User's Manual

TK-RF8058+SB-EE

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

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Revision History

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

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1. Introduction

1.1 Package contents

- 2 x TK-RF8058+SB evaluation board
  - 2 x SB-UD board
  - 2 x MB-RF8058
  - 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 documentation.
Host interface	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 http://www.renesas.eu/TK-RF8058+SB-EE

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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.

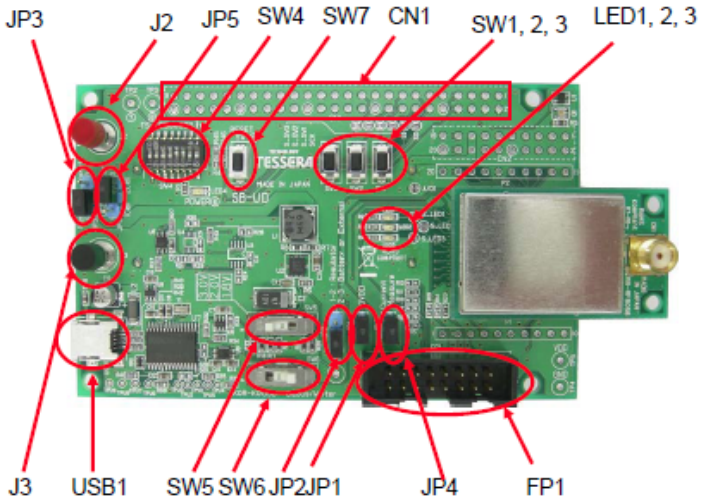

Figure 1: TK-RF8058+SB-EE demonstration board (Top View)

2.1 SW4 (Dip switch)

SW4 is the mode setting switch.

Switch No.	Setting	
	ON	OFF
SW4-1	USB debugging	PC HyperTerminal mode
SW4-2		
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.**

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	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 (Open)

Solder-short pad (Short)

Solder-short pad name	Factory default	Connection
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 *TK-RF8058+SB-EE* 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 RF4CE Virtual Remote Control tools.

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

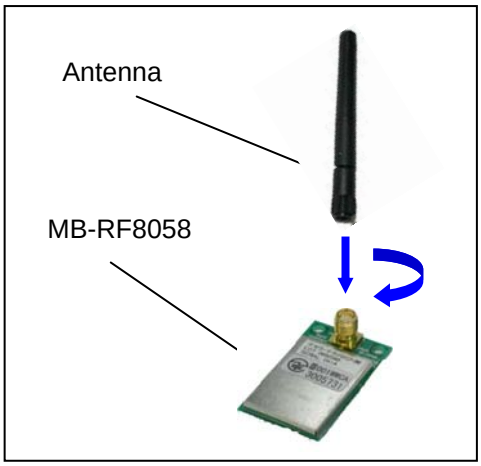

Figure 2: Mount antenna to MB-RF8058

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

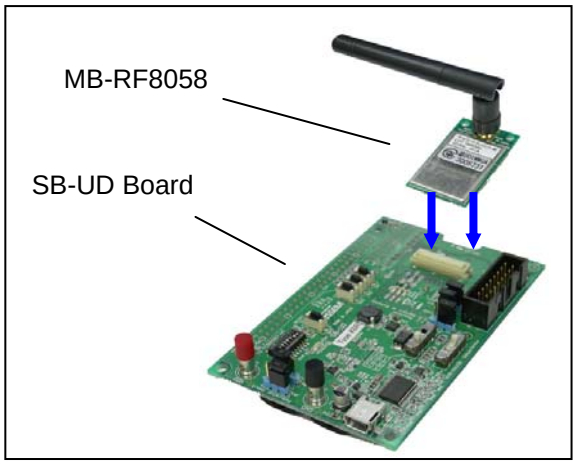

Figure 3: Mount MB-RF8058 to SB-UB

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

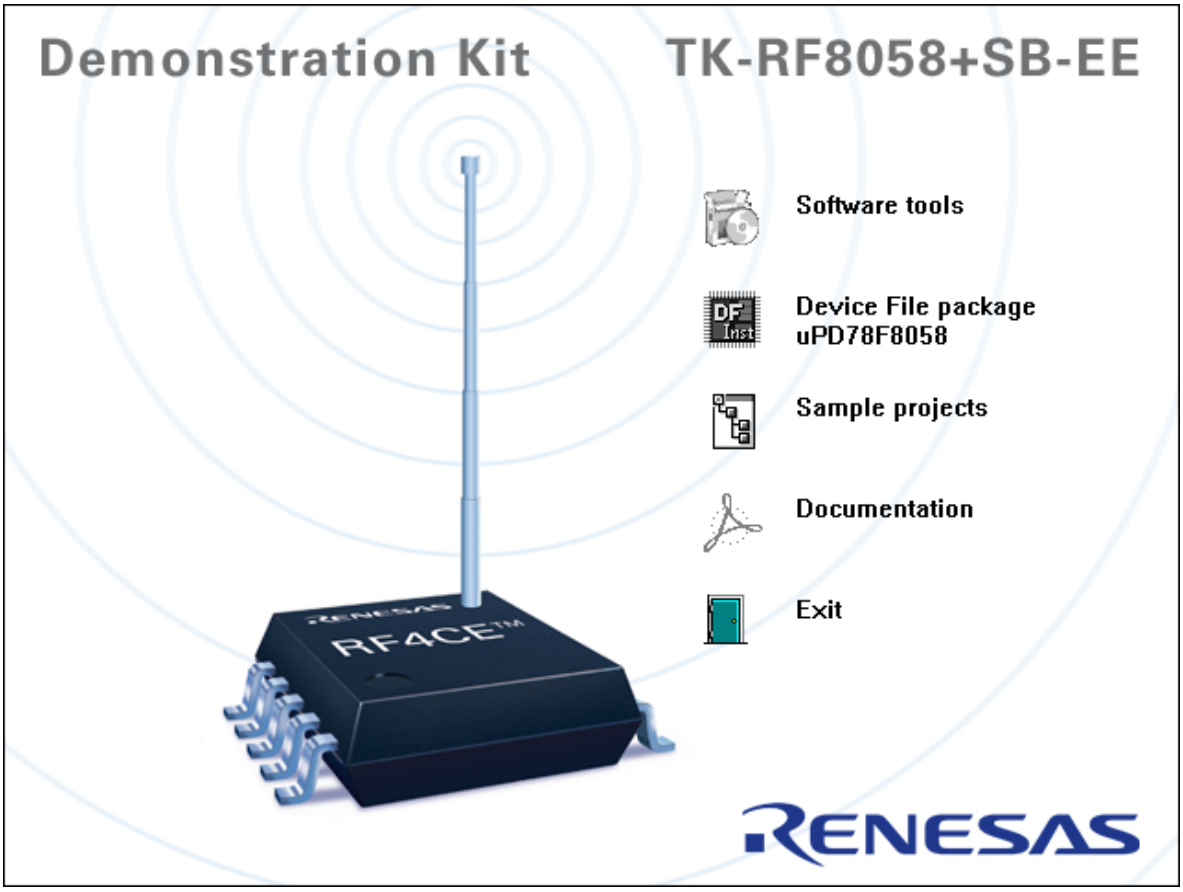

Figure 4: *TK-RF8058+SB-EE* CDROM autorun.exe

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.

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.

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 µPD78F8058 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:

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>.

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>.

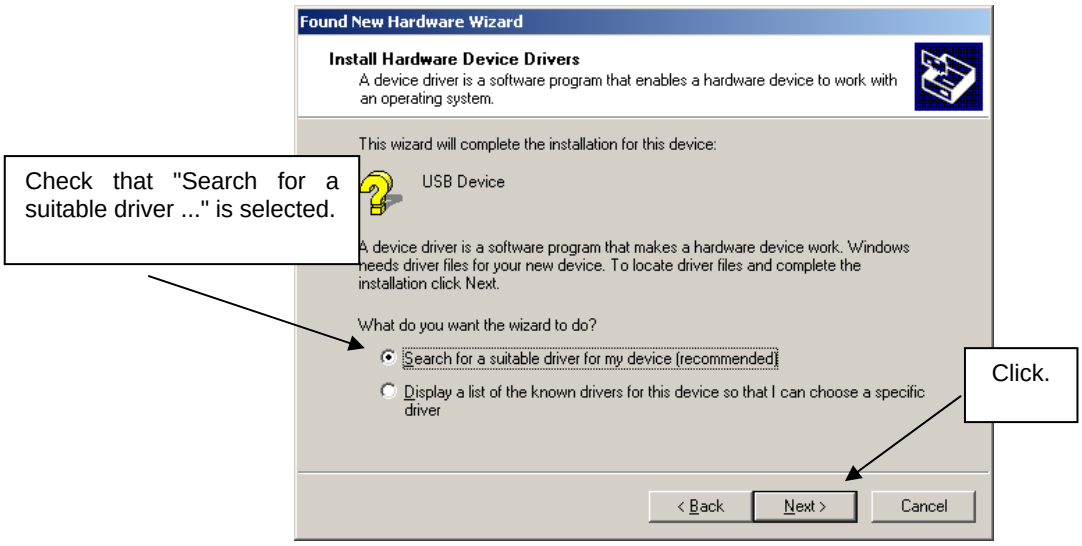

Figure 8: Search Method (Windows 2000)

