

User's Manual

TK-RF8058+SB-EE

Demonstration Kit for Renesas Electronics µPD78F8058 Zigbee[™] / RF4CE[™] ready Wireless Network Evaluation Board

Document No. R20UE0001ED0100 Date Published April 2010

© Renesas Electronics (Europe) GmbH



To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010 Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<u>http://www.renesas.com</u>)

Send any inquiries to http://www.renesas.com/inquiry.

All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.

- 2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
- 3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
- 4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
- 5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
- 6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
- 7. Renesas Electronics products are classified according to the following three quality grades: "Standard", "High Quality", and "Specific". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics. Further, you may not use any Renesas Electronics. Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as "Specific" or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is "Standard" unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.
 - "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.
 - "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.
 - "Specific": Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
- 8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
- 9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.



10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances,

including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.

- 11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
- 12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.
- (Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.
- (Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.



Revision History

Date	Revision	Chapter	Description
27-04-2010	V1.00		First release



Table of Contents

	Introduction	. 10
1.1	Package contents	. 10
1.2	Features	. 10
1.3	System requirements	. 10
1.4	Trademarks	. 10
2.	Hardware	. 11
2.1	SW4 (Dip switch)	. 11
2.2	SW5 Power regulator switch	. 11
2.3	SW6 Serial communication mode setting	. 12
2.4	SW7 Reset switch	. 12
2.5	SW1, SW2, SW3	. 12
2.6	JP1	. 12
2.7	JP2 Power source selection	. 12
2.8	JP3 Power source selection to voltage regulator	. 12
2.9	JP4 Current consumption measurement	. 12
2.10	JP5 Battery selection	. 12
2.11		. 13
2.12	LED1 – LED3	. 13
2.13	FP1 (MINICUBE2)	. 13
2.14	J2 and J3 External power supply	. 13
2.15	Solder-short pads	. 13
3.	TK-RF8058+SB-EE installation and operation	. 14
24	Catting started	
3.1	Getting started	. 14
3.1 3.2	Getting started CD-ROM contents	14 14
3.1 3.2 3.3	Getting started CD-ROM contents Pre-programmed Demo-Application	14 14 14
3.1 3.2 3.3 4.	Getting started CD-ROM contents Pre-programmed Demo-Application Hardware installation	14 14 14 . 15
3.1 3.2 3.3 4.	Getting started CD-ROM contents Pre-programmed Demo-Application Hardware installation	14 14 14 . 15 15
3.1 3.2 3.3 4. 4.1 4.2	Getting started CD-ROM contents Pre-programmed Demo-Application Hardware installation Hardware Assembly Connecting to a Host PC system	14 14 14 . 15 15 15
 3.1 3.2 3.3 4. 4.1 4.2 5. 	Getting started CD-ROM contents Pre-programmed Demo-Application Hardware installation Hardware Assembly Connecting to a Host PC system Software installation.	14 14 . 15 15 15 . 16
 3.1 3.2 3.3 4. 4.1 4.2 5. 5.1 	Getting started CD-ROM contents Pre-programmed Demo-Application Hardware installation Hardware Assembly Connecting to a Host PC system Software installation RF4CE Remote Control tools installation	14 14 15 15 15 16
 3.1 3.2 3.3 4. 4.1 4.2 5. 5.1 5.2 	Getting started CD-ROM contents Pre-programmed Demo-Application Hardware installation Hardware Assembly Connecting to a Host PC system Software installation RF4CE Remote Control tools installation IAR Systems Embedded Workbench for 78K installation	14 14 14 15 15 16 16 16
 3.1 3.2 3.3 4. 4.1 4.2 5. 5.1 5.2 5.3 	Getting started CD-ROM contents Pre-programmed Demo-Application Hardware installation	14 14 14 15 15 15 16 16 16 18
 3.1 3.2 3.3 4. 4.1 4.2 5. 5.1 5.2 5.3 5.4 	Getting started CD-ROM contents Pre-programmed Demo-Application Hardware installation Hardware Assembly Connecting to a Host PC system Software installation RF4CE Remote Control tools installation IAR Systems Embedded Workbench for 78K installation Device file package installation WriteEZ5 installation	14 14 14 15 15 15 16 16 18 18
 3.1 3.2 3.3 4. 4.1 4.2 5. 5.1 5.2 5.3 5.4 5.5 	Getting started CD-ROM contents Pre-programmed Demo-Application Hardware installation Hardware Assembly Connecting to a Host PC system Software installation RF4CE Remote Control tools installation IAR Systems Embedded Workbench for 78K installation Device file package installation WriteEZ5 installation Sample program installation	14 14 14 15 15 15 15 15 16 16 16 18 18 18
 3.1 3.2 3.3 4. 4.1 4.2 5. 5.1 5.2 5.3 5.4 5.6 	Getting started CD-ROM contents Pre-programmed Demo-Application Hardware installation Hardware Assembly Connecting to a Host PC system Software installation RF4CE Remote Control tools installation IAR Systems Embedded Workbench for 78K installation Device file package installation WriteEZ5 installation Sample program installation	14 14 14 15 15 15 15 15 15 15 15 16 16 18 18 18 18
 3.1 3.2 3.3 4. 4.1 4.2 5. 5.1 5.2 5.4 5.5 5.6 5.7 	Getting started CD-ROM contents Pre-programmed Demo-Application Hardware installation Hardware Assembly Connecting to a Host PC system Software installation RF4CE Remote Control tools installation IAR Systems Embedded Workbench for 78K installation Device file package installation WriteEZ5 installation Sample program installation Adobe Reader installation	14 14 14 15 15 15 15 15 15 15 15 16 16 18 18 18 18 18
3.1 3.2 3.3 4. 4.1 4.2 5. 5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.7.2	Getting started CD-ROM contents Pre-programmed Demo-Application Hardware installation Hardware Assembly Connecting to a Host PC system Software installation RF4CE Remote Control tools installation IAR Systems Embedded Workbench for 78K installation Device file package installation WriteEZ5 installation Sample program installation Adobe Reader installation USB Driver Installation	14 14 14 15 15 15 15 16 16 18 18 18 18 18 18
3.1 3.2 3.3 4. 4.1 4.2 5. 5.1 5.2 5.3 5.4 5.5 5.7 5.7.2	Getting started	14 14 14 15 15 15 16 16 16 18 18 18 18 18 18 18 12
3.1 3.2 3.3 4. 4.1 4.2 5. 5.1 5.2 5.3 5.4 5.5 5.7 5.7.2 5.8	Getting started	14 14 14 15 15 15 16 16 16 18 18 18 18 18 18 18 122 24

TK-RF8058+SB-EE

RENESAS

6.1 6.2	Device Setup Using WriteEZ5	26 27
7. I	RF4CE Remote Control tools	28
74	Setting up the Herdware	20
7.1	Setting up the Ratuware	20
73	Running the Application	20
7.5		23
8. I	AR Sample project	30
8.1	RF-Test program	30
8.1.1	Opening the IAR Embedded Workbench workspace	30
8.1.2	Predefined project settings	31
8.1.3	Setting up the Transmitter	31
8.1.4	Setting up the Receiver	33
8.1.5	Setting up HyperTerminal for the transmitter	34
8.1.6	Transmit/Receive test	36
8.1.7	Channel selection	37
8.1.8		38
8.1.9	Further RF-Test modes and settings	39
8.1.9.	1 PER test /receiver	39
8.1.9.	2 Continuous TX / Pseudo Noise	39
8.1.9.	3 Continuous TX / Raw Carrier	39
8.1.9.		39
0.1.9.	5 IDLE MODE	39
0.1.9.	 Statiuby Mode Z. Doop Sloop Mode 	40
0.1.9.	 Power down mode 	40
0.1.9.	0 Posotting PE	40
0.1.9.		40
9. I	Bill of Materials	41
9.1	SB-UD board	41
9.2	MB-RF8058 board	44
10.	Cables	45
10.1	USB interface cable (Mini-B type)	45
11.	Schematics	46

