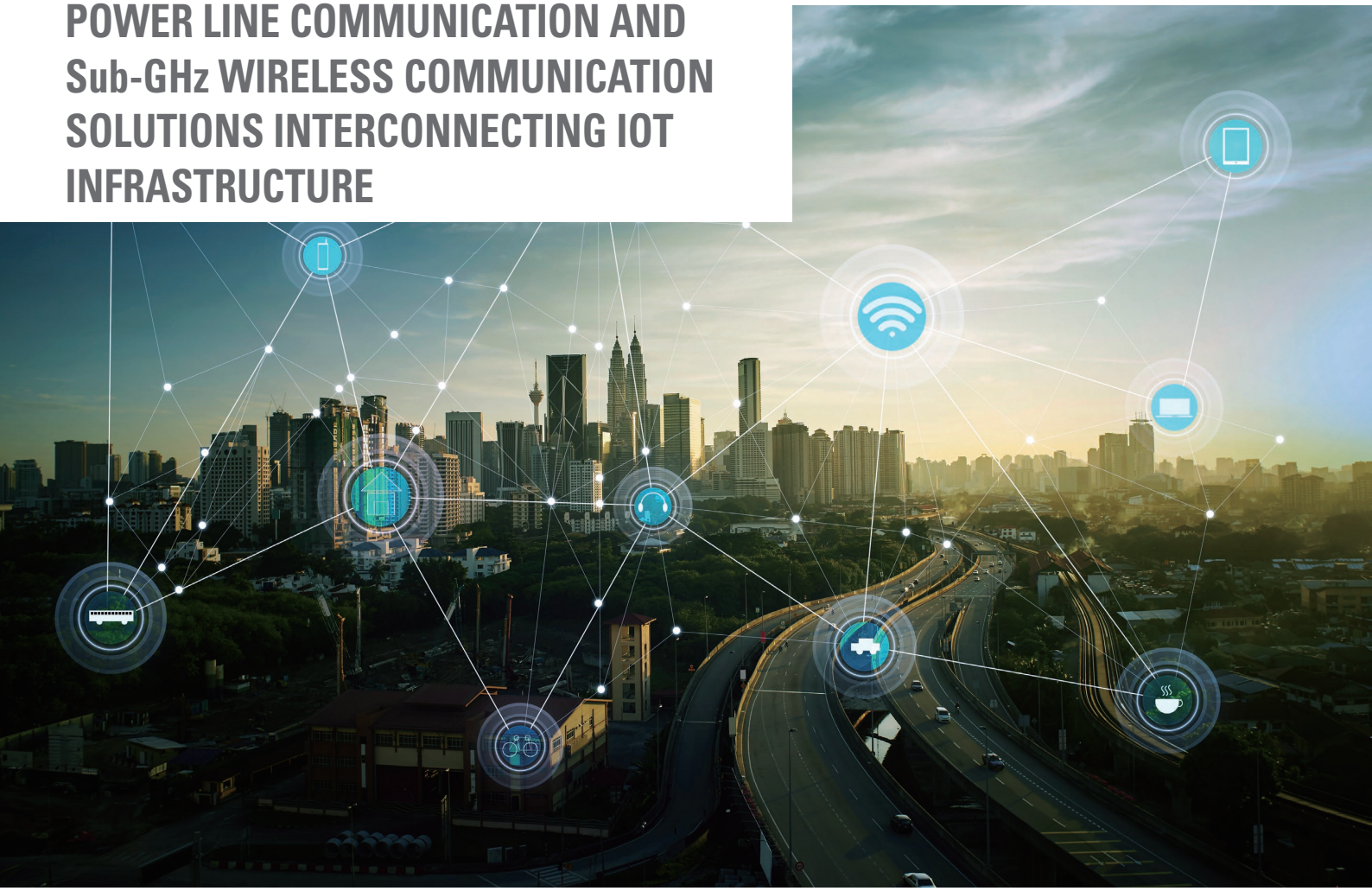
POWER LINE COMMUNICATION AND Sub-GHz WIRELESS COMMUNICATION SOLUTIONS

Brochure

2024.10

POWER LINE COMMUNICATION AND Sub-GHz WIRELESS COMMUNICATION SOLUTIONS INTERCONNECTING IOT INFRASTRUCTURE



Renesas supplies wired and wireless communication ICs that are used in applications such as smart meters and other IoT applications. Power line communication (PLC) modem ICs utilize existing power lines for communication. Renesas narrowband power line communication solutions that employ the frequency band up to 500kHz are widely used in PLC smart meters, which are achieving ever broader adoption in Europe in particular.

At the same time, the adoption of Renesas wireless solutions employing Sub-GHz band wireless communication technology that uses wireless radio signals at frequencies below 1GHz is expanding in applications such as flow meters and wireless sensor networks. Renesas offers PLC and Sub-GHz solutions conforming to international standards. By offering an array of solutions with features suitable for multiple applications, Renesas is contributing to the realization of a robust IoT infrastructure.

CONTENTS

Example Applications

Energy & Environment

- Smart meters
- PV solar systems
- Energy harvesting

Smart Buildings

- BEMS
- HVAC
- Fire and safety

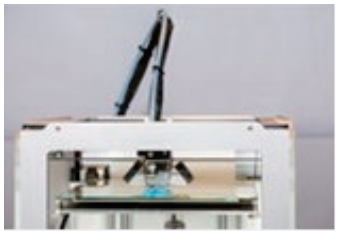
Smart Lighting

- Smart streetlights
- Illumination
- Digital signage

Sensor Networks

- Unit load systems
- Structural health monitoring
- Environmental monitoring

Device-to-device communication networks

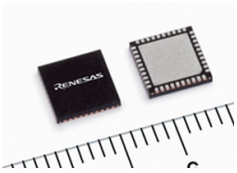


- Multifunction printers
- Underwater pump motor monitoring
- Cellular antenna monitoring

BEMS: Building and Energy Management System
HVAC: Heating, Ventilation, and Air Conditioning

PLC Solutions

PLC is a technology that uses existing power lines as the communication medium. Using the power grid as a communication network makes it possible to build out systems inexpensively and quickly. Either AC power lines or DC power lines can be employed as the communication medium.
Renesas offers narrowband PLC modem IC products with integrated high-performance DSPs and CPUs that support a variety of power line communication protocols. They employ orthogonal frequency-division multiplexing (OFDM) to deliver highly reliable, robust communication. Renesas PLC modem ICs support high data transfer speeds up to 1Mbps over distances of a kilometer or more.



Renesas
PLC Modem ICs

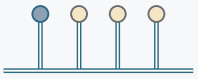
- **High-performance** — Sophisticated and robust communication algorithm adapted to the environment to achieve using a high-performance DSP running at 276MHz.
- **Flexible** — CPU/DSP dual-core architecture delivers flexible support for an array of power line communication protocols and multiple frequency bands used globally.
- **Long-distance High-speed** — High communication speeds up to 1Mbps over distances of a kilometer or more.
- **Safe** — AES-128 hardware encryption engine implements high-level communication security.
- **Optimized** — Optimized performance for large scale network with real environment.

Product Selection Guide

Renesas offers two PLC modem IC products. Select the one that best matches your application and the scale of your network.

