USER MANUAL

EVALUATION BOARD FOR RADIO MODULE CALYPSO

261001102500x

VERSION 1.6

JUNE 12, 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

Document version	HW version	Notes	Date
1.0	1.0	• Initial version	November 2018
1.1	2.0	• editorial changes	January 2019
1.2	2.0	• Added chapter `Regulatory compliance information`	February 2019
1.3	2.0	• Added Marketing name • Added Product image in chapter `Supported radio modules`	March 2019
1.4	2.0	• Improved description of CON8 • Added paragraph `BootUp` for controlling the APP_MODE pins on the EV board (depending on Calypso firmware version)	June 2019
1.5	2.0	• Added chapter `Radiation characteristic of the module's internal antenna`	June 2019
1.6	2.0	• New corporate design	June 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	

Contents

1 Supported radio modules

The Calypso evaluation board is exclusively for the Calypso module:

WE order code	Description
261001102500x	WLAN IEEE 802.11 b/g/n radio module with smart antenna configuration

Table 1: Compatibility
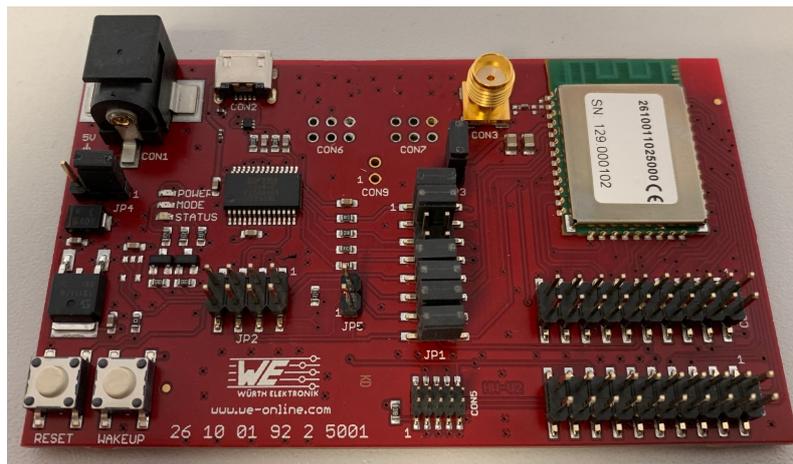
Figure 1: Product image

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 and provides a serial (virtual) COM port for interfacing the communication interface of the module.

> **STOP** Due to high peak power consumption of the Calypso radio module, this evaluation board must be operated with external power supply or an external powered USB Hub that can provide the peak current.

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 in the customers end application.

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

Before starting to work with the evaluation board make sure that,

- The jumpers on the EV board are placed on the default locations.

- FTDI driver package is installed on the PC. The latest version of the drivers can be downloaded from (*www.ftdichip.com/Drivers/VCP.htm*). Please use the setup executable package or follow the install instructions from FTDI.

- A stable and adequately dimensioned voltage source is connected to the power jack or external power source.

- Evaluation board is connected to the PC via USB-cable.

- COM port is detected and installed on the PC. The (COM) port name of the evaluation board can be found using the device manager on Windows and the display message (dmesg) on Linux. For example, the evaluation board might appears as "COM12" on windows and "/dev/ttyUSB0" on Linux.

- A terminal program like hterm for Windows has to be run and the corresponding COM port chosen and opened using the default UART settings of the mounted radio module (e.g. 921600 Baud, 8e1).

- To ensure a proper start-up of the module after applying VCC to the evaluation board the reset button should be pressed to perform a reset and clean restart before proceeding.

A detailed module specific quick start instruction is available in the module user manual.

