

# **RIGOL**

## **User Guide**

# **Vector Network Analyzer**

Applicable to RSA5000N/RSA3000N

**Jul. 2020**

**RIGOL TECHNOLOGIES CO., LTD.**



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## Publication Number

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## Software Version

00.03.00

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E-mail: [service@rigol.com](mailto:service@rigol.com)

Website: [www.rigol.com](http://www.rigol.com)

# Safety Requirement

## General Safety Summary

Please review the following safety precautions carefully before putting the instrument into operation so as to avoid any personal injury or damage to the instrument and any product connected to it. To prevent potential hazards, please follow the instructions specified in this manual to use the instrument properly.

### **Use Proper Power Cord.**

Only the exclusive power cord designed for the instrument and authorized for use within the local country could be used.

### **Ground the Instrument.**

The instrument is grounded through the Protective Earth lead of the power cord. To avoid electric shock, connect the earth terminal of the power cord to the Protective Earth terminal before connecting any input or output terminals.

### **Connect the Probe Correctly.**

If a probe is used, the probe ground lead must be connected to earth ground. Do not connect the ground lead to high voltage. Improper way of connection could result in dangerous voltages being present on the connectors, controls or other surfaces of the oscilloscope and probes, which will cause potential hazards for operators.

### **Observe All Terminal Ratings.**

To avoid fire or shock hazard, observe all ratings and markers on the instrument and check your manual for more information about ratings before connecting the instrument.

### **Use Proper Overvoltage Protection.**

Ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the operator might be exposed to the danger of an electric shock.

### **Do Not Operate Without Covers.**

Do not operate the instrument with covers or panels removed.

### **Do Not Insert Objects into the Air Outlet.**

Do not insert objects into the air outlet, as doing so may cause damage to the instrument.

### **Use Proper Fuse.**

Please use the specified fuses.

**Avoid Circuit or Wire Exposure.**

Do not touch exposed junctions and components when the unit is powered on.

**Do Not Operate with Suspected Failures.**

If you suspect that any damage may occur to the instrument, have it inspected by **RIGOL** authorized personnel before further operations. Any maintenance, adjustment or replacement especially to circuits or accessories must be performed by **RIGOL** authorized personnel.

**Provide Adequate Ventilation.**

Inadequate ventilation may cause an increase of temperature in the instrument, which would cause damage to the instrument. So please keep the instrument well ventilated and inspect the air outlet and the fan regularly.

**Do Not Operate in Wet Conditions.**

To avoid short circuit inside the instrument or electric shock, never operate the instrument in a humid environment.

**Do Not Operate in an Explosive Atmosphere.**

To avoid personal injuries or damage to the instrument, never operate the instrument in an explosive atmosphere.

**Keep Product Surfaces Clean and Dry.**

To avoid dust or moisture from affecting the performance of the instrument, keep the surfaces of the instrument clean and dry.

**Prevent Electrostatic Impact.**

Operate the instrument in an electrostatic discharge protective environment to avoid damage induced by static discharges. Always ground both the internal and external conductors of cables to release static before making connections.

**Use the Battery Properly.**

Do not expose the battery (if available) to high temperature or fire. Keep it out of the reach of children. Improper change of a battery (lithium battery) may cause an explosion. Use the **RIGOL** specified battery only.

**Handle with Caution.**

Please handle with care during transportation to avoid damage to keys, knobs, interfaces, and other parts on the panels.

## Safety Notices and Symbols

### Safety Notices in this Manual:

**WARNING**

Indicates a potentially hazardous situation or practice which, if not avoided, will result in serious injury or death.

**CAUTION**

Indicates a potentially hazardous situation or practice which, if not avoided, could result in damage to the product or loss of important data.

### Safety Terms on the Product:

**DANGER** It calls attention to an operation, if not correctly performed, could result in injury or hazard immediately.

**WARNING** It calls attention to an operation, if not correctly performed, could result in potential injury or hazard.

**CAUTION** It calls attention to an operation, if not correctly performed, could result in damage to the product or other devices connected to the product.

### Safety Symbols on the Product:



Hazardous  
Voltage



Safety Warning



Protective Earth  
Terminal



Chassis Ground



Test Ground

## Care and Cleaning

### Care

Do not store or leave the instrument where it may be exposed to direct sunlight for long periods of time.

### Cleaning

Clean the instrument regularly according to its operating conditions.

1. Disconnect the instrument from all power sources.
2. Clean the external surfaces of the instrument with a soft cloth dampened with mild detergent or water. When cleaning the LCD, take care to avoid scarifying it.



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**CAUTION**

To avoid damage to the instrument, do not expose it to caustic liquids.

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**WARNING**

To avoid short-circuit resulting from moisture or personal injuries, ensure that the instrument is completely dry before connecting it to the power supply.

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## Environmental Considerations

The following symbol indicates that this product complies with the WEEE Directive 2002/96/EC.



### Product End-of-Life Handling

The equipment may contain substances that could be harmful to the environment or human health. To avoid the release of such substances into the environment and avoid harm to human health, we recommend you to recycle this product appropriately to ensure that most materials are reused or recycled properly. Please contact your local authorities for disposal or recycling information.

You can click on the following link <https://int.rigol.com/services/declaration.html> to download the latest version of the RoHS&WEEE certification file.

## **RSA Series Overview**

RSA series is a new generation of cost-efficient real-time spectrum analyzer with high performance. With superb performance specifications and the clear user interface, the RSA series allows you to operate it through various ways, such as pressing keys on the front panel, using the touch screen, connecting the mouse and the keyboard. Remote communication interfaces are also available. The instrument can be widely used in education science, corporate R&D, industrial production, and other fields.



# Document Overview

## Topics in this manual:

### Chapter 1 Quick Start

This chapter introduces the front/rear panel and user interface as well as announcements during first use of the analyzer.

### Chapter 2 Functions of the Front Panel

This chapter gives detailed function descriptions of the front panel keys in VNA mode.

### Chapter 3 Appendix

This chapter lists the options and accessories that can be ordered along with your analyzer as well as the service and support information.

## Format Conventions in this Manual:

### 1. Keys:

The keys on the front panel are usually denoted by the format of "Key Name (Bold) + Text Box". For example, **FREQ** denotes the **FREQ** key.

### 2. Menu Keys:

The menu softkeys are usually denoted by the format of "Menu Word (Bold) + Character Shading". For example, **Center Freq** denotes the center frequency menu item under the **FREQ** function key.

### 3. Connectors:

The connectors on the front or rear panel are usually denoted by the format of "Connector Name (Bold) + Square Brackets (Bold)". For example, **[Gen Output 50Ω]**.

### 4. Operation Procedures:

"→" represents the next step of operation. For example, **FREQ** → **Center Freq** indicates pressing **FREQ** on the front panel and then pressing the menu softkey **Center Freq**.

## Content Conventions in this Manual:

The RSA series spectrum analyzer that supports VNA includes the following models. This manual takes RSA5065N as an example.

Model	Frequency Range	VNA Frequency Range
RSA5065N	9 kHz to 6.5 GHz	100 kHz to 6.5 GHz
RSA5032N	9 kHz to 3.2 GHz	100 kHz to 3.2 GHz
RSA3045N	9 kHz to 4.5 GHz	100 kHz to 4.5 GHz
RSA3030N	9 kHz to 3 GHz	100 kHz to 3 GHz
RSA3015N	9 kHz to 1.5 GHz	100 kHz to 1.5 GHz

**User Manuals of this Product:**

Quick Guide, User Guide, Programming Guide, Data sheet, etc. For the desired manual, please download it from [www.rigol.com](http://www.rigol.com).

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# Chapter 1 Quick Start

This chapter gives you a quick review about the appearance and dimensions of the RSA series, its front and rear panel, user interface, as well as announcements during first use of the analyzer.

Contents in this chapter:

- User Interface
- Mode Setting
- Install the Option

# User Interface

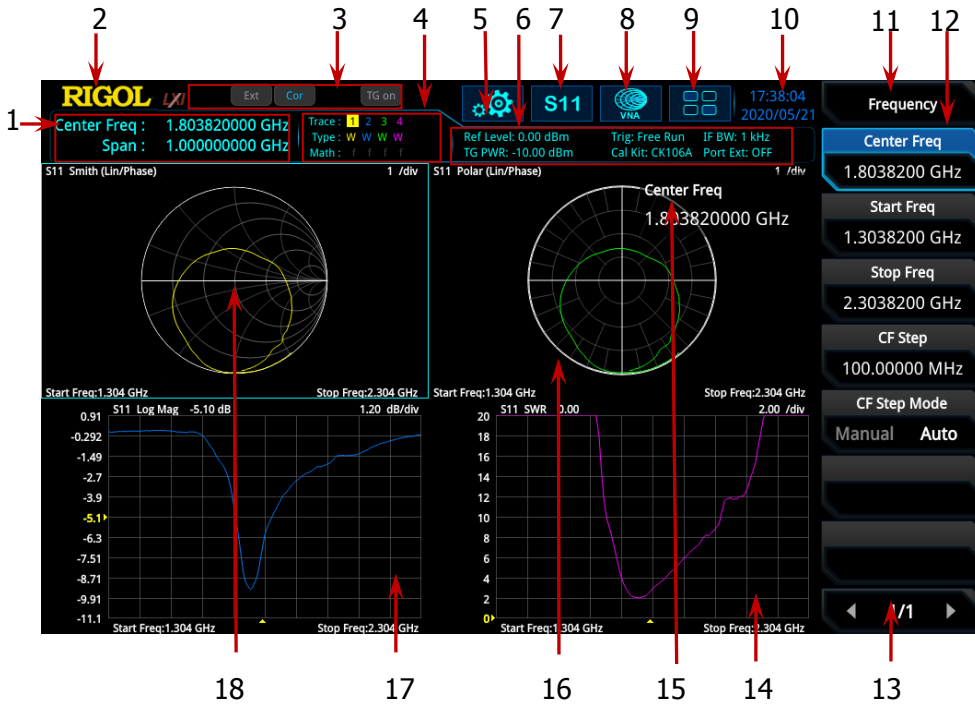








Figure 1-1 User Interface (VNA)

Table 1-1 User Interface Icons

No.	Name	Description
1	Measurement result	Displays the current measurement results for the marker (when no marker exists, the measurement results display frequency/span value).
2	<b>RIGOL</b>	Indicates the company logo.
3	System status	Rmt: indicates remote operation. Ext: indicates the external reference. Cor <sup>[1]</sup> : indicates the calibration status. TG on: indicates that the tracking generator has been enabled.
4	Trace indicator <sup>[2]</sup>	Displays information about the trace.
5	Information setting	: indicates messages, such as the prompt messages, alarm messages, and error messages. : indicates the speaker. You can tune it up and down to increase and decrease the speaker volume, or set it to mute . : indicates the network settings. You can

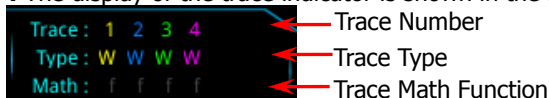
		<p>configure network parameters.</p> <p>: unlocks the front panel keys; : locks the front panel keys.</p> <p>: unlocks the touch screen; : locks the touch screen.</p> <p>: indicates that no USB storage device is inserted; : indicates that a USB storage device has been inserted.</p>
6	Measurement bar	Displays measurement settings.
7	Measurement function	Displays the currently selected measurement function.
8	Working mode	Displays the currently selected working mode.
9	Function keypad	Clicks the keypad to display the function keypad interface.
10	Time	Displays the system time.
11	Menu title	Displays the currently selected menu name.
12	Menu item	Displays the menu item of the current function.
13	Menu page	Shows the current page and the total number of pages for the menu.
14	Trace 4 window	Displays the waveform or data of Trace 4.
15	Active function area	Displays the current parameter and its value.
16	Trace 3 window	Displays the waveform or data of Trace 3.
17	Trace 2 window	Displays the waveform or data of Trace 2.
18	Trace 1 window	Displays the waveform or data of Trace 1.

**Note<sup>[1]</sup>:** The definition for the calibration status is shown below:

- --- (in gray): no user calibration data is available.
- Cor (in blue): user calibration data are normal.
- C! (in blue): the system is performing calibration operation.
- C? (in blue): re-calibration is required.

Remarks: When the calibration status shows "C?", it indicates that the current settings for sweep frequency range, sweep points, power level, IF BW, and other parameters are different from the values set for performing the calibration, users are required to restart to perform the calibration under the current configurations.

