RIGOL

ZigBee Test

For RSA6000 Series Spectrum Analyzer

User Guide

Apr. 2026

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Section	Description	Page

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1 Document Overview

This manual gives you a quick review about the operation methods for the functions of ZigBee 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*).

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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]**.

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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

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2 Introduction to ZigBee

ZigBee is a short-range, low-power wireless communication technology based on the IEEE 802.15.4 standard, applicable to smart home, industrial control, Internet of Things (IoT) sensor networks.

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

ZigBee Technology

- **Operating Band**

  It operates on the worldwide 2.4 GHz ISM band. It can be divided into 16 channels (Channel 11 to 26), and the center frequencies range from 2405 MHz to 2480 MHz, with channel spacing of 5 MHz.

- **Modulation Format**

  It uses O-QPSK (Offset Quadrature Phase Shift Keying) modulation with a half-sine pulse shaping filter. O-QPSK has a near constant envelope, which is better suitable for low-power IoT devices.

- **Transfer Rate**

  The operating rate is 250 kbps (Worldwide 2.4 GHz band).

- **Spreading Spectrum**

  It uses Direct Sequence Spread Spectrum (DSSS) to map each 4-bit symbol to 32-chip pseudo-random sequence.

ZigBee Measurement

- **Standard Compliance Demodulation**

  Compliant with IEEE 802.15.4 physical layer specification; supporting O-QPSK modulated signal demodulation, built-in half-sine pulse shaping filter to restore protocol-compliant signals.

- **Flexible Analysis Configuration**

  Supports configuring sampling points according to test requirements, 4-point rapid demodulation, 16-point at up to 1Msps sampling, and restore accurately waveform details.

- **Multi-dimensional Analysis**

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Views covering time domain (e.g., Frame Capture, Raw Time, EVM Error Time), frequency domain (e.g., Spectrum, Meas Spectrum), vector domain (IQ, Constellation, Eye).

The error vector is calculated to locate the I/Q channel fault by comparing the "actual measured value" with the "ideal reference value".

- **Key Metric Quantification**

  Provides modulation quality (EVM), amplitude/phase error), RF characteristics (frequency error, symbol clock error), and I/Q analysis.

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3 User Interface of ZigBee Measurement

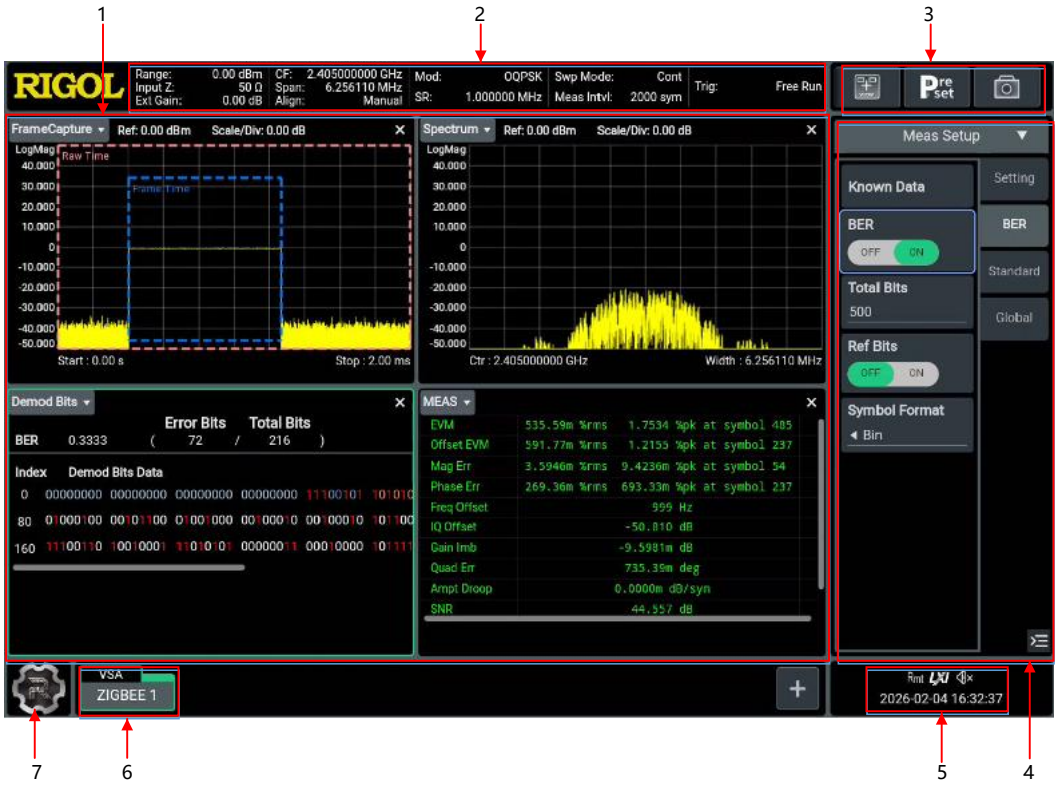

Figure 3.1 User Interface

1. Multi-pane Display Area

Displays different display views for ZigBee measurement. The signal can be analyzed and tested in various views. In the *Display View* section, you can view all available windows supported by the ZigBee feature.

This section will introduce the dedicated views for the ZigBee measurement.

