



USER MANUAL

EVALUATION BOARD FOR RADIO
MODULES PROTEUS-I AND
PROTEUS-II

2608011024000 /
2608011124000 /
2608011024010 /
2608011124010

VERSION 1.3

MAY 23, 2023

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	HW version	Notes	Date
0.3	2.0	<ul style="list-style-type: none">• Initial version	November 2016
1.0	2.0	<ul style="list-style-type: none">• New corporate design and structure	February 2019
1.1	2.0	<ul style="list-style-type: none">• Added chapter Regulatory compliance information	February 2019
1.2	2.0	<ul style="list-style-type: none">• Added marketing name Proteus-I and Proteus-II	March 2019
1.3	2.0	<ul style="list-style-type: none">• Added radiation characteristics in chapter 3.8• New corporate design	May 2023

Abbreviations

Abbreviation	Name	Description
FSE	Field Sales Engineer	Support and sales contact person responsible for limited sales area
HIGH	High signal level	
LOW	Low signal level	
RF	Radio frequency	Describes everything relating to the wireless transmission.
UART	Universal Asynchronous Receiver Transmitter	Universal Asynchronous Receiver Transmitter allows communicating with the module of a specific interface.
VDD	Supply voltage	

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1 Supported radio modules

The evaluation board described in this manual can be used to evaluate the following products:

Order code	Former order code	Marketing Name
2608011024000	AMB2621(-TR)	Proteus-I
2608011124000	AMB2621-1(-TR)	Proteus-I
2608011024010	AMB2623(-TR)	Proteus-II
2608011124010	AMB2623-1(-TR)	Proteus-II

Order code	Description
2608011024000	Bluetooth® LE 4.2 radio module with integrated antenna
2608011124000	Bluetooth® LE 4.2 radio module with antenna pad
2608011024010	Bluetooth® LE 5.0 radio module with integrated antenna
2608011124010	Bluetooth® LE 5.0 radio module with antenna pad

Table 1: Compatibility



Figure 1: Product image

2 Functional description

The evaluation board offers the user the possibility to develop hard- and software for the compatible radio module. It can be connected to an USB port of a PC.

For the connection to a micro controller system the development board is equipped with a multi-pin connector which is connected to all pins of the RF module. Jumpers allow the module

to be disconnected from components such as the USB interface which are not required.

Feel free to check our youtube channel:

www.youtube.com/user/WuerthElektronik/videos

for video tutorials, hands-ons and webinars relating to our products.

2.1 Taking into operation

To run the evaluation board place the jumpers on default location.

The corresponding FTDI driver package (www.ftdichip.com/Drivers/VCP.htm) has to be installed on your PC.

Connect the power jack or external power supply to the EV board and make sure the VCC is stable and able to reliably supply the module's static and peak current consumption as specified by the module manual.

The next step is to connect the evaluation board to the PC using a USB-cable. In that way a COM port can be detected and installed on your PC. Check the device manager to acquire the COM port name of the EV board. A typical name is "COM12" in Windows systems or "/dev/ttyUSB0" in Linux systems.

A terminal program (like hterm for Windows) has to be run and the corresponding COM port has to be opened using the default settings of the mounted radio module.

After the module is powered through the USB jack or an alternative power supply, the reset button should be pressed to ensure a clean start-up of the module.

Please refer to the module user manual to get the detailed module specific quick start instructions.

