the data entry area.

8. 4. Improve the measurement speed

8. 4. 1. Turn Off Update

Operating Procedure:

1. Press Display Key.
2. Click Update, State witch to OFF.

8. 4. 2. Turn Off Correction

1. Turn off measure calibration data.
   1) Press Cal Key.
   2) Click Correction, State witch to OFF.
2. Turn Off System calibration data
   1) Press System Key.
   2) Click Misc Setup.
   3) Click System Correction, Turn ON the System Correction, Be the System Correction; Turn OFF the System Correction, Be turn OFF the System Correction.

8. 4. 3. Performing a Segment-by-Segment Sweep

8. 4. 3. 1. Concept of Segment Sweep

To perform a segment sweep, the user must define two or more frequency ranges, called segments, and then specify the number of points, IF bandwidth, power level, sweep mode, sweep delay time, and sweep time for each segment. All segments are swept sequentially as if swept in one sweep operation.

- By skipping the frequency range, which does not need to be measured, the user can sweep and measure only the portions the user need.
- The user can define the optimum measurement conditions for each of the segments the user designate. For example, the user can specify as many points as possible in a segment requiring high trace resolution and as few points as possible in a segment not requiring high resolution. This shortens the measurement time, Enabling the user to optimize the overall measurement throughput by not having to perform the entire operation under the same measurement conditions of a particular frequency range.

To evaluate a band pass filter having the transmission characteristics shown in the following figure. for example, the user can select the frequency ranges the user need from A through G and determine the measurement conditions shown in the table below This Enables the user to measure them simultaneously in one sweep operation.

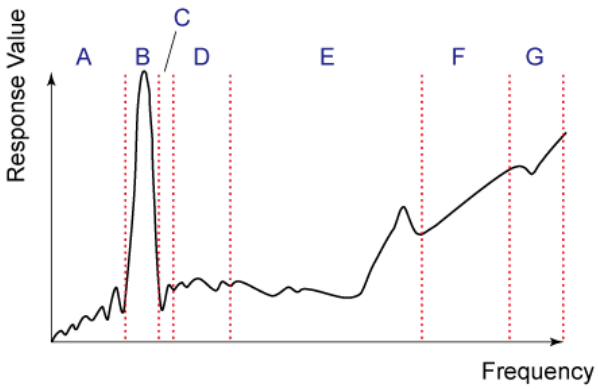


Figure 67 Segment Sweep

No.	Start Frequency	Stop Frequency	Number of points	IF Bandwidth	Power	Delay
A	440 MHz	915MHz	50	50kHz	0dBm	0s

No.	Start Frequency	Stop Frequency	Number of points	IF Bandwidth	Power	Delay
B	915 MHz	980MHz	130	70kHz	0dBm	0s
C	980 MHz	1.035GHz	60	50kHz	0dBm	0s
D	1.035GHz	1.07GHz	60	50kHz	0dBm	0s
E	1.07GHz	2GHz	100	70kHz	0dBm	0s
F	2GHz	2.6GHz	40	70kHz	0dBm	0s
G	2.6GHz	3GHz	40	70kHz	0dBm	0s

8. 4. 3. 2. Conditions for Setting Segment Sweep

The following conditions apply when setting up a segment sweep.

1. The frequency range of a segment must not overlap with that of another segment. (The start frequency of a segment must be higher than the stop frequency of the immediately preceding segment).
2. The start frequency of segment 1 must be greater than lowest frequency and the stop frequency of the last segment less than highest frequency, as per the frequency range depending on the option.
3. When the start frequency and stop frequency of a segment are not the same, the user can define from 2 to 2001 points in a segment.
4. When the start frequency and stop frequency of a segment are the same, the user can define from 1 to 2001 points in a segment.
5. The user can set the total number of points in the segment table from 2 to 2001.
6. The user can set the number of segments in the segment table to between 1 and 12.
7. The user can turn ON or OFF segments.

