IoT Signal Generation Solution

SOLUTIONS

AN0001-EN01A

SIGLENT TECHNOLOGIES CO.,LTD

Trademark Information

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Statement

Product Certification

SIGLENT certifies that this product complies with China's national product standards and industry product standards, and further certifies that this product complies with the relevant standards of other members of international standards organizations.

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1 Overview

The Internet of Things (IoT) refers to the interconnection of any object with a network via information sensing devices according to a predefined protocol. Objects exchange information and communicate through information transmission media to achieve intelligent identification, positioning, tracking, monitoring, and other functions.

The IoT has a wide range of applications across numerous fields, including intelligent transportation, environmental protection, government operations, public security, smart home, intelligent fire protection, industrial monitoring, elderly care, personal health, floriculture, water system monitoring, food traceability, enemy surveillance, and intelligence gathering.

IoT transmissions are typically based on wireless methods, generally utilizing license-free ISM frequency bands. They usually feature low power and narrow bandwidth, and may also employ technologies such as ad-hoc networking and relay transmission.

2 Challenges

There are numerous IoT standards. Depending on requirements for data rate, power consumption, and mobility, various national organizations, industry associations, and industry alliances define their own standards, particularly for wireless interfaces. Receiver testing, such as for receiver sensitivity, dynamic range, and anti-interference capability, is a crucial RF test item. SIGLENT SigIQPro signal generation software supports the following formats and, in conjunction with the SSG5000X-V series vector signal generators or SDG7000A series arbitrary waveform generators, can generate various IoT signals for testing receivers and modules.

- IEEE 802.15.4 OQPSK/BPSK -- ZigBee
- IEEE 802.15.4 FSK Wi-SUN
- IEEE 802.15.4 OFDM Wi-SUN
- ITU-T G.9959 Z-Wave

3 Solutions

3.1 IEEE 802.15.4 OQPSK/BPSK -- ZigBee

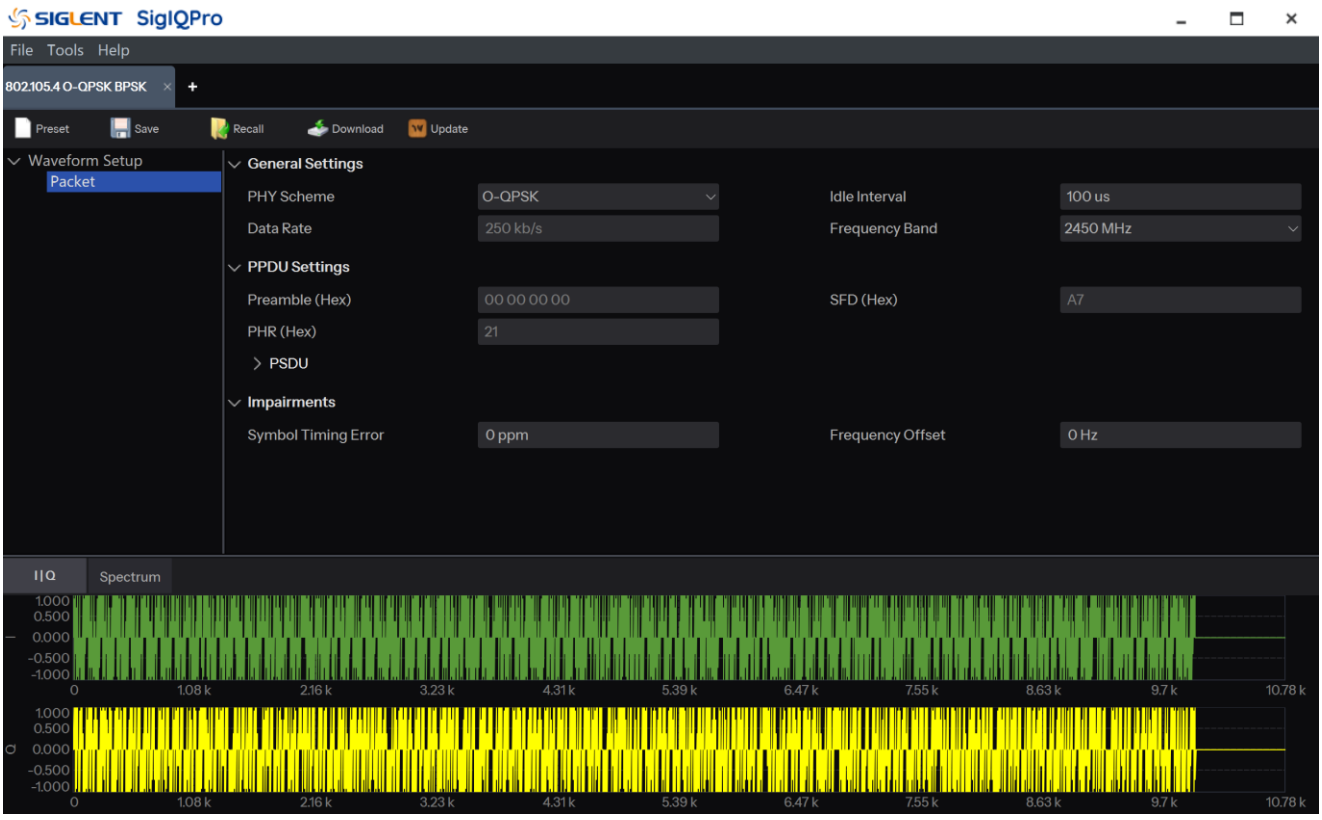
The IEEE 802.15.4 protocol is a standard developed by the IEEE 802.15.4 Working Group for Low-Rate Wireless Personal Area Networks (WPAN). Established in December 2002, the group aims to define a low-complexity, low-cost, low-power, low-data-rate wireless connection technology for use by fixed, portable, or mobile devices. The first 802.15.4 standard was approved in December 2003. With the development of wireless sensor network technology, the standard for wireless sensor networks has also evolved rapidly.

