EVALUATION BOARD MANUAL

FOR RADIO MODULES

<table>
<thead>
<tr>
<th>WE order code</th>
<th>Former order code</th>
<th>Marketing Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>260301102100x</td>
<td>AMB2220(TR)</td>
<td>Triton</td>
</tr>
<tr>
<td>260301112100x</td>
<td>AMB2220-1(TR)</td>
<td>Triton</td>
</tr>
</tbody>
</table>

VERSION 2.2

MARCH 11, 2019
<table>
<thead>
<tr>
<th>Manual version</th>
<th>HW version</th>
<th>Notes</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0-1.4</td>
<td>2.1</td>
<td>• Initial version</td>
<td>June 2017</td>
</tr>
<tr>
<td>2.0</td>
<td>2.1</td>
<td>• New corporate design and structure</td>
<td>December 2018</td>
</tr>
<tr>
<td>2.1</td>
<td>2.1</td>
<td>• Added chapter Regulatory compliance information</td>
<td>February 2019</td>
</tr>
<tr>
<td>2.2</td>
<td>2.1</td>
<td>• Added Marketing name</td>
<td>March 2019</td>
</tr>
</tbody>
</table>
## Abbreviations and abstract

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSE</td>
<td>Field Sales Engineer</td>
<td>Support and sales contact person responsible for limited sales area</td>
</tr>
<tr>
<td>HIGH</td>
<td>High signal level</td>
<td></td>
</tr>
<tr>
<td>LOW</td>
<td>Low signal level</td>
<td></td>
</tr>
<tr>
<td>RF</td>
<td>Radio frequency</td>
<td>Describes everything relating to the wireless transmission.</td>
</tr>
<tr>
<td>UART</td>
<td>Universal Asynchronous Receiver Transmitter</td>
<td>Universal Asynchronous Receiver Transmitter allows communicating with the module of a specific interface.</td>
</tr>
<tr>
<td>VDD</td>
<td>Supply voltage</td>
<td></td>
</tr>
</tbody>
</table>
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1 Supported radio modules

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

<table>
<thead>
<tr>
<th>Order code</th>
<th>Former order code</th>
<th>Marketing Name</th>
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<tr>
<td>260301112100x</td>
<td>AMB2220-1(TR)</td>
<td>Triton</td>
</tr>
</tbody>
</table>

Table 1: Compatibility

<table>
<thead>
<tr>
<th>Order code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>260301102100x</td>
<td>2.4 GHz proprietary radio module with integrated chip antenna</td>
</tr>
<tr>
<td>260301112100x</td>
<td>2.4 GHz proprietary radio module with antenna pad</td>
</tr>
</tbody>
</table>

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 microcontroller 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 which are not required such as the USB interface.

Feel free to check our youtube channel for video tutorials, hands-ons and webinars related to our products:
www.youtube.com/user/WuerthElektronik/videos

2.1 Taking into operation

To run the evaluation board place the jumpers and switches on their default position (see section 3.2).

The corresponding FTDI driver package (http://www.ftdichip.com/Drivers/VCP.htm) has to be installed on your PC. Please make sure you keep that driver up-to-date.

The next step is to connect the Mini-USB (CON2) of the evaluation board to the PC using an 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 in Linux system /dev/ttyUSB0

A terminal program (like hterm) has to be run and the corresponding COM port has to be opened using the default settings of the mounted radio module (e.g. 9600 baud with 8 data bits, no parity, 1 stop bit).

After the module is powered through the USB jack, 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 quick start instructions.
3 Development board

3.1 Block diagram

Figure 2: Block diagram
### 3.2 Jumpers

The following figure shows the default positioning (marked in red) of all jumpers on the EV board. This section also contains the details to any jumper connection that is supported by the EV board.