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

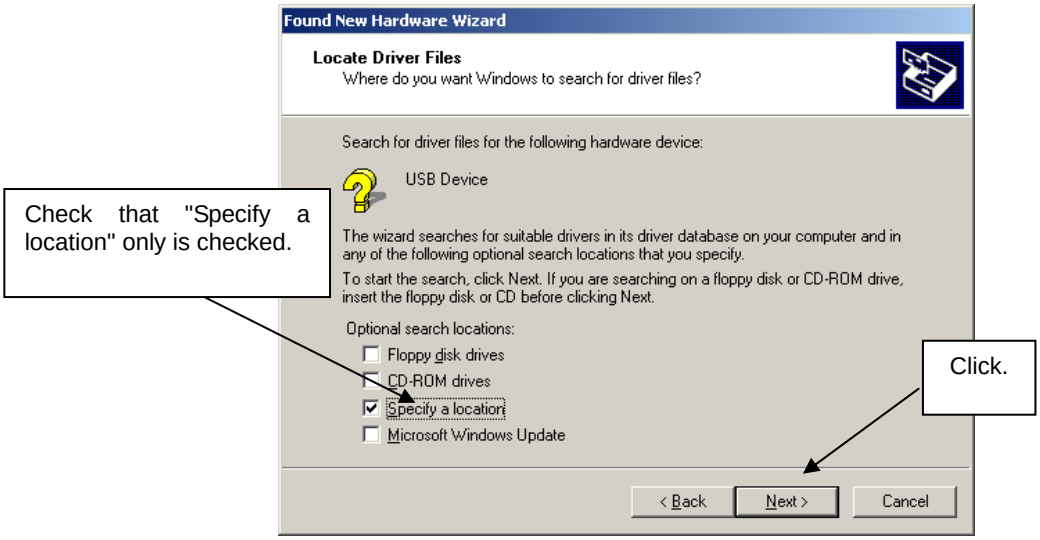

Figure 9: Driver File Location (Windows 2000)

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.

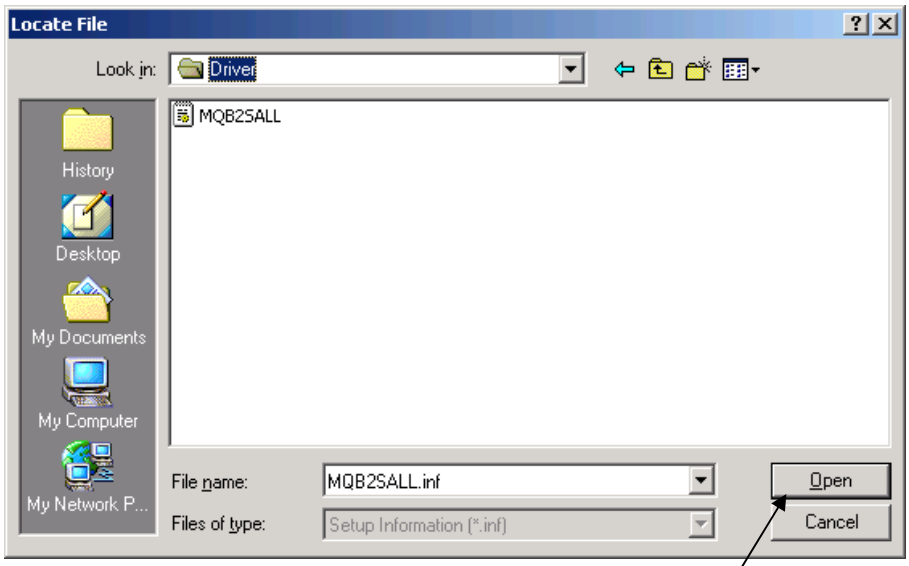

Figure 10: Address Specification 2 (Windows 2000)

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

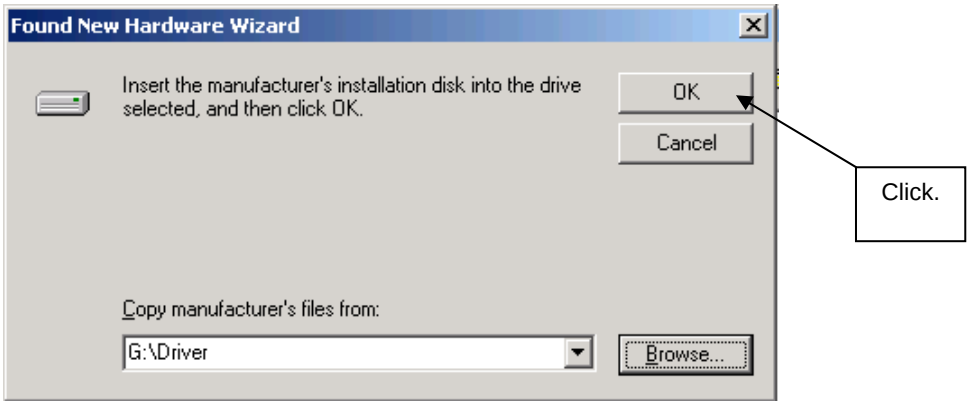

Figure 11: Address Specification 3 (Windows 2000)

7. Click Next>.

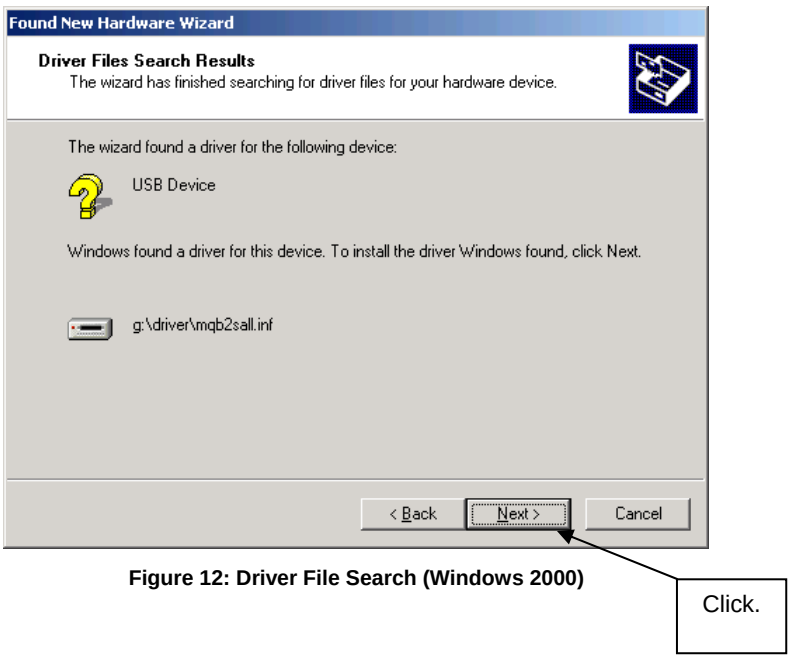

Figure 12: Driver File Search (Windows 2000)

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

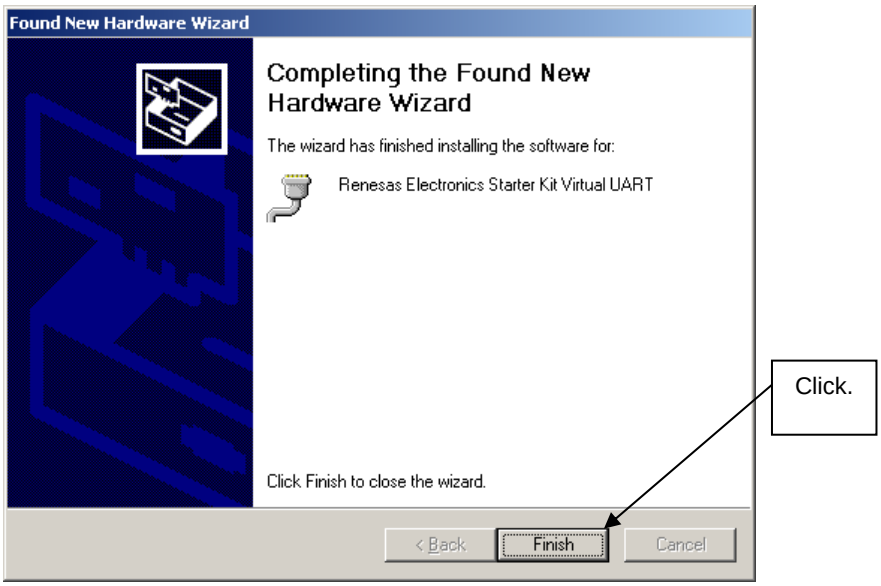

Figure 13: USB Driver Installation Completion (Windows 2000)

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>.