3 Development board

3.1 Block diagram

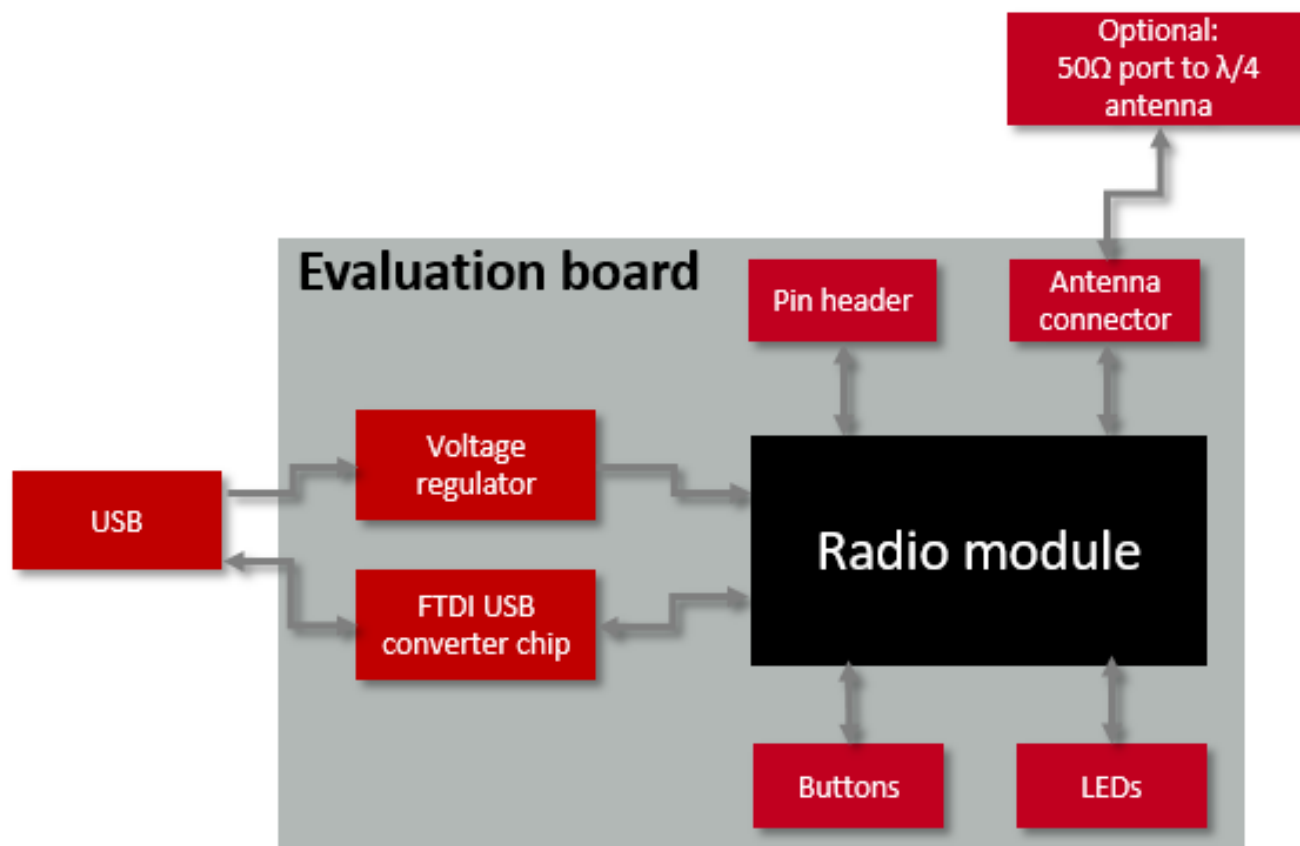


Figure 2: Block diagram

3.2 Jumpers

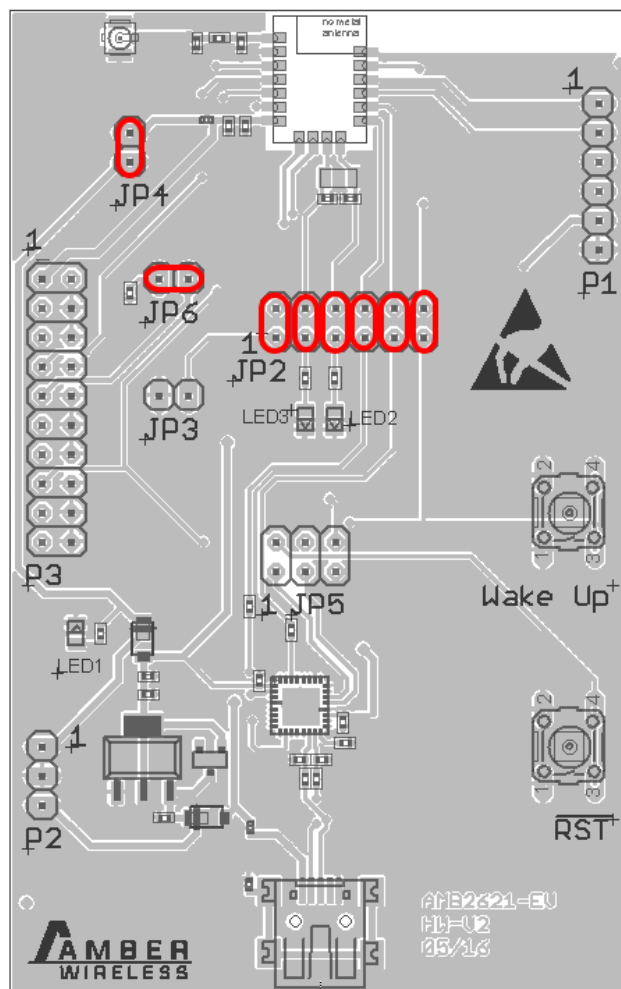


Figure 3: Jumpers, defaults

JP2	Module Pin Function	Jumper set (default)
1,2	BOOT	Yes
3,4	LED3	Yes
5,6	LED2	Yes
7,8	UART TX	Yes
9,10	UART RX	Yes
11,12	Wakeup	Yes

JP3	Module Pin Function	Jumper set (default)
1,2	Connect BOOT pin to GND if set	No

JP4	Function	Jumper set (default)