**Note<sup>[2]</sup>:** The display of the trace indicator is shown in the following figure:



- The first line displays the trace number. The color of the number is the same as that of the trace.
- The second line displays the trace type, including W (Clear/Write), A (Trace Average), M (Maximum Hold), and m (Minimum Hold). The letters with different colors and in different forms show different meanings.
  - The letter in blue indicates that the trace is updating.
  - The letter in gray indicates that the trace is not updated.
  - The letter with strikethrough and in gray color indicates that the trace will neither be updated nor displayed.

- The letter with strikethrough and in blue color indicates that the trace is updating but not displayed. It is useful in trace math operation.
- The third line displays the enabling or disabling status of the math operation function of each trace. If the letter in this line is grayed out, it indicates that the math operation is disabled. If the letter is indicated as the same color as that of the specified trace, it indicates that the math operation of this trace is enabled.



# Mode Setting

## Mode

RSA provides five working modes: GPSA, RTSA, VSA (option), EMI (option), and VNA. Press **Mode** or to select the working mode. You can also tap the function keypad to select the desired mode.

**Note:** In different working modes, the functions of the keys on the front panel may be different. Press **Help** to display the help information of the current working mode. If you need help information for other modes, exit the help interface first. Then select the desired working mode and obtain the corresponding help information.

### 1. GPSA

GPSA adopts two analysis methods: swept and FFT. GPSA can not only carry out frequency domain analysis, but also time domain (zero span) analysis.

Select GPSA. In this working mode, press **Meas** to select multiple measurements. For details, refer to Chapter 2 of *RSA5000 User Guide* or *RSA3000 User Guide*.

### 2. RTSA

RTSA provides the analysis function for the real-time signal, which can capture the complex signal seamlessly.

Select RTSA. In this working mode, you can also press **Meas** to select multiple measurements. For details, refer to Chapter 3 of *RSA5000 User Guide* or *RSA3000 User Guide*.

### 3. VSA

VSA mode provides the standard vector signal analysis measurement function. If you need this function, please purchase this option (order No. RSA5000-VSA) to install it. For installation methods, refer to "**Install the Option**".

### 4. EMI

EMI mode provides the EMI pre-compatibility measurement function. If you need this function, please purchase this option (order No. RSA5000-EMI/ RSA3000-EMI) to install it. For installation methods, refer to "**Install the Option**".

### 5. VNA

VNA mode provides the vector network analyzer function. It provides S11, S21, and DTF measurements. In this working mode, you can press **Meas** to select the desired measurement.

## Mode Setup

In VNA mode, the **Mode Setup** menu is grayed out and disabled. The menu items under **Mode Setup** are not available.

## Install the Option

RSA series provides various options (for option information, refer to "**Appendix**") to expand the function of the spectrum analyzer. If you need to purchase the option, please contact **RIGOL** sales representative. After you have purchased the option successfully, you will get the corresponding key. Then perform the following operations to install the option.

### 1. Acquire the License of the Option

- Log in to the **RIGOL** official website (www.rigol.com), click **License Activation** to enter the "Registered product license code" interface.
- Input the correct key, serial number (press **System** → **About System** → **System Info** to acquire the serial number of the instrument), and verification code. Click **Generate** to acquire the option license. In the license generation interface, click **Download** to download and save the license file to the PC.

### 2. Install the Option

You can install the option via the following 2 methods.

- 1) Install the option by reading the license file from the USB storage device
  - Copy the saved option license file to the root directory of the USB storage device.
  - Power on the instrument and insert the USB storage device. Press **File** to enter the file operation menu interface.
  - Press **File Explorer**, and then the file manager interface is displayed. In the interface, find the directory of the USB storage device. Then select the desired option license file (suffixed with ".lic"). Press **Import License** to import the activation code and complete the reading of the option installation file.
- 2) Install the option by sending SCPI Commands
  - Log in to **RIGOL** official website (www.rigol.com) to download the software Ultra Sigma. Then install it according to the installation wizard.
  - Use the USB cable to connect the rear-panel USB DEVICE interface of RSA series to the USB HOST interface of the PC.
  - Run Ultra Sigma. Search the resource and right-click the resource name. In the displayed menu, select "SCPI Panel Control". Input the following option installation command in the displayed SCPI control panel: `:SYSTem:LKEY <option info>@<license info>`. Wherein, `<option info>` indicates the option order No., and `<license info>` indicates the option license code.

For example, the following command is used to install the option RSA5000-PA.

```
:SYSTem:LKEY  
RSA5000-PA@8AD12B8EBC5DF492D1D4289B7CBA5B6150BF6F5D752  
D645C36D74530B05F39B49C461B23A50D6C94A34E06782AC4380070  
B0D1A86BA84E02768391FFD70C2103
```

## Chapter 2 Functions of the Front Panel

This chapter describes in detail the front-panel function keys of RSA series and their associated menu functions in VNA mode.

Contents in this chapter:

- Basic Settings
- Sweep and Function Settings
- Measurement Settings
- Marker Setup
- Input/Output
- Shortcut Key
- System Function

## Basic Settings

### FREQ

Sets the frequency parameters of the analyzer. Press **FREQ** on the front panel to enter the frequency setting menu. You can also tap the function keypad at the top of the screen to select FREQ. The analyzer sweeps within a specified frequency range and restarts sweeping every time the frequency parameters are modified.

The frequency range of a channel can be expressed by either of two groups of parameters: Start Frequency/Stop Frequency ( $f_{start}/f_{stop}$ ); or Center

Frequency/Span ( $f_{center}/f_{span}$ ). If any of the four parameters is changed, the other three parameters will make adjustment automatically to ensure the coupling relationship among them:

$$f_{center} = (f_{stop} + f_{start})/2 \quad (2-1)$$

$$f_{span} = f_{stop} - f_{start} \quad (2-2)$$

In this menu, Center Frequency is, by default, selected.

### Center Freq

Sets the center frequency of the current channel.

#### Remarks:

- When you modify the center frequency, the start and stop frequency will be modified automatically if the span remains to be unchanged.
- Modifying the center frequency indicates that the frequency is changed along the current channel horizontally, and the adjustable range should be within the frequency range specified in the technical specifications of the analyzer.

Table 2-1 Center Frequency

Parameter	Remarks
<b>Default</b>	(Fmax <sup>[1]</sup> - 10 MHz)/2
<b>Range</b>	(100 kHz + 5 Hz ) to (Fmax – 5 Hz)
<b>Unit</b>	GHz, MHz, kHz, Hz
<b>Knob Step</b>	step = span/200, Min = 1 Hz
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	

**Note**<sup>[1]</sup>: The maximum measurement frequency Fmax is determined by the instrument model. For RSA5065N, Fmax is 6.5 GHz; for RSA5032N, Fmax is 3.2 GHz; for RSA3045N, Fmax is 4.5 GHz; for RSA3030N, Fmax is 3 GHz; for RSA3015N, Fmax is 1.5 GHz.

## Start Freq

Sets the start frequency of the current frequency channel.

### Remarks:

When you modify the start frequency, the span and center frequency will be changed.

Table 2-2 Start Frequency

Parameter	Remarks
<b>Default</b>	10 MHz
<b>Range</b>	100 kHz to (Fmax – 10 Hz)
<b>Unit</b>	GHz, MHz, kHz, Hz
<b>Knob Step</b>	step = span/200, Min = 1 Hz
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	CF step

The recommended value for the start frequency is determined by IF BW. When you select a value for IF BW, the system will automatically test the start frequency.

- If the start frequency detected is smaller than the recommended start frequency value, the recommended start frequency prevails.
- If the start frequency detected is greater than the recommended start frequency value, the system will take your current setting as the start frequency.

The following table shows the relationship between the recommended value and the IF BW for different measurement items.

Table 2-3 Relationship between Recommended Start Frequency and IF BW

IF BW	S11 Start Freq	S21 Start Freq	DTF Start Freq
1 kHz	10 MHz	100 kHz	1 MHz
3 kHz	10 MHz	100 kHz	2 MHz
10 kHz	10 MHz	100 kHz	5 MHz
30 kHz	10 MHz	100 kHz	10 MHz
100 kHz	20 MHz	100 kHz	20 MHz
300 kHz	50 MHz	100 kHz	50 MHz
1 MHz	70 MHz	300 kHz	70 MHz
3 MHz	100 MHz	1 MHz	100 MHz
10 MHz	200 MHz	2 MHz	200 MHz

### Remarks:

- You can manually set the start frequency to be smaller than the recommended.
- If the start frequency is set too small, the test accuracy will be affected.

## Stop Freq

Sets the stop frequency of the current frequency channel.

### Remarks:

When you modify the stop frequency, the center frequency and start frequency will be modified automatically if the span remains to be unchanged.

Table 2-4 Stop Frequency

Parameter	Remarks
<b>Default</b>	Fmax
<b>Range</b>	(100 kHz + 10 Hz) to Fmax
<b>Unit</b>	GHz, MHz, kHz, Hz
<b>Knob Step</b>	step = span/200, Min = 1 Hz
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	CF step

## CF Step

Changes the step size for the center frequency. Changing the center frequency by a constant step-size value switches the channel to be measured continuously.

### Remarks:

Set a proper CF step value, and then select the center frequency. Use the Up/Down arrow key to switch the measurement channel at a fixed step size. Thus, the instrument can sweep the adjacent channels manually.

Table 2-5 CF Step

Parameter	Remarks
<b>Default</b>	Fspan/10
<b>Range</b>	-Fmax to Fmax
<b>Unit</b>	GHz, MHz, kHz, Hz
<b>Knob Step</b>	step = span/200, Min = 1 Hz
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	at 1-2-5 step

## CF Step Mode

The CF step mode consists of "Manual" and "Auto". By default, it is Auto.



**Remarks:**

- In Auto mode, the CF step is 1/10 of the span.
- In Manual mode, you can use the numeric keys to set the step size.

## SPAN

Sets the frequency range of the current channel. Press **SPAN** to enter the span setting menu. You can also tap the function keypad at the top of the screen to select SPAN.

Changing this parameter will change the frequency parameters, and after the span is changed, the sweep restarts.

### Span

Sets the frequency range of the current channel.

#### Remarks:

- When you modify the span, the start and stop frequency will be modified automatically if the center frequency remains to be unchanged.
- When the span is set to a maximum value, the analyzer enters full span mode.

Table 2-6 Span

Parameter	Remarks
<b>Default</b>	Fmax – 10 MHz
<b>Range<sup>[1]</sup></b>	10 Hz to (Fmax - 100 kHz)
<b>Unit</b>	GHz, MHz, kHz, Hz
<b>Knob Step</b>	step = span/200, Min = 2 Hz
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	at 1-2-5 step

**Note<sup>[1]</sup>:** If RSA3015N, RSA3030N, and RSA3045N have not been installed with the RSA3000-BW1 option, then the frequency range of span is from 100 Hz to (Fmax – 100 kHz).

### Last Span

Sets the span to the previous span setting.

### Full Span

Sets the maximum span.

#### Remarks:

The default value of full span is (Fmax – 100 kHz).

## AMPT

Sets the amplitude parameters of the analyzer. Press **AMPT** on the front panel to enter the amplitude setting menu. You can also tap the function keypad at the top of the screen to select AMPT.

You can modify these parameters to make the signals under test easy for you to observe.

## Ref Value

Sets the reference value of the selected trace to adjust the vertical position of the trace on the screen.

The reference value of each trace format is shown in the following table.

Table 2-7 Reference Value

Trace Format	Default	Range	Unit
<b>Log Mag</b>	0	-500G to 500G	dB
<b>Lin Mag</b>	0	-500G to 500G	N/A
<b>Phase</b>	0	-500G to 500G	degree (°)
<b>Group Delay</b>	0	-500G to 500G	ns
<b>Real</b>	0	-500G to 500G	N/A
<b>Imaginary</b>	0	-500G to 500G	N/A
<b>SWR</b>	1.0	-500G to 500G	N/A
<b>Expand Phase</b>	0	-500G to 500G	degree (°)
<b>Positive Phase</b>	180	-500G to 500G	degree (°)
<b>Return Loss(DTF)</b>	0	-500G to 500G	dB
<b>Log Mag(DTF)</b>	-100	-500G to 500G	dB
<b>Lin Mag(DTF)</b>	0	-500G to 500G	N/A

### Remarks:

When the format is "Smith" or "Polar", the reference value is unavailable.