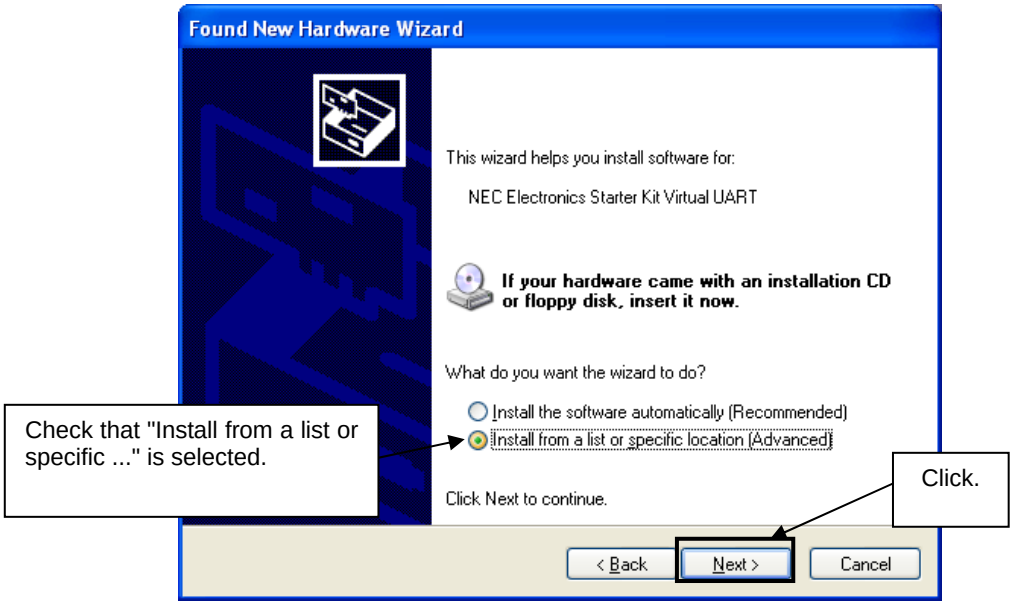

Figure 15: Found New Hardware Wizard 2 (Windows XP)

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.

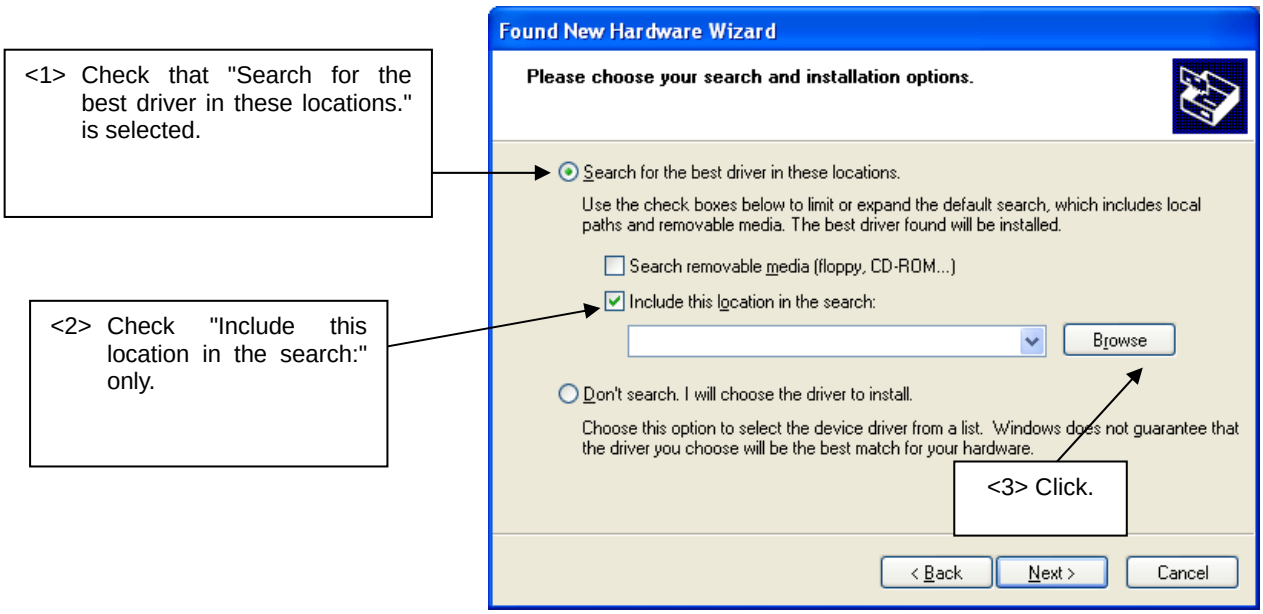

Figure 16: Search Location Specification 1 (Windows XP)

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

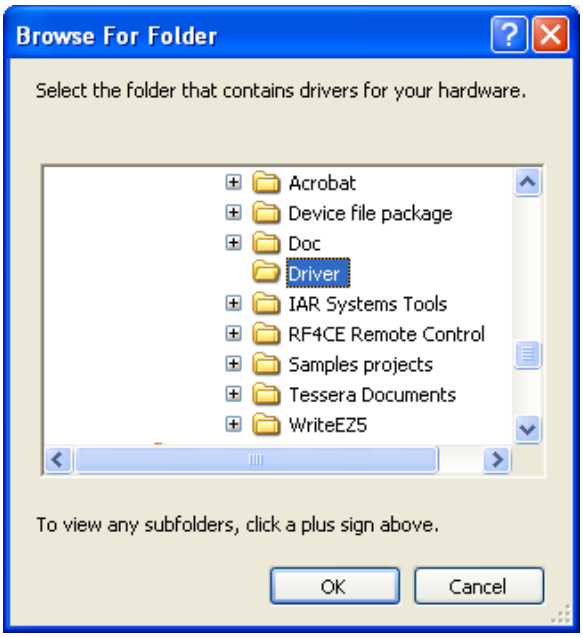

Figure 17: Search Location Specification 2 (Windows XP)

5. 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.

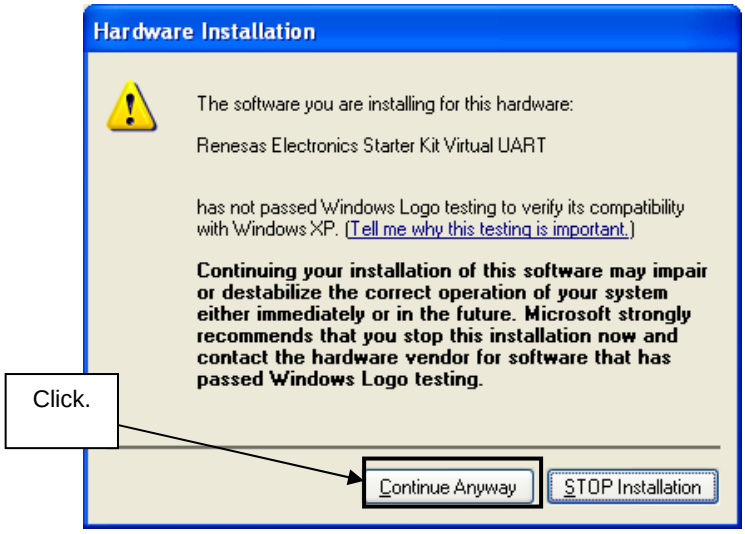

Figure 18: Windows XP Logo Testing (Windows XP)

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

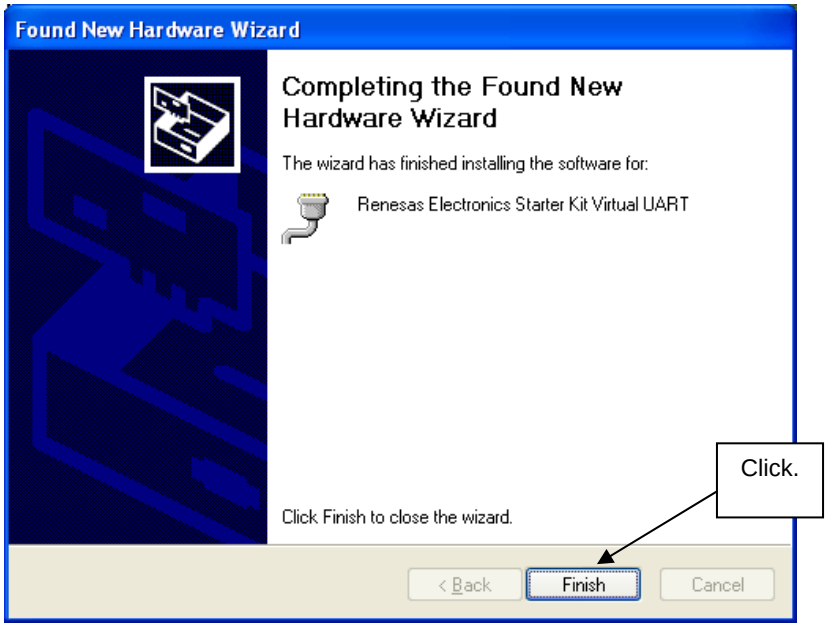

Figure 19: USB Driver Installation Completion (Windows XP)

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.

