

User's Manual

78K0R-UD-STICK-EE

Demonstration Kit for Renesas Electronics µPD78F1146 Zigbee[™] / RF4CE[™] ready Wireless Network Evaluation Stick

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CE0682

This equipment complies with directive 1999/5/EC

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EEDT-ST-004-10

CAUTION

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Revision History

Date	Revision	Chapter	Description
04-16-2010	V1.00		First release



Table of Contents

1.	Introduction	11
1.1	Package contents	11
1.2	Features	11
1.3	System requirements	11
1.4	Trademarks	11
2.	Hardware	12
2.1	Block diagram	
2.2	SW1: Power supply selection	12
2.3	SW2: USB setting	
2.4	LED1: Power LED	
2.5	LED2-LED4	
2.6	CN2 connector	15
2.6	.1 Connection of 78K0R-UD-STICK-EE adapter board	15
2.7	USB programming and debugging interface	
2.8	U1 Temperature sensor (S-8120CNB)	
2.9	Power supply	
-		
3.	78K0R-UD-STICK-EE installation and operation	17
3.1	Getting started	
3.2	CD-ROM contents	
3.3	Pre-programmed Demo-Application	17
4.	Hardware installation	18
5.	Software installation	19
5. 5.1	Software installation	19
5. 5.1 5.2	Software installation IAR Systems Embedded Workbench for 78K installation WriteEZ5 installation	19
5. 5.1 5.2 5.3	Software installation IAR Systems Embedded Workbench for 78K installation WriteEZ5 installation Sample projects installation	19
5. 5.1 5.2 5.3 5.4	Software installation IAR Systems Embedded Workbench for 78K installation WriteEZ5 installation Sample projects installation USB Driver Installation	19
5.1 5.2 5.3 5.4 5.4	Software installation IAR Systems Embedded Workbench for 78K installation WriteEZ5 installation Sample projects installation USB Driver Installation	
5. 1 5.2 5.3 5.4 5.4	Software installation IAR Systems Embedded Workbench for 78K installation WriteEZ5 installation Sample projects installation USB Driver Installation .1 Installation on Windows 2000 .2	
5.1 5.2 5.3 5.4 5.4 5.4 5.4 5.4	Software installation IAR Systems Embedded Workbench for 78K installation WriteEZ5 installation Sample projects installation USB Driver Installation 1 Installation on Windows 2000 2 Installation on Windows XP Confirmation of USB Driver Installation	
 5.1 5.2 5.3 5.4 5.4 5.4 5.5 6. 	Software installation IAR Systems Embedded Workbench for 78K installation WriteEZ5 installation Sample projects installation USB Driver Installation 1 Installation on Windows 2000 2 Installation on Windows XP. Confirmation of USB Driver Installation Flash Programmer WriteEZ5.	
 5.1 5.2 5.3 5.4 5.4 5.4 5.5 6. 6.1 	Software installation IAR Systems Embedded Workbench for 78K installation WriteEZ5 installation Sample projects installation USB Driver Installation	19191921
 5.1 5.2 5.3 5.4 5.4 5.5 6. 6.1 6.2 	Software installation IAR Systems Embedded Workbench for 78K installation WriteEZ5 installation Sample projects installation USB Driver Installation 1 Installation on Windows 2000 2 Installation on Windows XP. Confirmation of USB Driver Installation Flash Programmer WriteEZ5.	
 5.1 5.2 5.3 5.4 5.4 5.4 5.5 6. 6.1 6.2 7. 	Software installation IAR Systems Embedded Workbench for 78K installation WriteEZ5 installation Sample projects installation USB Driver Installation 1 Installation on Windows 2000 2 Installation on Windows XP. Confirmation of USB Driver Installation Flash Programmer WriteEZ5. Device Setup Using WriteEZ5.	
5. 5.1 5.2 5.3 5.4 5.4 5.4 5.5 6. 6. 7. 7.1	Software installation IAR Systems Embedded Workbench for 78K installation WriteEZ5 installation Sample projects installation USB Driver Installation Installation on Windows 2000 Installation on Windows XP. Confirmation of USB Driver Installation Flash Programmer WriteEZ5. Device Setup Using WriteEZ5. Sample projects RF-Test program	
 5.1 5.2 5.3 5.4 5.4 5.5 6. 6.1 6.2 7. 7.1 	Software installation IAR Systems Embedded Workbench for 78K installation WriteEZ5 installation Sample projects installation USB Driver Installation .1 Installation on Windows 2000 .2 Installation on Windows XP. Confirmation of USB Driver Installation Flash Programmer WriteEZ5 Device Setup Using WriteEZ5 Sample projects	

78K0R-UD-STICK-EE

RENESAS

7.1.2	Predefined project settings	32
7.1.3	Setting up the Transmitter	32
7.1.4	Setting up the Receiver	34
7.1.5	Setting up HyperTerminal for the transmitter	35
7.1.6	Transmit/Receive test	37
7.1.7	Channel selection	38
7.1.8	Output power adjustment	39
7.1.9	Further RF-Test modes and settings	40
7.1.9.1	PER test /receiver	40
7.1.9.2	Continuous TX / Pseudo Noise	40
7.1.9.3	Continuous TX / Raw Carrier	40
7.1.9.4	RX Mode	40
7.1.9.5	IDLE Mode	40
7.1.9.6	Standby Mode	41
7.1.9.7	Deep Sleep Mode	41
7.1.9.8	Power down mode	41
7.1.9.9	Resetting RF	41
7.2 N	IAC sample program: TextChat	41
7.2.1	Preparing the Hardware	41
7.2.2	Running the MAC sample program	41
7.2.2.1	Designation of the Coordinator	42
7.2.2.2	Designation of End Devices	43
7.2.2.3	Text Chat	44
8 B(OM list	16
0. D(-0

