Demonstration of using the SigIQPro Bluetooth signal generation and SSA5000A Bluetooth analysis functions

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Contents

1 Introduction

As a wireless communication technology, Bluetooth technology is widely used in various devices and application scenarios. The article aims at RF verification of Bluetooth transmitter. Through fast one-click RF measurement, SSA5000A spectrum analyzer is transformed into a standard-based Bluetooth RF transmission tester to help you design, evaluate and manufacture Bluetooth devices. The measurement application conforms to the standard of Bluetooth core specification, and can safely verify your Bluetooth design, covering Bluetooth BR, EDR and LE. The article will demonstrate how to use the Bluetooth analysis function of SSA5000A to carry out Bluetooth analysis and measurement quickly and effectively.

1.1 Bluetooth Analysis Function

Bluetooth SIG specifies the RF test items of Bluetooth® Classic and Bluetooth® Low Energy Bluetooth measurement specifications. Tables 2 and 3 list the corresponding test items supported by SSA5000A and suitable for transmitter testing. The SIGLENT Bluetooth measurement application refers to the following Bluetooth RF test specifications:

Table 1 Supported standard versions

Type	Bluetooth device
Standard version	Bluetooth radio frequency system specification 1.2/2.0/2.0+EDR/2.1/2.1+EDR revision 2.1.E.0 -- basic rate -- enhanced data rate Bluetooth Low Energy RF PHY test specification (LE RF-PHY.TS/4.0/4.2) Bluetooth RF PHY test specification (Bluetooth 5, 5.1 and 5.3)
Power	Class 1, class 2 and class 3
Frequency	Bluetooth basic rate and EDR system: 2.400 to 2.4835 GHz (f = 2402 +k MHz, k = 0, …, 78) Bluetooth low energy system: 2.400 to 2.4835 GHz (f = 2402 +kx2 MHz, k = 0, …, 39)

Table 2 Supported Classic test items

Transmitter test	TP/TRM/CA/BV-xx-C
Basic Rate (BR)	
Output power	01
Modulation characteristic	07
Initial carrier frequency tolerance	08
Carrier frequency drift	09
Enhanced Data Rate (EDR)	
EDR relative transmit power	10
EDR carrier frequency stability and modulation accuracy	11
EDR differential phase encoding	12

Table 3 Supported LE test items

Low Energy (LE)					
Transmitter test	LE 1M 1 Mb/s	LE 2M 2 Mb/s	LE 1M 1 Mb/s, SMI	LE 2M 2 Mb/s, SMI	Coded, S=8 1 Mb/s, SMI
Output power	01				
Modulation characteristics	05	10	09	11	13
Carrier frequency offset and drift	06	12			14

1.2 Configuration information

You need to install the appropriate firmware version and options on the required instruments.

Table 4 Configuration information

Type	Model	Configuration information
Signal Generation Software	SigIQPro	Optional: SigIQPro-BT
Vector Signal Generator	SSG5000X-V	Firmware: V2.1.2.4.1and above Optional: SigIQPro-BT
Arbitrary Waveform Generator	SDG7000A	Firmware: V1.1.1.32 and above Optional: SigIQPro-BT
Spectrum Analyzer	SSA5000A	Firmware: V1.1.2.2.0 and above Optional: SSA5000A-BT

1.3 Measurement Parameters

SSA5000A Bluetooth analysis provides one-button measurement.

Bluetooth Analysis	Basic Rate (BR)	Enhanced Data Rate (EDR)	Low Energy (LE)
Output power			
◆ Peak power	●		●
◆ Average power	●		●
Modulation characteristics			
◆ ΔF1 Avg/Max	●		●
◆ ΔF2 Avg/Max	●		●
◆ ΔF1/ΔF2 Ratio	●		●
Initial carrier frequency tolerance (ICFT)	●		
Frequency offset			●
Carrier frequency drift			
◆ Frequency drift	●		●
◆ Max drift rate	●		●
◆ Init freq drift			●
Relative transmit power			
◆ GFSK average power		●	
◆ DPSK average power		●	
◆ Rel average power		●	
Frequency stability and modulation accuracy			
◆ Freq offset w_i		●	
◆ Freq offset w_0		●	
◆ w_0+w_i		●	
◆ RMS DEVM		●	
◆ Peak DEVM		●	
Differential phase decoding			
◆ BER		●	
◆ Bit errors		●	
◆ 99% DEVM		●	
Guard Interval		●	