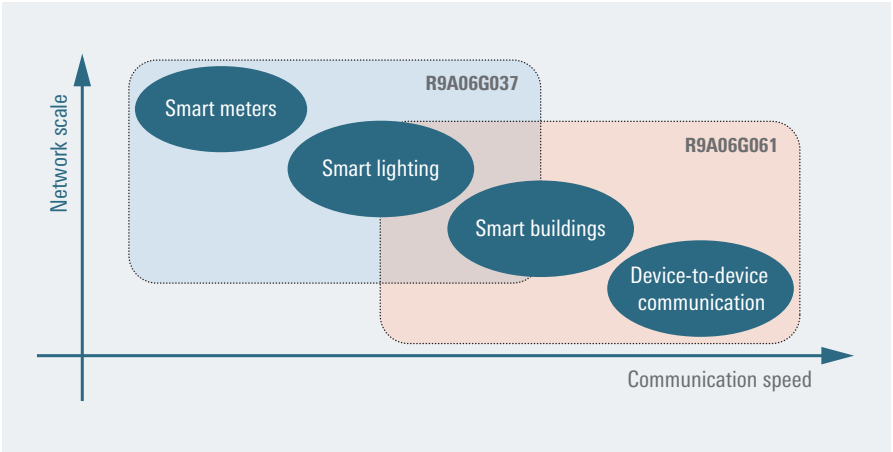
Product	Features
R9A06G037	This PLC modem IC complies with international power line communication standards (G3-PLC, PRIME, and Meters and More). Suitable for large-scale mesh networks with multi-hop support.
R9A06G061	This compact and powerful PLC modem IC is designed specifically for peer-to-peer (P2P) networks. It delivers high communication speeds up to 1Mbps.

Comparison of Product Features

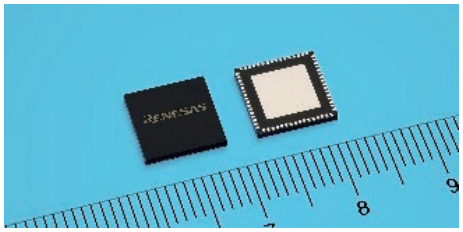
	R9A06G037	R9A06G061
Data rate	Max. 280kbps	Max. 1Mbps
Communication distance	1km or more	1km or more
Network type	Multi-hop (mesh or tree) 	P2P (star or bus) 

Product Application Fields

The R9A06G037 is intended for large-scale networks, while the R9A06G061 is suitable for networks requiring high-speed communication and networks with a simple topology.



R9A06G037



The R9A06G037 is a PLC modem IC that complies with international power line communication standards (G3-PLC, PRIME, and Meters and More). The R9A06G037 supports multi-hop networks and mesh networks with excellent redundancy, making it suitable for large-scale network applications such as smart meters.

Applications

• Smart meters • PV solar systems • BEMS • HVAC • Fire & Safety • Smart streetlights

Features

- High-performance DSP (max. operating frequency: 276MHz, IRAM: 128KB, DRAM: 128KB)
- MCU (ARM® Cortex™-M3, max. operating frequency: 138MHz, RAM: 512KB)
- Integrated analog frontend (AFE) circuit
- External I/O: UART (2 channels), CSI (2 channels), IIC, serial ROM interface (single/dual/quad), PWM (2 channels)
- Integrated regulator: Input 3.3V, output 1.1V
- Power supply voltage: 3.3V
- Package: 64-pin QFN, 9mm × 9mm, 0.5mm pin pitch
- Operating temperature range: –40 to +85°C

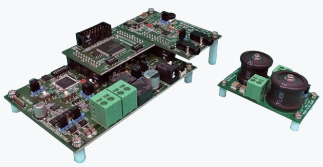
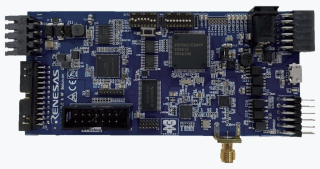
Supported Standards

- G3-PLC (CENELEC-A, CENELEC-B, FCC, ARIB)
- PRIME v1.3.6
- PRIME v1.4
- Meters and More

Evaluation Environment

Three evaluation kits optimized for AC power lines or DC power lines are available for R9A06G037 evaluation and development work. Circuit diagrams, parts lists, and Gerber data are available for each evaluation kit.

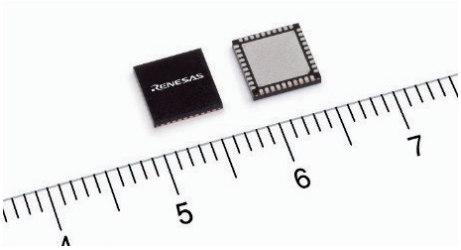
Evaluation Kit	Product No.	Description
CPX3 Evaluation Kit J70D1	RTK0EE0003D01002BJ	AC power line communication evaluation kit
CPX3 Evaluation Kit J80D1	RTK0EE0007D01001BJ	DC power line communication evaluation kit
CPX3 Evaluation Kit HYBRID	Y-G-HYBRID-PLC-RF	PLC&RF Hybrid communication evaluation kit

Evaluation Kit	J70D1	J80D1	Y-G-HYBRID-PLC-RF
Type	For AC power lines	For DC power lines	Support PLC&RF Hybrid communication
Supported voltage range	100V to 230V AC	16V to 48V DC	100V to 230V AC
Mounted MCU	RX631	RX651	RX651
Note	—	Audio board for voice communication included	—
Exterior view			

Evaluation tools and sample applications that work with the evaluation kits are also available. Refer to page 7 for information on this software.

R9A06G061

The R9A06G061 is a compact and powerful PLC modem IC designed specifically for peer-to-peer (P2P) networks. In addition to supporting high communication speeds up to 1Mbps over distances of a kilometer or more, the R9A06G061 provides improved drive capacity in direct-drive configurations to enable an expanded range of applications for DC power systems. This makes it possible to connect 200 or more devices at once. Optimized analog peripheral functions help to reduce the number of external components, enabling lower system cost and more compact size.



Applications

- PV solar systems
- BEMS
- HVAC
- Fire & Safety
- Smart streetlights
- Illumination
- Signage
- Multifunction printers
- Underwater pumps
- Cellular antenna monitoring

Features

- High-performance DSP (max. operating frequency: 276MHz, IRAM: 128KB, DRAM: 128KB)
- MCU (ARM® Cortex™-M0+, max. operating frequency: 92MHz, RAM: 32KB)
- Integrated analog frontend (AFE) circuit
- External I/O: UART (1 channel), SPIs (1 channel), serial flash interface (single/dual), clock output
- Integrated regulator: Input 3.3V, output 1.15V DC-to-DC converter
- Power supply voltage: 3.3V
- Package: 40-pin QFN, 6mm × 6mm, 0.5mm pin pitch
- Operating temperature range: R9A06G061GNP#AA0: -40 to +85°C
  R9A06G061GNP#AAA: -40 to +105°C

Supported Standards

- P2P-PLC (FCC, ARIB)

Evaluation Environment

Two evaluation kits optimized for AC power lines or DC power lines are available for R9A06G061 evaluation and development work. Circuit diagrams, parts lists, and Gerber data are available for each evaluation kit.