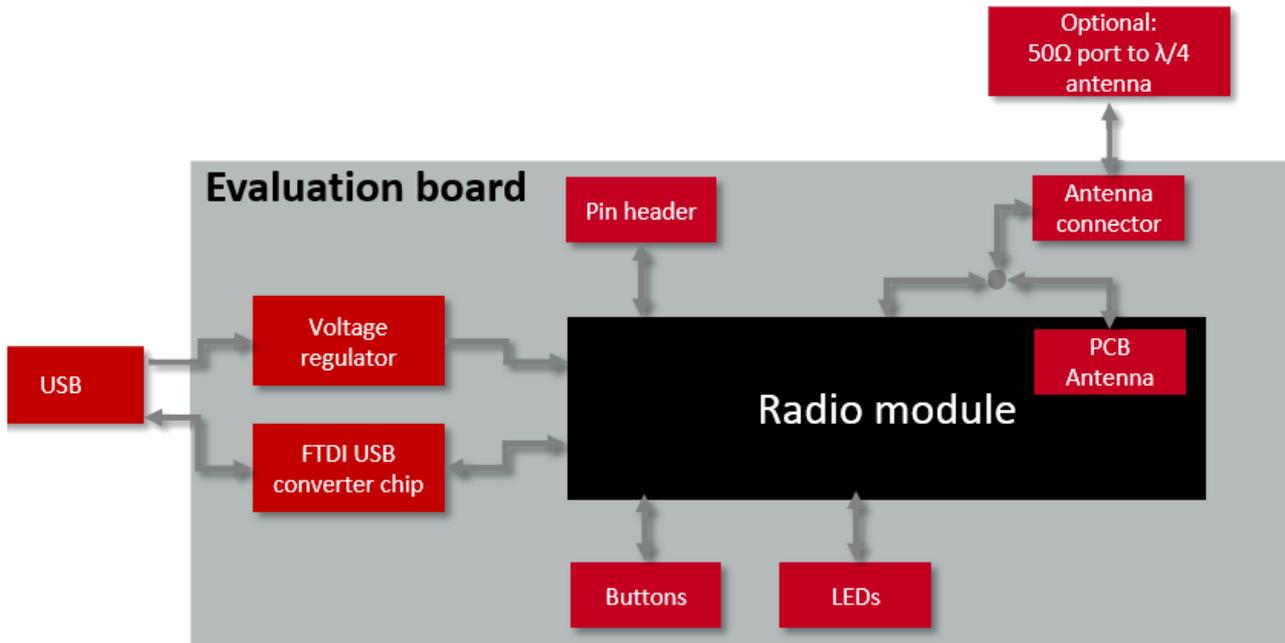# 3 Development board

3.1 Block diagram

Figure 2: Block diagram

3.2 Overview

The evaluation board is equipped with a number of jumpers and connectors. This allows the user to access to every signal/pin enabling complete evaluation of the radio module. In the following a detailed description of the jumpers and connectors is provided. As a quick reference, a table of all jumpers and connectors with the corresponding signals are printed on the back of the evaluation board.

```
----------------           -------------
CON1                       CON6
5V POWER SUPPLY            WE-SPI-SENSOR
===============-           =============
CON2                       CON7
MICRO USB                  WE-I2C-SENSOR
==============             ================----                   JP1
CON3                       CON8                                   ... <-> MODULE
SMA RF-SIGNAL              SPI/I2C/GPIO                            1: TXD_FTDI <-> 2: UART0_RX
==============            ------------------                      3: RXD_FTDI <-> 4: UART0_TX
CON4                      1: GND - 2: SPI_CLK                     5: RTS#_FTDI <-> 6: UART0_CTS
SERIAL_FLASH_INTERFACE    3: SPI_MISO - 4: SPI_CS_N              7: CTS#_FTDI <-> 8: UART0_RTS
--------------            5: SPI_MOSI - 6: VCC                    9: LED_G <-> 10: STATUS
1: VCC- 2: NC             7: GND - 8: I2C_SCL                    11: LED_Y <-> 12: MODE
3: NC - 4:GND             9: I2C_SDA - 10: VCC                   13: WAKEUP <-> 14: GPIO4
5: SFL_DOUT - 6: GND     11: GPIO12 - 12: GPIO22                15: BOOT <-> 16: BOOT
7: SFL_CS - 8: GND       13: GPIO0 - 14: GPIO30
9: SFL_CLK- 10: GND      15: GPIO3 - 16: GPIO4                   JP2
11: NC 12: GND           17: GPIO5 - 18: NC                      1: CBUS0_FTDI <-> 2: NRESET
13: SFL_DIN - 14: NC     19: GND - 20: NC                        3: CBUS1_FTDI <-> 4: WAKEUP
15: NRESET 16: NC        --------------------                    5: CBUS2_FTDI <-> 6:BOOT
17: NC - 18: NC          CON9                                    7: NC <-> 8: NC
19: NC - 20: NC          DIRECT POWER SUPPLY
---------                --------------------                    JP3
CON5                     1: GND                                  CURRENT MEASUREMENT
JTAG                     2: VCC 3.3V
---------                                                        JP4
1: VCC - 2: TMS                                                  SUPPLY SELECTION
3: GND - 4: TCK                                                  1-2 USB SUPPLIED
5: GND - 6: TDO                                                  2-3 CON1 SUPPLIED
7: GND - 8: TDI
9: GND - 10: NRESET                                              JP5
                                                                Connect Boot to pull up
```

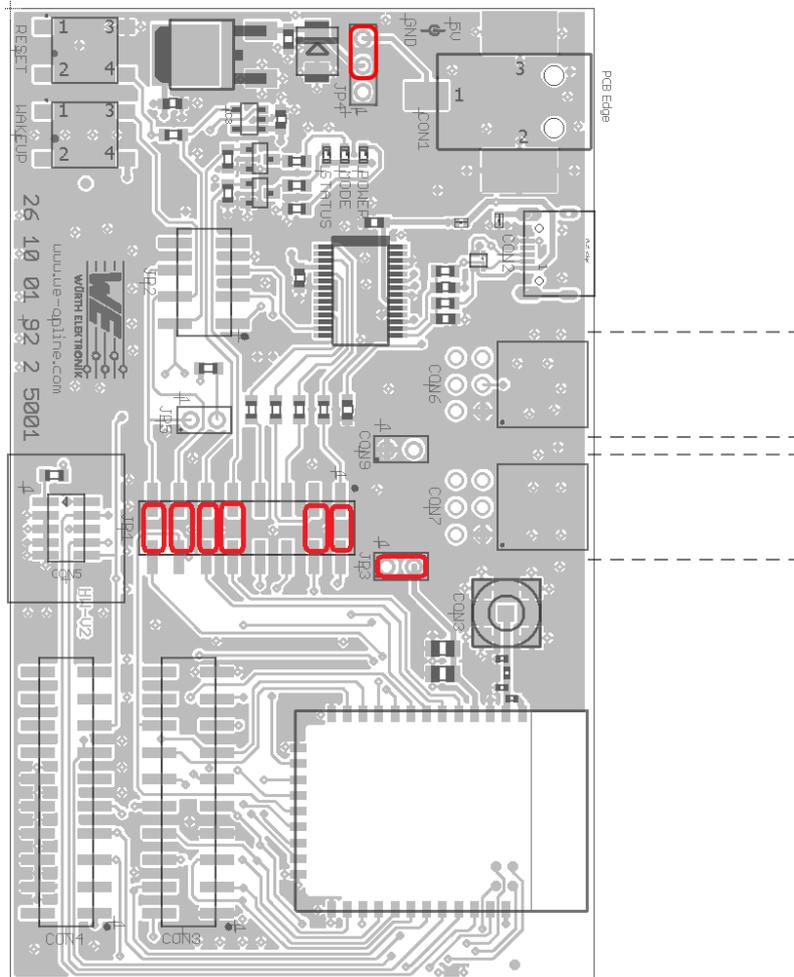Figure 3: Quick Reference - Table of connectors and jumper