1.4 Connection Settings

Connect a PC with SigIQPro software to SSG5000X-V / SDG7000A through GPIB / LAN / USB. Complete the connection according to the setup instructions of SigIQPro, and then perform the following steps to interconnect SSG5000X-V / SDG7000A and SSA5000A:

1) Connect SSG5000X-V/ SDG7000A RF output port to SSA5000A RF input port.
2) It is suggested to connect the 10 MHz IN output of SSG5000X-V / SDG7000A to the Ext RefI port (back panel) of SSA5000A to improve the frequency accuracy.

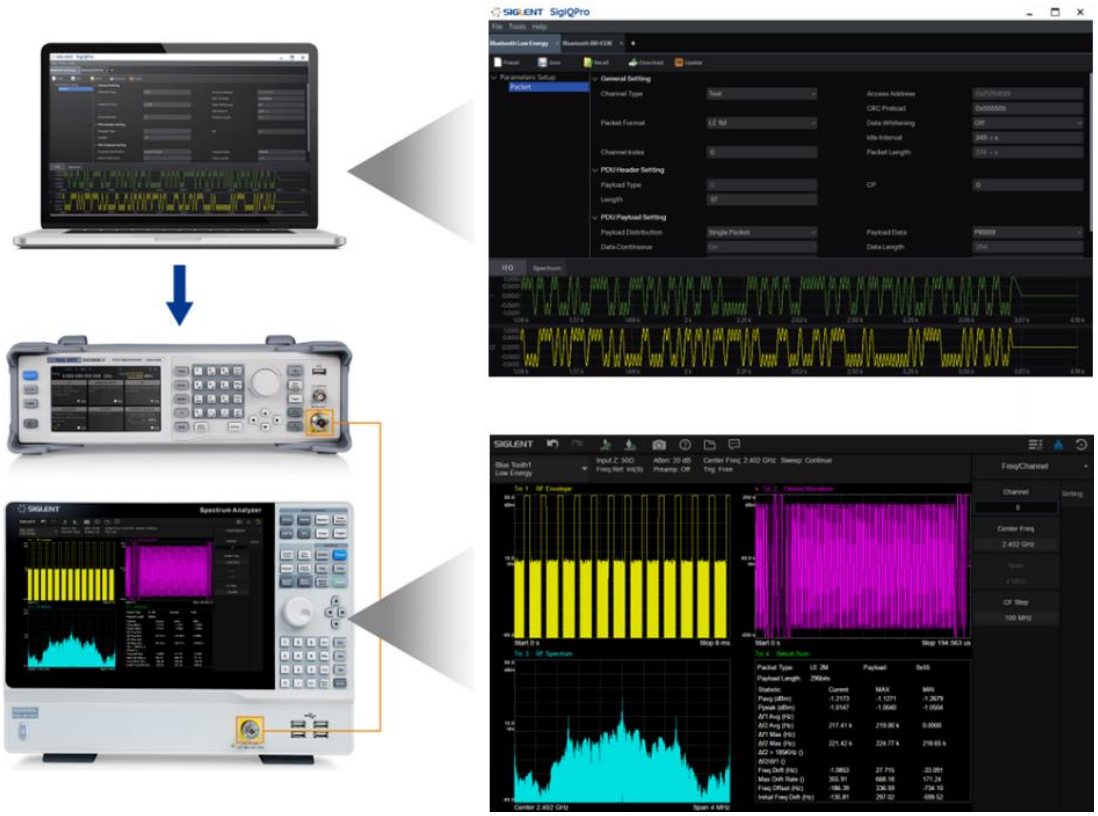

Figure 1–1 Connection settings

1.5 Test Result

SSA5000A calculates the measurement results according to the Bluetooth® RF test specification, carries out Bluetooth BR/ EDR/LE one-button measurement and displays a single view with four traces. The one-button measurement function can conveniently and quickly complete the test purposes listed in Table 2 and 3 at one time, and provide an overview of multiple emission tests. Users can switch from the four-trace overview to a single power, modulation and spectrum measurement display to view the results in more detail. All signal parameters can be modified independently, such as RF channel, packet type, mode type, etc. SSA5000A is helpful for users to troubleshoot flexibly in the laboratory and optimize RF design easily and quickly.