9.	Schematics	48
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RENESAS

List of Figures

Figure 1: 78K0R-UD-STICK-EE demonstration board (Top View)	12
Figure 2: 78K0R-UD-STICK-EE Block diagram	12
Figure 3: 78K0R-UD-STICK-EE LED1 (Top View)	13
Figure 4: 78K0R-UD-STICK-EE LED2-LED4 (Top View)	13
Figure 5: 78K0R-UD-STICK-EE CN2 Connector (Top View)	15
Figure 6: Connection 78K0R-UD-STICK-EE adapter board	15
Figure 7: 78K0R-UD-STICK-EE CDROM autorun.exe	19
Figure 8: IAR Embedded Workbench installation screen	20
Figure 9: IAR Embedded Workbench License request and install	20
Figure 10: Found New Hardware Wizard (Windows 2000)	21
Figure 11: Search Method (Windows 2000)	22
Figure 12: Driver File Location (Windows 2000)	22
Figure 13: Address Specification 2 (Windows 2000)	23
Figure 14: Address Specification 3 (Windows 2000)	23
Figure 15: Driver File Search (Windows 2000)	24
Figure 16: USB Driver Installation Completion (Windows 2000)	24
Figure 17: Found New Hardware Wizard 1 (Windows XP)	24
Figure 18: Found New Hardware Wizard 2 (Windows XP)	25
Figure 19: Search Location Specification 1 (Windows XP)	25
Figure 20: Search Location Specification 2 (Windows XP)	26
Figure 21: Windows XP Logo Testing (Windows XP)	26
Figure 22: USB Driver Installation Completion (Windows XP)	27
Figure 23: Windows Device Manager	27
Figure 24: WriteEZ5 Startup	28
Figure 25: WriteEZ5 Device Setup Dialogue	28
Figure 26: WriteEZ5 Device Menu	30
Figure 27: IAR Embedded Workbench Startup screen	31
Figure 28: IAR Embedded Workbench IDE view	32
Figure 29: IAR Embedded Workbench RF-Test project configuration selection	33
Figure 30: IAR Embedded Workbench Debugger Settings	34
Figure 31: IAR C-SPY debugger window	35
Figure 32: HyperTerminal Connection Description	36
Figure 33: HyperTerminal COM Port selection	36
Figure 34: HyperTerminal COM Port properties	36
Figure 35: RF-Test project opening window	37
Figure 36: HyperTerminal RF-Test PER test	37
Figure 37: RF-Test PER test result	38
Figure 38: RF-Test Channel selection	38
Figure 39: RF-Test PER test Channel 23	39
Figure 40: RF-Test Output power adjustment 1	39
Figure 41: RF-Test PER test power adjusted	40
Figure 42: MAC sample program startup screen	42
Figure 43: MAC sample configuration	43
Figure 44: MAC sample End Device	43
Figure 45: MAC sample End Device associated short address	44
Figure 46: MAC sample sending text message	44
Figure 47: MAC sample received message	45



List of Tables

Table 1: Power Supply	13
Table 2: USB I/F setting	13
Table 3: Communication switch setting	13
Table 4: Application LEDs	13
Table 5: 78K0R-UD-STICK-EE CN2 Connector Pin Out	15
Table 6: 78K0R-UD-STICK-EE CD-ROM directory structure	17
Table 7: WriteEZ5 action buttons	30
Table 8: Switch settings for flash programming	33
Table 9: Switch settings for serial communication	33
Table 10: Microsoft™ HyperTerminal COM port properties	42
Table 11: Bill of Materials	47



1. Introduction

1.1 Package contents

- 1 x 78K0R UD Stick
- 1 x Adapter board
- 1 x Battery case
- CD-ROM containing sample applications 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 *78K0R-UD-STICK-EE* demonstration kit package. If any part is missing or seems to be damaged, please contact the dealer from whom you received your *78K0R-UD-STICK-EE* demonstration kit.

1.2 Features

- Zigbee[™]/ RF4CE[™] communication
- Programming / On-chip debug supported
- UBEC UZ2400 Low Power 2.4 GHz Transceiver for IEEE 802.15.4 standard
- Easy to use RF4CE sample projects

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.		
Host interface	A web browser and Adobe Acrobat Reader to be able to access all the product 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 *78K0R-UD-STICK-EE* Demonstration Kit, if available, may be downloaded from the Renesas

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WEB page(s) at http://www.renesas.eu/78K0R-UD-STICK-EE



2. Hardware

This chapter describes the specification of 78K0R UD Stick board delivered with the *78K0R-UD-STICK-EE* demonstration kit.

The *78K0R-UD-STICK-EE* demonstration kit is assembled with a µPD78F1146 16-bit microcontroller and an UBEC UZ2400 Low Power 2.4 GHz Transceiver for IEEE 802.15.4 (Zigbee™) standard.



SW1(Power Source)

Figure 1: 78K0R-UD-STICK-EE demonstration board (Top View)

2.1 Block diagram



Figure 2: 78K0R-UD-STICK-EE Block diagram

2.2 SW1: Power supply selection

The *78K0R-UD-STICK-EE* can be powered either via USB or battery power connection, based on the SW1 setting.



Setting	Power supply
USB	USB power
BAT	CN2: Expansion I/F

Table 1: Power Supply

2.3 SW2: USB setting

SW2 is used to select the functionality of the USB I/F.

Setting	USB
SER	Normal mode (UART3 connection)
DBG	Debug mode

Table 2: USB I/F setting

2.4 LED1: Power LED

LED1 indicates the power supply status. LED1 can be turned off by setting P17 to Output High

Status	LED	
Power ON	On (green)	
Power ON	Off	P17 is Output High
Power OFF	Off	

Table 3: Communication switch setting



Figure 3: 78K0R-UD-STICK-EE LED1 (Top View)

2.5 LED2-LED4

These LEDs are assembled for application usage. They emit orange by setting the port output of P60, P61, or P62 of the μ PD78F1146 to low, respectively.