Data Item	Description
Start	Sets the start value of the sweep range
Stop	Sets the stop value of the sweep range
Points	Sets the number of points
IFBW	Sets the IF bandwidth
POWER	Sets the power level
Delay	Sets the sweep delay time

Operating Procedure:

1. Press Channel Next or Channel Prev Key, Choose to a new Segment Table data.
2. Press Sweep Setup Key.
3. Click Segment Table, Into Segment Table.

Softkey	Function
Add	Add a line in Segment table data
Delete	Delete the last line in Segment table data
Edit	Edit in Segment table data

Softkey	Function
List IFBW	ON/OFF IFBW
List Power	ON/OFF Power
List Delay	ON/OFF Delay

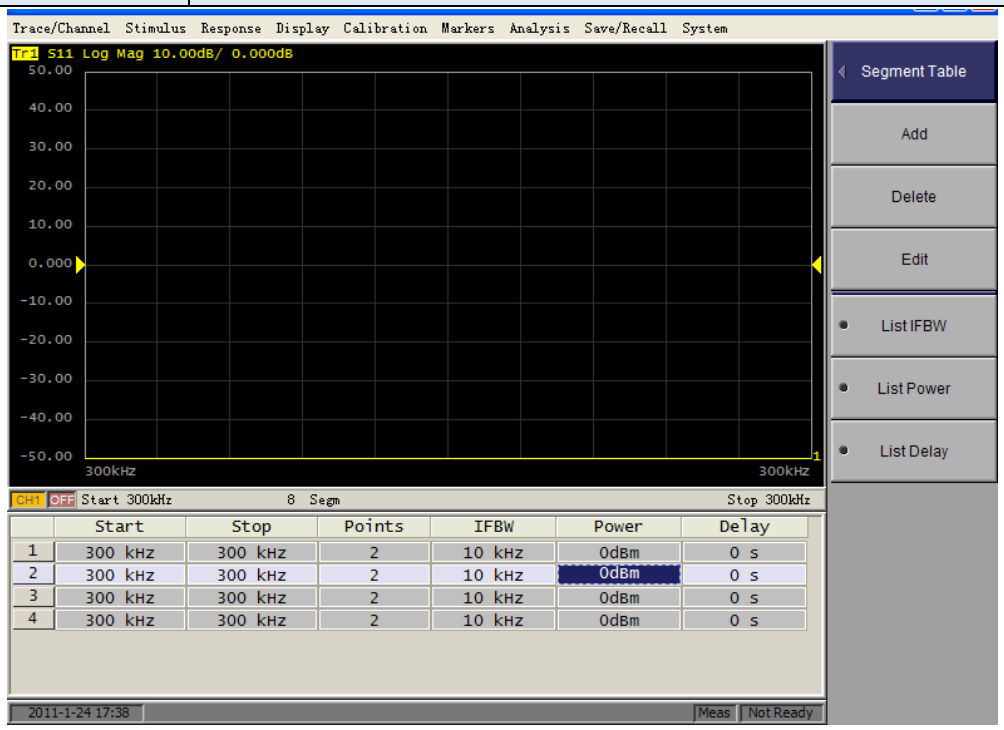


Figure 68 Segment Sweep

8. 4. 3. 3. Turning ON/OFF Segments

Operating Procedure:

1. Press Channel Next or Channel Prev Key, Choose to The Segment Working trace.
2. Press Sweep Setup Key.
3. Creating a segment table.
4. Click Sweep Type.
5. Click Segment.

9. System Function

9. 1. Print

9. 1. 1. Print Function

Operating Procedure:

1. Press System Key.
2. Click Print.
3. As necessary, press Invert Image to toggle between [OFF] for printing in colors close to the actually displayed screen and [ON] for printing in inverse colors.
4. Click Print, Shown below, Click “OK” begin to print.

9. 1. 2. Save Image To File

Operating Procedure:

1. Press System Key.
2. Click Print.
3. As necessary, press Invert Image to toggle between [OFF] for printing in colors close to the actually displayed screen and [ON] for printing in inverse colors.
4. Click Save Image to File, shown below, enter the file name, and click Open to save.