3.3 Jumpers

Figure 4: Jumpers, defaults

3.3.1 JP1

JP1 enables connection to functionally essential signals including the primary UART interface, *BOOT*, *WAKE_UP* as well as the status indication signals *STATUS_IND_x*. In its default configuration, the UART interface is connected to the USB via serial-USB (FTDI) adapter, *BOOT* to the push button and the *STATUS_IND_x* to the two LEDs.

JP1	Module Pin Function	Jumper set (default)
1,2	*URXD*	Yes
3,4	*UTXD*	Yes
5,6	*/RTS*	No
7,8	*/CTS*	No
9,10	*STATUS_IND_0*, *LED_G*	Yes
11,12	*STATUS_IND_1*, *LED_Y*	Yes
13,14	*WAKE_UP*	Yes
15,16	*BOOT*	Yes

3.3.2 JP2

JP2 allows *nReset*, *WAKE_UP* and the *BOOT* to be optionally driven from PC via the FTDI *CBUSx* pins.

JP2	Module Pin Function	Jumper set (default)
1,2	*nReset*, CBUS0	No
3,4	*WAKE_UP*, CBUS1	No
5,6	*BOOT*, CBUS2	No
7,8	not connected	No

3.3.3 JP3

JP3 allows connection of an ammeter in series with the power supply to measure the current consumption of the radio module.

JP3	Module Pin Function	Jumper set (default)
1,2	Connect VCC to voltage regulator output	Yes

3.3.4 JP4

JP4 determines the source of the supply voltage.

JP4	Module Pin Function	Jumper set (default)
1,2	Connect LDO to USB 5 V	No
2,3	Connect LDO to CON1 (barrel socket)	Yes

3.3.5 JP5

JP5 connects the *BOOT* pin to a logic HIGH level.

With JP5 set, the module will not start any of it's implemented application modes and will not behave as explained in the manual.

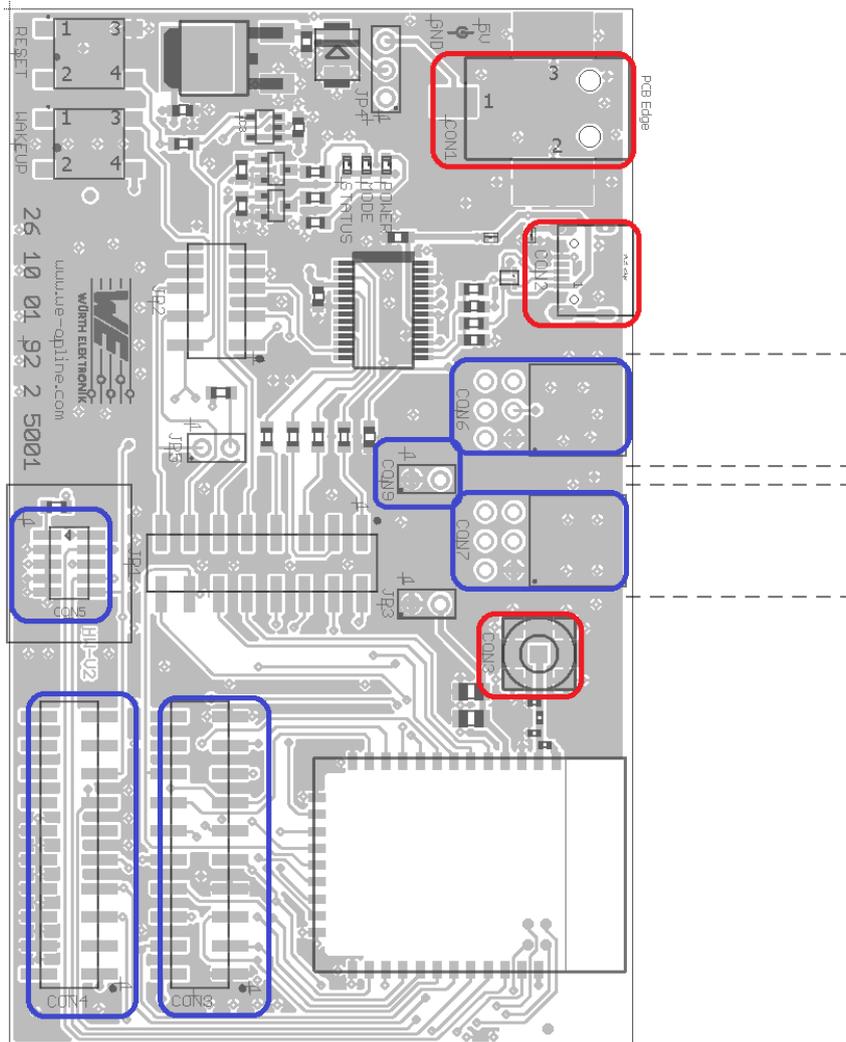| JP5	Module Pin Function	Jumper set (default)
1,2	BOOT Pin to pull up	No