LED	MCU Pin	Port Level	LED Status
	Dec	Low	LED active
LEDZ	F 02	High	LED off
	P61	Low	LED active
LEDS		High	LED off
	Beo	Low	LED active
LED4	FOU	High	LED off





Figure 4: 78K0R-UD-STICK-EE LED2-LED4 (Top View)

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2.6 CN2 connector

CN2 is an expansion connector (Hirose DF11-10DP-2DS).

Pin	Pin Name	µPD78F1146 connection	Notes
1	GND	GND	
2	Battery	Not connected	Battery supply
3	P12	P12/SO00/TxD0、P77/KR7/INTP11	
4	P11	P11/SI00/RxD0, P76/KR6/INTP10	
5	P141	P141/PCLBUZ1/INTP7, P05/TI05/TO05	
6	P10	P10/SCK00、P75/KR5/INTP9	
7	P25	P25/ANI5	
8	P23	P23/ANI3	
9	P24	P24/ANI4	
10	GND	GND	

Table 5: 78K0R-UD-STICK-EE CN2 Connector Pin Out



Figure 5: 78K0R-UD-STICK-EE CN2 Connector (Top View)

2.6.1 Connection of 78K0R-UD-STICK-EE adapter board

The *78K0R-UD-STICK-EE* Adapter board can be connected to the *78K0R-UD-STICK-EE* demonstration board via connector CN2.



Figure 6: Connection 78K0R-UD-STICK-EE adapter board

CN2 of the adapter board is the connector for the battery case. CN3 is a multi purpose connector.



2.7 USB programming and debugging interface

The *78K0R-UD-STICK-EE* evaluation board implements an on-board USB programming and debugging interface using the Renesas Electronics μ PD78F0730 USB microcontroller. You can download code to the μ PD78F1146 microcontroller from a host computer, and then proceed to debug that code (for information about debugging refer to the regarding chapter).

2.8 U1 Temperature sensor (S-8120CNB)

The temperature sensor "U1" (S-8120C from Seiko Instruments Inc.) is connected to the A/D converter input pin "P27/ANI7" of the μ PD78F1146. For detailed information regarding the temperature to voltage ratio please refer to the temperature sensor data sheet (432-01173-0-S-8110C-8120C_series.pdf) in the directory "\Doc" of the demonstration kit CD-ROM.

2.9 Power supply

The *78K0R-UD-STICK-EE* can be powered by two different sources, USB or an AA battery via CN2 and the 78K0R UD Stick Adapter Board, based on the setting chosen by <u>SW1</u>.

If using the battery as power supply, please make sure to replace the battery if the voltage level goes below 0.9V, as below this voltage level the functions of the board can not be guaranteed. The battery voltage can be checked as follows.

26.4% of the battery output voltage is available at ANI6 (P26/ANI6). If the supply voltage falls below 1V, the signal of "P30/INTP3/RTC1HZ" will be LOW output. Use the internal pull-up resistor (PU3).

3. 78K0R-UD-STICK-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 *78KOR-UD-STICK-EE* demonstration kit. As communication interface between the PC host system and the *78KOR-UD-STICK-EE* 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:

78K0R-UD-STICK-EE	CD-ROM ROOT
C Acrobat	- Acrobat Reader for 32Bit Windows OS
Doc	- Documentation
Driver	- 78K0R-UD-STICK-EE USB driver files
IAR Systems Tools	- IAR Embedded Workbench for 78K
Sample projects	- Sample projects for the <i>78K0R-UD-STICK-EE</i> demonstration kit
C WriteEZ5	 Flash Programmer WriteEZ5 incl. PRM file for µPD78F1146

Table 6: 78K0R-UD-STICK-EE CD-ROM directory structure

3.3 Pre-programmed Demo-Application

The *TK-RF8058+SB-EE* demonstration kit is pre-programmed with the RF-Test software. For further information about this program please refer to <u>chapter 7.1</u>.



4. Hardware installation

After unpacking the *78K0R-UD-STICK-EE* demonstration kit, connect the board with your host computer. When 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 *78K0R-UD-STICK-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 µPD78F1146



Figure 7: 78K0R-UD-STICK-EE CDROM autorun.exe

5.1 IAR Systems Embedded Workbench for 78K installation

To install the IAR Systems Embedded Workbench for 78K including C-SPY debugger / simulator press the regarding button from the Autorun of the CD-ROM provided within the *78K0R-UD-STICK-EE* package. 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 78K	
QuickStart installation information	
Install IAR Embedded Workbench [®]	
💮 Install visualSTATE [®]	
htm Release notes	
View the product documentation	
Install Adobe Acrobat Reader	
Explore the CD	
Exit	SYSTEMS
	www.iar.com

Figure 8: IAR Embedded Workbench installation screen

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

Welcome to	IAR System	● 日本語 (Japanese) S
IAR Embedded Work	pench [®] Kickstart installa	tion
You must have a license nu Embedded Workbench.	nber and an installation key to ins	tall this evaluation version of IAR
Follow these steps: 1. Click the IAR online regis 2. You will receive an email 3. Click the Install IAR Embo	tration link below to register on the with your license number and insta added Workbench [®] link below to s	e IAR Systems website. allation key within a few minutes. start the installation.
html IAR online registration		
Install IAR Embedded	Workbench [®]	

Figure 9: IAR Embedded Workbench License request and install

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



5.2 WriteEZ5 installation

To install WriteEZ5 just press the regarding button from the Autorun of the CD-ROM provided within the *78K0R-UD-STICK-EE* package. 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.

5.3 Sample projects installation

To copy the sample projects to the Host PC hard drive press the regarding button from the Autorun of the CD-ROM provided within the *78K0R-UD-STICK-EE* package. The setup dialogues will guide you through the copying process. The copy can also be started by executing the 78K0R-UD-STICK-EE_sample_projects.exe in the directory "\Sample projects" of the CD-ROM.