1,2	Power bridge	Yes

JP5	CBUS Connections	Jumper set (default)
1,2	Reset	No
3,4	Wake-up	No
5,6	Boot	No

JP6	Function	Jumper set (default)
1,2	Connect SWCLK to GND if set	Yes

3.3 Connectors and pin headers

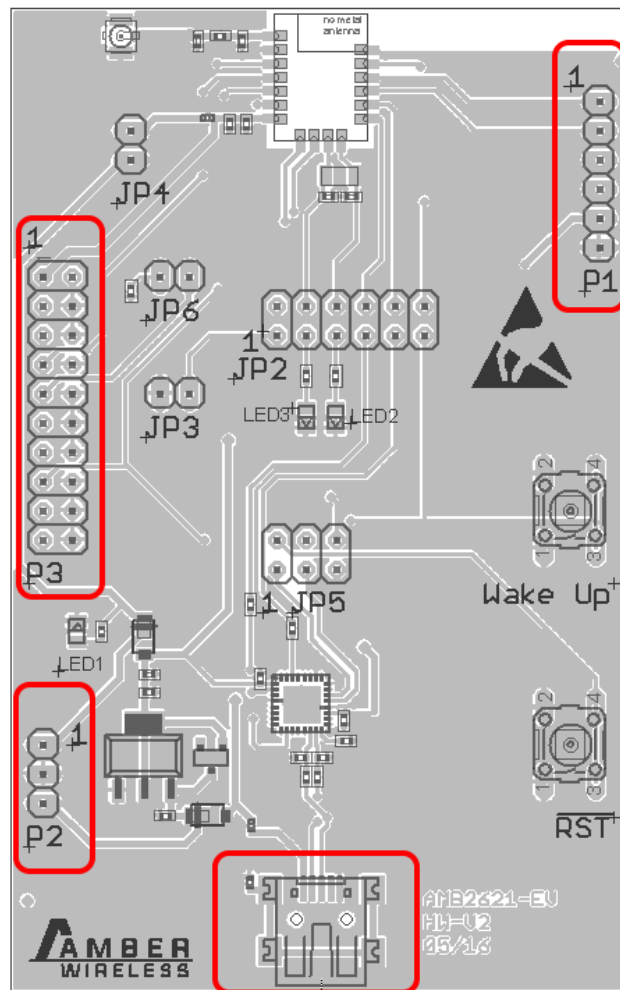


Figure 4: Connectors

USB	Function
	Mini-USB connector for host connection and VCC bus supply

P1	Function
1	P0.28 / AIN4
2	P0.04 / AIN2
3	P0.09 / NFC1
4	P0.10 / NFC2
5	VCC 3V
6	GND

