RIGOL

Bluetooth Test

For RSA6000 Series Spectrum Analyzer

User Guide

Apr. 2026

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Section	Description	Page

1 Document Overview

This manual gives you a quick review about the operation methods for the functions of BlueTooth (BTX) measurement in the VSA mode of RSA6000 series.

For the general functions of the VSA mode, its quick operation key operation, and system settings of the RSA6000 series spectrum analyzer, refer to *RSA6000 VSA User Guide*.

TIP

For the latest version of this manual, download it from the official website of RIGOL (*http://www.rigol.com*).

Publication Number

UGD34100-1110

Software Version

00.01.00.33

Software upgrade might change or add product features. Please acquire the latest version of the manual from RIGOL website or contact RIGOL to upgrade the software.

Format Conventions in this Manual

1. **Key**

   The front panel key is denoted by the menu key icon. For example, 

   indicates the "System" key.

2. **Menu**

   The menu item is denoted by the format of "Menu Name (Bold) + Character Shading" in the manual. For example, **Setup** indicates clicking or tapping the "Setup" sub-menu under the system menu to view the basic setting configuration items.

3. **Operation Procedures**

   The next step of the operation is denoted by "**>**" in the manual. For example,  **>** **Save** indicates that first clicking or tapping the icon  , then clicking or tapping **Save**.

4. **Connector**

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

Content Conventions in this Manual

The RSA6000 series spectrum analyzer includes the following models. Unless otherwise specified, this manual takes RSA6265 as an example to illustrate the functions and operation methods of the RSA6000 series.

Model	Frequency Range
RSA6265	5 kHz to 26.5 GHz
RSA6140	5 kHz to 14 GHz
RSA6085	5 kHz to 8.5 GHz

2 Bluetooth Function

Based on Bluetooth SIG standard short-range wireless communication technology, Bluetooth measurement is widely used in mobile devices, audio transmission, smart home, Healthcare and Industrial Internet of Things (IoT) data transfer.

RIGOL RSA6000 series real-time spectrum analyzer provides a standard physical layer test solution for the Bluetooth signals. It enables engineers to quickly assess signal quality and locate RF faults during the R&D, validation, and production line testing phases.

Bluetooth Technology

- **Operating Band**

  It operates on the worldwide 2.4 GHz ISM band. The Bluetooth Low Energy (BLE) standard divides the 2.4 GHz frequency band into 40 channels with the channel spacing of 2 MHz. CH0 through CH36 are data channels for actual data transmission and CH37 through CH39 are designated as advertising channels with adaptive frequency hopping (AFH).

- **Modulation Mode**

  BLE physical layer uses Gaussian Frequency Shift Keying (GFSK) modulation technology to balance low power consumption, transmission rate, and communication distance.

- **Transfer Rate**

  BLE supports multiple physical layer transfer rates, including 1 Mbps (LE 1M), 2 Mbps (LE 2M), LE 125 kbps and LE 500 kbps for long-range transmission.

- **Frequency Hopping Technology**

  In the data transmission phase after the connection is set up, data is transmitted by performing frequency hopping across the 37 data channels (CH0 to CH36). With FHSS (frequency hopping spread spectrum) and AFH (adaptive frequency hopping) technology, it can automatically avoid congestion channel, achieve anti-interference, anti-multi-path decline,multi-user coexistence and security.

Bluetooth Measurement

- **Standard Compliance Analysis**

  The instrument complies with the Bluetooth RF-PHY physical layer specification and supports multiple physical layer packet structures defined by the Bluetooth core standard. It has the built-in standard filters and demodulating algorithms, capable of accurately restoring protocol-compliant signal characteristics.

- **Multi-dimensional Visual Analysis**

Supports multi-pane window display, showing the signal details from time-domain, frequency-domain, and modulation-domain aspects.

- **RF Envelope:** displays the variation in signal power over time. The X-axis represents time and the Y-axis represents amplitude (dBm). You can observe the burst pulse shape and power stability.
- **Demod Waveform:** displays the demodulated time-domain waveform (such as the GFSK frequency deviation trace). The Y-axis, on a linear scale expressed in Hz, visually reflects the transient frequency offset and linearity of the modulated signal.
- **Spectrum:** displays the spectrum utilization of the signal. You can set the center frequency, span, and reference value, etc. to judge channel bandwidth and out-of-band spurious.
- **Metrics.** displays the packet information. The system automatically identifies the packet type, payload type, and payload length.

• **Key Metrics Quantification**

Core RF metrics are automatically calculated from demodulated data, including power metrics, modulation characteristic metrics, and frequency stability metrics.

3 User Interface of Bluetooth Measurement

Figure 3.1 User Interface

1. Multi-pane Display Area

Displays different display views for Bluetooth measurement. The signal can be analyzed and tested in various views.

2. Status Display Bar

- Standard: it is fixed to be LENergy (low energy).
- Impedance: input impedance. The available choices are 50 Ω or 75 Ω.
- Packet Type: Bluetooth measurement data packet type. The available choices include LE1M, LE2M, LE500k, or LE125k.
- Avg/Hold: by default, it is disabled. When it is enabled, it shows the averaging progress (Avg/Hold = Average Count Completed/Total Average Counts).
- Atten: Attenuation value. It can be set in the **Amplitude** menu.
- PA: Preamplifier (PA). It only shows ON or OFF.

- Trig: trigger source. It can be set in the **Trigger** menu. The available choices include Free Run and IF Power. When you select IF Power as the trigger source, Trig Delay will also be displayed in the status display bar.
- Channel: Bluetooth measurement channel number. It can be set in the **Frequency** menu.

3. Quick Operation Key

Adds a view; restores to its default settings; captures the screenshot.

- Add a view: Click or tap this icon to enter the "Add View" interface, where you can choose to add a specified view.
- Restore default settings: click or tap the Preset icon to restore the instrument to its default settings, as specified in *Preset*.
- Capture the screenshot: Click or tap the icon to save the instrument's current screen to the default path, and then display a prompt message informing you that the screenshot has been successfully captured and saved.

4. Menu Operation Area

Selects the specified menu to configure the relevant parameters. For example, Frequency, Amplitude, BandWidth, Meas Setup, Marker, etc.

5. Notification Area

Displays the USB storage device icon, LAN connection icon, sound icon, remote control icon, and system time. Click or tap this area, then the System menu is displayed. You can set the system-related parameters.

