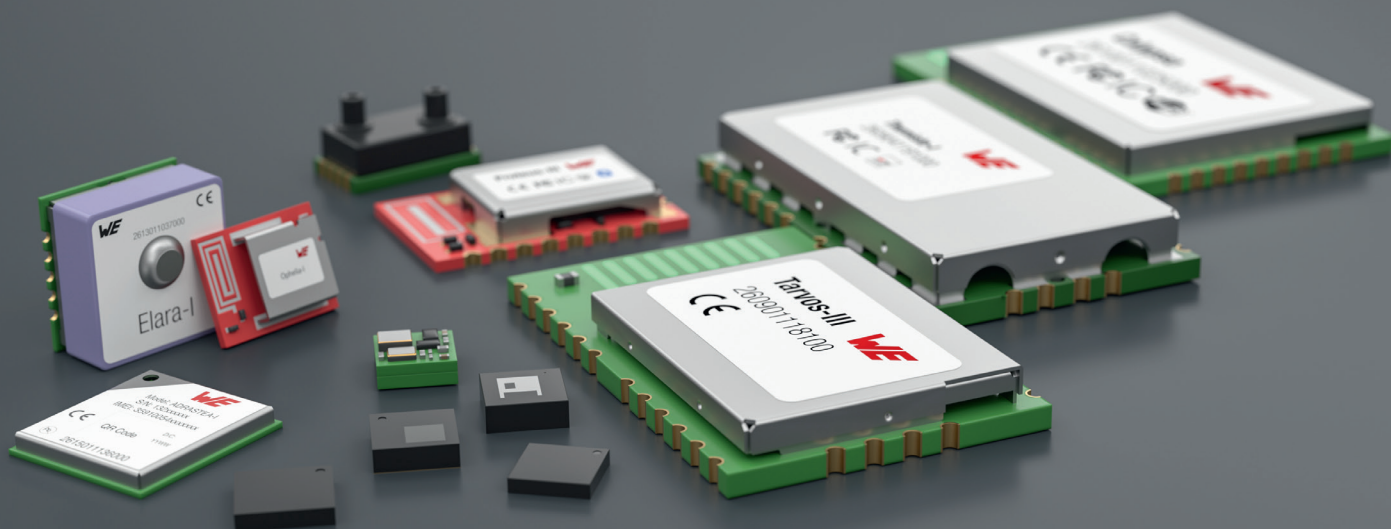




USER MANUAL

SKOLL-I

2620011024000

VERSION 0.1

JULY 22, 2024

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT

MUST READ

Check for firmware updates

Before using the product make sure you use the most recent firmware version, data sheet and user manual. This is especially important for Wireless Connectivity products that were not purchased directly from Würth Elektronik eiSos. A firmware update on these respective products may be required.

We strongly recommend to include in the customer system design, the possibility for a firmware update of the product.

Revision history

Manual version	FW version	HW version	Notes	Date
0.1	1.4.16.16	2.0	Initial version	July 2024

Abbreviations

Abbreviation	Name	Description
BR	Basic Rate	Bluetooth® Classic legacy radio mode
EDR	Enhanced Data Rate	Bluetooth® Classic radio mode with 2 and 3 Mbps for faster data transmission
HID	Human Interface Device	
HIGH	High signal level	
LOW	Low signal level	
LRM	Long Range Mode	Tx mode increasing the RX sensitivity by using spreading and forward error correction
PDS	Power Down Sleep	
RF	Radio Frequency	Describes everything relating to the wireless transmission.
SPP	Serial Port Profile	Standardized Bluetooth® Classic profile for serial data transmission
UART	Universal Asynchronous Receiver Transmitter	The UART allows communicating with the module via serial interface.
VDD	Supply voltage	

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Overview of helpful application notes

Application note ANR010 - Range estimation

<http://www.we-online.com/ANR010>

This application note presents the two most used mathematical range estimation models, Friis and two ray ground reflection, and its implementation in the range estimation tool of the RED-EXPERT.

Application note ANR016 - Radio module migration guide

<http://www.we-online.com/ANR016>

Due to our long term availability policy Würth Elektronik eiSos offers beside radio modules with most recent technology and chipset still the predecessor modules. This application note describes what to consider when switching in between module generations.

Application note ANR027 - Bluetooth qualification guide

<http://www.we-online.com/ANR027>

Every product containing Bluetooth® technology needs to be qualified at the Bluetooth® SIG (special interest group). This application note explains the steps to be done to gain a Bluetooth® qualification for the end product using a Würth Elektronik eiSos Bluetooth® LE radio module.

1 Introduction

1.1 Operational description

1.1.1 Key features

The Skoll-I offers the following key features:

Connection-based data transmission:

Bluetooth® Classic Serial Port Profile (SPP) communication: The Skoll-I firmware im-

plements the well known Bluetooth® Classic Serial Port Profile (SPP) profile that allows the bidirectional data transmission between several Skoll-I and/or to other Bluetooth® Classic devices implementing the SPP profile. Once started, it offers a single COM port for serial connectivity and communication. With that, the radio module is compatible to millions of Bluetooth® Classic devices already active in the field.

Bluetooth® LE communication: In addition to that, it further implements the CYSPP profile, which is a custom profile that acts as the pendant of the SPP profile in the Bluetooth® LE standard.

Having both profiles implemented allows to participate in Bluetooth® Classic as well as in Bluetooth® LE device networks, which enables maximum flexibility.

Connection setup and roles: The Skoll-I implements all roles of the Bluetooth® 5 standard. It can act as master or slave device in Bluetooth® Classic, as well as central or peripheral device in the Bluetooth® LE world. Thus it can initiate the connection setup as well as be connected by an external peer device.

Radio security: The Skoll-I provides all of the authentication and encryption functions defined in the Bluetooth® specification. This allows to setup secure connections to authenticated devices only, and to encrypt the transmission of data.

Additional Bluetooth® 5 radio modes: Besides the legacy radio phys, like BR (Basic Rate) for Bluetooth® Classic and LE 1 Mbps mode for Bluetooth® LE, the Skoll-I provides also the advanced radio modes EDR (Enhanced Data Rate, 2 and 3 Mbps) and LE 2 Mbps for faster data transmission.

Fast serial interface: The Skoll-I offers a UART-interface to communicate with a host micro controller using an user-defined baud rate and a simple command interface in binary or text mode.

