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# EVALUATION BOARD MANUAL

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## FOR RADIO MODULES

WE order code	Former order code	Marketing Name
260801102400x	AMB2621(-TR)	Proteus-I
260801112400x	AMB2621-1(-TR)	Proteus-I
260801102401x	AMB2623(-TR)	Proteus-II
260801112401x	AMB2623-1(-TR)	Proteus-II

VERSION 1.2

MARCH 5, 2019

## Revision history

Manual version	HW version	Notes	Date
0.3	2.0	<ul style="list-style-type: none"><li>• Initial version</li></ul>	November 2016
1.0	2.0	<ul style="list-style-type: none"><li>• New corporate design and structure</li></ul>	February 2019
1.1	2.0	<ul style="list-style-type: none"><li>• Added chapter Regulatory compliance information</li></ul>	February 2019
1.2	2.0	<ul style="list-style-type: none"><li>• Added Marketing name</li></ul>	March 2019

## Abbreviations and abstract

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
260801102400x	AMB2621(-TR)	Proteus-I
260801112400x	AMB2621-1(-TR)	Proteus-I
260801102401x	AMB2623(-TR)	Proteus-II
260801112401x	AMB2623-1(-TR)	Proteus-II

Order code	Description
260801102400x	Bluetooth Low Energy 4.2 radio module with integrated antenna
260801112400x	Bluetooth Low Energy 4.2 radio module with antenna pad
260801102401x	Bluetooth Low Energy 5.0 radio module with integrated antenna
260801112401x	Bluetooth Low Energy 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](http://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](http://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 reference manual to get the detailed module specific quick start instructions.