6. Working Mode

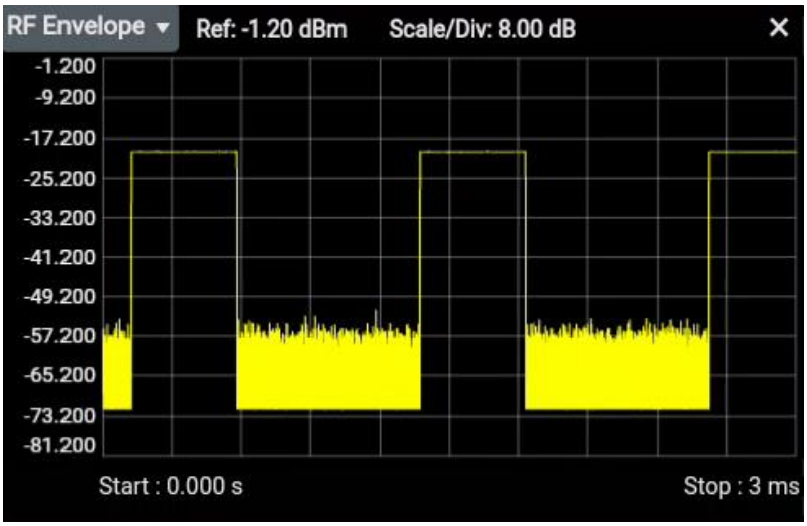
Displays the currently selected working mode.

7. Function Navigation Icon

Click or tap the icon  to open the function navigation menu. Click or tap the specified menu icon to enter the specified function setting menu.

3.1 RF Envelope

The RF Envelope window shows the signal power over time. The X-axis represents time and the Y-axis represents log scale, expressed in dBm.

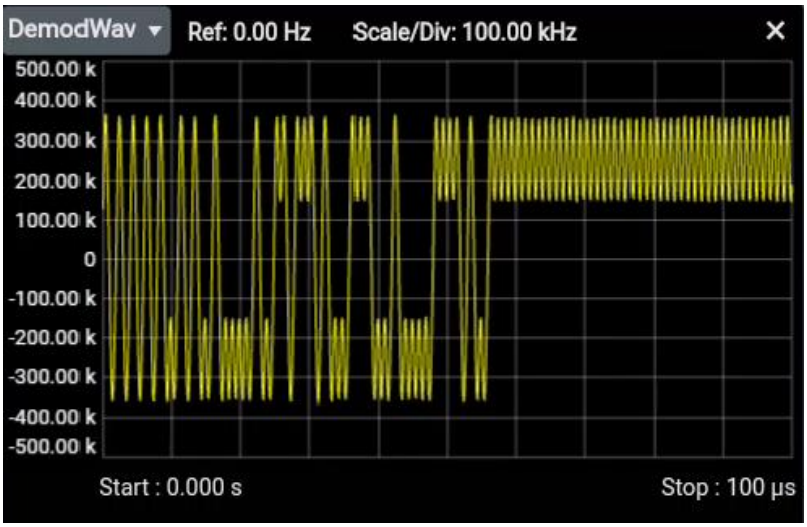


- Start: indicates the start time.
- Stop: indicates the stop time.
- Ref: indicates the Y-axis reference value.
- Scale/Div: indicates the Y-axis scale per division.

You can adjust the above parameter settings in the **Display** menu.

3.2 Demod Waveform

Displays the GFSK demodulated baseband time-domain waveforms. The horizontal axis represents time, and the vertical axis, on a linear scale, expressed in Hz, represents frequency offset.



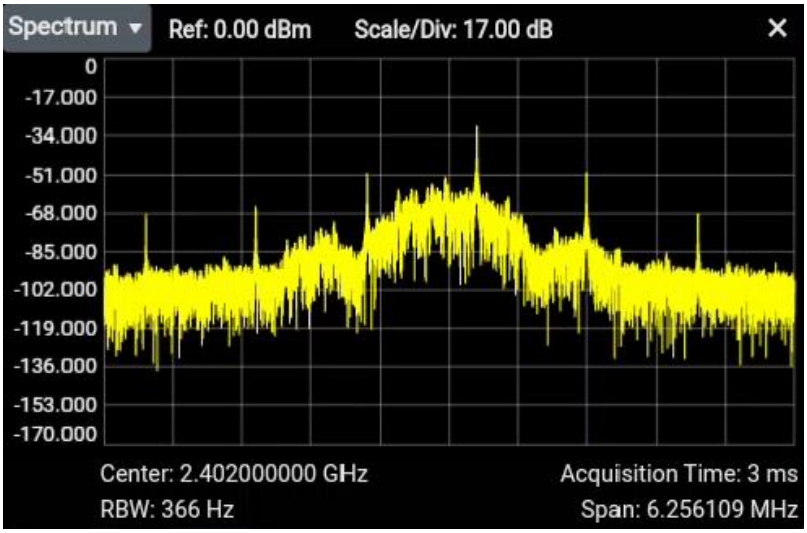
- Start: indicates the start time.
- Stop: indicates the stop time.

- Ref: indicates the Y-axis reference value.
- Scale/Div: indicates the Y-axis scale per division.

You can adjust the above parameter settings in the **Display** menu.

3.3 Spectrum

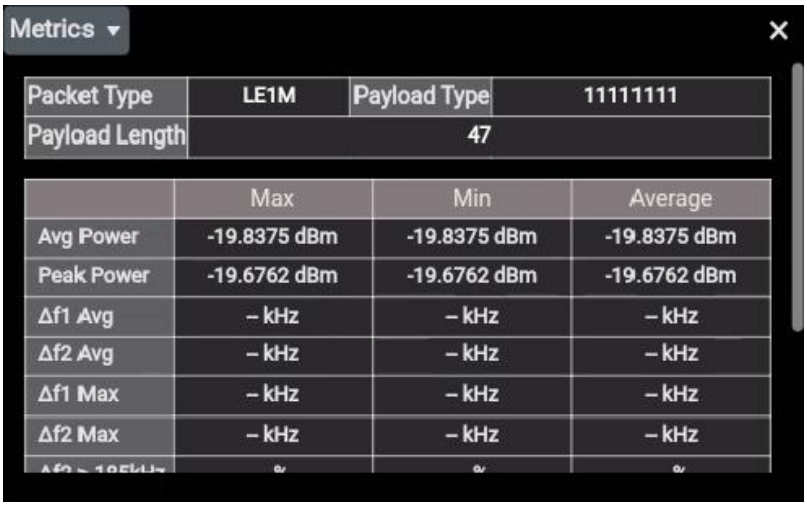
The Spectrum view displays the spectrum of the Bluetooth signal. In this view, its vertical axis represents logarithmic magnitude, expressed in dBm, and its horizontal axis represents frequency.