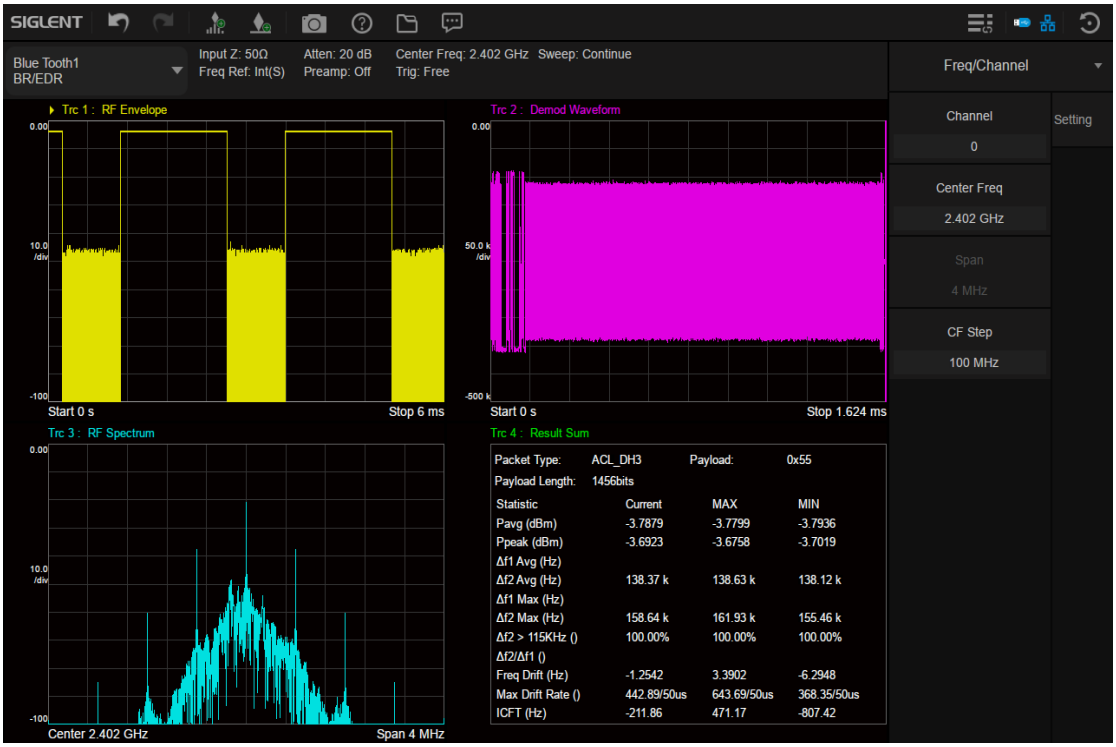

Figure 1–2 Test result

About SIGLENT

SIGLENT is an international high-tech company, concentrating on R&D, sales, production and services of electronic test & measurement instruments.

SIGLENT first began developing digital oscilloscopes independently in 2002. After more than a decade of continuous development, SIGLENT has extended its product line to include digital oscilloscopes, isolated handheld oscilloscopes, function/arbitrary waveform generators, RF/MW signal generators, spectrum analyzers, vector network analyzers, digital multimeters, DC power supplies, electronic loads and other general purpose test instrumentation. Since its first oscilloscope was launched in 2005, SIGLENT has become the fastest growing manufacturer of digital oscilloscopes. We firmly believe that today SIGLENT is the best value in electronic test & measurement.

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