RENESAS

R9A06G062GNP

RTK0EE0013D10003BJ　User's Manual

Sub-GHz Wireless Communication Evaluation Kit

For Japan

Rev.1.01

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General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. Handling of unused pins

   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

5. Clock signals

   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

6. Voltage application waveform at input pin

   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).

7. Prohibition of access to reserved addresses

   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

How to Use This Manual

1.   Purpose and Target Readers

This manual is intended to give users an understanding of the basic specifications and correct usage of this product. This manual is intended for users who want to use this product to evaluate the MCU and debug programs. The readers of this manual are expected to have knowledge of the MCU functions and debuggers.

> Particular attention should be paid to the precautionary notes when using the manual. These notes occur within the body of the text, at the end of each section, and in the Usage Notes section.

> The revision history summarizes the locations of revisions and additions. It does not list all revisions. Refer to the text of the manual for details.

The following documents apply to RTK0EE0013D10003BJ. Be sure to refer to the latest versions of these documents. The newest versions of the listed documents are available on the Renesas Electronics Web site.

Document Type	Description	Document Title	Document No.
User's manual	RTK0EE0013D10003BJ hardware specifications	RTK0EE0013D10003BJ User's Manual	R02UZ0007EJ (this manual)
Design data	RTK0EE0013D10003BJ Circuit schematics Parts list	RTK0EE0013D10003BJ Circuit schematics Parts list	R02AN0049EJ
User's manual for R9A06G062GNP	Hardware specifications (pin assignments, peripheral function specifications, electrical characteristics, timing charts) and descriptions of operation	R9A06G062GNP Sub-GHz Transceiver User's Manual: Hardware	R02UH0006EJ
RX65N User's manual for the hardware	Hardware specifications (pin assignments, memory maps, peripheral function specifications, electrical characteristics, timing charts) and descriptions of operation	RX65N Group User's Manual: Hardware	R01UH0590EJ
ISL80510 Datasheet	Hardware specifications (pin assignments, electrical characteristics) and descriptions of operation	ISL80510 Datasheet	FN8767
ISL9005A Datasheet	Hardware specifications (pin assignments, electrical characteristics) and descriptions of operation	ISL9005A Datasheet	FN6452

Table of Contents

1. Overview

1.1   Package Components

Thank you for purchasing the Sub-GHz Wireless Communication Evaluation Kit from Renesas (hereinafter referred to as "this product"). This product consists of the Target Board for Sub-GHz Wireless Communication Evaluation Kit (RTK0EE0013D10003BJ)

1.2   Purpose

This product is an evaluation tool for a Sub-GHz Wireless Communication Solutions. This manual descries hardware specifications.

1.3   Features

This product includes the following features:

- Sub-GHz Wireless Communication evaluation

  This product offers sub-GHz wireless communication solutions with Type certification of Japan to help you easily start developing your application.

1.4   Sub-GHz Wireless Communication Evaluation Kit: Table of Specifications

Table 1-1 shows the specifications of this product.

Table 1-1: Sub-GHz Wireless Communication Evaluation Kit Specification Table

Item	Specification
Enclosure size	Size: 92.0mm x 66.5mm x 28.0mm
Operating ambient temperature	-10 to +60°C
Power-supply circuit	USB connector: 5-V input
Transceiver IC (CWX-M)	Part Number: R9A06G062GNP (Renesas)
	Package: 40-Pin HVQFN
Control MCU (RX65N)	Part Number: R5F565NEDDFP (Renesas)
	Package: 100pin LFQFP
Power-supply IC	Part Number: ISL80510 (Renesas)
	Part Number: ISL9005A (Renesas)
SAW filter	Part Number: B39921B2672P810 (Qualcomm)
FEM	Part Number: SKY66122-11(Skyworks)
Control MCU/ Main clock	Connected to CKOUT pin of CWX-M (16MHz)
Control MCU/ Sub-clock	Crystal oscillator for the sub-clock (32.768KHz)
Wireless function	Sub-GHz Wireless circuit
	Japan band: 920 to 928MHz (Type certification)
	Modulation Method: FSK / OFDM
USB：Type-C 　USB bus power (DC5.0V/3.0A) 　USB2.0	Connector for an on-board emulator:
	USB Connector for a USB serial-conversion interface
Setting of USB Mode	DIP switch x1
Ethernet	Part Number: LAN8720A (Microchip) Note: The Ethernet function is disabled on this product.
Antenna	Part Number: TI.92.2113 (Taoglas limited)

1.5   **Block Diagram**

Figure 1-1 shows the block diagram of this product.