2. Status Display Bar

- Range: Dynamic range, configurable in the **Amplitude** menu.
- Input Z: input impedance. By default, it is 50.0 Ω. It can be set to 50 Ω or 75 Ω.
- Ext Gain: external gain. It can be set in the **Input/Output** menu.
- CF: center frequency. The value is the same as the **Center Freq** in the **Frequency** menu.
- Span: frequency span. It is related to the values of **Symbol Rate** and **Points/ Symbol**.

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- Align: displays the calibration state. It can be configured in **System** > **Calibration** > **Calibrate Auto** menu.
- Mod: modulation format. It is fixed to be OQPSK, and cannot be modified.
- SR: IQ sample rate. It is fixed to be 1 Msps, and cannot be modified.
- Swp Mode: sweep mode. It can be set to **Cont** or **Single** in the **Sweep** menu.
- Meas Intvl: measurement interval. It can be set in **Meas Setup** > **Setting** menu.
- Trig: trigger source. It can be set in the **Trigger** menu. The available choices include Free Run, External, and IF Power. When you select External or IF Power as the trigger source, Trig Delay will also be displayed in the status display bar.

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

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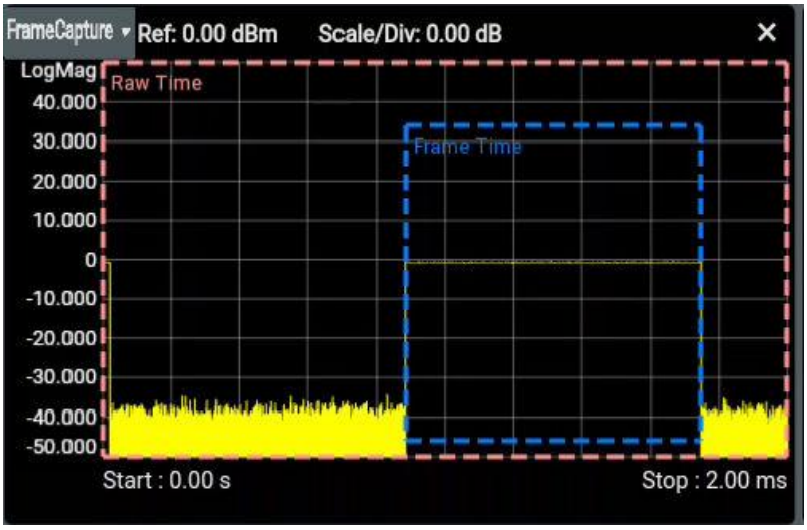
Click or tap the icon to open the function navigation menu. Click or tap the specified menu icon to enter the specified function setting menu.

3.1 Raw Signal View

Capture Data view. It supports capturing raw signals to be be displayed in the time-domain view and frequency-domain view.

Frame Capture View

In this view, it shows the variation of power of the captured raw signal over time, with the X-axis for time and the Y-axis for log power. The "RawTime" view is the same as the one in the "Frame Capture" view (**ZigBee** > **Frame Capture**).



- Start: indicates the start time value.
- Stop: indicates the stop time value.
- Ref: indicates the Y-axis reference value of the power.
- Scale/Div: indicates the Y-axis scale per division.
- Raw Time: indicates the length of time for all the I/Q raw data captured during the acquisition period.
- Frame Time: indicates the length of time for a valid Zigbee signal frame (Burst/Packet).

Frequency-domain

The view shows the characteristic distribution of the captured raw signal whose power varies with the frequencies. Its X-axis represents frequency and its Y-axis represents the log power.

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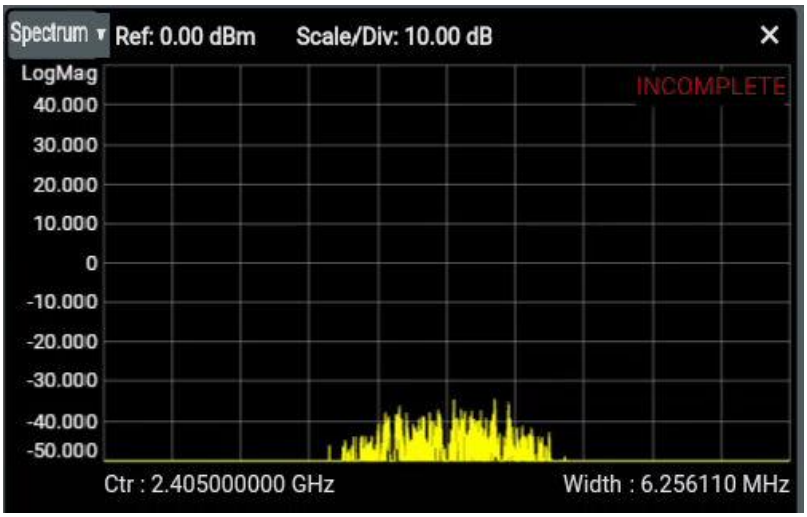
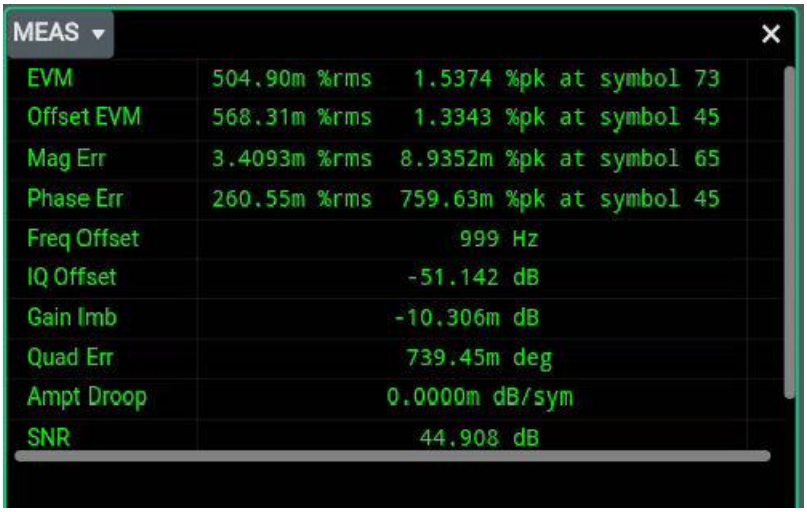