RENESAS

List of Figures

Figure 1: TK-RF8058+SB-EE demonstration board (Top View)	11
Figure 2: Mount antenna to MB-RF8058	15
Figure 3: Mount MB-RF8058 to SB-UB	15
Figure 4: TK-RF8058+SB-EE CDROM autorun.exe	16
Figure 5: IAR Embedded Workbench installation screen	17
Figure 6: IAR Embedded Workbench License request and install	17
Figure 7: Found New Hardware Wizard (Windows 2000)	19
Figure 8: Search Method (Windows 2000)	19
Figure 9: Driver File Location (Windows 2000)	20
Figure 10: Address Specification 2 (Windows 2000)	20
Figure 11: Address Specification 3 (Windows 2000)	21
Figure 12: Driver File Search (Windows 2000)	21
Figure 13: USB Driver Installation Completion (Windows 2000)	21
Figure 14: Found New Hardware Wizard 1 (Windows XP)	22
Figure 15: Found New Hardware Wizard 2 (Windows XP)	22
Figure 16: Search Location Specification 1 (Windows XP)	23
Figure 17: Search Location Specification 2 (Windows XP)	23
Figure 18: Windows XP Logo Testing (Windows XP)	24
Figure 19: USB Driver Installation Completion (Windows XP)	24
Figure 20: Windows Device Manager	25
Figure 21: WriteEZ5 Startup	26
Figure 22: WriteEZ5 Device Setup Dialogue	26
Figure 23: WriteEZ5 Device Menu	27
Figure 24: RCT COM port selection	28
Figure 25: RCR COM port selection	28
Figure 26: RCR Pairing Start	29
Figure 27: RCR Pairing Start	29
Figure 28: RCR channel selected	29
Figure 29: IAR Embedded Workbench Startup screen	30
Figure 30: IAR Embedded Workbench IDE view	31
Figure 31: IAR Embedded Workbench RF-Test project configuration selection	32
Figure 32: IAR Embedded Workbench Debugger Settings	33
Figure 33: IAR C-SPY debugger window	34
Figure 34: HyperTerminal Connection Description	35
Figure 35: HyperTerminal COM Port selection	35
Figure 36: HyperTerminal COM Port properties	35
Figure 37: RF-Test project opening window	36
Figure 38: HyperTerminal RF-Test PER test	36
Figure 39: RF-Test PER test result	37
Figure 40: RF-Test Channel selection	37
Figure 41: RF-Test PER test Channel 23	38
Figure 42: RF-Test Output power adjustment 1	38
Figure 43: RF-Test PER test power adjusted	39
Figure 44: USB interface cable (Mini-B type)	45



List of Tables

Table 1: TK-RF8058+SB-EE SW4 setting	11
Table 2: TK-RF8058+SB-EE SW5 setting	11
Table 3: TK-RF8058+SB-EE SW6 setting	12
Table 4: TK-RF8058+SB-EE SW1-SW3 settings	12
Table 5: TK-RF8058+SB-EE JP2 setting	12
Table 6: TK-RF8058+SB-EE JP3 setting	12
Table 7: TK-RF8058+SB-EE JP5 setting	13
Table 8: TK-RF8058+SB-EE JP5 setting	13
Table 9: TK-RF8058+SB-EE JP5 setting	13
Table 10: TK-RF8058+SB-EE CD-ROM directory structure	14
Table 11: WriteEZ5 action buttons	27
Table 12: Switch settings for flash programming	28
Table 13: Switch settings for serial communication	32
Table 14: SB-UD Bill of Material	42
Table 15: MB-RF8058 Bill of Material	44



1. Introduction

1.1 Package contents

- 2 x TK-RF8058+SB evaluation board
 - o 2 x SB-UD board
 - o 2 x MB-RF8058
 - o 2 x Antenna
- 2 x USB cable (Series "A" to Series "Mini-B")
- CD-ROM containing sample applications, Remote Controller PC software and an evaluation copy of the IAR Embedded Workbench for 78K with 16Kbyte code size limitation

Please verify that you have received all parts listed in the package contents list attached to the *TK-RF8058+SB-EE* package. If any part is missing or seems to be damaged, please contact the dealer from whom you received your *TK-RF8058+SB-EE* demonstration kit.

1.2 Features

- µPD78F8058 16-bit microcontroller with 802.15.4 Radio
- Zigbee™ / RF4CE™ wireless communication
- Industry leading low power consumption
- Wide operating voltage range (1.8V 5.5V) to extend battery life
- Programming / On-chip debug supported

1.3 System requirements

HOST PC	A PC supporting Windows 2000, Windows XP or Windows Vista is required for the IAR Systems Embedded Workbench demo-version. A Pentium processor with at least 1 GHz CPU performance, with at least 256 Mbytes of RAM, allowing you to fully utilize and take advantage of the product features. 500 Mbytes of free disk space and an additional 10 Mbytes of free disk space on the Windows system drive. A web browser and Adobe Acrobat Reader to be able to access all the product
Host interface	documentation. USB interface that enables communication based on USB (Ver1.1 or later)

Note: Updates of the IAR Embedded Workbench for 78K, documentation and/or utilities for the *TK-RF8058+SB-EE* demonstration kit, if available, may be downloaded from the Renesas WEB page(s) at <u>http://www.renesas.eu/TK-RF8058+SB-EE</u>

1.4 Trademarks

IAR Embedded Workbench, visualSTATE, IAR MakeApp and C-SPY are registered trademarks of IAR Systems AB. Microsoft, Windows and HyperTerminal are registered trademarks of Microsoft Corporation. Adobe and Acrobat Reader are registered trademarks of Adobe Systems Incorporated.

All other product names are trademarks or registered trademarks of their respective owners.



2. Hardware

This chapter described the specification of SB-UD and MB-RF8058 boards delivered with the *TK-RF8058+SB-EE* demonstration kit.

A µPD78F8058 16-bit microcontroller supporting an IEEE-compliant 802.15.4 (Zigbee™ / RF4CE™) wireless is mounted to the MB-RF8058 board.



Figure 1: TK-RF8058+SB-EE demonstration board (Top View)

2.1 SW4 (Dip switch)

SW4 is the mode setting switch.

Switch No.	Setting		
Switch NO.	ON	OFF	
SW4-1			
SW4-2		PC HyperTerminal mode	
SW4-3			
SW4-4			
SW4-5	Pull-up for RESET terminal	No pull-up	
SW4-6	Power LED on	Power LED off	
SW4-7	Not used	Not used	
SW4-8	Not used	Not used	

Table 1: TK-RF8058+SB-EE SW4 setting

2.2 SW5 Power regulator switch

Power regulator setting

SW position	Output voltage
1.8V	1.8V output to the module
2.0V	2.0V output to the module
3.0V	3.0V output to the module

Table 2: TK-RF8058+SB-EE SW5 setting

Caution: Never alter the SW5 setting while a power source is being applied to the demonstration kit. Doing so can destroy the voltage regulator chip. To change the output voltage, remove jumper SW3 first.

TK-RF8058+SB-EE



2.3 SW6 Serial communication mode setting

SW position	Serial communication mode setting
K0R-K0USB	UART- USB for HyperTerminal
Debug/Writer	For ID78K0R-QB or WriteEZ5

Table 3: TK-RF8058+SB-EE SW6 setting

2.4 SW7 Reset switch

Press this switch to reset the µPD78F8058.

2.5 SW1, SW2, SW3

	Connected MCU pin	Note
SW1	P15/RTCDIV/RTCCL/GPIO2	GPIO2 belongs to the RF part
SW2	SW2 Not connected	
SW3	Not connected	

Table 4: TK-RF8058+SB-EE SW1-SW3 settings

2.6 JP1

JP1 enables/disables the power supply to peripheral circuits, such as LEDs and the temperature sensor.

2.7 JP2 Power source selection

JP2 is used to select the power source for the TK-RF8058+SB-EE demonstration kit.

JP position	Power source
1-2 short-circuit	Regulation output of 1.8V, 2.0V, or 3.0V
2-3 short-circuit	No regulation from two batteries or the external power source

Table 5: TK-RF8058+SB-EE JP2 setting

2.8 JP3 Power source selection to voltage regulator

Selects the input voltage source for the power regulator

JP position	Voltage regulator input selection
1-2 short-circuit	USB
2-3 short-circuit	Battery

Table 6: TK-RF8058+SB-EE JP3 setting

2.9 JP4 Current consumption measurement

JP4 is a jumper to measure the current consumption of the *TK-RF8058+SB-EE* demonstration kit. If you don't execute a measurement, please keep this jumper short-circuited. If you measure a consumed current of the *TK-RF8058+SB-EE* demonstration kit, please use an external power supply or two batteries for a precise measurement.

2.10 JP5 Battery selection

JP5 selects if one or two batteries shall be used.



JP position	Battery setting
1-2	One battery
2-3	Two batteries

Table 7: TK-RF8058+SB-EE JP5 setting

2.11 LED4

LED4 indicates if power is being applied to the board, if SW4-6 is on. If you want to save power by turning the LED4 off, please set SW4-6 to off.

2.12 LED1 - LED3

LED1, LED2 and LED3 are available for application use. To turn a LED on, please set the output port LOW.