*Ethernet function is disabled.
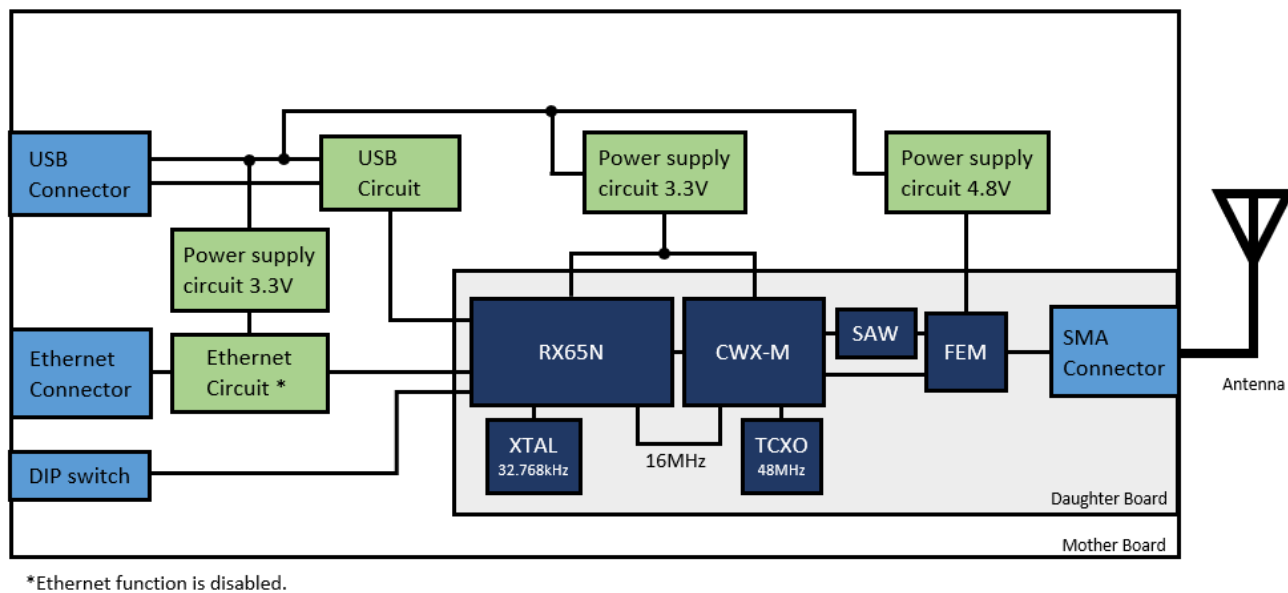
Figure 1-1: Block Diagram

2. External view

Figure 2-1 shows the external view of this product.

Figure 2-1: External view

Note:
Never disassemble or remodel this product.

3. Parts Layout

Figure 3-1 shows the parts layout of this product.

Figure 3-1: Parts Layout

Connect the antenna provided with the product to SMA connecter on this product

Figure 3-2: Antenna connection diagram

This product includes Sub-GHz wireless function.

Note:
Never use an antenna other than the antenna provided with the product, as it violates the radio-related laws.