- Ctr: indicates the center frequency. By default, it is 2.405000000 GHz.
- Width: indicates the frequency span. By default, it is 3.128 MHz.
- Ref: indicates the reference power level. By default, it is 0.00 dBm.
- Scale/Div: indicates the Y-axis scale per division. Its unit is dB.

3.2 Meas View

The Meas view shows detailed measurement data of the demodulated ZigBee signal.



The test items include:

- **EVM (Error Vector Magnitude)**

  Measures the vector deviation between the actual signal and the ideal signal. The smaller the EVM value (standard limit ≤ 35%), the better the signal quality and modulation accuracy. It directly reflects the overall modulation quality.

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- **Offset EVM (Offset Error Vector Magnitude)**

  A specific metric for ZigBee (O-QPSK) modulation. For the EVM with timing offset removed, the lower the value, the better the signal quality.

- **Mag Err (Magnitude Error)**

  Non-linear jitter or offset of the signal magnitude. The lower the Mag Error value, the better. It mainly reflects the linearity and stability of the power amplifier (PA).

- **Phase Err (Phase Error)**

  The degree of jitter in the signal phase. The lower the value (<5°), the better. It mainly reflects the local oscillator (LO) stability or phase noise level.

- **Freq Offset**

  The difference between the carrier frequency and the standard center frequency. The value closer to 0 (standard limit ±40 ppm) indicates better crystal oscillator accuracy.

- **IQ Offset**

  Local Oscillator (LO) Leak. The lower the value (<-30 dB recommended), the better. It reflects the isolation of the RF link and the hardware performance.

- **Gain Imb**

  The difference between the I-channel and Q-channel amplification gain. The closer the value is to 0 dB, the better. It reflects the symmetry of the modulator I/Q hardware circuits.

- **Quad Err (Quadrature Error)**

  The degree to which the phase difference between the I (in-phase) channel and Q (quadrature) channel deviates from the ideal 90°. The closer the value is to 0°, the better. It reflects the physical orthogonality of the demodulation link.

- **Ampt Droop**

  Power attenuation rate during packet transmission. The closer the value is to 0, the better. It reflects PA power supply capacity and thermal stability (no thermal effect).

- **SNR**

  Signal-to-Noise Ratio. It refers to the ratio of signal power to noise floor power. The greater the value (typically >30dB), the better. It reflects the purity of the signal and anti-interference capability.

- **Rho**

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Correlation coefficient. The correlation between the actual waveform and the ideal waveform. The closer the value is to 1.0, the better. It indicates that the waveform shape is intact and undistorted.

3.3 Demod Bits

The Demod Bits view displays the demodulated digital bit stream (0/1 sequence) and the bit error rate.

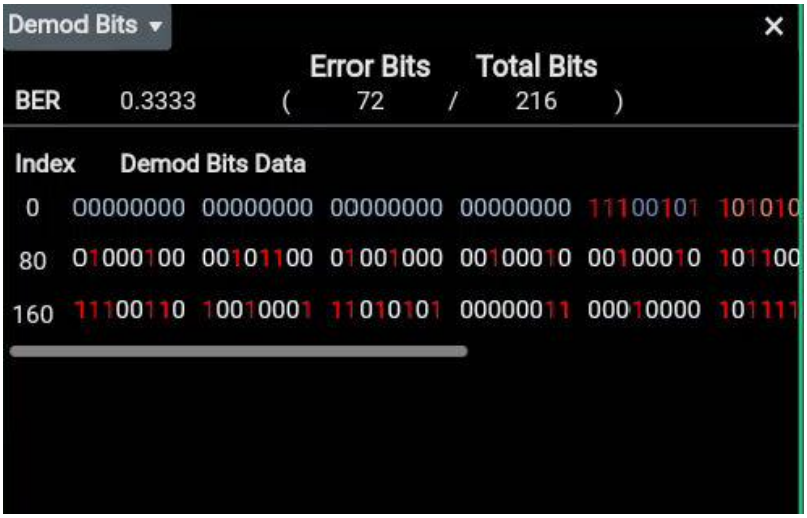

Figure 3.3 Demod Bits View

Bit Error Rate Statistics

BER is used to determine signal data quality. Click or tap **Meas Setup** > **BER**. Enable **BER** in this menu. Then the BER statistics are displayed in the Demod Bits view.

BER = Error Bits/Total Bits

- BER: Bit Error Rate.
- Error Bits: Number of error bits.
- Total Bits: Total number of bits.