- Center: center frequency. It can be set in the **Frequency** menu.
- Acquisition Time: It can be set in the **Sweep** menu.
- RBW: Resolution bandwidth. The RBW value cannot be modified. It varies automatically according to the FFT window type that you select in the **BandWidth** menu.
- Span: Frequency span. It can be set in the **Frequency** menu.
- Ref: Y Ref Value. It can be set in the **Display** menu.
- Scale/Div: Y Scale/Div. It indicates the Y-axis scale per division.

3.4 Metrics

Displays the quantitative metrics of the physical layer of Bluetooth signals.



- Packet Type:

  Displays the currently measured Bluetooth packet type (e.g. DM1/DH1, etc.); where "NA" indicates no valid packet data is found, or packet data is not recognized.

- Payload Type:

  The type of payload (such as data payload/control payload) in a Bluetooth packet. "NA" indicates no payload is found.

- Payload Length:

  The number of bytes of the payload in a Bluetooth packet.

Power Metrics (Max/Min/Average)

- Avg Power

  The average output power of a Bluetooth transmitter over a packet cycle is a basic indicator of the transmission performance of a Bluetooth device (subject to Bluetooth power class requirements such as -6 dBm to +4 dBm for Class 2 devices)

- Peak Power

  The instantaneous maximum output power of the Bluetooth signal, reflecting the magnitude of the signal's power fluctuations (Note: Avoid excessive peaks to prevent EMI limit violations.).

Modulation characteristic indicator (Bluetooth GFSK modulation core parameter)

- Δf1 Avg

  Δf1 is the Class 1 frequency deviation of Bluetooth GFSK modulation, representing the fundamental component of the nominal frequency deviation. It reflects the long-term stability of the modulation frequency deviation.

- Δf2 Avg

  Δf2 is the Class 2 frequency deviation of Bluetooth GFSK modulation, representing the fluctuation component of the frequency deviation. It reflects the fluctuation stability of the modulation frequency deviation.

- Δf1 Max

  The maximum variation value of Δf1, which represents the maximum deviation range of the modulation frequency deviation.

- Δf2 Max

  The maximum fluctuation value of Δf2, which reflects the instantaneous maximum variation in frequency deviation during modulation.

- Δf2 > 185 kHz

  The unit is %. The upper Δf2 limit in the Bluetooth specification is typically 185 kHz. This metric represents the percentage of packets where Δf2 exceeds the specified limit, reflecting modulation compliance.

- Δf2/Δf1

  Ratio of Δf2 to Δf1. It reflects the relative relationship between the two types of frequency deviation, reflecting the consistency of GFSK modulation (a larger ratio value indicates that the modulated waveform is seriously distorted).

Frequency stability class metrics

- Freq Drift

  Frequency Drift. It indicates the cumulative change in carrier frequency during the transmission of a Bluetooth signal, reflecting the frequency stability of the transmitter over time.

- Max Drift Rate

  Its unit is kHz/50 μs. It reflects the max. rate at which the carrier frequency varies. It can be used to evaluate frequency short-term stability of the transmitter. If the rate is too high, it will result in receiver demodulation errors.

- Freq Offset

  The deviation of the actual carrier frequency from the Bluetooth nominal channel frequency. It is a key RF metrics in evaluating the RF accuracy, receiving reliability, anti-interference, and certification compliance.

4 Bluetooth Measurement Configuration

Click or tap the working mode label 

at the lower-left corner of the screen to enter the measurement setting interface.

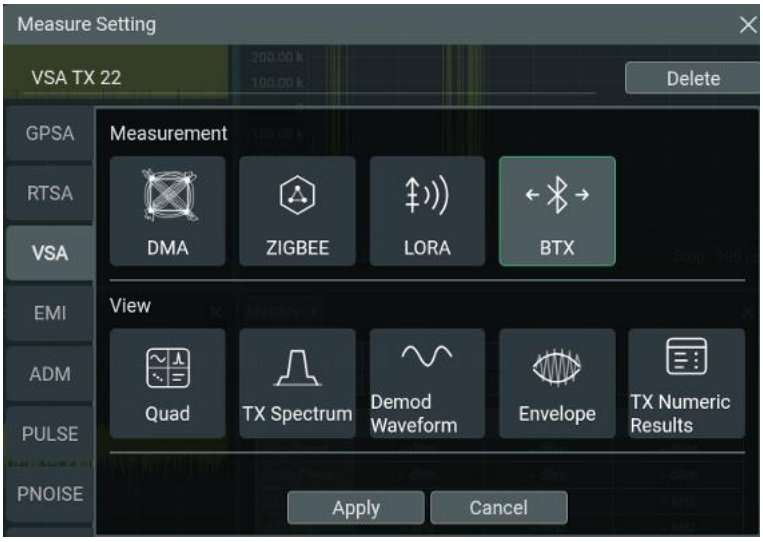


Figure 4.1 Measurement Setting Interface

Click or tap **BTX** > **Apply** to enter the Bluetooth measurement interface.

4.1 Frequency

Sets the frequency parameters of the analyzer.

4.1.1 Channel

Sets the working channels in the BTX measurement mode. There are a total of 40 working channels, with channel numbers ranging from CH0 to CH39 and channel spacing of 2 MHz.

Key Points:

- The channel number "n" can be set to a non-integer number where the channel number is represented greater than "n" when the decimal place is less than 5 and represented as smaller than "n+1" when the decimal place is greater than or equal to 5.

- The relationship between the channel number and the center frequency is as follows: Center Frequency = 2402 MHz + n x 2 MHz. Where n is the channel number, and its range is from 0 to 39.
- A different channel number corresponds to a different center frequency. Once you modify either one of them, the other one will change accordingly.

Parameter	Description
Default	0
Range	0 to 39
Unit	N/A
Knob Step	1
Left/Right Arrow Key Step	10

4.1.2 Center Freq

Sets the center frequency in the Spectrum view. It is represented as "Center" in the Spectrum view.