3.4 Connectors and pin headers

Figure 5: Connectors

The connectors marked red in figure 5 needs to be connected appropriately to ensure essential functionality of the module. The connectors marked blue can be optionally connected to additional equipment and/or are reserved future functions.

> **STOP** In this chapter, all available pins and connectors are described. This does not mean that these functions are or can be enabled in the firmware version currently running on the module.

3.4.1 CON1

CON1 is a barrel connector socket that can be used to provide the supply voltage through a 5.5 x 2.1 mm barrel connector plug.

CON1	Function
Inner	5 V
Outer	GND

3.4.2 CON2

Connector CON2 is a micro-USB socket that enables connection to PC via standard micro-USB cable.

CON2	Function
	Micro-USB connector for host connection and VCC bus supply

3.4.3 CON3

Connector CON3 (SMA receptacle) is used to connect an external antenna.

> ! Capacitor C1 has to be populated and C13 not populated to be able to use the external antenna.

> ! In order use the on-board PCB antenna, capacitor C13 has to be populated and C1 not populated.

CON3	Function
Inner	RF signal
Outer	GND

3.4.4 CON4

Connector CON4 is the serial flash interface used in the production for programming.

CON4	Function	CON4	Function
1	*VCC*	2	Not connected
3	Not connected	4	*GND*
5	*SFL_DOUT*	6	*GND*
7	*SFL_CS*	8	*GND*
9	*SFL_CLK*	10	*GND*
11	Not connected	12	*GND*
13	*SFL_DIN*	14	Not connected
15	*nRESET*	16	Not connected
17	Not connected	18	Not connected
19	Not connected	20	Not connected

3.4.5 CON5

Connector CON5 is the JTAG debugging interface. It can be used in case of custom firmware development with "debug" firmware and is locked when using a "production" firmware.

CON5	Function	CON5	Function
1	*VCC*	2	*TMS*
3	*GND*	4	*TCK*
5	*GND*	6	*TDO*
7	*GND*	8	*TDI*
9	*GND*	10	*nRESET*

3.4.6 CON6

Connector CON6 is the SPI interface to connect a Würth Elektronik Sensor Board. The interface is not yet enabled in the firmware.

CON6	Function	CON6	Function
1	*GND*	2	*SPI_CLK*
3	*SPI_MOSI*	4	*SPI_CS_N*
5	*SPI_MISO*	6	*VCC*

3.4.7 CON7

Connector CON7 is the I2C interface to connect a Würth Elektronik Sensor Board. The interface is not yet enabled in the firmware.

CON7	Function	CON7	Function
1	*GND*	2	*I2C_SCL*
3	*I2C_SDA*	4	Not connected
5	*GPIO*	6	*VCC*

3.4.8 CON8

On Connector CON8 several module pins are available.

CON8	Function	CON8	Function
1	*GND*	2	*SPI_CLK, GPIO14*
3	*SPI_MISO, GPIO15*	4	*SPI_CS_N, GPIO17*
5	*SPI_MOSI, GPIO16*	6	*VCC*
7	*GND*	8	*I2C_SCL, GPIO10*
9	*I2C_SDA, GPIO11*	10	*VCC*
11	*GPIO12*	12	*GPIO22, APP_MODE_0*
13	*GPIO0, APP_MODE_1*	14	*GPIO30*
15	*GPIO3*	16	*GPIO4*
17	*GPIO5*	18	Not connected
19	*GND*	20	Not connected

BootUp   For the Calypso firmware version 1.2.0 the application modes AT Command Default Mode, Provisioning, OTA mode and AT terminal mode the Calypso Pins 10 (APP_MODE_0, GPIO22) and 11 (APP_MODE_1, GPIO0) must be connected accordingly. To start the Calypso Default Operation mode no connection needs to be done on the evaluation board CON8 as both APP_MODE_0 and APP_MODE_1 use an internal weak pull-down leading to a LOW level ("0") during the check procedure.

For any other mode one or both APP_MODE pins need to be connected to logic HIGH (CON8_10) in order to achieve a "1" during the check procedure.

Connecting HIGH to an internal pull-down of one or both APP_MODE pins will lead to leakage current during the time the app mode evaluation takes place.

The following table shows the application modes as implemented in firmware version 1.2.0. Please check the Calypso manual for possible changes in other firmware versions.

APP_MODE_1, CON8_13	APP_MODE_0, CON8_12	Description
0	0	AT command normal mode
0	1	OTA mode
1	0	Provisioning mode
1	1	AT command terminal mode

3.4.9 CON9

Connector CON9 enables connection of an external power supply directly to the radio module and thereby the possibility to test the application power source.