5.4 USB Driver Installation

In order to use the *78K0R-UD-STICK-EE* evaluation board the USB driver needs to be installed on the host machine. Install the driver according to the following procedure:

Installation on Windows 2000	Page 21
Installation on Windows XP	Page 24

5.4.1 Installation on Windows 2000

1. When the *78K0R-UD-STICK-EE* 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>.

Found New Hardware Wizard	
	Welcome to the Found New Hardware Wizard This wizard helps you install a device driver for a hardware device.
	Click.
	< <u>Back</u> Cancel

Figure 10: 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>.

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

	Found New Hardware Wizard
	Locate Driver Files Where do you want Windows to search for driver files?
	Search for driver files for the following hardware device:
Check that "Specify location" only is checked	a d. 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 CD-ROM drives
	✓ Specify a location ✓ Specify a location ✓ Microsoft Windows Update < Back

Figure 12: Driver File Location (Windows 2000)

- 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.

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.ocate File						? ×
Look in:	Driver		•	🗢 🔁	-111 📩	
History Desktop My Documents My Computer	MQB25ALL					
	File <u>n</u> ame:	MQB2SALL.inf			•	<u>O</u> pen
My Network P	Files of <u>type</u> :	Setup Information (*.inf)				Cancel
	Figure 13:	Address Specificatio	on 2 (Wind	lows 20	00)	_
					Click.	

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

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

Figure 14: Address Specification 3 (Windows 2000)

7. Click Next>.



User's Manual R20UE0002ED0100



Figure 15: Driver File Search (Windows 2000)

Click.

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



Figure 16: USB Driver Installation Completion (Windows 2000)

5.4.2 Installation on Windows XP

1. When the *78K0R-UD-STICK-EE* 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 17: Found New Hardware Wizard 1 (Windows XP)

78K0R-UD-STICK-EE



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



Figure 18: 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.



Figure 19: Search Location Specification 1 (Windows XP)

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



Br	rowse For Folder	
2	Select the folder that contains drivers for your hardware	э.
	🗄 🚞 Acrobat	^
	표 🚞 Device file package	_
	🖽 🧰 Doc	
	Civer Driver	
	표 🚞 IAR Systems Tools	
	🗄 🚞 RF4CE Remote Control	_
	🗄 🚞 Samples projects	
	🗄 🚞 Tessera Documents	
	🖽 🚞 WriteEZ5	~
	< >	_
-	To view any subfolders, click a plus sign above.	
	OK Cancel	

Figure 20: 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.

	Har dwar	e 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. (Tell me why this testing is important.) 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
Click		contact the naroware vendor for software that has passed Windows Logo testing.
		Continue Anyway

Figure 21: 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 22: USB Driver Installation Completion (Windows XP)

5.5 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 *78K0R-UD-STICK-EE* 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 23: 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	
/ 🔑 🕞 🖏 🖌 😻 😺	
FlashOpenning FlashOpen OK Sourcess Read ParameterFile.	Name : Firmware :
	Parameter file – Name : 78F1146 Version : V1.00
	Load file Date : Chksum : Area :
	Connection to device Port: COM7 Speed 115200bps Range Chip Freq.: Internal-OSC Multiply: 1.00
Ready	NUM

Figure 24: 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) of the μ PD78F1146 is located on the CDROM. It can be found 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 78F1146.prm PRM File Read
Host connection Supply oscillator
Port COM13 Frequency Internal-OSC MHz
Speed 115200bps V Multiply rate 1.00
Operation Mode
Chip Start 000
C Block End 127
🔿 Area 📃 Show Addres
Target Reset Message
OK Cancel

Figure 25: WriteEZ5 Device Setup Dialogue

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

RENESAS



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.

🖥 WriteEZ5 📃 🗖 🔀				
File Device View Help	_			
Blank Check Erase Program		Device		
Flast Verify >> P Succ Succ Security >> L CheckSum		Name : Firmware :		
Succ >>C(Autoprocedure(EPV)		Parameter file Name : 78F8058		
Signature read Get Security settings		Version : V1.00		
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 26: WriteEZ5 Device Menu



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



7. Sample projects

The *78K0R-UD-STICK-EE* demonstration kit comes with two sample applications, a RF-Test program, which is provided as an IAR Embedded Workbench project, and a simple MAC application utilizing an IEEE 802.15.4 PHY/MAC standard star network, provided as hex file. To be able to run these projects please run the <u>Sample projects 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. For functional testing of these sample projects it is necessary to have at least two *78K0R-UD-STICK-EE* demonstration kits.

7.1 RF-Test program

To run this sample application with all possible tests, it is mandatory that you have at least two *78K0R-UD-STICK-EE* demonstration kits. Furthermore you need an identical number of PCs or one PC with more than one USB interface. Hereinafter, the first 78K0R-UD-STICK-EE demonstration kit is called "**transmitter**" and the other one with USB interface to the second PC or USB Port for debugging is called "**receiver**", which send back the test result to the **transmitter**.

7.1.1 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 🛛 🔯						
	<u>C</u> reate new project in current workspace					
	Add existing project to current workspace					
	Open existing workspace					
	Example applications					
<u>R</u> ecent w	<u>R</u> ecent workspaces:					
	Open					
<u>D</u> o not show this window at startup						
	Cancel					