Key Points:

- The relationship between the channel No. and the center frequency is as follows: Center Frequency = 2402 MHz + n x 2 MHz. Where n is the Channel No..
- When the modified center frequency is outside the frequency range of the specified channel, the channel number changes.
- Center Frequency = (Stop Frequency + Start Frequency)/2. Modifying the center frequency changes both the start frequency and the stop frequency.

Parameter	Description
Default	2.402 GHz
Range	2.402 GHz to 2.480 GHz
Unit	GHz, MHz, kHz, Hz
Knob Step	CF Step
Left/Right Arrow Key Step	CF step

4.1.3 Span

Sets the frequency span for the Spectrum view. It corresponds to the Span value in the spectrum view. Modifying the span changes the X-axis scale/div value (Scale/Div = Span/10), zooming in/out the trace in the view.

Key Points:

- Span = (Stop Frequency- Start Frequency). Once you modify the span, the start frequency and the stop frequency will change accordingly.
- Span is coupled to the sample rate in the **Sweep** menu.

Parameter	Description
Default	6.256109 MHz
Range	(2 x RBW) to (sample rate/1.27875)
Unit	GHz, MHz, kHz, Hz
Knob Step	31.28 kHz (default span/200)
Left/Right Arrow Key Step	1 Hz

4.1.4 Start Freq

Sets the start frequency in the Spectrum view.

Key Points:

- Start Frequency = Center Frequency - (Span/2)
- Modifying the center frequency or span will also make the start frequency change with it.
- Modifying the start frequency will make both the center frequency and the span change with it.

Parameter	Description
Default	2.40 GHz (Center Frequency - Span/2)
Range	(2.4 GHz - Span Limit/2) to (2.482 GHz - 10 Hz) Span Limit = Sample Rate/1.27875
Unit	GHz, MHz, kHz, Hz
Knob Step	31.28 kHz (default span/200)

Parameter	Description
Left/Right Arrow Key Step	6.256 MHz (default span)

4.1.5 Stop Freq

Sets the stop frequency in the Spectrum view.

Key Points:

- Stop Frequency = Center Frequency + (Span/2)
- Modifying the center frequency or span will also make the stop frequency change with it.
- Modifying the stop frequency will make both the center frequency and the span change with it.

Parameter	Description
Default	2.404 GHz (Center Frequency + Span/2)
Range	(2.40 GHz + 10 Hz) to (2.4820 GHz + Span Limit/2) Span Limit = Sample Rate/1.27875
Unit	GHz, MHz, kHz, Hz
Knob Step	31.28 kHz (default span/200)
Left/Right Arrow Key Step	6.256 MHz (default span)

4.1.6 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 Left/Right arrow key to switch the measurement channel at a fixed step size. Thus, the instrument can sweep the adjacent channels manually.
- 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.

Parameter	Description
Default	2.0 MHz

Parameter	Description
Range	-F_{max} to F_{max} F_{max} is the maximum frequency supported by the current instrument model.
Unit	GHz, MHz, kHz, Hz
Knob Step	31.28 kHz (default span/200)
Left/Right Arrow Key Step	1 Hz

4.1.7 CF Step Mode

The CF step mode consists of "Manual" and "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.

4.2 Amplitude

Sets the amplitude parameters of the analyzer. You can modify these parameters to make the signals under test be displayed with minimal errors in the current window, easy for you to observe.

4.2.1 Attenuation

Sets the attenuation of the RF front-end attenuator.

Key Points:

Sets the RF front-end attenuator to allow high-level signals to pass through the mixer with low distortion, and low-level signals to pass through the mixer with low noise. Same as **Attenuation** under **Amplitude** in VSA DMA mode.

Parameter	Description
Default	10 dB
Range	0 dB to 50 dB
Unit	dB
Knob Step	Scale/Div ≥ 1: step = 1 dB Scale/Div < 1: step = 0.1 dB

Parameter	Description
Left/Right Arrow Key Step	at 1-5 step

4.3 Sweep

Sets the sweep-related parameters.

4.3.1 Sample Rate

1M Sample Rate

When the package types are LE1M, LE500k, and LE125k:

Parameter	Description
Default	8 MHz
Range[1]	4 MHz to 32 MHz
Unit	mHz, Hz, kHz, MHz, GHz
Knob Step	1 MHz
Left/Right Arrow Key Step	2 MHz

2M Sample Rate

When the package type is LE2M:

Parameter	Description
Default	8 MHz
Range[1]	8 MHz to 64 MHz
Unit	mHz, Hz, kHz, MHz, GHz
Knob Step	1 MHz
Left/Right Arrow Key Step	2 MHz

4.3.2 Acq Time

Sets the acquisition time for a complete packet. The symbol rate determines the duration of a single packet, and further determines the upper limit of the acquisition time range.

1M Symbol Rate

LE1M, LE500k, and LE125k

Parameter	Description
Default	3.0 ms
Range	100 μs to 20 ms
Unit	s, ms, μs, ns, ps
Knob Step	0.03 ms
Left/Right Arrow Key Step	at 1-1.5-2-3-5-7.5 step

2M Symbol Rate

LE2M

Parameter	Description
Default	3.0 ms
Range	100 μs to 10 ms
Unit	s, ms, μs, ns, ps
Knob Step	0.03 ms
Left/Right Arrow Key Step	at 1-1.5-2-3-5-7.5 step

4.3.3 Sweep Mode

RSA6000 series spectrum analyzer supports two sweep modes: Single sweep and Continuous sweep.

Continuous Sweep

- If the current system is in single sweep mode and no measurement is performed, click or tap Sweep > **Sweep Mode** > **Cont** to enter continuous sweep mode. In this case, if the trigger conditions are met, the system will sweep continuously.
- If the current system is in single sweep mode and is performing the specified measurement, click or tap Sweep > **Sweep Mode** > **Cont** to enter continuous sweep mode. In this case, if the trigger conditions are met, the system will perform measurements continuously.

- In continuous sweep mode, the system will send a trigger initialization signal automatically and enter the trigger condition judgment directly after each sweep is completed.