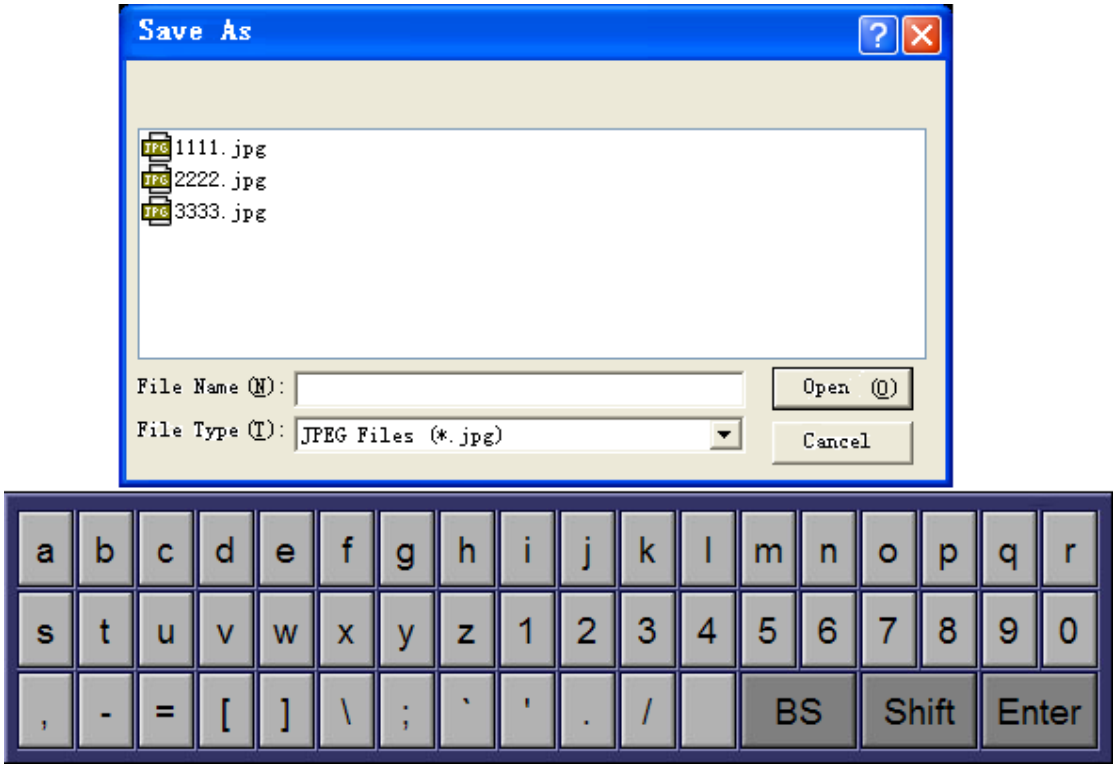


Figure 69 Save Image to File

9. 2. Misc Setup

9. 2. 1. Ref Source setup

Operating Procedure:

1. Press System Key.
2. Click Misc Setup.
3. Click Ref Source, Choose Interal or Choose External.

9. 2. 2. System Correction

The S3631 executes Port Characteristics Correction in the data processing flow shown in Data Processing Flowchart, by using the system calibration data set at the factory. This system error correction process is not required if the user performs proper calibration by using the Cal key and the soft-keys that subsequently appear, which automatically turns on error correction.

By turning off system error correction, the user can reduce the data processing time needed during measurement and thus improve measurement throughput.

Operating Procedure:

1. Press System .
2. Click Misc Setup.
3. Click System Correction to turn ON/OFF the system correction

9. 2. 3. Beeper Setup

The S3631 has a speaker that sounds a beep tone. The beeper allows the user to make two types of settings.

Type	Function
Operation complete beeper	Sounds a beep tone to inform the user that operations have completed. * When calibration data measurements are done * When data storage has completed
Warning beeper	Sounds a beep tone to prompt the user to use caution. * When an instrument error occurs (An error message appears at the same time.) * When a limit test fails

1. Setting the Operation Complete Beeper

Operating Procedure:

1) Press System .
2) Click Misc Setup > Beeper > Beep Complete to switch the operation complete beeper on/off.
3) Clicking Test Beep Complete allows the user to hear and check the beep tone of the operation complete beeper.