Figure 27: IAR Embedded Workbench Startup screen

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

78K0R-UD-STICK-EE



🔀 IAR Embedded Workbench IDE				
<u> E</u> ile <u>E</u> dit <u>V</u> iew <u>P</u> roject <u>T</u> ools <u>W</u> indow <u>H</u> elp				
□ ※ 目 創 長 ½ 略 記 >> >> ▼ <> >> ▼ <> >> ★ <				
Workspace × main c				
Debug	85 #define TEST DATA LEN 20			
Files 80 BB	86 SK_UB gTestData[] = { 0x7e ,0xff ,0x00 ,0x01 ,0x02 ,0x03 ,0x04 ,	Jx05 ,0x06 ,0x07 ,0x0		
E BETest - Debug	87			
⊢⊞ Chardware 78k0r.c	88			
🚽 🖸 main.c	90 // Main Loop			
–⊞ 🖸 uart_interface.c	91 //			
□	92 void main() {			
	93 SK_UB ch,ch2,i,j,flg,len,rssi,t_restart,dst,kk,th	,lqi,freq,temp_lmhz,c		
	94 SK_UW uw2,uw2,uw3,1w1,1w2,tm,wd,rr;			
	96 SK H perl,per2,temp2,avg rssi,avg lgi;			
	97 SK_UB destMACShort[2];			
	98			
	99 static SK_UW nReceiveCount,nRSSItotal,nSendCount,nSendTo, temp, m	hLQItotal;		
	101 temp = 0:			
	102 lqi = 0;			
	103 th = 0;			
	104 cca= 0;			
	$105 avg_{rss1} = 0;$			
	$100 avg_1q1 = 0;$ 107 freg = 0x80;			
	108 ff = 0;			
	109 $temp_lmhz = 0;$			
	110 gmCurrentChannel = 11; // 2405MHz			
	<pre>111 gmturrentFreq = 2405; 112 Hardware Initialize();</pre>			
		-1		
RFTest		•		
×				
Messages	File	Line		
Duilding configuration: RFT est - Debu	9			
opdating band tee				
Configuration is up-to-date.				
p				
Build Find in Files Debug Log		×		
Ready	Errors 0, Warnings 0			

Figure 28: IAR Embedded Workbench IDE view

7.1.2 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 *78K0R-UD-STICK-EE* 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>.

7.1.3 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				
Eile Edit View Project Tools Window Help				
D 😂 🖬 🕼 & ™ 🖻 ♡ ♡ 🔽 🖉 🖌 🧏 🔽 🗩 🖉 🚱 🖉 🐼 😓 ♪ ♪				
Workspace × main.c				
Release 0001 🔹	85 #define TEST DATA LEN 20			
Debug	86 5K_UB gTestData[] = { 0x7e ,0xff ,0x00 ,0x01 ,0x02 ,0x03 ,0x04 ,0x05 ,0x06 ,0x07 ,0x04			
Release 0002	87			
He hardware 78k0r.c				
- 🕀 🖸 main.c	99//			
🗕 🕀 🖻 uart_interface.c	91 //			
🖃 🖸 ubec_chip_interface.c	92 void main() (
u u u u u u u u u u u u u u u u u u u	93 SK_UB ch,ch2,i,j,flg,len,rssi,t_restart,dst,kk,th,lqi,freq,temp_lmhz,c			
He RFIEST_0001.hex	94 SK UW uw,uw2,uw3,iw1,iw2,tm,wd,ff;			
- BRETEST_0001.ntml	95 SK w p,giemp;			
	97 SK IB 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;			
	103 ch = 0; 104 cca= 0;			
l	105 avg_rss1 = 0;			
	106 avg_lqi = 0;			
	107 freq = 0x80;			
	108 ff = 0;			
	$109 \text{temp_imp} = 0;$			
	111 mcurrentFreg = 2405;			
	112 Hardware_Initialize();			
	113			
RFTest				
× Managana	Ein Ling			
messages				
Build Find in Files Debug Log				

Figure 29: IAR Embedded Workbench RF-Test project configuration selection

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

Switch	Position
SW1	DBG
SW2	USB

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 **SW2** setting from **DBG** to **SER** and connect it to the Host PC again.

Switch	Position
SW1	SER
SW2	USB

Table 9: Switch settings for serial communication



7.1.4 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.

Figure 30: IAR Embedded Workbench Debugger Settings

Before connecting the **receiver** to the Host PC, make sure that the switch setting described in <u>Table 8</u> is chosen.