Single Sweep

- If the current system is in continuous sweep mode and no measurement is performed, selecting this menu to enter the single sweep mode. In this case, if the trigger conditions are met, the system performs one sweep.
- If the current system is in continuous sweep mode and is performing the specified measurement, selecting this menu to set the measurement mode to "Single". In this case, if the trigger conditions are met, the system will execute the specified number of measurements.
- If the system is already in single sweep mode, press this key and then the system will execute the specified number of sweeps (or measurements) once the trigger conditions are met.
- In single sweep mode, trigger initialization (click or tap **Sweep** > **Sweep Mode** > **Cont** or send the SCPI command through the remote interface) should be executed before judging the trigger conditions.

NOTE

Switching between Single and Continuous sweep mode will result in restarting the sweep.

4.3.4 Restart

Click or tap **Restart**, the current sweep will be suspended. All the previously measured data will be remeasured, and the trigger restores to the not-triggered state.

4.4 BandWidth

4.4.1 FFT Window

Sets the type of the FFT window function.

Four FFT window types are available: Rectangular, Hanning, Gaussian, and Flattop.

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

Window Function	Characteristics	Application
Rectangular	Its main lobe is relatively concentrated, but its side lobe is	If you have a high requirement on the accuracy

Window Function	Characteristics	Application
	relatively high, with negative side lobes. This will result in high-frequency interference and leakage during transform, even worse, the negative spectrum. The frequency recognition accuracy is the highest, and the amplitude recognition accuracy is the lowest.	of the frequency readout of the main lobe, without needing to consider the accuracy of the amplitude, then the rectangular window is recommended.
Hanning	It is also called the cosine window. Its main lobe is widened and lowered, and its side lobe is reduced significantly. In terms of leakage reduction, the Hanning window is superior to the Rectangular window. However, the wide main lobe of the Hanning window signifies the widened analysis bandwidth and reduced frequency resolution. Compared with the Rectangular window, the leakage and fluctuation of the Hanning window are reduced, with more choices.	The Hanning window is preferred under the following conditions: the signal under test has several frequency components; the spectrum is very complex; the test aim focuses more on the frequency point rather than the energy size; the signal under test is random or unknown.
Gaussian	It is an exponential window. Its main lobe is wide and frequency resolution is low. It has no negative side lobe, and the attenuation of its first side lobe reaches -55dB. It is often used to truncate some non-periodic signals, such as the exponential decay signal.	For the time-varying exponential decay function, you can use the exponential window to improve the S/N ratio.
Flattop	The flattop window has few low pass band fluctuations in the frequency domain.	As there are minor errors in the amplitude, this window can be used in calibration.

4.4.2 Resolution Bandwidth (RBW)

The RBW value is related to the sample rate/acq time and filter type. This menu is grayed out and you cannot modify it manually.

4.5 Trigger

Selects the trigger source and sets trigger-related parameters.

4.5.1 Trigger Source

Sets the trigger source to "Free Run" or "IF Power".

4.5.1.1 Free Run

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

4.5.1.2 IF Power

A trigger signal will be generated when the system detects a IF signal whose power level exceeds the specified trigger level.

- **Trigger Level**

  Sets the trigger level of the IF power trigger. A trigger signal will be generated when the signal whose power level exceeds the specified trigger level.

Parameter	Description
Default	-20 dBm
Range	-200 dBm to 100 dBm
Unit	dBm
Knob Step	1 dBm
Left/Right Arrow Key Step	10 dBm

- **Delay State**

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

- **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.

Parameter	Description
Default	1 μs

Parameter	Description
Range	0 to 500 ms
Unit	s, ms, μs, ns, ps
Knob Step	Trigger Delay/100, Min. 1 μs
Left/Right Arrow Key Step	at 1-1.5-2-3-5-7.5 step

4.5.2 Holdoff Time

Sets the holdoff time between trigger signals. 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.

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

Parameter	Description
Default	100 ms
Range	0 us to 500 ms
Unit	s, ms, μs, ns, ps
Knob Step	Trigger holdoff time/100, Min. 1 μs
Left/Right Arrow Key Step	at 1-1.5-2-3-5-7.5 step

4.5.2.1 Holdoff State

Click or tap the ON/OFF tab for "Holdoff State" to enable or disable the trigger holdoff state.

4.5.2.2 Auto Trig State

Enables or disables the auto trigger function.

4.5.2.3 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.

Parameter	Remarks
Default	100 ms
Range	1 ms to 100 s
Unit	s, ms, us, ns, ps
Knob Step	auto trigger time/100, Min = 1 us
Left/Right Arrow Key Step	at 1-1.5-2-3-5-7.5 step

The relationship of the trigger parameters is shown in the following figure.

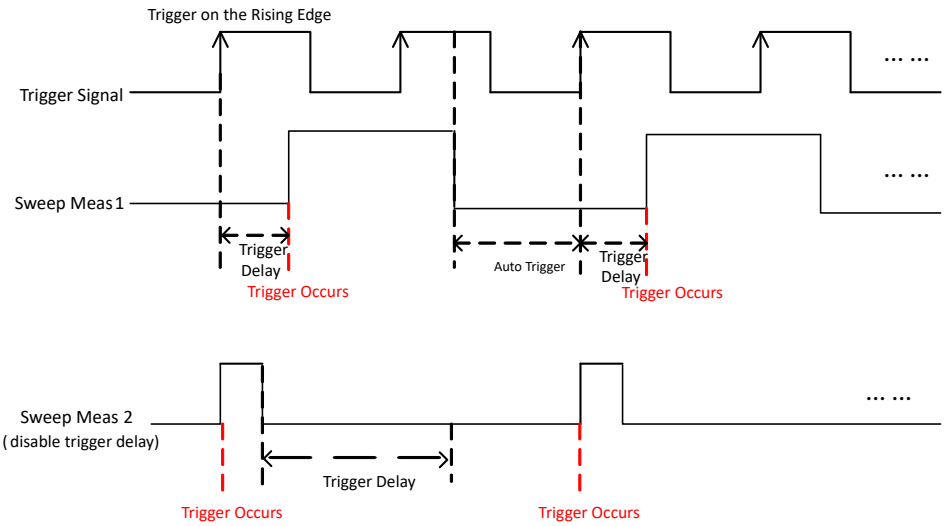


Figure 4.2 Relationship of Trigger Parameters

4.6 Meas Setup

In the **Meas Setup** (Meas Setup) menu, only the menu items related to the current measurement function are displayed. Please view the relevant menus according to the current measurement function.