## Ref Position

Sets the reference position to adjust the vertical position of the currently selected trace in the screen.

When it is set to 5, the reference position is located in the middle of the graticule; when set to 0, it is at the bottom of the graticule; when set to 10, it is located at the top of the graticule.

Table 2-8 Ref Position

Parameter	Remarks
<b>Default</b> <sup>[1]</sup>	0 or 5
<b>Range</b>	0 to 10
<b>Unit</b>	N/A
<b>Knob Step</b>	1
<b>Left/Right Arrow Key Step</b>	1
<b>Up/Down Arrow Key Step</b>	

**Note**<sup>[1]</sup>: The default values of the reference position for different trace formats are as follows:

- When the trace format is Lin Mag, SWR, Lin Mag(DTF), or Log Mag(DTF), the default value of the reference position is 0.
- When the trace format is Log Mag, Phase, Group Delay, Real, Imaginary, Expand Phase, Positive Phase, or Return Loss(DTF), the default value of the reference position is 5.

### Remarks:

When the format is "Smith" or "Polar", the reference position is unavailable. The **Ref Position** menu is unavailable.

## Scale/Div

Sets the Y scale per division of the selected trace. The scale value is displayed at the graticule top.

When you select a different trace format, the default Y-axis scale value and unit are different.

Table 2-9 Scale/Div

Trace Format	Default	Range	Unit
<b>Log Mag</b>	10	100f to 100G	dB
<b>Lin Mag</b>	100	1a to 100G	N/A
<b>Phase</b>	90	1a to 100G	degree (°)
<b>Group Delay</b>	10	1a to 100G	ns
<b>Real</b>	200	1a to 100G	N/A
<b>Imaginary</b>	200	1a to 100G	N/A
<b>SWR</b>	1	1a to 100G	N/A
<b>Smith</b>	1	0.03 to 20	N/A
<b>Polar</b>	1	0.03 to 20	N/A
<b>Expand Phase</b>	90	1a to 100G	degree (°)
<b>Positive Phase</b>	90	1a to 100G	degree (°)
<b>Return Loss (DTF)</b>	10	100f to 100G	dB
<b>Log Mag(DTF)</b>	10	100f to 100G	dB
<b>Lin Mag(DTF)</b>	0.1	1a to 100G	N/A

## **Auto Scale**

Auto adjusts the graticule scale of the currently selected trace and the reference value to make it optimal for display and observation.

## **All Auto Scale**

Auto adjusts the graticule scale of all displayed traces and the reference value to make them optimal for display and observation.

### **Remarks:**

- Once you enable this function, the graticule scale and reference position of the corresponding traces will be updated automatically.
- The All Auto Scale function only affects the display effects, but unable to affect the measurement results.

## Sweep and Function Settings

### BW

Sets the bandwidth of the analyzer. Press **BW** to enter the bandwidth setting menu. You can also tap the function keypad at the top of the screen to select BW.

### IF BW

Sets the IF BW.

Table 2-10 IF BW

Parameter	Remarks
<b>Default</b>	1 kHz
<b>Range<sup>[1]</sup></b>	1 kHz to 10 MHz (at 1-3-10 step)
<b>Unit</b>	kHz/MHz
<b>Knob Step</b>	1-3-10
<b>Left/Right Arrow Key Step</b>	1-3-10
<b>Up/Down Arrow Key Step</b>	

**Note<sup>[1]</sup>:** If RSA3015N, RSA3030N, and RSA3045N have not been installed with the RSA3000-BW1 option, then the maximum value of IF BW is 3 MHz.

#### Remarks:

- Reducing the IF BW of the receiver can undermine the impact of random noises on the measurement.
- Reducing the IF BW to 1/10 of the original bandwidth can reduce the ground noise by 10 dB.

## Sweep

Press **Sweep** to enter the sweep setting menu. You can also tap the function keypad to select Sweep. The menu sets sweep-related parameters, such as sweep time, sweep points, and sweep time mode.

### Sweep Points

Sets the number of points acquired in each sweep, i.g. the number of the trace points.

In DTF, the **Sweep Points** menu is grayed out and disabled. You are not allowed to set it. It will be set automatically according to the span, stop distance, and velocity factor. The system will automatically calculate the number of sweep points based on the values of Stop Distance, Span, and Velocity Factor. Once one of the parameters is modified, the other parameters will be adjusted automatically to achieve optimal measurement effects according to the formula below.

$$SweepPoints = \frac{StopDistance * Span}{1.5 * 10^8 * VelocityFactor} + 1$$

Table 2-11 Number of Sweep Points

Parameter	Remarks
<b>Default</b>	S11/S21: 201
<b>Range</b>	101 to 10,001
<b>Unit</b>	N/A
<b>Knob Step</b>	1
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	5

#### Remarks:

- With the increase of the sweep points, the frequency resolution of the marker will increase with it, but the sweep speed will decrease with it.
- Due to the limitation of the minimum interval of sweep points, when the number of sweep points is increased, the sweep time will be prolonged.
- Changing the number of the sweep points will affect multiple parameters of the system. Therefore, the system will make a new sweep and measurement again.

### Sweep Time

Sets the time required for the spectrum analyzer to complete one sweep operation within the span range.

Table 2-12 Sweep Time

Parameter	Remarks
Default	S11/S21: 1.09194 s DTF: 2.12730 s
Range	1 ms to 4,000 s
Unit	s, ms, us, ns, ps
Knob Step	sweep time/100, Min = 1 us
Left/Right Arrow Key Step	
Up/Down Arrow Key Step	sweep time/10, Min = 10 us

## Sweep Time Mode

Sets the "Sweep Time" to be "Auto" or "Manual". By default, it is "Auto".

### Continue

Sets the current sweep mode to Continuous.

In continuous sweep mode, the system will go to the next sweep after each sweep is completed.

### Single

Sets the current sweep mode to Single.

#### Remarks:

- When the system is in Continuous sweep mode, you need to press this key to enter the single sweep mode and perform one measurement.
- When the system is in Single sweep mode, only when you press **Single** or tap **Single** again, can you launch the sweep process.



## TG

Sets the parameter related to the tracking generator (TG).

### Output

Enables or disables the tracking generator. In VNA mode, TG is enabled by default.

When the tracking generator is enabled, a signal with the same frequency of the current sweep signal will be output from the **[GEN OUTPUT 50Ω]** connector on the front panel. The power of the signal can be set through the menu.

### Amplitude

Sets the output power of the TG signal.

Table 2-13 Tracking Generator Output Signal Amplitude

Parameter	Remarks
Default	S11/S21: -10 dBm DTF: 0.00 dBm
Range	-40 dBm to 0 dBm
Unit	dBm, -dBm, V, mV, uV
Knob Step	1 dB
Left/Right Arrow Key Step	
Up/Down Arrow Key Step	

## Trace

Displays the sweep signal on the screen. Press **Trace** on the front panel to enter the trace setting menu. You can also tap the function keypad to select Trace to set the relevant parameters of trace.

### Selected Trace

Selects the current trace.

In VNA mode, at most 4 traces can be displayed simultaneously. Each trace is indicated by a different color.

- Trace1: yellow
- Trace2: blue
- Trace3: green

- Trace4: purple

For details, refer to the notes about "**trace indicator**" in "**User Interface**".

Select the corresponding trace to set the relevant parameters for the specified trace. By default, Trace1 is selected, and the trace type is "Clear Write".

**Note:** The trace currently displayed on the screen can be saved to the internal or external memory. If needed, you can recall it at any time. Press **Save** to save it according to descriptions in "**Save**".

## Trace Type

Sets the type of the currently selected trace. The system calculates the sampled data by a specific operation method according to the selected trace type. The results will be displayed if the trace display is not disabled.

Trace types include Clear Write, Average, Max Hold, and Min Hold.

By default, it is Clear Write.

- **Clear Write**  
Displays the real-time sweep data of each point on the trace.
- **Average**  
Displays an average trace, which is represented by averaging the data of each point on the trace. The type of the trace is displayed to be smooth.
- **Max Hold**  
When a new maximum value is generated, data will be updated, and the newly updated maximum value prevails.
- **Min Hold**  
When a new minimum value is generated, data will be updated, and the newly updated minimum value prevails.

### Remarks:

When the trace format is set to "Smith" or "Polar", Max Hold and Min Hold are unavailable.

## Trace Update

Enables or disables trace update. By default, it is On.

## Trace Display

Sets the display contents of the selected trace. By default, it is Data.

- Data
- Memory
- Data&Memory
- OFF

### Remarks:

- You need to perform **Data->Memory** operation first, and then the memory data can be displayed.
- If you do not perform **Data->Memory** operation, the menu items **Memory** and **Data&Memory** under **Trace Display** are grayed out and disabled.
- If you select "OFF", the trace is not displayed.

## Data->Memory

Saves the measurement data of the selected trace to the memory. You can use the storage trace to compare the data trace on the screen.

After performing **Data->Memory** operation, when you select "Memory" or "Data&Memory" as the trace display, an additional trace called memory trace is displayed on the screen. The measurement data trace is slightly brighter than the memory trace, so you can distinguish them from this point.

## Trace Format

Sets the display format of the selected trace.

1. Log Mag  
Shows the log magnitude of the measurement results of the trace. The unit is dB.
2. Phase Mag  
Shows the phase of measurement results of the trace. The display range is from  $-180^{\circ}$  to  $+180^{\circ}$ . The unit is degree ( $^{\circ}$ ).
3. Group Delay  
Shows the group delay characteristics of the DUT. The unit is second (s).
4. Smith  
A circular diagram that primarily shows impedance or reflection characteristics of a DUT. In this format, the position of trace plotting is the same as that in Polar

format. It allows users to select one of the following data groups for displaying the value of the marker.

- Lin/Phase: shows the converted magnitude and the phase at the current marker position.
- Log/Phase: shows the magnitude (in dB) and the phase at the current marker position.
- Real/Imag: shows the real and imaginary components at the current marker position.
- R + jX: shows the real and imaginary components of the impedance at the current marker position.
- G + jB: shows the real and imaginary components of the admittance at the marker position.

#### 5. Polar

The distance from the trace to the origin of the polar axis is expressed as the magnitude of the measurement result; and the phase is expressed as an angle counterclockwise from the positive X-axis to the line connected between the trace and the origin.

The polar chart allows users to select one of the following data groups for displaying the value of the marker.

- Lin/Phase: linear magnitude and phase.
- Log/Phase: log magnitude and phase.
- Real/Imag: real and imaginary parts.

#### 6. Lin Mag

Sets the trace format to linear magnitude. The trace is represented in the form of Lin Mag for the measurement results.

#### 7. SWR

$SWR = \frac{1+\rho}{1-\rho}$ . Wherein,  $\rho$  represents the reflection coefficient. The unit is N/A.

#### 8. Real

Indicates the real part of the complex parameter.

#### 9. Imaginary

Indicates the imaginary part of the complex parameter.

#### 10. Expand Phase

The trace represents the phase of the measurement results. It can display phase above  $180^\circ$  and below  $-180^\circ$ . The unit is degree ( $^\circ$ ).

#### 11. Positive Phase

The trace represents the phase of the measurement results. The display range is from  $0^\circ$  to  $360^\circ$ . The unit is degree ( $^\circ$ ).

12. Log Mag(DTF)  
The trace represents the time-domain log magnitude display format in DTF. The unit is dB.
13. Lin Mag(DTF)  
The trace represents the time-domain linear magnitude display format in DTF.
14. Return Loss(DTF)  
The trace represents the return loss in DTF. The unit is dB.

## Math Function

After performing **Data->Memory** operation, you can perform the calculation between measurement data and memory trace.

- Data/Memory  
Measurement data divided by data in the memory trace.
- Data\*Memory  
Measurement data multiplied by data in the memory trace.
- Data - Memory  
Measurement data subtracted by data in the memory trace.
- Data + Memory  
Measurement data added data in the memory trace.
- Off  
Disables the math function.

**Note:** The trace math functions are mutually exclusive. If you apply one math operation to a certain trace, the last selected math operation function should be disabled.

The math operation function is disabled when the trace format is "Log Mag(DTF)" or "Lin Mag(DTF)".

## Window Layout

Sets the window layout for the trace.

- By default, it is Four Window for S11. The window layout function is available.
- By default, it is UD Window for S21. The window layout function is available.
- By default, it is UD Window for DTF. The window layout function is unavailable.