The 802.15.4 standard defines the methods and protocols for device interconnection via radio frequency within a personal area network. It employs Carrier Sense Multiple Access with Collision Avoidance (CSMA-CA) as the medium access mechanism and supports both star and peer-to-peer network topologies.

The 802.15.4 standard specifies two physical frequency bands and Direct Sequence Spread Spectrum (DSSS) physical layer frequency bands: 868/915 MHz and 2.4 GHz. The 2.4 GHz physical layer supports an over-the-air data rate of 250 kbps, while the 868/915 MHz physical layer supports 20 kbps and 40 kbps transmission rates. Due to packet overhead and processing delays, the actual data throughput is less than the specified bit rate. As a protocol standard supporting low-rate, low-power, short-range wireless communication, 802.15.4 provides specifications for radio frequency and data rate, data transfer models, device types, network operation modes, security, and more. It also implements the protocol model by dividing it into two sublayers: the Physical Layer (PHY) and the Medium Access Control (MAC) layer.

SigIQPro software allows free definition of the following parameters:

- Number of Frames
- Modulation Mode: OQPSK, BPSK
- Data rate and chip rate are automatically set based on the selected Frequency Band and Modulation Mode.
- PSDU Data Content: Pseudo-random sequences PN9, PN15, or user-defined content.
- Artificial Signal Impairment Addition: Symbol Timing Error, Frequency Offset.