4.6.1 Setting

4.6.1.1 Standard Type

Bluetooth supports the following standard types. However, the BTX measurement of the instrument only supports the "Low Power (LE)" type.

- BR (Basic Rate)

The original operating mode of traditional Bluetooth, using GFSK modulation, with a transmission rate of 1 Mbps, primarily for audio streaming and serial port transmission.

- EDR (Enhanced Data Rate)

  EDR is an extension of BR, with different modulation techniques in the packet header and payload.

- **LE (Low Energy)**

  Bluetooth Low Energy (BLE) is a wireless technology designed for the Internet of Things for short-range, small data transfers. The "deep sleep, wake-on-demand" mechanism reduces power consumption to an extreme, and is widely used in smart wearing, smart home, and industrial sensing.

- HS (High Speed)

  The HS mode is no longer common in modern consumer electronics.

Key characteristics of the low energy standard type:

- Center frequency range of the channel: 2.402 GHz – 2.48 GHz (in the ISM band)
- Modulation: GFSK (Gaussian Frequency Shift Keying)
- Channels: 40 physical channels, CH0 through CH36 are data channels; CH37 through CH39 are advertising channels, with the channel spacing of 2 MHz
- Symbol rate of the physical layer:
  - LE 1M: 1 Mbps (uncoded)
  - LE 2M: 2 Mbps (HS)
  - LE 125 kbps and LE 500 kbps (long range, FEC S = 8/2)

4.6.1.2 Averaging

The averaging function averages the numerical results (such as power, frequency deviation) of multiple packets acquired to obtain more stable readouts.

Avg State

Enables or disables the average state. By default, it is disabled. When enabled, the instrument performs the averaging operation on the measurement values based on the currently set average count.

Key Points:

- When the average state is disabled; or when the average state is enabled but the average count is set to 1:

- Spectrum view and RF Envelope view: displays the trace of the most recently captured waveform of real-time measurement data.
- Demod Waveform view: displays the current demodulation signal.
- Metrics view: The Average, Min, and Max columns display the same value for the currently captured packets.

• When the average state is enabled and the average count is set to a value other than 1:

- Spectrum view and RF Envelope view: displays the trace of the averaged measurement data.
- Demod Waveform view: displays the maximum value by default, varying depending on the configuration of the average type.
- Metrics view: The Average, Min, and Max columns display the average (scalar) value, min. value, and max. value of the captured packets.

Avg Number

Used to specify the data acquisitions of the latest received packets in the averaging calculation of the measurement results.

Parameter	Description
Default	1
Range	1 to 10,000
Unit	N/A
Knob Step	1
Left/Right Arrow Key Step	1

Average Type

By default, it is Max. The available average types include: Scalar (average), Max, or Min. They represent the specified number of packets for averaging.

4.6.1.3 Packet Type

Selects the physical layer format of the Bluetooth signal packet.

Packet Type	Symbol Rate	Coding Mode	Application Scenarios
LE 1M	1 Mbps	Uncoded	Most common BLE signal, universal data transfer
LE 2M	2 Mbps	Uncoded	Double the data transfer rate, high-speed data transfer
LE 500k	500 kbps	FEC coded (S=2)	For medium to long range transmission, lower rate
LE 125k	125 kbps	FEC coded (S8)	For long-range transmission, high anti-interference capability, and low rate.

- FEC (Forward Error Correction) is a technique that actively incorporates redundant information into data transmission, and in the event of weak signal or interference, the receiver side calculates and corrects the wrong bits via algorithms, without requesting a retransmission from the transmitter side. FEC improves anti-interference capability, but reduces effective data transfer rate.
- The value of S (Coding Expansion Factor) defines the FEC (Forward Error Correction) coding scheme. It specifies the number of symbols that each original data bit is expanded into after FEC encoding. A higher S value results in more redundancy, stronger error correction capability, but lower data rate.
  - LE 500k: operates at 500 kbps with FEC coding scheme (S=2). After FEC coding, each original data bit generates 2 symbols. Since the symbol rate remains at 1 Msps, dividing by S=2 results in a bit rate of 500 kbps.
  - LE 125k: operates at 125 kbps with FEC coding scheme (S=8). After FEC coding, each original data bit generates 8 symbols. Since the symbol rate remains at 1 Msps, dividing by S=8 results in a bit rate of 125 kbps.

4.6.2 Global CF Mode

1. Global CF Mode

Turns on or off the global center frequency. In any working mode, if you enable the global center frequency mode, then the global center frequency will be set to the center frequency of the current mode. When a different working mode is selected,

the global center frequency will be set to the center frequency of the previous working mode, that is, the one that is before switching the working mode. If you change the center frequency in any working mode, then the global center frequency will change with it.

2. Global CF

Sets the global center frequency. It is only available when you enable the global CF mode.

4.7 Marker

4.7.1 Marker Setting

Marker is used for marking the point on the trace. Through the marker, you can read the X-axis and Y-axis readouts of the point on the trace.

Key Points:

- RSA6000 offers 8 markers, and only a single marker or one pair of markers can be turned on each time.
- The marker readout will be displayed at the upper-right corner of the marker trace view.
- In the Marker menu, you can use the numeric keys, the knob, or the arrow keys to modify X-axis readout; to view the readout of different points on the trace. You can also use the touch screen to do the above things.

4.7.1.1 Selected Marker

RSA6000 provides 8 markers. By default, Marker1 is selected under "Selected Marker". After you select a marker, you can set parameters such as the marker mode and the marker trace. The currently enabled marker will be marked on the selected marker trace.

4.7.1.2 Next Marker

Click or tap **Next Marker** to select the next enabled marker.

4.7.1.3 Marker Trace

Selects the trace that the current marker marks. The available traces for the **Marker Trace** menu are as follows. One marker can only mark one trace.

- RF Envelope Trace
- Spectrum Trace
- Demod Waveform Trace

4.7.1.4 Marker Mode

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

1. Position

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

Key Points:

- When the currently selected display view is not consistent with the one selected for the marker trace, then the marker will be opened in the currently selected display view, and the marker trace will be changed accordingly.
- If no active marker exists currently, a marker will be enabled in the center of the X-axis of the current trace.

2. Delta

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

Key Points:

- 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 in the center of X-axis of the current trace.
- When you change the position of the Delta marker, the position of the reference marker remains unchanged, but the Delta between the two markers will change along with it.

