EVK-ANNA-B112

Evaluation Kit for ANNA-B112 Bluetooth® LE modules
User guide

Abstract

This document describes how to set up the EVK-ANNA-B112 evaluation kit to evaluate ANNA-B112 series standalone Bluetooth® Low Energy modules. It also describes the different options for debugging and the development capabilities included in the evaluation board.

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Document Information

Title	**EVK-ANNA-B112**	
Subtitle	Evaluation Kit for ANNA-B112 Bluetooth® LE modules	
Document type	User guide	
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This document applies to the following products[1]:

Product name	Type number	Description	Suitable for evaluation of
EVK-ANNA-B112U*	EVK-ANNA-B112U-00	Evaluation kit for ANNA-B112 module, with connector for external antenna	All ANNA-B112 module variants
EVK-ANNA-B112C	EVK-ANNA-B112C-00	Evaluation kit for ANNA-B112 module, with onboard trace antenna	All ANNA-B112 module variants

* Variant is discontinued

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[1] There is no separate EVK variant for the ANNA-B112-70B module variant. To simulate this module please erase the flash of the EVK.

Contents

1 Product description

1.1 Overview

The u-blox EVK-ANNA-B112 evaluation kit is a versatile development platform that allows quick prototyping of a variety of extremely low-power Internet of Things (IoT) applications, with support for Bluetooth® Core 5.0 functionality, Bluetooth mesh, and NFC.

The EVK-ANNA-B112 evaluation kit is available with two board variants that offer different antenna solutions:

- EVK-ANNA-B112U – supplied with an ANNA-B112U module, u-connectXpress software, and antenna connector for connecting to external antennas.
- EVK-ANNA-B112C – supplied with an ANNA-B112C module, u-connectXpress software, and internal, 2.4 GHz antenna (integrated in the SiP).

Through a variety of connectors, including Arduino™ Uno R3 and Raspberry Pi header connectors, the EVK-ANNA-B112 provides access to all 25 IO pins on the ANNA-B112 module.

The stand-alone ANNA-B112 module, included in the kit, is based on the Nordic Semiconductor nRF52832 chip. The nRF52832 uses an Arm® Cortex®-M4F microcontroller with 512 kB internal flash and 64 kB RAM, running at a system clock of 64 MHz.

The evaluation board offers simple USB drag-n-drop programming with a SEGGER J-Link debug interface that can be used with the open CPU variants of the EVK. Nordic provide a free Software Development Kit (SDK) with a broad selection of drivers, libraries, and example applications that can be used for rapid prototyping.
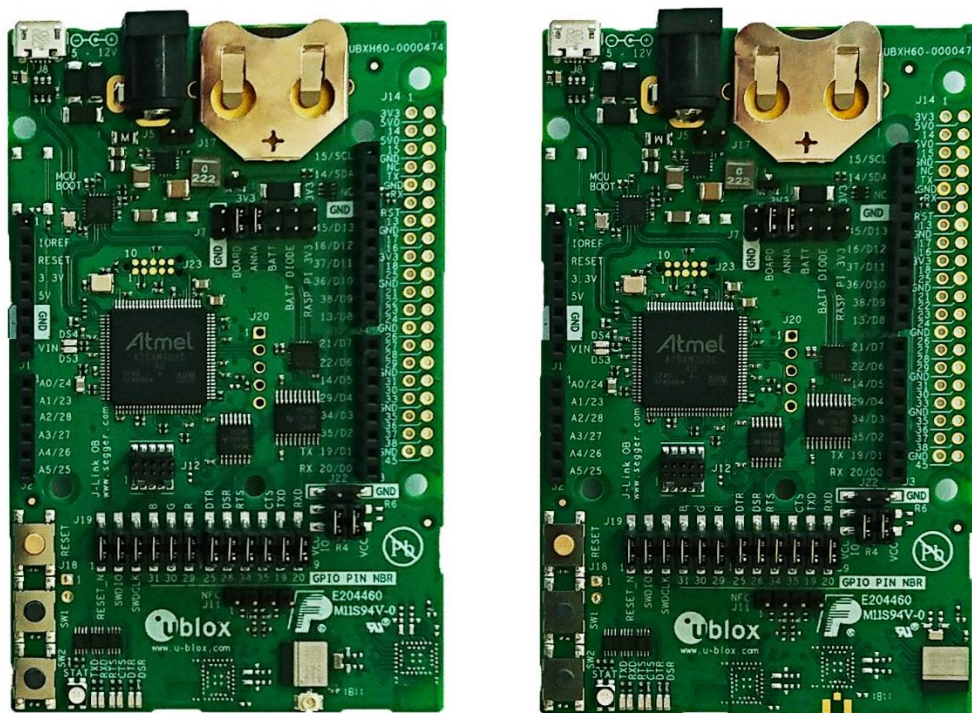
Figure 1: EVK-ANNA-B112 evaluation boards
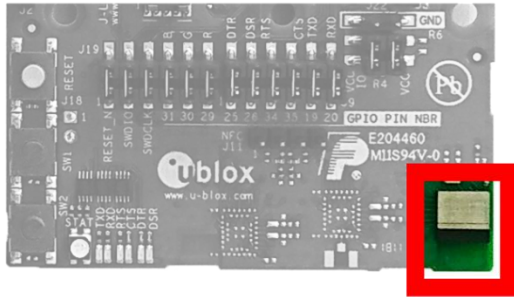
Figure 2: Left: EVB ANNA-B112U including U.FL connector; Right: EVB ANNA-B112C including an internal antenna.
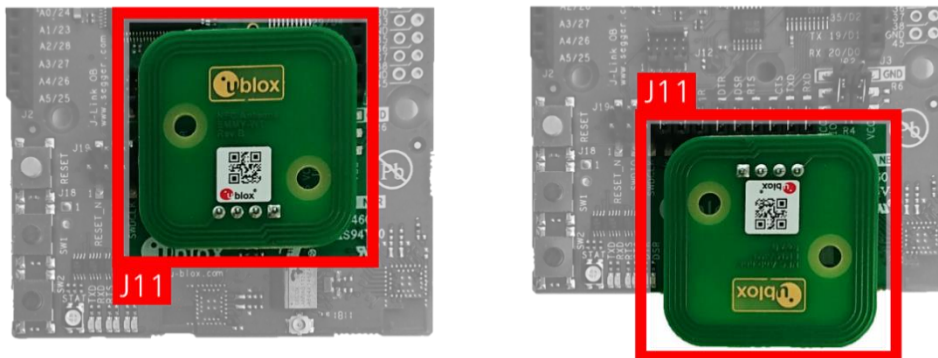
Figure 3: Left: EVB ANNA-B112U including NFC antenna; Right: EVB ANNA-B112U including NFC antenna, turned 180 degrees. Both options are valid.