Data mode: The Skoll-I firmware provides the "data" operation mode, in which the radio module acts as a transparent wireless bridge. Data received on the UART interface is sent via radio to the connected peer device, and data received via radio interface it sent out via UART to the connected host. This allows a quick integration of the module into the end device.

OTA firmware update: The Skoll-I firmware provides over the air firmware update capabilities. Firmware updates can be applied using the Bluetooth® LE interface.

1.3 Ordering information

WE order code	Description
2620011024000	Skoll-I radio module with PCB antenna
2620029024001	EV-Kit with mounted Skoll-I radio module

Table 1: Ordering information

2 Electrical specifications

Unless otherwise stated, all the values given in the manual were measured on the Skoll-I EV-Board with T = 25 °C, VDD = 3.0 V, BER 0.1 % internal DC-DC converter active.

2.1 Recommended operating conditions

Description	Min.	Typ.	Max.	Unit
Supply voltage (VDD)	1.71	3.0	3.3	V
Input Supply Voltage Ramp Time 0 to 3.3 V	40			µs
Temperature range	-30		+85	°C

Table 2: Recommended operating conditions

2.2 Absolute maximum ratings

Description	Min.	Typ.	Max.	Unit
Supply voltage (VDD)	-0.5		+3.45	V

Table 3: Absolute maximum ratings

2.3 Power consumption

2.3.1 Static

Description	Test conditions	Min	Typ.	Max	Unit
Bluetooth® LE TX current consumption	Continuous TX at max output power		10.4		mA
BR TX current consumption	Continuous TX at max output power		10.4		mA
EDR TX current consumption	Continuous TX at max output power		13.2		mA
Bluetooth® LE RX current consumption	1 Mbps		6.9 mA		mA
Bluetooth® LE RX current consumption	2 Mbps		7.9 mA		mA
BR RX current consumption	1 Mbps, DH1		4.8		mA
EDR RX current consumption	2 Mbps, 3 Mbps, x-DH1		5.1		mA

Low power mode (PDS)			270		μA
Low power mode (HID-off)			1.8		μA

Table 4: Power consumption

2.4 Radio characteristics

Description	Min	Typ.	Max	Unit
Max input	-20			dBm
Max output power		4		dBm
Input sensitivity 1 Mbps		-95		dBm
Input sensitivity 2 Mbps		-89		dBm
Frequencies	2.402		2.480	GHz

Table 5: Radio characteristics Bluetooth® LE

Description	Min	Typ.	Max	Unit
Max input	-20			dBm
Max output power BR		4		dBm
Max output power EDR		0		dBm
Input sensitivity BR		-92		dBm
Input sensitivity EDR 2 Mbps		-93.5		dBm
Input sensitivity EDR 3 Mbps		-87		dBm
Frequencies	2.402		2.480	GHz

Table 6: Radio characteristics Bluetooth® Classic

2.5 Pin characteristics

Property	Min	Typ.	Max	Unit
Pin input low voltage			0.8	V
Pin input high voltage	2.4			V
Pin output low voltage			0.4	V
Pin output high voltage	VDDO-0.4			V
Pin output current sunk by P26-P29		16		mA
Pin output current sourced by P26-P29		16		mA
Pin output current sunk by any other I/O and control pin		8		mA

Pin output current sourced by any other I/O and control pin		8		mA
GPIO internal pull-up/pull-down resistor		45		kΩ
GPIO input capacitance			0.4	pF

Table 7: Pin characteristics

3 Pinout

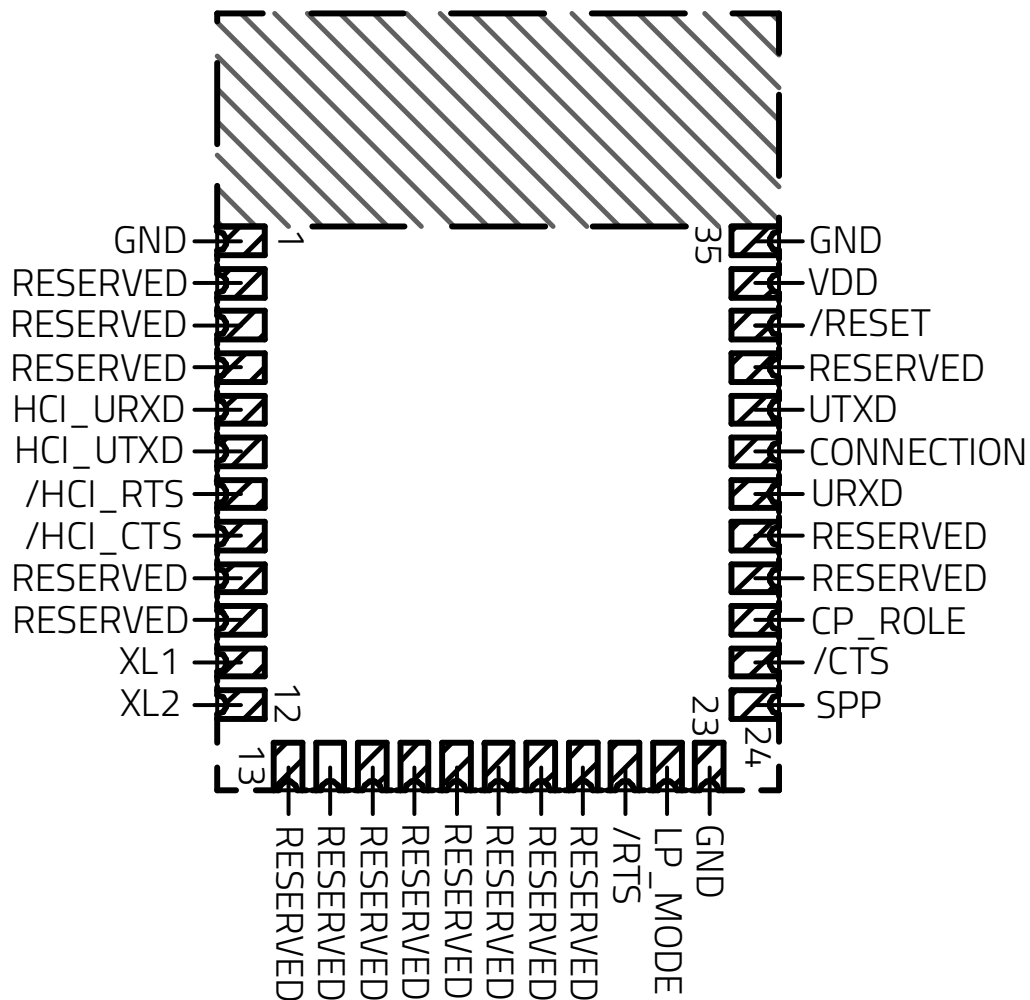


Figure 2: Pinout (top view)