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

×	IAR Embedded Workbench IDE					PX
Eil	e Edit View Project Debug Emulator Tools Wi	idow Help				
) 🛩 🖬 🕼 🐇 🐘 🛍 🛏 🗠 🚺	🗾 🗸 🏷 🐂 殖 🖬 🛸 🏟 🖬 🖬 🐨 😒 🎂 🍲				
2	5 🕒 B Z B B B B B B 🗙					
	🛯 🞯 🚿 🔗 📕 🥒					
W	orkspace 🗶 main		Disassembly			×
)ebug 🗾 📑	85 #define TEST_DATA_LEN 20	Go to	Memory	-	
	Files 🤼 🗠	86 SK_UB gTestData[] = { 0x7e ,0xff ,0x00 ,0x01 ,0x02 ,0x03 ,0x04 ,0x05 ,(01936	2052 4629	SUBW CMPW	SP. 🔨
E	RFTest - Debug	88	0193A	0D 0A0D0A	ADD	A, C · t
	HE C hardware_78kur.c	89 //	0193E	00	NOP	3.1
	- 🖽 🖸 uart_interface.c	90 // Main Loop 91 //	void main()	00	NOP	
	- E [] ubec_chip_interface.c	92 void main() {	main: 01940	C3	PUSH	BC
	- I Output	93 SK_UB ch,ch2,i,j,flg,len,rssi,t_restart,dst,kk,th,lqi,f) 94 SK_UB uw uw2 uw3 iw1 iw2 tw wd ff.	01941	C5	PUSH	DE
		95 SK_W p,gTemp;	temp = 0;	2040	SOBW	SP,
		96 SK_H perl,per2,temp2,avg_rssi,avg_lqi;	01944 01947	3634D0 300000	MOVU MOVU	HL AX
		97 SK_06 desthatShort[2]; 98	0194A 0194B	BB 300000	MOVW	[HI
		99 static SK_UW nReceiveCount,nRSSItotal,nSendCount,nSendTo, temp, nLQIto:	0194E	BC02	MOVW	[HÍ
		<pre>100 static SK_UB nRSSImin,nRSSImax,nLQImin,nLQImax; 101 temm = 0:</pre>	01950	5100	MOV	A,
		102 lqi = 0;	01952 th = 0;	981E	MOV	[SF
		103 th = 0; 104 ccm 0;	01954	5100 9834	MOV	A, LSE
		105 avg_rssi = 0;	<u>cca= 0;</u>	500M	NOU	101
		106 avg_lq1 = 0;	0195A	981F	MOV	ÍSE
		107 freq = 0x00; 108 ff = 0;	avg rssi = (0195C	300000	MOVW	AX,
		109 temp_lmhz = 0;	0195F	B838	MOAM	[SI
		110 gnCurrentChannel = 11; // 2405MHz	01961	300000	MOVW	AX,
		<pre>112 Hardware_Initialize();</pre>	$\frac{01964}{\text{freg} = 0x80}$	B036	MOVW	[Sr
		113	01966	5180 9829	MOV MOV	A. ISE
		114 // MAC_ADDR	$\frac{ff = 0}{0196\lambda}$	AFE8	MOVI	AY
		116 // gaMACLong[7] = gaMACLong[7] + (MAC_ADDR) - 1;	01960	043C00	ADDW	AX (
		$\frac{117}{gamaCShort[1]} = \frac{gamaCShort[1]}{gamaCShort[1]} + \frac{(mac_ADDR)}{gamaCShort[1]} + \frac{11}{gamaCShort[1]} + $	0196F	300000	MOVW	AX,
		119 gaMAC_ADDR [1] = (SK_UB) MAC_ADDR;	01973	BB 300000	MOVW MOVW	[HI AX
		120 gaMACLong[2] = gaMACLong[2] + gaMAC_ADDR[0]; 121 gaMACLong[2] = gaMACLong[2] + gaMAC_ADDR[0];	01977	BC02	MOVW	[HI
		<pre>121 gamacbong[0] = gamacbong[0] + gamac_ADDR[1]; 122 gaMACShort[0] = gaMACShort[0] + gaMAC_ADDR[0];</pre>	01979	5100	MOV	A,
		<pre>123 gaMACShort[1] = gaMACShort[1] + gaMAC_ADDR[1];</pre>	gnCurrentCha	9828 annel = 11: //	2405MHz	[5:
1	RFTest 1fr		0197D	CE3CD00B	MOA	N · c
×						
	Log Word April 414:16:05 2010: Download con	lio to Memory				
	Wed Apr 14 14:16:05 2010: Download con Wed Apr 14 14:16:05 2010: Loaded debug	ee: C\Data\RF4CE\78K0R UDSTICK RF Test IAF	tt 11 11 11 11 11 1 ff ff ff ff ff ff	tt tt tt ff ff ff		🎽
	Wed Apr 14 14:16:05 2010: Target reset		ff ff ff ff 86 1	05 ff ff ff ff ff		
	Wed Apr 14 14:16:05 2010: 78K0R MINICU	BE Executor E1.15b 00000040 ff ff ff ff ff ff ff ff ff	ff ff ff ff ff	ff ff ff		
	Device chipname: uPD78F1146_64(f1146	i4). file version: V3.00	ff ff ff ff ff ff	ff ff ff		
g	Boardinfo: 00008004, product id: 4100 vers	ion: A, firmware version: 04.06f	ff ff ff ff ff ff ff ff ff ff ff	ff ff ff ff ff ff		
ng L	<	00000000 ff f				🗸
Deb	Debug Log Build	×				>
Re	ady		pos	00000000	NUM OV	/R

Figure 31: 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.

7.1.5 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 MicrosoftTM HyperTerminal please press Start \rightarrow All Programs \rightarrow Accessories \rightarrow Communication \rightarrow HyperTerminal from your MicrosftTM 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	
lcon:	
	%
OK Car	ncel

Figure 32: 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	? 🔀
🦓 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
	COM17 COM17 COM13 COM18 M(comb)

Figure 33: 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	lts	

Figure 34: HyperTerminal COM Port properties

User's Manual R20UE0002ED0100



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

🗞 transmitter - HyperTerminal	
<u>Eile Edit View Call Iransfer Help</u>	
<< 78K0R UD Stick RF Test : MAR 2010 >> <u>1. PER</u> 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 0:00:09 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo	

Figure 35: 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.

7.1.6 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	
Eile Edit View Call Iransfer Help	
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? >1 (PER test/sender)	
[My Profile]	
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	<u>•</u>

Figure 36: HyperTerminal RF-Test PER test

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



🗞 transmitter - HyperTerminal	
Elle Edit View Call 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 37: 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.

7.1.7 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	
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	
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)	
Connected 1:46:38 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo	

Figure 38: RF-Test Channel selection

78K0R-UD-STICK-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 📃	
Eile Edit View Call Iransfer Help	
PanID : 2514 Send to (Short addr) ? : 0002 Send count (dec) ? : 1000 Interval (dec/msec) ? : 5 Iset channel to 11 (Cmd)] Prepare to send0K IResults]	
Connected 1:53:16 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo	

Figure 39: RF-Test PER test Channel 23

7.1.8 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	
Eile Edit View Call Transfer Help	
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=0x00, 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 40: 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



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	
Elle Edit View Çall 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 41: 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.

7.1.9 Further RF-Test modes and settings

7.1.9.1 PER test /receiver

Pressing "2" in the opening window sets the 78K0R-UD-STICK-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.

7.1.9.2 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".

7.1.9.3 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".

7.1.9.4 RX Mode

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

7.1.9.5 IDLE Mode

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

7.1.9.6 Standby Mode

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

7.1.9.7 Deep Sleep Mode

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

7.1.9.8 Power down mode

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

7.1.9.9 Resetting RF

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

7.2 MAC sample program: TextChat

The MAC Sample program is developed to provide a simple example to construct a star network utilizing the IEEE 802.15.4 PHY/MAC standard. It supports a text chat for one **coordinator** and up to four **End Devices**.

The MAC Sample Program offers,

- 1. Designation of a network coordinator in a star configuration
- 2. A Text chat between a End Devices and an End Device

To use the MAC Sample Program, you need to prepare at least two PC with a USB interface or one PC with more than one USB interface, and two 78K0R-UD-STICK-EE demonstration kits. The program is provided as hex files with different short address settings. You will find these hex files after a successful installation of the sample projects in the subfolder "MAC_sample_project".