Bitstream Contents

Demod Bit Data are demodulated bit data and also the specific contents of the ZigBee signal transmission, including the preamble, frame header, MAC address, payload data, etc. The bits in white/gray represent the correct ones and those in red represent the wrong ones (Error Bits).

Index: The number on the left (0, 80, 160) represents the position of the bitstream in the cache.

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4 ZigBee Configuration

Click or tap the working mode label 

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

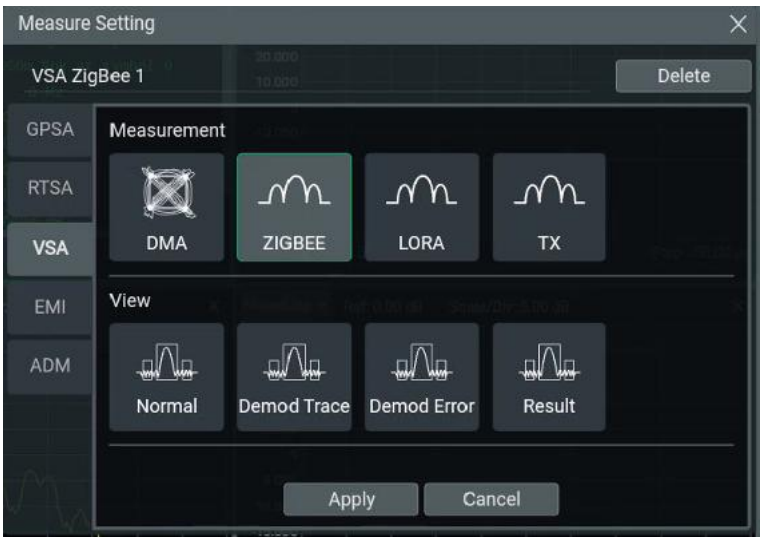

Figure 4.1 Measurement Setting Interface

Click or tap **ZIGBEE** > **Apply** to enter the ZigBee measurement interface.

4.1 FREQ

Sets the frequency parameters of the analyzer.

4.1.1 Center Freq

Preset Standard

The center frequency of the ZigBee feature is determined by the channel No. you select under **ZigBee Channel** (**Meas Setup** > **Standard** > **ZigBee Channel**). The value of Center Freq cannot be modified but only allows you to view it.

Center Frequency Values for Different ZigBee Channels

There are 16 channels, which are numbered from 11 to 26.

Channel No.	Center Freq	Single-channel Bandwidth
11	2405 MHz	5 MHz
12	2410 MHz	5 MHz

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Channel No.	Center Freq	Single-channel Bandwidth
13	2415 MHz	5 MHz
14	2420 MHz	5 MHz
15	2425 MHz	5 MHz
16	2430 MHz	5 MHz
17	2435 MHz	5 MHz
18	2440 MHz	5 MHz
19	2445 MHz	5 MHz
20	2450 MHz	5 MHz
21	2455 MHz	5 MHz
22	2460 MHz	5 MHz
23	2465 MHz	5 MHz
24	2470 MHz	5 MHz
25	2475 MHz	5 MHz
26	2480 MHz	5 MHz

4.2 AMPT

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 Range

Sets the amplitude of the largest sinusoidal input signal without being clipped by the IF ADC.

Parameter	Remarks
Default	20 dBm
Range	-15 dBm to +25 dBm
Unit	dBm

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Parameter	Remarks
Knob Step	1 dBm
Left/Right Arrow Key Step	10 dBm

4.2.2 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.

4.2.3 Ref Value

Sets the Y-axis reference value of the selected trace.

Parameter	Description
Default	0
Range	(-1e+12) to (1e+12)
Unit	Same as the Y Axis Unit
Knob Step	(Scale/Div)/10
Left/Right Arrow Key Step	Scale/Div

Window Type	Ref Value	Scale/Div
RawTime	dBV_{pk}	dB
	dBV_{rms}	dB
	dBm	dB
Spectrum	dBV_{pk}	dB
	dBV_{rms}	dB
	dBm	dB
MeasLog	dB	dB
MeasLin	Without Unit	Without Unit
MeasReal	Without Unit	Without Unit
MeasImag	Without Unit	Without Unit

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Window Type	Ref Value	Scale/Div
MeasPhase	°	°
MeasPhaseUnwrap	°	°
MeasIQ	Without Unit	Without Unit
MeasCons	Without Unit	Without Unit
MeasIEye	Without Unit	Without Unit
MeasQEye	Without Unit	Without Unit
MeasIQEye	Without Unit	Without Unit
MeasSpectrum	dB	dB
RefLog	dB	dB
RefLin	Without Unit	Without Unit
RefReal	Without Unit	Without Unit
RefImag	Without Unit	Without Unit
RefPhase	°	°
RefPhaseUnwrap	°	°
RefIQ	Without Unit	Without Unit
RefCons	Without Unit	Without Unit
RefIEye	Without Unit	Without Unit
RefQEye	Without Unit	Without Unit
RefIQEye	Without Unit	Without Unit
RefSpectrum	dB	dB
EVMErrorTime	%	%
EVMErrorSpectrum	dB%	dB
MagError	dB%	dB%
PhaseError	°	°

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4.2.4 Scale/Div

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

NOTE

The default value of the Y scale and its unit are different for the different trace data. For details, refer to Scale/Div of Y Axis.