2. Setting the Warning Beeper

Operating Procedure:

1) Press System .
2) Click Misc Setup > Beeper > Beep Warning to switch the warning beeper on/off.
3) Clicking Test Beep Warning allows the user to hear and check the beep tone of the warning beeper.

9. 2. 4. Locking the Front Keys and the Touchscreen

The user can lock (disable) the front keys and touchscreen. This feature prevents erroneous operation caused by inadvertently touching

any of these devices.

Operating Procedure:

1. Press System.
2. Click Misc Setup.
3. Click Keyboard Lock to lock the front keys.
4. Click Touch Screen Lock to lock the touch screen.
5. If both keyboard and touch screen are locked, the user should to press Enter to unlock them.

9. 2. 5. Setup the color of trace

Operating Procedure:

1. Press System.
2. Click Misc Setup.
3. Click Color Setup.
4. Click trace to select one.
5. Click Red/Green/Blue to setup the color.

9. 2. 6. Time Setup

Operating Procedure:

1. Press System.
2. Click Misc Setup.
3. Click Time Setup to set the time.
4. Click OK to save and exit.

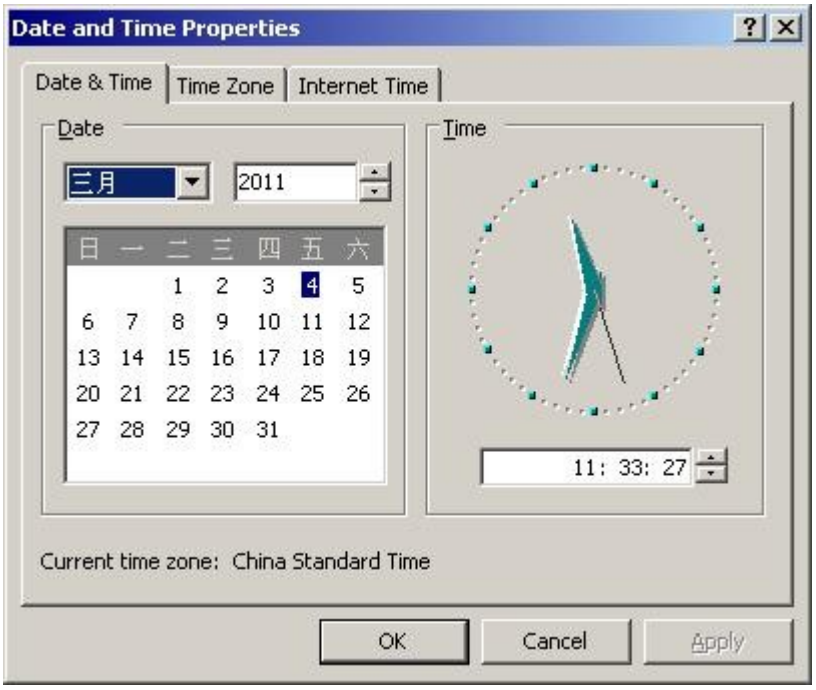


Figure 70 Time Setup

9. 2. 7. Touchscreen Calibration

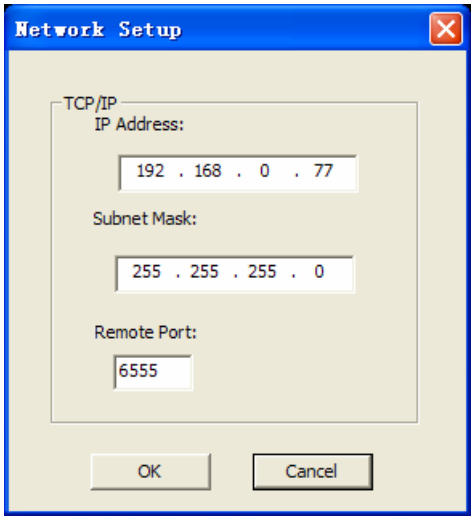
Operating Procedure:

1. Press System .
2. Click Misc Setup.
3. Click Touchscreen Cal.

9. 3. LAN Setup

Operating Procedure:

1. Press System .
2. Click Network Setup, the window is shown below.



3. Edit IP Address、Subnet Mask, then press OK.

9. 4. Preset

Operating Procedure:

1. Press Preset .
2. Click OK.

9. 5. File Manage

With thisfunction, the user can copy files from the instrument to the U-disk. And the user can copy files from U-disk into the instrument, too.