![Figure 3: Jumpers, defaults](image)

<table>
<thead>
<tr>
<th>JP1</th>
<th>Jumper placed (default)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2</td>
<td>Set 1-2</td>
<td>Measuring bridge current supply of the module</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JP3</th>
<th>Jumper placed (default)</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1,2,3 | Set 2-3                 | 1-2 enable the accelerometer  
2-3 turn off the accelerometer |
<table>
<thead>
<tr>
<th>JP4</th>
<th>Jumper placed (default)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Not Set</td>
<td>BOOT0 pin of module</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JP5</th>
<th>Jumper placed (default)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2</td>
<td>Not Set</td>
<td>Connection of interrupt pin 1 of accelerometer sensor</td>
</tr>
<tr>
<td>3,4</td>
<td>Not Set</td>
<td>Connection of interrupt pin 2 of accelerometer sensor</td>
</tr>
</tbody>
</table>
### 3.3 Connectors and pin headers

This section explains all connectors and pin headers on the EV board.

All reserved pins shall be handled/terminated as described in the module specific manual.

**Figure 4: Connectors**

**Figure 5: Pin headers**

<table>
<thead>
<tr>
<th>CON1</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>USB1</td>
<td>USB connector to STM32 USB, not supported by standard firmware, do not connect</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CON2</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>USB2</td>
<td>USB connector to module UART and power supply</td>
</tr>
<tr>
<td>CON3</td>
<td>Function</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>----------</td>
<td>-------------</td>
</tr>
<tr>
<td>-</td>
<td>Battery</td>
<td>Connector for battery-pack, 3 Volt</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CON4</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>Antenna</td>
<td>U.FL socket connection to 50Ω radio path of the module, only active for Modules with RF-pad (i.e. without internal antenna).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P1</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-11</td>
<td>Direct access to module pins</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P2</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-6</td>
<td>Direct access to module pins</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P3</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-11</td>
<td>Direct access to module pins</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P8</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>VDD</td>
<td>Power</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P9</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>n.c.</td>
<td>not connected</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P10</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>
3.4 LEDs
This section explains all LEDs on the EV board.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED1</td>
<td>Power LED: lights up if EV board power is supplied</td>
</tr>
<tr>
<td>LED2</td>
<td>TX LED: lights up if module transmits radio data</td>
</tr>
<tr>
<td>LED3</td>
<td>RX LED: lights up if module receives radio data</td>
</tr>
</tbody>
</table>

3.5 Switch
This section explains all switches on the EV board. The default switch positions are indicated in red.

Figure 6: Switch SW2 default position and SW1 Reset button
3.6 Reset button

Every module provides a /RESET pin that is connected to this SW1 button so the module can be (re)started properly. A pressed button connects the /RESET to LOW logic level and holds the module in reset until it is released. Most modules provide an internal pull-up resistor.

Please refer to the module specific manual for detailed information upon the module’s /RESET pin and recommended start-up sequences for the module.

<table>
<thead>
<tr>
<th>SW2</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SW2.1</td>
<td>WAKE_UP pin of module</td>
</tr>
<tr>
<td>2</td>
<td>SW2.2</td>
<td>Boot1 pin of module</td>
</tr>
</tbody>
</table>

Table 2: Switch SW2

<table>
<thead>
<tr>
<th>SW1</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW1</td>
<td>Button to /RESET pin of module</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Button SW1
4 Function blocks

4.1 Power supply

There are several possibilities to supply the evaluation board and the module with power.

![Power supply schematic](image)

The different power terminals are all connected with diodes to protect them from each other, therefore no selection by additional jumpers is necessary. Nevertheless the customer shall apply only one USB connector to the EV board. An external power supply through P8 and P10 shall not be used when a battery pack is connected to CON3.

4.1.1 Power supply over USB: CON2

Connecting the USB interface CON2 supplies the board through the low dropout voltage (LDO) regulator. The module is supplied by approximately 2.5V (2.5V LDO minus forward voltage of the diode of approx. 0.2V).

4.1.2 Power supply over battery pack 3V: CON3

Connecting the battery pack supplies the module with the voltage delivered from the pack minus approx. 0.2V forward voltage of the diode.

4.1.3 External supply: P8, P10

Two 2.54 mm headers are available for connection from an external source to VCC and GND. Make sure you provide a stable current in the range of 2.5 to 3.6 Volt to this pins. It is suitable to supply the development board and associated electronics from one power supply, as well as to test the system with different voltage levels.
4.2 Current measurement

JP1 can be used to measure the power consumption of the module. By default a bridge is set on JP1 to close the circuit. Remove the bridge and connect a current meter in place of the jumper to measure the power consumption of the module. If the meter is not attached and the bridge is not set, the module will not receive a supply voltage and is not active.