	Connected MCU pin	Note
LED1	P16/TI01/TO01/INTP5/GPIO3	GPIO2 belongs to the RF part
LED2	Not connected	
LED3	Not connected	

Table 8: TK-RF8058+SB-EE JP5 setting

2.13 FP1 (MINICUBE2)

This is a connector for the Renesas MINICUBE2 OCD debug emulator. Please set up the MINICUBE2 side switches to "M1" and "T".

2.14 J2 and J3 External power supply

J2 and J3 is a pair of terminals to input power supply from an external power source. The accepted range of power source is from 1.8V to 3.6V.

2.15 Solder-short pads

The solder-short pads offer a way to modify the circuit on the *TK-RF8058+SB-EE* demonstration kit. The solder-short pad looks like the picture below. To open it, please cut the narrow part by a knife. To connect them back, please form a solder bridge on the pad.



Solder-short pad	Factory	Connection
name	default	
S_LED1	Short	Connection between P16/TI01/TO01/INTP5/GPIO3 and LED1
S_LED2	Short	Connection to LED2. No connection to the MB-RF8058 board.
S_LED3	Short	Connection to LED3. No connection to the MB-RF8058 board.
S_SW1	Short	Connection from SW1
S_SW2	Short	Connection from SW2. No connection to the MB-RF8058 board
S_SW3	Short	Connection from SW3. No connection to the MB-RF8058 board
AD1	Short	Analogue output from the temperature sensor No connection to the MB-RF8058 board
AD2	Short	Analogue output from the illumination sensor. No connection to the MB-RF8058 board
SCK	Open	Not used
SI	Open	Not used
SO	Open	Not used

Table 9: TK-RF8058+SB-EE JP5 setting

3. TK-RF8058+SB-EE installation and operation

3.1 Getting started

It is necessary to have a valid IAR Embedded Workbench for 78K installation on the PC host system, to be able to compile and debug the available software samples provided with the TK-RF8058+SB-EE demonstration kit. As communication interface between the PC host system and the SB-UD evaluation board a standard USB interface line is needed. Before you can download and run a program, soft- and hardware have to be installed properly.

3.2 CD-ROM contents

The CD-ROM shows following directory structure:

TK-RF8058+SB-EE	CD-ROM ROOT
acrobat	- Acrobat Reader for 32Bit Windows OS
Device file package	 µPD78F8058 device file package for IAR Embedded Workbench
Doc	- Documentation
Driver	- TK-RF8058+SB-EE USB driver files
IAR Systems Tools	- IAR Embedded Workbench for 78K
RF4CE Remote Control	- PC Remote Control program
Sample projects	- Example projects for the <i>TK-RF8058+SB-</i> <i>EE</i> demonstration kit
WriteEZ3	 Flash Programmer WriteEZ5 incl. PRM file for µPD78F8058

Table 10: TK-RF8058+SB-EE CD-ROM directory structure

3.3 Pre-programmed Demo-Application

The *TK-RF8058+SB-EE* demonstration kit is pre-programmed with the ATCommand.hex software, which is needed for the <u>RF4CE Virtual Remote Control tools</u>.





4. Hardware installation

4.1 Hardware Assembly

After unpacking all parts of the TK-RF8058+SB-EE demonstration kit please follow the assembly procedure.

Note: Please make sure that the no power is supplied to the board during the mounting process

1. Connecting the Antenna to the MB-RF8058 board



Figure 2: Mount antenna to MB-RF8058

2. Connecting SB-UD board with the MB-RF8058 board



Figure 3: Mount MB-RF8058 to SB-UB

4.2 Connecting to a Host PC system

After assembling all parts of the TK-RF8058+SB-EE demonstration kit as shown above, connect the board via connector USB1 to your host computer, using the provided USB interface cable. When the SB-UD evaluation board is connected, the USB driver needs to be installed on the host machine. Please refer to the following **Chapter 5 Software Installation**.



5. Software installation

The TK-RF8058+SB-EE package comes with the following software packages:

- IAR Systems Embedded Workbench for 78K 16Kbyte code size limited, including C compiler, assembler, linker, librarian and IAR C-SPY debugger / simulator
- Sample project for the IAR Embedded Workbench for 78K
- WriteEZ5 flash programmer including the PRM file for µPD78F8058



Figure 4: TK-RF8058+SB-EE CDROM autorun.exe

5.1 RF4CE Remote Control tools installation

To install the RF4CE Remote Control tools just press the Software tools button from the Autorun of the CD-ROM provided within the *TK-RF8058+SB-EE* package and select the regarding entry from list. The setup dialogues will guide you through the installation process. The installation can also be started by executing the RF4CE_RC.exe in the directory "\RF4CE Remote Control" of the CD-ROM.

5.2 IAR Systems Embedded Workbench for 78K installation

To install the IAR Systems Embedded Workbench for 78K including C-SPY debugger / simulator press the Software tools button from the Autorun of the CD-ROM provided within the *TK-RF8058+SB-EE* package and select the regarding entry from list. The installation can also be started by executing the Autorun.exe program in the directory "\IAR Systems Tools\" of the CD-ROM. The setup dialogues will guide you through the installation process.



Welcome to IAR Systems	● 日本語 (Japanese)
IAR Embedded Workbench [®] 16K Kickstart for NEC 78I	K
QuickStart installation information	
Install IAR Embedded Workbench [®]	
Install visualSTATE [®]	
Release notes	
View the product documentation	
Install Adobe Acrobat Reader	
Explore the CD	EIAR SYSTEMS
	www.iar.com

Figure 5: IAR Embedded Workbench installation screen

Note: To be able to install the IAR Embedded Workbench 16K Kickstart for 78K a License number and key has to be requested free of charge via an online registration.

Welcome to I	AR Systems	● 日本語 (Japanese)
IAR Embedded Workben	h ^e Kickstart installation	
You must have a license number a Embedded Workbench.	and an installation key to install this	s evaluation version of IAR
Follow these steps: 1. Click the IAR online registration 2. You will receive an email with p 3. Click the Install IAR Embedded	h link below to register on the IAB our license number and installation Workbench [®] link below to start th	Systems website. 1 key within a few minutes. 1e installation.
ht IAR online registration		
Install IAR Embedded Work	bench [®]	
Hack		
		SYSTEMS

Figure 6: IAR Embedded Workbench License request and install

For further information about the IAR Embedded Workbench installation refer to the InstallationGuide.ENU.pdf in the directory "\IAR Systems Tools\doc\common\doc" of the CD-ROM.

Note: Before using the IAR Embedded Workbench in combination with the *TK-RF8058+SB-EE* demonstration kit, please make sure to install the µPD78F8058 device file package correctly.



5.3 Device file package installation

To install μ PD78F8058 device file package just press the regarding button from the Autorun of the CD-ROM provided within the *TK-RF8058+SB-EE* package. The setup dialogues will guide you through the installation process.

The installation can also be started by executing the EW78K_setup_78K0R-78F8058_V1.00.exe in the directory "\Device file package" of the CD-ROM.

5.4 WriteEZ5 installation

To install WriteEZ5 just press the Software tools button from the Autorun of the CD-ROM provided within the *TK-RF8058+SB-EE* package and select the regarding entry from list. The setup dialogues will guide you through the installation process. The installation can also be started by executing the WriteEZ5_V100_r3_EE.exe in the directory "\WRITEEZ5" of the CD-ROM.

5.5 Sample program installation

To copy the IAR sample project to the Host PC hard drive press the regarding button from the Autorun of the CD-ROM provided within the *TK-RF8058+SB-EE* demonstration kit package. The setup dialogues will guide you through the copying process. The copy can also be started by executing the TK-RF8058+SB-EE_sample_projects.exe in the directory "\sample program" of the CD-ROM.

5.6 Adobe Reader installation

To install the Adobe Reader just press the Software tools button from the Autorun of the CD-ROM provided within the *TK-RF8058+SB-EE* package and select the regarding entry from list. The setup dialogues will guide you through the installation process. The installation can also be started by executing the AdbeRdr930_en_US.exe in the directory "\Acrobat" of the CD-ROM.

5.7 USB Driver Installation

In order to use the SB-UD evaluation board the USB driver needs to be installed on the host machine. Install the driver according to the following procedure:

Installation on Windows 2000Page 18Installation on Windows XPPage 22

5.7.1 Installation on Windows 2000

1. When the SB-UD evaluation board is connected with the host machine, the board is recognized by <Plug and Play>, and the wizard for finding new hardware is started. Click Next>.



Welcome to the Found New Hardware Wizard This wizard helps you install a device driver for a hardware device.
< <u>B</u> ack. [<u>Next></u>] Cancel

Figure 7: Found New Hardware Wizard (Windows 2000)

2. Following the window below is displayed. So, check that "Search for a suitable driver ..." is selected, then click Next>.