4.2.5 Ref Position

Click or tap **Ref Position** to set the amplitude reference position to "Top", "Center", or "Bottom".

4.2.6 Last Scale

Sets Y Scale to the last modified Y-axis reference value and scale/div value.

4.3 Sweep

Sets the sweep-related parameters.

4.3.1 Sweep Settings

Sweep Mode

Sets the current sweep mode to Single or Continuous.

Restart

When the sweep is Single, click or tap this menu, the sweep measurement is restarted for one single time. When the sweep is Continuous, this menu is disabled and grayed out.

4.4 BW

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.

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

4.5 Trigger

Selects the trigger source and sets trigger-related parameters.

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4.5.1 Trigger Source

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

4.5.2 Free Run

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

4.5.3 External Trigger

Click or tap **Trigger** > **Source** > **External**, then an external signal is input via the **[TRIG IN]** 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. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

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.

Parameter	Remarks
Default	1 µs
Range	-500 ms[1] to 500 ms
Unit	s, ms, us, 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

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NOTE

[1]: When the trigger delay is set to a negative value, it indicates a pre-trigger.

4.5.4 IF Power Trigger

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

1. Trigger Level

Sets the trigger level of the IF power trigger. When the signal meets the set trigger level value, a trigger occurs.

Parameter	Remarks
Default	-25 dBm
Range	(-140+Level Offset) to (30+Level Offset)
Unit	dBm, -dBm, V, mV, uV
Knob Step	1 dBm
Left/Right Arrow Key Step	5 dBm

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.

Parameter	Remarks
Default	1 µs
Range	-500 ms[1] to 500 ms
Unit	s, ms, us, ns, ps
Knob Step	trigger delay/100, Min = 1 us
Left/Right Arrow Key Step	at 1-1.5-2-3-5-7.5 step

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NOTE

[1]: When the trigger delay is set to a negative value, it indicates a pre-trigger.

4.5.5 Trigger Holdoff State

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

4.5.6 Trigger Holdoff

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

4.5.7 Auto Trig State

Enables or disables the auto trigger function.

4.5.8 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

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Parameter	Remarks
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.

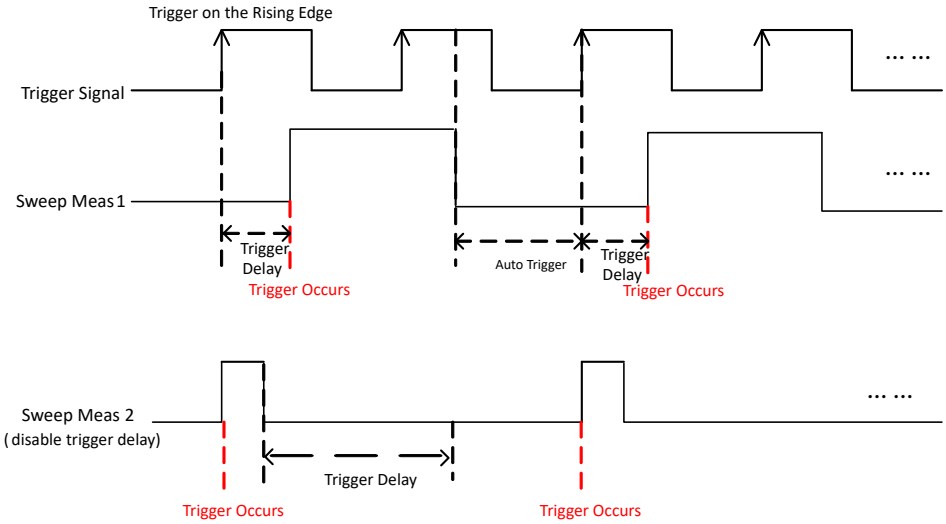

Figure 4.2 Relationship of Trigger Parameters

4.6 Meas Setup

Press Meas Setup to enter the measurement setup menu.

4.6.1 Setting

Modulation Format

It is fixed to be OQPSK and cannot be modified.

O-QPSK (Offset Quadrature Phase Shift Keying) is the physical layer modulation scheme used for the 2.4 GHz band defined by the IEEE 802.15.4 standard. Through I/Q offset and half-sine pulse shaping, this modulation technique achieves constant envelope, low power consumption, and phase continuity. It features high data rate, low power consumption, and strong anti-interference capability.

Meas Interval

Sets the number of symbols for analysis in digital demodulation.

This parameter, together with the symbol rate, determines the overall time record length in seconds for the modulator. It also indirectly sets the resolution bandwidth for various spectral results (RBW cannot be set independently).

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Parameter	Description
Default	50
Range	10 to 4,096
Unit	N/A
Knob Step	1
Left/Right Arrow Key Step	10

Symbol Rate

Symbol rate (bit rate) refers to the number of binary bits transmitted per unit of time, which is the actual data transfer rate. The ZigBee 2.4 GHz standard specifies the symbol rate is 250 kbps (250 kbits/s). Using O-QPSK modulation, where each symbol carries 4 bits of data, this corresponds to a symbol rate (baud rate) of 62.5 ksym/s.

Here the symbol rate is the IQ sample rate for demodulation analysis, fixed to be 1 Msps and cannot be modified. The instrument analyzes the signal with the highest accuracy, ensuring that each symbol contains 16 sample points (16 x 62.5 ksym/s = 1 Msamples/s).