7.2.1 Preparing the Hardware

To be able to chat, at least 2 *78K0R-UD-STICK-EE* demonstration kits, with different short addresses, have to be prepared. One *78K0R-UD-STICK-EE* demonstration kit will be used as **Coordinator** and up to four *78K0R-UD-STICK-EE* demonstration kits can be used as **End Devices**. Basically the same sample project is used for **Coordinator** and **End Devices**, the only thing to take care for is that any module needs an independent short address.

To program the software please set the switches of the *78K0R-UD-STICK-EE* demonstration kit to the <u>flash</u> <u>programming setting</u> and use the <u>WriteEZ5</u> flash programming tool.

After a successful download, please disconnect the *78K0R-UD-STICK-EE* demonstration kit from the Host PC and change the switch setting to the <u>serial communication setting</u>. Now you can connect the *78K0R-UD-STICK-EE* demonstration kit to the Host PC again.

7.2.2 Running the MAC sample program

To run the the MAC sample program a terminal program is needed. In this document the Microsoft[™] HyperTerminal is used, but in fact any kind of other terminal tool should be sufficient, too.

To open MicrosoftTM HyperTerminal please press Start \rightarrow All Programs \rightarrow Accessories \rightarrow Communication \rightarrow HyperTerminal from your MicrosftTM Windows.

Please select following settings when configuring the connection using the HyperTerminal.



COM port properties	Setting
Bits per second	115200
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

Table 10: Microsoft™ HyperTerminal COM	port properties
Table 10. Millionosoft Tryper Terminal Com	port properties

For further information regarding the HyperTerminal configuration please refer to <u>Chapter 7.1.5</u>. To start the application set SW1 from **USB** to **BAT** and back once. Now the startup screen shall occur.

🍓 Coordinator - Hype	rTerminal								×
<u>F</u> ile <u>E</u> dit ⊻iew ⊆all <u>T</u> r	ansfer <u>H</u> elp								
D 🚅 🍵 🕉 🗈 ไ	<mark>-</mark> 1								
									~
<< 78K0R+UD My MAC exte = 123400019	Sample nded add ABC0001	Applicati Hress	ion: Sk	yley	Netw	orks≯	•>		
Command? >_									111
									>
<								>	
Connected 0:03:55	Auto detect	115200 8-N-1	SCROLL	CAPS	NUM	Capture	Print echo		

Figure 42: MAC sample program startup screen

In the same way, connect the other *78K0R-UD-STICK-EE* demonstration kits to PC, and start HyperTerminal. If the PC has more than one USB port, you can connect more than one *78K0R-UD-STICK-EE* demonstration kits and start more than one HyperTerminal on this PC. Only the COM ports of each *78K0R-UD-STICK-EE* demonstration kits have to be set up correctly.

7.2.2.1 Designation of the Coordinator

Now you have to decide which *78K0R-UD-STICK-EE* demonstration kits shall be used as **coordinator**. To do so open the regarding HyperTerminal window and press Enter.

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🇞 Coordinator - HyperTerminal	
<u>Eile E</u> dit <u>V</u> iew <u>C</u> all <u>I</u> ransfer <u>H</u> elp	
D 🚔 🍘 🐉 🗈 🎦 📾	
(< 78K0R+10 Sample Application: Skulou Networks >>	^
My MAC extended address = 123400019ABC0001	
Command? >	
[Help] My MAC extended address = 123400019ABC0001	
S: Send Message M: MLME Associate test C: Start Coordinator test	
Command? >	~
	>
Connected 0:10:45 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo	

Figure 43: MAC sample configuration

Press "C" to start the **coordinator**.

7.2.2.2 Designation of End Devices

All other attached *78K0R-UD-STICK-EE* demonstration kits (up to 4) have to be set up as **End Devices**. Therefore press "Enter" from the startup screen and then "M".

🌯 end_device - HyperTerminal		
<u>File Edit View Call Iransfer H</u> elp		
🗅 🚔 🍙 🔏 🗈 🎦 😭		
<pre><< 78K0R+UD Sample Application: My MAC extended address = 123412349ABC0001</pre>	Skyley Networks >>	
Command? >		
[Help] My MAC extended address = 123412349ABC0001		
S: Send Message M: MLME Associate test C: Start Coordinator test		
Command? >M		
> MLME-ASSOCIATE.request > MLME-ASSOCIATE.confirm > Associated ShortAddr:4321 > Status:00	Ι	
Command? >_		
Connected 0:20:34 Auto detect 115200 8-N-1 SCRO	LL CAPS NUM Capture Print echo	

Figure 44: MAC sample End Device

On the **coordinator** side you will find the following message. In this message you will find the associated short address which is needed for the text chat later on.

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🍣 coordinator - HyperTerminal	
<u>File Edit View Call Iransfer H</u> elp	
D 🖆 🍘 🕉 🗈 🎦 📸	
<pre>> MLME-START.request > MLME-START.confirm > Status:00 Command? > > MLME-ASSOCIATE.indication > from 123412349ABC0001 associated to 4321</pre>	
[Help] My MAC extended address = 123400019ABC0001	=
S: Send Message	
Command? >	~
	>
Connected 0:23:08 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo	

Figure 45: MAC sample End Device associated short address

7.2.2.3 Text Chat

Now the network is prepared to start a text chat between an **End Device** and the coordinator. At first, you may start with the **coordinator**. Press "S", then input the short address of an **End Device**, 4321 in this example and input your text message, which can be up to 102 bytes per text block.

🍣 coordinator - HyperTerminal				
Eile Edit View Call Iransfer Help				
D 🖙 📨 🐉 🗈 🎦 📾				
<pre>> MLME-ASSOCIATE.indication > from 123412349ABC0001 associated to 4321</pre>	~			
[Help] My MAC extended address = 123400019ABC0001				
S: Send Message				
Command? >S				
<pre>> MCPS-DATA.request > Send to (short address) ? 4321 > Message ? Hello!</pre>				
Command? >_				
	>			
Connected 0:41:54 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo				

Figure 46: MAC sample sending text message

On the End Device you will find the received text message and the information from whom it was received.