3. Fixed

When you select "Fixed" marker, you can directly or indirectly set the X-axis and Y-axis values for the marker. Once specified, its position remains unchanged, and its Y-axis value does not change along with the trace. The fixed marker is generally used as the reference marker for the Delta marker. It is indicated by the sign "×".

4. **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.

4.7.1.5 Reference Marker

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

Key Points:

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

4.7.1.6 Marker Trace Auto

Enables or disables the auto marking trace function.

Key Points:

- When you enable the marker's auto marking trace function, the marker shifts from its off state to on state, and the marker's marking trace is automatically determined by the instrument.
- When you disable the marker's auto marking trace function, whatever states of the marker and the trace, the marker will be associated to the current marker trace.
- If you specify the marker's marking trace manually, the marker's auto marking trace function is automatically disabled.

4.7.1.7 Marker X

Sets the X-axis readout of the marker to change the position of the marker on the trace. You can modify this value to change the position of the marker.

Key Points:

- If the marker mode is set to Position or Fixed, this value sets the X value at the marker.
- If the marker mode is set to Delta, this value sets the X value of the Delta marker in relative to that of the reference marker.

4.7.1.8 Couple Markers

Enables or disables the marker coupling function.

Key Points:

- When this function is enabled, moving any marker will enable other markers (except the Fixed or Off marker) to move with it.
- The fixed marker does not move along with other marker, but if the fixed marker moves, other non-fixed markers will move with it.

4.7.1.9 All Markers Off

Turns off all the enabled markers and their related functions.

4.7.2 Marker To

Use the current marker settings to set other system parameters, such as center frequency, reference level, and etc.

4.7.2.1 Marker->CF

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

- This menu is only available when the marker trace is set to Spectrum.
- If Position marker is selected, the center frequency will be set to the frequency of the current marker.
- If Delta marker is selected, the center frequency will be set to the frequency of the Delta marker.

4.7.2.2 Marker->Start

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

- This menu is only available when the marker trace is set to Spectrum.

- 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.

4.7.2.3 Marker->Stop

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

- This menu is only available when the marker trace is set to Spectrum.
- 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.

4.7.2.4 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.

4.7.2.5 MarkerΔ->CF

Sets the center frequency of the analyzer to the frequency difference between the two Delta markers.

- This menu is only available when the marker trace is set to Spectrum.
- This function is only valid when the Delta marker is selected.

4.7.2.6 MarkerΔ->Span

Sets the span of the analyzer to the frequency difference between the two Delta markers.

- This menu is only available when the marker trace is set to Spectrum.
- This function is only valid when the Delta marker is selected.

4.7.3 Peak Search

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.

4.7.3.1 Peak Search

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

4.7.3.2 Next Peak

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

4.7.3.3 Next Peak Right

Searches for and marks the peak closest to the right side of the current peak.

4.7.3.4 Next Peak Left

Searches for and marks the peak closest to the left side of the current peak.

4.7.3.5 Minimum Search

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

4.7.3.6 Pk-Pk Search

Executes Peak Search and Minimum Peak functions at the same time, and marks the results with the Delta marker. Wherein, the result of Peak Search is marked with the reference marker and the result of Minimum Peak is marked with the Delta marker.

4.7.3.7 Continuous 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.

4.8 Display

4.8.1 Auto Scale

Sets the Y-axis reference value and the Y-axis scale value automatically to ensure that the signal can be fully displayed for better observation of the trace.

4.8.2 Y Ref Value

Sets the Y-axis reference value of the selected trace in the specified view.

- **RF Envelope View**

Parameter	Description
Default	-1.2 dBm
Range	-169.00 dBm to 30.00 dBm
Unit	dBm
Knob Step	0.8 dBm
Left/Right Arrow Key Step	1 dBm

- **Demod Waveform**

Parameter	Description
Default	0 Hz
Range	-(10 GHz - 10 Hz) to (10 GHz - 10 Hz)
Unit	GHz, MHz, kHz, Hz
Knob Step	10 kHz
Left/Right Arrow Key Step	1 kHz

- **Spectrum View**

Parameter	Description
Default	0 dBm
Range	-169.00 dBm to 30.00 dBm
Unit	dBm
Knob Step	1.7 dBm
Left/Right Arrow Key Step	1 dBm

4.8.3 Y Scale/Div

Sets the Y-axis scale per division of the selected trace in the specified view.

- **RF Envelope View**

Parameter	Description
Default	10 dB
Range	0.1 dB to 20 dB
Unit	dB
Knob Step	1 dB
Left/Right Arrow Key Step	1 dB

- **Demod Waveform**

Parameter	Description
Default	50.00 kHz
Range	1.00 Hz to 2.0 GHz
Unit	GHz, MHz, kHz, Hz
Knob Step	10 kHz
Left/Right Arrow Key Step	1 Hz

- **Spectrum View**

Parameter	Description
Default	10 dB
Range	0.1 dB to 20 dB
Unit	dB
Knob Step	1 dB
Left/Right Arrow Key Step	1 dB

4.8.4 X Scale/Div

Sets the X-axis scale per division for the window in which the current trace is located. It is available to set only in the RF Envelope view and Demod Waveform view.

- **X Scale/Div in the RF Envelope View**

Parameter	Description
Default	0.30 ms
Range	0.1 μs to (Acq Time – X Ref Value)/10
Unit	μs, ms, s
Knob Step	0.1 μs
Left/Right Arrow Key Step	at 1-2-5 step

- **X Scale/Div in the Demod Waveform View**

Parameter	Description
Default	10 μs
Range	0.1 μs to (Acq Time – X Ref Value)/10
Unit	μs, ms, s
Knob Step	0.1 μs
Left/Right Arrow Key Step	at 1-2-5 step

4.8.5 X Ref Value

Sets the X-axis reference value for the window in which the current trace is located. It is available to set only in the RF Envelope view and Demod Waveform view.

- **X Ref Value in the RF Envelope View**

Parameter	Description
Default	0 ms
Range	0 to (acq time – X Scale/Div x 10)
Unit	s, ms, μs, ns, ps
Knob Step	0.1 μs
Left/Right Arrow Key Step	at 1-2-5 step

- **X Ref Value in the Demod Waveform View**

Parameter	Description
Default	0 s

Parameter	Description
Range	0 to (acq time – X Scale/Div x 10)
Unit	s, ms, μs, ns, ps
Knob Step	0.1 μs
Left/Right Arrow Key Step	at 1-2-5 step

4.9 Input/Output

Sets the input/output interface.