The available window layout includes:

- Single Window

- LR Window
- UD Window
- LRD Window
- UDR Window
- Four Window

## Trigger

Selects the trigger source and sets trigger-related parameters.

### Source

Sets "Free Run", "External 1", and "External 2" to be the trigger source.

### Free Run

The trigger conditions are met at any time, that is, the analyzer generates trigger signals continuously.

### External 1

In this mode, an external signal is input via the **[TRIGGER IN]** connector on the rear panel. When the signal meets the set trigger conditions, trigger signals are generated.

#### 1. Slope

Sets the trigger polarity for External Trigger 1 to "POS" or "NEG". By default, it is POS.

#### 2. Delay State

Enables or disables the trigger delay function. After the trigger delay function is enabled, you can set the trigger delay time.

#### 3. Delay Time

Sets the time interval during which the instrument waits to start the sweep operation after the trigger signal that meets the trigger conditions is generated. You can use the numeric keys, the knob, or arrow keys to modify this parameter; you can also use the touch screen to modify the parameter.

Table 2-14 Trigger Delay Time

Parameter	Remarks
<b>Default</b>	1 $\mu$ s
<b>Range</b>	0 $\mu$ s to 500 ms
<b>Unit</b>	s, ms, $\mu$ s, ns, ps
<b>Knob Step</b>	trigger delay/100, Min = 1 $\mu$ s
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	at 1-1.5-2-3-5-7.5 step

## External 2

Press **Input/Output** → **Ext Trigger2** to select "In". Then, an external signal is input via the **[TRIGGER IN/OUT]** connector on the rear panel. When the signal meets the set trigger conditions, trigger signals are generated.

**Note:** The input signal frequency on the external trigger interface should not be greater than 1 MHz.

### 1. Slope

Sets the trigger polarity for External Trigger 2 to "POS" or "NEG". By default, it is POS.

### 2. Delay State

Enables or disables the trigger delay function. After the trigger delay function is enabled, you can set the trigger delay time.

### 3. Delay Time

Sets the time interval during which the instrument waits to start the sweep operation after the trigger signal that meets the trigger conditions is generated. You can use the numeric keys, the knob, or arrow keys to modify this parameter; you can also use the touch screen to modify the parameter.

Table 2-15 Trigger Delay Time

Parameter	Remarks
Default	1 $\mu$ s
Range	0 $\mu$ s to 500 ms
Unit	s, ms, $\mu$ s, ns, ps
Knob Step	trigger delay/100, Min = 1 $\mu$ s
Left/Right Arrow Key Step	
Up/Down Arrow Key Step	

## Hold-off State

Turns on or off the trigger hold-off function. By default, it is off.

## Hold-off Time

Sets the hold-off time between trigger signals. You can use the numeric keys, the knob, and the arrow keys on the front panel to modify this parameter; also you can modify it on the touchscreen.



When the trigger conditions are met, the trigger occurs. Then, the delay begins, and the hold-off time begins. During the hold-off time, new trigger signals will be ignored. For a free-running trigger, the hold-off value is the minimum time between two trigger signals.

Table 2-16 Trigger Hold-off Time

Parameter	Remarks
<b>Default</b>	100 ms
<b>Range</b>	0 $\mu$ s to 500 ms
<b>Unit</b>	s, ms, $\mu$ s, ns, ps
<b>Knob Step</b>	trigger holdoff time/100, Min = 1 $\mu$ s
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	
	at 1-1.5-2-3-5-7.5 step

## Auto Trig State

Enables or disables the auto trigger function. By default, it is disabled.

## Auto Trig

Sets the time that the instrument will wait for the trigger conditions to be met. When the set waiting time times out, the instrument will not wait and start to initiate the sweep measurement.

Table 2-17 Auto Trigger Time

Parameter	Remarks
<b>Default</b>	100 ms
<b>Range</b>	1 ms to 100 s
<b>Unit</b>	s, ms, $\mu$ s, ns, ps
<b>Knob Step</b>	auto trigger time/100, Min = 1 $\mu$ s
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	
	at 1-1.5-2-3-5-7.5 step

The relationship among the relevant parameters concerning trigger is shown in the following figure.

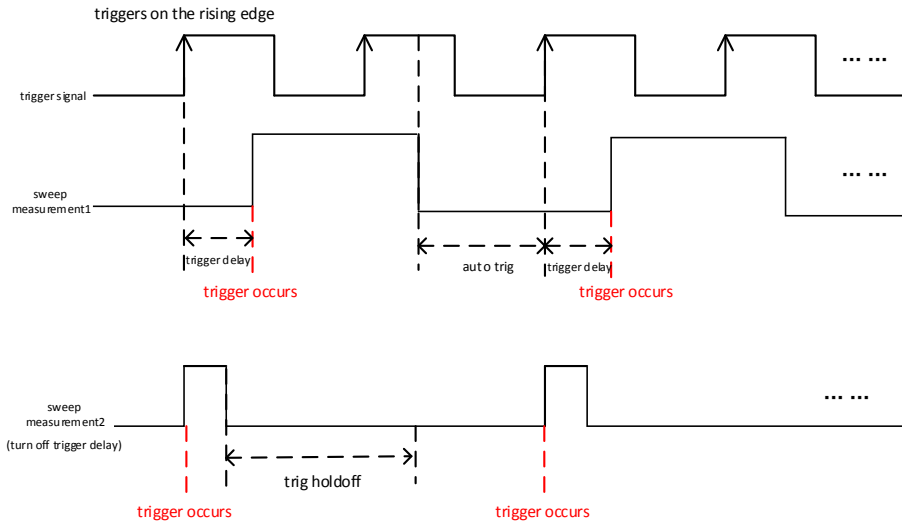


Figure 2-1 Trigger Parameter Relationship

# Measurement Settings

## Meas

VNA provides measurement for S11, S12, and DTF. Press **Meas** to enter the measurement setting menu. You can also tap the function keypad at the top of the screen to select Meas.

Under the **Meas** menu, three measurement items are available: S11, S21, and DTF.

### S11

Provides the reflection measurement for measuring the amount of RF power that is being reflected from the connected DUT port. The measurement shows the ratio of the reflected power to the stimulus signal over the frequency range you select.

### S21

Provides the transmission measurement, measures the variation coefficient of the signal that passes through the DUT in forward direction (from port 1 to port 2). It is therefore an indicator of showing how much loss or gain is caused by the DUT.

### DTF

DTF (Distance to Fault) provides measurement for determining the exact location of possible faults in a transmission system.

## S11 Meas Setup

### Avg Number

Specifies the number of counts (N) for Average, Max Hold, and Min Hold. It is valid when Trace Type is "Average". The greater the value of N, the smoother the trace is displayed.

In Average, Max Hold, and Min Hold modes, when performing the single measurement, the instrument stops sweeping after the sweep count has reached N.

Table 2-18 Average Count

Parameter	Remarks
Default	100
Range	1 to 10,000
Unit	N/A
Knob Step	1
Left/Right Arrow Key Step	1
Up/Down Arrow Key Step	10

## Ref Level

Indicates the reference level of the receiver channel of the spectrum analyzer. The reference level for S11 measurement is a fixed value 0 dBm and it cannot be modified.

## Aperture Step Width

Sets the aperture step width. The aperture step width  $k$  determines the value  $f_d$  for group delay  $\tau_G$ . VNA can measure S-parameters at the discrete frequencies.

Frequency step  $\Delta f$ , aperture step width  $k = f_d / \Delta f$ .

Group delay  $\tau_G$  is obtained through differentiation calculation based on the phase of S11 or S21, then obtain the result by weight method through the factor  $-\frac{1}{360^\circ}$  (take S21 as an example).

$$\begin{aligned} \tau_G(f_0) &= -\frac{1}{360^\circ} \frac{d}{df} \arg(S_{21}(f_0)) \\ &= -\frac{1}{360^\circ} \frac{\arg\left(S_{21}\left(f_0 + \frac{f_d}{2}\right)\right) - \arg\left(S_{21}\left(f_0 - \frac{f_d}{2}\right)\right)}{f_d} \end{aligned}$$

Wherein,  $f_d$  indicates the aperture. The measurement accuracy of group delay is determined by the aperture  $f_d$  that you use. If it is too large, it will affect the details; if it is too small, it will produce more noises. There is no standard rule for aperture selection, and you can only rely on experience in choosing it.

Table 2-19 Aperture Step Width

Parameter	Remarks
<b>Default</b>	10
<b>Range</b>	1 to (sweep points/10)
<b>Unit</b>	N/A
<b>Knob Step</b>	1
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	at 1-2-5 step

## Align

In single port calibration, the calibration coefficients are measured by connecting the OPEN, SHORT, and LOAD to the test port (Port 1). This calibration effectively eliminates the frequency response reflection tracking error, directivity error, and source match error from the test set in a reflection test using that port.

In S11 and DTF measurement, single port calibration is adopted.

### Open

Performs the Open calibration measurement.

### Short

Performs the Short calibration measurement.

### Load

Performs the Load calibration measurement.

### Abort

Aborts the current calibration measurement

### Done

Saves the calibration coefficients.

### Remarks:

The calibration is only valid for the S11 measurement item. When switching to S21 or DTF, you need to recalibrate.

## Clear

Clears the saved calibration coefficients.

## Port Extension

Extends the calibrated plane by setting the delay and loss of the test signal resulting from the electrical length and compensation fixture of the connector. In this way, you do not need to perform extra calibration any more.

### Port Extension

Enables or disables the port extension function. By default, it is disabled. Only when the port extension function is enabled, can you set its parameters.

### Port 1 Delay

Sets the delay time for Port 1 extension.

The relationship between port delay and port length is correlative, as shown in the following formula. Once one of the parameters is modified, other parameters will also be modified.

$$\text{Port Delay} = \frac{\text{Port Length}}{\text{Velocity of Light} * \text{Velocity Factor}}$$

Table 2-20 Port 1 Delay

Parameter	Remarks
<b>Default</b>	0.00 ns
<b>Range</b>	-10.00 s to 10.00 s
<b>Unit</b>	us, ns, ps, fs, as
<b>Knob Step</b>	Port 1 delay/100
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	Port 1 delay/10

### Unit

Sets the length unit for port extension: meter or feet. The default unit is meter.

### Port 1 Length

Sets the extension length for Port 1. You should set it based on the actual parameters of the cable for the port.

Table 2-21 Port 1 Length

Parameter	Remarks
<b>Default</b>	0.00 cm
<b>Range</b>	-3.00 Gm to 3.00 Gm
<b>Unit</b>	Meter: m, dm, cm Feet: ft
<b>Knob Step</b>	Port 1 length/100
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	Port 1 length/10

### Port 1 Velocity Factor

Sets the velocity factor of Port 1.

Table 2-22 Port 1 Velocity Factor

Parameter	Remarks
<b>Default</b>	0.66
<b>Range</b>	0.1 to 1
<b>Unit</b>	N/A
<b>Knob Step</b>	0.1
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	at 1-2-5 step

### Port 1 Specific Loss

Sets the cable loss for Port 1.

Table 2-23 Port 1 Cable Loss

Parameter	Remarks
<b>Default</b>	0.00 dB/m
<b>Range</b>	0.00 dB/m to 5.00 dB/m
<b>Unit</b>	dB/m
<b>Knob Step</b>	0.1 dB/m
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	at 1-2-5 step

### Cal Kits

Before performing calibration, select one of the calibration kits. The kits supported by VNA include:

- CK106A
- CK106E
- Custom

By default, CK106A is selected.