Evaluation Kit	Product No.	Description
CPX4 Evaluation Kit M01D01	RTK0EE0009D01001BJ	DC power line communication evaluation kit
CPX4 Evaluation Kit M02D02	RTK0EE0009D02001BJ	AC power line communication evaluation kit

Evaluation Kit	M01D01	M02D02
Type	For DC power lines	For AC power lines
Supported voltage range	16V to 48V DC	100V to 230V AC
Mounted MCU	RX651	RX651
Exterior view		

Evaluation tools and sample applications that work with the evaluation kits are also available. Refer to page 7 for information on this software.

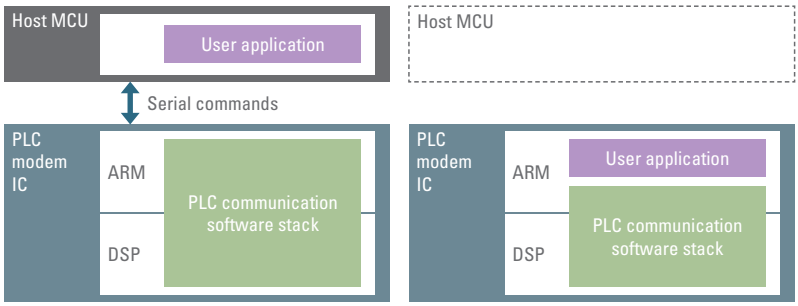
Software

Software for PLC Solutions

A sample application software is available that runs on the evaluation kits. The sample application is provided as both source code and in project file format, so customers can make use of them when developing or debugging their own applications. Each sample application package includes a PLC communication software stack.

There are two types of sample application: A two-chip solution that operates the PLC modem IC from the Host MCU, and a one-chip solution that implements the User Application in the PLC modem IC itself.

Sample Application Software Package	
Software	Sample application
	Sample application project (e² studio project file and source code)
	PLC communication software stack
Documentation	User's manual
	Startup guide
	Debugging guide
	Serial command specification



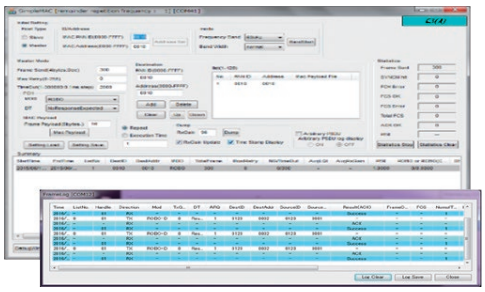
Communication Software Stack for PLC Solutions

PLC communication software stacks and sample application software are available for various standards. Renesas also offers communication software for P2P network.

Communication Software Stack	Supported Network Type	Supported PLC Modem IC
G3-PLC communication software	Multi-hop networks	R9A06G037
PRIME v1.3.6 communication software		
PRIME v1.4 communication software		
Meters and More communication software		
F3AL (Renesas proprietary communication software for the R9A06G037)	P2P networks	R9A06G037
P2P-PLC (Communication software for the R9A06G061)		R9A06G061

Development Support Tools for PLC Solutions

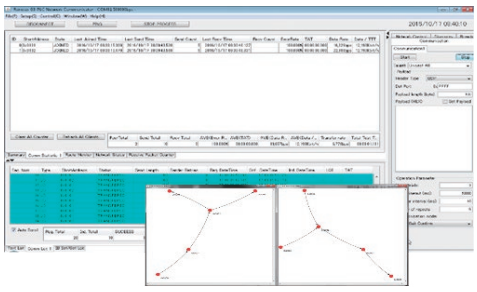
Tools are available that run on the evaluation kits and enable evaluation of communication performance and network configurations. Using these tools, customers can efficiently evaluate power line communication conditions of virtual venues or perform on-site inspections, monitor communication quality, analyze errors, and more.



SimpleMAC GUI

Tool for the evaluation of communication performance

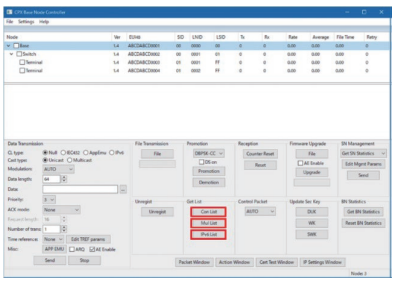
- Packet transmission and reception
- Measuring communication quality
- Display of data on reception statistics



G3-PLC Network Communicator

G3-PLC network evaluation tool

- Building networks as a coordinator
- Multi-hop communication
- Display of network topology



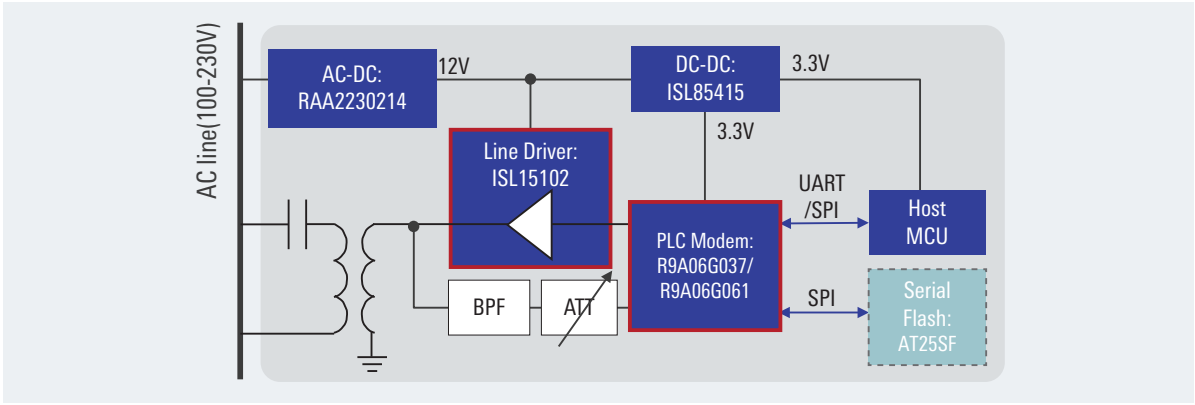
PRIME Base Node Tool

- Functions as a PRIME base node to enable confirmation and evaluation of the functionality of service nodes developed by customers.

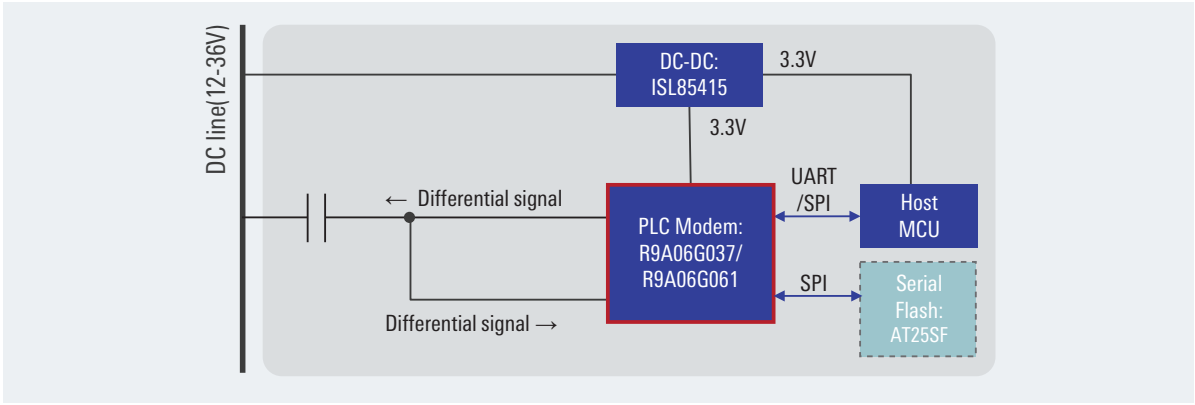
Evaluation Tool	Supported PLC Modem IC	Supported Evaluation Kits
SimpleMAC GUI	R9A06G037	J70D2, J80D1, Y-G-HYBRID-PLC-RF
	R9A06G061	M01D01, M02D02
G3-PLC Network Communicator	R9A06G037	J70D2, Y-G-HYBRID-PLC-RF
PRIME Base Node Tool	R9A06G037	J70D2, Y-G-HYBRID-PLC-RF