	Found New Hardware Wizard
	Install Hardware Device Drivers A device driver is a software program that enables a hardware device to work with an operating system.
	This wizard will complete the installation for this device:
Check that "Search for suitable driver" is select	Image: NF a software program that makes a hardware device work. Windows heeds driver files for your new device. To locate driver files and complete the installation click Next. What do you want the wizard to do?
	Search for a suitable driver for my device (recommended) Display a list of the known drivers for this device so that I can choose a specific driver
	< <u>Back</u> <u>N</u> ext > Cancel
	Figure 8: Search Method (Windows 2000)

3. Check the "Specify a location" check box only, then click Next>.

Locate Driver Files Where do you want Windows to search for driver files? Search for driver files for the following hardware device: Search for driver files for the following hardware device: Check that "Specify a location" only is checked. USB Device To start the search soft suitable drivers in its driver database on your computer and in any of the following optional search locations that you specify. To start the search, click Next. If you are searching on a floppy disk or CD-RDM drive, insert the floppy disk drives Optional search locations: Floppy disk drives Click. PRDM drives Microsoft Windows Update Click.		Found New Hardware Wizard
Check that "Specify a location" only is checked. USB Device The wizard searches for suitable drivers in its driver database on your computer and in any of the following optional search locations that you specify. To start the search, click Next. If you are searching on a floppy disk or CD-RDM drive, insert the floppy disk or CD before clicking Next. Optional search locations: Floppy disk drives Click. Specify a location Microsoft Windows Update Click.		Locate Driver Files Where do you want Windows to search for driver files?
	Check that "Specify location" only is checked	a d. USB Device USB Device The wizard searches for suitable drivers in its driver database on your computer and in any of the following optional search locations that you specify. To start the search, click Next. If you are searching on a floppy disk or CD-ROM drive, insert the floppy disk or CD before clicking Next. Optional search locations:
		Floppy disk drives CD-ROM drives Specify a location Microsoft Windows Update < <u>Back</u> <u>Next</u> > Cancel

- 4. Locate to the folder "CDROM:\Driver".
- 5. The setup information file "MQB2ALL.inf" is automatic selected, then click Open to proceed within driver installation.

Locate File						? ×
Look jn:			•	(† 🖻 🔿	•	
History Desktop My Documents My Computer	MQB2SALL					
Mu Nobuork P	File <u>n</u> ame:	MQB2SALL.inf		•		<u>O</u> pen
My NetWOIK F	Files of <u>type</u> :	Setup Information (*.	inf)	7	/_	Cancel
	Figure 10:	Address Specifica	ation 2 (Wind	lows 20 <u>00)</u>	/	
				CI	lick.	

6. After the location of the USB driver has been specified click OK to proceed.

RENESAS

TK-RF8058+SB-EE

Found New Hardware Wizard	
Insert the manufacturer's installation disk into the drive OK selected, and then click OK.	
	Click.
Copy manufacturer's files from:	
G:\Driver	

Figure 11: Address Specification 3 (Windows 2000)

7. Click Next>.

The wiz	s Search Results ard has finished searching for driver files for your hardware device.
The wiz	ard found a driver for the following device:
2	USB Device
Windov	is found a driver for this device. To install the driver Windows found, click Next.
	g:\driver\mqb2sall.inf
	Carood

8. Click Finish to complete the installation of the USB driver.



Figure 13: USB Driver Installation Completion (Windows 2000)

User's Manual R20UE0001ED0100



5.7.2 Installation on Windows XP

1. When the SB-UD evaluation board is connected with the host machine, the board is recognized by Plug and Play, and the wizard for finding new hardware is started. At first the hardware wizard will ask if windows should search on the windows update web, check "No, not this time" and then click Next>.



Figure 14: Found New Hardware Wizard 1 (Windows XP)

2. Check that "Install from a list or specific location (Advanced)" is selected, then click Next>.



Figure 15: Found New Hardware Wizard 2 (Windows XP)

3. Check that "Search for the best driver in these locations." is selected. Select the "Include this location in the search:" check box and then click Browse.

RENESAS



Figure 16: Search Location Specification 1 (Windows XP)

4. Locate the folder "CDROM:\Driver\" and click OK.

Br	owse For Folder		
9	Select the folder that contains drivers for your hardware.		
	🗉 🧰 Acrobat 🛛 🔼		
	🗄 🚞 Device file package		
	🗄 🧰 Doc		
	🗁 Driver		
	🗄 🚞 IAR Systems Tools		
	🗄 🚞 RF4CE Remote Control 🗧		
	🗄 🚞 Samples projects 📃		
	🗄 🚞 Tessera Documents		
	🖽 🚞 WriteEZ5 🛛 🗸 🗸		
To view any subfolders, click a plus sign above.			
	OK Cancel		

Figure 17: Search Location Specification 2 (Windows XP)

 As shown below, "Renesas Electronics Starter Kit Virtual UART has not passed Windows Logo testing to verify its compatibility with Windows XP." is displayed. Click Continue Anyway.



	Hardware Installation		
	The software you are installing for this hardware: Renesas Electronics Starter Kit Virtual UART		
	has not passed Windows Logo testing to verify its compatibility with Windows XP. (<u>Tell me why this testing is important.</u>)		
Click	Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.		
[

Figure 18: Windows XP Logo Testing (Windows XP)

6. After the installation of the USB driver is completed the window below is displayed. Click Finish to close the hardware wizard.



Figure 19: USB Driver Installation Completion (Windows XP)

5.8 Confirmation of USB Driver Installation

After installing the USB driver, check that the driver has been installed normally, according to the procedure below. When using the 78K0/IB2 HBLED evaluation board the "Renesas Electronics Starter Kit Virtual UART" should be present like in the figure below.

Please check in the Windows "Device Manager" within the Windows Properties ("Hardware" tab), that the driver is installed normally.





Figure 20: Windows Device Manager



6. Flash Programmer WriteEZ5

The WriteEZ5 is flash programming software to flash hex files to the related device. For installation information refer to the chapter <u>WriteEZ5 installation</u>.

📲 WriteEZ5	
<u>File D</u> evice <u>V</u> iew <u>H</u> elp	
/ 🖓 气 🖵 🖏 🗸	
>>> FlashOpenning Flash Open OK >> ParameterFile Reading Success Read ParameterFile. >>> LoadFile Reading Success and HEX file	Device - Name : Firmware :
Success read they life.	Parameter file – Name : 78F8058 Version : V1.00
	Load file Name UDSNIFFER_78KOR_S Date: 2010/02/05 22:09:24 Chksum:094Fh Area: 000000h-03FFFFh
~	Connection to device Port : COM1 Speed 115200bps Range Chip Freq : Internal-OSC Multiply : 1.00
Ready	NUM

Figure 21: WriteEZ5 Startup

6.1 Device Setup

To provide all necessary information about the device to be programmed, only the corresponding flash parameter file must be loaded. The parameter file (*.prm) for the μ PD78F8058 is located on the CDROM, in a subfolder of the WriteEZ5 setup file. Please use the menu "**Device** \rightarrow **Setup...**" to open the following dialogue and the button "**PRM File Read**" to select the parameter file.

📲 Device Setup 🛛 🔀			
Standard Advance			
Parameter file 78F8058.prm PRM File Read			
Host connection Supply oscillator			
Port COM1 Frequency Internal-OSC MHz			
Speed 115200bps V Multiply rate 1.00			
Operation Mode			
Chip Start 000 -			
C Block End 127			
C Area 🔲 Show Addres			
Target Reset Message			
OK Cancel			

Figure 22: WriteEZ5 Device Setup Dialogue

TK-RF8058+SB-EE



Please check that the correct host communication port is selected. The used communication port can be seen in the <u>Windows Device Manager</u>.

6.2 Using WriteEZ5

After a successful device selection the internal flash memory can be blank-checked, erased, programmed and/or verified. WriteEZ5 can be controlled either by menu or by buttons.

4월 V	🗏 WriteEZ5 📃 🗆 🔀			
File	Device View Help			
	Blank Check Erase Program	# # #		
þ> Fl Flash >> P	Verify Security		Name : Firmware :	
Succ >> Li Succ	CheckSum		Barrada (la	
>>CC PRM	Autoprocedure(EPV)		Name : 78F8058 Version : V1.00	
	Get Security settings			
	Setup		Load file Name UDSNIFFER_78K0R_S Date: 2010/02/05 22:09:24 Chksum:094Fh Area: 000000h-03FFFFh	
		~	Connection to device Port: COM1 Speed 115200bps Range Chip Freq.: Internal-OSC Multiply: 1.00	
<		>		
			NUM	

Figure 23: WriteEZ5 Device Menu



Table 11: WriteEZ5 action buttons

WriteEZ5 supports Intel-Hex and Motorola S-record file formats as input file.