The default parameters of CK106A are as follows:

Table 2-24 Default Parameters of CK106A

Parts Type	Offset Length	Z <sub>0</sub>	Att	Parameter			
Open	14.89mm	50Ω	-	C0(fF)	C1(fF/GHz)	C2(fF/GHz <sup>2</sup> )	C3(fF/GHz <sup>3</sup> )
			-	-2.71202	2.47817088	-0.19730637	-0.02094
Short	13.47mm	50Ω	-	L0(pH)	L1(pH/GHz)	L1(pH/GHz <sup>2</sup> )	L1(pH/GHz <sup>3</sup> )
			-	-18.165068	28.77678	-8.6055475	0.6595
Match	0.00mm	50Ω	-	-	-	-	-
Through	0.0000mm	-	0.00dB	-	-	-	-

The default parameters of CK106E are as follows:

Table 2-25 Default Parameters of CK106E

Parts Type	Offset Length	Z <sub>0</sub>	Att	Parameter			
Open	0.000mm	50Ω	-	C0(fF)	C1(fF/GHz)	C2(fF/GHz <sup>2</sup> )	C3(fF/GHz <sup>3</sup> )
			-	0.000	0.000	0.000	0.000
Short	0.000mm	50Ω	-	L0(pH)	L1(pH/GHz)	L1(pH/GHz <sup>2</sup> )	L1(pH/GHz <sup>3</sup> )
			-	0.000	0.000	0.000	0.000
Match	0.00mm	50Ω	-	-	-	-	-
Through	0.0000mm	-	0.00dB	-	-	-	-

#### Remarks:

- CK106A and CK106E are standard calibration kits. Their parameters are not recommended to be modified.
- CK106E is applicable to VNA calibration in the following condition: frequency range not greater than 1.5 GHz.
- If you choose **Custom** under **Cal Kits**, you can configure the kit according to your actual situation.



## S21 Meas Setup

### Avg Number

Specifies the number of counts (N) for Average, Max Hold, and Min Hold. It is valid when Trace Type is "Average". The greater the value of N, the smoother the trace is displayed.

In Average, Max Hold, and Min Hold modes, when performing the single measurement, the instrument stops sweeping after the sweep count has reached N.

Table 2-26 Average Count

Parameter	Remarks
<b>Default</b>	100
<b>Range</b>	1 to 10,000
<b>Unit</b>	N/A
<b>Knob Step</b>	1
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	10

### Ref Level

Sets the reference level of the receiver channel of the spectrum analyzer.

Table 2-27 Reference Level

Parameter	Remarks
<b>Default</b>	-10 dBm
<b>Range</b>	-170 dBm to 30 dBm
<b>Unit</b>	dBm, -dBm, V, mV, uV
<b>Knob Step</b>	1
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	10

### Aperture Step Width

Sets the aperture step width.

Table 2-28 Aperture Step Width

Parameter	Remarks
<b>Default</b>	10
<b>Range</b>	1 to (sweep points/10)
<b>Unit</b>	N/A
<b>Knob Step</b>	1

<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	at 1-2-5 step

For details about aperture step width, refer to descriptions in "**Aperture Step Width**" for S11.

## Align

In S21 measurement, the calibration coefficients are measured by connecting the Through to the two test ports. This calibration effectively eliminates the transmission tracking error resulting from the transmission test set using that port.

## Through

Performs the Through calibration measurement.

## Abort

Aborts the current calibration measurement

## Done

Saves the calibration coefficients.

## Remarks:

The calibration is only valid for the S21 measurement item. When switching to S11 or DTF, you need to recalibrate.

## Clear

Clears the saved calibration coefficients.

## Port Extension

Extends the calibrated plane by setting the delay and loss of the test signal resulting from the electrical length and compensation fixture of the connector. In this way, you do not need to perform extra calibration any more.

## Port Extension

Enables or disables the port extension function.

## Port 1 Delay

Sets the delay time for Port 1 extension.

The relationship between port delay and port length is correlative, as shown in the following formula. Once one of the parameters is modified, other parameters will also be modified.

$$\text{Port Delay} = \frac{\text{Port Length}}{\text{Velocity of Light} * \text{Velocity Factor}}$$

Table 2-29 Port 1 Delay

Parameter	Remarks
<b>Default</b>	0.00 ns
<b>Range</b>	-10.00 s to 10.00 s
<b>Unit</b>	us, ns, ps, fs, as
<b>Knob Step</b>	Port 1 delay/100
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	Port 1 delay/10

## Unit

Sets the length unit for port extension: meter or feet. The default unit is meter.

### Remarks:

When the unit is changed, the lengths of Port 1 and Port 2 should be changed along with the unit conversion.

## Port 1 Length

Sets the extension length for Port 1.

Table 2-30 Port 1 Length

Parameter	Remarks
<b>Default</b>	0.00 cm
<b>Range</b>	-3.00 Gm to 3.00 Gm
<b>Unit</b>	Meter: m, dm, cm Feet: ft
<b>Knob Step</b>	Port 1 length/100
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	Port 1 length/10

## Port 1 Velocity Factor

Sets the Velocity Factor of Port 1.

Table 2-31 Velocity Factor

Parameter	Remarks
Default	0.66
Range	0.1 to 1
Unit	N/A
Knob Step	0.1
Left/Right Arrow Key Step	
Up/Down Arrow Key Step	at 1-2-5 step

### Port 1 Specific Loss

Sets the cable loss for Port 1.

Table 2-32 Cable Loss

Parameter	Remarks
Default	0.00 dB/m
Range	0.00 dB/m to 5.00 dB/m
Unit	dB/m
Knob Step	0.1 dB/m
Left/Right Arrow Key Step	
Up/Down Arrow Key Step	at 1-2-5 step

### Port 2 Delay

Sets the delay time for Port 2 extension.

The relationship between port delay and port length is correlative, as shown in the following formula. Once one of the parameters is modified, other parameters will also be modified.

$$Port\ Delay = \frac{Port\ Length}{Velocity\ of\ Light * Velocity\ Factor}$$

Table 2-33 Port 2 Delay

Parameter	Remarks
Default	0.00 ns
Range	-10.00 s to 10.00 s
Unit	us, ns, ps, fs, as
Knob Step	Port 2 delay/100
Left/Right Arrow Key Step	
Up/Down Arrow Key Step	Port 2 delay/10

### Port 2 Length

Sets the extension length for Port 2.

Table 2-34 Port 2 Length

Parameter	Remarks
<b>Default</b>	0.00 cm
<b>Range</b>	-3.00 Gm to 3 Gm
<b>Unit</b>	Meter: m, dm, cm Feet: ft
<b>Knob Step</b>	Port 2 length/100
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	Port 2 length/10

### Port 2 Velocity Factor

Sets the Velocity Factor of Port 2.

Table 2-35 Velocity Factor

Parameter	Remarks
<b>Default</b>	0.66
<b>Range</b>	0.1 to 1
<b>Unit</b>	N/A
<b>Knob Step</b>	0.1
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	at 1-2-5 step

### Port 2 Specific Loss

Sets the cable loss for Port 2.

Table 2-36 Cable Loss

Parameter	Remarks
<b>Default</b>	0.00 dB/m
<b>Range</b>	0.00 dB/m to 5.00 dB/m
<b>Unit</b>	dB/m
<b>Knob Step</b>	0.1 dB/m
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	at 1-2-5 step

### Cal Kits

For details about the calibration kits, refer to "**Cal Kits**" in "**S11 Meas Setup**".

## DTF Meas Setup

The measurement results of DTF is displayed in the upper and lower windows, as shown in the figure below.

- The upper window displays the relationship between transmission loss and distance. The available trace formats are Lin Mag(DTF) and Log Mag(DTF).
- The lower window displays the relationship between transmission loss and frequency. The available trace formats are Lin Mag, SWR, and Return Loss(DTF).

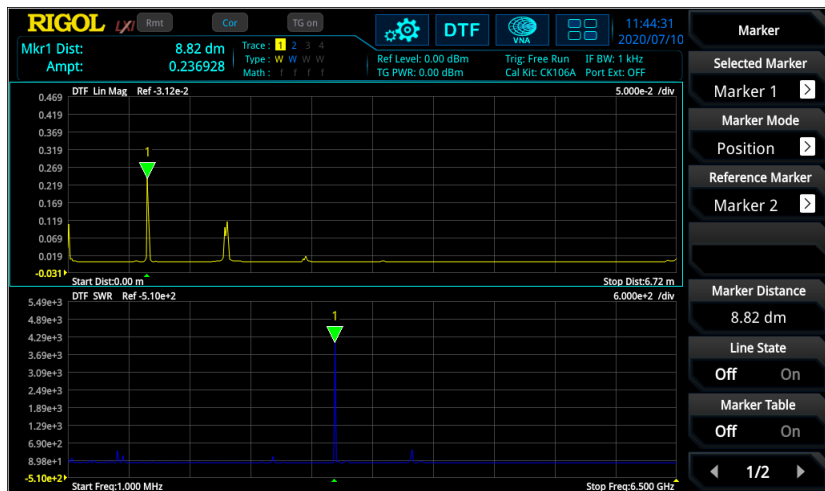


Figure 2-2 Display Mode of Measurement Results in DTF

## Avg Number

Specifies the number of counts (N) for Average, Max Hold, and Min Hold. It is valid when Trace Type is "Average". The greater the value of N, the smoother the trace is displayed.

In Average, Max Hold, and Min Hold modes, when performing the single measurement, the instrument stops sweeping after the sweep count has reached N.

Table 2-37 Average Count

Parameter	Remarks
Default	100
Range	1 to 10,000
Unit	N/A
Knob Step	1
Left/Right Arrow Key Step	
Up/Down Arrow Key Step	10

## Ref Level

Indicates the reference level of the receiver channel of the spectrum analyzer. The reference level for DTF measurement is a fixed value 0 dBm and it cannot be modified.

## Align

For details about calibration, refer to "**Align**" in S11.

### Remarks:

The calibration is only valid for the DTF measurement item. When switching to S11 or S21, you need to recalibrate.

## Clear

Clears the saved calibration coefficients.

## Port Extension

For details about the port extension, refer to "**Port Extension**" in S11.

## Cal Kits

For details about calibration kits, refer to "**Cal Kits**" in S11.

## Unit

Sets the length unit for port extension: meter or feet. The default unit is meter.

## Stop Distance

Sets the maximum distance that can be measured in DTF.

Table 2-38 Stop Distance

Parameter	Remarks
<b>Default</b>	6.72 m
<b>Range<sup>[1]</sup></b>	0.231 m to 150 Gm
<b>Unit</b>	Meter: m, dm, cm Feet: ft
<b>Knob Step</b>	Stop distance/100
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	Stop distance/10

Note<sup>[1]</sup>: The values of Stop Distance, Span, Sweep Points, and Velocity Factor are correlative. The formula is shown as follows:

$$\text{StopDistance} = \frac{(\text{SweepPoints} - 1) * \text{VelocityFactor} * 1.5 * 10^8}{\text{Span}}$$

### Remarks:

Once the value of Stop Distance is modified, the value of Sweep Points will be automatically modified.

## Port Velocity Factor

Sets the Velocity Factor of cable under test relative to the velocity of light in the vacuum. The velocity factor for the common dielectric materials is as follows:

- VF (velocity factor) for solid PE (solid polyethylene) is about 0.66.
- VF (velocity factor) for solid PTFE (Polytetrafluoroethylene) is about 0.70.

Table 2-39 Velocity Factor

Parameter	Remarks
<b>Default</b>	0.66
<b>Range</b>	0.1 to 1
<b>Unit</b>	N/A
<b>Knob Step</b>	0.1
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	at 1-2-5 step

## Port Specific Loss

Sets the cable loss for the port. It is used to compensate the attenuation of the stimulus signal in different positions of a cable.



Table 2-40 Cable Loss

Parameter	Remarks
<b>Default</b>	0.00 dB/m
<b>Range</b>	0.00 dB/m to 5.00 dB/m
<b>Unit</b>	dB/m
<b>Knob Step</b>	0.1 dB/m
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	at 1-2-5 step

## FFT Window

Sets the type of the FFT window function.

Five FFT window types are available for RSA: Rectangular (default), Hanning, Gaussian, Flattop, and Hamming.

You can select a proper filter type by referring to the following table according to the actual measurement requirements.

Window Function	Spectral Leakage	Amplitude Accuracy	Frequency Resolution
Gaussian	Moderate	Good	Moderate
Flattop	Good	Excellent	Poor
Rectangular	Poor	Poor	Excellent
Hanning	Good	Moderate	Good
Hamming	Good	Moderate	Good

# Marker Setup

## Marker

Marker is used for marking the point on the trace. Reads the amplitude, frequency, or distance of a certain point on the trace via marker.

### Remarks:

- In VNA mode, each trace window provides 8 markers. By default, Marker 1 is selected. Only a single marker or one pair of markers can be turned on each time.
- Before enabling the marker in a certain trace window, you need to set the current trace first.
- In the Marker menu, you can use the numeric keys, the knob, or the arrow keys to modify frequency or distance to view the readout of different points on the trace. You can also use the touch screen to do the above things.