4. Operating Environment

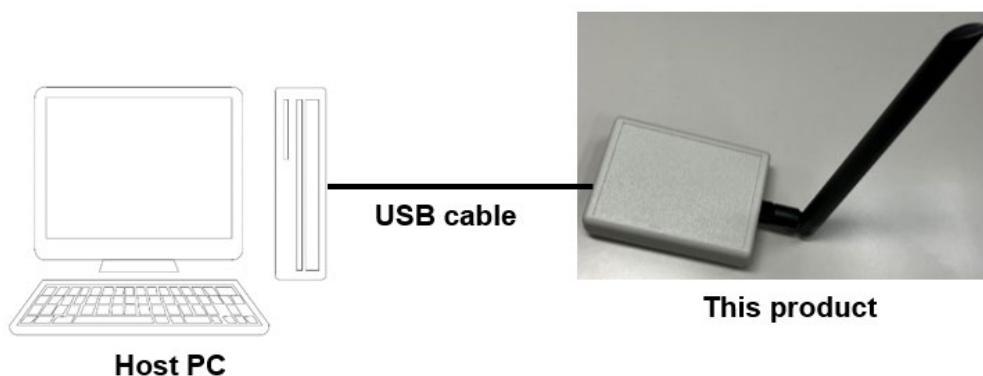**Figure 4-1** shows the operating environment of this product. Install "Virtual COM Port USB Driver" on the host PC. In addition, install the serial terminal software as it will be used for wireless evaluation.

Figure 4-1: Operating Environment

4.1 Virtual COM Port USB Driver

If your PC is connected to the Internet, Windows Update will automatically install the latest driver. Please wait until you see the following pop-up message: Your device is ready to use. If you have not yet installed the driver on your PC, Download and install the driver. Virtual COM port drivers can be downloaded from the FTDI website. FTDI manufactures USB chips embedded in this product.

FTDI website：http://www.ftdichip.com/Drivers/VCP.htm

4.2 Serial Terminal Software

The serial terminal software enables data to be input to and output from a serial console.
The serial terminal settings are as shown in **Table 4-1**.

Table 4-1: Serial Terminal Settings

Setting item	Setting value
Baud rate	500000 bps
Data	8 bits
Parity	None
Stop bit	1 bit
Flow control	Not used
Newline code	Reception: LF or AUTO Transmission: CR+LF or LF
Local echo	Enabled

Note:
Windows does not come with serial terminal software. Please use the free terminal software of your choice.

5. User Circuits

5.1   DIP switch

Set the following when evaluating (normal mode).

Table 5-1: DIP switch Settings

Mode	DIP switch Settings
Evaluation (normal mode)	ON:1,2 OFF:3,4,5,6,7,8

5.2   Connection of control MCU(RX65N) and wireless transceiver IC (CWX-M)

Table 5-2: Connection of control MCU(RX65N) and wireless transceiver IC (CWX-M)

Control MCU(RX65N)	Transceiver IC (CWX-M)	Note
RSTB	P46	CWX-M reset control
MODE	P47	CWX-M operation mode control
INTOUT0	PD5	CWX-M GPIO0
INTOUT1	PD6	CWX-M GPIO1 *1
INTOUT2	PD7	CWX-M GPIO2 *1
CLK	PD3	SPI Serial clock *2
SEN	PD4	SPI Slave select *2
SIN	PD1	SPI MOSI(Master Out Slave In) *2
SOUT	PD2	SPI MISO(Master In Slave Out) *2

*1 Reserved for option use.
*2 RX65N is master device.

6. Wireless evaluation

6.1   Serial terminal software connection settings
1.   Connect the host PC and this product with a USB cable.
2.   Check which COM port the USB of this product is assigned to using the device manager.
3.   Start up the serial terminal software and set serial port.

6.2   Command specification
1.   When the sample program is started, it enters "command menu mode" and is ready to accept commands.**Table 6-1** shows the command list of sample program.
2.   To execute the function of a command, enter the command and then press the return key. When the command has an argument, enter the command, a space and the argument, and then press the return key.