7. RF4CE Remote Control tools

The RF4CE Virtual Remote Control tools are designed to demonstrate the functionality of the RF4CE stack provided with the *TK-RF8058+SB-EE* demonstration kit. When receiving the *TK-RF8058+SB-EE* demonstration kit it is pre-programmed with the ATCommand.hex firmware that enables the user to work with the **Remote Controller Transmitter** (RF4CEController.exe) hereinafter called **RCT** and the **Remote Controller Receiver** (RF4CETarget.exe) hereinafter called **RCR**, included in the RF4CE Remote Control tools package.

For a full functional usage of the RF4CE Remote Control tools you need both *TK-RF8058+SB-EE* boards and two PCs or a PC with at least two free USB ports. To use the RF4CE Remote Control tools please make sure that you have <u>installed</u> them correctly on the used Host PCs.

If the ATCommand.hex file is overwritten in the devices it can be found in the RF4CE Remote Control tools installation folder. To reprogram it to the target device please use the <u>WriteEZ5</u> flash programming software. To flash the device the following hardware configuration has to be chosen.

Switch	Position
SW4	1-6 ON, 7+8 OFF
SW5	3.0V
SW6	Debug/Writer

Table 12: Switch settings for flash programming

7.1 Setting up the Hardware

After starting the tools the first step is to select one of the *TK-RF8058+SB-EE* boards as transmitter and one as receiver. To do so select the COM port of your preferred transmitter board for the **RCT** with a Baud Rate of 115200 and the COM port of the receiver for the **RCR** also with a Baud Rate of 115200. Press OPEN PORT on both tools to activate the COM ports. You can use the <u>Windows Device Manager</u> to check which COM port is used for the boards.



Figure 24: RCT COM port selection

Figure 25: RCR COM port selection

7.2 Establish the Connection

To establish the connection between the **RCT** and **RCR** press "Pairing" on both programs and wait until the following pop up boxes occur.

TK-RF8058+SB-EE

RENESAS

	1. Target 🛛		2. Controller 🔀	
	Pairing Start		Pairing Start	
	ОК		ОК	
Figu	re 26: RCR Pairing	Start Fig	ure 27: RCR Pairing Sta	art

Wait until both pop up boxes occur. Then press OK in the "1. Target" box and afterwards in the "2. Controller" box. When the connection is established you will find the controller address in the **RCR** window.

7.3 Running the Application

After the **RCT** and **RCR** are connected you can send channel change commands by clicking the different channel buttons on the **RCT**. On the **RCR** side you will see that the selected channel is highlighted in RED as for example channel "2" in the screenshot below.

🔜 RF4CE Target		
UART Setting		
PORT: COM9	BaudRate: 115200	V OPEN PORT
Pairing		
Pairing	Controller address: FFFFFF	FFFFFFFFF
Channel		Volume
1	2 3	
4	5 6	
7	8 9	
10	11 12	
ESTATCHG 01 FF		
UK		~

Figure 28: RCR channel selected

Furthermore a short video is played on the PC where the RCR is running.

Note: To be able to play the video, you need a video player that supports the playback of .3GP video files.



8. IAR Sample project

The *TK-RF8058+SB-EE* demonstration kit is provided with the RF-Test_IAR program. To be able to execute this project please run the <u>Sample project installation</u> to copy the files to your Host PC.

To be able to run the RF-Test application, make sure that the <u>IAR Embedded Workbench</u> and the <u>WriteEZ5</u> are installed correctly on your Host PC.

8.1 RF-Test program

To run the RF Test sample application you need two PCs or one PC with more than one USB interface. Hereinafter, the first *TK-RF8058+SB-EE* board is called "**transmitter**" and the other one with USB interface to the second PC or USB Port for debugging is called "**receiver**", which sends back the test result to the **transmitter**.

8.1.1 Opening the IAR Embedded Workbench workspace

To start the IAR Embedded Workbench 16K Kickstart for 78K click Start \rightarrow All Programs \rightarrow IAR Systems \rightarrow IAR Embedded Workbench for 78K 4.62 Kickstart \rightarrow IAR Embedded Workbench.

The Embedded Workbench Startup screen comes up. To open the sample project workspace press the **Open existing workspace** button and locate the **TK78K0R.eww** file in the "RF-Test_IAR" sub-folder, of your Sample projects installation.

Embedded Workbench Startup		
	Create new project in current workspace	
	Add existing project to current workspace	
R	Open existing workspace	
	Example applications	
<u>R</u> ecent w	orkspaces:	
	Open	
Do no	t show this window at startup	
	Cancel	

Figure 29: IAR Embedded Workbench Startup screen

The project shall show up on the left side of the IAR Embedded Workbench window in the Workspace view.



🔀 IAR Embedded Workbench IDE	
<u>Eile Edit View Project Tools Window H</u> elp	
🗅 🚅 🖬 🗿 🎒 👗 🛍 💼 🗠 🗠	✓ ◇ > % 注 圖 > ,
Workspace ×	main.c
Debug 💌	85 #define TEST DATA LEN 20
Files 🐉	86 SK_UB gTestData[] = { 0x7e ,0xff ,0x00 ,0x01 ,0x02 ,0x03 ,0x04 ,0x05 ,0x06 ,0x07 ,0x0
🛛 🗇 RFTest - Debug 🗸 🗸	87
⊨ 🗄 hardware_78k0r.c	88
	90 // Main Loop
uart_interface.c	91 //
- to bec_chip_interface.c	92 void main() (
	93 SK_UB ch,ch2,i,j,flg,len,rssi,t_restart,dst,kk,th,lqi,freq,temp_lmhz,c
	96 SKH perl, perl, perl, avg rssi, avg lgi;
	97 SK_UB destMACShort[2];
	98
	99 static SK UW nReceiveCount, nRSSItotal, nSendCount, nSendTo, temp, nLQItotal;
	100 static sk_05 nkssimin,nkssimax,nkųimin,nkųimax;
	102 loi = 0;
	103 th = 0;
	104 cca= 0;
	105 avg_rssi = 0;
	106 avg_lqi = 0;
	107 If $eq = 0.000$
	109 temp lmhz = 0;
	110 gnCurrentChannel = 11; // 2405MHz
	111 gnCurrentFreq = 2405;
	112 Hardware_Initialize();
DET-11	
* Messages	File Line
Building configuration: RFTest - Deb	nd
Updating build tree	
Configuration is up to dote	
Configuration is up-to-date.	
Build Find in Files Debug Log	x
Ready	Errors 0, Warnings 0 NUM 📃

Figure 30: IAR Embedded Workbench IDE view

8.1.2 Predefined project settings

The RF-Test project contains 3 predefined project settings, two release settings only differing in the short address (MAC_ADDR) 0x0001 and 0x0002, which is used to identify the *TK-RF8058+SB-EE* boards in the network, and a debug configuration with a predefined short address (MAC_ADDR) of 0x0002 and a fixed setting as **receiver**. The debug configuration generates an IAR C-SPY specific output format and the release versions are generating .hex files that can be flashed with the <u>WriteEZ5 software</u>.

8.1.3 Setting up the Transmitter

To set up the transmitter please select the predefined project configuration "Release 0001" from the dropdown menu in the upper side of the Workspace window and rebuild the project (Project \rightarrow Make). Now you will find the file "RFTEST_0001.hex" in the subfolder "\Release 0001\exe" of the RF-Test project.



🔀 IAR Embedded Workbench IDE	
<u>File E</u> dit <u>V</u> iew <u>P</u> roject <u>T</u> ools <u>W</u> indow <u>H</u> elp	
🗅 📽 🖬 🕼 📇 🖟 🛍 📾 🗠 🖂	🔽 🗸 🏷 🐂 🚾 💷 🐢 🐗 🕼 啡 🎇 🕺 🕭
Workspace ×	main.c
Release 0001	85 #define TEST DATA LEN 20
Debug	86 SK_UB grestData[] = { 0x7e ,0xff ,0x00 ,0x01 ,0x02 ,0x03 ,0x04 ,0x05 ,0x06 ,0x07 ,0x0
Release 0002	87
- ardware_78k0r.c	
🗕 🖽 💽 main.c	90 // Main Loop
🗕 🖃 🖸 uart_interface.c	91 //
🕀 🗄 ubec_chip_interface.c	92 void main() {
u utput	93 SK_UB ch,ch2,i,j,flg,len,rssi,t_restart,dst,kk,th,lqi,freq,temp_lmhz,c
H-⊞ RFIESI_UUU1.hex	94 SK UW uw,uw2,uw3,iw1,iw2,tm,wd,ff;
- BRETEST_0001.html	95 XK_W p,glemp;
	97 SK IIB destMaCShort[2]:
	98
	99 static SK_UW nReceiveCount,nRSSItotal,nSendCount,nSendTo, temp, nLQItotal;
	100 static SK_UB nRSSImin,nRSSImax,nLQImin,nLQImax;
	101 temp = 0;
	102 $101 = 0;$
	105 avg rssi = 0;
	106 avg_lqi = 0;
	107 freq = 0x80;
	108 ff = 0;
	109 temp_imrz = 0;
	110 gittaffeltenamer = 11, // 2403mz
	112 Hardware Initialize();
	113
RFTest	
×	
Messages	File Line
2 <u></u>	
Build Find in Files Debug Log	x
Ready	Errors 0. Warpions 0. NUM

Figure 31: IAR Embedded Workbench RF-Test project configuration selection

To download the program to the **transmitter** has to be set up with the following setting.