Gena_actice - Hyper reminar	
<u>E</u> ile <u>E</u> dit <u>V</u> iew <u>C</u> all <u>T</u> ransfer <u>H</u> elp	
D 🖻 💮 🕈 🗈 🎦 🖆	
S: Send Message M: MLME Associate test C: Start Coordinator test Command? >M > MLME-ASSOCIATE.request > MLME-ASSOCIATE.confirm > Associated ShortAddr:4321 > Status:00	~
Command? > > MCPS-DATA.indication > from 1975/2420 Hello! -	
Connected 0:47:03 Auto detect 115200 8-N-1 SCROLL CAPS	NIIM Capture Print echo .

Figure 47: MAC sample received message

As you now know the short address of the **coordinator** you can send back a message from the **End Device** by inputting "S", the **coordinator** short address (i. e. "1975" in this sample) and the reply text message. You will find the received text message on the **coordinator** HyperTerminal window.



8. BOM list

No.	Mount	Mount Parts	Unmount Parts	Туре	Parts No	Manufacturer
	Quantity	Reference	Reference			
1	0	<u> </u>	CN1	Connecter	SICA2P20S	TET
2	1	CN2	<u> </u>	Connecter	DF11-10DP-2DS(24)	Hirose
3	0		CN3	Patern anntena	-	
4	1	CN4		Connecter	MS-156C	Hirose
5	12	C1,C4,C6,C7,		Chip ceramic cap	0.1uF	
		C23 C38				
6	2	C2 C3	+	Chin ceramic cap	18nF	
7	3	C5 C15 C17	+	Chin ceramic cap	0 47µF	+
8	1	C8	+	Chip ceramic cap	2.2uF	1
9	1	C9	+	Chip tantal cap	F931A476MCC	Nichicon
10	2	C16,C10	1	Chip ceramic cap	4.7uF/16V	
11	1	C11	1	Chip ceramic cap	10uF/16V	1
12	1	C21	1	Chip ceramic cap	0.1uF	1
13	3	C24,C26,C40	1	Chip ceramic cap	10pF	1
14	4	C25,C30,C34,	1	Chip ceramic cap	0.01uF	1
		C44		·		
15	5	C27,C29,C31,		Chip ceramic cap	47pF	
		C33,C39				
16	2	C41,C28		Chip ceramic cap	1uF	
17	1	C32		Chip ceramic cap	39pF	
18	2	R4,C35	<u> </u>	Chip resister	0	
19	0		C36	Chip ceramic cap		ļ!
20	0		C37	Chip ceramic cap		
21	1	C42	<u> </u>	Chip ceramic cap	4.7uF/10V	
22	1	C43	+	Chip ceramic cap	10uF/10V	<u> </u>
23	1		+	Chip inductor	LDB212G4020C-001	Murata
24			+		UZ2400V4.1	UBEC
25	1		+			Stanly
20	3	LED2,LED3, LED4			AATTTO	Starily
27	1	L1		inductor	VLCF4020T- 6B8N1B0	TDK
28	1	1_2	+	Filter	BLM41PG750S	Murata
29	1	1.3	+	Chip inductor	HK10052N7S-T	Taivo Yuden
30	0		L5	Chip inductor		
31	1	L6	1	Chip inductor	HK10055N6S-T	Taiyo Yuden
32	1	L7	1	inductor	LQH2MCN8R2M02	Murata
33	2	MR3,MR1		resister module	CN1E4K-105J	KOA
34	1	MR2		resister module	CN1E4K-122J	KOA
35	1	R1		Chip resister	100	
36	6	R2,R3,R5, R11.R12, R21		Chip resister	10K	
37	2	R6.R8	1	Chip resister	390K	1
38	1	R7	1	Chip resister	1M,1%	1
39	1	R9		Chip resister	360K,1%	1
40	1	R10		Chip resister	4.7K	
41	3	R13,R16,R22		Chip resister	1.5K	T
42	2	R15,R14		Chip resister	27	
43	3	R17,R18,R19	<u> </u>	Chip resister	100K	
44	1	R20		Chip resister	1M	
45	2	SW2,SW1		Switch	SSSS222700	ALPS
46	8	TPU1, TPU2, TPU3, TPU4,		Pad	TPU	

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78K0R-UD-STICK-EE

No.	Mount Quantity	Mount Parts Reference	Unmount Parts Reference	Туре	Parts No	Manufacturer
		TPU5, TPU6, TPU7, TPU8				
47	1	TP1		Pad	PAD	
48	4	T1,T2,T3,T4		Pad	Т	
49	1	USB1		Connecter	UAR10-4W5J00	Hirose
50	1	U1		IC	S-8120CNB	Seiko
51	1	U2		IC	uPD78F1146AGB- GAH-AX	NECEL
52	3	U3,U6,U8		IC	SN74LVC1G125DCK	TI
53	1	U4		IC	TPS61024DRC	TI
54	1	U5		IC	SN74LVC2G125DCU	TI
55	1	U7		IC	UPD78F0730MC	NECEL
56	1	U9		IC	SN74LVC2T45DCU	TI
57	1	Y1		Resonator	FC-135(32.768KHz)	Epson
58	1	Y2		Resonator	CSTCE16M0VH3L99- R0	Murata
59	1	Y3		Resonator	NX3225SA-32.000M- STD-CSR-3	NDK
60	1	L4		Chip ceramic cap	UVK105CH020BW-F	Taiyo Yuden
61	1	C45		Chip ceramic cap	UVK105CH1R3BW-F	Taiyo Yuden

Table 11: Bill of Materials



9. 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 78 KOR-UD-STICK-EE schematics.pdf.



[MEMO]