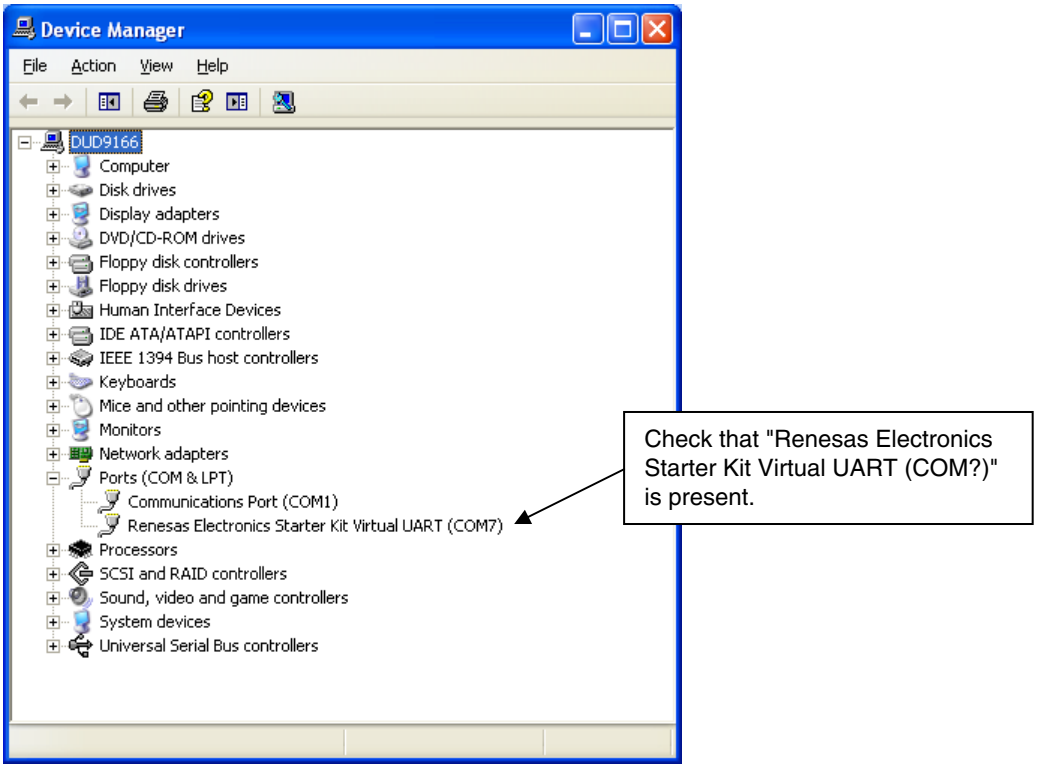

Figure 20: Windows Device Manager

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 WriteEZ5 installation.

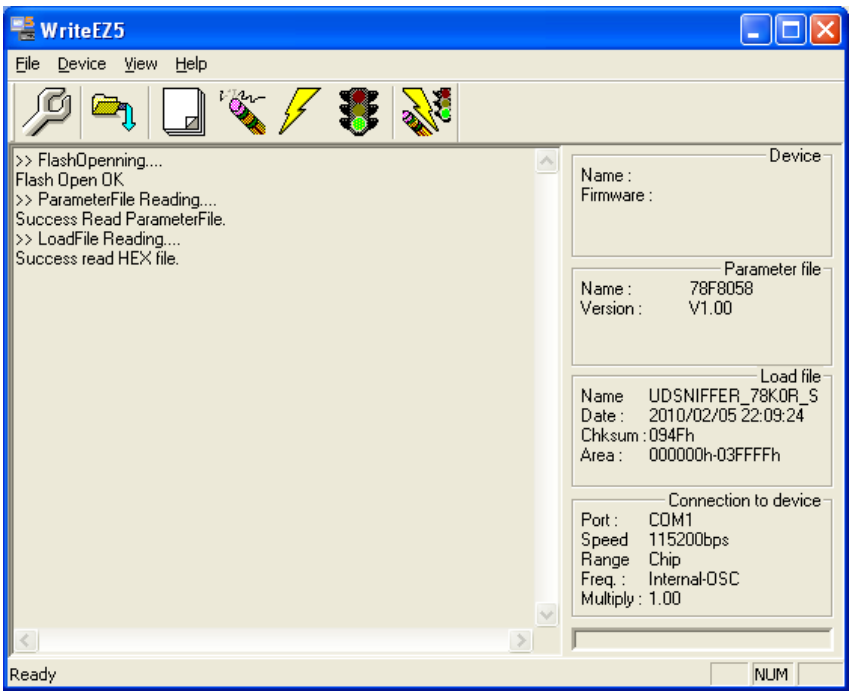

Figure 21: WriteEZ5 Startup

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 µPD78F8058 is located on the CDROM, in a subfolder of the WriteEZ5 setup file. Please use the menu **"Device → Setup…"** to open the following dialogue and the button **"PRM File Read"** to select the parameter file.

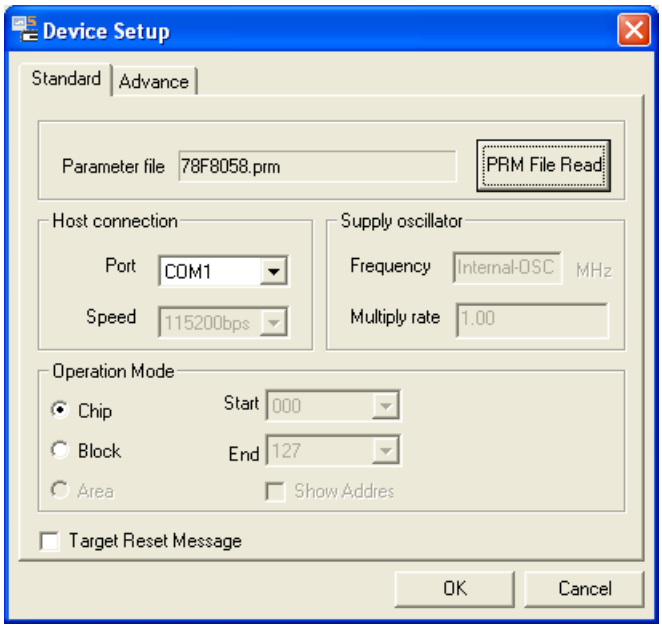

Figure 22: WriteEZ5 Device Setup Dialogue

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

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.

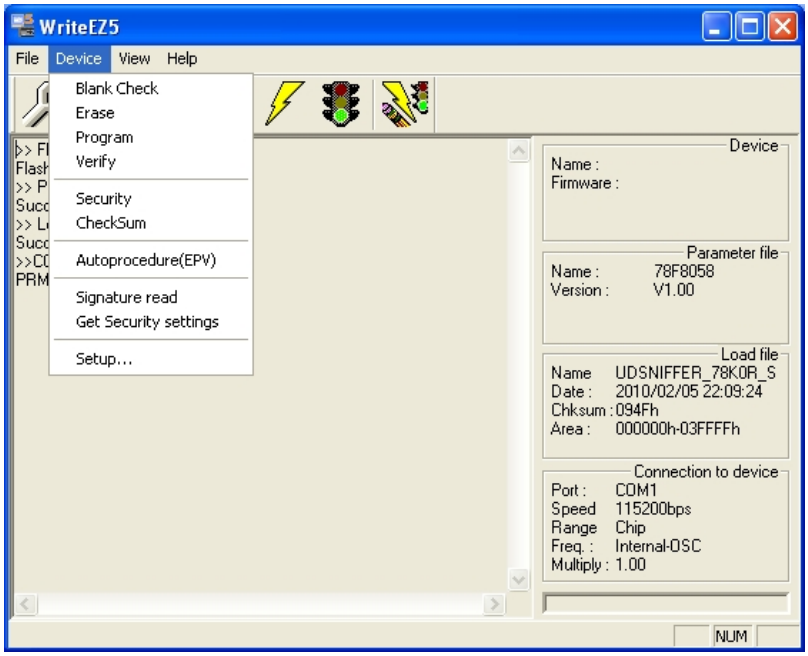

Figure 23: WriteEZ5 Device Menu

	device setup button
	load file button
	blank check button
	erase button
	program button
	verity button
	erase / program / verify button

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 installed 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 WriteEZ5 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 Windows Device Manager to check which COM port is used for the boards.