1.2   Kit includes

The EVK-ANNA-B112 evaluation kit includes the following:

- EVK-ANNA-B112 evaluation board
- 2 pcs 2.4 GHz external antennas with U.FL connector (only in EVK-ANNA-B112U)
- NFC antenna
- USB cable
- Quick Start card

1.3   Key features

- u-blox ANNA-B112 Bluetooth low energy module based on the Nordic nRF52832 chipset:
- Bluetooth 5 support
- Bluetooth mesh
- NFC tag functionality
- Integrated Arm® Cortex®-M4F microcontroller with 512 kB flash, 64 kB RAM, and 64 MHz system clock
- Wide 1.7-3.6 V supply range
- The ANNA-B112 module supports different interfaces that can be configured to any of the 25 available IO pin(s):
- 8 analog capable inputs
- 12 PWM capable outputs
- 3x SPI
- 1x UART with HW flow control
- 2x I2C
- 1x I2S

- Full UART to USB converter with a Virtual COM port that allows control of the extended UART features of the u-blox u-connectXpress software
- On-board J-Link debugger/programmer:
- Mass Storage Device interface to PC, for drag-n-drop programming
- Debug port
- An additional Virtual COM port that, for example, may be connected to add-on boards or to a debug UART on the ANNA-B112
- RGB LED and push buttons
- Arduino UNO R3 and Raspberry Pi compatible pin header interfaces
- Jumper headers and level shifters allow for flexible powering options of the ANNA-B112 module, even with full board support. They isolate the module entirely and control each power net separately in order to precisely measure low power applications or disconnect only unused parts of the board to save battery life.
- Multiple-board power supply options:
- 5-12 V power plug
- 5 V USB supply
- 5-12 V Arduino VIN input
- Battery holder supporting CR2032 coin cell batteries

1.4   EVK-ANNA-B112 block diagram

The block diagram of EVK-ANNA-B112 is shown in Figure 4.
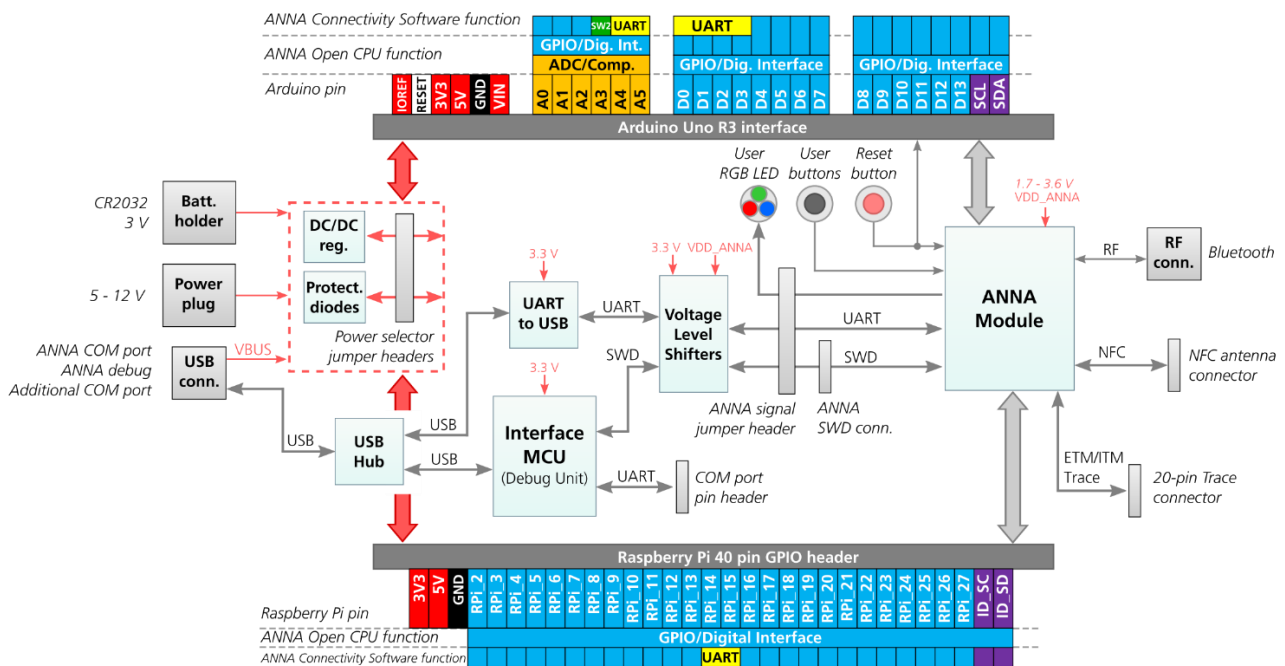

Figure 4: EVK-ANNA-B112 block diagram

The block diagram shows the major interfaces and internal connections of the EVK-ANNA-B112. The following sections describe in detail how the different interfaces are connected and used, and how the evaluation board may be configured to suit the needs of the user.

1.5 Connectors

Figure 5 shows the available connectors on the EVK-ANNA-B112 and their layout. Table 1 describes the connectors and their uses in detail.
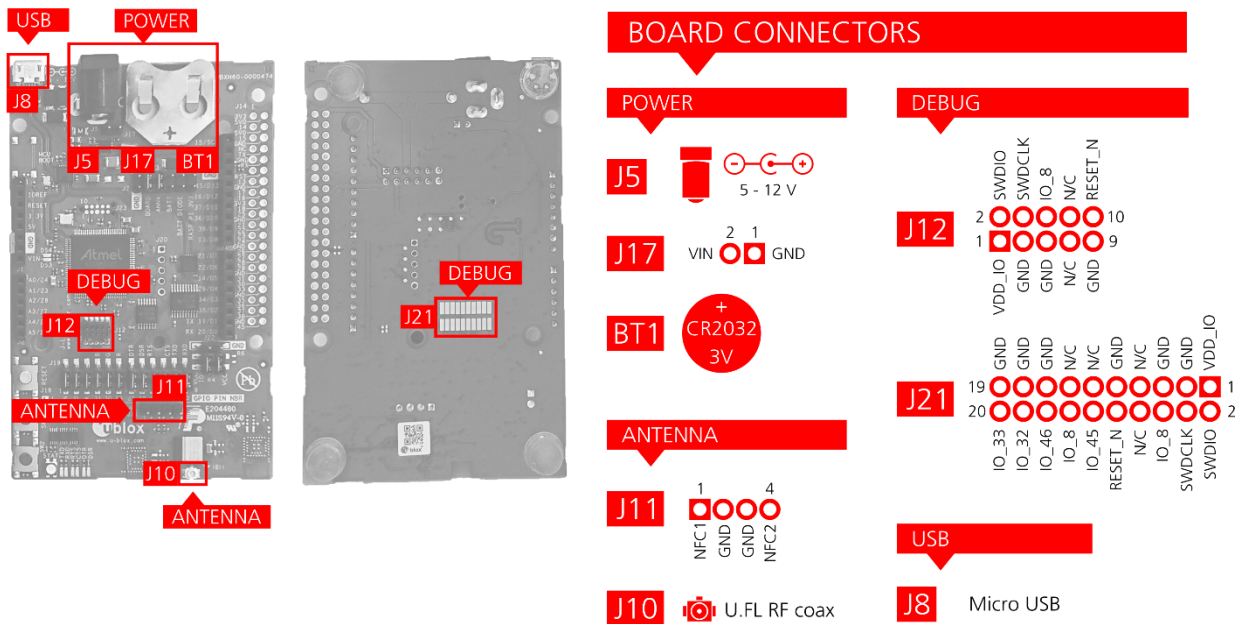

Figure 5: Available connectors and their pinout

Connector annotation	Function	Description
J5	Power supply	2.1 mm power jack, the center pin is the positive terminal. 5 – 12 V input.
J17	Power supply	Pin header that can be used to connect external power supplies. 5 – 12 V input.
BT1	Battery holder	CR2032 coin cell battery holder. CR2032 usually has a 3 V potential when fully charged.
J11	NFC antenna connector	Pin header that connects to the u-blox NFC antenna included in the kit.
J10	2.4 GHz RF antenna connector	U.FL coaxial connector that can be used to connect antennas or RF equipment. This connector is included only in the EVK-ANNA-B112U.
J12	Cortex Debug connector	10-pin, 50 mil pitch connector that can be used to connect external debuggers to the ANNA-B112 module. The ANNA-B112 modules support Serial Wire debug (SWD) and Serial Wire Viewer, but not JTAG debug.
J21	Cortex Debug+ETM connector	20-pin, 50 mil pitch connector. This extended connector has the same features as J12, but also allows for instruction trace operations via the Embedded Trace Macrocell (ETM) of the Cortex®-M4F microcontroller inside the ANNA-B112 module. This requires a special external debugger. Note that the 50 mil pitch pin header is not soldered onto the evaluation board by default.
J8	Power supply, COM port and debug USB	The main USB connector that is used to program, debug, and communicate with the ANNA-B112 module. It can also be used to power the entire board.