Points/Symbol

Sets the number of sample points per symbol in the demodulation data. It can be set to 4, 8, and 16.

Sample Rate = Symbol Rate x Sample Points/Symbol

Points/Symbol	Symbol Rate	Symbol Duration	Sample Rate
4	62.5 ksym/s	16 μs	250 kHz
8	62.5 ksym/s	16 μs	500 kHz
16	62.5 ksym/s	16 μs	1 MHz

Meas Filter

The measurement filter type is used to filter out noise of the actually measured IQ signal, restore waveforms, and simulate receiver behavior.

It is fixed to be Half Sine, and cannot be modified.

Ref Filter

The reference filter is used to generate the ideal reference signal, which is used as a reference for the calculation of EVM.

It is fixed to be Half Sine, and cannot be modified.

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4.6.2 BER

The BER menu is only valid when you select the Demod Bits (**ZigBee** > **Demod Bits**).

Known Data

Click or tap this menu, then the file management interface is displayed. Select the specified BER test file (.xml) to the system.

Enable or Disable BER

- By default, BER is disabled. The Demod Bits view does not display BER information, but only the demodulation bit stream.
- When you enable BER, and the demodulation bits view displays error BER information. For example, *Figure 3.3* .

Total Bits

Display the total number of bits counted and displayed in the Demod Bits view.

Ref Bits

A reference bit sequence is a known, fixed, pseudo-random bit stream that provides a standard comparison template for the receiver in the bit error rate test to determine the error and to perform the bit error rate statistics.

By default, it is disabled. When you enable Ref Bits, the receiver compares the demodulated bit stream with the reference sequence bit by bit, precisely marking the location of the wrong bit.

Bit Format

Sets the bit sequence format.

NOTE

- **Bin:** corresponds directly to the original bitstream transmitted by the physical layer. 1 character = 1 bit, exactly aligned with the bit-level definition of BER. When you are making BER statistics, the error bits marked in red are the actual error positions at the physical layer.
- **Hex:** 4 binary bits are packed into 1 hexadecimal character (0-F). 1 character = 1 ZigBee symbol, which corresponds directly to the symbol mapping result after the spreading spectrum.

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4.6.3 Standard

Preset To Standard

It is fixed to be ZIGBEE2450, and cannot be modified. It is a physical layer (PHY) specification based on the IEEE 802.15.4 standard and operating at 2.4 GHz band ZigBee communication system.

Item	Parameter	Description
Frequency Band	2.4 GHz	Globally unified and open ISM band
Center Frequency Range	2400 MHz to 2483.5 MHz	Fixed to 2.405 GHz and cannot be modified
No. of Channels	16	No. CH11 to No. CH26
Modulation Format	O-QPSK	Offset Quadrature Phase Shift Keying O-QPSK carries 4 raw data bits per symbol.
SFactor	32	1 Symbol = 32 Chips (each data symbol is spread into 32 chips)
Chip Rate	2 MChip/s	Fundamental bandwidth of the signal after spreading Chip Rate = Symbol Rate × Chips per Symbol
Symbol Rate	62.5 ksymbol/s	2M/32 (Chip Rate/Spreading Factor)
Data Rate	250 kbps	Data Rate = Symbol Rate x Net Data Bits per Symbol = 62.5 ksymbol/s × 4 bits/symbol = 250 kbps

ZigBee Channel

There are 16 channels, which are numbered from 11 to 26.

Channel No.	Center Freq	Single-channel Bandwidth
11	2405 MHz	5 MHz
12	2410 MHz	5 MHz
13	2415 MHz	5 MHz
14	2420 MHz	5 MHz
15	2425 MHz	5 MHz

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Channel No.	Center Freq	Single-channel Bandwidth
16	2430 MHz	5 MHz
17	2435 MHz	5 MHz
18	2440 MHz	5 MHz
19	2445 MHz	5 MHz
20	2450 MHz	5 MHz
21	2455 MHz	5 MHz
22	2460 MHz	5 MHz
23	2465 MHz	5 MHz
24	2470 MHz	5 MHz
25	2475 MHz	5 MHz
26	2480 MHz	5 MHz

4.6.4 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

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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 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.

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- 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.

4.7.1.4 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.

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4.7.1.5 Marker Trace

Selects the trace that the current marker marks. The available marker traces include:

- **Capture Data**

  sets the selected trace to display pre-demodulated data in the "RawTime", "Spectrum", and "FrameCapture" view. The "RawTime" view is the same as the one in the "Frame Capture" view (ZigBee > Frame Capture).

- **Meas Signal**

  sets the selected trace to display the characteristics of the "time-domain" or "frequency-domain" demodulation data.

  - The time domain includes "MeasLog", "MeasLin", "MeasReal", "MeasImag", "MeasPhase", "MeasPhaseUnwrap", "MeasIQ", "MeasCons", "MeasIEye", "MeasQEye", "MeasIQEyeI", and "MeasIQEyeQ".
  - The frequency domain includes "MeasSpectrum".

- **Ref Signal**

  Sets the displayed reference signal data of the selected trace to time-domain or frequency-domain data.