Note: Make sure to disconnect the transmitter is not connected to the Host PC while making hardware setting changes.

When the hardware is set up with the above shown configuration please use the <u>WriteEZ5 software</u> to program the hex file of the **transmitter**.

After a successful download of the program close WriteEZ5, disconnect the **transmitter** from your Host PC to change the switch settings as follows.

Switch	Position
SW4	1-4 OFF, 5+6 ON, 7+8 OFF
SW5	3.0V
SW6	K0R-K0USB

Table 13: Switch settings for serial communication



8.1.4 Setting up the Receiver

To set up the receiver please select the predefined debug configuration of the IAR project. Make sure that the MINICUBE is selected as debugger driver (Project \rightarrow Options \rightarrow Debugger \rightarrow Driver \rightarrow MINICUBE) as shown below.

Options for node "RI	Test"
Category: General Options C/C++ Compiler Assembler Custom Build Build Actions Linker Debugger IE-78 IECUBE MINICUBE Simulator TK-78	Factory Settings Setup Extra Options Driver MINICUBE QB-78KOMINI, QB-78KOSxxxMINI, QB-MINI2 Imain Setup macros Use macro file Device descriptions Override default \$TOOLKIT_DIR\$\CONFIG\DDF\io78f1146_64.ddf
	OK Cancel

Figure 32: IAR Embedded Workbench Debugger Settings

Before connecting the **receiver** to the Host PC, make sure that the switch setting described in <u>Table 12</u> is chosen.

Note: Before the first use of the IAR C-SPY debugger please make sure to erase the flash memory using WriteEZ5.

When the *TK-RF8058+SB-EE* evaluation board is connected correctly to the Host PC, the flash is erased and MINICUBE is selected as Debugger driver you shall be able to build, download and debug the sample project. Therefore just press the **Download and Debug** button (\triangleright) or click **Project** \rightarrow **Download and Debug**. After downloading the sample project to the target device the IAR C-SPY debugger shows up and the program execution shall be stopped at the beginning of the **main()** function.

K-RF8058+SB-EE		•<	ENES	ΛS
🔏 IAR Embedded Workbench IDE				
Eile Edit Yiew Project Debug Emulator Too	ils <u>W</u> indow <u>H</u> elp			
	✓ ✓ > > > # E > # 4 > ii: !!! > # 4			
5 I B B B B B B B X				
🔲 🞯 ೫ 🖉 📕 🥒				
Workspace >	main.c	Disassembly		×
Debug 💌	85 #define TEST DATA LEN 20	Go to	 Memory 	• 🗈
Files #: Dial Image: Strain S	<pre>66 SR_UB gTestData[] = { 0x7e ,0xff ,0x00 ,0x01 ,0x02 ,0x03 ,0x04 ,0x05 , 87 99 /// Main Loop 91 /// Main Loop 91 /// — 9 2 woid main() { 93 SR_UB ch,ch2,i,j,flg,len,rssi,t_restart,dst,kk,th,lqi,fl</pre>	01936 01938 01938 0193B 0193E 0193F void main() { main: 01940 01941	2052 4629 0D 0A0D0A 00 00 00 C3 C5	SUBW SP. CMPW AX. ADD A. ADD S: F NOP NOP PUSH DE PUSH DE
	94 SK_UW uw,uw2,uw3,uw1,uw2,tm,wd,ff; 95 SK_W p,gTemp; 96 SK_H perl,per2,temp2,avg_rssi,avg_lqi; 97 SK_UB destMACShort[2]; 98 static SK_UW nReceiveCount,nRSSItotal,nSendCount,nSendTo, temp, nLQItot	01942 <u>temp = 0</u> 01944 01947 0194A 0194B 0194E	2040 3634D0 300000 BB 300000 BC02	SUBW SP, MOVW HL, MOVW AX, MOVW [H1 MOVW AX, MOVW AX, MOVW [H1
	100 static SK_UE nPSSImin,nPSSImax,nL0Imin,nL0Imax; 101 temp = 0; 102 1qi = 0; 103 th = 0; 104 ccca 0; 105 avg rssi = 0;	<u>101 = 0;</u> 01950 01952 <u>th = 0;</u> 01954 01956 <u>cca= 0;</u>	5100 981E 5100 983A	MOV A. MOV [SE MOV A. MOV [SE
	106 avg_lqi = 0; 107 freq = 0x80; 108 ff = 0; 109 temp_lmhz = 0;	01958 0195A avg rssi = 0 0195C 0195F	981F 300000 B838	MOV A, MOV [SE MOVU AX, MOVU [SÉ
	110 gnCurrentChannel = 11; // 2405MHz 111 gnCurrentFreq = 2405; 112 Hardware Initialize();	01961 01964 freg = 0x80;	300000 B836	MOVU AX. MOVU [SÉ
	113 114 // MAC Address (DipSW 3.6)	01966 01968 ff = 0;	5180 9829	MOV A. MOV [SE
	116/#100E maxaouxx 116/// gaMACLong[7] = gaMACLong[7] + (MAC_ADDR) - 1; 117 // gaMACLong[7] = gaMACLong[7] + (MAC_ADDR) - 1; 118 gaMAC_ADDR [0] = (SK_UB) (MAC_ADDR) - 0; 119 gaMAC_ADDR [1] = (SK_UB) (MAC_ADDR); 120 gaMACLong[2] = gaMACLong[2] + gaMAC_ADDR[1]; 121 gaMACLong[3] = gaMACLong[3] + gaMAC_ADDR[1]; 122 gaMACLong[0] = gaMACLong[0] + gaMAC_ADDR[0];	0196A 0196C 0196F 01970 01973 01974 01977 temp 1mhz = 01979 01979	AEF8 043C00 16 300000 BB 300000 BC02 0 5100 9828	MOVW AX, ADDW AX, MOVW HI, MOVW AX, MOVW [HI MOVW AX, MOVW [HI MOV A, MOV A,
RFTest	123 geMACShort[1] = geMACShort[1] + geMAC_ADDR[1]; 124 #else fo	gnCurrentCha 0197D	CF3CD00B	2405MHz MOV N·c

Test 124#else				97D CE3CD00B	
Log	Go to	Memory	• • 1	 nn	
Wed Apr 14 14:16:05 2010: Download complete. Wed Apr 14 14:16:05 2010: Loaded debugee: C\Data\RF4CE\78K0R_UDSTICK_RF_Test_IAF Wed Apr 14 14:16:05 2010: Target reset Wed Apr 14 14:16:05 2010: 78K0R MINICUEE Executor E1.15b OCD Contol Code V1:00 (B) Device chipname: uPD78F1146_54(114664), file version: V3:00 Boardinfo: 00008004, product id: 4100 version: A firmware version: 04.06f	00000000 0000010 0000020 0000030 0000050 0000050 00000060 0000070 0000070	d0 00 d4 00 ff ff 8b 05 ff ff fd d0 5 ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff	if if<	fif fif <td></td>	
ebug Log Build ×	900000a0	ff ff ff ff ff ff ff	ff ff ff ff ff	ff ff ff ff ff	
y				pos 00000000	NUM OVR

Figure 33: IAR C-SPY debugger window

To run the application press the **Run** button²². After pressing the run button the **receiver** is in the reception mode.

8.1.5 Setting up HyperTerminal for the transmitter

When the software is flashed into the transmitter device and the switches are set up correctly the software can be tested by using a terminal program.

In this document the Microsoft™ HyperTerminal is used, but in fact any kind of other terminal tool should be sufficient, too.

To open Microsoft[™] HyperTerminal please press Start → All Programs → Accessories → Communication → HyperTerminal from your Microsft[™] Windows.

