

USER MANUAL

EVALUATION BOARD/KIT FOR RADIO
MODULE ADRASTEIA-I

2615011136000

VERSION 2.0

OCTOBER 16, 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 including the possibility of a firmware update in the customer system design.

Revision history

Manual version	HW version	Notes	Date
1.0	3.1	<ul style="list-style-type: none">• Initial version	August 2021
2.0	3.1	<ul style="list-style-type: none">• Value of L2, L3 and L4 in table 30 updated• New corporate design• HW version typo fixed• Added chapter References• Updated chapter Abbreviations• Updated chapter Supported radio modules• Added chapter Marking• Updated chapter Important notes• Updated chapter Legal notice	October 2024

Abbreviations

Abbreviation	Name	Description
EJTAG	Embedded Joint Test Action Group	
EV	Evaluation	
ESD	Electro Static Discharge	
FEM	Front end modem	
FTDI	Future Technology Devices International	
GND	Ground	
GNSS	Global Navigation Satellite System	
HIGH	High signal level	
IO	Input & Output	
LED	Light Emitting Diode	
LOW	Low signal level	
PC	Personal Computer	
PCB	Printed Circuit Board	
RF	Radio frequency	Describes everything relating to the wireless transmission.
THT	Through-hole technology	
UART	Universal Asynchronous Receiver Transmitter	Universal Asynchronous Receiver Transmitter allows communicating with the module of a specific interface.
USB	Universal Serial Bus	
VDD	Voltage Drain Drain	Supply voltage

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1 Supported radio modules

The EV-Board described in this manual can be used to evaluate the following products:

Order code	Product Name	Description
261501113600	Adrastea-I	LTE-Cat.M1 and NB1-IoT module with GNSS and Integrated MCU

Order code	Product Name
2615029236001	Adrastea-I LTE-Cat.M1 and NB1-IoT EV-kit

Table 1: Compatibility

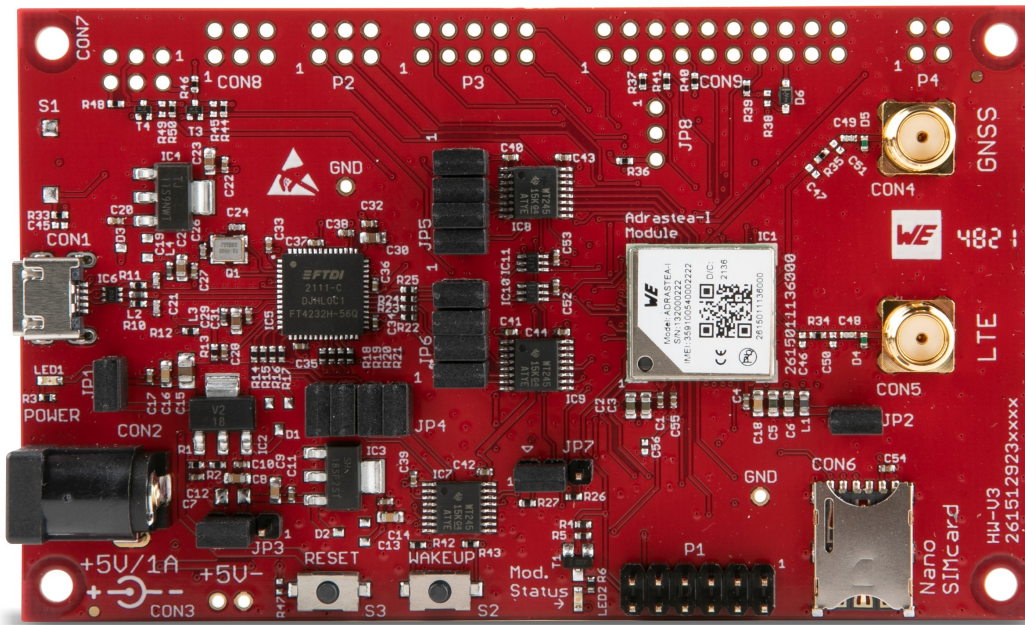


Figure 1: Product image

Kit Content 2615029236001	Quantity
EV-Board with Adrastea-I	1
LTE dipole antenna	1
GNSS dipole antenna	1
5 V/1A plug-in power adapter	1
USB-2.0-Typ-A to USB-2.0-Micro-B cable	1
Packaging: Cardboard Box, ESD safe cover	1

Table 2: Content Adrastea-I EV-kit

2 Functional description

The EV-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.



This EV-Board should be operated with an external power supply or an external powered USB hub that can provide the peak current of 1 A.

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

- Step 1: To run the EV-Board place the jumpers on default location, as shown in figure 6.
- Step 2: Insert a valid nano SIM card for NB-IoT or LTE-M.
(<https://iotcreators.com/wuerth/>)
- Step 3: Install on your PC the corresponding FTDI driver package.
(www.ftdichip.com/Drivers/VCP.htm).
- Step 4: Connect the power jack or external power supply to the EV-Board and verify that the VDD is stable and able to reliably supply the module's static and peak current consumption, as specified by the module manual.
- Step 5: Connect the EV-Board to the PC using a USB-cable. In that manner, four COM ports can be detected and installed on your PC. Check the device manager to acquire the COM port names of the EV-Board. A typical name is "COM57" in Windows systems or /dev/ttyUSB0 in Linux systems.
Note that usually the four COM ports are assigned in ascending order, as shown in figure 2.
- Step 6: To interact with the module, it is advised to use the Adrastea Commander tool [1]. Otherwise, a terminal program (like "PuTTY" for Windows) has to be run, and the corresponding COM port has to be opened using the default settings of the mounted radio module.
- Step 7: Press the reset button to ensure a clean start-up of the module. See figure 3.
- Step 8: Check if the SIM card is detected. Send command `map` followed by the command `AT+CPIN?`. See figure 4.



The "map" command is required before sending AT commands to the modem.

Please refer to the module user manual to get detailed quick start instructions [2].