  - The time domain includes "RefLog", "RefLin", "RefReal", "RefImag", "RefPhase", "RefPhaseUnwrap", "RefIQ", "RefCons", "RefIEye", "RefQEye", "RefIQEyeI", and "RefIQEyeQ".
  - The frequency domain includes "RefSpectrum".

- **Demod Error**

  Selects the demodulation error data of the selected trace.

  - EVMErrorTime

    Displays the vector difference between the IQ measurement time and IQ reference time at each time point.

  - EVMErrorSpectrum

    Displays the FFT operation results of the vector difference between the IQ measurement time and IQ reference time at each time point.

  - MagError

    Displays the amplitude difference between the IQ measurement signal and the reference signal at each time point.

  - PhaseError

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Displays the phase difference between the IQ measurement signal and the reference signal at each time point.

4.7.1.6 Marker X

Sets the X-axis readout of the marker to change the position of the marker on the trace. Click or tap this menu to modify the 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.
- When "Fixed" is selected for the marker mode and the marker is in the constellation or IQ view, Marker X is used to locate the data points.

4.7.1.7 Marker Y

When the marker mode is set to "Fixed", you can click or tap this menu to set the Y value of the current marker.

NOTE

When you select the fixed marker mode and the marker is in the constellation or IQ view, Marker Y is used to set the marker's in-phase component (real part) of the Y value.

4.7.1.8 Marker Y Image

When "Fixed" is selected for the marker mode and the marker is in the constellation or I-Q view, Marker Y is used to set the marker's quadrature component (imaginary part) of the Y value.

4.7.1.9 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.

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4.7.1.10 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 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.

4.7.3 Marker Function

4.7.3.1 Band Function

The band function defines the corresponding parameters for a frequency band measurement signal at the marker point.

1. **Band Power**

   Calculates the total power within a certain band.

2. **OFF**

   Disables the band function.

   Disabling the band function will neither affect the frequency band parameters nor disable the marker.

4.7.3.2 Band Setting

Adjusts the band parameter for the band function.

1. **Band Span**

   Sets the bandwidth of the signal involved in the calculation for the band function.

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2. Band Left

Sets the left edge frequency of the signal involved in the calculation for the band function.

3. Band Right

Sets the right edge frequency of the signal involved in the calculation for the band function.

NOTE

The band function is available for the Spectrum view, MeasSpectrum view, RefSpectrum view, and EVMErrorSpectrum view.

4.7.4 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.

4.7.4.1 Peak Search

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

4.7.4.2 Next Peak

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

4.7.4.3 Next Higher

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

4.7.4.4 Next Peak Right

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

4.7.4.5 Next Peak Left

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

4.7.4.6 Minimum Search

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

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4.7.4.7 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 Display View

View Type

Click or tap  on the quick operation tool bar at the upper-right part of the screen to select the desired display view. You can also click or tap the drop-down button of the display view name to set the display view for the selected trace.

- **Capture Data**

  The view is used to demonstrate the characteristics of the captured original pre-demodulated data in the "RawTime", "Spectrum", and "FrameCapture". The "RawTime" view is the same as the one in the "Frame Capture" view (**ZigBee** > **Frame Capture**).

- **Meas Signal**

  The view is used to demonstrate the characteristics of the demodulation data in the "time-domain" or "frequency-domain".

  - The time domain includes "MeasLog", "MeasLin", "MeasReal", "MeasImag", "MeasPhase", "MeasPhaseUnwrap", "MeasIQ", "MeasCons", "MeasIEye", "MeasQEye", and "MeasIQEye".
  - The frequency domain includes "MeasSpectrum".

- **Ref Signal**

  The view is used to demonstrate the characteristics of the reference signal data in the "time-domain" or "frequency-domain".

  - The time domain includes "RefLog", "RefLin", "RefReal", "RefImag", "RefPhase", "RefPhaseUnwrap", "RefIQ", "RefCons", "RefIEye", "RefQEye", and "RefIQEye".
  - The frequency domain includes "RefSpectrum".

- **Demod Error**

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The view is used to demonstrate the error of the reference demodulation data in each dimension.

- EVMErrorTime

  Displays the vector difference between the IQ measurement time and IQ reference time at each time point.

- EVMErrorSpectrum

  Displays the FFT operation results of the vector difference between the IQ measurement time and IQ reference time at each time point.

- MagError

  Displays the amplitude difference between the IQ measurement signal and the reference signal at each time point.

- PhaseError

  Displays the phase difference between the IQ measurement signal and the reference signal at each time point.

- **ZigBee**

  The dedicated demonstration view of the ZigBee signal.

  - **Frame Capture**

    This view plots raw time domain data (Raw Time), which includes data prepared for the filter before and after and the subsequent processed data.

  - **Demod Bits**

    In this view, a table displays the demodulated bit sequence is displayed.

  - **MEAS**

    This view displays the analysis results of the ZigBee data frame in a tabular form.

Combination View

Click or tap **Display** > **Display View** > **Comb View** to select the type of view you want to display, with the following available combinations views.

- **Normal:** A combination of RawTime, Spectrum, MeasLog, and MEAS windows.
- **Demod Trace:** A combination of MeasLog and MeasSpectrum windows.
- **Demod Error:** A combination of EVMErrorTime, MagError, PhaseError, and MEAS windows.

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- **Result Summary:** shows the MEAS window only.

Restore View

Restores the layout of the current combination view to its defaults. If the layout remains unchanged, and you have modified the display view type, click or tap this menu to restore to its previously selected display view.