## Selected Marker

After you select a marker, you can set parameters such as the marker mode and the marker frequency. The readout of the currently activated marker at the marker point will be displayed in the measurement result bar at the upper-left corner of the screen.

## Marker Mode

Sets the type of the marker. The available marker modes include Position, Delta, and Off.

### 1. Position

It is used to measure the X (Frequency or Distance) and Y (Amplitude) values of a certain point on the trace. When "Position" is selected, a marker indicated by a number ("1") appears on the trace.

#### Remarks:

If no active marker exists currently, a marker will be enabled at the X-axis center of the current trace.

### 2. Delta

It is used to measure the difference between "reference point" and "certain point on the trace": X (frequency or distance) and Y (amplitude) value. When "Delta" is selected, a pair of markers appears on the trace: Reference Marker (marked by "X") and the Delta Marker (marked by "Δ").

#### Remarks:

- If an active marker exists currently, then activate a reference marker at the current marker; otherwise activate both the reference marker and Delta marker at the same time at the center frequency.
- When you change the position of the Delta marker, the position of the reference marker remains unchanged, but the frequency (or distance) difference between the two markers will change along with it.
- The frequency (or distance) difference between the two markers and the amplitude difference between them are displayed in the measurement result bar at the upper-left corner of the screen.

### 3. Off

Turns off the marker currently selected. Then, the marker information displayed on the screen and the functions concerning the marker will also be disabled.

## Reference Marker

Sets the reference marker for the current marker. By default, the reference marker is the marker next to it.

### Remarks:

- Each marker can have another marker to be its reference marker.
- Any marker cannot take itself to be the reference marker.
- If the current marker is a Delta marker, the measurement result of the marker will be determined by the reference marker.

## Marker Frequency

Sets the frequency of the marker to change the position of the marker on the trace. Press this key to modify the value to change the position of the marker.

Table 2-41 Marker Frequency

Parameter	Remarks
<b>Default</b>	$(F_{max} - 10 \text{ MHz})/2$
<b>Range</b>	0 to $F_{max}$
<b>Unit</b>	GHz, MHz, kHz, Hz
<b>Knob Step</b>	span/(sweep points - 1)
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	step = span/10

### Remarks:

In DTF measurement, when the trace you selected currently is in the frequency-domain trace window, **Marker Frequency** is grayed out and disabled.

## Marker Distance

Sets the marker distance.

Table 2-42 Marker Distance

Parameter	Remarks
<b>Default</b>	3.36 m
<b>Range</b>	0 to stop distance
<b>Unit</b>	m, dm, cm feet
<b>Knob Step</b>	stop distance/(sweep points - 1)
<b>Left/Right Arrow Key Step</b>	
<b>Up/Down Arrow Key Step</b>	stop distance/10

### Remarks:

In DTF measurement, only when the trace you selected is in the DTF time-domain trace window, can this menu be unavailable. Setting the marker distance will change the position of the marker in the time-domain trace for DTF measurement.

## Line State

Enables or disables the marker line. By default, it is disabled.

### Remarks:

- When you enable the marker line, a cross line is displayed at the amplitude point where the marker resides. The width of the horizontal line and the height of the vertical line are consistent with the length and height of the graticule in the waveform display area.
- If the marker is not visible in the selected area, extend the marker line to the display area for better observation. This function is useful for the marker outside the display area. The marker extension line can better display the amplitude of the marker, making it easy for you to observe and compare.

## Marker Table

Enables or disables the marker table. By default, it is disabled.

When it is set to "On", the lower section of the split screen displays all the enabled markers in the form of lists. They include marker number, trace number, X (frequency or distance) value, and Y (amplitude) value. Through this table, you can view the measurement values of multiple points.

**All Off(Curr)**

Turns off all the enabled markers in the currently selected trace window and their related functions.

**All Off**

Turns off all the enabled markers and their related functions.

## Marker

Sets the other system parameters (such as center frequency and reference level) by using the current marker values. Press any key under **Marker To** to activate a marker automatically if no marker is currently enabled.

In DTF, when you select the time-domain trace window, **Mkr->CF**, **Mkr->Start**, and **Mkr->Stop** menus are grayed out and disabled.

### Mkr->CF

Sets the center frequency of the analyzer to the frequency of the current marker.

- If Position marker is selected, the center frequency will be set to the frequency of the current marker.
- If Delta marker is selected, the start frequency will be set to the frequency of the Delta marker.

### Mkr->Start

Sets the start frequency of the analyzer to the frequency of the current marker.

- If Position marker is selected, the start frequency will be set to the frequency of the current marker.
- If Delta marker is selected, the start frequency will be set to the frequency of the Delta marker.

### Mkr->Stop

Sets the stop frequency of the analyzer to the frequency of the current marker.

- If Position marker is selected, the stop frequency will be set to the frequency of the current marker.
- If Delta marker is selected, the stop frequency will be set to the frequency of the Delta marker.

### Mkr->Ref

Sets the reference level of the analyzer to the amplitude of the current marker.

- If Position marker is selected, the reference level will be set to the amplitude of the current marker.
- Given a Delta marker, if the current marker is the reference marker, then the reference level is set to the amplitude of the reference marker; if the current marker is the Delta marker, then the reference level is set to the amplitude of the Delta marker.
- When the trace format is "Smith" or "Polar", this menu is grayed out and disabled.

## Peak

The peak search function enables the marker to move to the specific signal peak point, and then in combination with the function of Delta marker, it can provide a powerful analysis capability.

### Peak Search

Performs the peak search function. Searches for the maximum value on the trace and marks it with a marker.

### Next Peak

Searches for and marks the peak whose amplitude on the trace is next to that of the current peak.

### Next Peak Right

Searches for and marks the nearest peak which is located at the right side of the current peak.

### Next Peak Left

Searches for and mark the nearest peak which is located at the left side of the current peak.

### Minimum Search

Searches for and marks the peak with the minimum amplitude on the trace.

### Cont Peak

Enables or disables continuous peak search. By default, it is Off. When it is enabled, after finishing each sweep, the analyzer will automatically execute one peak search operation to track the measurement signal.

#### Remarks:

When the Cont Peak function is on, if the current marker is off, set the marker to Position mode, and then execute the peak search operation.

## Input/Output

Sets the input/output interface.

### Input Impedance

Sets the input impedance for voltage-to-power conversion. The default input impedance is 50 Ω. To measure a 75 Ω device, you should use a 75 Ω to 50 Ω adapter (option) supplied by **RIGOL** to connect the analyzer with the system under test, and then set the input impedance to 75 Ω.

Smith chart not only shows the reflection coefficient, but also the normalized impedance. The impedance of the DUT can be obtained through the input impedance. The formula for the normalized impedance is as follows:

$$Z = \frac{1 + \Gamma_{DUT}}{1 - \Gamma_{DUT}}$$

Wherein,  $\Gamma_{DUT}$  is the reflection coefficient.

When the input impedance is set to 50Ω, the impedance of the DUT is the result of (normalized impedance \* 50); when the input impedance is set to 75Ω, the impedance of the DUT is the result of (normalized impedance \* 75).

### Ext Trig2

Sets **Ext Trig2** to "In" or "Out".

## Shortcut Key

### Preset

Recalls the preset setting and restores the system settings of the analyzer to a specified status.

#### Remarks:

- To set the preset type, press **System** → **Preset** → **Preset Type** to select "Default" or any one of the items from "User1" to "User6".
- Press **Preset** to recall the specified factory settings or user settings.



Parameter Name	VNA Parameter
<b>FREQ</b>	
Center Freq	$(F_{\max} - 10 \text{ MHz})/2$
Start Freq	10 MHz
Stop Freq	$F_{\max}$
CF Step	$F_{\text{span}}/10$
CF Step Mode	Auto
<b>SPAN</b>	
Span	$F_{\max} - 10 \text{ MHz}$
<b>AMPT</b>	
Ref Value	When trace format is Lin Mag, Lin Mag(DTF), Log Mag, Phase, Group Delay, Real, Imaginary, Expand Phase, or Return Loss(DTF), the reference value is 0. When trace format is SWR, the reference value is 1.0. When trace format is Positive Phase, the reference value is 180. When trace format is Log Mag(DTF), the reference value is -100.
Ref Position	When trace format is Lin Mag, SWR, Lin Mag(DTF), or Log Mag(DTF), the reference position is 0. When trace format is Log Mag, Phase, Group Delay, Real, Imaginary, Expand Phase, Positive Phase, or Return Loss(DTF), the reference position is 5.
Scale/Div	When the trace format is Lin Mag(DTF), the scale/div value is 0.1. When the trace format is SWR, Smith, or Polar, the scale/div value is 1. When the trace format is Log Mag, Group Delay, Return Loss(DTF), or Log Mag(DTF), the scale/div value is 10. When the trace format is Phase, Positive Phase, or Expand Phase, the scale/div value is 90. When the trace format is Lin Mag, the scale/div value is 100. When the trace format is Real or Imaginary, the scale/div value is 200.
<b>BW</b>	
IF BW	1 kHz
<b>Trigger</b>	
Trigger Source	Free Run
Slope	POS
Delay State	Off
Delay Time	1.00000 us
Hold-off State	Off
Hold-off Time	100.000 ms

Auto Trig State	Off
Auto Trig	100.000 ms
<b>Trace</b>	
Selected Trace	Trace 1
Trace Type	Clear Write
Trace Update	On
Trace Display	Data
Trace Format	S11: Smith Lin/Phase S21: Log Mag DTF: Lin Mag(DTF)
Math Function	Off
Window Layout	Four Window (S11); UD Window (S21/DTF)
<b>Meas</b>	
Measurement Function	S11
<b>Meas Setup (S11)</b>	
Avg Number	100
Reference Level	0.00 dBm
Aperture Step Width	10
Port Extension	Off
Port 1 Delay	0.00 ns
Unit	meter
Port 1 Length	0.00 cm
Port 1 Velocity Factor	0.66
Port 1 Specific Loss	0.00 dB/m
Cal Kits	CK106A
<b>Meas Setup (S21)</b>	
Avg Number	100
Ref Value	-10.00 dBm
Aperture Step Width	10
Port Extension	Off
Unit	meter
Port 1 Delay	0.00 ns
Port 1 Length	0.00 cm
Port 1 Velocity Factor	0.66
Port 1 Specific Loss	0.00 dB/m
Port 2 Delay	0.00 ns
Port 2 Length	0.00 cm
Port 2 Velocity Factor	0.66

Port 2 Specific Loss	0.00 dB/m
Cal Kits	CK106A
<b>Meas Setup (DTF)</b>	
Avg Number	100
Ref Value	0.00 dBm
Port Extension	Off
Port Delay	0.00 ns
Unit	meter
Port Length	0.00 cm
Port Velocity Factor	0.66
Port Specific Loss	0.00 dB/m
Cal Kits	CK106A
Stop Distance	6.72 m
Velocity Factor	0.66
Cable Loss	0.00 dB/m
FFT Window	Rectangular
<b>Marker</b>	
Selected Marker	Marker 1
Marker Type	Position
Reference Marker	Marker 2
Marker Frequency	(Fmax - 10 MHz)/2
Marker Distance	3.36 m
Line State	Off
Marker Table	Off
<b>Peak</b>	
Cont Peak	Off
<b>System<sup>[1]</sup></b>	
Power On	Preset
Preset Type	Default
LAN Setting Mode	DHCP
HDMI Output	Off
HDMI Resolution	1280*720 60Hz
LCD Switch	On
LCD Backlight	100%
Power Switch	Default
Beep Switch	Off
SCPI Display	On
User Key	Off
Language	English

**Note<sup>[1]</sup>:** Not affected by Preset settings.

## User

User-defined shortcut key. For some hard-to-find but commonly used function menu, you can define it as shortcut key (for the defining method, refer to the introduction in "**User Key**"). After that, press the shortcut key under any operation interface to quickly open and set the desired menu or function.

**Note:** You can use the User key to define all the keys on the front panel and the sub-menus of these keys (except **Save**).

## Quick Save

Repeats the most recent save that was performed from the **Save** menu. Its saving path is the currently defined "quick save path".

## Cont

Press this key to perform the continuous sweep operation.

## Single

Press this key to perform the single sweep operation.

# System Function

## System

Sets the system parameters.

### Preset

Functions include: select the instrument settings to be recalled after the analyzer is powered on ("Last" or "Preset"); set the preset type ("Default" or one of the items from "User1" to "User6"); save preset.