Table 1: EVK-ANNA-B112 connector description

1.6 Antennas

The ANNA-B112 can be used both with an external and internal antenna. The EVK-ANNA-B112C uses the internal antenna of the ANNA-B112 and the EVK-ANNA-B112U has the antenna signal connected to a U.FL connector.

The EVK-ANNA-B112U is delivered with two different types of external antennas.

- FXP75.07.0045B
- PC17.07.0070A

Both are designed for mounting on a plastic casing for best performance.
For more details on the parameters of the internal and the external antennas, see the ANNA-B112 data sheet [1].

1.7 Powering options

Power can be supplied to the board in one of the following ways:

- Via the USB connector, **J8**
- Using the power jack, **J5**
- Using the Arduino interface VIN pin
- Using the pin header **J17**
- Plugging a battery to the battery holder **BT1**

These power supply sources are distributed to the rest of the board as shown in Figure 6.
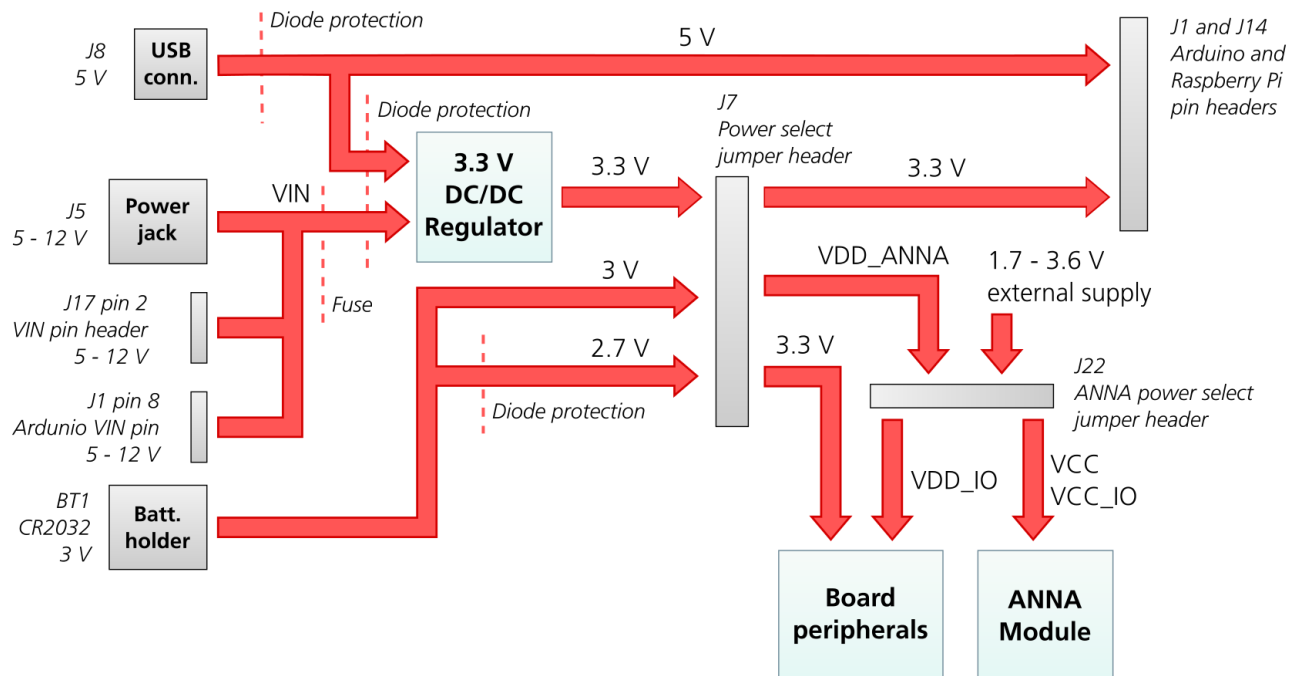
Figure 6: Block diagram of the power net distribution

1.7.1 Selecting power configuration jumpers

The EVK-ANNA-B112 offers flexible powering options for the ANNA-B112 module and the board itself. To configure this, jumpers are added to or removed from pin headers, shorting two of the pins together and connecting or disconnecting different power nets on the evaluation board.

Figure 7 shows the location of the power configuration jumper headers. The **3V3** net is supplied by the board and is always powered so long as any of the power sources shown in Figure 6 are connected. The **3V3** net does not provide power unless a jumper is added to jumper header **J7**.

Figure 7: Jumper headers J7 and J22 are used to select power configurations

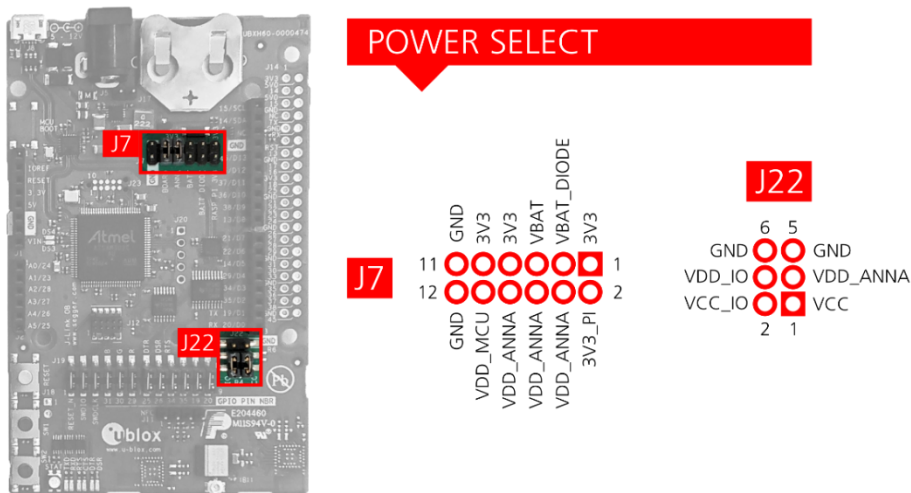| Connector annotation	Pin number	Schematic net name	Description
J7	1	3V3	Regulated 3.3 V net. This net is supplied by the board and will always be powered as long as a power source is connected.
	2	3V3_PI	Connects to the Raspberry Pi header's (J14) 3V3 pins. If a Raspberry Pi is connected, this net must be floating to prevent back currents. If a HAT is connected, this net can be shorted to the EVK 3.3 V supply to power the HAT.
	3	VBAT_DIODE	To protect the battery from current back surges, connect the battery to the ANNA-B112 module via a protection diode using this pin.
	4	VDD_ANNA	Connects to J22 pin 3, from where it can be connected to the module supply pin or somewhere else.
	5	VBAT	Battery + terminal
	6	VDD_ANNA	Connects to J22 pin 3, from where it can be connected to the module supply pin or somewhere else.
	7	3V3	Regulated 3.3 V net. This net is supplied by the board and will always be powered as long as a power source is connected.
	8	VDD_ANNA	Connects to J22 pin 3, from where it can be connected to the module supply pin or somewhere else.
	9	3V3	Regulated 3.3 V net. This net is supplied by the board and will always be powered as long as a power source is connected.
	10	VDD_MCU	Supply net for the board functions not directly connected to the ANNA-B112 module; Interface MCU, USB hub, UART to USB converter etc.
	11	GND	Ground net.
	12	GND	Ground net.
J22	1	VCC	ANNA-B112 module voltage supply that connects to the module VCC pin. Shorted to the VCC_IO net via 0 Ω resistor R4 by default.
	2	VCC_IO	VCC_IO pin not connected.
	3	VDD_ANNA	Connects to J7 pins 4, 6 and 8. Short J22 pins 1 and 3 allow the EVK to power the ANNA-B112 module.
	4	VDD_IO	Supply net for LEDs and peripherals connected directly to the ANNA-B112 module. Short J22 pins 2 and 4.
	5	GND	Ground net.
	6	GND	Ground net.