No	Designation	µC pin	I/O	Description
1	<i>GND</i>	GND	Supply	Ground
2	<i>RESERVED</i>	P26	–	Reserved pin
3	<i>RESERVED</i>	DEV_WAKE	Input	Reserved pin
4	<i>RESERVED</i>	HOST_WAKE	Output	Reserved pin
5	<i>HCI_URXD</i>	UART_RXD	Input	HCI-UART RX
6	<i>HCI_UTXD</i>	UART_TXD	Output	HCI-UART TX
7	<i>/HCI_RTS</i>	UART_RTS_N	Output	HCI-UART RTS
8	<i>/HCI_CTS</i>	UART_CTS_N	Input	HCI-UART CTS, connect to external pull-up
9	<i>RESERVED</i>	P8	–	Reserved pin
10	<i>RESERVED</i>	P15	–	Reserved pin
11	<i>XL1</i>	XTALO_32K	Output	External Oscillator
12	<i>XL2</i>	XTALI_32K	Input	External Oscillator
13	<i>RESERVED</i>	P3	–	Reserved pin
14	<i>RESERVED</i>	P2	–	Reserved pin
15	<i>RESERVED</i>	P4	–	Reserved pin
16	<i>RESERVED</i>	P6	–	Reserved pin
17	<i>RESERVED</i>	P5	–	Reserved pin
18	<i>RESERVED</i>	P17	–	Reserved pin
19	<i>RESERVED</i>	P14	–	Reserved pin
20	<i>RESERVED</i>	P9	–	Reserved pin
21	<i>/RTS</i>	P11, /RTS_PUART	Output	Application UART RTS. Leave open if not needed
22	<i>LP_MODE</i>	P12, LP_MODE	Input	Disable low power mode. HIGH means "no not allow to sleep". Connect to HIGH or LOW
23	<i>GND</i>	GND	Supply	Ground
24	<i>SPP</i>	P13, CYSPP	I/O	Enter SPP data mode. LOW means "enter CYSPP data mode", HIGH means "leave CYSPP data mode". Leave open if not needed
25	<i>/CTS</i>	P10, /CTS_PUART	Input	Application UART CTS. Leave open if not needed
26	<i>CP_ROLE</i>	P1, CP_ROLE	I/O	GAP role selection. LOW means central mode, HIGH means peripheral mode. Leave open if not needed
27	<i>RESERVED</i>	P0	–	Reserved pin

28	<i>RESERVED</i>	P28	–	Reserved pin
29	<i>URXD</i>	P37, RX_PUART	Input	Application UART RX
30	<i>CONNECTION</i>	P27, CONNECTION	Output	Connection status. LOW means peer is connected. Leave open if not needed
31	<i>UTXD</i>	P32, TX_PUART	Output	Application UART TX
32	<i>RESERVED</i>	P29	–	Reserved pin
33	<i>/RESET</i>	XRES	Input	Reset pin, active low, internal pull-up
34	<i>VDD</i>	VDD	Supply	Supply voltage
35	<i>GND</i>	GND	Supply	Ground

Table 8: Pinout

4 Firmware history

Version 1.4.16.16 "Release"

- Initial version

5 Design in guide

5.1 Advice for schematic and layout

For users with less RF experience it is advisable to closely copy the relating EV-Board with respect to schematic and layout, as it is a proven design. The layout should be conducted with particular care, because even small deficiencies could affect the radio performance and its range or even the conformity.

The following general advice should be taken into consideration:

- A clean, stable power supply is strongly recommended. Interference, especially oscillation can severely restrain range and conformity.
- Variations in voltage level should be avoided.
- LDOs, properly designed in, usually deliver a proper regulated voltage.
- Blocking capacitors and a ferrite bead in the power supply line can be included to filter and smoothen the supply voltage when necessary.



No fixed values can be recommended, as these depend on the circumstances of the application (main power source, interferences etc.).



The use of an external reset IC should be considered if one of the following points is relevant:



- The slew rate of the power supply exceeds the electrical specifications.
- The effect of different current consumptions on the voltage level of batteries or voltage regulators should be considered. The module draws higher currents in certain scenarios like start-up or radio transmit which may lead to a voltage drop on the supply. A restart under such circumstances should be prevented by ensuring that the supply voltage does not drop below the minimum specifications.
- Voltage levels below the minimum recommended voltage level may lead to malfunction. The reset pin of the module shall be held on LOW logic level whenever the VDD is not stable or below the minimum operating Voltage.
- Special care must be taken in case of battery powered systems.

- Elements for ESD protection should be placed on all pins that are accessible from the outside and should be placed close to the accessible area. For example, the RF-pin is accessible when using an external antenna and should be protected.
- ESD protection for the antenna connection must be chosen such as to have a minimum effect on the RF signal. For example, a protection diode with low capacitance such as the 8231606A or a 68 nH air-core coil connecting the RF-line to ground give good results.
- Placeholders for optional antenna matching or additional filtering are recommended.
- The antenna path should be kept as short as possible.



Again, no fixed values can be recommended, as they depend on the influencing circumstances of the application (antenna, interferences etc.).