First of all a new connection has to be configured as follows.

1. Insert a Name of the new configuration (for example: "transmitter")



Connection Description	?×
New Connection	
Enter a name and choose an icon for the connection:	
Name:	
transmitter	
leon:	
	2
OK Car	ncel

Figure 34: HyperTerminal Connection Description

 Select the correct COM Port. If you are not sure about the COM port number, click Start → Settings → Control Panel → System → Hardware → Device Manager and check the number at "Renesas Electronics Starter Kit Virtual UART" under "Ports (COM & LPT)".

Connect To	? 🛛
쵫 transmitt	er
Enter details for	the phone number that you want to dial:
Country/region:	Germany (49) 💌
Ar <u>e</u> a code:	0049
Phone number:	
Co <u>n</u> nect using:	COM17 🗸
	COM1
	COM17 COM13
	TCP/IP (Winsock)

Figure 35: HyperTerminal COM Port selection

3. Setting the COM properties as follows

COM17 Properties	? 🗙
Port Settings	
	_
Bits per second: 115200	
Data bits: 8	
Parity: None	
Stop bits:	
Elow control: None	
<u>R</u> estore Defaul	ts
OK Cancel A	pply

Figure 36: HyperTerminal COM Port properties

User's Manual R20UE0001ED0100

TK-RF8058+SB-EE



After pressing "ENTER" on the keyboard the opening menu will show up in the HyperTerminal window.

🗞 transmitter - HyperTerminal
Eile Edit View Call Iransfer Help
[Set channel to 26 (Current)] << 78F8058 RF Test : MAR 2010 >> 1. PER test / sender (shift+1 Retry result) 2. PER test / receiver 3. Continuous TX / Pseudo Noise 4. Continuous TX / Raw carrier
5. RX mode 6. Idle mode 8. Standby mode 9. Deep Sleep mode 0. Power down mode
A. Set RF channel C. Disable CSMA/CA M. Manually set RF registers P. Packet receive report: RSSI/LQI T. Packet Transmission for the command P R. Reset RF
My MAC_ADDR = 0x0001 Command? >
Connected 0:10:26 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo

Figure 37: RF-Test project opening window

If the opening window is not displayed after pressing "ENTER" please check the following. Set SW1 of the **transmitter** from **USB** to **BAT** and back to **USB** once.

8.1.6 Transmit/Receive test

The sample software provides a so called PER (<u>Packet Error Rate</u>) test. To start this test, insert 1 in the HyperTerminal. You will see the [MyProfile] and will be asked to insert the Short Address (MAC_ADDR) of the destination. Make sure that the **receiver** is running at this time in the IAR C-SPY debugger. The **receiver** address is 0x0002. So please insert 0002 in the HyperTerminal. Now you are asked how many packets you want to send to the **receiver** in this test. 1000 is a sufficient amount of packets. As last information you have to insert the interval time of the packets to send to the **receiver** in msec. Here a time between 3-10 msec is sufficient.

🗞 transmitter - HyperTerminal	
Elle Edit View Call Iransfer Help	
5. RX mode 6. Idle mode 8. Standby mode 9. Deep Sleep mode θ. Power down mode	
A. Set RF channel C. Disable CSMA/CA M. Manually set RF registers P. Packet receive report: RSSI/LQI T. Packet Transmission for the command P R. Reset RF	
My MAC_ADDR = 0x0001 Command? >1 (PER test/sender) [My Profile]	III
MAC : 22:95:00:01:00:00:00:47 Short : 0001 PanID : 2514	
Send to (Short addr) ? : 0002 Send count (dec) ? : _	
Connected 0:02:09 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo	

Figure 38: HyperTerminal RF-Test PER test

After a short time you will get the result displayed in the HyperTerminal window of the transmitter.



🗞 transmitter - HyperTerminal	
Eile Edit View ⊆all Iransfer Help	
PanID : 2514	
Send to (Short addr) ? : 0002 Send count (dec) ? : 1000 Interval (dec/msec) ? : 4 [Set channel to 11 (Cmd)] Prepare to send0K [Set channel to 11 (Current)] Request to result0K [Results]	
 From : 0001 To : 0002	
Sent : 1000 Received : 1000 PER : 0.0000% RSSI : max FA / min CC	
Press any key to the menu -	
Connected 1:24:19 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo	

Figure 39: RF-Test PER test result

The result is shown as a list of Sent, Received, PER and RSSI (Received Signal Strength Indication).

RSSI is expressed in a hexadecimal value of 256 levels, which indicates the signal strength in the received signal. For more details of the RSSI value, please refer to the datasheet of the UZ2400 RF chip. Please note the PER and the RSSI are measured at the receiver side. The receiver does not send back the test packets, but only the test result.

8.1.7 Channel selection

In the previous example, you may have also found the RF channel used in this test is the Channel 11. The channel is specified by the IEEE 802.15.4 specification. Channel 11 is assigned at 2405 MHz. You can change the channel used for the PER test in 5MHz steps to the maximum channel of 26th at 2480 MHz. To do so, please press "A" in the HyperTerminal when you are in the opening window. Then, please choose the channel by "+", "-", "A", "B", or "C". In the example below, the channel 23th, 2465 MHz, was selected.

🗣 transmitter - HyperTerminal	
Elle Edit View Call Iransfer Help	
0. Power down mode	
A. Set RF channel C. Disable CSMA/CA M. Manually set RF registers P. Packet receive report: RSSI/LQI T. Packet Transmission for the command P R. Reset RF	
My MAC_ADDR = 0x0001 Command? >[My Profile]	
MAC : 22:95:00:01:00:00:00:47 Short : 0001 PanID : 2514	
A (Set RF channel)	
Select Channel: [-] decrease channel [+] increase channel [Enter]Set [ESC] Cancel [A]2405MHz [B]2440MHz [C]2480MHz RF Channel : 2465MHz (Ch:23)	

Figure 40: RF-Test Channel selection

TK-RF8058+SB-EE



To start a PER test at channel 23 now, press "ENTER" on your keyboard to get back to the Opening window and press "1" once more. To run the test insert the receiver short address, the amount of packets to send and the interval time again. Please check that the correct channel is selected for communication, shown in the **transmitter** window.

🗞 transmitter - HyperTerminal	
Elle Edit View Call Iransfer Help	
PanID : 2514	
Connected 1:53:16 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo	

Figure 41: RF-Test PER test Channel 23

8.1.8 Output power adjustment

(

The RF-Test project also provides the functionality to adjust the used output power. To do this press "M", when being the opening window.

🗞 transmitter - HyperTerminal	
<u>E</u> ile <u>E</u> dit <u>V</u> iew <u>C</u> all <u>I</u> ransfer <u>H</u> elp	
	- 1 -
Ø. Power down mode	
A. Set RF channel C. Disable CSMA/CA M. Manually set RF registers P. Packet receive report: RSSI/LQI T. Packet Transmission for the command P R. Reset RF	
My MAC_ADDR = 0x0001 Command? >[My Profile]	
MAC : 22:95:00:01:00:00:00:47 Short : 0001 PanID : 2514	
M (Manually set RF reg)	
0 dBm: LREG253=0x00, LREG274=0xC4/0xC6(DCDC on/off), LREG203=0x00 -16 dBm: LREG253=0x0C, LREG274=0x81, LREG203=0xF8 -24 dBm: LREG253=0x0C, LREG274=0x09, LREG203=0xF8 -32 dBm: LREG253=0x02, LREG274=0x01, LREG203=0xF8 -40 dBm: LREG253=0x08, LREG274=0x01, LREG203=0xF8 Register:	
Connected 1:59:00 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo	

Figure 42: RF-Test Output power adjustment 1

You will be asked to insert the register ID. Please input "**274**". Then you will see, "LREG[274] : C4 >". It means the current value at the register [274] is 0xC4h, which means 0 dB. 0xC4h is the reset default.

LREG[274]: [7:6] -> large scale tuning C4: 0 dB 81: -8 dB 09: -16 dB 01: -24 dB LREG[203]: [7:3] -> small scale tuning 000000: 0 dB 000001: -0.1dB | 111111: -8.00 dB

User's Manual R20UE0001ED0100

TK-RF8058+SB-EE



So if you wish, for instance, a power adjustment of -8dB, please insert "81". Then start the PER test again and insert the receiver short address, packet count and interval time.

You may find a larger PER and a smaller RSSI value in this case.

🗣 transmitter - HyperTerminal	
Ele Edit ⊻iew ⊆all Iransfer Help	
D 🖨 📨 🕉 🗈 🗃	
PanID : 2514	
[Results] From : 0001 To : 0002	
Sent : 1000 Received : 1000 PER : 0.0000% RSSI : max CD / min C7	
Press any key to the menu	
Connected 0:16:56 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo	.:

Figure 43: RF-Test PER test power adjusted

Note: Only the transmitter output power is adjusted. The receiver always sends back the result with a 0db adjusted output power.