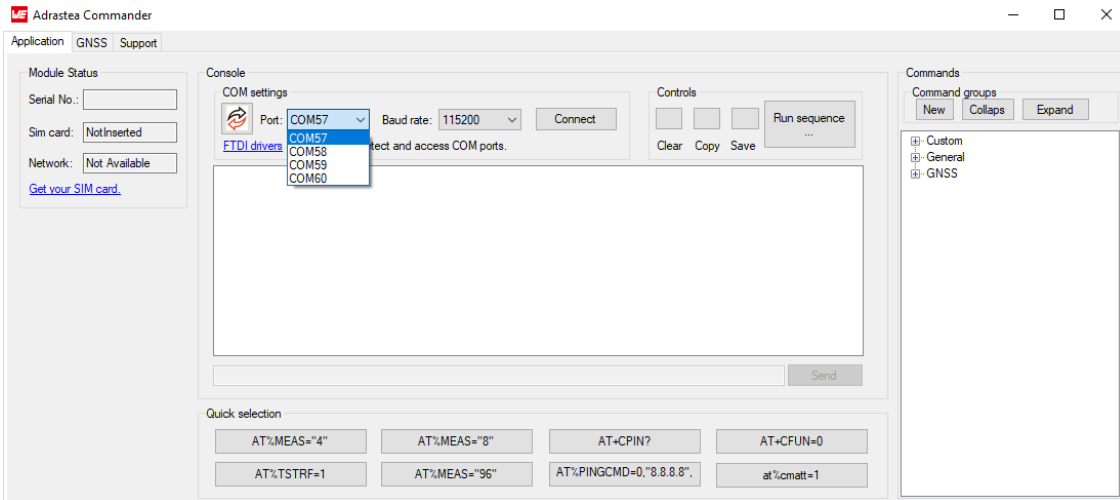


Figure 2: 4 COM ports detected - Adrastea Commander

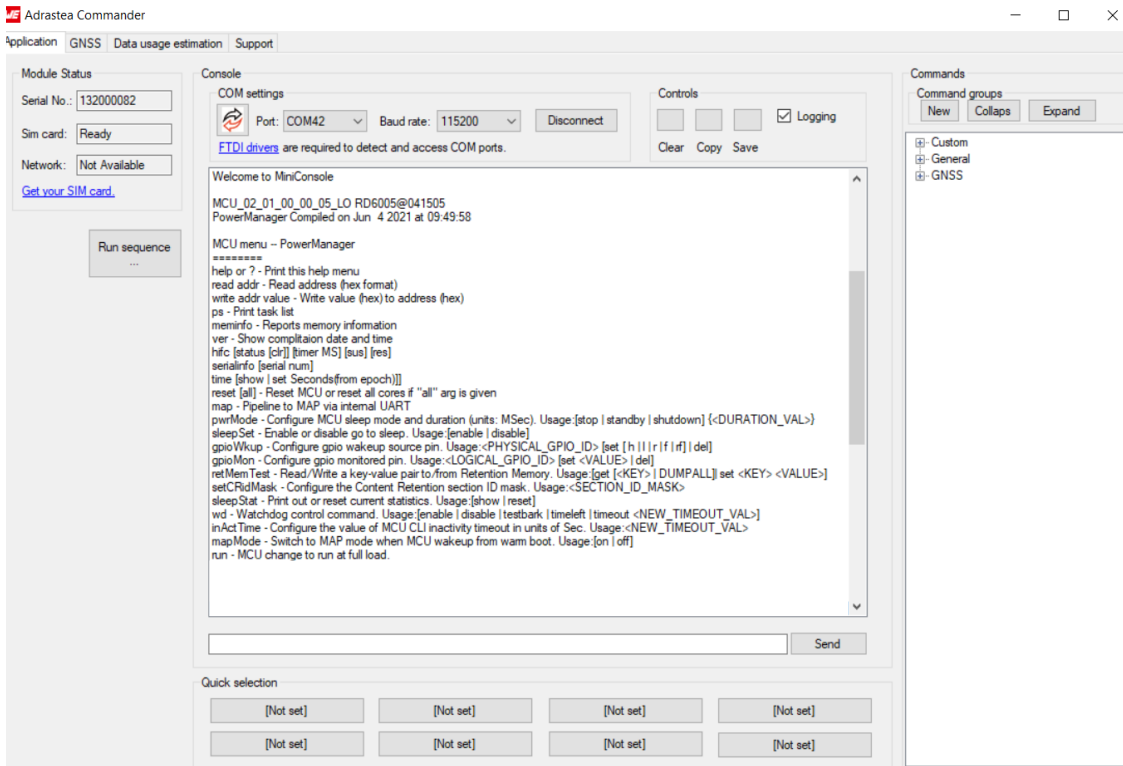


Figure 3: MiniConsole start view - Adrastea Commander

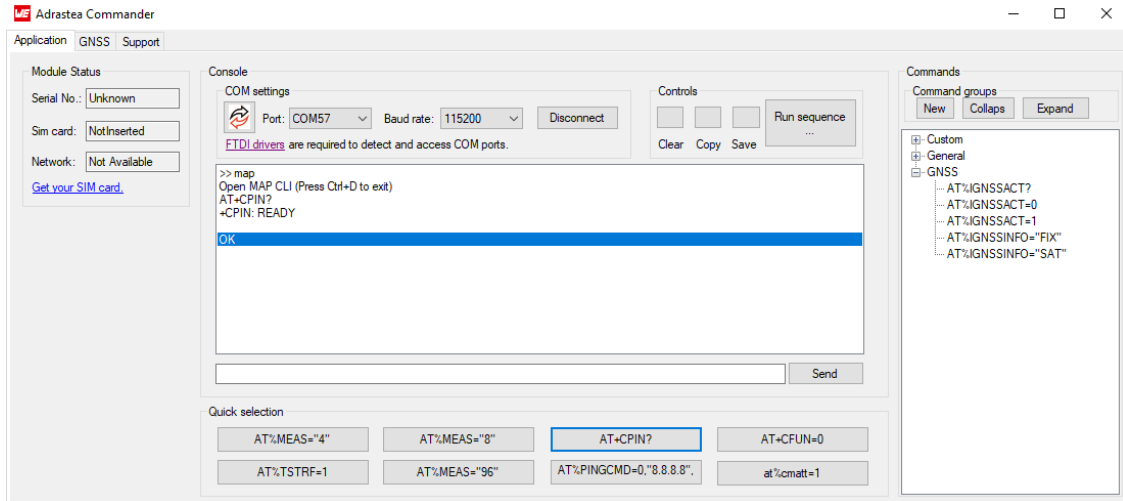


Figure 4: SIM card detected - Adrastea Commander

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

3 Development board

3.1 Block diagram

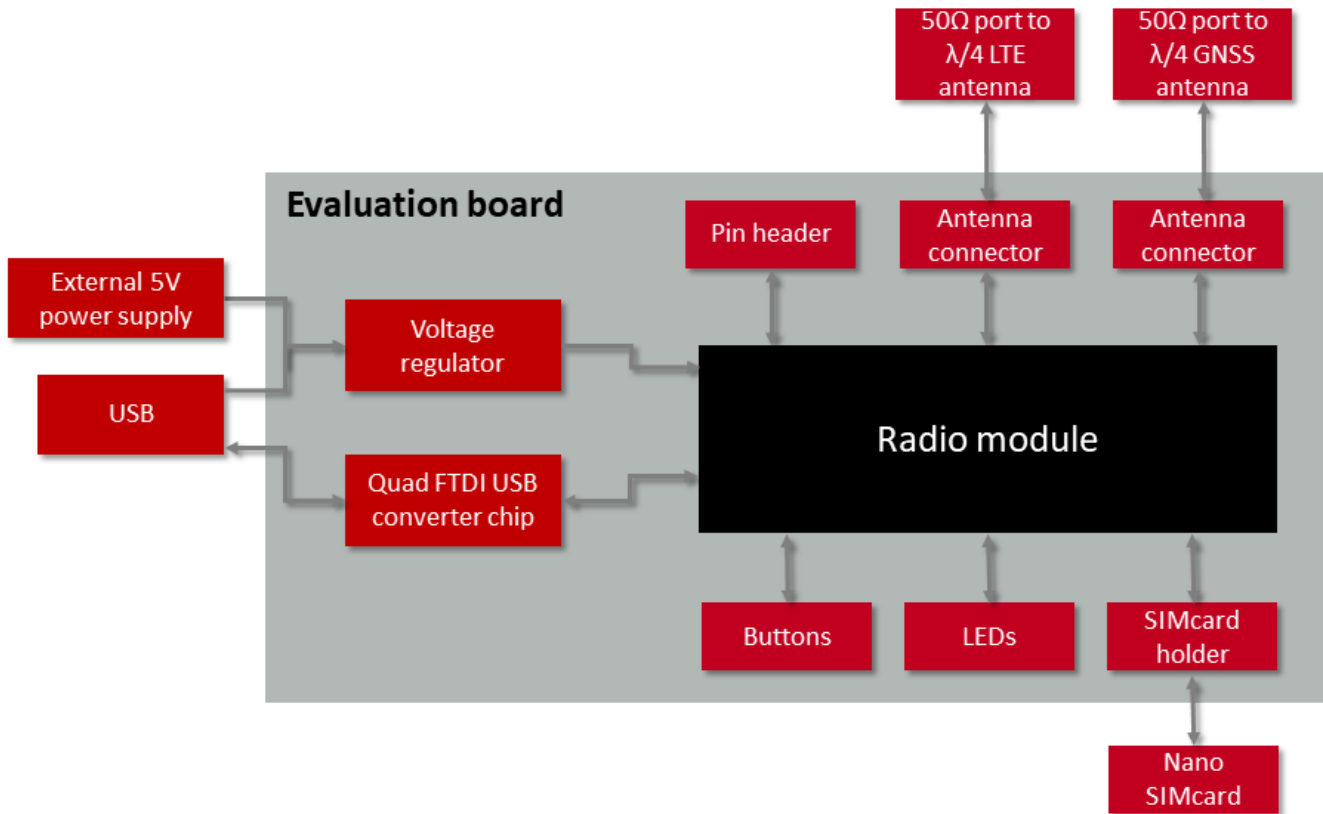


Figure 5: Block diagram

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.

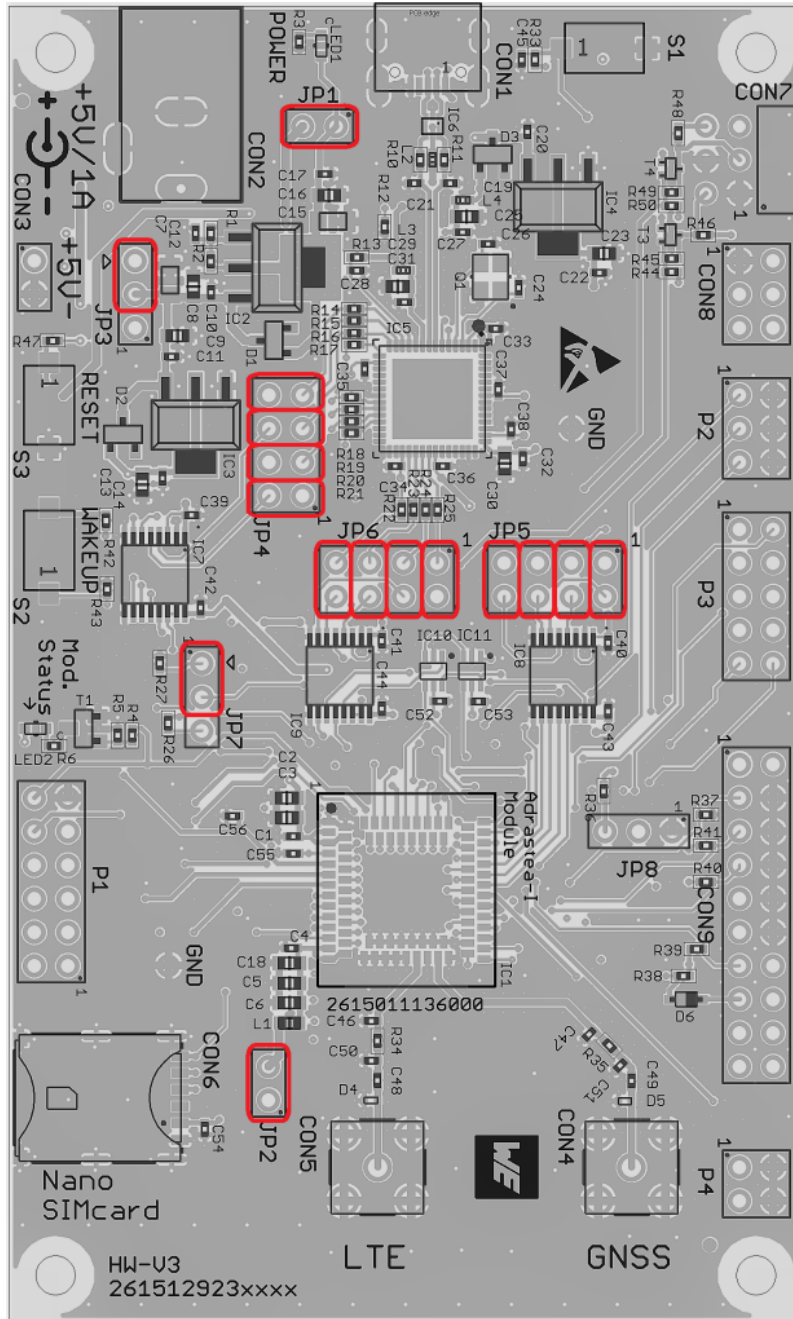


Figure 6: Jumpers, default

JP1	Function	Jumper set (default)
1,2	Power bridge. Remove for measuring the complete current flowing into the module	Yes

Table 3: Jumper JP1

JP2	Function	Jumper set (default)
1,2	Power bridge FEM. Remove for only measuring the current flowing into the FEM	Yes

Table 4: Jumper JP2



Current measured in JP1 includes the FEM current.

JP3	Function	Jumper set (default)
1,2	Board supplied via USB	No
2,3	Board supplied via Plug-in power adapter	Yes

Table 5: JP3 input power selection

JP4	Function	Jumper set (default)
1,2	FTDI /CTS - Module's UART /RTS	Yes
3,4	FTDI /RTS - Module's UART /CTS	Yes
5,6	FTDI Rx - Module's Tx UART	Yes
7,8	FTDI Tx - Module's Rx UART	Yes

Table 6: JP4 UART0 to USB communication - Miniconsole

JP5	Function	Jumper set (default)
1,2	FTDI /CTS - Module's UART /RTS	Yes
3,4	FTDI /RTS - Module's UART /CTS	Yes
5,6	FTDI Rx - Module's Tx UART	Yes
7,8	FTDI Tx - Module's Rx UART	Yes

Table 7: JP5 UART1 to USB communication - Console logs

JP6	Function	Jumper set (default)
1,2	FTDI /CTS - Module's UART /RTS	Yes
3,4	FTDI /RTS - Module's UART /CTS	Yes
5,6	FTDI Rx - Module's Tx UART	Yes
7,8	FTDI Tx - Module's Rx UART	Yes

Table 8: JP6 UART2 to USB communication - FW update



Logic level on JP4, JP5 and JP6 is 3.3 V.

Inbetween the radio module and the jumpers, level shifters are included for signal level compatibility with the FTDI Chip.