Table 2: Pinout of jumper headers J7 and J22 used to configure the board power nets

The following sections describe different jumper configurations and power scenarios that is available on the board, including the default configuration.

⚠ Check the jumper positions carefully. If a jumper is connected incorrectly, it can permanently damage the components that are on the board or connected to it.

1.7.2 Default power, 3.3 V

This is the default power configuration for the evaluation board, and the jumpers are installed out of the box with this power configuration. All board peripherals are powered up, the ANNA module is directly supplied by the board, and everything is running at 3.3 V.

Figure 8: Jumper positions for default power configuration

Connector annotation	Add jumper to pins	Description
J7	7, 8	Selects the board regulated 3.3 V net as source for the VDD_ANNA net.
	9, 10	Powers up the Interface MCU, USB hub, and UART to USB converter with 3.3 V.
J22	1, 3	Powers up the ANNA module. The ANNA VCC and VCC_IO pins are connected to the selected source for the VDD_ANNA net.
	2, 4	Powers up the peripherals directly connected to ANNA such as LEDs and external memory with the ANNA supply voltage.

Table 3: Jumper positions for default power configuration

1.7.3 Battery powered, 3 V

Figure 9 shows the default configuration when using a battery. The battery voltage is connected to **VDD_ANNA**, which in turn, is connected to the ANNA-B112 VCC supply. If needed, a jumper can be added to **J22** pins 2 and 4 to supply LEDs and other peripherals with power, as long as this does not exceed the maximum current rating of the battery. If the ANNA module has to be configured, the **VDD_MCU** net can be connected to enable PC communications by adding a jumper to **J7** pins 9 and 10.

Figure 9: Jumper positions for battery powered operation, two jumpers are optional

Connector annotation	Add jumper to pins	Description
J7	5, 6	Selects the battery connected to the battery holder as source for the VDD_ANNA net.
	9, 10	(Optional) Powers up the Interface MCU, USB hub, and UART to USB converter with 3.3 V.
J22	1, 3	Powers up the ANNA module. The ANNA VCC and VCC_IO pins are connected to the selected source for the VDD_ANNA net.
	2, 4	(Optional) Powers up the peripherals directly connected to ANNA such as LEDs and external memory with the ANNA supply voltage.

Table 4: Jumper positions for battery powered operation, two jumpers are optional

1.7.4 Battery powered with protection diode, 2.7 V

This use case is meant to protect the battery from current back surges. When using the NFC interface, there is a risk that the applied electromagnetic field can cause back surges that will typically damage a non-chargeable battery. To prevent this damage, a schottky diode can be added in series to the battery, which will block any back current surges. A jumper should then be added to **J7** pins - 3 and 4 instead of 5 and 6.

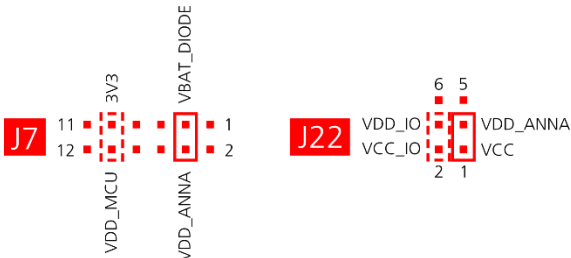The diode will lower the voltage level of the battery by about 0.3 V.

Figure 10: Jumper positions for battery powered operation with a protection diode, two jumpers are optional

Connector annotation	Add jumper to pins	Description
J7	3, 4	Selects the diode protected battery as a source for the VDD_ANNA net.
	9, 10	(Optional) Powers up the Interface MCU, USB hub, and UART to USB converter with 3.3 V.
J22	1, 3	Powers up the ANNA module. The ANNA VCC and VCC_IO pins are connected to the selected source for the VDD_ANNA net.
	2, 4	(Optional) Powers up the peripherals directly connected to ANNA such as LEDs and external memory with the ANNA supply voltage.

Table 5: Jumper positions for battery powered operation with a protection diode, two jumpers are optional

1.7.5 External supply

When measuring current consumption or performing other ANNA-B112 module characterization measurements, it can be useful to power the module with an external source such as a DC power analyzer. In such a case, all jumpers can be removed and the required supply nets can be fed externally by connecting to the pin headers. For example, the ANNA-B112 module can be powered by connecting an external supply directly to the **J22** pin 1 and **GND**.

☞ Take care that unpowered parts of the board are properly isolated. If a voltage is applied to the signal of an unpowered device, current might leak through various protection circuits of the device. This might give false readings when measuring current consumption etc.

Figure 11 below shows a few optional jumper connections that can be helpful when supplying the module with an external supply.

Figure 11: Optional jumper positions while using an external power supply
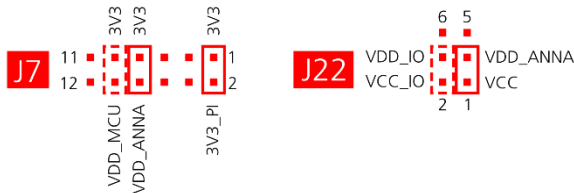
Connector annotation	Add jumper to pins	Description
J7	7, 8	(Optional) Selects the board regulated 3.3 V net as a source for the VDD_ANNA net.
	9, 10	(Optional) Powers up the interface MCU, USB hub, and UART to USB converter with 3.3 V.
J22	3, 4	(Optional) Powers up the peripherals directly connected to ANNA such as LEDs and external memory with the selected source for the VDD_ANNA net.

Table 6: Optional jumper positions while using an external supply

1.7.6 Raspberry Pi HAT

When connecting a HAT to the Raspberry Pi interface, the following jumper configuration can be used. Depending on how the ANNA module should communicate with a test PC over USB or with the HAT. The **VDD_MCU** net can be left unpowered.

⚠ The **3V3_PI** supply net must only be powered when connecting to a Raspberry Pi expansion board (HAT). When connecting to a Raspberry Pi board, the jumper must be disconnected.