Table 6-1: Command list of sample program

Command	Function	Argument
tboot	Renesas Sub-GHz transceiver bootstrapping	Boot mode
tinit	Test function initialization and reset Renesas Sub-GHz transceiver	(None)

tope	PHY operation mode setting	FSK/OFDM operation mode
		Prohibit the use in modes other than the following.
		   tope FSK JP FSKwoFEC 2b 22
		   tope OFDM JP OFDMOP4 MCS6 21
		   tope OFDM JP OFDMOP3 MCS6 22

tch	Channel number setting	Channel number
ttxpow	FSK and OFDM transmission output power setting	Transmission output power value (Index number)
ttxpowd	FSK and OFDM transmission output power setting (dBm)	Transmission output power value (dBm)
tftxpowd	FSK transmission output power setting (dBm)	FSK transmission output power value (dBm)
totxpowd	OFDM transmission output power setting (dBm)	OFDM transmission output power value (dBm)
trxgain	External gain setting for reception signal	External gain value for RF input signal
trxgaind	External gain setting for reception signal	External gain value for RF input signal(dBm)
tfrlen	Transmission packet length setting	Transmission packet length
ti	Continuous transmission interval time setting	Continuous transmission interval time setting
ttxopt	Transmission option setting	Transmission option
tsfd	FSK SFD mode setting	FSK SFD mode
tfpl	FSK Preamble length setting	FSK Preamble length
tdw	FSK Data whitening option setting	FSK Data whitening option
tffcs	FSK FCS length setting	FSK FCS length
tfscheme	FSK FEC scheme setting	FSK FEC Scheme
tffecrx	FSK Reception packet FEC setting	FSK FEC setting
tofcs	OFDM FCS length setting	FSK FCS length (CRC bit width)
tointl	OFDM Interleaving mode setting	Interleaving mode
toscr	OFDM Scrambler value setting	OFDM Scrambler value
tostf	OFDM STF length setting	OFDM STF length

tccam	CCA mode setting	CCA mode
tfcdr	CCA duration setting for FSK	CCA duration for FSK
tfccavt	CCA level threshold for FSK	CCA level threshold value for FSK
tfccavtd	CCA level threshold for FSK in dBm	CCA level threshold value (dBm) for FSK
tocdr	CCA duration setting for OFDM	CCA duration for OFDM
toccavt	CCA level threshold for OFDM	CCA level threshold value for OFDM
toccavtd	CCA level threshold for OFDM in dBm	CCA level threshold value (dBm) for OFDM
tgpios	GPIO terminal setting	GPIO terminal function
tgpio	Get the current settings of the GPIO terminal	(None)
tgpioo	GPIO output port voltage level setting	GPIO output port voltage level
tgpioi	Get the GPIO input port voltage level	GPIO port number
tberlen	Frame length for RX BER setting	Frame length for RX BER
tberpn9	PN9 mode for BER setting	PN9 mode for BER
tffh	Frequency hopping transmission (FSK)	Setting for frequency hopping transmission
tofh	Frequency hopping transmission (OFDM)	Setting for frequency hopping transmission
ram	RAM read and write mode	read and write mode setting
reg	Register read and write mode	read and write mode setting
tftx	FSK Packet transmission	Number of transmissions
totx	OFDM Packet transmission	Number of transmissions
tfpn9	FSK PN9 continuous modulated transmission	(None)
topn9	OFDM PN9 continuous modulated transmission	(None)
tnmtx	Continuous unmodulated transmission	(None)
tfrx	FSK Packet reception	Reception option
torx	OFDM Packet reception	Reception option
te	ED measurement	(None)
tcca	CCA execution	(None)
tmstxs	Tx setting for ModeSwitch & New Mode Frame	Setting option
tmstx	ModeSwitch & New Mode Frame transmission	Number of transmissions
tmsrxs	Rx setting for ModeSwitch & New Mode Frame	Setting option
tmsrx	ModeSwitch & New Mode Frame reception	Reception options
tttl	Regulation mode setting (Tx Total Time Limit, Max Tx Duration and Min Pause Duration Setting)	Regulation mode and parameters Fixed to the following settings. Function OFF and settings cannot be changed. mode: JP tcum_period: 60
tantdv	Antenna diversity setting	Enable / Disable
tantnum	Setting the number of antennas to use	Number of antennas
tantsel	Setting the antenna number used for Tx / Rx	Antenna number
rst	Reset all (Test function, RF driver and Renesas Sub-GHz transceiver)	(None)
opt	Test function option setting	Display mode of Test function
val	Test function settings display	(None)
help	Command list display	(None)

| tsleep | Sleep Mode Setting | (None) |

- The gray areas are commands not supported by this product.
- The transmission output power setting of R9A06G062GNP is fixed to the following settings. It cannot be changed by command.
  FSK : -14.0dBm   OFDM : -12.5dBm
- Details on the command specification is explained in the application note " RF Characteristic Evaluation Program for Renesas Sub-GHz Transceiver Operation Manual (R30AN0376)". Obtain the latest version of this document from the Renesas website.