#### 1. Power On

Sets the power on setting to "Last" or "Preset".

- When "Last" is selected, the last system settings before power-off would be recalled automatically at power-on.
- When "Preset" is selected, settings defined in **Preset Type** would be recalled automatically at power-on.

#### 2. Preset Type

Sets the preset type to "Default" (by default) or any one of the items from "User1" to "User6".

- When Power On is set to "Preset", the specified preset type will be recalled at power-on.
- After the instrument starts, press **Preset** on the front panel in any operation interface will recall the specified preset type.

#### 3. Save User Preset


Saves the current system setting as user-defined settings to the internal non-volatile memory. You can store up to 6 system states (correspond to "User1" to "User6" in the preset type) and name each state file.

When one of the items from "User1" to "User6" is selected under **Preset Type**, press **Save User Preset**, and the then automatically enter the filename input interface. Then, perform the saving operation.

## Interface

The analyzer supports the LAN or USB communication interface.

#### 1. LAN

Sets the LAN parameters. Tap the setting information icon  at the top of the user interface or use the externally connected mouse to click the icon, and

then click the network setting icon . Then, the LAN parameter setting interface, as shown below, is displayed.

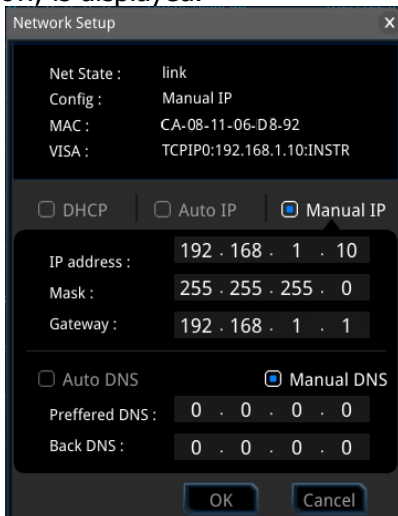


Figure 2-3 LAN Parameter Setting

The following items can be set by the front panel keys, the keyboard shortcut keys, the externally connected mouse, the touchscreen, or remote operation.

### 1) Mode

Sets the mode of obtaining the IP address.

- **DHCP:** When DHCP is selected, the DHCP server assigns network parameters (such as the IP address, subnet mask, and gateway) to the analyzer based on the current network configuration.
- **Auto:** When "Auto" is selected, the instrument will acquire the IP address ranging from "169.254.0.1" to "169.254.255.254" and the subnet mask (255.255.0.0) automatically based on the current network configuration.
- **Manual:** When "Manual" is selected, you can self-define a desired IP address for the analyzer.

**Note:** The analyzer attempts to acquire the IP address configuration according to the sequence of DHCP, Auto IP, and Manual IP. These three methods cannot be disabled at the same time.

### 2) IP

Press **IP** and use the numeric keys to input the desired IP address.

The format of the IP address is "nnn.nnn.nnn.nnn". The range for the first segment (nnn) of the address is from 1 to 223 (except 127); and the range for the other three segments is from 0 to 255. You are recommended to ask your network administrator for an IP address available.

### 3) Subnet mask

Press **Subnet mask** and use the numeric keys to input the desired subnet mask.

The format of the subnet mask is nnn.nnn.nnn.nnn; wherein, the range of "nnn" is from 0 to 255. You are recommended to ask your network administrator for a subnet mask available.

### 4) Gateway

Press **Gateway** and use the numeric keys to input the desired gate address.

The format of the default gateway is "nnn.nnn.nnn.nnn". The range for the first segment (nnn) of the address is from 1 to 223 (except 127); and the range for the other three segments is from 0 to 255. You are recommended to ask your network administrator for a gate address available.

### 5) DNS

- mDNS: enables or disables the sending of the network information (including IP address, host name, etc.).
- DNS Mode: Sets the mode of obtaining the DNS address to be "Manual" or "Auto".
- Preferred DNS: Sets the preferred address for the DNS.
- Backup DNS: Sets the backup address for the DNS.

The format of the DNS address is "nnn.nnn.nnn.nnn". The range for the first segment (nnn) of the address is from 1 to 223 (except 127); and the range for the other three segments is from 0 to 255. You are recommended to ask your network administrator for an address available.

### 6) Apply

After the LAN interface configuration is finished, press this key to apply the current configuration to the instrument.

### 7) Reset

Turns on DHCP and Auto-IP; turns Manual-IP off. Clears the set network password and restores it to the factory defaults.

## 2. USB

RSA provides a USB DEVICE interface on the rear panel. The analyzer may serve as a "slave" device to be connected to the PC via this interface.

## Display

Controls the screen display. You can set the current mode, the current measurement interface or window, and other display-related parameters.

### 1. HDMI

Enables or disables HDMI.

## 2. HDMI Resolution

Selects the resolution supported by HDMI interface to be "1280\*720 60Hz", "640\*480 60Hz", or "720\*480 60Hz".

## 3. LCD

Enables or disables LCD. By default, it is On.

### Remarks:

- If you are not updating data, turning off LCD can improve the measurement speed.
- To reduce the electromagnetic radiation of some circuit component, turn off the LCD.
- To avoid misoperation, turn off the LCD.

## 4. LCD Backlight

Sets the brightness of the LCD backlight.

The brightness is expressed in percentage. When it is 100, it indicates that the backlight is the brightest; when it is 1, the backlight is the darkest.

## About System

Displays the system information or the option information.

### 1. System Info

- Model
- Serial Number
- Hardware Version Number
- Firmware Version Number
- Software Version

### 2. Option Info

Displays the option information.

RSA5000N provides many kinds of options to meet various measurement requirements. To purchase the corresponding option, please contact **RIGOL**.

### 3. Self Test

- **Screen**  
Tests whether the screen has a dot defect by using six colors: blue, red, green, gray, white, and black. Press any key to switch the screen color and exit the test.
- **Multi-point Touch**  
Enters the multi-point touch test interface. Use multiple fingers to make pinch or stretch gestures on the screen, and observe the size of the



characters. If they do not change along with your gestures, it indicates that problems occurred to the multi-point touch function. To exit the test, press **Esc** for three consecutive times.

- **Single-point Touch**

Enters the single-point touch test interface. Touch or use the mouse to make stretch or strike gestures on the screen, if the corresponding traces are displayed, then it indicates that the point on the touchscreen is valid. To exit the test, press **Esc** for three consecutive times.

- **Keyboard**

Enter the keyboard test interface. Press the function keys on the front panel one by one and observe whether the corresponding key is illuminated. If not, an error may have occurred to that key. To exit the test, press **Esc** for three consecutive times.

**Note:** For the transparent keys on the front panel, they will be also illuminated during the test.

#### 4. License Info

Displays the license registration information about the components such as Linux, QT OS, etc.

#### 5. Online Update

Connect the analyzer to the external network by using the network cable. If you do not have the right to access the Internet, please ask the administrators to grant your right to access the external internet first. Then, press this key to update the software.

## Date/Time

Sets the system date and time.

### 1. Set Time

Sets the displayed system time of the analyzer. Press the **Hour**, **Minute**, and **Second** softkeys respectively to set the time.

### 2. Set Date

Sets the displayed system date of the analyzer. Press the **Year**, **Month**, and **Day** softkeys respectively to set the date. You can also press **Date Format** to select whether the date is displayed in "YMD" or "MDY" form.

## Security Clear

Press this key to perform the security clear function. This function includes the

following operations:

- Deletes all the user data, including the state file, trace+state file, screen file, measdata file, and etc. in all modes.
- Executes the factory resetting operation.

## Language

RSA supports multi-language menu, Chinese and English built-in help and pop-up messages.

Press this key to select the desired display language.

## Settings

### 1. Power Switch

Sets whether the power switch on the front panel is effective or not.

- Default: When the analyzer is powered on, press the power switch on the front panel to start up the analyzer.
- Always: When the analyzer is powered on, it starts automatically.

### 2. Beep Switch

Turns on or off the beeper. By default, it is Off.

### 3. Volume

After you turn on the beeper, you can press this key to adjust the volume of the beeper.

### 4. User Key

Defines an associated function for the **User** key on the front panel. The definition method is as described below. After that, pressing **User** in any operation interface can quickly enable the defined function.

- Press **User Key** to select "On";
- Open the function menu that needs to be defined. For example, press **System** → **Display** → **LCD Backlight**;
- Press **User** and the definition is finished. At this time, **User Key** turns off automatically.

### 5. SCPI Display

When you use the SCPI commands to control the instrument remotely, turning on the SCPI Display will go to the specified menu of the corresponding command; turning off the SCPI Display will not go to the specified menu.

## Messages

Press this key, and then a prompt message dialog box will be displayed. You can press the corresponding softkey to select to view all the messages, the messages that have been read or not read. You can also use the touch screen or the externally connected mouse to tap or click the specified icon in the prompt message dialog box.

- 1. Select All**  
Selects all the displayed messages.
- 2. Select Read**  
Only selects the messages that have been read.
- 3. Select Unread**  
Only selects the messages that have not been read.
- 4. Delete**  
Deletes the selected messages.
- 5. Query All**  
Views all the displayed messages.
- 6. Query Read**  
Only views the messages that have been read.
- 7. Query Unread**  
Only views the messages that have not been read.

## File

RSA allows you to save various types of files to the internal or external memory, and recall them when necessary.

Press **File** on the front panel to enter the file operation menu interface.

### File Explorer

Press the key to enter the file manager interface. You can use the touch gestures to tap the screen or use the mouse to click on the screen to select the corresponding file or folder. Displays all the files with the specified file types. When you select a file, you can press the **Copy**, **Paste**, or **Delete** softkeys to copy, paste, or delete the specified file.

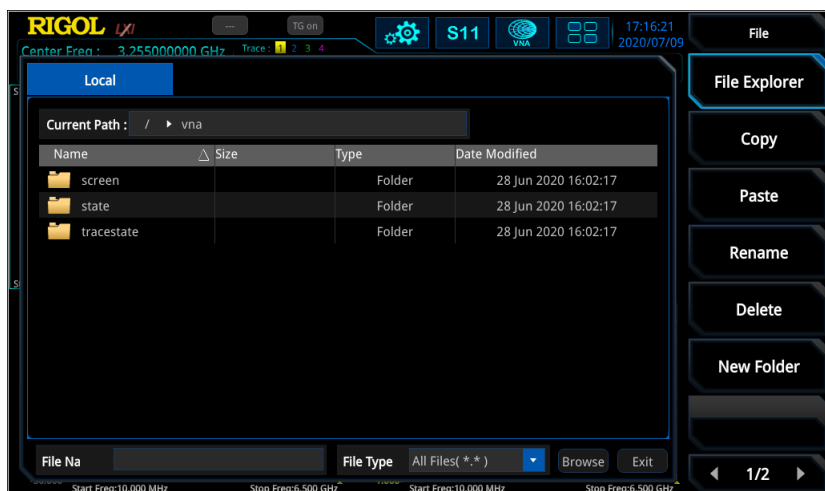


Figure 2-4 File Manager

The available file types include: State, Trace+State, Screen Image, and License. The descriptions for various file types are shown in the following table.

Table 2-43 Descriptions of File Type

File Type	Format	Suffix Name
Limit	LIMIT	.csv/.lim
Trace&State	BIN	.bin/.dat/.sta/.trs
Screen Image	IMAGE	.jpg/bmp/png
License	LICENSE	.lic
Text	TEXT	.txt

**Note:**

- RSA can only recognize files whose filenames consist of Chinese characters, English letters, or numbers. If the filename or folder name contains other

characters, the file or the folder might not be displayed normally in the file manager interface.

- The file types saved under each mode are different. Please save the file as the specified form of the file type supported for the current mode.

## Copy

Copies the currently selected file or folder.

## Paste

Pastes the file or folder.

When the current path has contained a file or folder whose name is the same as the one that you want to paste, after you perform the paste operation, the original file or folder will be overwritten.

## Rename

Rename a file that has been stored. After you select a file, press this key to input a new filename.

## Delete

Deletes the selected file.

## New Folder

Creates a folder. Press this key to create a new empty folder under the current directory, and the file is named with a default filename. To modify this filename, press **Rename** to rename the file.

## Quick Print

If the printer has been successfully installed, press this key to quickly print the currently displayed screen image.

## Print

Prints the current screen according to print parameter settings when the printer has been successfully installed and is in idle state.