Operating Procedure:

1. Press System .
2. Click File Manage.
3. Insert the U-disk device.
4. Select the files the user want to copy.
5. Click the <<< or >>> button.

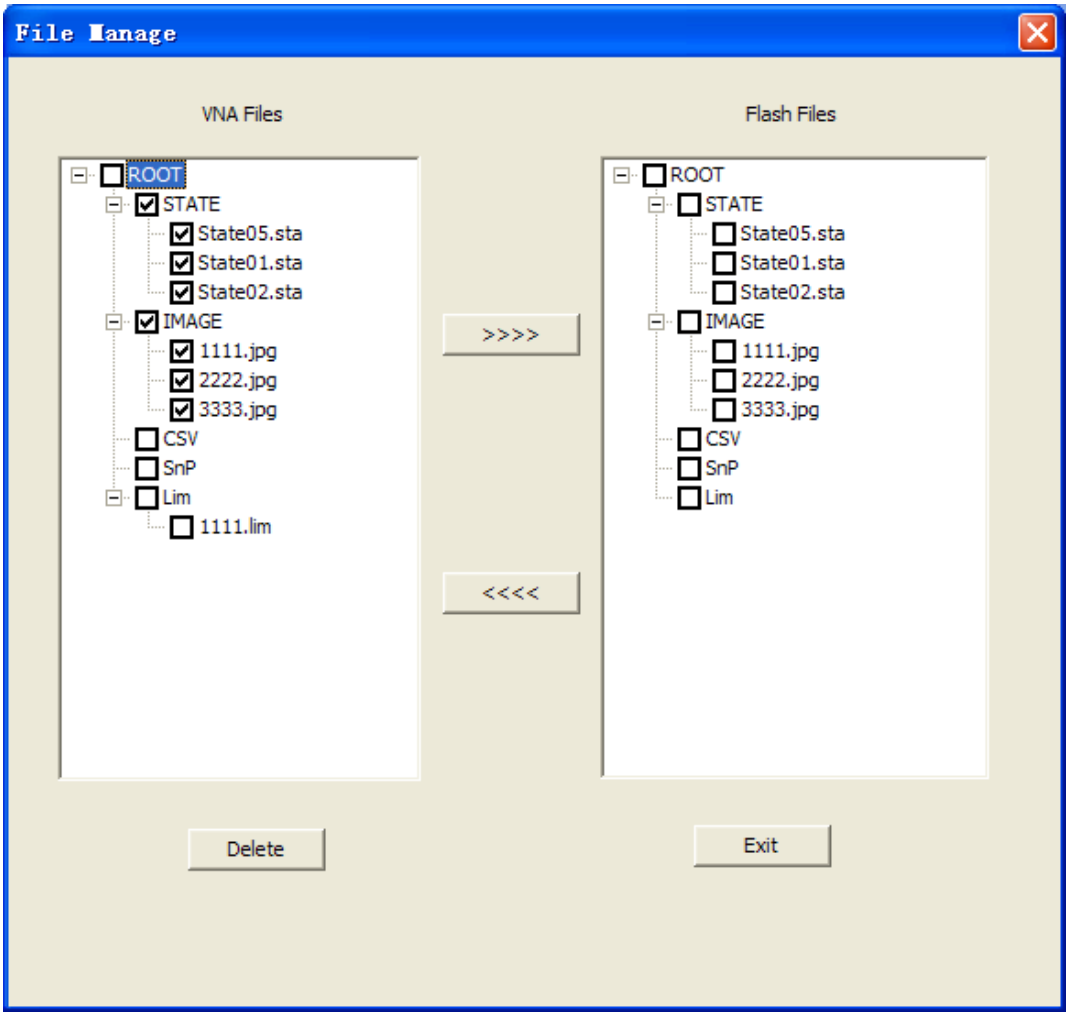


Figure 71 File Manage

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