When the EV board is supplied with VCC the power LED is active even if JP1 is left open. This is to avoid measuring the current through the LED during module current measurements.

Measuring module currents, especially in low power mode, SW2.2 has to be turned to position "up" (default position) and SW2.1 has to be left in position "down" (default position), else additional leakage current because of the pull resistors will be observed. All other module pins shall be terminated as indicated in the module specific manuals.

4.3 Host interface: USB, CON2

The UART of the module is available on CON2 as USB. The parallel usage of the USB on CON2 and standalone UART TX1 & RX1 on P3 is not possible as these two share the same module pins. Using P3 for direct UART connection requires the CON2 to be not connected to USB as the electronic switch will then disable the connection of TX and RX module to the FTDI converter IC to prevent signal disturbance because of the converter IC.

Figure 8: UART to USB converter: FT232R
4.4 Host interface: UART P3

The UART of the module is available on P3.11 and P3.12. The parallel usage of the USB on CON2 and standalone UART TX1 & RX1 on P3 is not possible as these two share the same module pins. Using P3 for direct UART connection requires the CON2 not to be connected to USB as the electronic switch will then disable the connection of TX and RX module to the FTDI converter IC to prevent signal disturbance because of the converter IC.

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).

4.5 UART bootloader vs. application

The levels at the pins Boot0 and Boot1 decide, right after a module reset, if the application or the UART bootloader of the module is started.
To start the application safely and measure a correct current the default switch and jumper settings of the evaluation board are sufficient. See figures 3 and 6.

To safely start the module's bootloader JP4 must be mounted while SW2.2 is in position "up". Then a reset of the module using the reset button SW1 must be performed to start the module in UART bootloader mode.

The UART bootloader mode can be left by reverting the Jumpers and switches back to defaults and perform another reset of the module.

4.6 Wake-up function, switch SW2.1

Switch SW2.1 is connected to module pin 10, which is used as wake-up in the standard firmware. In default case the SW2.1 is in position "down". If the module is in sleep mode, the SW2.1 can be used as WAKE-UP pin. To trigger the wake up a falling edge has to be applied at the WAKE-UP pin of the module, which means to switch SW2.1 from position "down" to position "up". When the module is no longer in sleep mode, SW2.1 should be switched back to default position "down" to prevent leakage current.
4.7 Programming interface

The evaluation board provides a 1*6 pin connector in RM2.54 to connect to a SWD flash adapter used for development. Please take care of the correct mounting of the flash adapter. Depending on your Flasher an additional adapter may be required. The recommended flash adapter is one of the "Segger J-Link" family with SWD support or an ST-Link V2 adapter with SWD support.
4.8 Full schematic

Figure 11: Wiring diagram
4.9 Full layout

Figure 12: Assembly diagram

Figure 13: Top and Bottom Layer
4.10 Sensor: SPI accelerometer

JP3 serves to either supply the accelerometer from the common power supply, or to de-activate the accelerometer (triple axis, type: STM LIS3DH) by holding its supply pin to GND level.

To be able to use the accelerometer a customer specific module firmware is required.

The accelerometer is not used in AMB2220/Triton standard firmware, thus JP3 should be placed to connect 2-3 and JP5 connections 1-2 and 3-4 shall be left open.

Figure 14: Connection of SPI accelerometer to module
5 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.

5.1 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 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.

6.3 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 document can be downloaded from the product specific sections on the wireless connectivity homepage.

6.4 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.
6.5 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 hard- or firmware. In case of further queries regarding the PCN, the field sales engineer, the internal sales person or the technical support team in charge should be contacted. The basic responsibility of the customer as per section 6.1 and 6.2 remains unaffected.

6.6 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.

6.7 Property rights

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6.8 General terms and conditions

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7 Legal notice

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8 License agreement for Würth Elektronik eiSos GmbH & Co. KG connectivity product firmware and software

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8.9 Miscellaneous

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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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Automated Meter Reading
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