## Printer Setup

### 1. Printer Parameters

#### 1) Page Size

Sets the page size for printing. When "Default" is selected, the page size depends on the printer currently connected.

#### 2) Quality

Sets the print quality.

#### 3) Color

Sets the print color to Color, Mono, Inverse, or Inverse-Mono.

#### 4) Orientation

Sets the print orientation to "Landscape" or "Portrait".

#### 5) Adjust

Sets the print border to be Adaptive, Non-Adpt, and Hold Min.

#### 6) Counts

Sets the print copies and the default is 1. The range available is from 1 to 99.

#### 7) Border

Turns on or off the border.

In addition, you can preview the print page, and set to print the image or the text in All page, 1/2, 1/4, or 1/9 page.

### 2. Add Device

Queries and adds a printer. Inputs the IP address of the printer, the manufacturer of the printer, the printer model, and printer drive. Then, the printer is added.

### 3. Select Device

Selects the desired printer.

## Import License

In the file manager interface, select a file to be imported and then press **Import License** to import the file.

## System Update

Press this key to update the analyzer software after selecting the update file in the USB storage device.

## Recall

RSA allows you to recall various types of files saved to the internal or external storage memory.

Press **Recall** on the front panel to enter the file recalling menu. The available file types include: State and Trace&State.

### State

Press **State** to enter the state recalling menu. The state can be recalled from the file.

### Recall

Press **File Explorer** to enter the file manager interface. Select a file and then press **Recall** to recall the file from a register or a file.

### Trace&State

Press **Trace&State** to enter the trace&state recalling menu. The state of the instrument and the selected trace can be recalled from a file.

#### 1. Recall

Press **File Explorer** to enter the file manager interface. Select a file and then press **Recall** to import the file.

#### 2. To Trace

Selects the trace&state file to recall them to the selected trace.

## Save

RSA allows you to save various types of files to the internal or external memory.

Press **Save** on the front panel to enter the file saving menu. The available file types include: State, Trace&State, and Screen Image.

### State

Press **State** to enter the state saving menu. The state can be saved to the file.

#### 1. Save

Press this key to save the current state in the default filename or user-defined filename.



The default state filename is determined by the following methods:

- If you haven't input a filename by pressing the **Save As** key, its default filename is state<n>.sta. Wherein, n refers to the file number of the filenames that are named based on the naming mode in the current file directory. The value of <n> is the existing maximum file number plus 1. For example, if 3 files (state1.sta、state2.sta、state5.sta) exist in the current directory, then the new filename for the file that you want to save should be state6.sta by default.
- If you have pressed the **Save As** key to input the filename abc, then the file is saved to be "abc.sta". After that, press the **Save** key again, another file is saved automatically with the filename "abc1.sta".

## 2. Save As

Press this key and then use the numeric keypad on the front panel to input the filename. Then, press **Save** to save the corresponding state file.

You can also touch the screen or use the mouse to touch or click the **Save As** menu, and then input the filename with the keypad.

## Trace&State

Press **Trace&State** to enter the trace&state saving menu. The state of the instrument and the selected trace can be saved to the file.

### 1. Save

Press this key to save the current trace&state file in the default filename or user-defined filename.

The default filename is determined by the following methods:

- If you haven't input a filename by pressing the **Save As** key, its default filename is tracestate<n>.trs. Wherein, n refers to the file number of the filenames that are named based on the naming mode in the current file directory. The value of <n> is the existing maximum file number plus 1.
- If you have pressed the **Save As** key to input the filename abc, then the file is saved to be "abc.trs". After that, press the **Save** key again, another file is saved automatically with the filename "abc1.trs".

### 2. Save As

Press this key and then use the numeric keypad on the front panel to input the filename. Then, press **Save** to save the corresponding trace+state file.

You can also touch the screen or use the mouse to touch or click the **Save As** menu, and then input the filename with the keypad.

### 3. Save From Trace

Selects the trace to be saved. You can select any single trace from Trace1 to Trace4.

## Screen Image

Press **Screen Image** to enter the screen saving menu.

### 1. Save

Press this key to save the current screen image in the default filename or user-defined filename.

The default filename is determined by the following methods:

- If you haven't input a filename by pressing the **Save As** key, its default filename is screen<n>.jpg. Wherein, n refers to the file number of the filenames that are named based on the naming mode in the current file directory. The value of <n> is the existing maximum file number plus 1.
- If you have pressed the **Save As** key to input the filename abc, then the file is saved to be "abc.jpg". After that, press the key again, another file is saved automatically with the filename "abc1.jpg".

### 2. Save As

Press this key and then use the numeric keypad on the front panel to input the filename. Then, press **Save** to save the corresponding Screen Image file.

You can also touch the screen or use the mouse to touch or click the **Save As** menu, and then input the filename with the keypad.

### 3. Screenshot Info

#### 1) Format

Press this key to select the file format of the current screen image to be "JPEG", "BMP", or "PNG".

#### 2) Color Type

Press this key to select the color of the current screen image to be "Normal" or "Inverted".

## Quicksave Path

### 1. Set Path

Press the **Set Path** softkey to open the file explorer interface. Select the corresponding path, and then press **OK** to set the current path to be the quick save path.

**2. View Path**

Press the **View Path** softkey to display the current quick save path information in the center of the user interface.



## Chapter 3 Appendix

### Appendix A: RSA5000 Accessories and Option List

	Description	Order No.
Model	Real-time Spectrum Analyzer, 9 kHz to 3.2 GHz	RSA5032
	Real-time Spectrum Analyzer, 9 kHz to 6.5 GHz	RSA5065
	Real-time Spectrum Analyzer, 9 kHz to 3.2 GHz (include TG)	RSA5032-TG
	Real-time Spectrum Analyzer, 9 kHz to 6.5 GHz (include TG)	RSA5065-TG
	Real-time Spectrum Analyzer, 9 kHz to 3.2 GHz (include TG and VNA)	RSA5032N
	Real-time Spectrum Analyzer, 9 kHz to 6.5 GHz (include TG and VNA)	RSA5065N
Standard Accessories	Quick Guide (hard copy)	-
	Power Cable	-
Option	Vector Signal Analysis Measurement Application	RSA5000-VSA
	EMI Measurement Application	RSA5000-EMI
	Preamplifier (PA)	RSA5000-PA
	High Stability Clock	OEXO-C08
	Real-time/Analysis Bandwidth 40 MHz	RSA5000-B40
	Advanced Measurement Kit	RSA5000-AMK
	Spectrum Analyzer PC Software	Ultra Spectrum
	EMI Pre-compliance Test Software	S1210 EMI Pre-compliance Software
Optional Accessories	High-performance Network Analysis Calibration Kit (frequency range: DC to 6.5 GHz)	CK106A
	Economical Network Analysis Calibration Kit (frequency range: DC to 1.5 GHz)	CK106E
	Include: N-SMA cable, BNC-BNC cable, N-BNC adaptor, N-SMA adaptor, 75 Ω-50 Ω adaptor, 900 MHz/1.8 GHz antenna (2pcs), 2.4 GHz antenna (2pcs)	DSA Utility Kit
	Include: N(F)-N(F) adaptor (1pcs), N(M)-N(M) adaptor (1pcs), N(M)-SMA(F) adaptor (2pcs), N(M)-BNC(F) adaptor (2pcs), SMA(F)-SMA(F) adaptor (1pcs), SMA(M)-SMA(M) adaptor (1pcs), BNC T type adaptor (1pcs), 50 Ω SMA load (1pcs), 50 Ω BNC impedance adaptor (1pcs)	RF Adaptor Kit
	Include: 50 Ω to 75 Ω adaptor (2pcs)	RF CATV Kit
	Include: 6 dB attenuator (1pcs), 10 dB attenuator (2pcs)	RF Attenuator Kit
	30 dB high-power attenuator, with the max power of 100 W	ATT03301H
	N(M)-N(M) RF Cable	CB-NM-NM-75-L-12G
	N(M)-SMA(M) RF Cable	CB-NM-SMAM-75-L-12G

	VSWR Bridge, 1 MHz to 3.2 GHz	VB1032
	VSWR Bridge, 2 GHz to 8 GHz	VB1080
	Near-field Probe	NFP-3
	Rack Mount Kit	RM6041
	USB Cable	CB-USBA-USBB-FF-150

**Note: For more details about the accessories and the options, please contact RIGOL sales representatives or the local distributors.**

## Appendix B: RSA3000 Accessories and Option List

	Description	Order No.
Model	Real-time Spectrum Analyzer, 9 kHz to 1.5 GHz (include TG and VNA)	RSA3015N
	Real-time Spectrum Analyzer, 9 kHz to 3.0 GHz	RSA3030
	Real-time Spectrum Analyzer, 9 kHz to 4.5 GHz	RSA3045
	Real-time Spectrum Analyzer, 9 kHz to 3.0 GHz (include TG)	RSA3030-TG
	Real-time Spectrum Analyzer, 9 kHz to 4.5 GHz (include TG)	RSA3045-TG
	Real-time Spectrum Analyzer, 9 kHz to 3.0 GHz (include TG and VNA)	RSA3030N
	Real-time Spectrum Analyzer, 9 kHz to 4.5 GHz (include TG and VNA)	RSA3045N
Standard Accessories	Quick Guide (hard copy)	-
	Power Cord	-
Option	EMI Measurement Application (includes RSA3000-EMC)	RSA3000-EMI
	Preamplifier (PA)	RSA3000-PA
	High Stability Clock	OCXO-C08
	RBW 1 Hz to 10 MHz	RSA3000-BW1
	Real-time Analysis Bandwidth 25 MHz	RSA3000-B25
	Real-time Analysis Bandwidth 40 MHz	RSA3000-B40
	Advanced Measurement Kit	RSA3000-AMK
	EMC Filter and Quasi-Peak Detector Kit	RSA3000-EMC
	Spectrum Analyzer PC Software	Ultra Spectrum
	EMI Pre-compliance Test Software	S1210 EMI Pre-compliance Software
Optional Accessories	High-performance Network Analysis Calibration Kit (frequency range: DC to 6.5 GHz)	CK106A
	Economical Network Analysis Calibration Kit (frequency range: DC to 1.5 GHz)	CK106E
	Include: N-SMA cable, BNC-BNC cable, N-BNC adaptor, N-SMA adaptor, 75 Ω-50 Ω adaptor, 900 MHz/1.8 GHz antenna (2pcs), 2.4 GHz antenna (2pcs)	DSA Utility Kit
	Include: N(F)-N(F) adaptor (1pcs), N(M)-N(M) adaptor (1pcs), N(M)-SMA(F) adaptor (2pcs), N(M)-BNC(F) adaptor (2pcs), SMA(F)-SMA(F) adaptor (1pcs),	RF Adaptor Kit

SMA(M)-SMA(M) adaptor (1pcs), BNC T type adaptor (1pcs), 50 $\Omega$ SMA load (1pcs), 50 $\Omega$ BNC impedance adaptor (1pcs)	
Include: 50 $\Omega$ to 75 $\Omega$ adaptor (2pcs)	RF CATV Kit
Include: 6 dB attenuator (1pcs), 10 dB attenuator (2pcs)	RF Attenuator Kit
30 dB high-power attenuator, with the max power of 100 W	ATT03301H
N(M)-N(M) RF Cable	CB-NM-NM-75-L-12G
N(M)-SMA(M) RF Cable	CB-NM-SMAM-75-L-12G
VSWR Bridge, 1 MHz to 3.2 GHz	VB1032
VSWR Bridge, 2 GHz to 8 GHz	VB1080
Near-field Probe	NFP-3
Rack Mount Kit	RM6041
USB Cable	CB-USBA-USBB-FF-150

**Note: For more details about the accessories and the options, please contact RIGOL sales representatives or the local distributors.**

## Appendix C: Warranty

**RIGOL** TECHNOLOGIES CO., LTD. (hereinafter referred to as **RIGOL**) warrants that the product will be free from defects in materials and workmanship within the warranty period. If a product proves defective within the warranty period, **RIGOL** guarantees free replacement or repair for the defective product.

To get repair service, please contact with your nearest **RIGOL** sales or service office.

There is no other warranty, expressed or implied, except such as is expressly set forth herein or other applicable warranty card. There is no implied warranty of merchantability or fitness for a particular purpose. Under no circumstances shall **RIGOL** be liable for any consequential, indirect, ensuing, or special damages for any breach of warranty in any case.



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