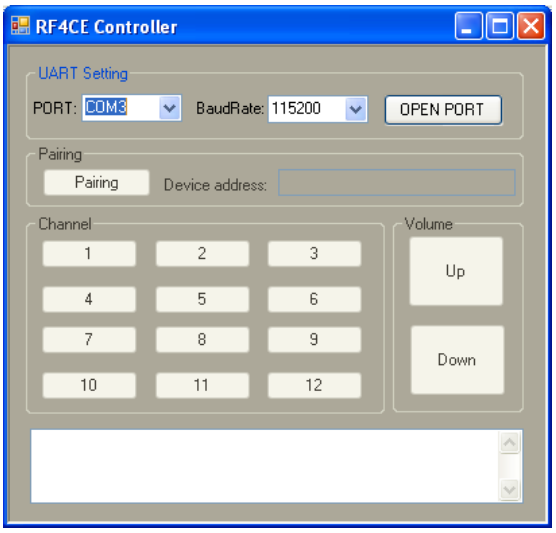

Figure 24: RCT COM port selection

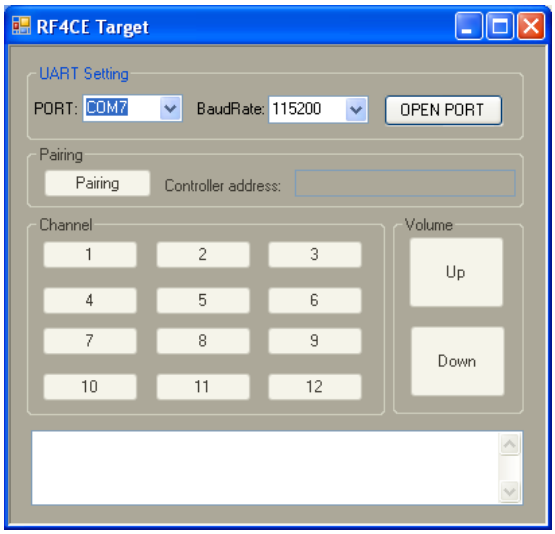

Figure 25: RCR COM port selection

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.

Figure 26: RCR Pairing Start

Figure 27: RCR Pairing Start

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.

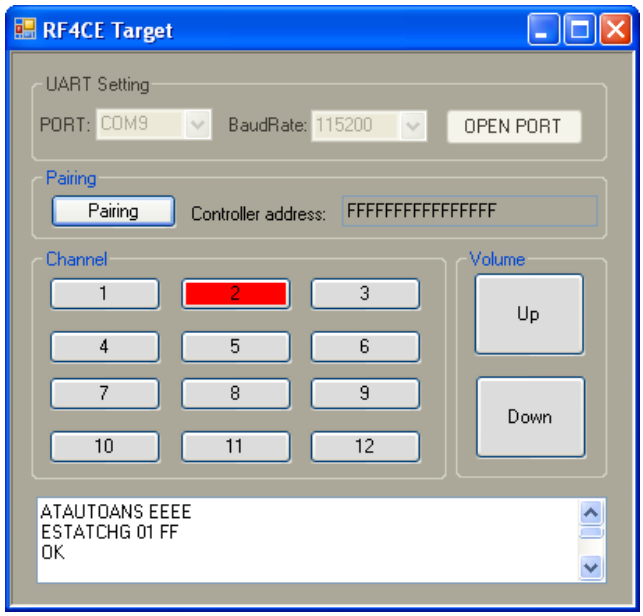

Figure 28: RCR channel selected

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 Sample project installation to copy the files to your Host PC.

To be able to run the RF-Test application, make sure that the IAR Embedded Workbench and the WriteEZ5 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 → All Programs → IAR Systems → IAR Embedded Workbench for 78K 4.62 Kickstart → 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.

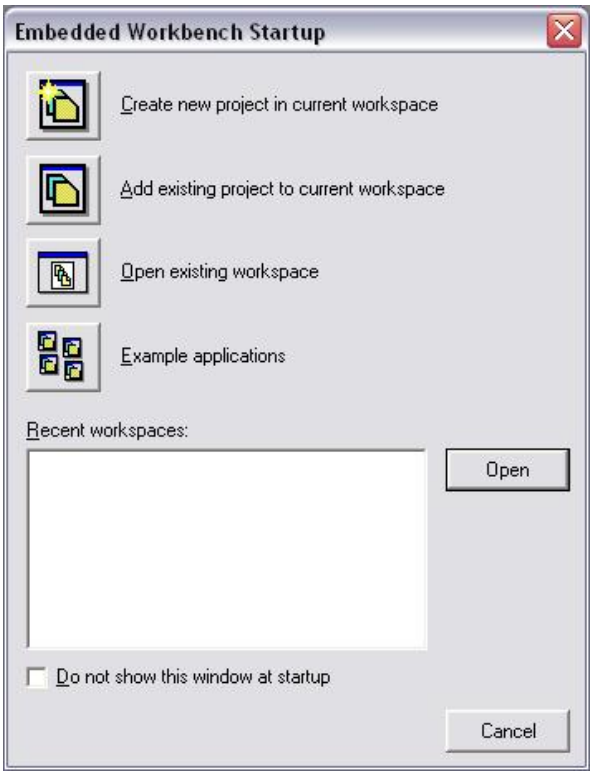

Figure 29: IAR Embedded Workbench Startup screen

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

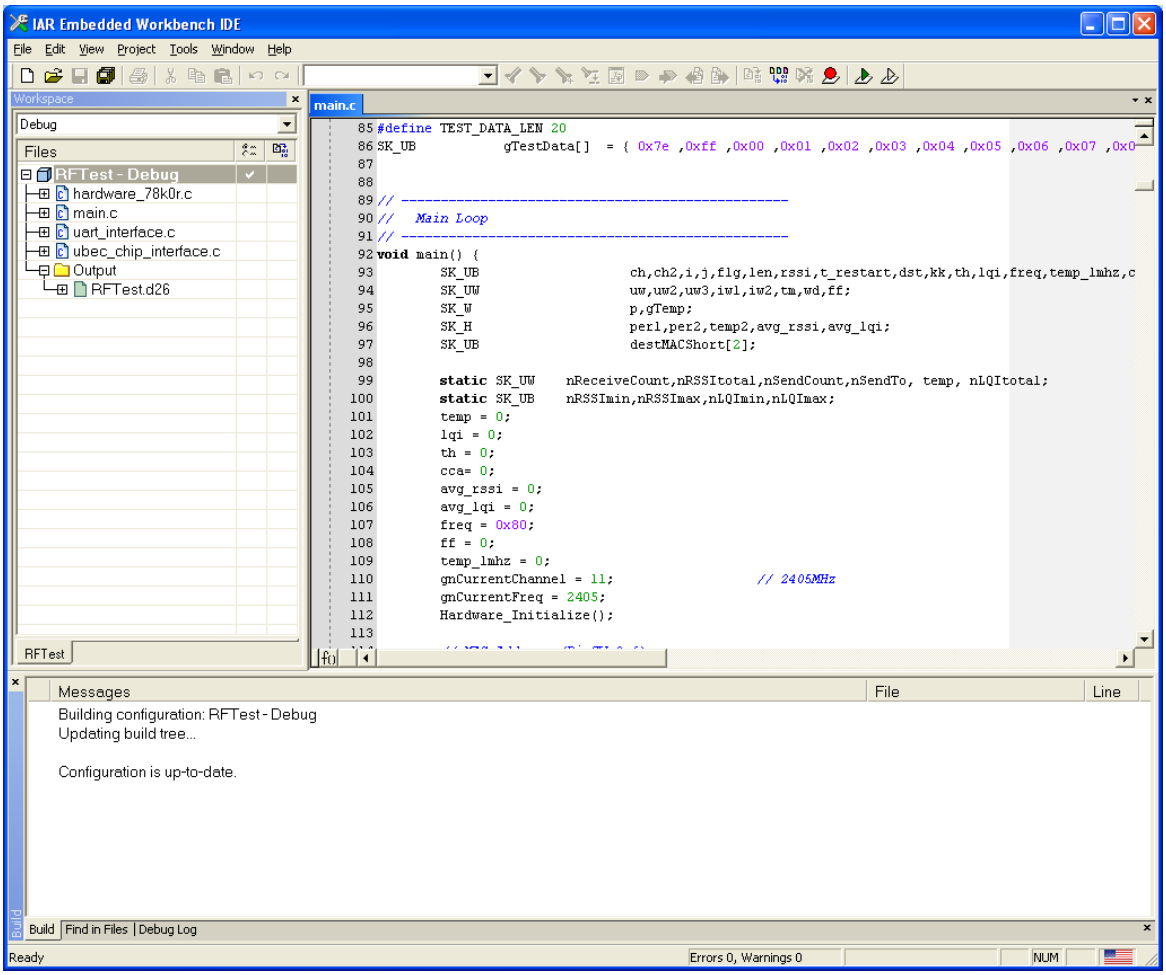

Figure 30: IAR Embedded Workbench IDE view

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 WriteEZ5 software.