## 3 Development board

### 3.1 Block diagram

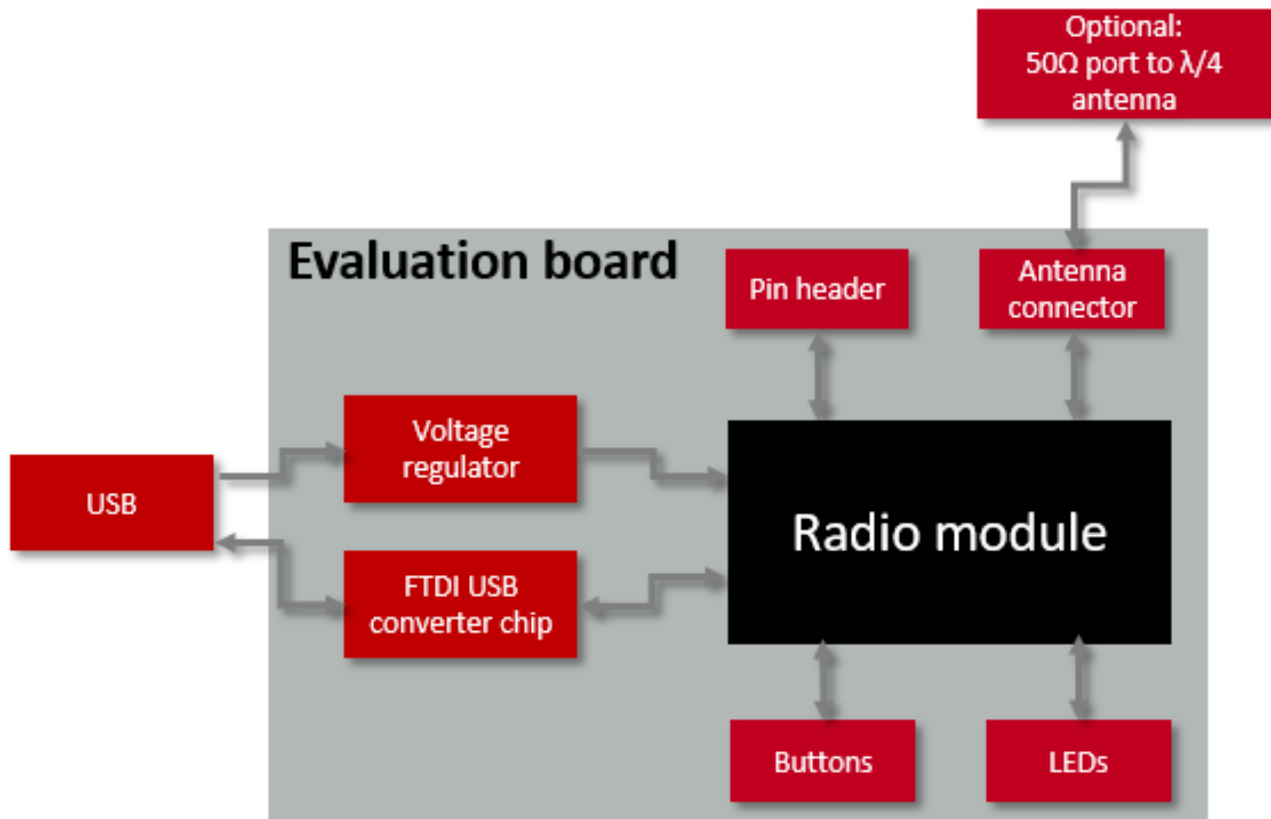


Figure 2: Block diagram



### 3.2 Jumpers

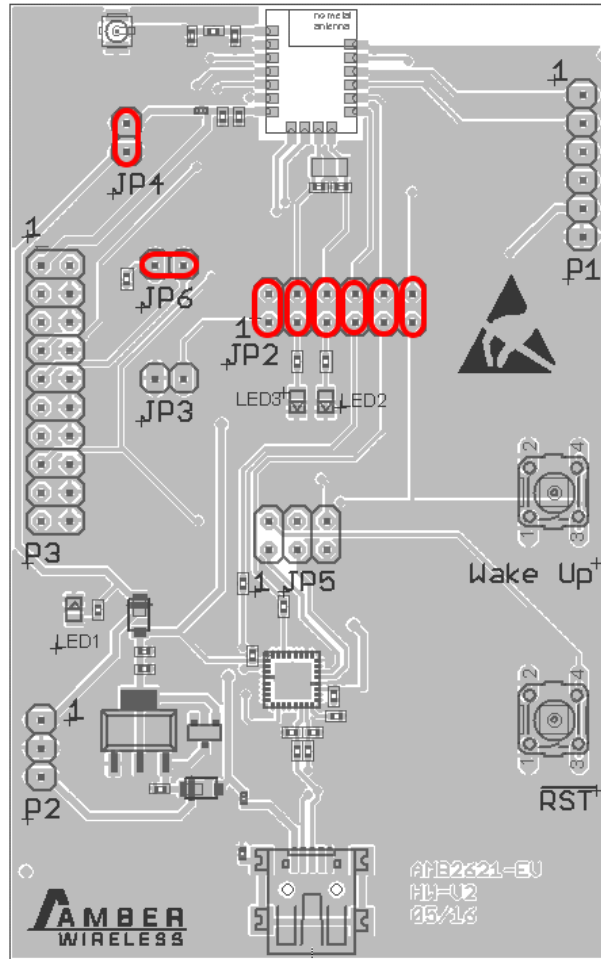


Figure 3: Jumpers, defaults

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

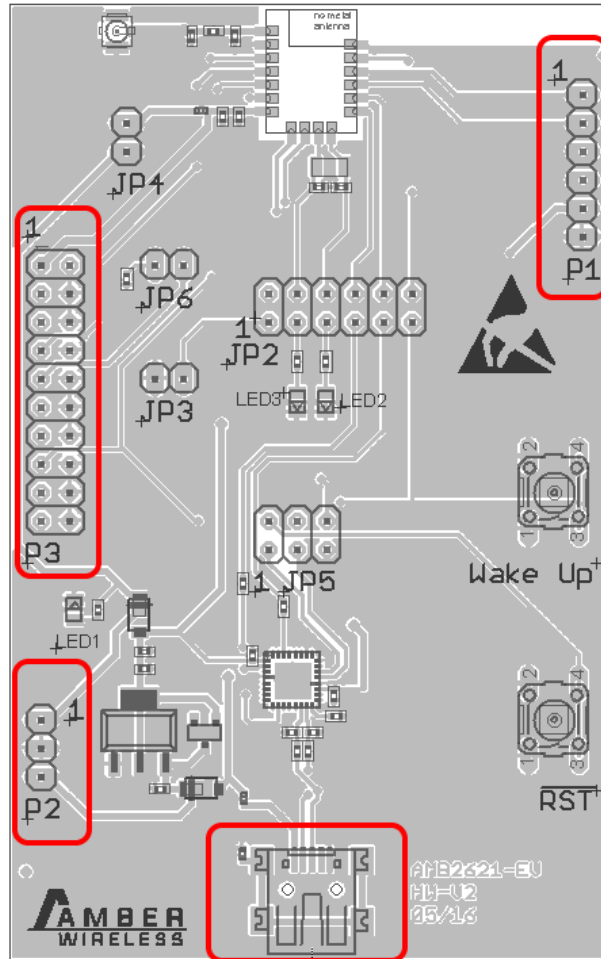


Figure 4: Connectors

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 5V

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