STOP The supply voltage connected here has to be between 2.1V and 3.6 V. Refer to the module specific manual for more details.

! When connecting power to CON9 the Jumper on JP4 should not be set.

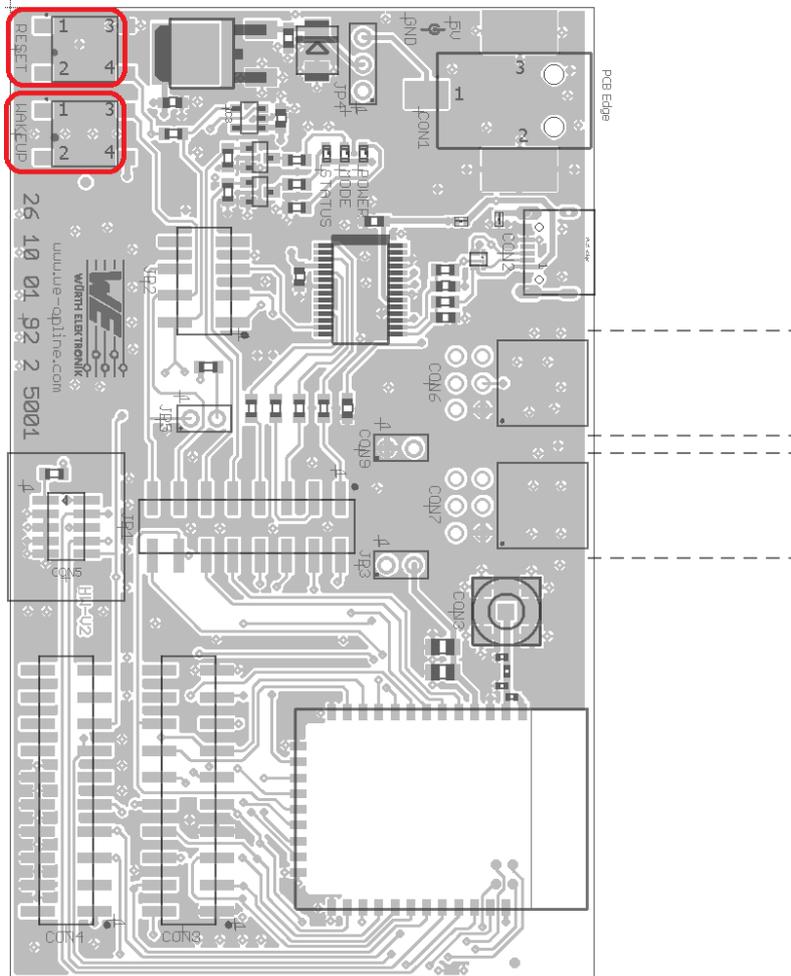| CON9	Function	CON9	Function
1	GND	2	VCC

3.5 Buttons

Figure 6: Buttons

3.5.1 *nRESET* 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. Please refer to the module specific manual for detailed information.

3.5.2 Wake-up button

The wake-up button is connected to *WAKE_UP* pin in order to trigger wake up of the module from sleep mode. Please refer to the module specific manual for detailed information.

3.6 LEDs

This evaluation board has three LEDs

3.6.1 Power

An active power LED indicates that the power supply to the evaluation board is active. See Section 3.7.1 for more details.

3.6.2 Mode

The mode LED is connected to the *STATUS_IND_0* pin of the module and indicates specific events based on the application mode. Please refer to the module specific manual for detailed information.

3.6.3 Status

The status LED is connected to the *STATUS_IND_1* pin of the module and indicates specific events based on the application mode. Please refer to the module specific manual for detailed information.

3.7 Function blocks

3.7.1 Power supply

The development board can be run and supplied via USB when the module's current draw is not exceeding the USB specification. The integrated voltage regulator regulates the connected USB voltage 5 V down to 3.3 V and supplies the remaining parts of the circuit. If the evaluation board is power sourced the power *LED1* lights up.

3.7.2 JP3 - Current measurement

By default, JP3 is set 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 measurement.

3.7.3 UART via USB

The UART of the module can be connected to the USB converter by setting the corresponding jumpers on JP1. 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 shall not exceed 3 meters.

3.7.4 UART direct

If a micro-controller is to be connected to the module, remove the corresponding jumpers on JP1. The UART can be connected directly on pin 2 and pin 4 on JP1. 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).