JP7	Function	Jumper set (default)
1,2	I/O of level shifter enable	Yes
2,3	I/O of level shifter set to high impedance	No

Table 9: JP7 Isolation control of level shifter

In case of measuring the current flowing into the module in deep hibernate mode (DH0, DH1 and DH2), the jumper link shall be set in the position 2,3. Notice that in this position, no UART communication is possible, therefore, the jumper shall be placed back in the position 1,2 to be able to communicate with the module via UART.

JP8	Function	Jumper set (default)
1,2	Reserved	No
2,3	Debugging microcontroller	No

Table 10: JP8 debugging selector (not mounted)

3.3 Connectors and pin headers

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

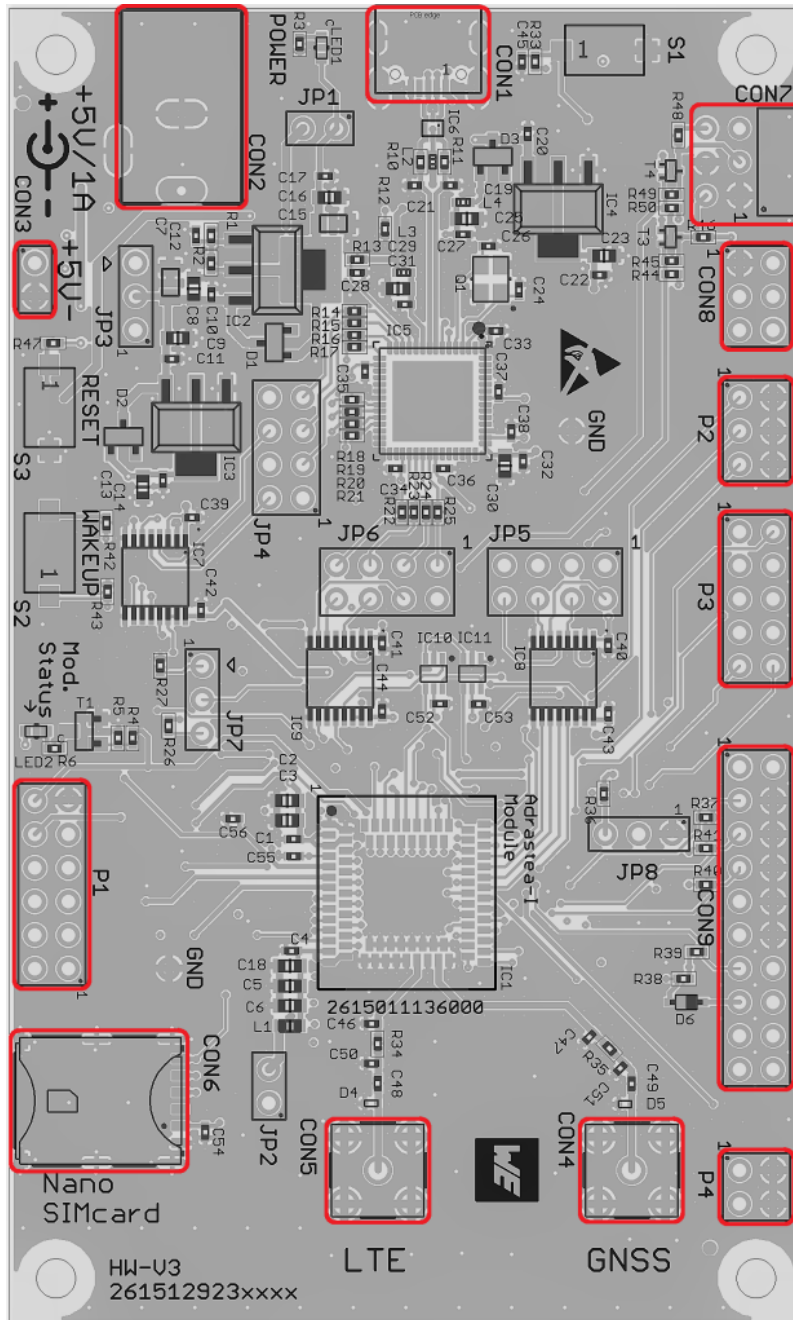


Figure 7: Connectors and pin headers

The table 11 lists connectors and pin header assembled by default on the EV-Board.

Pin header	Function	WE article number
CON1	Micro-USB connector for host connection and VDD bus supply	629105150521
CON2	Plug-in power jack	694106301002
CON4	GNSS RF signal	60312002114503
CON5	LTE RF signal	60312002114503
CON6	SIM card connection	693043020611
P1	Direct access to signals of the radio module	61301221121

Table 11: Default assembled connectors and pin headers

Additionally, the following connectors can be assembled, if needed.

Pin header	Function	WE article number
CON3	External power supply	61300211121
CON7	I ² C interface	613006243121
CON8	SPI interface	61300621821
CON9	EJTAG debug	61302021121
P2	Direct access to signals of the radio module	61300621121
P3	Direct access to signals of the radio module	61301021121
P4	ADC interface	61300421121

Table 12: Optional connectors



CON7 and CON8 suits to connect *WSEN-EVAL* by mounting the corresponding headers.

3.3.1 CON1

Connector CON1 is a micro-USB connector that enables connection to PC via standard micro-USB cable.

CON1	Function
-	Micro-USB connector for host connection and VDD bus supply

Table 13: Micro-USB connector

3.3.2 CON2

Connector CON2 is a power jack right angled connector that can be used to provide the main power to the board.

CON2	Function
-	Power jack, External 5 V/1A power supply

Table 14: Power jack

3.3.3 CON3

Connector CON3 can be used to provide the main power to the board using an external power supply. This connector is not populated by default.

CON3	Function
1	+5 V
2	GND

Table 15: External power connection

3.3.4 CON4

Connector CON4 (SMA receptacle) is used to connect the GNSS antenna.

CON4	Function
Inner	RF signal
Outer	GND

Table 16: SMA connector for GNSS



Optional: The antenna is matched with the marked components. Following this reference design, it served experts for filtering and fine tuning.

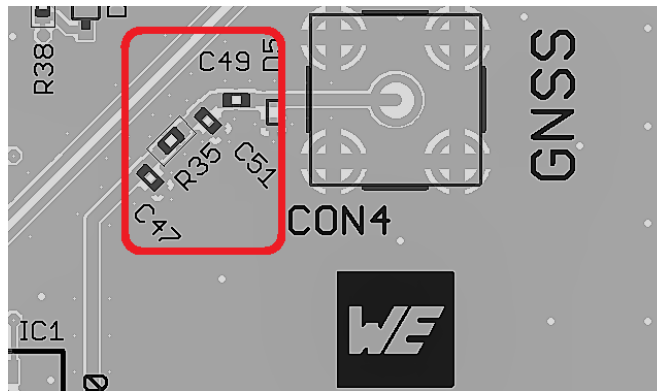


Figure 8: Matching filter for GNSS transmission line

3.3.5 CON5

Connector CON5 (SMA receptacle) is used to connect the LTE antenna.

CON5	Function
Inner	RF signal
Outer	GND

Table 17: SMA connector for LTE



Optional: The antenna is matched with the marked components. Depending on the exact application and band of operation experts may use the placeholder (C46, C50 and R34) for additional filtering and tuning.

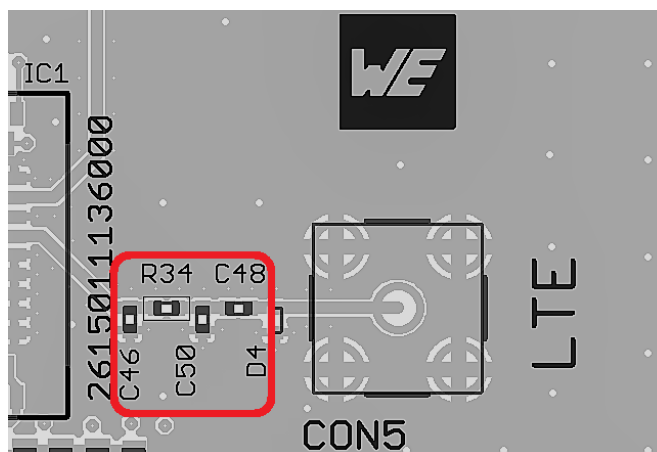


Figure 9: Matching filter for GNSS transmission line

3.3.6 CON6

Connector CON6 is a push/pull nano SIM card holder.

CON6	Function
C1	Voltage supply for SIM card
C2	SIM card reset signal
C3	SIM card clock signal
C5	SIM card GND
C6	Not connected
C7	SIM card data signal

Table 18: Nano SIM card holder

3.3.7 CON7

Connector CON7 can be used to connect the WE Sensor EV-Boards via I²C interface. This feature is subjected to a customized firmware and not supported by default firmware.

CON7	Module pin	Function
1	-	GND
2	I2C0_SCL/GPIO43	Clock signal
3	I2C0_SDA/GPIO42	Data signal
4	-	GND
5	-	Not connected
6	-	+1.8 V

Table 19: 2x3 right angle socket



This EV-Board includes pull-up resistors (equivalent 500 Ohm approx.) in I²C bus.

3.3.8 CON8

Connector CON8 can be used to connect the WE Sensor EV-Boards via SPI interface. This feature is subjected to a customized firmware and not supported by default firmware.

CON8	Module pin	Function
1	-	GND
2	SPIM1_CLK/GPIO41	Clock signal
3	SPIM1_MOSI/GPIO38	MOSI signal
4	SPIM1_EN/GPIO40	Enable signal
5	SPIM1_MISO/GPIO39	MISO signal
6	-	+1.8 V

Table 20: 2x3 socket

3.3.9 CON9

Connector CON9 is the EJTAG debugging interface.

CON9	Module pin	Function
1	VDDIO	+1.8 reference output voltage
3	EJ_TRST	JTAG reset
5	EJ_TDI	JTAG data input
7	EJ_TMS	JTAG mode select
9	EJ_TCK	JTAG clock
13	EJ_TDO	JTAG data output
15	DEBUG_ /RST	Reset pin for the JTAG probe
4,6,8,10,12	-	GND
2,11,14,16,17,18,19,20	-	Not Connected

Table 21: 2x10 EJTAG connector

3.3.10 P1

P1	Module pin	Function
1	RESERVED (70)	Reserved pin
2	EXT_ALARM	Additional module's status indicator
3	AT_OUT	Antitamper output pin
4	AT_IN	Antitamper input pin
5	RESERVED (11)	Reserved pin
6	RESERVED (64)	Reserved pin
7	VCAP	Temporal power supply input for battery replacement
8	VBACKUP	Temporal power supply input for battery replacement
9	/RESET	Hardware reset
10	WAKEUP	Full power enable
11	GND	Ground
12	STATUS	Module's status indicator

Table 22: Pin header P1

On P1 non categorized module pins are available.