Figure 12: Jumper configuration when connected to a Raspberry Pi HAT

Connector annotation	Add jumper to pins	Description
J7	1,2	Connects the 3V3_PI net to the regulated 3.3 V supply.
	7, 8	Selects the board regulated 3.3 V net as a source for the VDD_ANNA net.
	9, 10	(Optional) Powers up the Interface MCU, USB hub, and UART to USB converter with 3.3 V.
J22	1, 3	Powers up the ANNA module. The ANNA VCC and VCC_IO pins are connected to the selected source for the VDD_ANNA net.
	2, 4	(Optional) Powers up the peripherals directly connected to ANNA such as LEDs and external memory with the ANNA supply voltage.

Table 7: Jumper configuration when connected to a Raspberry Pi HAT

1.8 Arduino interface

The EVK-ANNA-B112 includes a set of pin headers and mounting holes that are compatible with certain Arduino or Arduino inspired shields. Figure 13 shows the layout of the Arduino interface and Table 8 explains the pinout in more detail. For information about the specifications that must be met for a shield to be compatible for use with the EVK-ANNA-B112, see Arduino shield compatibility.

☞ The silk screen text on EVB marked UBXH60-0000474 **J3** pin 6 shall be **IO_31**.
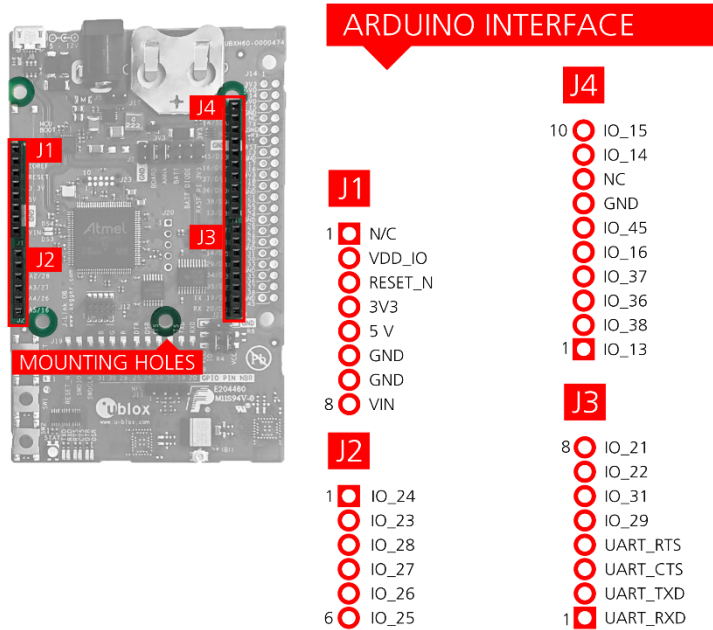
Figure 13: Pin headers that are compatible with some Arduino shields

Conn.	Pin No.	Arduino pin	Description	Schematic net name	nRF52 pin	u-blox connectivity and alternate functions with notes
J1	1	N/C	Not Connected	-	-	Not connected
	2	IOREF	I/O reference voltage level. Selectable by user to 1.7 – 3.6 V	VDD_IO	-	See section 1.6
	3	RESET	Reset signal input. Active low logic	RESET_N	P0.21	
	4	3.3V	3.3 V DC regulated supply output	3V3	-	
	5	5V	5 V regulated supply output	5V	-	Cannot be used as supply input, use VIN instead. Only supplied by USB VBUS.
	6	GND	Ground	GND	GND	
	7	GND	Ground	GND	GND	
	8	VIN	External DC supply input, 5 – 12 VDC	VIN	-	
J2	1	A0	Analog input	IO_24	P0.04	Analog function capable IO
	2	A1	Analog input	IO_23	P0.05	Analog function capable IO
	3	A2	Analog input	IO_28	P0.28	Analog function capable IO
	4	A3	Analog input	IO_27	P0.29	Analog function capable IO
	5	A4	Analog input	UART_DSR/ IO_26	P0.30	Analog function capable IO, UART_DSR signal on ANNA-B1
	6	A5	Analog input	UART_DTR/ IO_25	P0.31	Analog function capable IO, UART_DTR signal on ANNA-B1
J3	1	D0/RX	Digital I/O, UART RX	UART_RXD	P0.02	UART_RXD signal on ANNA-B1
	2	D1/TX	Digital I/O, UART TX	UART_TXD	P0.03	UART_TXD signal on ANNA-B1
	3	D2	Digital I/O	UART_CTS	P0.19	UART_CTS signal on ANNA-B1
	4	D3	Digital I/O	UART_RTS	P0.11	UART_RTS signal on ANNA-B1
	5	D4	Digital I/O	IO_29	P0.27	RED
	6	D5	Digital I/O	IO_31	P0.26	BLUE
	7	D6	Digital I/O	IO_22	P0.10	Signal not connected by defualt, configured for NFC use
	8	D7	Digital I/O	IO_21	P0.09	Signal not connected by defualt, configured for NFC use

Conn.	Pin No.	Arduino pin	Description	Schematic net name	nRF52 pin	u-blox connectivity and alternate functions with notes
J4	1	D8	Digital I/O	IO_13	P0.14	
	2	D9	Digital I/O	IO_38	P0.24	SWITCH_2 on ANNA-B1. This signal is pulled low when the button SW2 is pressed
	3	D10	Digital I/O	IO_36	P0.22	
	4	D11	Digital I/O	IO_37	P0.23	
	5	D12	Digital I/O	IO_16	P0.18	
	6	D13	Digital I/O	IO_45	P0.20	
	7	GND	Ground	GND		
	8	AREF	Analog reference voltage level	-	-	Not connected
	9	SDA	I2C data signal	IO_14	P0.15	
	10	SCL	I2C clock signal	IO_15	P0.16	

Table 8: Pinout of the Arduino UNO R3 compatible interface

1.8.1 Arduino shield compatibility

The EVK-ANNA-B112 has an I/O voltage range of 1.7-3.6 V. It can therefore be used only with shields that also support an I/O voltage within this range.

The EVK-ANNA-B112 has a pinout that is compatible with some Arduino or Arduino inspired shields. This section describes the features of the EVK pins that a shield must comply with:

- **IOREF**: The I/O voltage level of the ANNA-B112 module is 3.3 V by default, but the EVK can be modified to allow other voltages (1.7-3.6 V).
- **RESET**: Is connected to the RESET button (SW0).
- **3.3 V**: A regulated 3.3 V output. Should not be used as a voltage supply input, use the VIN pin instead.
- **5 V**: Is only a 5 V supply output if the EVK is being powered by USB. If any other power configuration is used, this pin will be unconnected (floating). It is safe to connect an external 5 V supply to this pin even when a USB cable is connected. This pin cannot be used to power the board, use the **VIN** pin instead.
- **VIN**: May be used as a 5 -12 V supply input to power the EVK-ANNA-B112.
- Pin 0 (RX): Is connected to the ANNA-B112 UART RX pin (ANNA pin 23).
- Pin 1 (TX): Is connected to the ANNA-B112 UART TX pin (ANNA pin 22).

Note on SCL/SDA: On some Arduino boards, the I2C signals, SCL, and SDA are connected to the pins A4 and A5 and to the SCL and SDA pins in the top right-hand corner. Since these pins will be shorted together it might cause problems when connected to the EVK-ANNA-B112, which has not shorted these pins together.

Note on digital I/O pins: Some of the digital I/O pins can be connected to the on-board debug MCU, thus allowing serial communication and flashing/debugging over USB. This can cause interference on the signals that are also used by an Arduino shield. For information about disconnecting these signals from the debug MCU, see also Disconnecting ANNA signals from board peripherals.