PLC Communication Module Configuration

Example of PLC Communication Module Configuration for AC Power Lines



Example of PLC Communication Module Configuration for DC Power Lines



Recommended Renesas Devices

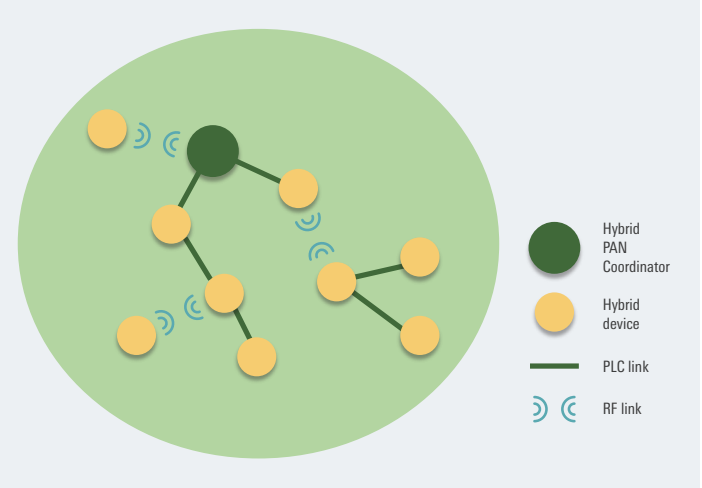
Block	Product Category	Recommended Product
Control MCU	MCU	RX Family
Communication module	PLC modem IC	R9A06G037
		R9A06G061
	Line driver	ISL15102
	AC/DC regulator	RAA2230214
	DC/DC regulator	ISL85415
	Serial flash	AT25SF

Reference URL:
https://www.renesas.com/eu/en/application/communications/global-standards-based-power-line-communication-unit-ac-or-dc-line

PLC&RF Hybrid Solution

Renesas offers a PLC&RF hybrid solution that combines a PLC solution and a Sub-GHz wireless communication solution. The PLC&RF hybrid solution provides Sub-GHz wireless communication coverage in areas where communication cannot be implemented using PLC alone, thereby enhancing network reliability and expandability.

The PLC&RF hybrid solution brings together two different communication technologies in a way that makes it easy for users to make use of them as a single network.



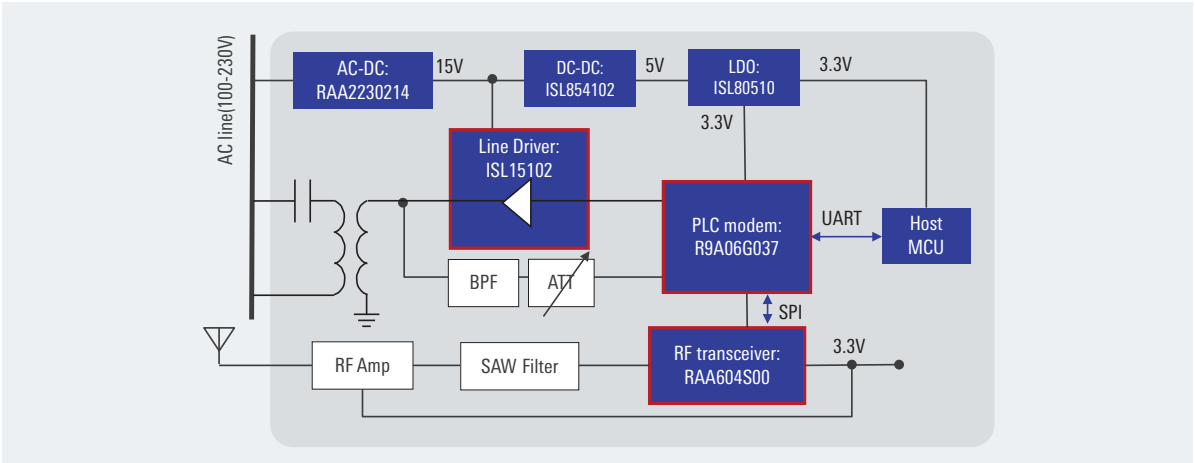
Applications

- Smart meters
- BEMS
- Smart streetlights

Supported Standards

- G3-PLC Hybrid (CENELEC-A, FCC and ARIB)
- PRIME Hybrid (PRIME v1.4 MultiPHY)

PLC&RF Hybrid Communication Module Configuration Example

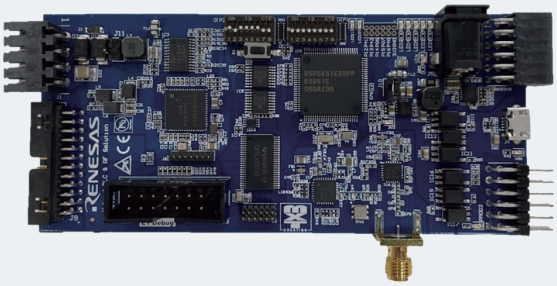


Recommended Renesas Devices

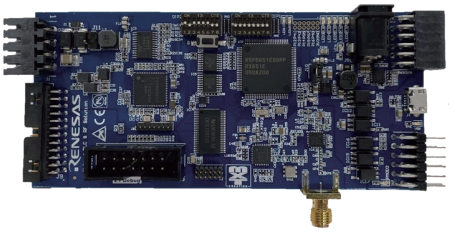
Block	Product Category	Recommended Product
Control MCU	MCU	RX Family
Communication module	PLC modem IC	R9A06G037
	Sub-GHz wireless communication IC	RAA604S00
	Line driver	ISL15102
	AC/DC regulator	RAA2230214
	DC/DC regulator	ISL854102
	LDO	ISL80510

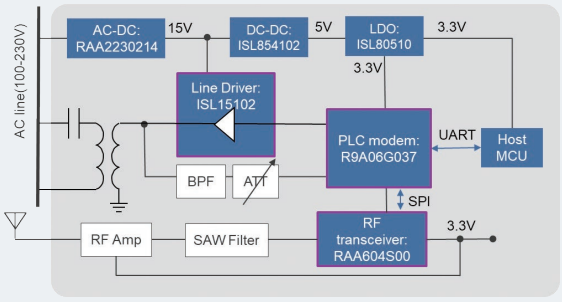
Evaluation Environment

An evaluation kit is available for evaluation and development work using the PLC&RF hybrid solution. Circuit diagrams, parts lists, and Gerber data for the evaluation kit are also available.