## 3.4 Buttons

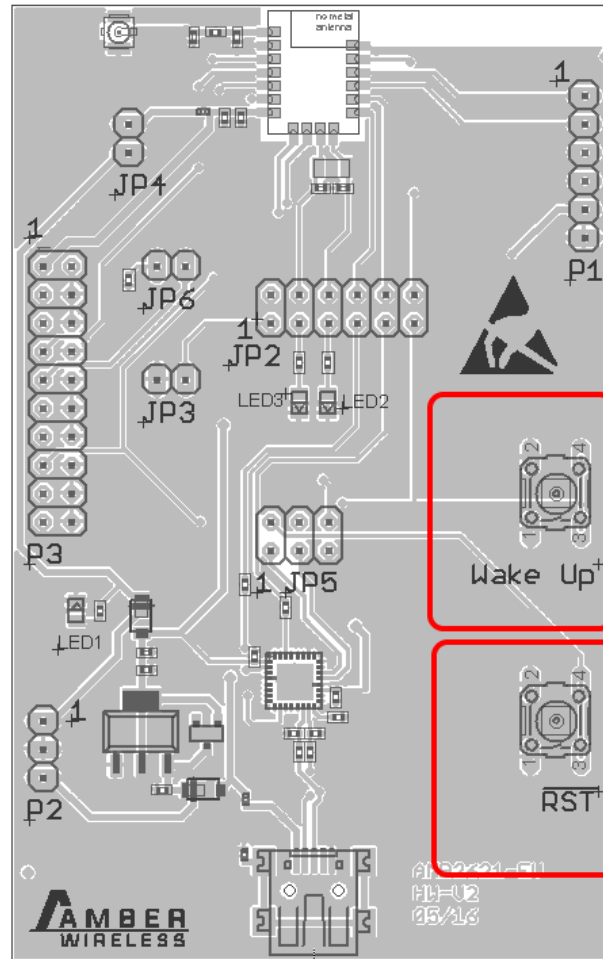


Figure 5: Buttons

### 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 5V 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 JP5. The UART can be connected directly on the pin strip JP5 (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).

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  $\pm 250$ 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.