8.1.9 Further RF-Test modes and settings

8.1.9.1 PER test /receiver

Pressing "2" in the opening window sets the TK-RF8058+SB-EE demonstration kit in the receiver mode of the PER test. In fact this is the mode, in which the **receiver** is set to, in the predefined debug configuration for the IAR C-SPY debugger.

8.1.9.2 Continuous TX / Pseudo Noise

Pressing "3" in the opening window initiates a modulated RF transmission. The data carried are pseudo random numbers. You can define the channel using the menu "A" from the opening window, and the output power using the menu "M".

8.1.9.3 Continuous TX / Raw Carrier

Pressing "4" in the opening window initiates the carrier transmission. The output power is not 0 dB as a reset default. You can define the channel using the menu "A".

8.1.9.4 RX Mode

Pressing "5" in the opening window initiates the receiver mode.

8.1.9.5 IDLE Mode

Pressing "6" in the opening window sets the UZ2400 into the IDLE mode.



8.1.9.6 Standby Mode

Pressing "8" in the opening window sets the UZ2400 into the Standby mode.

8.1.9.7 Deep Sleep Mode

Pressing "9" in the opening window sets the UZ2400 into the Deep Sleep mode.

8.1.9.8 Power down mode

Pressing "0" in the opening window sets the UZ2400 into the Power down mode.

8.1.9.9 Resetting RF

Pressing "R" in the opening window allows you to reset the UZ2400 registers.



9. Bill of Materials

9.1 SB-UD board

No.	Mount	Mount Parts Reference	Unmount Parts	Туре	Parts No	Maker	Note
4				Ob ant Da d			
1	0		5_5W1, 5_LED1, A/D1,	Short Pad	55		
			S SW2, S_LED2, A/D2,				
2	0		SO SI SCK	Short Pad	SO		
3	2	BT1 BT2		Batt case	2460	KEYSTONE	
4	0		CN1	Connecter	HIF3H-50DA-2.54DSA	HIROSE	
5	0		CN2	Connecter	HIF3H-20DA-2.54DSA	HIROSE	
6	1	C1		Chip ceramic cap	2.2uF		
7	1	C2		Tantal cap	F931A476MCC	NICHICON	
8	1	C3		Chip ceramic cap	10uF		
9	8	C6, C7, C11, C12, C13,	C4, C5	Chip ceramic cap	0.1uF		
		C14, C15, C16					
10	2	C10,C8		Chip ceramic cap	0.47uF		
11	1	C9		Aluminum	4.7uF/25V		
				Electrolytic Cap			
12	1	FP1		Connecter	HIF3FC-16PA-2.54DSA	HIROSE	
13	2	JP1,JP4		Connecter	FFC-2AMEP1	HONDA	
14	3	JP2,JP3,JP5		Connecter	FFC-3AMEP1	HONDA	
15	1	J1		Connecter	DF17(3.0)-60DS-0.5V(57)	HIROSE	
16	1	J2		Terminal	T-16-Red	SATO PARTS	
17	1	J3		Terminal	T-16-Black	SATO PARTS	
18	3	LED1,LED2,LED3		LED	SML-311UTT86	STANLY	
19	1	LED4		LED	PG1112H	ROHM	
20	1	L1		inductor	CDRH5D28NP-8R2NC	Sumida	
21	1	L2		Filter	BLM41PG750S	MURATA	
22	1	MR1		resistor module	CN1E4K-105J	KOA	
23	0		P2,P1	Connecter	XR2C-1011N	OMRON	for A&D
24	1	Q1		IC	TPS851	TOSHIBA	
25	2	R1,R44		Chip resistor	120		
26	8	R2, R3, R4, R32, R33,	R24,R25,R26,R28	Chip resistor	1.5K		

User's Manual R20UE0001ED0100

TK-RF8058+SB-EE

RENESAS

No.	Mount	Mount Parts Reference	Unmount Parts	Туре	Parts No	Maker	Note
	Quantity		Reference				
		R38, R42, R45					
27	1	R5		Chip resistor	7.5K		
28	2	R7,R8		Chip resistor	390K		
29	1	R16		Chip resistor	487K		
30	1	R17		Chip resistor	562K		
31	1	R18		Chip resistor	909K		
32	2	R20,R21		Chip resistor	187K		
33	1	R22		Chip resistor	182K		
34	4	R27,R34,R37,R43	R29,R31	Chip resistor	100K		
35	2	R39,R40	R30	Chip resistor	27		
36	4	R6,R35,R36,R41		Chip resistor	10K		
37	0			Chip resistor	100		
38	4	SW1,SW2,SW3,SW7		Switch	SKQMBB	ALPS	
39	1	SW4		Switch	CHS-08B	COPAL	
40	2	SW6,SW5		Switch	SSSS223600	ALPS	
41	0		TPU1, TPU2, TPU3, TPU4, TPU5, TPU6, TPU7, TPU8, TPU9	Trough hole	TPU		
42	0		TP1, TP2, TP3, TP4, TP5	Terminal	LC-2	MAC8	
43	1	USB1		Connecter	UX60A-MB-5ST	HIROSE	
44	1	U1		IC	S-8120CNB	SII	
45	1	U2		IC	TPS61020DRC	TI	
46	0		U3	IC	SN74LVC3G07DCT	TI	For SIO I/F
47	1	U5	U4	IC	SN74LVC2G125DCU	TI	
48	1	U6		IC	SN74LVC2G07DCK	TI	
49	1	U7		IC	UPD78F0730MC	NECEL	
50	1	U8		IC	SN74LVC1G125DCK	TI	
51	1	U9		IC	SN74LVC2T45DCU	TI	
52	1	Y1		IC	CSTCE16M0V53-R0	MURATA	
53	5	JP1,JP2,JP3,JP4,JP5		Jumper	HIF3GA-2.54SP	HIROSE	
54	0		R9, R10, R12, R13, R14, R15, R19	Chip resistor			For K0R
55	3	R11,R23,R46		Chip resistor	0		For K0R

Table 14: SB-UD Bill of Material

User's Manual R20UE0001ED0100

TK-RF8058+SB-EE

RENESAS

RENESAS

9.2 MB-RF8058 board

No.	Mount	Mount Parts Reference	Unmount Parts	Туре	Parts No	Manufacturer
	Quantity		Reference			
1	1	CN1		Connecter	901-144-8RFX	AMPHENOL
2	5	C2, C5, C6, C11, C15		Chip ceramic cap	47pF	
3	4	C4, C7, C10, C16		Chip ceramic cap	0.01uF	
4	2	C8, C18		Chip ceramic cap	1uF	
5	1	C9		Chip ceramic cap	39pF	
6	1	C12		Chip resistor	0	
7	2	C24, C13		Chip ceramic cap	0.1uF	
8	3	C14, C1, C3		Chip ceramic cap	10pF	
9	1	C17		Chip ceramic cap	0.47uF	
10	1	C19		Chip ceramic cap	4.7uF/10V	
11	2	C23, C20		Chip ceramic cap	10uF/10V	
12	1	C21		Chip ceramic cap	3pF	
13		C22		Chip ceramic cap	4pF	
14	1	F1		Filter	LDB212G4020C-001	MURATA
15	1	J1		Connecter	DF17(2.0)-060DP-0.5V(57)	HIROSE
16	1	L1		inductor	LQG15HN3N9S02	Murata
17	1	L2		inductor	LQH2MCN8R2M02	MURATA
18	0		L3, L4	inductor		
19	1	R1		Chip resistor	1M	
20	7	R2, R4, R5, R7, R8, R9, R10		Chip resistor	10K	
21	1	R3		Chip resistor	0	
22	0		R6	Chip resistor		
23	0		TP1,TP2,TP3,TP4	Check Pin	LC-33	
24	1	U1		IC	uPD78F8058	NECEL
25	0		VDD_R,VDD	Short pad	SS	
26	1	Y1		Resonator	NX3225SA-32.000M-STD-CSR-3	NDK
27	1	Y2		Resonator	SSP-T7-FL 3.7pF	SII

Table 15: MB-RF8058 Bill of Material

RENESAS

10. Cables

10.1 USB interface cable (Mini-B type)



Figure 44: USB interface cable (Mini-B type)



11. Schematics

Please find the schematics attached to this document. To open the attachments view in the Adobe Reader press the paper clip in the lower left corner of the window. To open the attachment double click the TK-RF8058+SB_schematics.pdf.



[MEMO]