8.1.3 Setting up the Transmitter

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

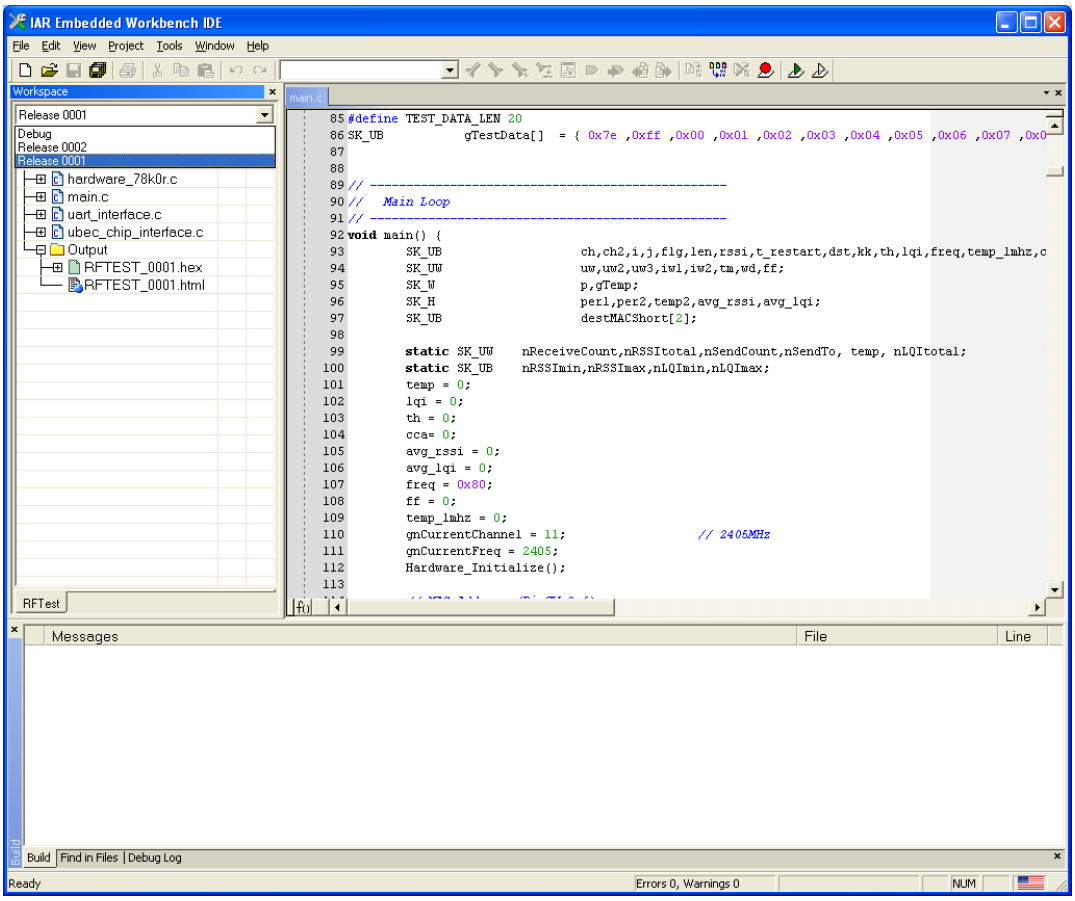

Figure 31: IAR Embedded Workbench RF-Test project configuration selection

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 WriteEZ5 software 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 → Options → Debugger → Driver → MINICUBE) as shown below.

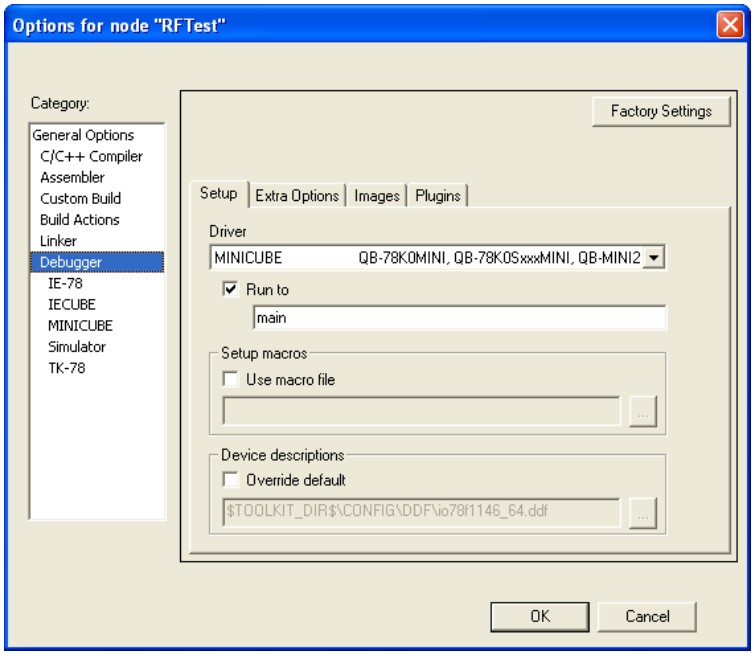

Figure 32: IAR Embedded Workbench Debugger Settings

Before connecting the **receiver** to the Host PC, make sure that the switch setting described in Table 12 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 ( ) or click **Project → 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.

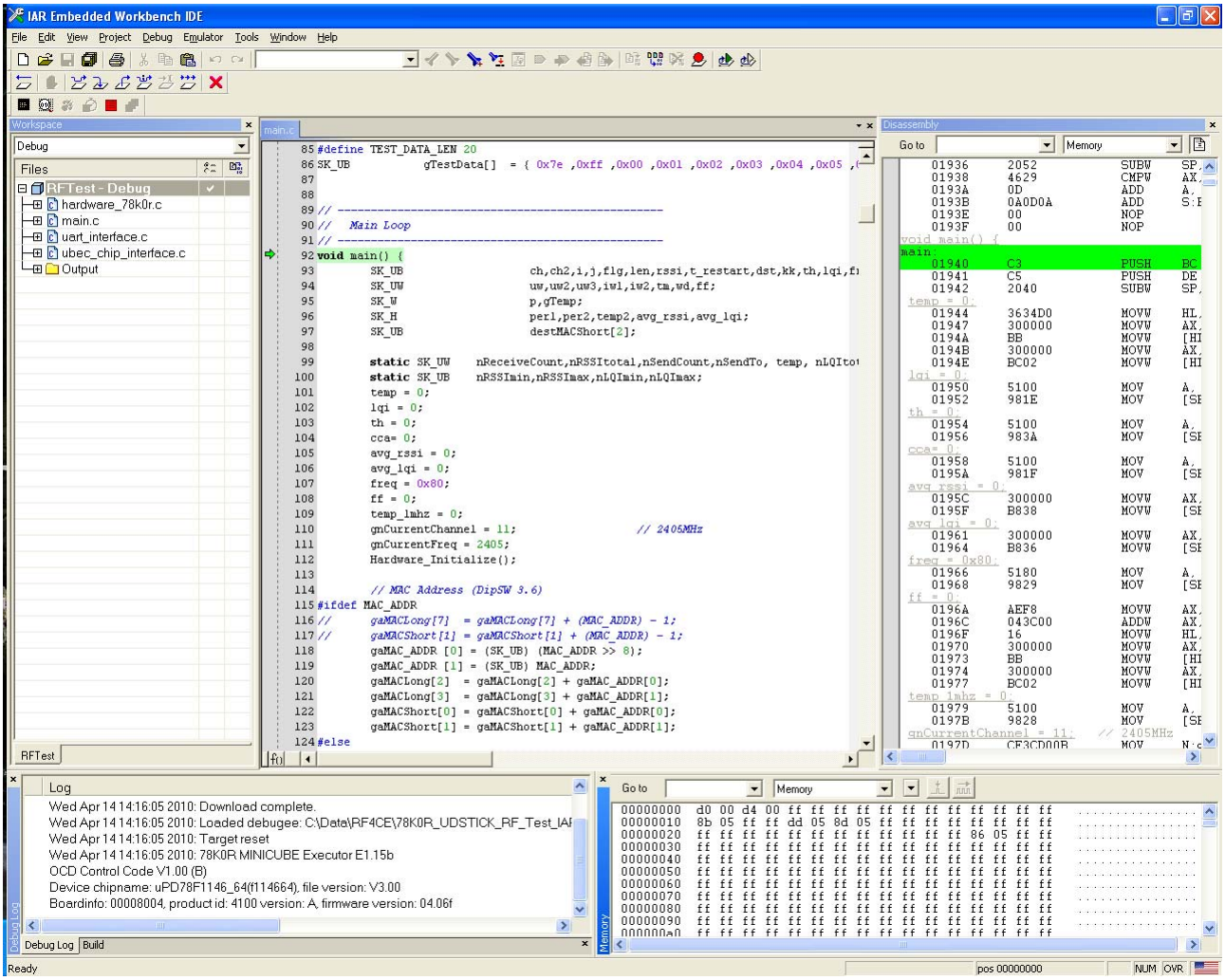

Figure 33: IAR C-SPY debugger window

To run the application press the **Run** button. 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”)

Figure 34: HyperTerminal Connection Description

2. 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)".