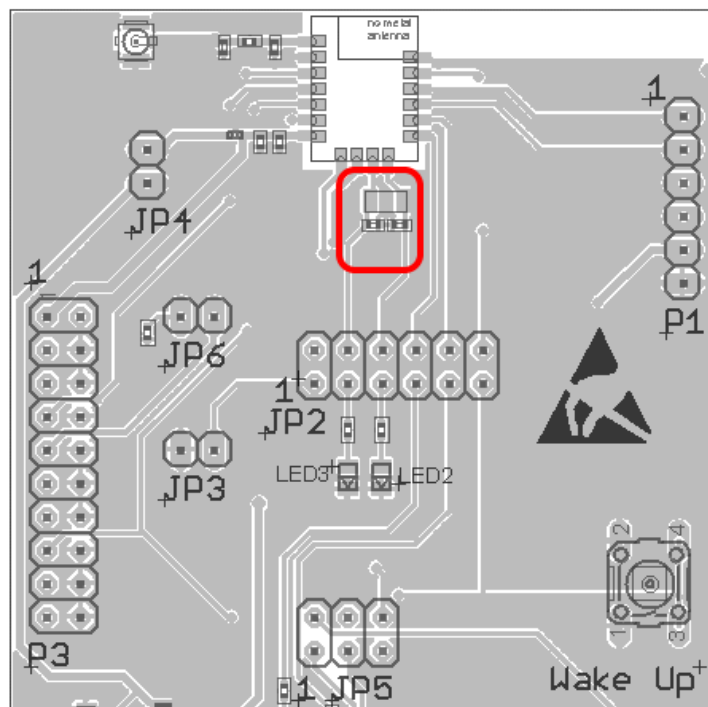


Figure 6: LFXO mounting

### 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

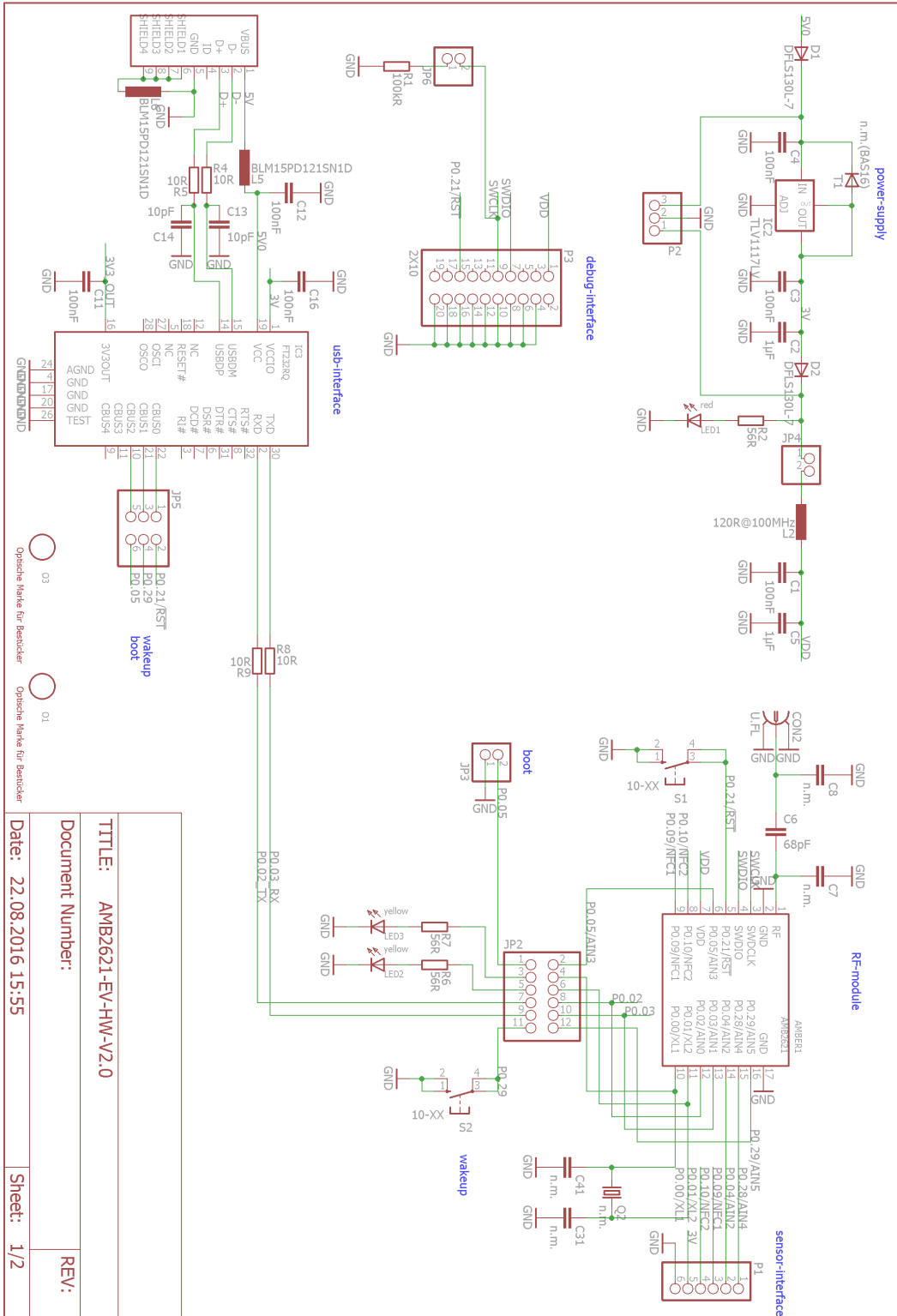


Figure 7: Circuit diagram

### 3.7 Layout

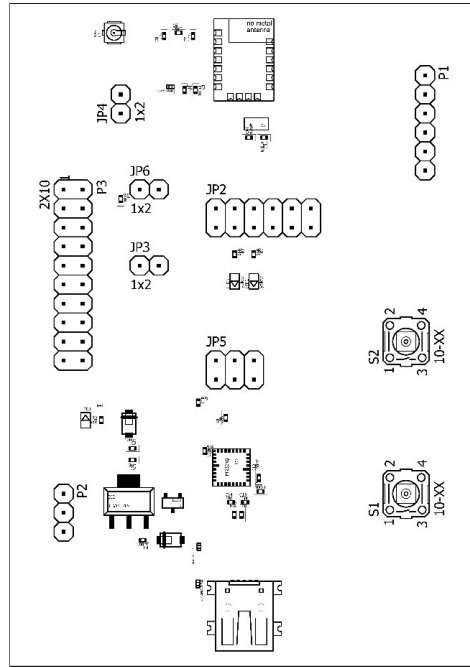


Figure 8: Assembly diagram

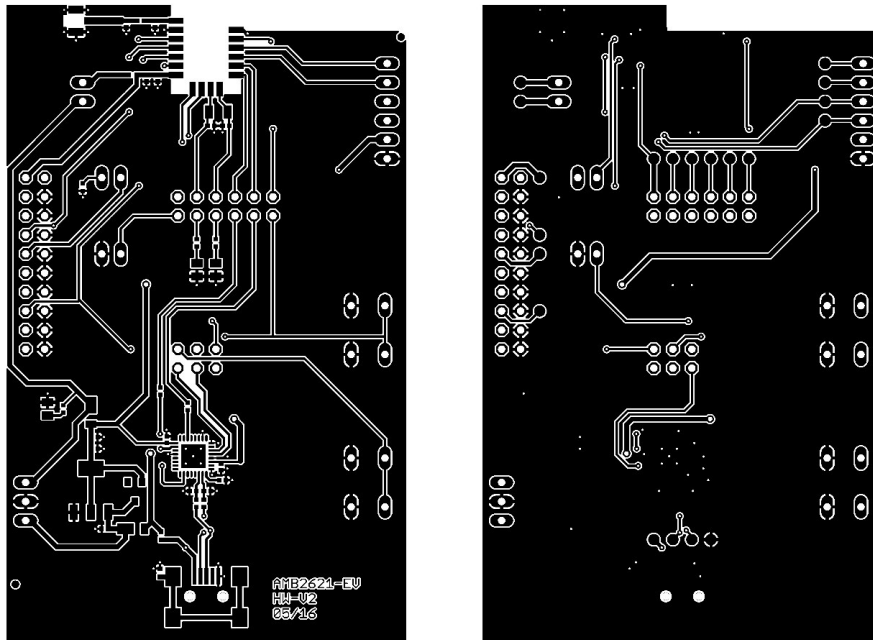


Figure 9: Top & bottom Layer

## 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.

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.

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### 5.1 General customer responsibility

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### 5.2 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 and firmware parts contained in or used with or for products in the wireless connectivity 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 datasheets, 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.

### 5.4 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 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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## 5.6 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 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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## 7 License agreement for Würth Elektronik eiSos GmbH & Co. KG connectivity product firmware and software

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The following terms of this license agreement for the usage of the Würth Elektronik eiSos GmbH & Co. KG wireless connectivity product firmware are a legal agreement between you and Würth Elektronik eiSos GmbH & Co. KG and/or its subsidiaries and affiliates (collectively, "Würth Elektronik eiSos "). You hereby agree that this license agreement is applicable to the product and the incorporated software and firmware (collectively, "Firmware") made available by Würth Elektronik eiSos in any form, including but not limited to binary, executable or source code form.

The Firmware included in any Würth Elektronik eiSos wireless connectivity product is purchased to you on the condition that you accept the terms and conditions of this license agreement. You agree to comply with all provisions under this license agreement.

### 7.1 Limited license

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You are not entitled to transfer the Firmware in any form to third parties without prior written consent of Würth Elektronik eiSos .