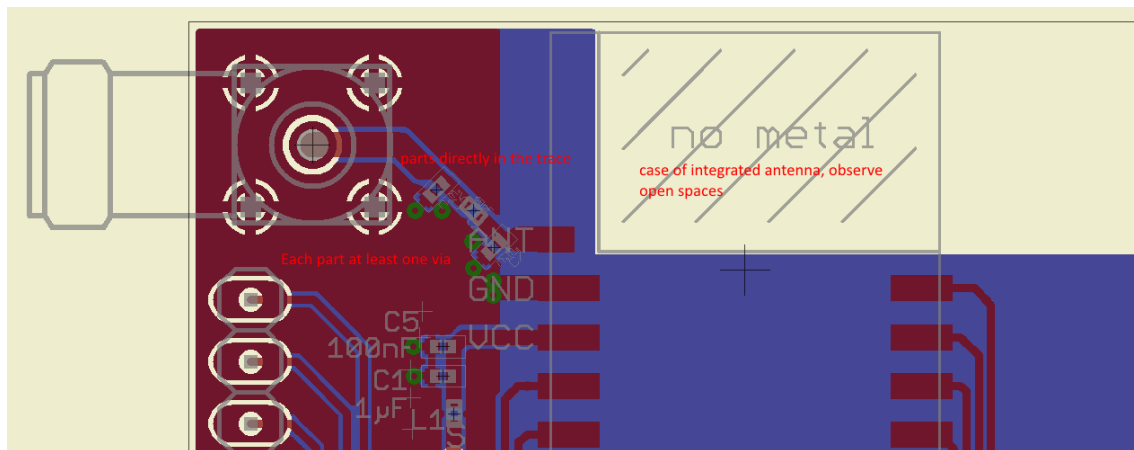


Figure 3: Layout

- To avoid the risk of short circuits and interference there should be no routing underneath the module on the top layer of the baseboard.
- On the second layer, a ground plane is recommended, to provide good grounding and shielding to any following layers and application environment.
- In case of integrated antennas it is required to have areas free from ground. This area should be copied from the EV-Board.
- The area with the integrated antenna must overlap with the carrier board and should not protrude, as it is matched to sitting directly on top of a PCB.
- Modules with integrated antennas should be placed with the antenna at the edge of the main board. It should not be placed in the middle of the main board or far away from the edge. This is to avoid tracks beside the antenna.

- Filter and blocking capacitors should be placed directly in the tracks without stubs, to achieve the best effect.
- Antenna matching elements should be placed close to the antenna / connector, blocking capacitors close to the module.
- Ground connections for the module and the capacitors should be kept as short as possible and with at least one separate through hole connection to the ground layer.
- ESD protection elements should be placed as close as possible to the exposed areas.

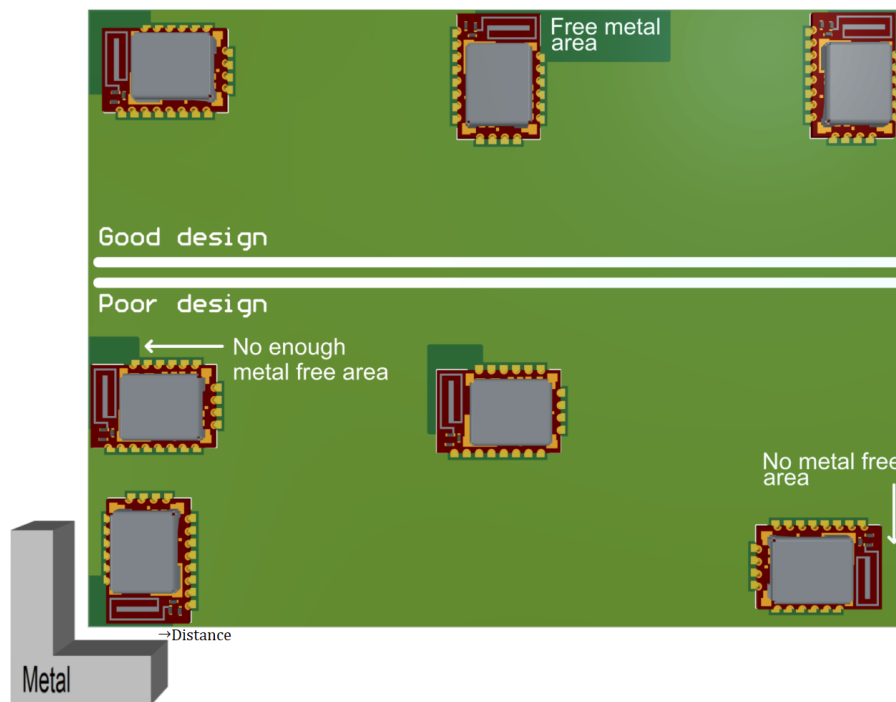


Figure 4: Placement of the module with integrated antenna

6 Reference design

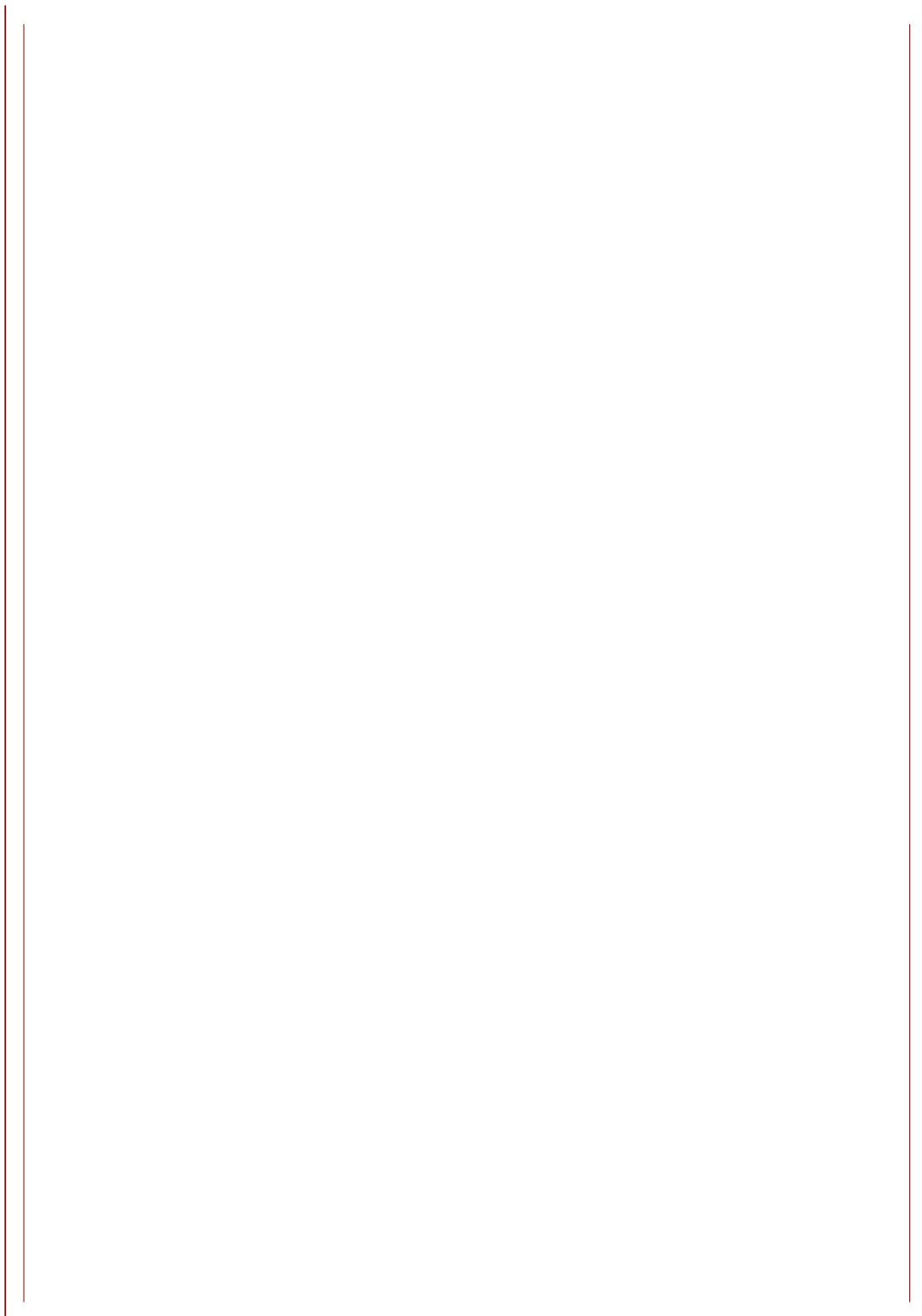
Skoll-I was tested and certified on the corresponding Skoll-I EV-Board. For the compliance with the EU directive 2014/53/EU Annex I, the EV-Board serves as reference design.