3.3.11 P2

P2	Module pin	Function
1	RESERVED (67)	Reserved pin
2	RESERVED (62)	Reserved pin
3	RESERVED (69)	Reserved pin
2,4,6	-	GND

Table 23: Pin header P2



Reserved pins are restricted for internal use.

3.3.12 P3

P3	Module pin	Function
1	RESERVED (73)	Reserved pin
2	RESERVED (66)	Reserved pin
3	RESERVED (68)	Reserved pin
4	RESERVED (71)	Reserved pin
5	RESERVED (44)	Reserved pin
6	RESERVED (47)	Reserved pin
7	RESERVED (89)	Reserved pin
8	RESERVED (49)	Reserved pin
9	RESERVED (78)	Reserved pin
10	RESERVED (54)	Reserved pin

Table 24: Pin header P3



Reserved pins are restricted for internal use.

3.3.13 P4

P4	Module pin	Function
1	ADC0/GPIO1	Analog to digital converter channel 0
3	ADC1/GPIO2	Analog to digital converter channel 1
2,4	-	GND

Table 25: Pin header P4

3.4 Buttons

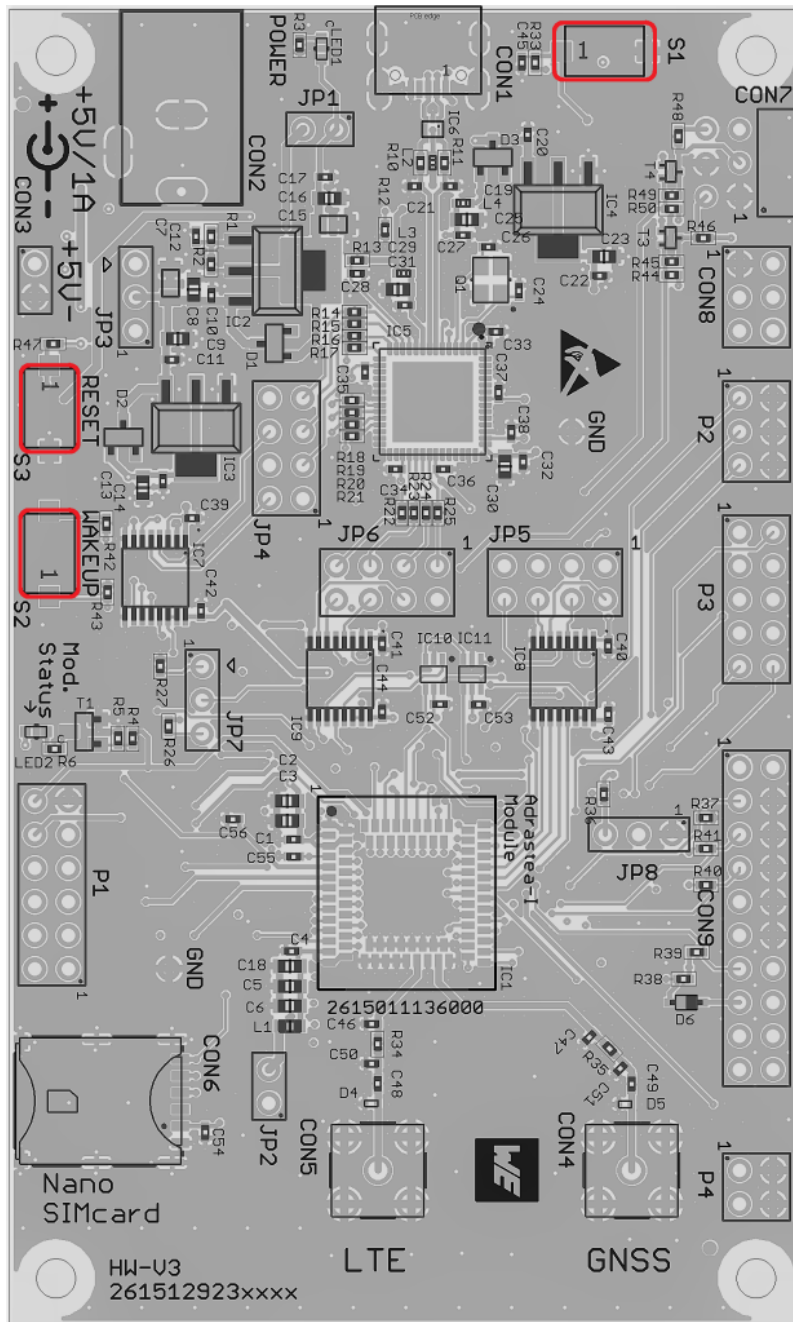


Figure 10: Connectors and pin headers

3.4.1 Reserved - S1

The functionality of this button is reserved for future use.

3.4.2 Wake-up button - S2

This button drives *WAKEUP* pin. When the wake-up button is pushed, it pulls up the *WAKEUP* pin to allow the module to get out from sleep mode. After pushing the S2, the command `sleepSet disable` should be sent to indefinitely wake-up the module. If this command is not received, the module goes back to the sleep state.

If S2 is not pushed, it enables the module to get into sleep mode.

3.4.3 Reset button - S3

This button starts a power down cycle, which leads to a hardware reset 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 Self powered, power jack

Make sure JP3 is in default position (2-3) and JP1 and JP2 jumper are put on.

The USB for communication must be connected only after the power jack was connected and VCC is stable.

The development board can be powered via 5 V power jack. The integrated voltage regulator regulates the connected voltage 5 V down to 3.6 V and supplies the remaining parts of the circuit. If the EV-Board is power sourced, the power LED1 lights up.



It is recommended to use the power adapter included in the EV-Kit (or equivalent) for supplying power to avoid damage of the USB interface, when pulling high transmission currents.

3.5.1.2 Bus powered, power supply through USB

The radio module may be powered via USB connector (requires the JP3 to be placed at 1-2). As the maximum current of the board might exceed the "Max Bus Power" configured in the FTDI IC, this method is not recommended to be used as it may damage the connected PC permanently.

3.5.2 Current measurement

By default, JP3 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.

Likewise, the current consumption of the FEM in module can be measured separately at JP2.

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 to JP2 and is available on the USB jack so that the module can be connected directly to a PC. Using the FTDI-driver the PC will show four virtual COM-Ports (see Figure 2. Normally, the PC assigns the COM-PORT number in ascending order, which respectively corresponds to the UART0, UART1 and UART2. The following table shows an example of possible assignment of

COM-PORTs.

COM-Port number	UART	Function
COM57	UART0	Miniconsole
COM58	UART1	Console logs
COM59	UART2	FW update
COM60	not used	-

Table 26: COM-Port to UART assignment



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 bridge on JP4, JP5 and/or JP6. The UART can be connected directly on the pin strips (all even numbered pins) as shown below.

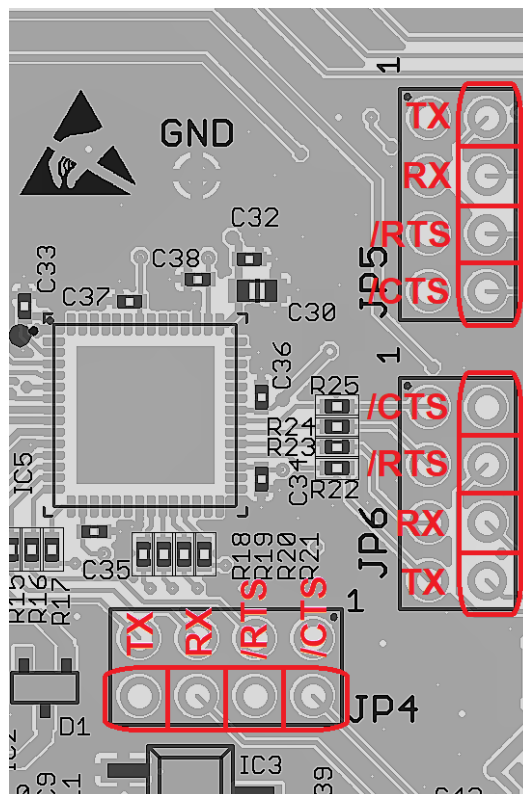


Figure 11: UART Interface

The UARTs connection to host micro-controller should be as follows:

UART interface in EV-Board	Host micro-controller	Voltage level
TX	TX	3.3 V
RX	RX	3.3 V
/CTS	/CTS	3.3 V
/RTS	/RTS	3.3 V

Table 27: COM-PORT to UART assignment



In the EV-Board the UART signals are level shifted from 1.8 V to 3.3 V and correspondingly cross-coupled as shown below.

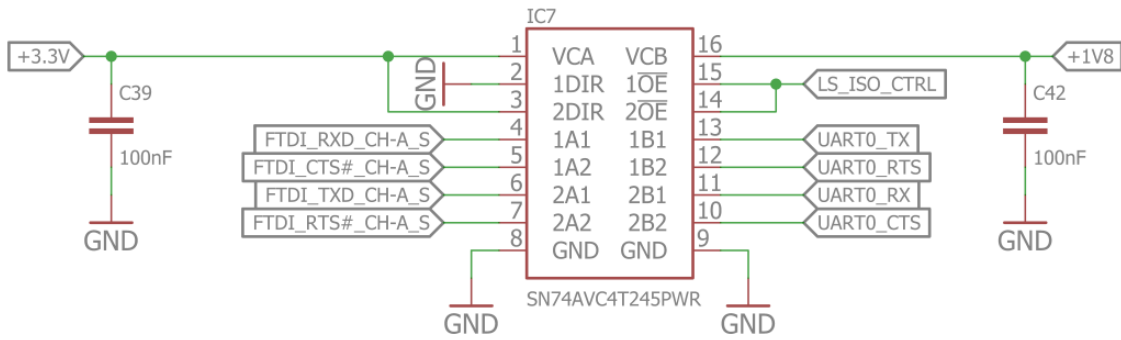
3.5.5 Debugging interface

The EV-Board provides a 2*10 pin connector to debug the internal micro-controller via EJTAG. Please take care of the correct mounting of the debugging adapter (Pin 1 is marked as such). Depending on the used debugger an additional adapter may be required.