1.9 Raspberry Pi compatible interface

The EVK-ANNA-B112 includes a 40-pin IO header that can be used to interface with either a Raspberry Pi computer board or with a Raspberry Pi expansion board (HAT). The EVK-ANNA-B112 uses different hardware and software configurations depending on if it is connected to a Pi or a HAT; the differences are covered in this section. The default configuration is to connect to a Pi.

Not all the Raspberry Pi versions and HATs are supported, since it requires the 40-pin IO header, which older versions did not have. Table 9 lists the compatible Raspberry Pi versions.

Compatible Raspberry Pi boards
Raspberry Pi 1 Model A+
Raspberry Pi 1 Model B+
Raspberry Pi 2 Model B
Raspberry Pi 3 Model B
Raspberry Pi Zero
Raspberry Pi Zero W

Table 9: Compatible Raspberry Pi boards

Figure 14 shows the layout of the Raspberry Pi interface and Table 10 explains the pinout in detail. There are three mounting holes that can be used for increased mechanical stability. The two on either side of connector J14 are common to all Raspberry Pi boards, but the third one is only compatible with the Pi Zero boards.
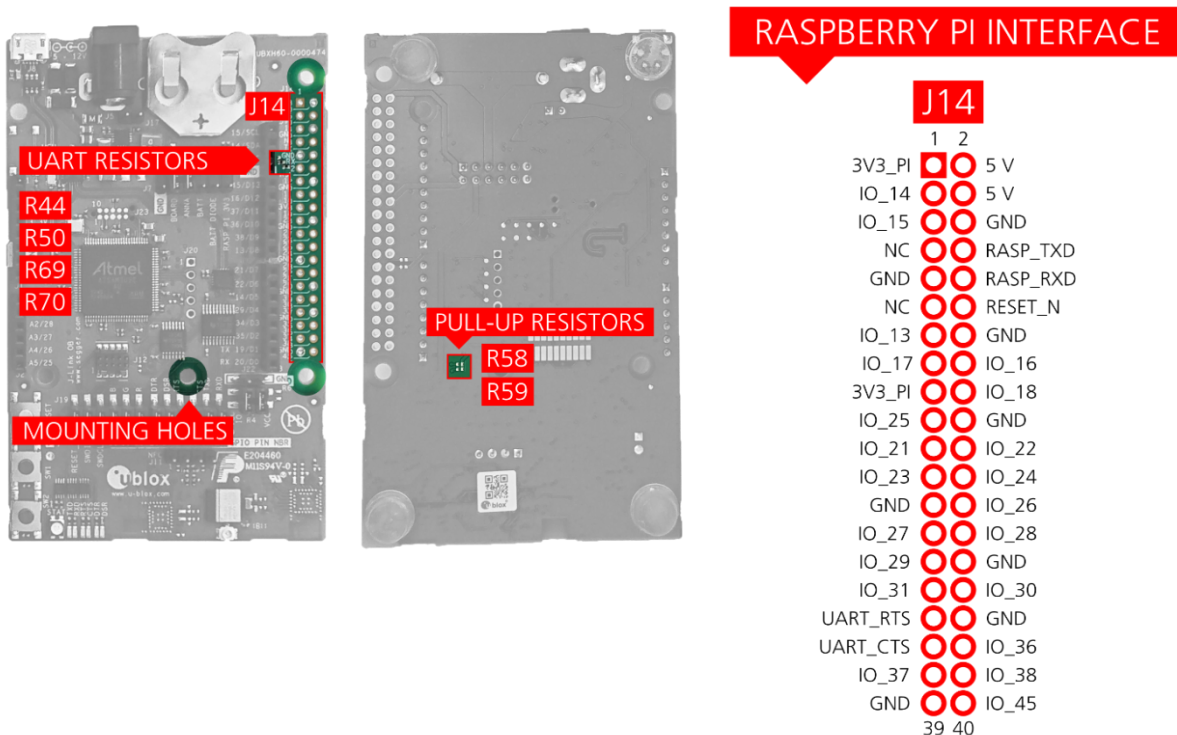

Figure 14: Pin header J14 that is compatible with the Raspberry Pi IO connectors

Conn.	Pin No.	Raspberry Pi pin	Description	Schematic net name	nRF52 pin	Alternate functions and notes
J14	1	3.3 V	3.3 V supply pin	3V3_PI	-	Not connected by default. See Antennas.
	2	5 V	5 V supply pin	5V	-	Cannot be used as supply input. Supplied by USB VBUS and protected from back powering.
	3	IO02	Digital I/O	IO_14	P0.15	
	4	5 V	5 V supply pin	5V	-	Cannot be used as supply input. Supplied by USB VBUS and protected from back powering.
	5	IO03	Digital I/O	IO_15	P0.16	
	6	GND	Ground	GND	GND	

Conn.	Pin No.	Raspberry Pi pin	Description	Schematic net name	nRF52 pin	Alternate functions and notes
	7	IO04	Digital I/O			N/C
	8	IO14	Digital I/O, UART TX/RX	RASP_TXD	P0.02	Connected to ANNA UART_RXD pin by default. See Powering considerations.
	9	GND	Ground	GND	GND	
	10	IO15	Digital I/O, UART RX/TX	RASP_RXD	P0.03	Connected to ANNA UART_TXD pin by default. See Powering considerations.
	11	IO17	Digital I/O			N/C
	12	IO18	Digital I/O	RESET_N	P0.21	
	13	IO27	Digital I/O	IO_13	P0.14	
	14	GND	Ground	GND	GND	
	15	IO22	Digital I/O	IO_17		Can be connected to IO_17 via zero Ωresistor. Resistor not mounted by default. IO_17 is connected to 32.768 LPO crystal by default
	16	IO23	Digital I/O	IO_16	P0.18	
	17	3.3 V	3.3 V supply pin	3V3_PI	-	Not connected by default. See Antennas.
	18	IO24	Digital I/O	IO_18		
	19	IO10	Digital I/O	IO_25	P0.31	
	20	GND	Ground	GND	GND	
	21	IO09	Digital I/O	IO_21	P0.09	Can be connected to IO_21 via zero Ω resistor. Resistor not mounted by default. IO_21 is connected to NFC antenna by default
	22	IO25	Digital I/O	IO_22	P0.10	Can be connected to IO_22 via zero Ω resistor. Resistor not mounted by default. IO_22 is connected to NFC antenna by default
	23	IO11	Digital I/O	IO_23	P0.05	
	24	IO08	Digital I/O	IO_24	P0.04	
	25	GND	Ground	GND	GND	
	26	IO07	Digital I/O	IO_26	P0.30	
	27	ID_SD	EEPROM config I2C data signal	IO_27	P0.29	Should only be used to read or simulate HAT EEPROMs. See EEPROM support.
	28	ID_SC	EEPROM config I2C clock signal	IO_28	P0.28	Should only be used to read or simulate HAT EEPROMs. See EEPROM support.
	29	IO05	Digital I/O	IO_29	P0.27	
	30	GND	Ground	GND	GND	
	31	IO06	Digital I/O	IO_31	P0.26	
	32	IO12	Digital I/O	IO_30	P0.25	
	33	IO13	Digital I/O	UART_RTS	P0.11	
	34	GND	Ground	GND	GND	
	35	IO19	Digital I/O	UART_CTS	P0.19	
	36	IO16	Digital I/O	IO_36	P0.22	
	37	IO26	Digital I/O	IO_37	P0.23	
	38	IO20	Digital I/O	IO_38	P0.24	
	39	GND	Ground	GND	GND	
	40	IO21	Digital I/O	IO_45	P0.20	

Table 10: Pinout of the Raspberry Pi compatible interface

1.9.1 Powering considerations

There are two voltage nets used in the Raspberry Pi interface 3V3_PI and 5V. Both the **3V3_PI** and **5V** nets can be used to power HATs, but these should not be used when connecting to a Raspberry Pi. See also Raspberry Pi HAT.

