

The Latest Technology Trends of Wi-SUN Wireless Communication Modules

White Paper

Introduction

Low Power Wide Area (LPWA), which as its name implies covers a wide area with low power consumption, is attracting increased attention as a wireless protocol for IoT. LPWA actually encompasses numerous methods, each with different advantages and drawbacks. In this article we will introduce the latest development trends of Wi-SUN, a protocol ROHM is promoting.

1. What is Wi-SUN?

Wi-SUN is short for Wireless Smart Utility Network, a newer communication standard formulated in recent years. The Wi-SUN Alliance was established in 2012, and standardization based on IEEE802.15.4g is currently underway.



Figure 1 shows how Wi-SUN compares with other wireless standards for IoT.

Figure 1. Wireless Communication Technologies for IoT

As you can see from the above chart, Wi-SUN is characterized by longer communication distance than Wi-Fi and faster speeds than LoRaWAN and Sigfox. These balanced characteristics featuring a moderate transmission rate that does not depend on a base station make it the best wireless protocol for the IoT market. This allows it to coexist with 5G, which is expected to be launched in the near future, enabling complementary usage of 5G.

2. Wi-SUN Profile Types

The Wi-SUN Alliance includes Working Groups (WG) that formulate technical specifications and profiles. Among these, Working Groups have started certification of 3 different profiles, HAN, FAN, and JUTA, with market commercialization currently progressing. ROHM is already developing products compatible with these 3 profiles. (Fig. 2).





Figure 2. Profiles Developed by the Wi-SUN Alliance and ROHM Compatible Products

3. Wi-SUN HAN

3-1. Wi-SUN HAN and Wi-SUN Enhanced HAN

Wi-SUN HAN (Home Area Network), is a standard that assumes a *one-to-many* (gateway/end device) star-type connection linking smart meters and HEMS (Home Energy Management Systems) with appliances.

Wi-SUN Enhanced HAN is the latest HAN wireless communication standard that adds 2 functions to the Wi-SUN HAN profile. The first is support for relay transmission using a single relay, enabling a tree-type *one-to-many-to-many* (gateway/relay/end device) configuration that allows users to construct more stable networks, even over longer distances. The second is a sleep function that achieves low-power two-way communication ideal for battery-equipped devices, providing communication over a wider range with less power than before.

As such, Wi-SUN-compatible devices are expected to see wide adoption in factories, commercial facilities, and home networks mentioned above.

From 2019 ROHM began production of a wireless communication module, BP35C0-J11, compatible with Wi-SUN Enhanced HAN that delivers the following features.

1 Support for all modes

The BP35C0-J11 supports all modes specified by Wi-SUN Enhanced HAN. This eliminates the need for troublesome hardware replacement and firmware updates, ensuring compatibility based on various needs.



	B Route		Enhanced HAN			
Mode	Smart Meter	Gateway	Sleeping Devices Battery-Powered Devices	Relay Device Relay	End Devices	
BP35C0-J11		\bigcirc	\bigcirc	\bigcirc	\bigcirc	

Figure 3. Compatible Modes of the BP35C0-J11

2 Built-in FOTA (Firmware update Over The Air) function

The BP35C0-J11 leverages 2 key characteristics of LAPIS Semiconductor's wireless IC, namely fast 100 kbps Wi-SUN communication speed and built-in ROM (512 kB), to achieve FOTA functionality ideal for efficient operation.

Integrating FOTA makes it possible to quickly respond to problems and carry out minor standard updates with minimal cost.

③ Evaluation boards

To facilitate customer evaluation, ROHM launched online sales of various boards and kits to suit application needs, including an evaluation board that integrates the BP35C0-J11 (BP35C0-J11-T01), a compact board with built-in antenna (BP35C1-J11-T01), and USB dongle type evaluation kit (BP35C2-J11-T01). (Fig. 4)

In addition, all documents required for development, including wireless module start guides, hardware specifications, and external antenna lists, are available for download from ROHM's dedicated support page.



Figure 4. BP35C0-J11 Evaluation Kit

3-2. Wi-SUN HAN Applications

NextDrive's Cube, the industry's smallest IoE (Internet of Energy) gateway, utilizes ROHM's BP35C0 Wi-SUN HAN compatible wireless communication module.

Support for Wi-SUN HAN makes it possible to control home appliances such as electric power smart meters, energy storage batteries, residential solar power systems, and Eco Cute. Also equipped is a function for visualizing both power generation and power consumption along with a storage battery and Eco Cute scheduling function optimized for HEMS and smart home services.

In the future, NextDrive plans to release a cloud platform that will enable faster VPP (Virtual Power Plant) services. At the same time, a Cube is being developed that supports Wi-SUN Enhanced HAN to broaden the applicable scope and expand the control of target devices.