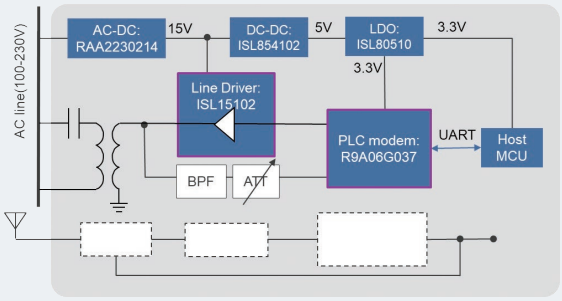
Evaluation Kit	PLC&RF Hybrid Evaluation Kit	
Product No.	Y-G-HYBRID-PLC-RF	
Type	For AC power lines	
Supported voltage range	100V to 230V AC	
Mounted devices	PLC modem IC	R9A06G037
	Sub-GHz wireless communication IC	RAA604S00
	Host MCU	RX651
Note	—	
Exterior view		

Y-G-HYBRID-PLC-RF allows seamless evaluation of communication performance for PLC&RF Hybrid, PLC only, and RF only.

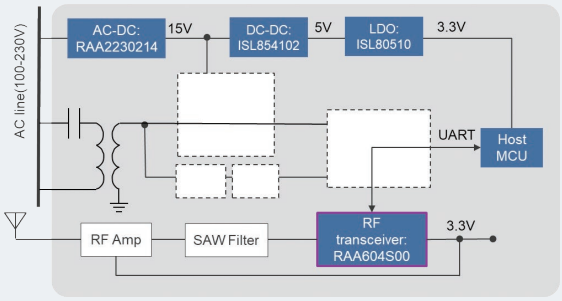




PLC&RF communication configuration



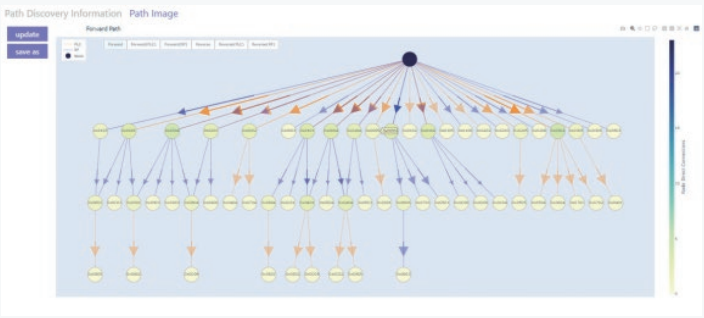
PLC communication configuration



RF communication configuration

Development Support Tools

The following development support tools are available.

PLC&RF Hybrid Development Support Tools		Supported Evaluation Kit
PHY Communicator	PLC and RF PHY communication performance evaluation tool	Y-G-HYBRID-PLC-RF / Y-G-HYBRID-PLC-RF-JP
G3-PLC Network Communicator	Combining PLC and RF hybrid network evaluation tool	
		

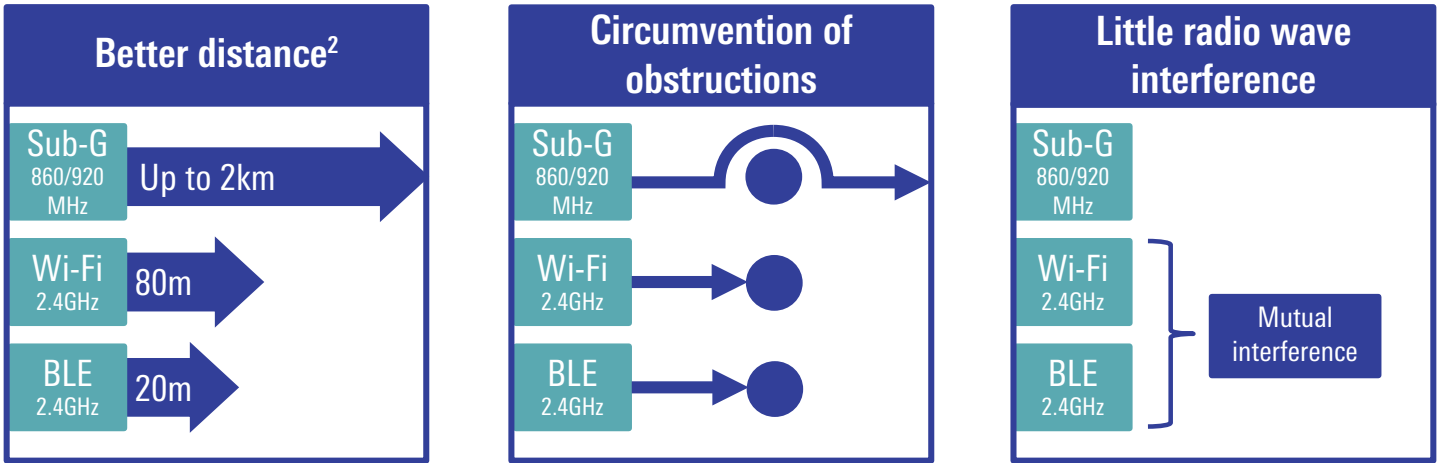
Communication Software Stacks and Sample Application Software

Available software for PLC&RF hybrid communication includes the communication software stacks listed below and sample application software that runs on the PLC&RF hybrid evaluation kit.

Communication Software Stacks	Supported Networks	Supported Modem ICs
Communication software supporting G3-PLC Hybrid	Multi-hop networks	R9A06G037 RAA604S00
Communication software supporting PRIME Hybrid (PRIME v1.4 MultiPHY)		

Sub-GHz Wi-SUN Wireless Communication Solutions

Sub-GHz band wireless communication is a technology that uses wireless radio signals at frequencies below 1GHz to transfer data.
Utilizing the Sub-GHz band provides advantages over Wi-Fi or Bluetooth Low Energy (BLE) communication, which use the 2.4GHz band, in terms of coverage over longer distances, ability to bend around obstacles, and low interference with other radio signals. It is therefore an ideal communication technology for a "smart society" in which all sorts of things, indoors and out, are interconnected, and where the goal is to provide a variety of services in an energy-efficient manner.



Note: Varies according to the communication distance and the environment in which the technology is used.

Product Selection Guide

Renesas Sub-GHz Wireless Communication Devices for "High Performance" and "Design Simplicity"

Renesas offers discrete Sub-GHz wireless communication ICs and MCUs with an integrated Sub-GHz wireless communication IC. Customers can select the one that best meets their system requirements.

Product	Product Category	Supported Standard	Modulation	Features
R9A06G062	Wireless communication IC	IEEE 802.15.4-2020	FSK / OFDM	OFDM modulation enables high-speed communication. Conformant with Wi-SUN FAN 1.1 protocol.
RAA604S00			FSK	Integrated RF peripheral components help keep product costs down. Delivers low power consumption.
NEW RX65W-A	MCU with integrated wireless communication IC		FSK / OFDM	A single-chip solution combining RX CPU and wireless communication LSI conformant with Wi-SUN FAN1.1.
RL78/G1H			FSK	A single-chip solution combining RL78 CPU and low-power wireless communication LSI.

R9A06G062

The R9A06G062 is conformant with the IEEE 802.15.4-2020 and Wi-SUN FAN 1.1 protocols and provides Sub-GHz wireless communication using OFDM and FSK modulation. OFDM modulation is suitable for IoT devices and delivers high-speed, robust communication. FSK modulation maintains compatibility with the FAN 1.0 protocol, making it indispensable for IoT communication.