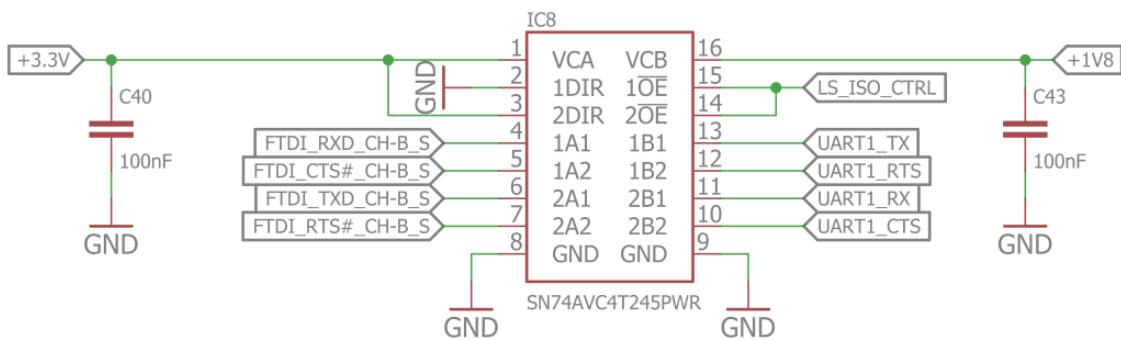
The recommended debugger adapter is Segger J-Link plus.

To debug it is necessary to assemble JP8 and bridge pins 2-3.

USB_A - UART0



USB_B - UART1



USB_C - UART2

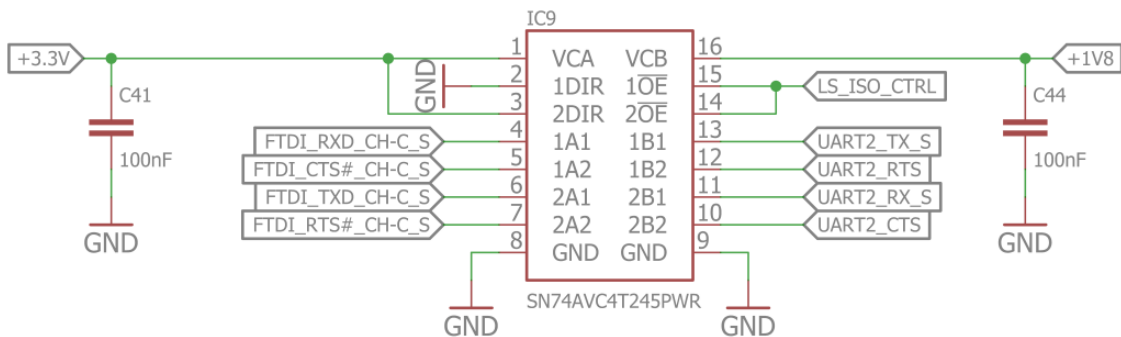


Figure 12: Signal crossing and level shifting of the UART signals

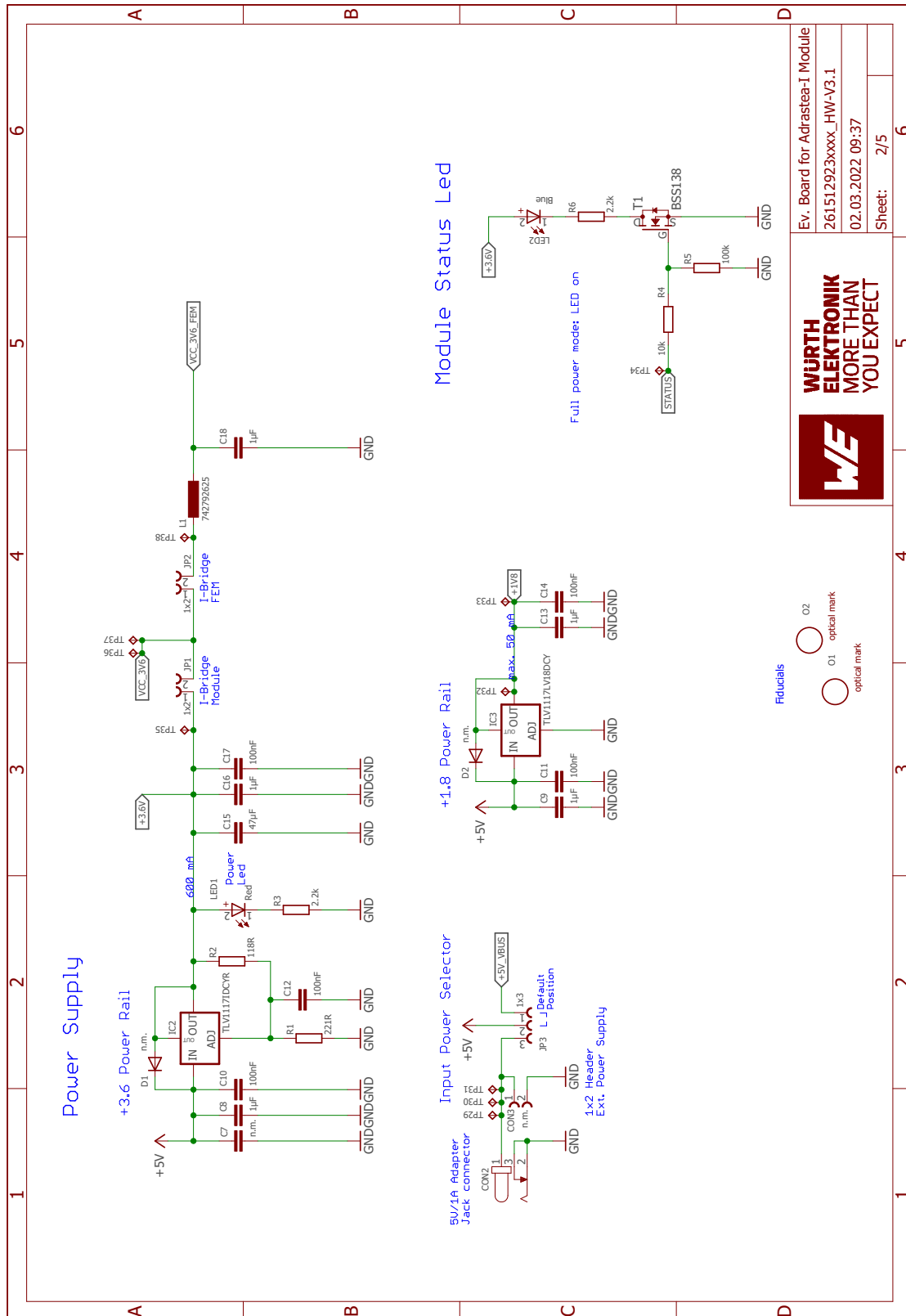
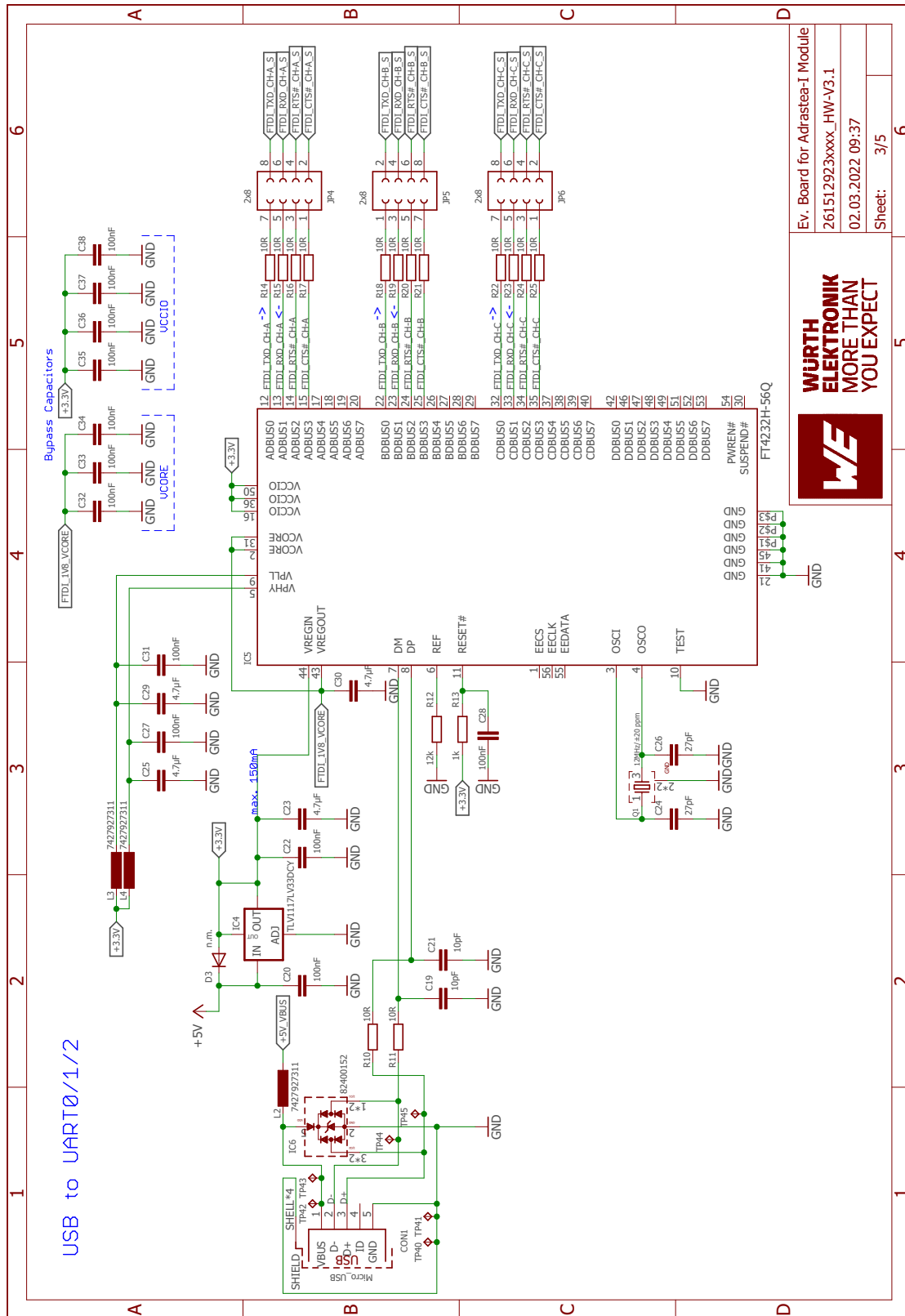