Figure 5. NextDrive IoE Gateway "Cube"

4. Wi-SUN JUTA

4-1. Wi-SUN JUTA

Wi-SUN JUTA is a new international wireless communication standard for battery-driven smart meters characterized by 2 features – long-term operation and high-reliability communication. To ensure long-term operation, original intermittent operation (all sleep except for transmission/reception at fixed intervals) is carried out that significantly reduces reception time, extending the operating life of battery-equipped smart meters (i.e. gas, water) to 10 years or more. And to achieve high-reliability communication, the transmission is not performed until a beacon is captured during the reception. This reduces the likelihood of a rise in wave occupancy time even when the number of communication operations increases, resulting in stable communication.

ROHM has been developing products for Wi-SUN JUTA from the standards formulation stage. The following are features of ROHM's Wi-SUN JUTA compatible wireless communication module.

1 Enables the configuration of high reliability mesh networks

Mesh networks that support multi-hop communication can be constructed, capable of reconfiguring routes by passing through multiple relays (3 max.).

2 Integrated security function

The built-in security function enables communication encryption and security key updates on the wireless communication module side, making it possible to easily perform secure communication without the need for complicated processing at the host side.

4-2. Wi-SUN JUTA Applications

Tokyo Gas's 'Life Monitoring Service' utilizes ROHM's Wi-SUN JUTA wireless communication module to allow communication between various sensors and the home gateway.

Life Monitoring Service is a smart home service that allows remote monitoring of children and the elderly by checking window and door locks as well as people entering and exiting using a smartphone. (Fig. 6) Adopting ROHM's wireless communication module makes it possible to utilize the F-RIT method conforming to Wi-SUN JUTA to achieve high-reliability communication required for monitoring services in a compact form factor with low power consumption.





Figure 6. Tokyo Gas's "Life Monitoring Service"

5. Wi-SUN FAN

5-1. Wi-SUN FAN

Wi-SUN FAN (Field Area Network) is an interoperable low power wireless communication standard that combines IEEE802.15.4g low power wireless transmission with IPv6 multistage technology.

It is characterized by the following 3 features.

The first is support for multi-hop mesh networks that can cover a wide area as a plane, not a point. Stable system operation is achieved by selecting an alternate route in response to radio interference or sudden changes in terrain after installation. For example, when constructing a network inside a building, pillars and the like can act as obstacles, but Wi-SUN FAN can circumvent these barriers, making it ideal for smart meters and smart cities.

The second feature is secure communication through advanced authentication. Wi-SUN FAN performs authentication using the EAP-TLS method and RADIUS/AAA servers. Connected devices are configured using client certificates, and only authorized devices are centrally managed by the border router, eliminating the need for individual settings for each device, even if the route changes. Secure communication is also possible using AES encryption.

The third feature is compatibility with frequency hopping that enables communication while switching frequencies. In Japan, each device operates by performing channel switching in the range of 28 channels from 922.4 MHz (CH 33) to 928.0 MHz (CH 61) at 50kbps transmission and 14 channels from 922.5 MHz (CH 33/34) to 927.7 MHz (CH 59/60) at 150 kbps. Constructing a robust system strong against radio interference and noise by frequency hopping ensures secure, confidential communication. Under Japan's Radio Law, there is a transmission time limit of only 6 minutes per hour when using a single channel, but using multiple channels through frequency hopping extends the limit to 12 minutes per hour, expanding the application range.

In 2019 a Wi-SUN FAN compatible wireless device jointly developed by ROHM along with Nissin Systems Co., Ltd. and a research group headed by Professor Hiroshi Harada of the Graduate School of Informatics at Kyoto University was the first in the industry to pass testing and obtain certification. In 2020 ROHM plans to produce and sell Wi-SUN FAN wireless modules, while Nissin Systems will launch the sale of Wi-SUN FAN USB boards.

5-2. Wi-SUN FAN Application Diagram

Wi-SUN FAN is expected to be adopted in large-scale, high-reliability network environments in



conjunction with the spread of IoT devices in the future. Examples of use include smart cities and infrastructure linked with electric cars (EVs) and next-generation smart meters and street lights, product management in factories, automatic maintenance of mandatory inspection facilities in buildings, and logistics management such as product temperature monitoring in commercial facilities. (Fig. 7)



Figure 7. Utilizing Wi-SUN FAN for Equipment Maintenance (Building)

6. Future Prospects

Going forward, ROHM will continue to promote various Wi-SUN standards while focusing on the development and production of Wi-SUN FAN wireless communication modules.

We are working to make a positive contribution to society by advocating the widespread use of Wi-SUN, which in addition to offering the broadest application scope in the LPWA market and as such is attracting attention in areas (i.e. IoT used in smart homes and cities, logistics, asset management, security, and smart buildings), can coexist with 5G as well which is expected to launch in the near future.

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