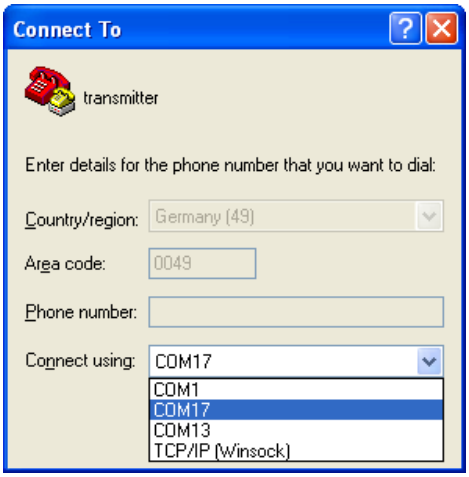

Figure 35: HyperTerminal COM Port selection

3. Setting the COM properties as follows

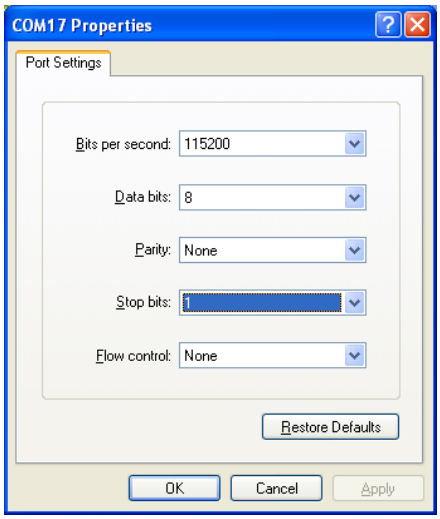

Figure 36: HyperTerminal COM Port properties

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

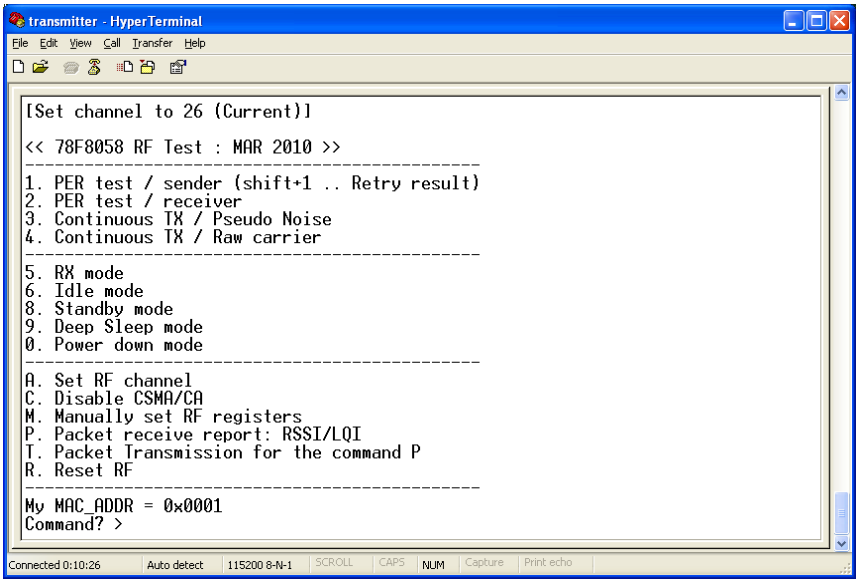

Figure 37: RF-Test project opening window

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 (Packet Error Rate) 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 r**eceiver** 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.

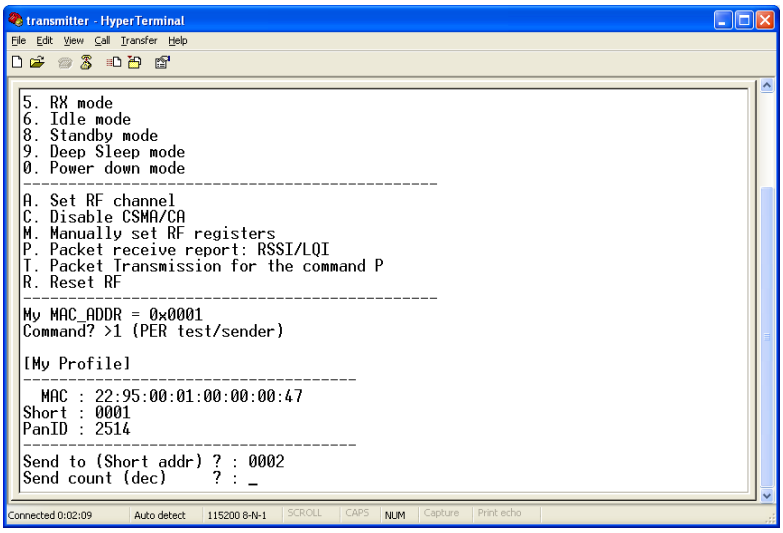

Figure 38: HyperTerminal RF-Test PER test

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

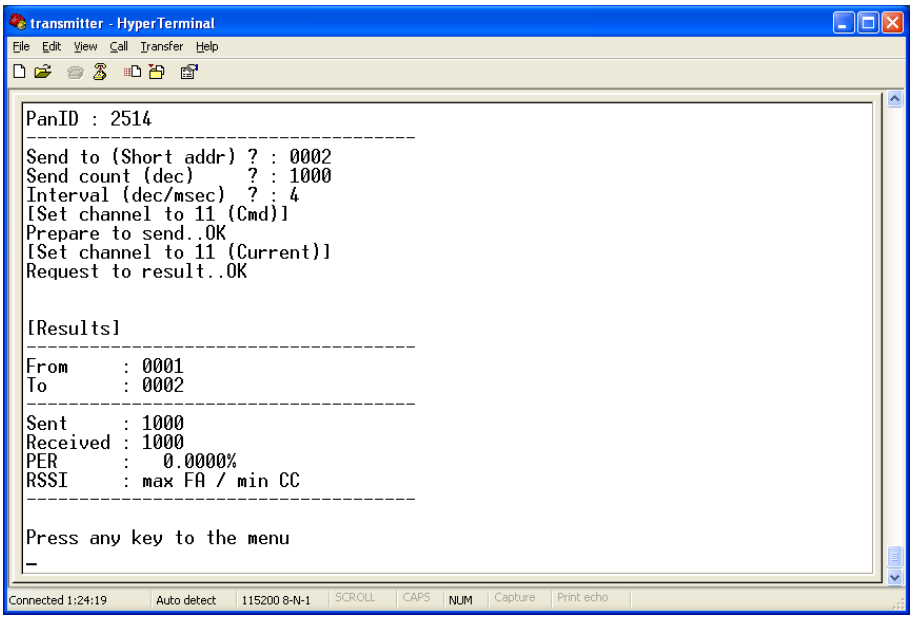

Figure 39: RF-Test PER test result

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.

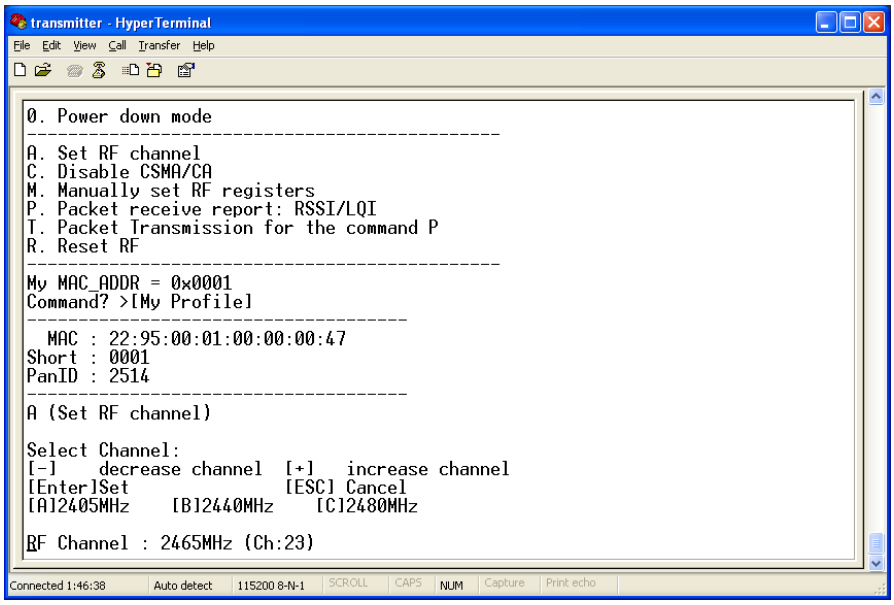

Figure 40: RF-Test Channel selection

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.