Applications

- Smart meters
- Environmental monitoring
- Structural health monitoring
- Digital signage

Features

- RF frequency range: 863MHz to 928MHz
- Data rate: SUN FSK, max. 200 kbps
  SUN OFDM, max. 2,400 kbps
- 32-bit timer function
- Operating voltage: 2.7V to 3.6V
- Operating temperature range: –40 to +85°C
- Package: 40-pin HVQFN (6mm × 6mm, 0.5mm pitch)
- Maximum Tx output power: +15dBm (FSK)
  +11dBm (OFDM)
- Minimum reception sensitivity: -109dBm (FSK/50kbps, PER<10%)
  -95dBm (OFDM/2,400kbps, PER<10%)

Evaluation Environment

This kit has received Japanese construction design certification, FCC certification for North America, and the CE marking indicating compliance with EU specifications, so developers can start using it to evaluate Sub-GHz wireless communication performance right away. It can also be used to evaluate systems employing Wi-SUN FAN 1.1–certified stacks obtained elsewhere and as a development kit for customers' own Wi-SUN FAN systems.

Product No.: RTK0EE0013D10001BJ (FCC certified)
RTK0EE0013D10002BJ (CE certified)
RTK0EE0013D10003BJ (construction design certified in Japan)
Manufactured by Renesas Electronics Corporation.

RAA604S00

The RAA604S00 is a Sub-GHz wireless communication IC that delivers current consumption of 5.8mA (3.3V) in RF reception standby mode, among the lowest in the industry. The RF peripheral components necessary for connecting a wireless antenna are integrated into the IC, simplifying the design of the antenna connection circuit and reducing the number of external components needed for reduced overall product cost.
Built-in hardware support for the IEEE 802.15.4-2020 standard reduces the load on the CPU during wireless communication.

Applications

• Smart meters • Smart buildings • Smart lighting • Sensor networks

Features

- RF frequency range: 863MHz to 928MHz
- Data rate: 2GFSK, max. 300 kbps
- 32-bit timer function
- Operating voltage: 1.8V to 3.6V
- Operating temperature range: –40 to +85°C
- Package: 32-pin HVQFN (5mm × 5mm, 0.5mm pitch)
- Maximum Tx output power: +15dBm
- Minimum reception sensitivity: -107dBm (FSK/50kbps, BER<0.1%)

Evaluation Environment

This kit has received Japanese construction design certification and the CE marking indicating compliance with EU specifications, so developers can start using it to evaluate Sub-GHz wireless communication performance right away. It can also be used to evaluate systems employing Wi-SUN FAN–certified stacks obtained elsewhere and as a development kit for customers' own Wi-SUN FAN systems.

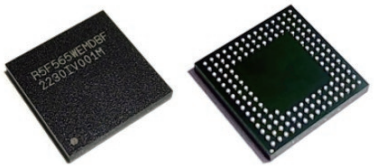
Product No.: MB-RX604S-02 (RX651), manufactured by Tessera Technology Inc.

RX65W-A NEW

The new RX65W-A is a Sub-GHz wireless microcontroller that integrates an RXv2 core, large RAM, security functions, and RF LSI supporting OFDM and FSK. It can realize Wi-SUN FAN1.1 Border Router and Router Node as a single-chip solution, contributing to downsizing of wireless communication modules and reduction of product cost.
Please contact Renesas sales office for board design and evaluation environment.

Applications

• Smart meters • Environmental monitoring • Structural health monitoring • Digital signage



Features

- CPU: RXv2 core, up to 120MHz
- On-chip memory: SRAM:640KB, Code flash:2MB, data flash:32KB
- RF frequency range: 863MHz to 928MHz
- Data rate: SUN FSK, max. 200 kbps
  SUN OFDM, max. 2,400 kbps
- 32-bit timer function
- Operating voltage: 2.7V to 3.6V
- Operating temperature range: –40 to +85°C
- Package: 145 pin TFBGA (8mm × 8mm, 0.5mm pitch)
- Maximum Tx output power: +15dBm (FSK)
  +11dBm (OFDM)
- Minimum reception sensitivity: -109dBm (FSK/50kbps, PER<10%)
  -95dBm (OFDM/2,400kbps, PER<10%)

RL78/G1H

The RL78/G1H MCU is a single-chip Sub-GHz wireless solution that incorporates an ultra-low power RL78 CPU core and an integrated Sub-GHz wireless communication IC. It can be mounted as a single-chip solution in combination with a Renesas high-quality certified Wi-SUN stack (see page 12), or a separately obtained protocol stack package and a user application, reducing the mounting area associated with the control MCU and contributing to reduced product cost overall. The ultra-low power consumption of the RL78 core, one of its key features, makes the RL78/G1H ideal for battery-driven devices.

Applications

- Smart meters
- Smart buildings
- Smart lighting
- Sensor networks, battery-driven devices

Features

- CPU: RL78 core, up to 32MHz
- On-chip memory: Code flash: 256KB to 512KB, SRAM: 24KB to 48KB, data flash: 8KB
- RF frequency range: 863MHz to 928MHz
- Data rate: 2GFSK, max. 300 kbps
- Operating voltage: 1.8V to 3.6V
- Operating temperature range: –40 to +85°C
- Package: 64-pin HVQFN (9mm × 9mm, 0.5mm pitch)
- Timers: 16-bit timer (channels) × 9, watchdog timer (channel) × 1, 12-bit interval timer (channel) × 1
- Analog function: 10-bit A/D converter (channels) × 6
- On-chip oscillator frequencies:
  High-speed: 32, 24, 16, 12, 8, 4, 1MHz
  Low-speed: 15kHz
- Other: RTC, power-on reset, low-voltage detection
- Maximum Tx output power: +15dBm
- Minimum reception sensitivity: -107dBm (FSK/50kbps, BER<0.1%)

Evaluation Environment

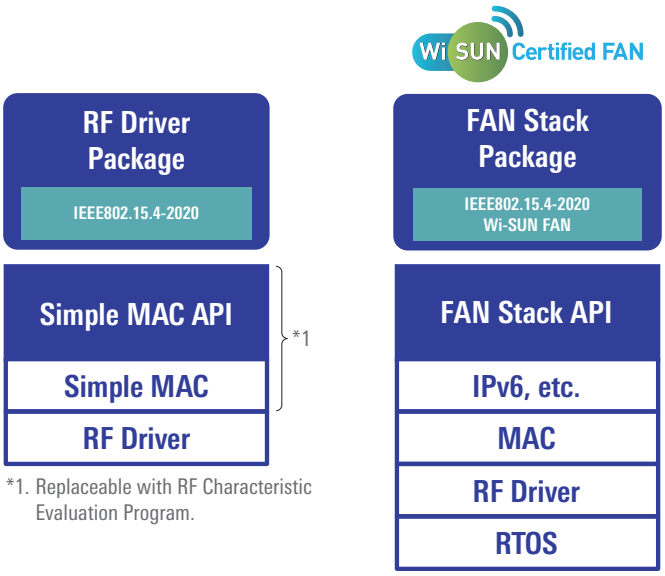
This kit has received Japanese construction design certification, so developers can start using it to evaluate Sub-GHz wireless communication performance right away. It can also be used to evaluate systems employing Wi-SUN FAN–certified stacks obtained elsewhere and as a development kit for customers' own Wi-SUN FAN systems.

Product No.: TK-RLG1H+SB2, manufactured by Tessera Technology Inc.