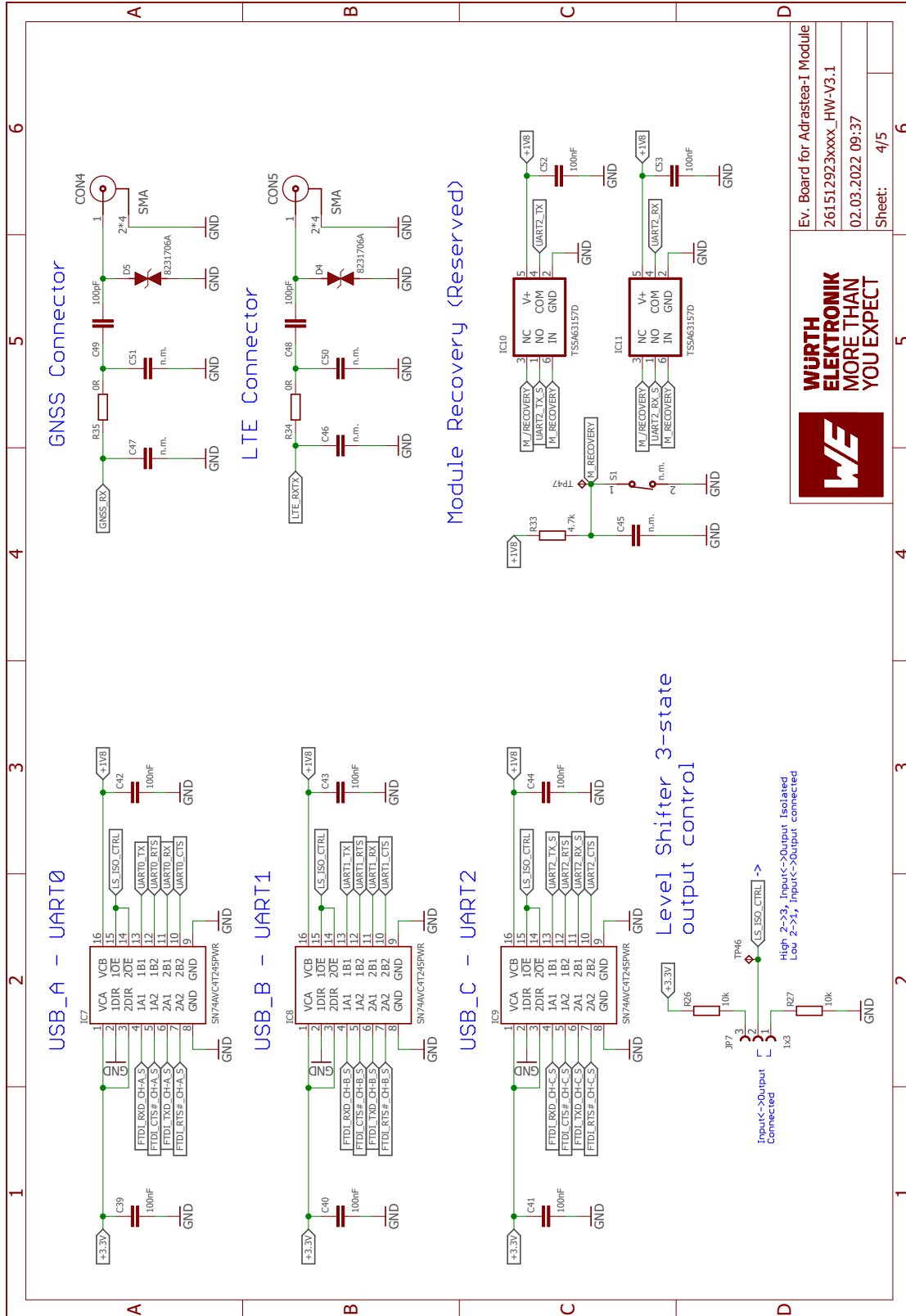
Figure 14: Circuit diagram 2



Ev. Board for Adrastea-I Module
261512923xxxxx_HW-V3.1
02.03.2022 09:37
Sheet: 3/5



Figure 15: Circuit diagram 3



Ev. Board for Adrastea-I Module
261512923xxxx_HW-V3.1
02.03.2022 09:37
Sheet: 4/5



Figure 16: Circuit diagram 4

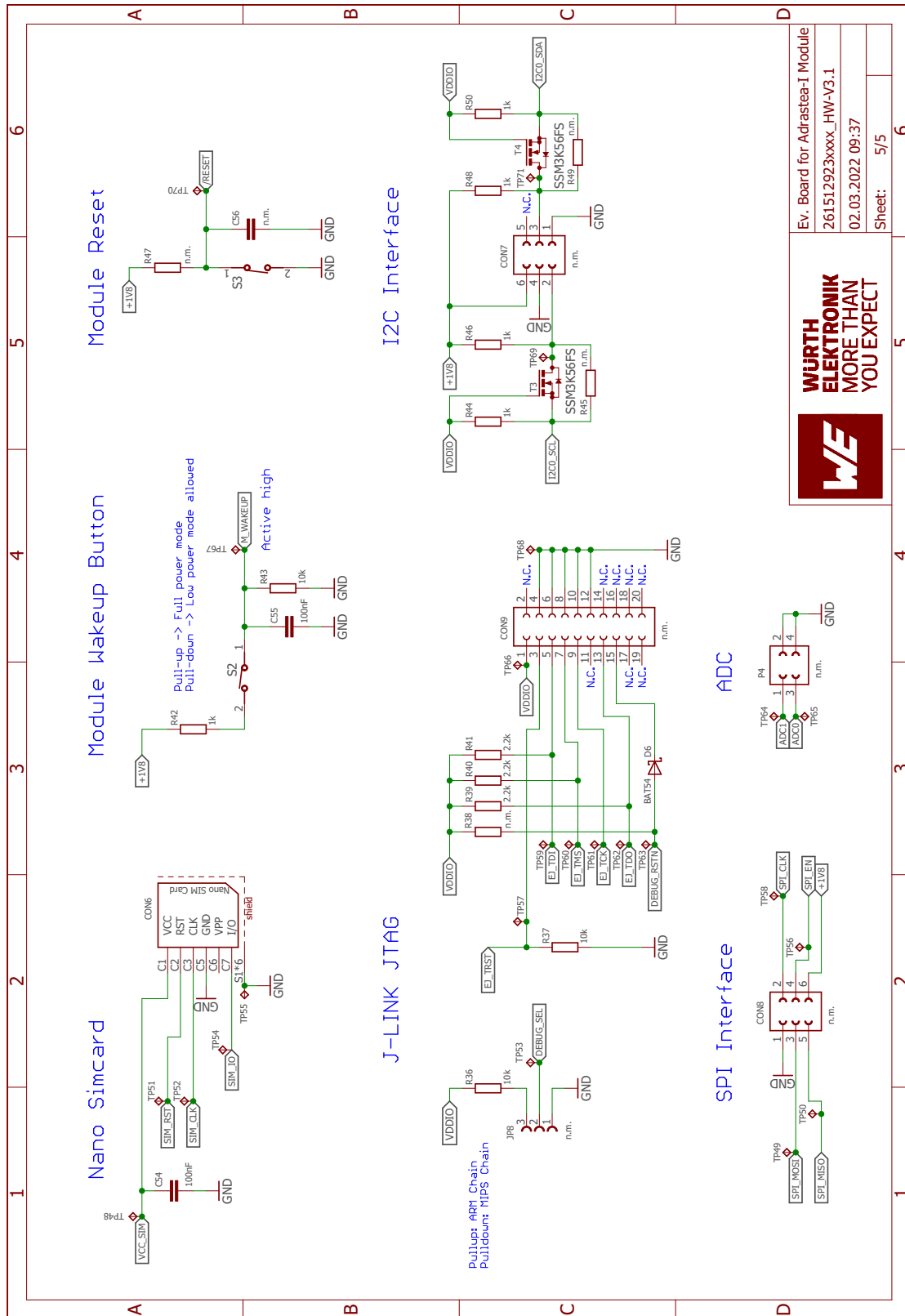


Figure 17: Circuit diagram 5

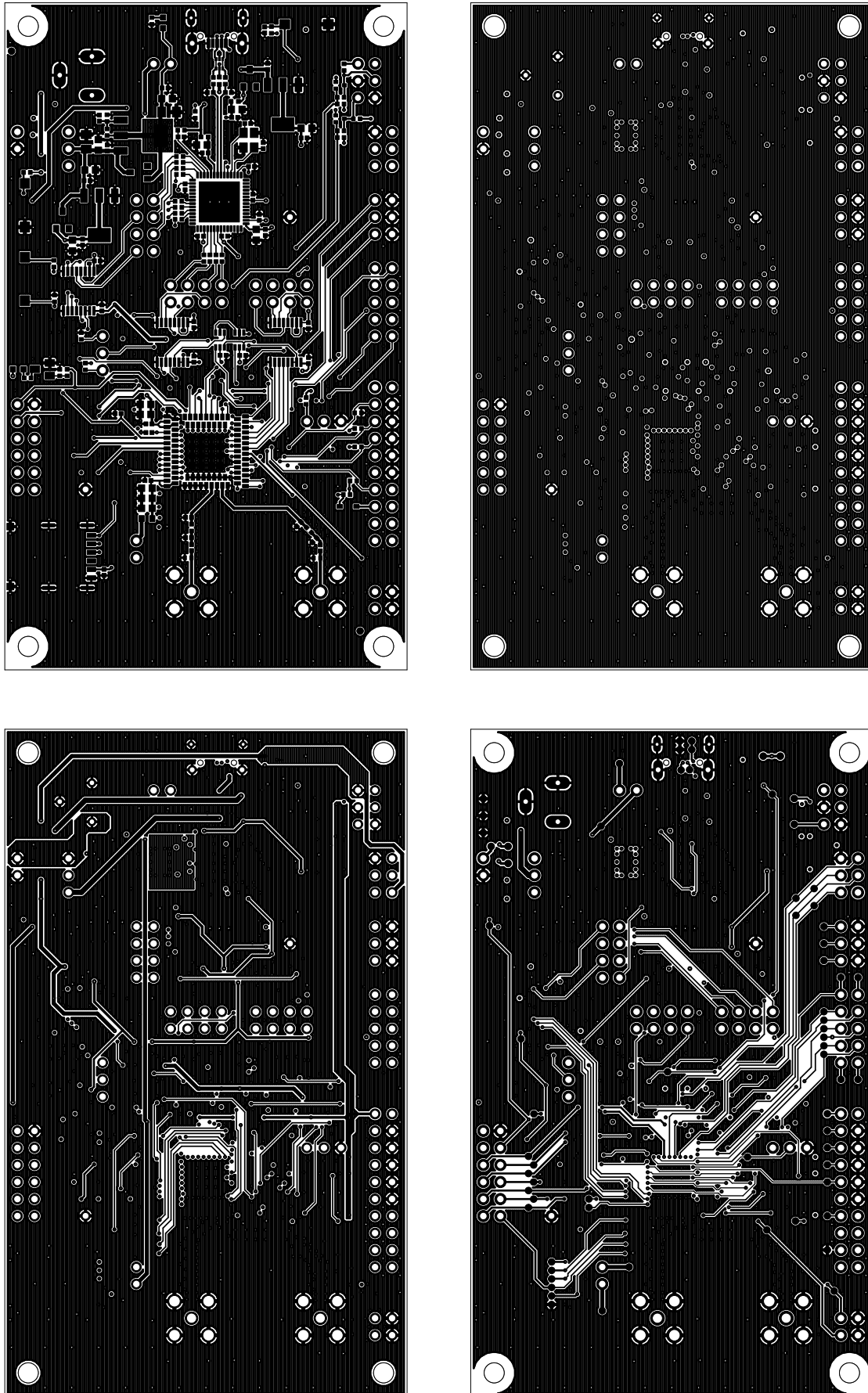


Figure 19: Top layer (upper left), second layer (upper right), third layer (bottom left), fourth layer (bottom right)