This is no discrepancy due to the fact that the EV-Board itself does not fall within the scope of the EU directive 2014/53/EU Annex I as the module is tested on the EV-Board, which is also the recommended use.

Further information concerning the use of the EV-Board can be found in the manual of the Skoll-I EV-Board.

6.1 EV-Board

6.1.1 Schematic



6.1.2 Layout

7 Manufacturing information

7.1 Moisture sensitivity level

This wireless connectivity product is categorized as JEDEC Moisture Sensitivity Level 3 (MSL3), which requires special handling.

More information regarding the MSL requirements can be found in the IPC/JEDEC J-STD-020 standard on www.jedec.org.

More information about the handling, picking, shipping and the usage of moisture/reflow and/or process sensitive products can be found in the IPC/JEDEC J-STD-033 standard on www.jedec.org.

7.2 Soldering

7.2.1 Reflow soldering

Attention must be paid on the thickness of the solder resist between the host PCB top side and the modules bottom side. Only lead-free assembly is recommended according to JEDEC J-STD020.

Profile feature		Value
Preheat temperature Min	$T_{S \text{ Min}}$	150 °C
Preheat temperature Max	$T_{S \text{ Max}}$	200 °C
Preheat time from $T_{S \text{ Min}}$ to $T_{S \text{ Max}}$	t_S	60 - 120 seconds
Ramp-up rate (T_L to T_P)		3 °C / second max.
Liquidous temperature	T_L	217 °C
Time t_L maintained above T_L	t_L	60 - 150 seconds
Peak package body temperature	T_P	260 °C
Time within 5 °C of actual peak temperature	t_P	20 - 30 seconds
Ramp-down Rate (T_P to T_L)		6 °C / second max.
Time 20 °C to T_P		8 minutes max.

Table 9: Classification reflow soldering profile, Note: refer to IPC/JEDEC J-STD-020E

It is recommended to solder this module on the last reflow cycle of the PCB. For solder paste use a LFM-48W or Indium based SAC 305 alloy (Sn 96.5 / Ag 3.0 / Cu 0.5 / Indium 8.9HF / Type 3 / 89%) type 3 or higher.

The reflow profile must be adjusted based on the thermal mass of the entire populated PCB, heat transfer efficiency of the reflow oven and the specific type of solder paste used. Based on the specific process and PCB layout the optimal soldering profile must be adjusted and verified. Other soldering methods (e.g. vapor phase) have not been verified and have to be validated

by the customer at their own risk. Rework is not recommended.