3.8 Schematic
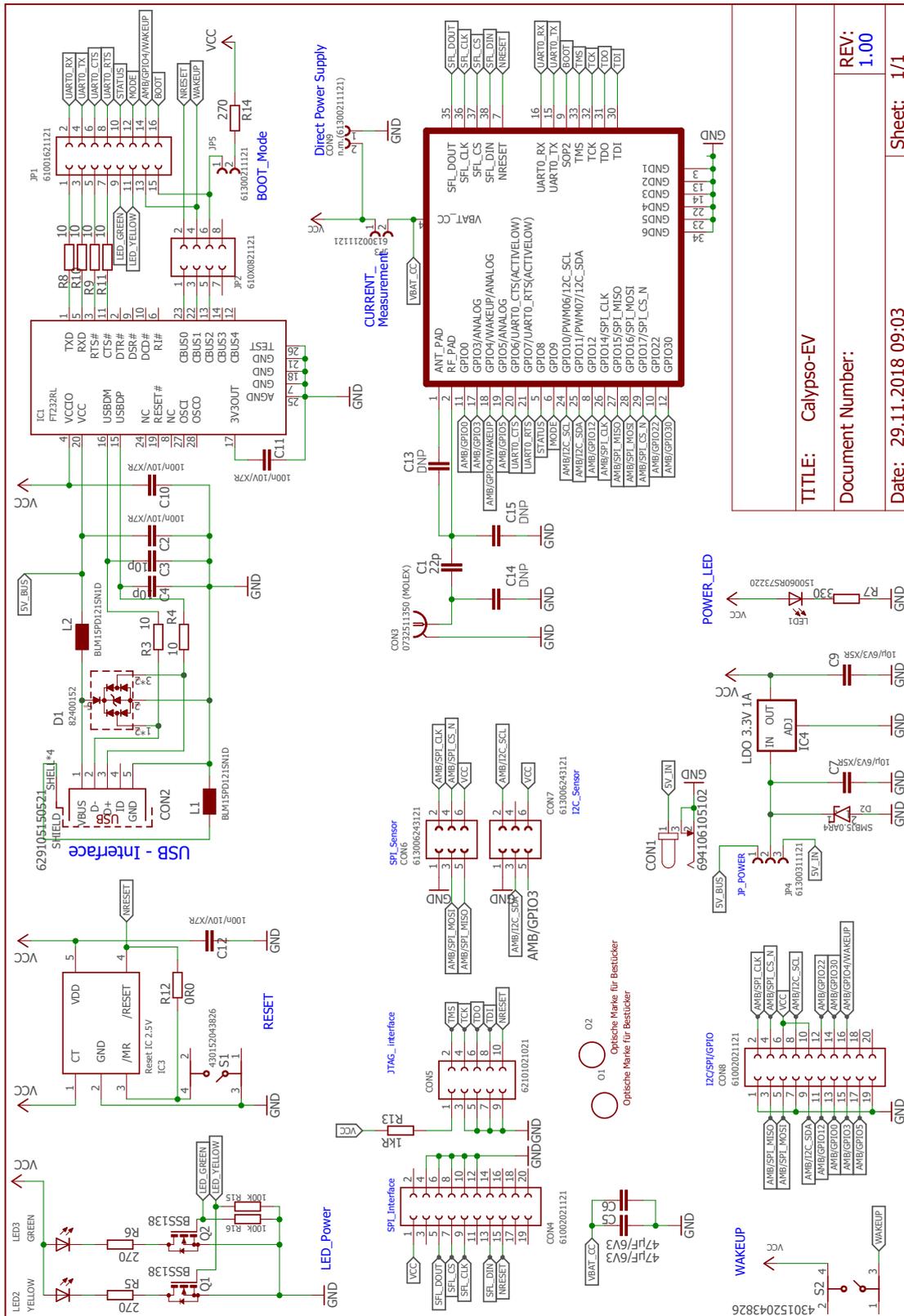
Figure 7: Circuit diagram