P2	Function
1	VCC 3V
2	GND
3	VCC 5 V

P3	Function
1-20	2×10 JTAG/SWD Connector

3.4 Buttons

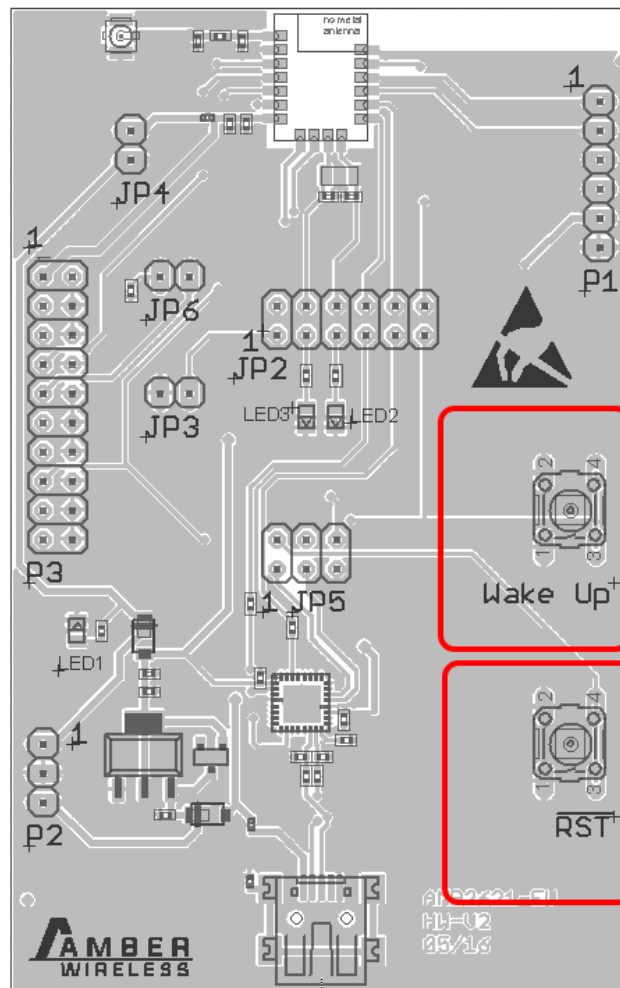


Figure 5: Buttons

3.4.1 /RST button

Internally the active low reset input of the micro processor is connected via a RC combination with the power supply to ensure a proper startup of the module. Any module provides a */RESET* pin that is connected to this button so the module can be restarted properly. Most modules provide an internal pull-up resistor. Please refer to the module specific manual for detailed information.

3.4.2 Wake-up button

Some modules use the wake-up button connected to their *WAKE-UP* pin to exit from sleep mode of the module. Please refer to the module specific manual for detailed information.

3.5 Function blocks

3.5.1 Power supply

3.5.1.1 Bus powered, power supply through USB

The development board can be run via USB. The integrated voltage regulator regulates the connected USB voltage 5 V down to 3V and supplies the remaining parts of the circuit. If the evaluation board is power sourced the power *LED1* lights up.

3.5.2 JP4 - Current measurement

By default, JP4 is bridged for normal operation. If a current meter is connected in place of the jumper, the power consumption of the radio module can be measured.

If the meter is not attached and the bridge is not set, the module will not receive a supply voltage. However, the power *LED1* may be active, as it is connected prior to the current measurement bridge in order not to distort the module's power consumption.

3.5.3 UART / USB

The UART of the module can be connected to the USB converter by setting the bridge JP2. In this case it is available on the USB jack. Using the FTDI-driver the PC will show a virtual COM-Port which can be used to communicate with the module.