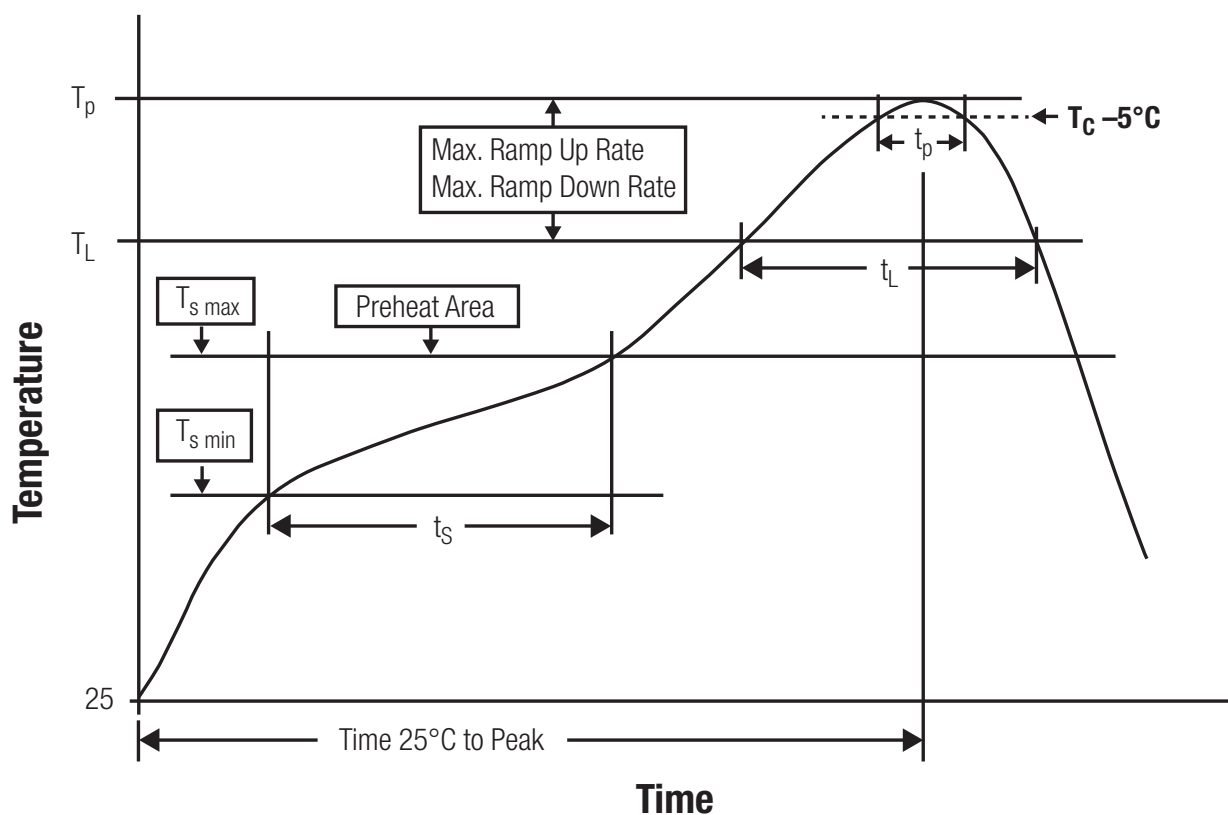


Figure 7: Reflow soldering profile

After reflow soldering, visually inspect the board to confirm proper alignment

7.2.2 Cleaning

Do not clean the product. Any residue cannot be easily removed by washing. Use a "no clean" soldering paste and do not clean the board after soldering.

- Do not clean the product with water. Capillary effects can draw water into the gap between the host PCB and the module, absorbing water underneath it. If water is trapped inside, it may short-circuit adjoining pads. The water may also destroy the label and ink-jet printed text on it.
- Cleaning processes using alcohol or other organic solvents may draw solder flux residues into the housing, which won't be detected in a post-wash inspection. The solvent may also destroy the label and ink-jet printed text on it.
- Do not use ultrasonic cleaning as it will permanently damage the part, particularly the crystal oscillators.

7.2.3 Potting and coating

- If the product is potted in the customer application, the potting material might shrink or expand during and after hardening. Shrinking could lead to an incomplete seal, allowing contaminants into the component. Expansion could damage components. We recommend a manual inspection after potting to avoid these effects.
- Conformal coating or potting results in loss of warranty.
- The RF shield will not protect the part from low-viscosity coatings and potting. An undefined amount of coating and potting will enter inside the shielding.
- Conformal coating and potting will influence the parts of the radio front end and consequently influence the radio performance.
- Potting will influence the temperature behaviour of the device. This might be critical for components with high power.

7.2.4 Other notations

- Do not attempt to improve the grounding by forming metal strips directly to the EMI covers or soldering on ground cables, as it may damage the part and will void the warranty.
- Always solder every pad to the host PCB even if some are unused, to improve the mechanical strength of the module.
- The part is sensitive to ultrasonic waves, as such do not use ultrasonic cleaning, welding or other processing. Any ultrasonic processing will void the warranty.

7.3 ESD handling

This product is highly sensitive to electrostatic discharge (ESD). As such, always use proper ESD precautions when handling. Make sure to handle the part properly throughout all stages of production, including on the host PCB where the module is installed. For ESD ratings, refer to the module series' maximum ESD section. For more information, refer to the relevant chapter 2. Failing to follow the aforementioned recommendations can result in severe damage to the part.

- the first contact point when handling the PCB is always between the local GND and the host PCB GND, unless there is a galvanic coupling between the local GND (for example work table) and the host PCB GND.
- Before assembling an antenna patch, connect the grounds.
- While handling the RF pin, avoid contact with any charged capacitors and be careful when contacting any materials that can develop charges (for example coaxial cable with around 50-80 pF/m, patch antenna with around 10 pF, soldering iron etc.)
- Do not touch any exposed area of the antenna to avoid electrostatic discharge. Do not let the antenna area be touched in a non ESD-safe manner.
- When soldering, use an ESD-safe soldering iron.

7.4 Safety recommendations

It is your duty to ensure that the product is allowed to be used in the destination country and within the required environment. Usage of the product can be dangerous and must be tested and verified by the end user. Be especially careful of:

- Use in areas with risk of explosion (for example oil refineries, gas stations).
- Use in areas such as airports, aircraft, hospitals, etc., where the product may interfere with other electronic components.

It is the customer's responsibility to ensure compliance with all applicable legal, regulatory and safety-related requirements as well as applicable environmental regulations. Disassembling the product is not allowed. Evidence of tampering will void the warranty.

- Compliance with the instructions in the product manual is recommended for correct product set-up.
- The product must be provided with a consolidated voltage source. The wiring must meet all applicable fire and security prevention standards.
- Handle with care. Avoid touching the pins as there could be ESD damage.

Be careful when working with any external components. When in doubt consult the technical documentation and relevant standards. Always use an antenna with the proper characteristics.



Würth Elektronik eiSos radio modules with high output power of up to 500 mW, as for example the radio module Thebe-II, generate a high amount of warmth while transmitting. The manufacturer of the end device must take care of potentially necessary actions for his application.

8 Physical specifications

8.1 Dimensions

Dimensions
16.61 x 12 x 1.7 mm

Table 10: Dimensions

8.2 Weight

Weight
1.288 g

Table 11: Weight

9 Marking

9.1 Lot number

The 15 digit lot number is printed in numerical digits as well as in form of a machine readable bar code. It is divided into 5 blocks as shown in the following picture and can be translated according to the following table.

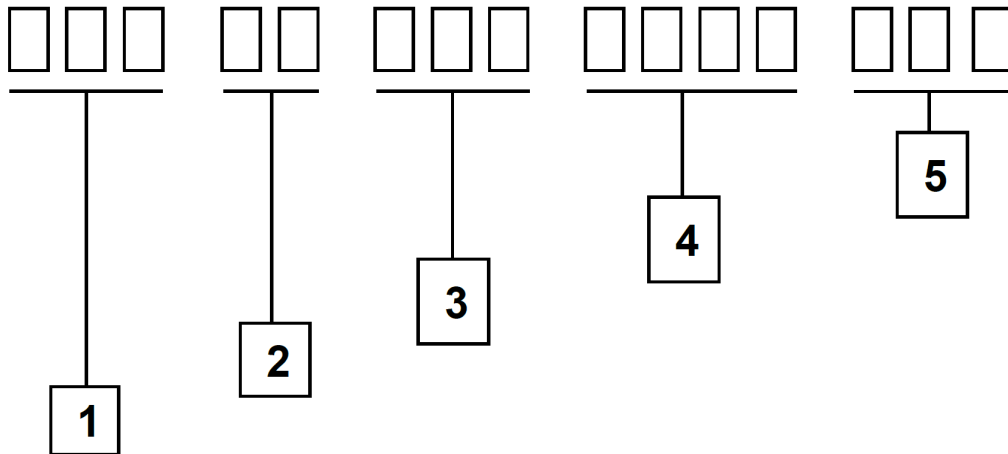


Figure 8: Lot number structure

Block	Information	Example(s)
1	eiSos internal, 3 digits	439
2	eiSos internal, 2 digits	01
3	Hardware version, 3 digits	V2.4 = 024, V12.2 = 122
4	Date code, 4 digits	1703 = week 03 in year 2017, 1816 = week 16 in year 2018
5	Firmware version, 3 digits	V3.2 = 302, V5.13 = 513

Table 12: Lot number details

As the user can perform a firmware update the printed lot number only shows the factory delivery state. The currently installed firmware can be requested from the module using the corresponding product specific command. The firmware version as well as the hardware version are restricted to show only major and minor version not the patch identifier.