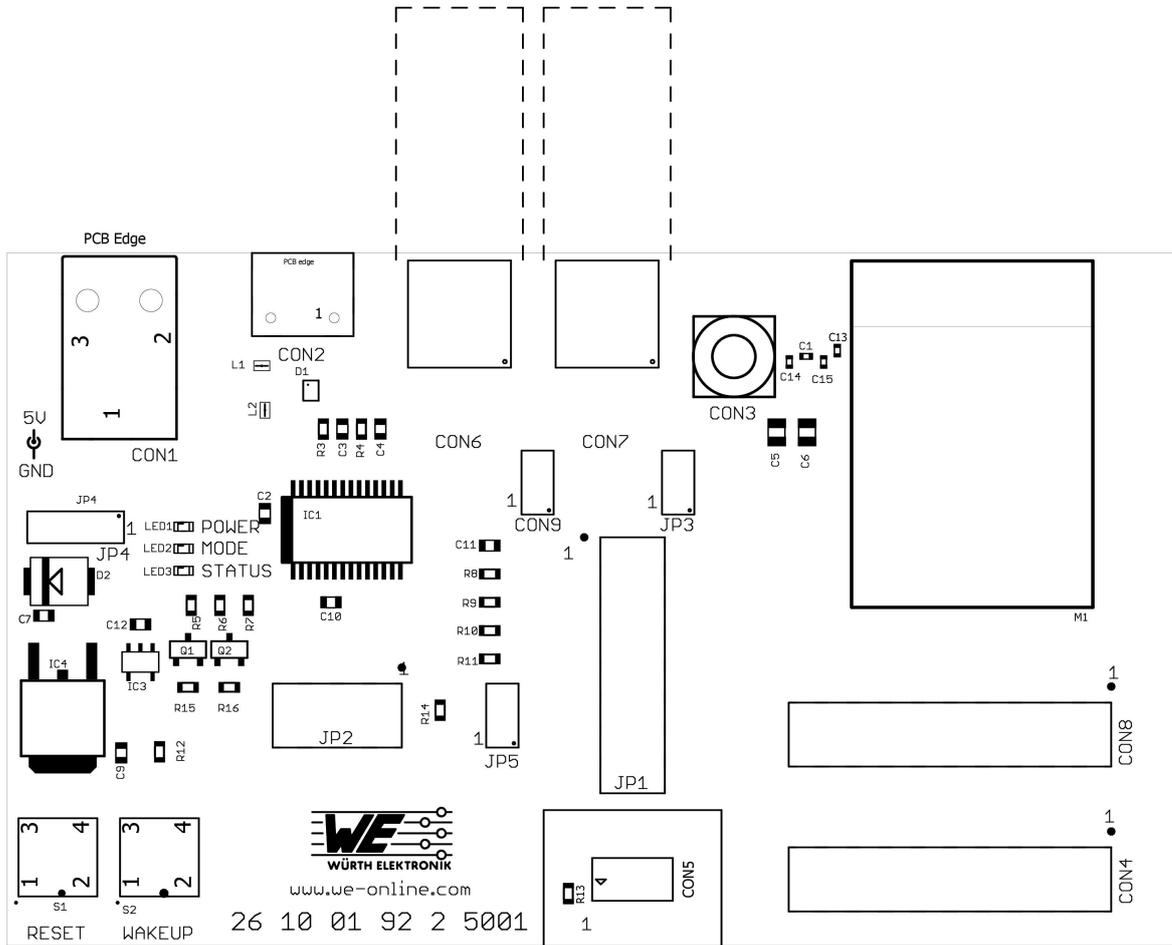
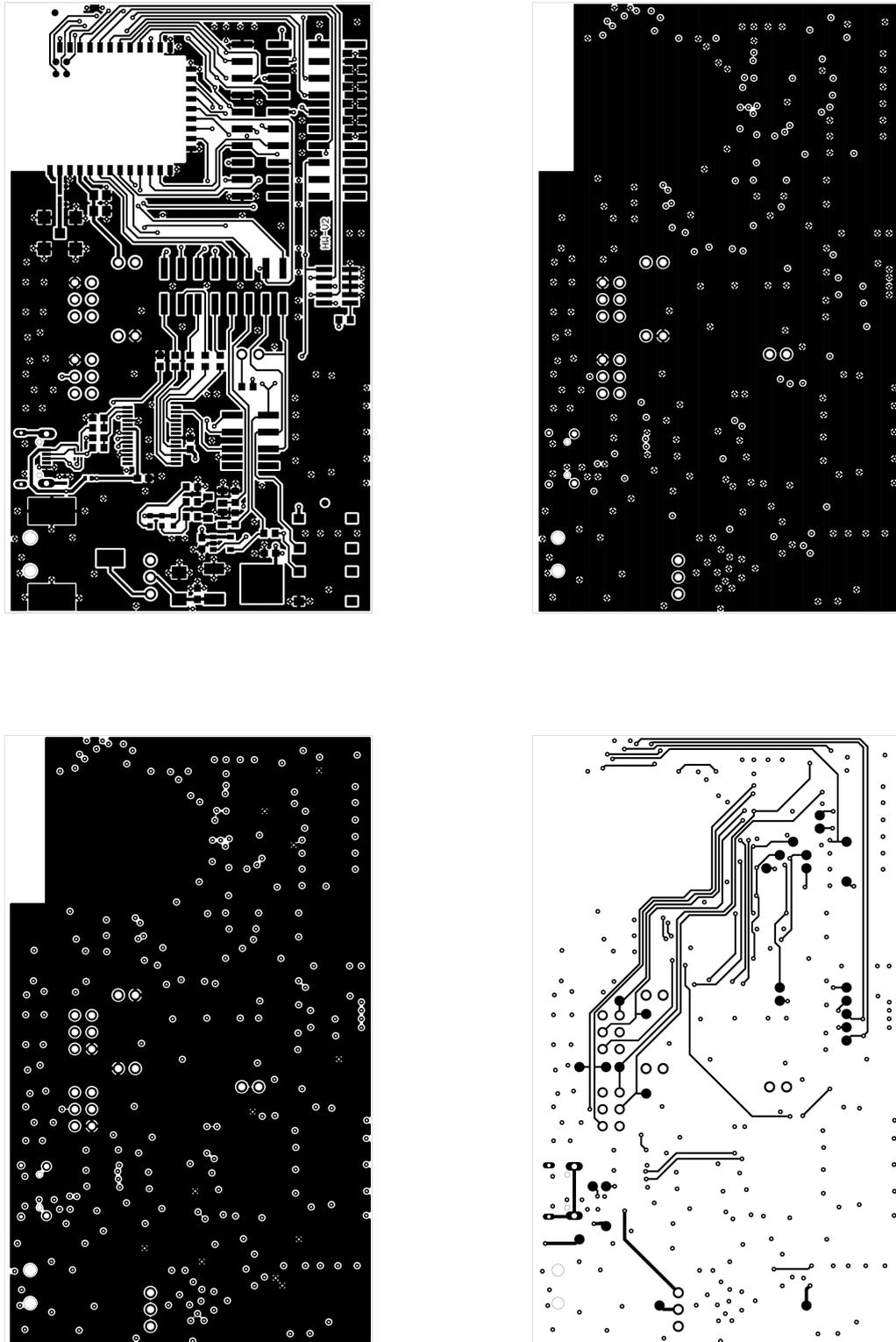## 3.9 Layout