⚠ The **3V3_PI** power net must not be connected to the 3.3 V supply when connected to a Raspberry Pi board. Connecting the power net in this way could damage both boards.

1.9.2 UART

The Raspberry Pi interface provides two pins - **IO14** and **IO15, which** can be used for UART communications. In UART communications, signals are always connected RX <-> TX and vice versa. This means that on a Raspberry Pi board **IO14** will be TX and on a HAT it will be RX. To support talking to both HATs and Pi boards, the 0 Ω resistors - **R57**, **R58**, **R59** and **R60** can be used to toggle the ANNA TX and RX pins between **IO14** and **IO15**. If an ANNA-B112 is used, this switch can also be made in the software. By default, the EVK-ANNA-B112 will be configured to simulate a HAT, and **IO14** is connected to the ANNA **UART_RXD** pin and **IO15** is connected to the ANNA **UART_TXD** pin respectively.

1.9.3 EEPROM support

The Raspberry Pi interface supports a unique EEPROM solution to store the HAT specific IO configurations on the HAT board, to be read by the Raspberry Pi before configuring its IOs. The two pins used for this are **ID_SD** and **ID_SC and** are connected to the ANNA-B112 module. The ANNA-B112 module can thus either read the IO configuration from a HAT or simulate an EEPROM and send configurations to a connected Pi. This requires an ANNA-B112 module and a custom-built application.

It is not mandatory to use this EEPROM solution; if not used, the two ANNA pins - **IO_42** and **IO_41** can be without configurations.

Two pull-up resistors - R44 and R50, can be added to the I2C lines if needed. They are not mounted on the evaluation board by default.

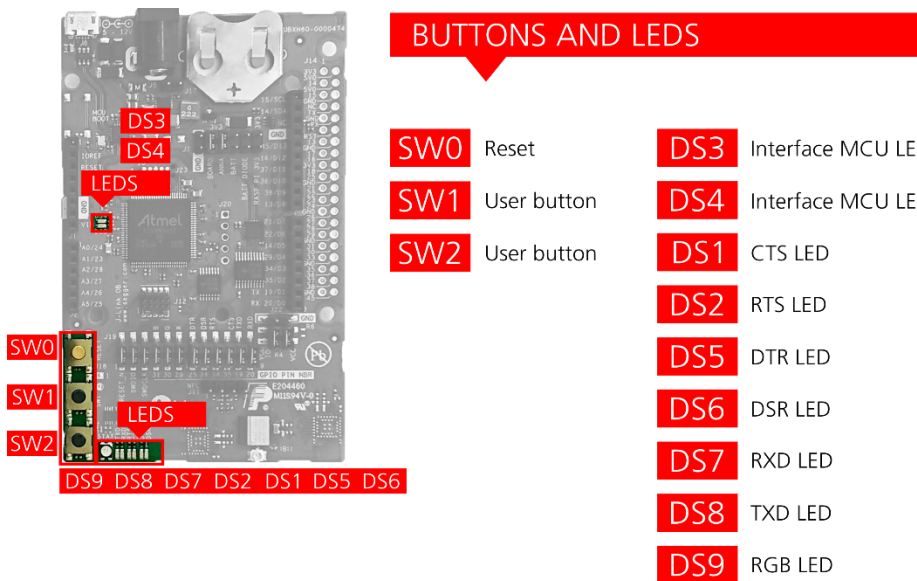For more information on the ID EEPROM specification visit:
https://github.com/raspberrypi/hats/blob/master/designguide.md.

1.10 Buttons and LEDs

Figure 15: Position of the push-buttons and LEDs on the evaluation board

Annotation	Function	Description
SW0	Reset button	Connected directly to the ANNA RESET_N pin.
SW1	User button	Push button for application use. Connected directly to the ANNA SWITCH_1 (IO_30) pin
SW2	User button	Push button for application use. Connected directly to the ANNA SWITCH_2 (IO_38) pin

Table 11: EVK-ANNA-B112 buttons

Annotation	Function	Description	Color
DS1	UART CTS LED	Connected to the ANNA UART_CTS (IO_35) pin via jumper header J9	
DS2	UART RTS LED	Connected to the ANNA UART_RTS (IO_34) pin via jumper header J9	
DS3	Interface MCU LED	Blinks on USB enumeration and activity, lit when the Interface MCU is connected via USB	
DS4	Interface MCU LED	Error LED	
DS5	UART DTR LED	Connected to the ANNA UART_DTR (IO_25) pin via jumper header J9	
DS6	UART DSR LED	Connected to the ANNA UART_DSR (IO_26) pin via jumper header J9	
DS7	UART RXD LED	Connected to the ANNA UART_RXD (IO_20 pin via jumper header J9	
DS8	UART TXD LED	Connected to the ANNA UART_TXD (IO_19) pin via jumper header J9	
DS9	RGB LED	Connected to the ANNA RED (IO_29), GREEN (IO_30) and BLUE (IO_31) pins via jumper header J19. Used as status indication for u-connectXpress software. For further information, see also the RGB system status signals section in the ANNA-B112 data sheet [1].	

Table 12: EVK-ANNA-B112 LED indicators

1.11 Disconnecting ANNA signals from board peripherals

All evaluation board peripherals, such as level shifters, LEDs, and the interface MCU will be connected to the ANNA-B112 module by default. This might not suit all evaluation scenarios. All peripherals can be switched off by disconnecting their power supplies (see also Antennas) – but finer control is necessary if only specific signals have to be isolated.

All the ANNA module signals that are connected to board peripherals have thus been routed via jumper headers, so that jumpers can be pulled or added as needed by the evaluation board user, isolating, or connecting specific signals. Figure 16 shows the layout of these jumper headers.
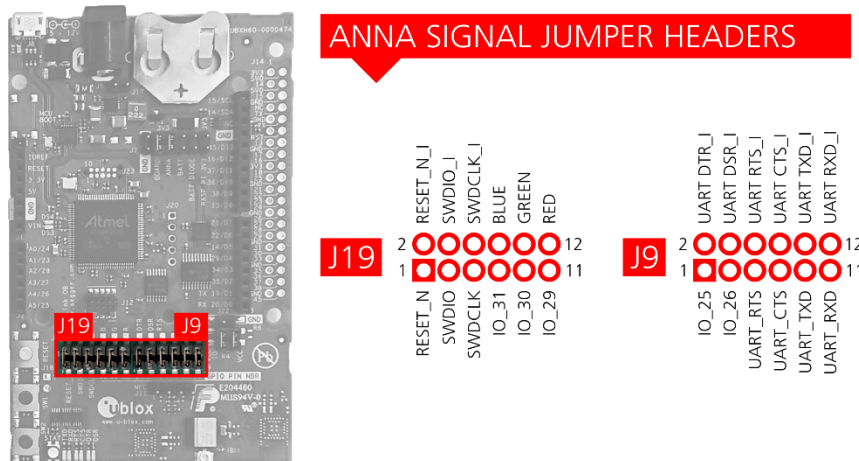

Figure 16: Jumper headers J19 and J9 that are used to isolate specific ANNA signals