9.2 General labeling information

Labels of Würth Elektronik eiSos radio modules include several fields. Besides the manufacturer identification, the product's *WE* order code, serial number and certification information are placed on the label. In case of small labels, additional certification marks are placed on the label of the reel.

The informations on the label are fixed. Only the serial number changes with each entity of the radio module. For Skoll-I the label is as follows:

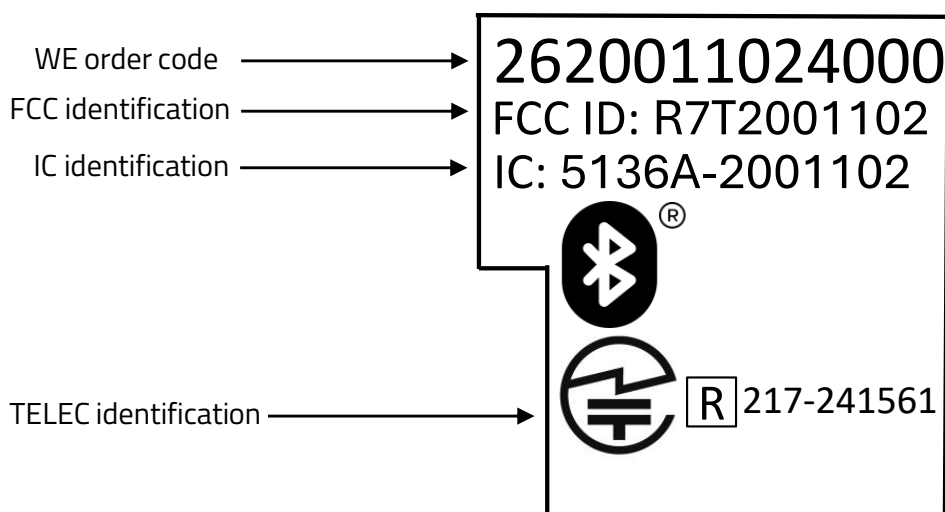


Figure 9: Label of the Skoll-I

10 Information for explosion protection

In case the end product should be used in explosion protection areas the following information can be used:

- The module itself is unfused.
- The maximum output power of the module is 4 dBm.
- The total amount of capacitance of all capacitors is 19.9 μF .
- The total amount of inductance of all inductors is 2.206 μH .

11 References

- [1] Bluetooth®. Bluetooth® Core Specification, version 5.4. <https://www.bluetooth.com/specifications/specs/core-specification-5-4/>.

12 Regulatory compliance information

12.1 Conformity assessment of the final product

The Skoll-I is a subassembly. It is designed to be embedded into other products (products incorporating the Skoll-I are henceforward referred to as "final products").

It is the responsibility of the manufacturer of the final product to ensure that the final product is in compliance with the essential requirements of the underlying national radio regulations.

The conformity assessment of the subassembly Skoll-I carried out by Würth Elektronik eiSos does not replace the required conformity assessment of the final product.

12.2 Exemption clause

Relevant regulation requirements are subject to change. Würth Elektronik eiSos does not guarantee the accuracy of the before mentioned information. Directives, technical standards, procedural descriptions and the like may be interpreted differently by the national authorities. Equally, the national laws and restrictions may vary with the country. In case of doubt or uncertainty, we recommend that you consult with the authorities or official certification organizations of the relevant countries. Würth Elektronik eiSos is exempt from any responsibilities or liabilities related to regulatory compliance.

Notwithstanding the above, Würth Elektronik eiSos makes no representations and warranties of any kind related to their accuracy, correctness, completeness and/or usability for customer applications. No responsibility is assumed for inaccuracies or incompleteness.

12.3 FCC Compliance Statement (US)

FCC ID: R7T2001102

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference, and
 - (2) this device must accept any interference received, including interference that may cause undesired operation.
- (FCC 15.19)

Modifications (FCC 15.21)

Caution: Changes or modifications for this equipment not expressly approved by Würth Elektronik eiSos may void the FCC authorization to operate this equipment.

12.4 IC Compliance Statement (Canada)

Certification Number: 5136A-2001102

HVIN: 2001102

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

12.5 FCC and IC requirements to OEM integrators

This module has been granted modular approval. OEM integrators for host products may use the module in their final products without additional FCC/IC (Industry Canada) certification if they meet the following conditions. Otherwise, additional FCC/IC approvals must be obtained. The host product with the module installed must be evaluated for simultaneous transmission requirements.

- The users manual for the host product must clearly indicate the operating requirements and conditions that must be observed to ensure compliance with current FCC/IC RF exposure guidelines.
- A label must be affixed to the outside of the host product with the following statements:
This device contains FCCID: R7T2001102
This equipment contains equipment certified under ICID: 5136A-2001102
- The final host / module combination may also need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device.

- If the final host / module combination is intended for use as a portable device (see classifications below) the host manufacturer is responsible for separate approvals for the SAR requirements from FCC Part 2.1093 and RSS-102.

OEM requirements:

The OEM must ensure that the following conditions are met.

- End users of products, which contain the module, must not have the ability to alter the firmware that governs the operation of the module. The agency grant is valid only when the module is incorporated into a final product by OEM integrators.
- The end-user must not be provided with instructions to remove, adjust or install the module.
- The Original Equipment Manufacturer (OEM) must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the final product. Attaching a label to a removable portion of the final product, such as a battery cover, is not permitted.
- The label must include the following text:
Contains FCC ID: R7T2001102
The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(i.) this device may not cause harmful interference and
(ii.) this device must accept any interference received, including interference that may cause undesired operation.