You are not allowed to reproduce, translate, reverse engineer, read out, decompile, disassemble or create derivative works of the incorporated Firmware in whole or in part.

No more extensive rights to use and exploit the Firmware granted to you.

### 7.2 Usage and obligations

The responsibility for the applicability and use of the Würth Elektronik eiSos wireless connectivity product with the incorporated Firmware in a particular customer design is always solely within the authority of the customer. Due to this fact, it is up to you to evaluate and investigate, where appropriate, and to decide whether the device with the specific product characteristics described in the product specification is valid and suitable for your respective application or not.

You are responsible for using the Würth Elektronik eiSos 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.

Würth Elektronik eiSos ' products with the incorporated Firmware are not authorized for use in safety-critical applications, or where a failure of the product is reasonably expected to cause severe personal injury or death. Moreover, Würth Elektronik eiSos ' products with the incorporated Firmware are neither designed nor intended for use in areas such as military, aerospace, aviation, nuclear control, submarine, transportation (automotive control, train



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

## 7.9 Miscellaneous

This license agreement constitutes the entire understanding and merges all prior discussions between the parties relating to this license agreement.

No ancillary verbal agreements have been made and no such agreements shall be valid. Any additions and amendments to this license agreement shall require the written form in order to be binding.

We recommend you to be updated about the status of new firmware, which is available on our website or in our data sheet, and to implement new firmware in your device where appropriate. In case only firmware is provided, we expressly exclude the automatic receipt of PCN information. Thus, new firmware will also not be provided automatically.

By ordering a wireless connectivity Product, you accept this license agreement in all terms.

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