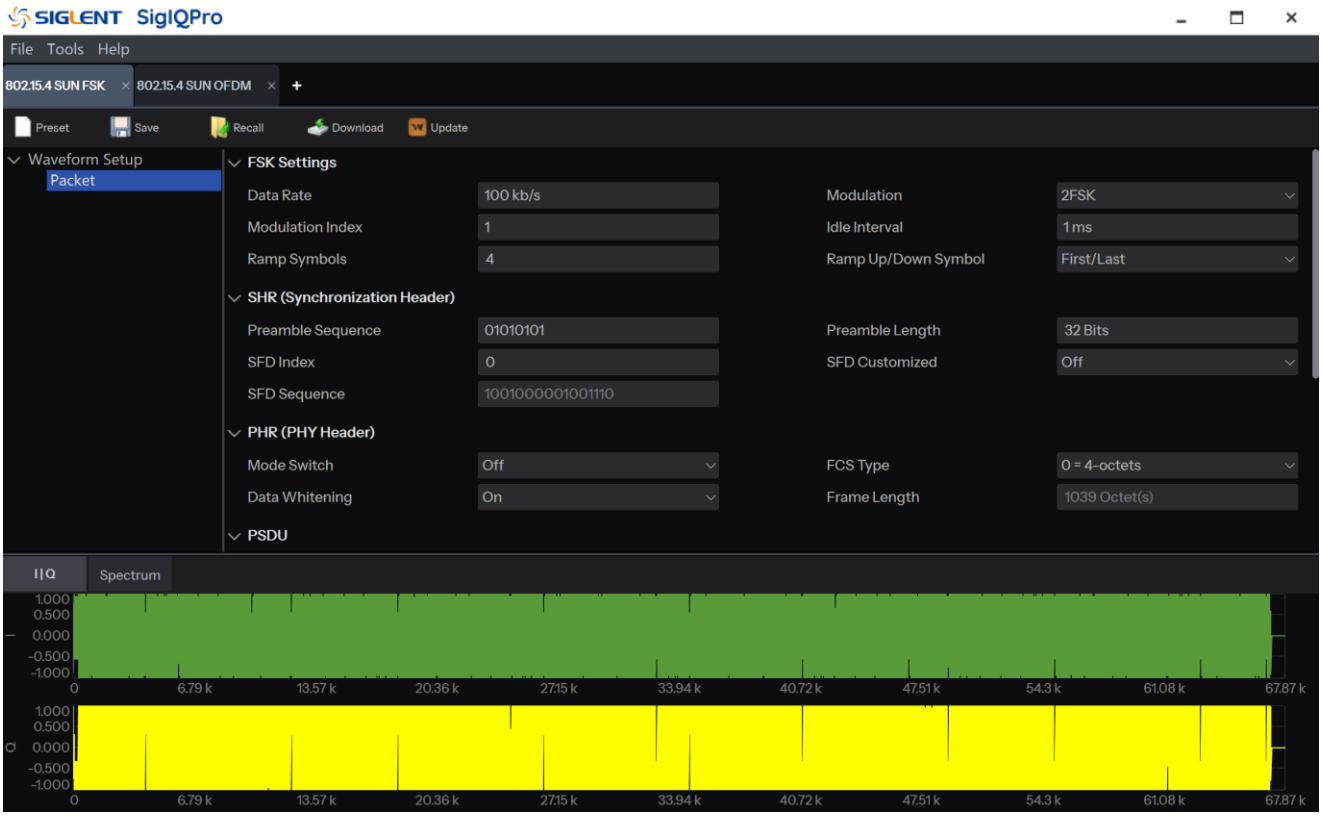
3.2 IEEE 802.15.4 FSK/OFDM Wi-SUN

Wi-SUN, short for Wireless Utility Networks, is a collective term for a series of standard wireless communication networks based on the IEEE 802.15.4 protocol as the underlying layer. It mainly includes Wi-SUN FAN (Wireless Utility Field Area Network) and Wi-SUN HAN (Wireless Home Area Network).

Prior to 2008, there was no unified wireless communication standard for Wide Area IoT (Wide-Area IoT) in the industry, while various WAN IoT communication protocols coexisted. The commonality among these protocols was their use of the IEEE 802.15.4 technical standard, but interoperability at the application layer could not be achieved. To address this complex issue, large-scale IP-based wide-area wireless mesh networks emerged, referred to as Wi-SUN FAN (Wireless Utility Field Area Network). This standard aims to become a global wireless mesh network standard with interoperability. Accompanying the establishment of the standard, the Wi-SUN Alliance is responsible for its development, promotion, maintenance, and certification of interoperability. The relationship between the IEEE 802.15.4 specification, the Wi-SUN Alliance, and end products can be understood by analogy with Wi-Fi.

SigIQPro software allows free definition of the following parameters:

- Number of Frames
- Modulation Mode: 2FSK / 4FSK / OFDM
- Option1 ~ Option4 (Applicable only in OFDM mode)
- Data Rate
- PSDU Data Content: Pseudo-random sequences PN9, PN15, or user-defined content.