Figure 8: Assembly diagram

Figure 9: Top, inner & bottom Layers

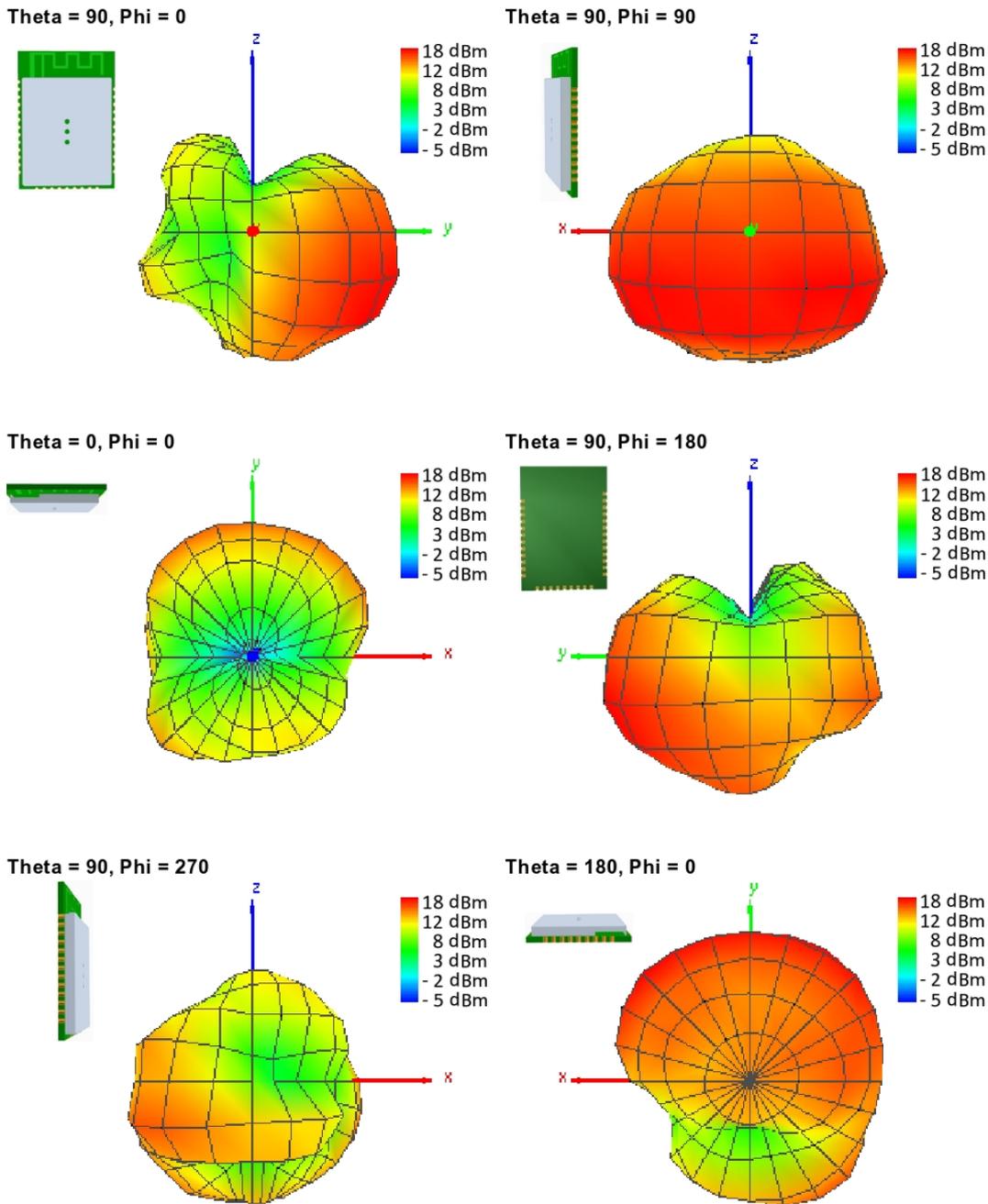## 3.10 Radiation characteristic of the module's internal antenna

Figure 10: Antenna characteristic of the module with its integrated antenna measured on the official evaluation board

> It is important to be aware that size and shape of the ground plane as well as the 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.

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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 control, ship control), transportation signal, disaster prevention, medical, public information network etc. You

shall inform Würth Elektronik eiSos about the intent of such usage before design-in stage. In certain customer applications requiring a very high level of safety and in which the malfunction or failure of an electronic component could endanger human life or health, you must ensure to have all necessary expertise in the safety and regulatory ramifications of your applications. You acknowledge and agree that you are solely responsible for all legal, regulatory and safety-related requirements concerning your products and any use of Würth Elektronik eiSos' products with the incorporated firmware in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by Würth Elektronik eiSos. YOU SHALL INDEMNIFY WÜRTH ELEKTRONIK EISOS AGAINST ANY DAMAGES ARISING OUT OF THE USE OF WÜRTH ELEKTRONIK EISOS' PRODUCTS WITH THE INCORPORATED FIRMWARE IN SUCH SAFETY-CRITICAL APPLICATIONS.

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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7.6 Limitation of liability

Any liability not expressly provided by Würth Elektronik eiSos shall be disclaimed.
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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.
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List of Figures

List of Tables

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