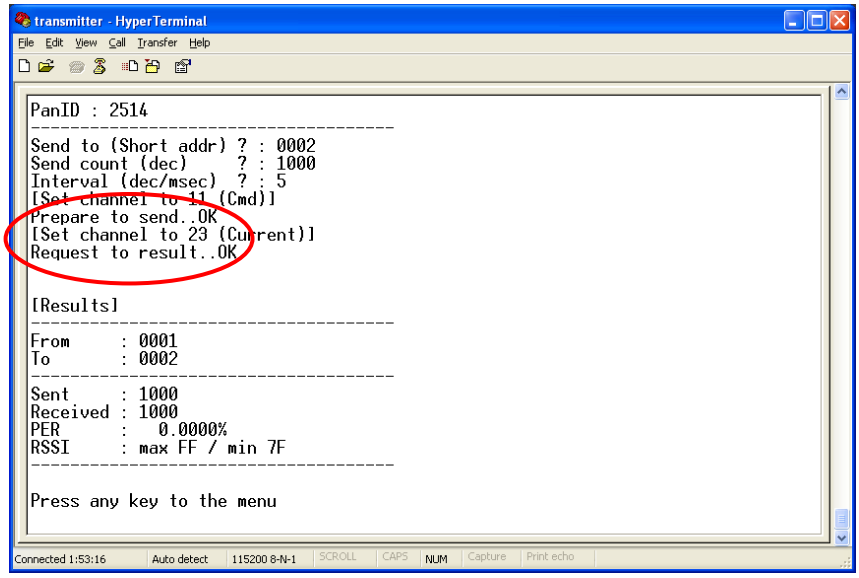

Figure 41: RF-Test PER test Channel 23

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.

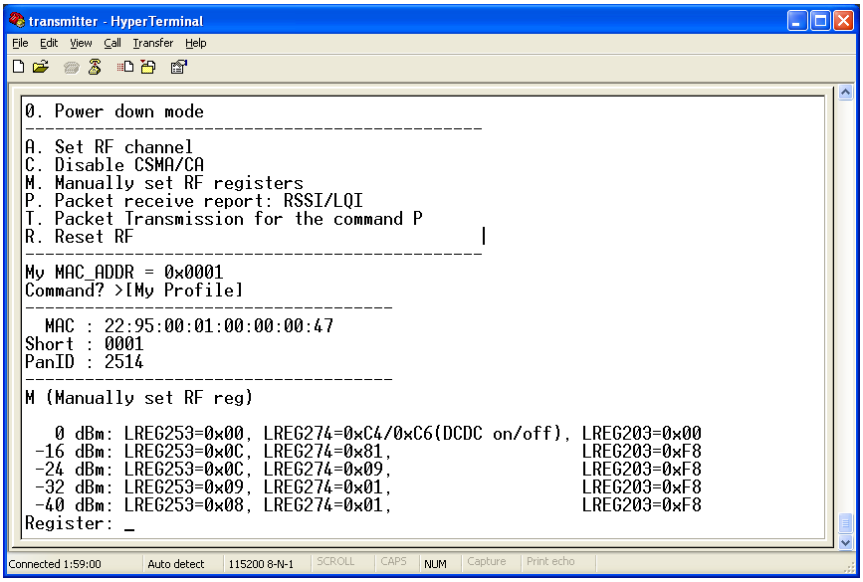

Figure 42: RF-Test Output power adjustment 1

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

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.

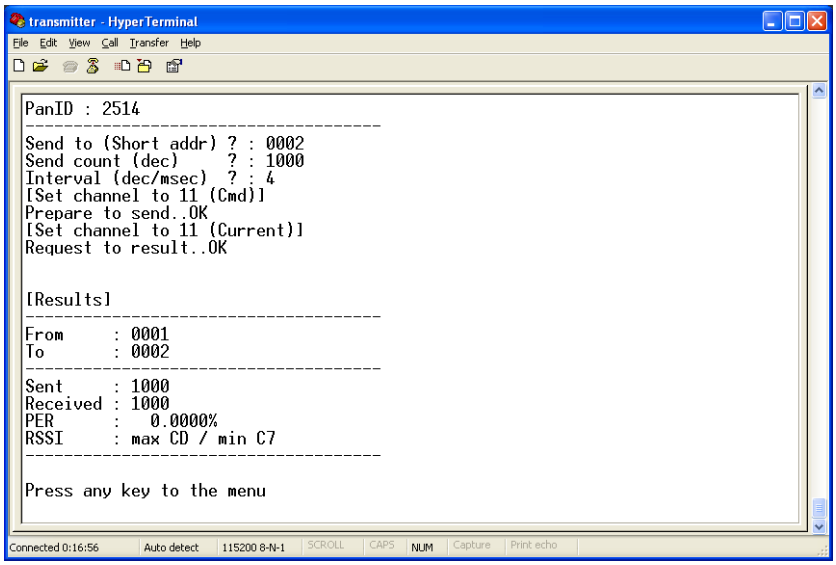

Figure 43: RF-Test PER test power adjusted

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 Quantity	Mount Parts Reference	Unmount Parts Reference	Type	Parts No	Maker	Note
1	0		S_SW1, S_LED1, A/D1, S_SW2, S_LED2, A/D2, S_SW3, S_LED3	Short Pad	SS		
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, C14, C15, C16	C4, C5	Chip ceramic cap	0.1uF		
10	2	C10,C8		Chip ceramic cap	0.47uF		
11	1	C9		Aluminum Electrolytic Cap	4.7uF/25V		
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		

No.	Mount Quantity	Mount Parts Reference	Unmount Parts Reference	Type	Parts No	Maker	Note
		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

9.2 MB-RF8058 board

No.	Mount Quantity	Mount Parts Reference	Unmount Parts Reference	Type	Parts No	Manufacturer
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

10. Cables

10.1 USB interface cable (Mini-B type)

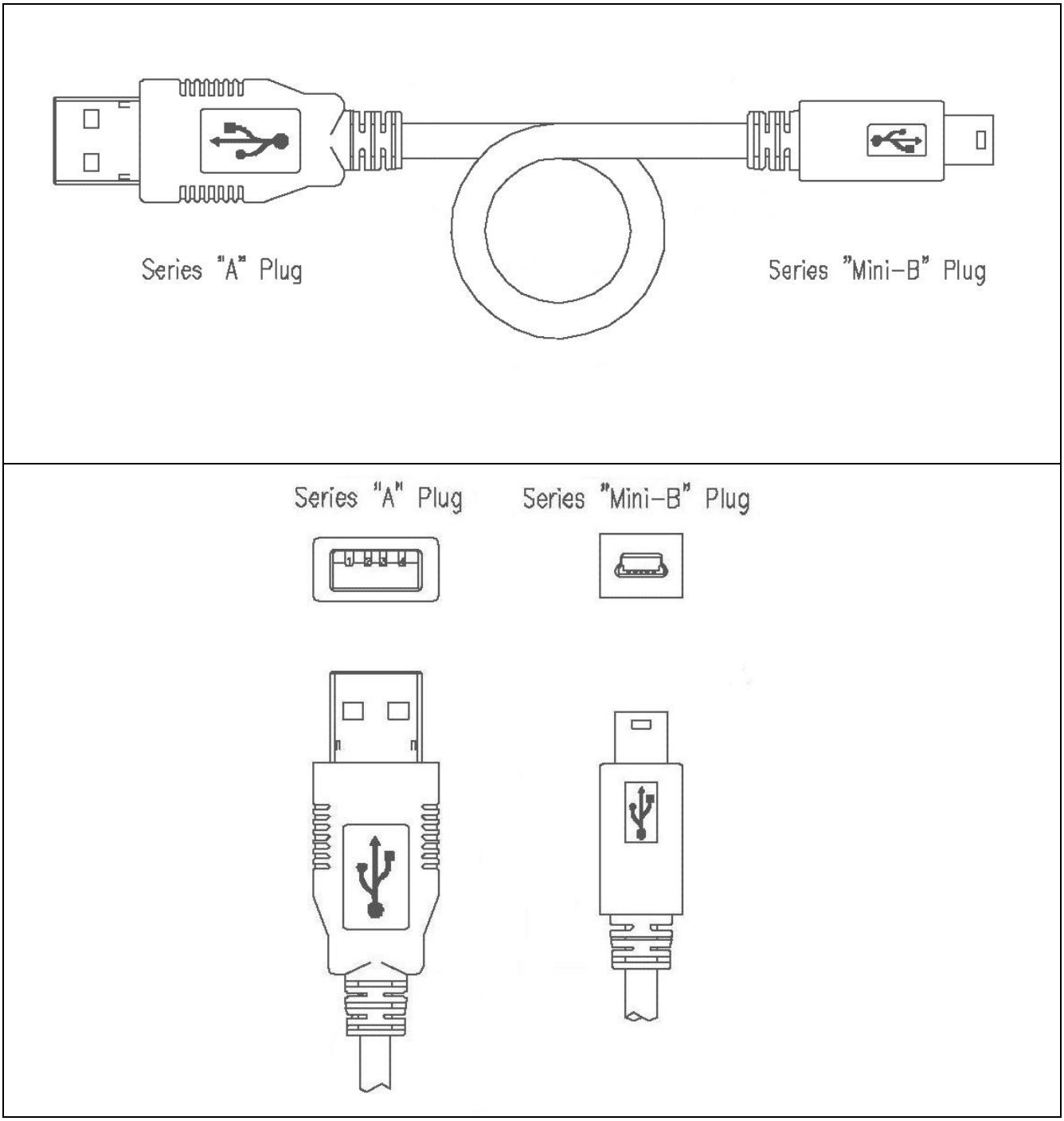

Figure 44: USB interface cable (Mini-B type)

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]