4.9.1 Input Impedance

Sets the input impedance for voltage-to-power conversions. 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.

4.9.2 Ext Gain

Compensates for gain or loss in the measurement system outside the instrument.

Remarks:

- This value can change the trace position, but will not change the Y-axis reference value and scale.
- 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.

Parameter	Remarks
Default	0 dB
Range	-120 dB to 120 dB
Unit	dB
Knob Step	1 dB
Left/Right Arrow Key Step	1 dB

4.9.3 Corrections

Amplitude correction is an important tool for improving measurement accuracy, ensuring accuracy and consistency of measurement results by compensating for amplitude errors caused by the gain or loss of the device during transmission.

It is enabled by default. When enabled, the trace and the corresponding measurement results are corrected. The amplitude correction will not be affected whether you power on or power off the instrument. After performing the Preset operation, the amplitude correction state restores to its enabled state.

4.10 Save

RSA6000 allows you to save various types of files to the internal or external memory.

Click or tap  > **Save** to enter the file saving interface. The available file types include: State, Measurement Data, and Screen Image.

4.10.1 State

Click or tap **State** to enter the state saving menu. The state can be saved to the register or the file.

1. **Save to File**

   Click or tap **Save to File** to save the current state in the default filename or user-defined filename.

2. **Register1 through Register16**

   When any one of the items from Register1 to Register16 is selected, the current state of the instrument will be saved to the corresponding register. The register supports quick save and recalling instrument state. The register menu displays the time for saving the instrument state.

4.10.2 Preset

1. **Select Preset**

   Click or tap **Select Preset** to select the desired preset settings. The available choices include "Default", "User1", "User2", "User3", "User4", "User5", and "User6".

2. **User1 through User6**

   When any one of the items from User1 to User6 is selected, the selected user state will be saved.

4.10.3 Measurement Data

Click or tap **Meas Data** to enter the measurement data saving menu. The selected measurement data type (raw data or measurement results) can be saved to the specified file. The data will be saved in .csv format. They are separated with a comma, and this is convenient for you to use the Excel to analyze the data.

1. **Save to File**

   Click or tap this menu to save the currently selected type of measurement data in the default filename or user-defined filename.

2. **Measure Type**

   Selects the measurement data type to be saved. The measurement data types supported by the instrument include raw data and measurement results.

4.10.4 Screen Image

Click or tap **Screen** to enter the screen saving menu. You can also click or tap  on the quick operation toolbar to quick save the screen image.

1. **Save to File**

   Click or tap **Save to File** to save the current screenshot in the default filename or user-defined filename.

2. **Screenshot Info**

   a. Image Format

   Click or tap Format to select the file format of the current screen image to be "*png", "*.bmp", or "*.jpg".

   b. Invert

   Click or tap the ON/OFF tab for **Invert** to enable or disable inverting the color of the current screen image.

   c. Screenshot Path

   Click or tap to select "Local" or "External" under **Screenshot Path** to save the screenshot image to the local path or the external device.

4.11 Recall

RSA6000 allows you to recall various types of files from the internal or external storage memory.

Click or tap > **Recall** to enter the file recalling menu. The available file types include: State and Measurement Data.

4.11.1 State

Click or tap **State** to enter the state recalling menu. The state can be recalled from the register or the file.

1. **Load from File**

   Click or tap **Load from File** to enter the file management interface. Select a file and then click or tap **Recall** to recall the specified file.

2. **Register1 through Register16**

   When any one of the items from Register1 to Register16 is selected, the state of the specified register will be recalled.

4.11.2 Measurement Data

Click or tap **Meas Data** to enter the measurement data recalling menu.

1. **Load from File**

   Click or tap **Load from File**, then the file management interface is displayed. Select the file to be loaded, click or tap **Recall** to load the file.

2. **Measure Type**

   Only Raw Data is available to choose.

4.12 Preset

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

Press Preset on the front panel to restore the factory default settings. You can also click or tap Preset at the upper-right corner of the screen to recall the factory settings. The following table lists the factory default settings (except items specified in Note [3]) or user-defined settings.

Parameter Name	Bluetooth Parameter Value
Frequency	
Channel	0
Center Freq	2.402 GHz

Parameter Name	Bluetooth Parameter Value
Span	6.256109 MHz
Start Freq	2.40 GHz
Stop Freq	2.404 GHz
CF Step	2.0 MHz
Amplitude	
Input Attenuation	10 dB
Sweep	
Sample Rate	8 MHz
Acq Time	3.0 ms
Sweep Mode	Continuous
Bandwidth	
FFT Window	Hanning
Trigger	
Trigger Source	Free Run
Trigger Hold	OFF, 100 ms
Auto Trig	OFF, 100 ms
Meas Setup	
Global CF	OFF
Setting	
Standard Type	LowEnergy
Avg State	OFF
Avg Number	1
Average Type	Max
Packet Type	LE 1M

Parameter Name	Bluetooth Parameter Value
Marker	
Setting	
Selected Marker	Marker1
Marker Mode	Position
Reference Marker	Marker2
Marker Trace	RF Envelope
Marker X	1.5 ms
Couple Markers	OFF
Peak Search	
Cont Peak	OFF
Display	
Y Ref Value	-1.2 dBm
Y Scale/Div	8.0 dB
X Ref Value	0 s
X Scale/Div	300 μs
Input/Output	
Input Impedance	50 Ω
Ext Gain	0 dB
Corrections	ON
System (Not affected by Preset settings)	
Power On	Preset
Power Switch	OFF
Beeper	OFF
Screen Brightness	80%

Parameter Name	Bluetooth Parameter Value
Fan Speed	49%
Display Time	ON
Calibrate Auto	OFF
Language	English

Boost Smart World and Technology Innovation

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Semiconductors

Education& Research

Communication

System Integration

New Energy

- Cellular-5G/WIFI
- UWB/RFID/ ZIGBEE
- Digital Bus/Ethernet
- Optical Communication

- Digital/Analog/RF Chip
- Memory and MCU Chip
- Third-Generation Semiconductor
- Solar Photovoltaic Cells

- New Energy Automobile
- PV/Inverter
- Power Test
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