7. Hardware specifications

Table 7-1 shows the communication specifications of this product.

Table 7-1: Communication specifications

		Channel Spacing	Modulation		
			Option	MCS	Data Rate / Modulation Index
Japan Band 920 - 928MHz	OFDM	400KHz	Option3	MCS6	600kbps
		200KHz	Option4	MCS6	300kbps
	FSK	400KHz	Operating mode #2b		100kbps / m=1.0

7.1   **Japan Band**

7.1.1   OFDM、Channel Spacing = 400KHz、Modulation = Option3 / MCS6 / 600kbps
● Transmission output power at SMA connecter = +13dBm
● Channel Number Setting: ChanPlanID 22

Channel number	Frequency [MHz]	Channel number	Frequency [MHz]	Channel number	Frequency [MHz]	Channel number	Frequency [MHz]
0	920.9	1	921.3	2	921.7	3	922.1
4	922.5	5	922.9	6	923.3	7	923.7
8	924.1	9	924.5	10	924.9	11	925.3
12	925.7	13	926.1	14	926.5	15	926.9
16	927.3	17	927.7				

The gray areas are channels that this product does not support and should not be used for wireless evaluation.

7.1.2   OFDM、Channel Spacing = 200KHz、Modulation = Option4 / MCS6 / 300kbps
● Transmission output power at SMA connecter = +13dBm
● Channel Number Setting: ChanPlanID 21

Channel number	Frequency [MHz]	Channel number	Frequency [MHz]	Channel number	Frequency [MHz]	Channel number	Frequency [MHz]
0	920.6	1	920.8	2	921.0	3	921.2
4	921.4	5	921.6	6	921.8	7	922.0
8	922.2	9	922.4	10	922.6	11	922.8
12	923.0	13	923.2	14	923.4	15	923.6
16	923.8	17	924.0	18	924.2	19	924.4
20	924.6	21	924.8	22	925.0	23	925.2
24	925.4	25	925.6	26	925.8	27	926.0
28	926.2	29	926.4	30	926.6	31	926.8
32	927.0	33	927.2	34	927.4	35	927.6
36	927.8	37	928.0				

The gray areas are channels that this product does not support and should not be used for wireless evaluation.

7.1.3   FSK、Channel Spacing = 400KHz、100kbps / m = 1.0
● Transmission output power at SMA connecter = +13dBm
● Channel Number Setting: ChanPlanID 22

Channel number	Frequency [MHz]	Channel number	Frequency [MHz]	Channel number	Frequency [MHz]	Channel number	Frequency [MHz]
0	920.9	1	921.3	2	921.7	3	922.1
4	922.5	5	922.9	6	923.3	7	923.7
8	924.1	9	924.5	10	924.9	11	925.3
12	925.7	13	926.1	14	926.5	15	926.9
16	927.3	17	927.7				

The gray areas are channels that this product does not support and should not be used for wireless evaluation.

8. Additional Information

Technical Support

For details on the Transceiver IC (CWX-M), refer to the R9A06G062GNP Sub-GHz Transceiver User's Manual: Hardware.

The latest information is available from the Web page.

Technical Contact Details

General information on Renesas microcontrollers can be found on the Renesas website at:
https://www.renesas.com/

Note

- Do not install this product into your product.
- When using this product, be sure to use the antenna provided with the product.
- Never disassemble or modify this product.
- Do not use any firmware other than the dedicated firmware for this product during wireless evaluation.
- This product have Construction Type Certification. In order to use wireless equipment and devices, it is necessary to comply with the wireless regulations established in the country of use. This fact must be taken into account when this product is used in your country.

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Japan: Construction Type Certification (authentication number: 006-001118）

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