The USB cable length must not exceed 3 meters.

3.5.4 UART direct

If a micro-controller is to be connected to the module, remove the bridges on JP2. The UART can be connected directly on the pin strip JP2 (all odd numbered pins). The module *RXD* line must be handled accordingly by your host (i.e. pulled up while inactive and during module boot-up). Furthermore on P1, the flow control pins RTS and CTS can be found, in case flow control is used.

Beware of IO level incompatibility. The host must obey the values stated in the module's manual. Especially the IO level restrictions must be implemented by a host system (i.e. using a level shifter to use the allowed IO levels).

3.5.5 LFXO crystal

For higher LFCLK accuracy (better than $\pm 250\text{ppm}$) a low frequency crystal oscillator of about 32.768kHz (LFXO) may be used. A crystal, 3.2 x 1.6mm package, for example CC7V-T1A 32.768kHz 12.5pF 10ppm TA QC, can be placed on the evaluation board to position Q2. The needed load capacitance can be reached with capacitors C31 and C41, 0402 package. Depending on parasitic capacities a capacity of 6.8pF may be a good starting value for C31 and C41.

Furthermore, the LFXO Crystal avoids the regularly recalibration of the clock and therefore optimizes low power current consumption.

If a LFXO is mounted to the EV board the JP2.3-4 and JP2.5-6 jumpers shall not be connected, therefore the LED2 and LED3 function is no longer available.



Using standard firmware the external crystal is not needed. To enable use of the LFXO a custom firmware is required.

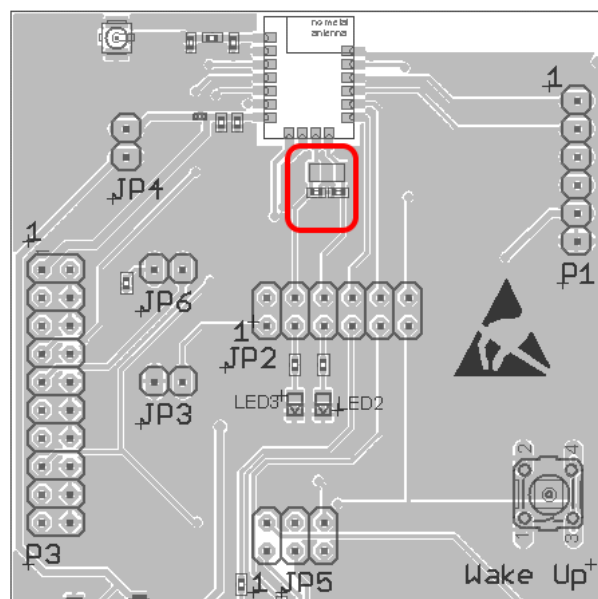


Figure 6: LFXO mounting

3.5.6 NFC



Using standard firmware NFC is not supported. To enable use of the NFC a custom firmware is required and an antenna and antenna matching network needs to be connected to the corresponding pins.

3.5.7 Programming interface

The evaluation board provides a 2×10 pin connector to connect directly to a JTAG flash adapter used for development. Please take care of the correct mounting of the flash adapter. The recommended flash adapter is one of the "Segger J-Link" family.

Jumper JP6 will prevent the module from starting in debug mode when no flash adapter is connected. To apply this, remove the flash adapter connection. Make sure a jumper at JP6 is placed. Unplug and replug the USB connection of the device. Press the reset button on the evaluation board.