3.8 Bill of materials

Part	Value	Pack	Manufacturer	NR
C1	100nF	0402	Würth Elektronik eiSos	885012205037
C2	10uF	0603	Würth Elektronik eiSos	885012106006
C3	10uF	0603	Würth Elektronik eiSos	885012106006
C4	100nF	0402	Würth Elektronik eiSos	885012205037
C5	10uF	0603	Würth Elektronik eiSos	885012106006
C6	10uF	0603	Würth Elektronik eiSos	885012106006
C7	n.m.	0805	n.m.	n.m.
C8	1uF	0603	Würth Elektronik eiSos	885012206076
C9	1uF	0603	Würth Elektronik eiSos	885012206076
C10	100nF	0402	Würth Elektronik eiSos	885012205037
C11	100nF	0402	Würth Elektronik eiSos	885012205037
C12	100nF	0402	Würth Elektronik eiSos	885012205037
C13	1uF	0603	Würth Elektronik eiSos	885012206076
C14	100nF	0402	Würth Elektronik eiSos	885012205037
C15	47uF	0805	Würth Elektronik eiSos	885012107006
C16	1uF	0603	Würth Elektronik eiSos	885012206076
C17	100nF	0402	Würth Elektronik eiSos	885012205037
C18	1uF	0603	Würth Elektronik eiSos	885012206076
C19	10pF	0402	Würth Elektronik eiSos	885012005055
C20	100nF	0402	Würth Elektronik eiSos	885012205037
C21	10pF	0402	Würth Elektronik eiSos	885012005055
C22	100nF	0402	Würth Elektronik eiSos	885012205037
C23	4,7uF	0603	Würth Elektronik eiSos	885012106005
C24	27pF	0402	Samsung	CL05C270JB5NUNC
C25	4,7uF	0603	Würth Elektronik eiSos	885012106005
C26	27pF	0402	Samsung	CL05C270JB5NUNC
C27	100nF	0402	Würth Elektronik eiSos	885012205037
C28	100nF	0402	Würth Elektronik eiSos	885012205037
C29	4,7uF	0603	Würth Elektronik eiSos	885012106005
C30	4,7uF	0603	Würth Elektronik eiSos	885012106005
C31	100nF	0402	Würth Elektronik eiSos	885012205037
C32	100nF	0402	Würth Elektronik eiSos	885012205037
C33	100nF	0402	Würth Elektronik eiSos	885012205037

Table 28: Bill of materials part 1

Part	Value	Pack	Manufacturer	NR
C34	100nF	0402	Würth Elektronik eiSos	885012205037
C35	100nF	0402	Würth Elektronik eiSos	885012205037
C36	100nF	0402	Würth Elektronik eiSos	885012205037
C37	100nF	0402	Würth Elektronik eiSos	885012205037
C38	100nF	0402	Würth Elektronik eiSos	885012205037
C39	100nF	0402	Würth Elektronik eiSos	885012205037
C40	100nF	0402	Würth Elektronik eiSos	885012205037
C41	100nF	0402	Würth Elektronik eiSos	885012205037
C42	100nF	0402	Würth Elektronik eiSos	885012205037
C43	100nF	0402	Würth Elektronik eiSos	885012205037
C44	100nF	0402	Würth Elektronik eiSos	885012205037
C45	n.m.	0402	n.m.	n.m.
C46	n.m.	0402	n.m.	n.m.
C47	n.m.	0402	n.m.	n.m.
C48	100pF	0402	Würth Elektronik eiSos	885012005061
C49	100pF	0402	Würth Elektronik eiSos	885012005061
C50	n.m.	0402	n.m.	n.m.
C51	n.m.	0402	n.m.	n.m.
C52	100nF	0402	Würth Elektronik eiSos	885012205037
C53	100nF	0402	Würth Elektronik eiSos	885012205037
C54	100nF	0402	Würth Elektronik eiSos	885012205037
C55	100nF	0402	Würth Elektronik eiSos	885012205037
C56	n.m.	0402	n.m.	n.m.
P1	2x6	THT	Würth Elektronik eiSos	61301221121
P2	n.m.	THT	n.m.	n.m.
P3	n.m.	THT	n.m.	n.m.
P4	n.m.	THT	n.m.	n.m.
CON1	Micro USB 2.0	SMT-THT	Würth Elektronik eiSos	629105150521
CON2	Jack Connector	THT	Würth Elektronik eiSos	694106301002
CON3	n.m.	THT	n.m.	n.m.
CON4	SMA	THT	Würth Elektronik eiSos	60312002114503
CON5	SMA	THT	Würth Elektronik eiSos	60312002114503
CON6	NanoSIM	SMT	Würth Elektronik eiSos	693043020611
CON7	n.m.	THT	n.m.	n.m.
CON8	n.m.	THT	n.m.	n.m.
CON9	n.m.	THT	n.m.	n.m.
D1	n.m.	SMT	n.m.	n.m.

Table 29: Bill of materials part 2

Part	Value	Pack	Manufacturer	NR
D2	n.m.	SMT	n.m.	n.m.
D3	n.m.	SMT	n.m.	n.m.
D4	8231706A	SMT	Würth Elektronik eiSos	<i>8231706A</i>
D5	8231706A	SMT	Würth Elektronik eiSos	<i>8231706A</i>
D6	BAT54	SOT323	ON Semiconductor	BAT54HT1G
IC1	WIRL-CLTI	SMT	Würth Elektronik eiSos	2615011136000
IC2	TLV1117IDCYR	SMT	Texas Instruments	TLV1117IDCYR
IC3	TLV1117LV18	SMT	Texas Instruments	TLV1117LV18DCY
IC4	TLV1117LV33	SMT	Texas Instruments	TLV1117LV33DCY
IC5	FT4232H-56Q	VQFN-56	FTDI	FT4232H-56Q
IC6	82400152	SMT	Würth Elektronik eiSos	<i>82400152</i>
IC7	SN74AVC4T245	SMT	Texas Instruments	SN74AVC4T245PWR
IC8	SN74AVC4T245	SMT	Texas Instruments	SN74AVC4T245PWR
IC9	SN74AVC4T245	SMT	Texas Instruments	SN74AVC4T245PWR
IC10	TS5A63157D	SMT	Texas Instrument	TS5A63157DCKR
IC11	TS5A63157D	SMT	Texas Instrument	TS5A63157DCKR
JP1	1x2	THT	Würth Elektronik eiSos	<i>61300211121</i>
JP2	1x2	THT	Würth Elektronik eiSos	<i>61300211121</i>
JP3	1x3	THT	Würth Elektronik eiSos	<i>61300311121</i>
JP4	2x8	THT	Würth Elektronik eiSos	<i>61300821121</i>
JP5	2x8	THT	Würth Elektronik eiSos	<i>61300821121</i>
JP6	2x8	THT	Würth Elektronik eiSos	<i>61300821121</i>
JP7	1x3	THT	Würth Elektronik eiSos	<i>61300311121</i>
JP8	n.m.	THT	n.m.	n.m.
L1	742792625	0603	Würth Elektronik eiSos	<i>742792625</i>
L2	7427927311	0402	Würth Elektronik eiSos	<i>7427927311</i>
L3	7427927311	0402	Würth Elektronik eiSos	<i>7427927311</i>
L4	7427927311	0402	Würth Elektronik eiSos	<i>7427927311</i>
LED1	Red	0603	Würth Elektronik eiSos	<i>150060RS75000</i>
LED2	Blue	0603	Würth Elektronik eiSos	<i>150060BS75000</i>
Q1	12MHz +-20 ppm	SMT	Würth Elektronik eiSos	<i>830070868</i>
R1	221R	0402	Yageo	RC0402FR-07221RL
R2	118R	0402	Yageo	RC0402FR-07118RL
R3	2.2k	0402	Yageo	RC0402FR-072K2L
R4	10k	0402	Yageo	RC0402FR-0710KL
R5	100k	0402	Yageo	RC0402FR-07100KL
R6	2.2k	0402	Yageo	RC0402FR-072K2L

Table 30: Bill of materials part 3

Part	Value	Pack	Manufacturer	NR
R10	10R	0402	Yageo	RC0402FR-0710RL
R11	10R	0402	Yageo	RC0402FR-0710RL
R12	12k	0402	Yageo	RC0402FR-0712KL
R13	1k	0402	Yageo	RC0402FR-071KL
R14	10R	0402	Yageo	RC0402FR-0710RL
R15	10R	0402	Yageo	RC0402FR-0710RL
R16	10R	0402	Yageo	RC0402FR-0710RL
R17	10R	0402	Yageo	RC0402FR-0710RL
R18	10R	0402	Yageo	RC0402FR-0710RL
R19	10R	0402	Yageo	RC0402FR-0710RL
R20	10R	0402	Yageo	RC0402FR-0710RL
R21	10R	0402	Yageo	RC0402FR-0710RL
R22	10R	0402	Yageo	RC0402FR-0710RL
R23	10R	0402	Yageo	RC0402FR-0710RL
R24	10R	0402	Yageo	RC0402FR-0710RL
R25	10R	0402	Yageo	RC0402FR-0710RL
R26	10k	0402	Yageo	RC0402FR-0710KL
R27	10k	0402	Yageo	RC0402FR-0710KL
R33	4.7k	0402	Yageo	RC0402FR-074K7L
R34	0R	0402	Yageo	RC0402FR-070RL
R35	0R	0402	Yageo	RC0402FR-070RL
R36	10k	0402	Yageo	RC0402FR-0710KL
R37	10k	0402	Yageo	RC0402FR-0710KL
R38	n.m.	0402	n.m.	n.m.
R39	2.2k	0402	Yageo	RC0402FR-072K2L
R40	2.2k	0402	Yageo	RC0402FR-072K2L
R41	2.2k	0402	Yageo	RC0402FR-072K2L
R42	1k	0402	Yageo	RC0402FR-071KL
R43	10k	0402	Yageo	RC0402FR-0710KL
R44	1k	0402	Yageo	RC0402FR-071KL
R45	n.m.	0402	n.m.	n.m.
R46	1k	0402	Yageo	RC0402FR-071KL
R47	n.m.	0402	n.m.	n.m.
R48	1k	0402	Yageo	RC0402FR-071KL
R49	n.m.	0402	n.m.	n.m.
R50	1k	0402	Yageo	RC0402FR-071KL
S1	n.m.	SMT	n.m.	n.m.