Software

Sub-GHz/Wi-SUN FAN Protocol Stack Packages

Software is available from Renesas for Sub-GHz wireless communication solutions that implements the Wi-SUN profile wireless communication protocol, based on the IEEE 802.15.4-2020 international standard. The Wi-SUN FAN IP stack is conformant with the FAN protocol established by the Wi-SUN Alliance, the body that promotes Wi-SUN standards. Customers can select the package that best meets the requirements of their application.



*1. Replaceable with RF Characteristic Evaluation Program.

	RF Driver Package		FAN Stack Package		
	RF Characteristic Evaluation Program	Simple MAC	Wi-SUN FAN 1.0 stack (for Router Only)	Wi-SUN FAN 1.0 stack (for Router & Border Router)	Wi-SUN FAN 1.1 stack (for Router & Border Router)
MCU	RL78/G1H RX651+RAA604S00 RX65W-A RX65N+R9A06G062	RL78/G1H RX651+RAA604S00 RX65W-A RX65N+R9A06G062	RL78/G1H	RX651+RAA604S00	RX65W-A RX65N+R9A06G062
Compliant standards	IEEE802.15.4-2020	IEEE802.15.4-2020	IEEE802.15.4-2020	IEEE802.15.4-2020	IEEE802.15.4-2020
Wi-SUN Profile	Wi-SUN PHY Profile	Wi-SUN PHY Profile	Wi-SUN FAN Profile	Wi-SUN FAN Profile	Wi-SUN FAN Profile
Connection form	1 to 1 (Peer to Peer)	1 to N Broadcast	Multi-hop (up to 24 hops)	Multi-hop (up to 24 hops)	Multi-hop (up to 24 hops)
Network scale	Small network	Small network	Large network	Large network	Large network
Software provision form	RF driver (Source code) Sample Application (Source code) Project file	RF driver (Source code) Sample Application (Source code) Project file	Stack (library) Sample application (source code) Project file	Stack (library) Sample application (source code) Project file	Stack (library) Sample application (source code) Project file
RTOS	Unnecessary	Unnecessary	FreeRTOS	FreeRTOS	FreeRTOS
Compatible compiler	CA78K0R, CC-RL, CC-RX	CA78K0R, CC-RL, CC-RX	IAR	CC-RX	CC-RX
Supported integrated environment	CS+, e² studio	CS+, e² studio	IAR	e² studio	e² studio

RF Driver

This RF driver is an OS-independent program that provides PHY layer level API to control Renesas Sub-GHz communication LSI. It enables wireless communication in compliance with IEEE802.15.4-2020.

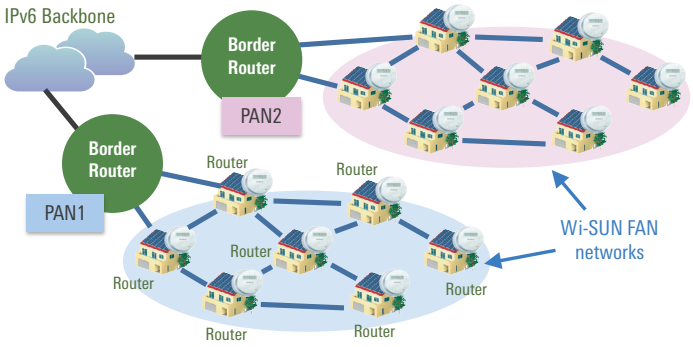
Additionally, it includes transmission control functions such as a carrier sense function to avoid transmission collisions with other wireless stations, and regulatory controls for total transmission time and transmission pause time. This makes it easier to design and certify wireless equipment in accordance with the radio laws of various countries.

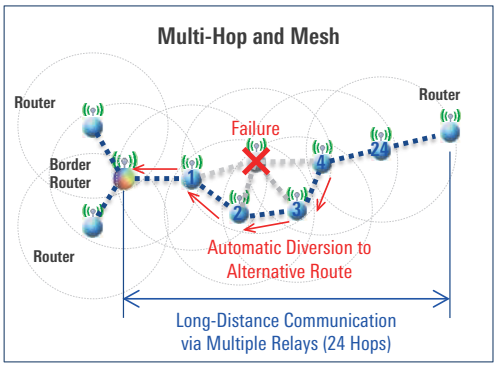
Simple MAC: Serial Command Sample Program

This product includes a sample program for setting MAC addresses and transmission and reception of broadcast and unicast frames. Using the sample program and RF driver together makes it easy to build a 1-to-N network.

IP Stack: Wi-SUN FAN (Field Area Network)

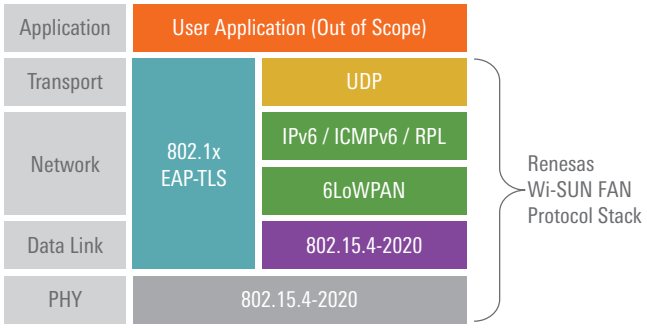
Wi-SUN FAN is an open, standards-based communication protocol that enables wide-area, long-distance communication while avoiding interference and collisions. It is a system with multi-hop (multi-stage relay) and mesh functionality, making it exceptional even among low-power wide-area (LPWA) technologies for its ability to enable stable and robust data connections over long distances and with coverage of dead zones.





Wi-SUN FAN has been deployed in millions of smart meters worldwide and has great potential also for smart cities and smart grids for applications such as smart homes, building management, and lighting systems.

The Renesas Wi-SUN FAN IP stacks support the IP base functionality required by Wi-SUN FAN, including 6LoWPAN, IPv6, ICMPv6, RPL, and UDP. For secure authentication, both IEEE 802.1X authentication used by wireless LANs and access security based on EAP-TLS are supported. The IP stacks have passed interoperability testing by the Wi-SUN Alliance and are Wi-SUN FAN certified. In addition, they are officially certified by the Wi-SUN Alliance as a test bed unit (TBU), so developers can use them with confidence when designing wireless network systems.