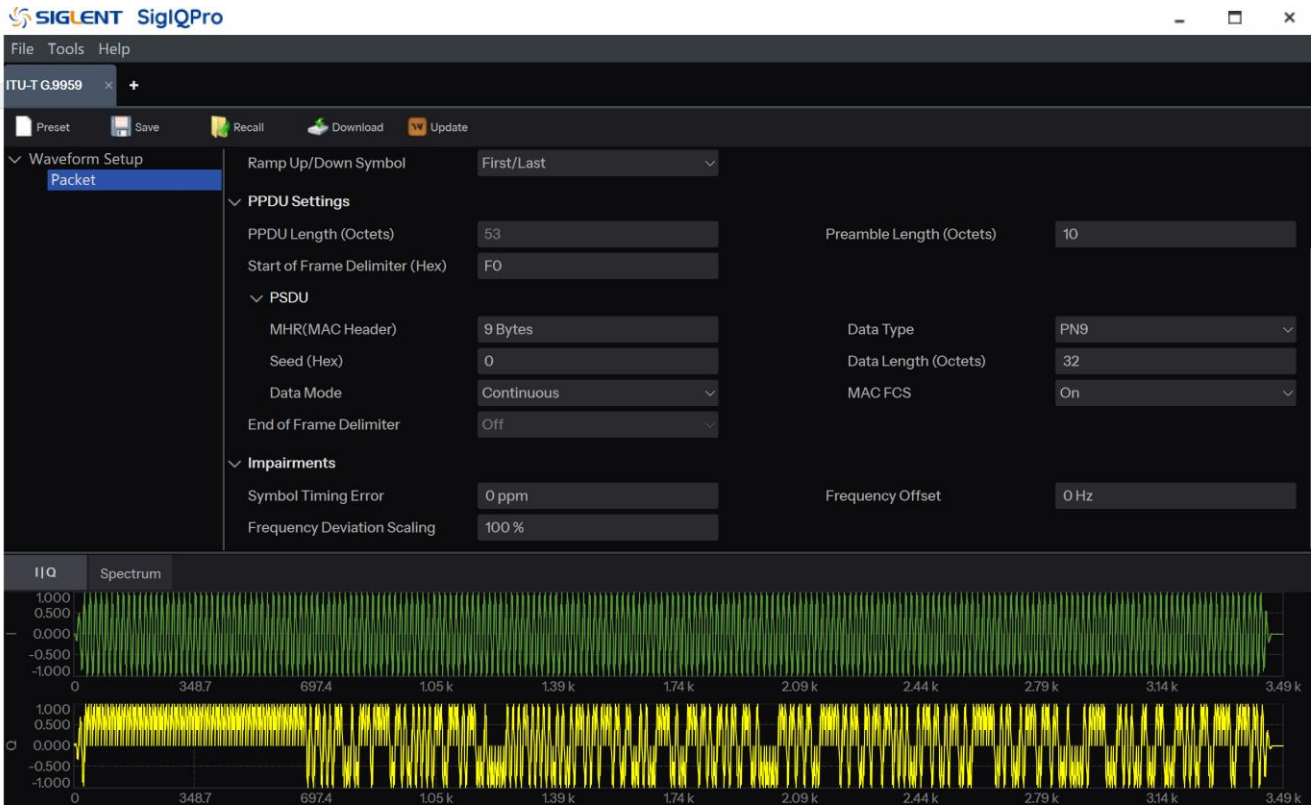


3.3 Z-Wave

Z-Wave is an emerging short-range wireless technology based on the international ITU-T G.9959 standard. It features low power consumption, flexible networking, and a unified interface protocol. It operates in the 908.42 MHz (USA) - 868.42 MHz (Europe) frequency band with a data transmission rate of 9.6 kbps. The effective signal range is approximately 30m indoors and can exceed 100m outdoors. Z-Wave is widely used in lighting and appliance control, meter reading, security, and other fields. It can convert any independent device into a smart network device, enabling control and wireless monitoring.

SigIQPro software allows free definition of the following parameters:

- Modulation Mode: FSK / GFSK
- Data Rate: R1 ~ R3
- PSDU Data Content: Pseudo-random sequences PN9, PN15, or user-defined content.
- Artificial Signal Impairment Addition: Symbol Timing Error, Frequency Offset, Frequency Deviation Scaling.



4 Summary

SIGLENT SigIQPro signal generation software supports the configuration and generation of signals for multiple IoT standards. In conjunction with the SSG5000X-V, SSG6082A-V series vector signal generators or the SDG7000A series arbitrary waveform generators, it can generate various IoT signals for testing receivers and modules.

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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