P3 Pin	SWD Function
1	VCC
7	SWDIO
9	SWCLK
15	/RST
2, 3, 5, 7, 11, 13, 17, 19	n.c.
6, 8, 10, 12, 14, 16, 18, 20	GND

3.6 Schematic

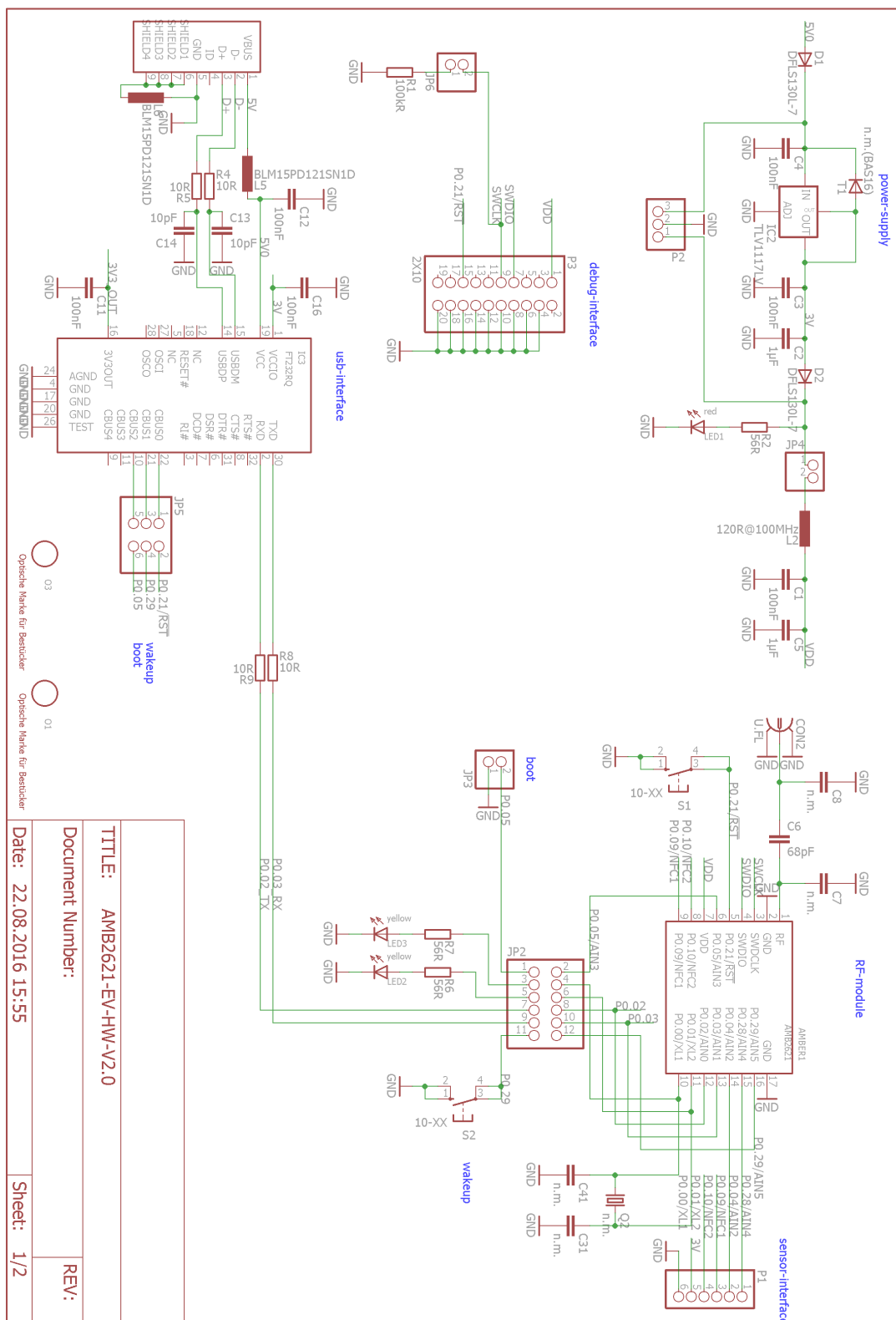


Figure 7: Circuit diagram

3.7 Layout

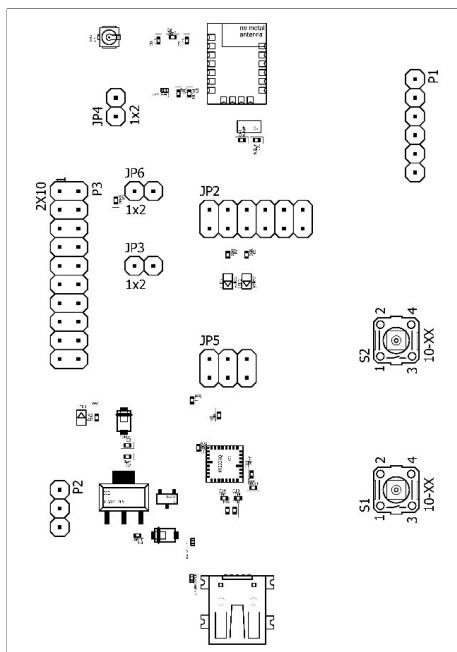


Figure 8: Assembly diagram

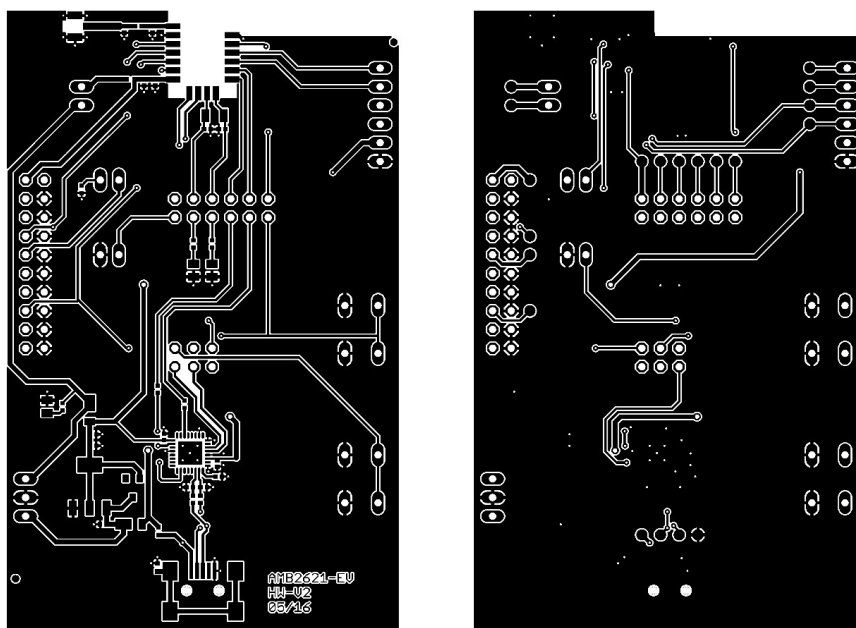


Figure 9: Top & bottom Layer

3.8 Internal antenna radiation characteristics

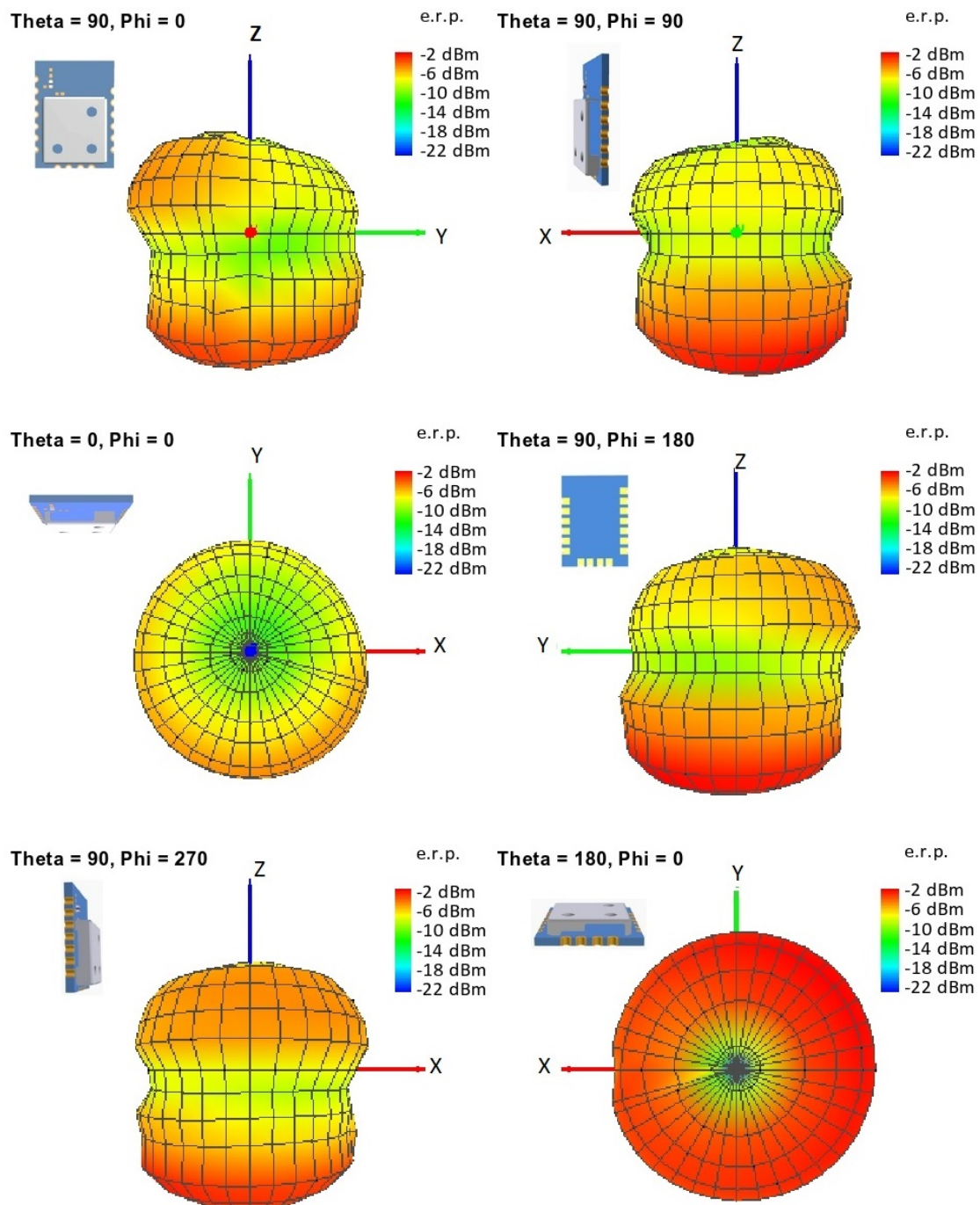


Figure 10: Antenna characteristic from integrated antenna measured on official evaluation board¹

¹Radiation characteristic shown is valid for the module on the evaluation board. It is important to be aware that size of groundplane and placement of module has influence on the radiation pattern.

4 Regulatory compliance information

Pursuant to Article 1 (2.) of the EU directive 2014/53/EU, Article 1 (2.) the directive does not apply to equipment listed in Annex I (4.): custom-built evaluation kits destined for professionals to be used solely at research and development facilities for such purposes.

4.1 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.

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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 sourcecode 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.

5.3 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 firmware revisions. This documents can be downloaded from the product specific sections on the wireless connectivity homepage.

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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 field sales engineer or the internal sales person in charge should be contacted who will be happy to support in this matter.

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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 field sales engineer 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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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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7.3 Ownership

The incorporated firmware created by Würth Elektronik eiSos is and will remain the exclusive property of Würth Elektronik eiSos.

7.4 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.

7.5 Disclaimer of warranty

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7.8 Severability clause

If a provision of these license terms is or becomes invalid, unenforceable or null and void, this shall not affect the remaining provisions of the terms. The parties shall replace any such provisions with new valid provisions that most closely approximate the purpose of the terms.

7.9 Miscellaneous

Würth Elektronik eiSos reserves the right at any time to change this terms at its own discretion. It is your responsibility to check at Würth Elektronik eiSos homepage for any updates. Your continued usage of the products will be deemed as the acceptance of the change.

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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