When the device is so small or for such use that it is not practicable to place the statement above on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

- The user manual for the end product must also contain the text given above.
 - Changes or modifications not expressly approved could void the user's authority to operate the equipment.
 - The OEM must ensure that timing requirements according to 47 CFR 15.231(a-c) are met.
 - The OEM must sign the OEM Modular Approval Agreement.
 - The module must be used with only the following approved antenna(s).
- The OEM shall perform testing in accordance to 996369 D04 Module Integration Guide V01.

12.6 Pre-certified antennas

The Skoll-I is pre-certified with the following antennas.

Product	Certified antenna
Skoll-I	PCB antenna included in the Skoll-I

12.7 TELEC radio law approval

Japanese Radio Law Compliance



This device has passed the Radio Law approval for Japan through the registered certification body TELEC. The corresponding ARIB (Association of Radio Industries and Businesses) standard has been applied. Accordingly, the market approval is given by the MIC (Ministry of Internal Affairs and Communications).

This device should not be modified (otherwise the granted designation number will become invalid)

12.7.1 Label

Due to the small size of the Skoll-I label, the certification label of the Skoll-I is not placed onto the module label.

2620011024000:



After integration of the Skoll-I in the end device, the corresponding certification label must be recognized from the outside. Otherwise this information must be referenced on the housing as well as in the user manual. E labeling is allowed.

12.7.2 Certified antennas

The Skoll-I is pre-certified with the following antennas.

Product	Certified antenna
Skoll-I (2620011024000)	PCB antenna included in the Skoll-I

12.8 Certification of the end device

For the certification of the end device, which integrates the Skoll-I, it is necessary to set the Skoll-I to transmission mode and check the radio emissions.

By default the Skoll-I already implements all test commands needed for certification tests. These are accessible by the HCI UART (*HCI_URXD* - */HCI_CTS*) of the module. To run the tests, connect the Bluetooth® tester to the Skoll-I with 115200 Baud, 8N1 and flow control enabled. Then send a HCI reset command to check whether it responds correctly.

Info	Message
⇒ Sent HCI reset command	0x01 03 0C 00
⇐ Response from module "Success"	0x04 0E 04 01 03 0C 00

Now the tester can control the radio module by HCI commands. Refer to Bluetooth® specification [1] for HCI command documentation.

13 Important notes

The following conditions apply to all goods within the wireless connectivity and sensors product range of Würth Elektronik eiSos GmbH & Co. KG:

General customer responsibility

Some goods within the product range of Würth Elektronik eiSos GmbH & Co. KG contain statements regarding general suitability for certain application areas. These statements about suitability are based on our knowledge and experience of typical requirements concerning the areas, serve as general guidance and cannot be estimated as binding statements about the suitability for a customer application. The responsibility for the applicability and use in a particular customer design is always solely within the authority of the customer. Due to this fact, it is up to the customer to evaluate, where appropriate to investigate and to decide whether the device with the specific product characteristics described in the product specification is valid and suitable for the respective customer application or not. Accordingly, the customer is cautioned to verify that the documentation is current before placing orders.

Customer responsibility related to specific, in particular safety-relevant applications

It has to be clearly pointed out that the possibility of a malfunction of electronic components or failure before the end of the usual lifetime cannot be completely eliminated in the current state of the art, even if the products are operated within the range of the specifications. The same statement is valid for all software source code and firmware parts contained in or used with or for products in the wireless connectivity and sensor product range of Würth Elektronik eiSos GmbH & Co. KG. In certain customer applications requiring a high level of safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health, it must be ensured by most advanced technological aid of suitable design of the customer application that no injury or damage is caused to third parties in the event of malfunction or failure of an electronic component.

Best care and attention

Any product-specific data sheets, manuals, application notes, PCN's, warnings and cautions must be strictly observed in the most recent versions and matching to the products revisions. This documents can be downloaded from the product specific sections on the wireless connectivity and sensors homepage.

Customer support for product specifications

Some products within the product range may contain substances, which are subject to restrictions in certain jurisdictions in order to serve specific technical requirements. Necessary information is available on request. In this case, the Business Development Engineer (BDM) or the internal sales person in charge should be contacted who will be happy to support in this matter.

Product improvements

Due to constant product improvement, product specifications may change from time to time. As a standard reporting procedure of the Product Change Notification (PCN) according to the JEDEC-Standard, we inform about major changes. In case of further queries regarding the PCN, the Business Development Engineer (BDM), the internal sales person or the technical support team in charge should be contacted. The basic responsibility of the customer as per section 13 and 13 remains unaffected.

All software like "wireless connectivity SDK", "Sensor SDK" or other source codes as well as all PC software tools are not subject to the Product Change Notification information process.

Product life cycle

Due to technical progress and economical evaluation we also reserve the right to discontinue production and delivery of products. As a standard reporting procedure of the Product Termination Notification (PTN) according to the JEDEC-Standard we will inform at an early stage about inevitable product discontinuance. According to this, we cannot ensure that all products within our product range will always be available. Therefore, it needs to be verified with the Business Development Engineer (BDM) or the internal sales person in charge about the current product availability expectancy before or when the product for application design-in disposal is considered. The approach named above does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.

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14 Legal notice

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You are responsible for using the Würth Elektronik eiSos wireless connectivity product with the incorporated firmware in compliance with all applicable product liability and product safety laws. You acknowledge to minimize the risk of loss and harm to individuals and bear the risk for failure leading to personal injury or death due to your usage of the product.

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Firmware update(s)

You have the opportunity to request the current and actual firmware for a bought wireless connectivity product within the time of warranty. However, Würth Elektronik eiSos has no obligation to update a modules firmware in their production facilities, but can offer this as a service on request. The upload of firmware updates falls within your responsibility, e.g. via ACC or another software for firmware updates. Firmware updates will not be communicated automatically. It is within your responsibility to check the current version of a firmware in the latest version of the product manual on our website. The revision table in the product manual provides all necessary information about firmware updates. There is no right to be provided with binary files, so called "firmware images", those could be flashed through JTAG, SWD, Spi-Bi-Wire, SPI or similar interfaces.

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We recommend you to be updated about the status of new firmware and software, which is available on our website or in our data sheet and manual, and to implement new software in your device where appropriate.

By ordering a product, you accept these license terms in all terms.

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**Contact**

Würth Elektronik eiSos GmbH & Co. KG
Division Wireless Connectivity & Sensors

Max-Eyth-Straße 1
74638 Waldenburg
Germany

Tel.: +49 651 99355-0
Fax.: +49 651 99355-69
www.we-online.com/wireless-connectivity

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