TIP

If you have modified the default view layout of the current combination view, click or tap **Restore View**, the modified view layout may be lost and will not be saved to the state file.

4.8.2 Display Meas

X Scale

When it is enabled, the system auto adjusts the X-axis Ref Value and Width value for the current window. At this time, both Ref Value and Width menus are grayed out and cannot be modified. When it is disabled, you can set the Ref Value and Width value manually.

Ref Value

Sets the X-axis reference value of the selected trace. When the time-domain data source is selected, the reference unit is symbol or s; when the frequency-domain data source is selected, the reference unit is Hz.

Table 4.15 Ref Value (Time-Domain Data)

Parameter	Description
Default	0 (0 μs)
Range	(-1e+12) to (1e+12)
Unit	Symbol (s, ms, μs, ns, ps)
Knob Step	Width/100
Left/Right Arrow Key Step	Width/10

Table 4.16 Ref Value (Frequency-Domain Data)

Parameter	Description
Default	998.4375 MHz

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Parameter	Description
Range	-1 THz to 1 THz
Unit	GHz, MHz, kHz, Hz
Knob Step	Width/100
Left/Right Arrow Key Step	Width/10

Width

Sets the X-axis width of the selected trace. When the time-domain data source is selected, the reference unit is symbol or s; when the frequency-domain data source is selected, the reference unit is Hz.

Key Points:

- For the frequency-domain trace, the X-axis width can be set to be smaller than the span, enabling you to zoom in on a portion of the measurement values.
- For the time-domain trace, the X-axis width can be set to be smaller than the time span, enabling you to zoom in on a portion of the measurement values.

Table 4.17 Width (Time-Domain Data)

Parameter	Description
Default	50 μs
Range	0 to (1e+12)
Unit	Symbol (s, ms, μs, ns, ps)
Knob Step	Width/100
Left/Right Arrow Key Step	Width/10

Table 4.18 Width (Frequency-Domain Data)

Parameter	Description
Default	3.128055 MHz
Range	1 THz to 1 THz
Unit	GHz, MHz, kHz, Hz

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Parameter	Description
Knob Step	Width/100
Left/Right Arrow Key Step	Width/10

Ref Position

Sets X-axis scale's reference value of the selected trace. It can be set to "Left", "Center", and "Right".

Last Scale

Sets X Scale to the last modified X-axis reference value and X-axis width. When X Scale is enabled, this menu item is grayed out and disabled.

Eye Length

Click or tap **Eye Length** to set the width of the selected eye diagram, expressed in symbols.

NOTE

This menu is enabled when the trace is displayed in eye view.

Parameter	Description
Default	2
Range	1 to 40
Unit	N/A
Knob Step	1
Left/Right Arrow Key Step	1

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.

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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 Trig Out

Enable or Disable the Trigger Output

Select to enable or disable the trigger output.

Set the Trig Out Polarity

Select the trigger output as "Positive" or "Negative".

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5 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	ZigBee Parameter Value
Frequency	
Center Frequency	2.405 GHz
Amplitude	
Range	0 dBm
Ref Value[1]	10 dBm
Y Axis Unit[1]	Power
Scale/Div[1]	10 dB
Ref Position[1]	Center
Bandwidth	
FFT Window	Flattop
Sweep	
Sweep Mode	Continuous
Trigger	
Trigger Source	Free Run
Trigger Hold	OFF, 100 ms
Auto Trig	OFF, 100 ms
Slope	POS
Trigger Delay	OFF, 1 μs

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Parameter Name	ZigBee Parameter Value
Trigger Level	-25 dBm
Measure Setup[2]	
Global CF	
Global CF	OFF, 13.25 GHz
Setting	
Mod Format	OQPSK
Meas Interval	50
Symbol Rate	1 Msps
Points/Symbol	4
Measurement Filter	Half Sine
Reference Filter	Half Sine
BER	
BER	OFF
Total Bits	500
Ref Bits	OFF
Bit Format	Bin
Preset	
Preset To Standard	ZIGBEE2450M
ZigBee Channel	11
Marker	
Marker Setup	
Selected Marker	Marker1
Marker Mode	OFF
Reference Marker	Marker2

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Parameter Name	ZigBee Parameter Value
Marker Trace	Raw Time
Marker X	0 s
Couple Markers	OFF
Marker Function	
Band Span	OFF, 156.403 kHz
Band Left	2.404921799 GHz
Band Right	2.405078201 GHz
Peak Search	
Cont Peak	OFF
Display	
X Scale[1]	ON
Ref Value[1]	0 Hz
Width[1]	3.128054 MHz
Ref Position[1]	Left
Copy X Scale[1]	Spectrum
Eye Length[1]	2
Comb View	Normal
Input/Output	
Input Impedance	50 Ω
Ext Gain	0 dB
Trig Out	OFF
Trig Out Polarity	Positive
System[3]	
Power On	Preset

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Parameter Name	ZigBee Parameter Value
Power Switch	OFF
Beeper	OFF
Screen Brightness	80%
Fan Speed	49%
Display Time	ON
Calibrate Auto	OFF
Language	English

NOTE

[1]: Take Spectrum view as an example.

[2]: This function is only available for RSA6000 installed with the corresponding option.

[3]: Not affected by Preset settings.

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