Table 31: Bill of materials part 4

Part	Value	Pack	Manufacturer	NR
S2	WS-TASV	SMT	Würth Elektronik eiSos	434121025816
S3	WS-TASV	SMT	Würth Elektronik eiSos	434121025816
T1	BSS138	TO-236-3	ON semiconductor	BSS138
T3	SSM3K56FS	SOT-416-3	Toshiba	SSM3K56FS
T4	SSM3K56FS	SOT-416-3	Toshiba	SSM3K56FS

Table 32: Bill of materials part 5

4 Marking

4.1 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.

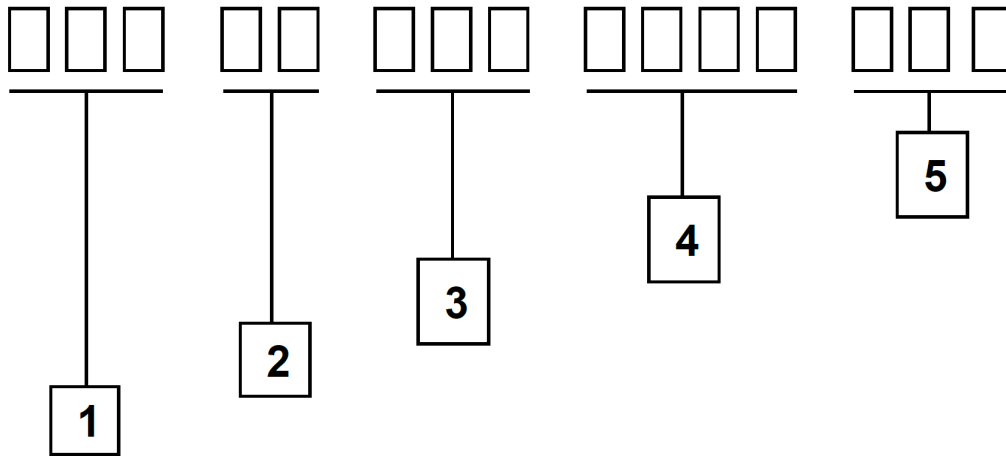


Figure 20: Lot number structure

Block	Information	Example(s)
1	eiSos internal, 3 digits	438
2	eiSos internal, 2 digits	01
3	Radio module 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	Radio module firmware version, 3 digits	V3.2 = 302, V5.13 = 513

Table 33: 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.

5 References

- [1] Würth Elektronik. Adrastea Commander. <http://www.we-online.com/Adrastea-Commander>.
- [2] Würth Elektronik. Adrastea-I user manual. <https://www.we-online.de/katalog/de/manual/2615011136000>.

6 Regulatory compliance information

6.1 European Conformity

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 EV-Kits designed for professionals to be used solely at research and development facilities for such purposes.

6.2 FCC

Pursuant to §2.803 (c) of Title 47 Chapter I Subchapter A Part 2 Subpart I, the EV-Kit falls under the FCC exception. Therefore it is marked as "For evaluation only; not FCC approved for resale".

6.3 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.

7 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, PCNs, warnings and cautions must be strictly observed in the most recent versions and matching to the products revisions. These 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 7 and 7 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. The approach named above does not apply in the case of EV-Boards. EV-Boards may be changed without any notification.

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Unless otherwise agreed in individual contracts, all orders are subject to the current version of the "General Terms and Conditions of Würth Elektronik eiSos Group", last version available at www.we-online.com.

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Würth Elektronik eiSos GmbH & Co. KG provide you as a user with technical data (including data sheets), design resources (including reference designs), recommendations for use or other design recommendations, web tools, safety information and other information in the form of evaluation-boards, -kits or -modules (hereinafter jointly referred to as "EVB") in accordance with the terms and conditions contained here. The EVB is provided in the "as is" state. WE disclaims all express and implied warranties, in particular those concerning the suitability for a certain purpose, the absence of defects or non-violation of third-party rights. The EVB is intended for experienced developers to develop

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General warnings

Do not touch the EVB when it is live, and allow charged components, such as capacitors, to discharge completely before handling the EVB. Depending on the individual application, high voltages can occur on the EVB and some components can reach temperatures above 50 °C. Even after disconnecting the EVB from the power source, these conditions remain for a significant time. Please ensure that the appropriate safety precautions are taken when installing and operating this EVB, as one of the following may occur if you handle or use this EVB without observing the relevant safety precautions: - Death - Serious injury - Electric shock - Electric burns - Severe heat burns -

When using the EVB, you undertake to read the instructions for use in full together with the relevant information supplied and/or available on the homepage www.we-online.de/wcs-manuals before putting this EVB into operation. The following points have to be observed in particular:

- Do not touch the EVB while it is live.
- The EVB must be fully assembled and all devices to be tested must be connected before voltage is applied to the EVB.
- The EVB should never be left unattended during operation.
- Capacitors must be completely discharged. The capacitors must be actively discharged using a suitable resistor.

Protection against static electricity

Use the unpackaged product only in ESD protected areas. Wear the ESD personal protective equipment prescribed for these areas. Ground all conductive components, including personnel, as prescribed in ESD protected areas. Ensure that the product is only used by trained personnel.

Purpose and use

The EVB is not a finished product and is not intended for general use by the consumer. The EVB is intended exclusively for use in the evaluation of WE components in the lab or in development environments by highly qualified technicians or engineers, familiar with the risks involved in handling electrical or mechanical components, systems and subsystems. The use of the EVB is your full and independent responsibility. The EVB is expressly not intended to be installed in a terminal device or to be part of a terminal device in whole or in part. WE reserves the right, at its own discretion, to make corrections, improvements, adjustments or other changes to the EVB or to discontinue the EVB. The EVB is not intended for use in devices and applications for which a higher safety and reliability standard is prescribed. It is also not approved for use in safety-relevant applications or where personal injury or fatal consequences must be expected in the event of failure.

Operation of the EVB

The EVB may only be operated within the specifications and environmental parameters recommended by WE, as described in the instructions for use. Exceeding the specified parameters (including, but not limited to, input and output voltage, current, power, and ambient conditions) may result in damage to property. If you have questions about these electrical parameters, please contact WE at (regulatory-compliance@we-online.com) prior to connecting peripheral electronics (including the input voltage and intended loads). Any load outside a certain power range may lead to negative consequences, including, but not limited to, unintended or inaccurate evaluations or possibly permanent damage to the EVB or the electronics connected to it. Please ensure that the appropriate safety precautions are taken when working with the EVB, as serious injuries, including severe or even fatal injuries from electric shock or electric burns, may occur if you do not follow the appropriate safety precautions. Under no circumstances should the EVB be touched while live. When the EVB is connected to a power source, some of its components are electrically charged and/or have temperatures above 50 °C. This condition also applies for a short time after disconnecting from the supply voltage until the capacitors are completely discharged and hot components have cooled down. These components include connectors, linear regulators, switching transistors, heat sinks, resistors, diodes, inductors and other components, which can be identified from the documentation in the instructions for use. As with all electronic lab work, only qualified persons with knowledge of electronic performance evaluation, measurement and diagnostic tools, should use the EVB.

Hazards and warnings

Before putting the EVB into operation, please read the instructions for use and especially the various hazards and warnings described therein. The instructions for use contain important safety information on voltages and temperatures. You take full responsibility and liability for the proper and safe handling of the EVB. You agree to comply with all safety requirements, rules and regulations related to the use of the EVB. You also take full responsibility for: (1) establishing safeguards to ensure that the use of the EVB does not cause damage to property, personal injury or death, even if the EVB does not function as described, intended or expected, (2) the test setup in which the EVB is integrated, all safety requirements, rules and regulations and also that no damage to property, personal injury or other hazardous situation occurs even if the EVB fails, and (3) ensuring the safety of all activities performed by you or your employees when using the EVB. In particular, this means that the technical rules VDE [German Electrical Engineering, Electronic and Information Technology Association] 0105-100 and BGI [German trade association information] 891 (or corresponding applicable safety regulations outside Germany) for the operation of electrical test setups must be observed, the test area is protected against unauthorized access or accidental touching, current limitations, and emergency stop mechanisms are functional and test setups are never operated unattended. If you have any questions about the safe use of the EVB, please contact WE at regulatory-compliance@we-online.com for more information.

Your responsibility with regard to the applicable laws

- You are responsible for being sufficiently informed about and complying with all international, national, state and local applicable laws, rules and regulations that apply to the handling or use of the EVB by you or your employees.
- The EVB generates, uses and radiates radio frequency energy, but has not been tested for conformity with the limits applicable to the product category, which are applicable according to the European Union regulations for protection against radio frequency interference. Operation of the EVB may cause interference with radio communication. In this case, the costs incurred for necessary measures to remedy the interference are to be borne by the user.

As the EVB is not a finished product, it may not comply with applicable regulatory, safety or certification standards that are normally as-

sociated with other products, such as Directive 2011/65/EC of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of hazardous substances and Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). You take full responsibility for compliance with such standards that apply to the EVB. You also take responsibility for the proper disposal of the components and materials of the EVB.

Exclusion of further rights and rights of use for intellectual property of EVB

The sale of an EVB does not constitute the granting by WE of any license or other right of any kind - expressly or implicitly - including, but not limited to, any patent, copyright, trademark or other proprietary rights. All rights from such patent, copyright, trademark or other proprietary rights are expressly reserved by WE. The EVB must not be used in any manner that directly or indirectly infringes any patent, copyright, trademark or other proprietary rights of WE.

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WE ensures that the EVB meets the specifications given in the instructions for use (within the deviations stated therein) for a period of 12 months from the date of purchase and functions in accordance with the instructions for use. On the basis of the underlying statutory provisions, WE shall rectify defects or offer free replacement of the EVB to which damage occurs that is evidently attributable to a defect for which WE is responsible and is at fault. A warranty claim is subject to the user having complied with the statutory duties of inspection and notification of defects and that the EVB has been received by WE no later than ten (10) days after expiry of the warranty period. This warranty is not transferable to others. This warranty does not apply to defects or impairments in performance resulting from incorrect use, use contrary to WE's instructions, improper installation, improper operation or misuse. WE accepts no liability whatsoever for the failure of equipment or other items not manufactured by or for WE, including, but not limited to, equipment or items to which the EVB is attached or for which the EVB is used. WE DOES NOT GRANT ANY WARRANTIES OR ASSURANCES WHATSOEVER, EXPRESS OR IMPLIED, WITH RESPECT TO THE EVB, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MARKETABILITY OR SUITABILITY FOR A PARTICULAR PURPOSE.

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