Wi-SUN FAN 1.0 profile

Router Node | Border Router | Router Node

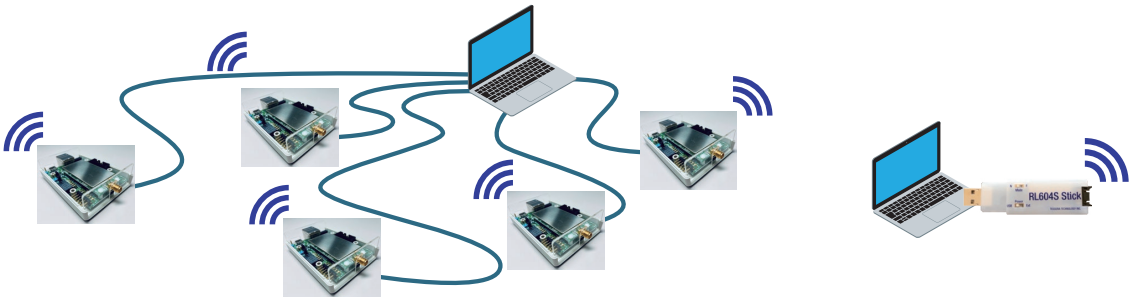
MB-RX604S-02 (RX651) | TK-RLG1H+SB2

Wi-SUN FAN 1.1 profile for PHY layer

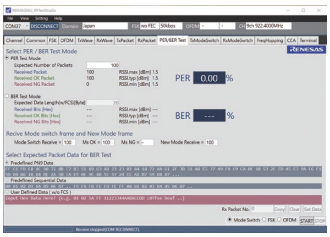
RTK0EE0013D10002BJ

Development Support Tools for Sub-GHz Wireless Communication Solutions

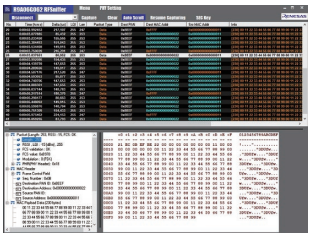
These tools enable developers to easily evaluate communication for each protocol stack by making use of sample programs and a graphical user interface. Analyzing wireless communication system status can be difficult because the strength of wireless signals often varies due to environmental conditions and obstructions. The packet capture GUI tool can display wireless communication data in visual format and show analysis results for each protocol.



Sub-GHz/Wi-SUN FAN Evaluation Environment



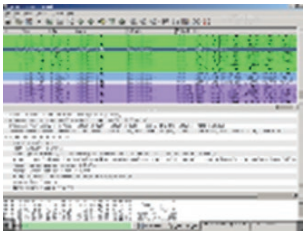
RF Test Studio (RF performance evaluation tool)



RF Sniffer (RF encrypted packet analyzer)

Wi-SUN Demonstrator
(Wi-SUN FAN network demo tool)

Wi-SUN FAN Developer GUI
(Wi-SUN FAN detail evaluation and
user application design support tool)



Wireshark Renesas Edition
(Wi-SUN encrypted packet analyzer)

Renesas Partner Vendors

RF board setting configuration technology is necessary when developing control boards for communication devices. Sub-GHz wireless modules equipped with wireless communication ICs (RAA604S00 and RL78/G1H), antennas, and peripheral circuits are available from Renesas partner vendors. Customers can incorporate these boards into their mass-produced products. These products simplify the process of developing and mass producing products with Sub-GHz support for customers who are unfamiliar with RF board setting configuration technology.

vizmo

Vizmonet Pte. Ltd.

This company develops, manufactures, and sells Sub-GHz wireless communication modules mounted with the RL78/G1H.

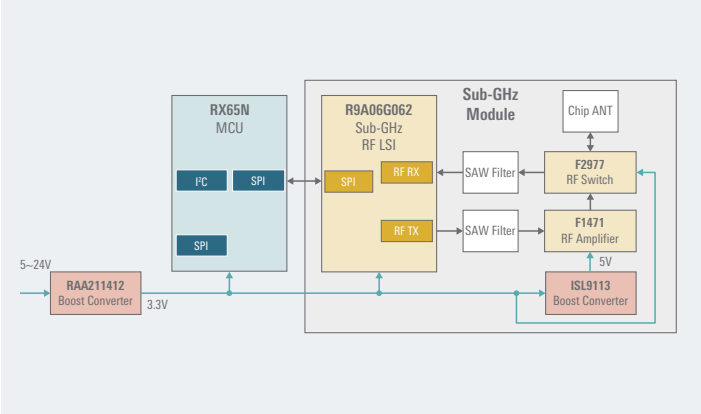
TESSERA TECHNOLOGY INC.

Tessera Technology Inc.

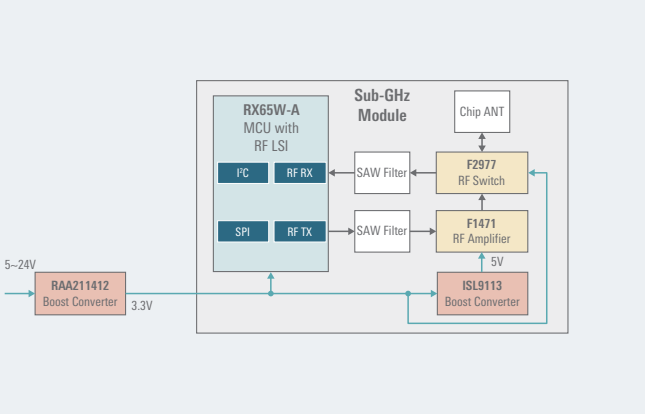
This company develops, manufactures, and sells evaluation environments for Sub-GHz wireless communication.

Sub-GHz Communication Module Configuration

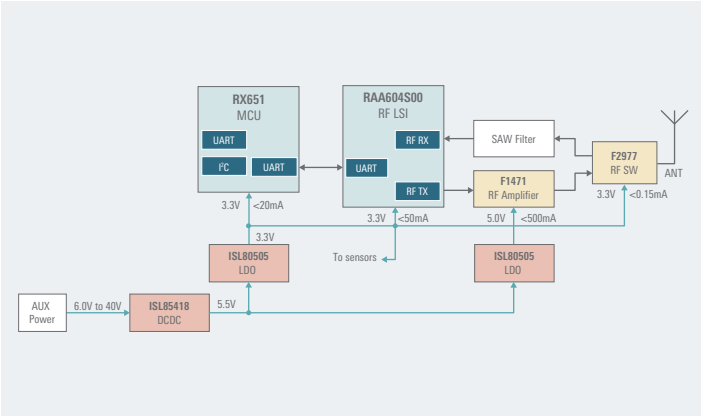
RX65N+R9A06G062 Sub-GHz Wireless Communication Module Example



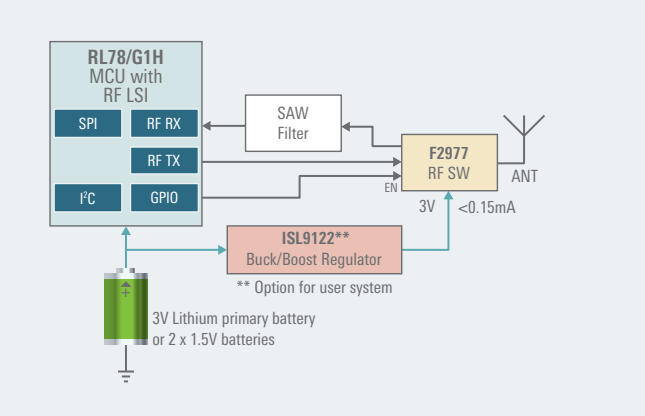
RX65W-A Sub-GHz Wireless Communication Module Example



RX651+RAA604S00 Sub-GHz Wireless Communication Module Example



RL78/G1H Sub-GHz Wireless Communication Module Example



Block	Product Category	Recommended Product
Communication module	Wireless communication IC	R9A06G062, RAA604S00
	Wireless communication IC control MCU	RX65N, RX651
	MCU with integrated wireless communication IC	RL78/G1H, RX65W-A NEW
	RF switch	F2977
	RF amplifier	F1471
	DC-to-DC converter	ISL85418
	Power regulator	ISL9113, RAA211412, ISL80505, ISL9122

* SAW Filter and RF Amplifier: Regional optional parts

Renesas Electronics Corporation TOYOSU FORESIA, 3-2-24 Toyosu, Koto-ku, Tokyo 135-0061, Japan

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