Connector annotation	Pin number	Schematic net name	Description
J19	1	RESET_N	Reset signal, active low
	2	RESET_N_I	Connects to the Interface MCU's reset line
	3	SWDIO	SWD data signal
	4	SWDIO_I	Interface MCU SWD data signal, used to program/debug the ANNA module
	5	SWDCLK	SWD clock signal
	6	SWDCLK_I	Interface MCU SWD data signal, used to program/debug the ANNA module
	7	IO_31	ANNA-B112: BLUE signal
	8	BLUE	RGB diode blue signal, active low
	9	IO30/ SWITCH_1	ANNA-B112: SWITCH_1 and GREEN signal
	10	GREEN	RGB diode green signal, active low
	11	IO_29	ANNA-B112: RED signal
	12	RED	RGB diode red signal, active low
J9	1	IO_25/ UART_DTR	ANNA-B112: UART DTR output
	2	UART_DTR_I	UART to USB DTR signal
	3	IO_26/ UART_DSR	ANNA-B112: UART DSR input
	4	UART_DSR_I	UART to USB DSR signal

Connector annotation	Pin number	Schematic net name	Description
	5	IO_34/ UART_RTS	ANNA-B112: UART RTS output
	6	UART_RTS_I	UART to USB RTS signal
	7	IO_35/ UART_CTS	ANNA-B112: UART CTS input
	8	UART_CTS_I	UART to USB CTS signal
	9	IO_19/ UART_TXD	ANNA-B112: UART TXD output
	10	UART_TXD_I	UART to USB TXD signal
	11	IO_20/ UART_RXD	ANNA-B112: UART RXD input
	12	UART_RXD_I	UART to USB RXD signal

Table 13: Pinout of jumper headers - J19 and J9

1.12 Software debug options

You can debug the software using the following two options in EVK-ANNA-B112:

* Onboard debug solution available on the USB connector
* An external debugger connected to **J12** connector

An external debugger connected to the **J12** connector is useful when powering the evaluation board with the CR2032 coin cell battery, or through the external power supply connector **J5**. It could also be useful in a scenario where the debug MCU interface has been disconnected from the ANNA-B112 module using the jumpers on **J9** header. The SEGGER J-Link software [4] is required to debug using the onboard J-Link hardware on the EVK-ANNA-B112.

2 Setting up the evaluation board

2.1 Evaluation board setup

The EVK-ANNA-B112 is delivered with u-blox u-connectXpress software pre-flashed to the module.

Before connecting the module, download and install the latest s-center evaluation software from the u-blox website.

To use Bluetooth Low Energy on the EVK-ANNA-B112, connect a 2.4 GHz antenna to the U.FL antenna connector (J10). The EVK-ANNA-B112C has an onboard antenna.

Plug in either an external power supply in **J5** connector or connect to a USB host with a USB cable attached to **J8** connector. You can also power the evaluation board with a CR2032 coin cell battery. The status light (**DS6**) turns green when power is applied to the board. The NFC antenna can be connected to the **J11** connector. The connector pinning is symmetrical, so the antenna can be positioned either up or down in relation to the evaluation board.

⚠️ Be careful to check polarity before connecting an external power supply to the EVK-ANNA-B112 evaluation board. The center conductor is positive (+) and the ring is negative (-).

The very first time you connect the unit to a new computer, drivers need to be installed. The operating system should handle this automatically.

⚠️ If the drivers are not installed automatically, download the nRF Connect application from www.nordicsemi.com that includes the Jlink CDC UART driver.

The EVK-ANNA-B112 EVKs have an FTDI chip mounted to provide serial port connectivity. Normally, the driver for the UART is installed automatically when the board is connected. If not driver files can be retrieved form the manufacturer web site [7].

Windows automatically assigns a COM to the unit by. Perform the following actions to view the assigned COM ports on Windows 7:

1. Open the Control Panel and click Hardware and Sound.
2. Select **Device Manager** in **Devices and Printers**. This opens **Device Manager** window where you can view the assigned COM ports.

2.2 Starting up

2.2.1 EVK-ANNA-B112

Perform the following steps to enable communication with the module:

1. Start the s-center evaluation software.
2. Use the default baud rate 115200, 8N1 with flow control. You should now be able to communicate with the module using AT commands.

For a list of available AT commands, see the u-blox u-connect AT commands manual [3]. To get started with a basic use case setup of the EVK-ANNA-B112 with u-blox u-connectXpress software, see the u-connectXpress user guide [5].

2.2.2 Getting the latest u-connectXpress software

Go to the u-blox support webpage to get the latest firmware. Instructions for flashing the EVK-ANNA-B112 can be found in the Software section of the ANNA-B112 system integration manual [2].

2.2.3 Open CPU
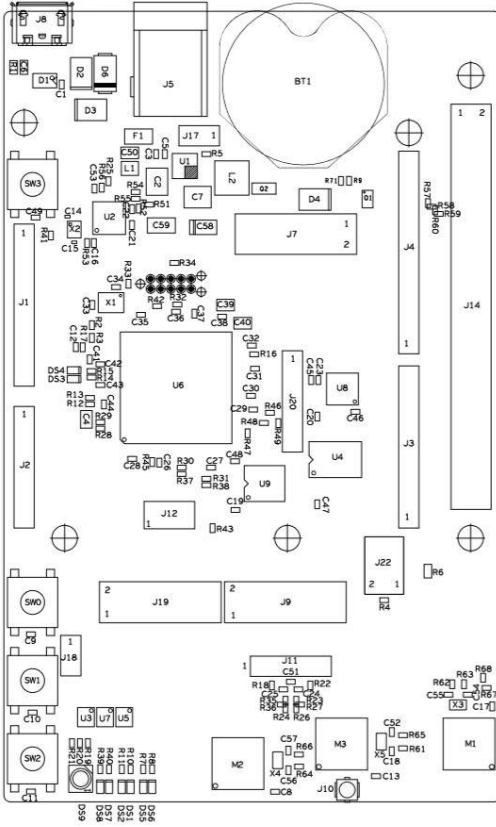
To use the EVK-ANNA-B112 together with the Nordic Semiconductor SDK, refer to the software section of the ANNA-B112 system integration manual [2] that describes how to:

- Create your own board file
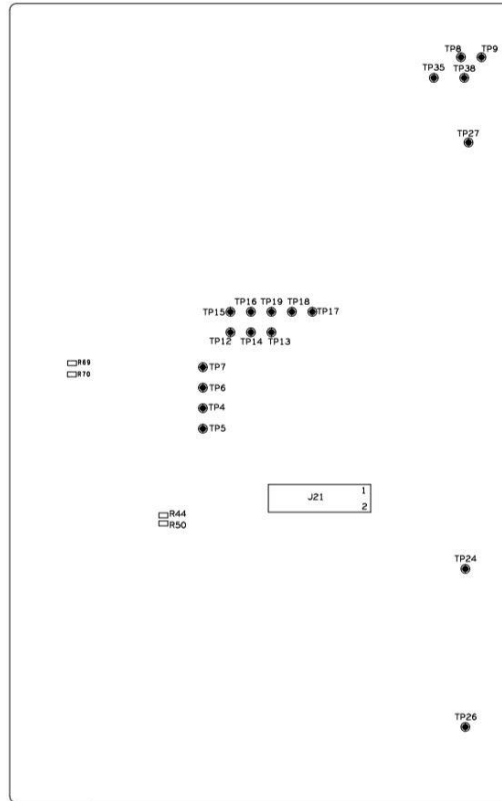- Adapt the examples in the Nordic Semiconductor SDK to use this board file

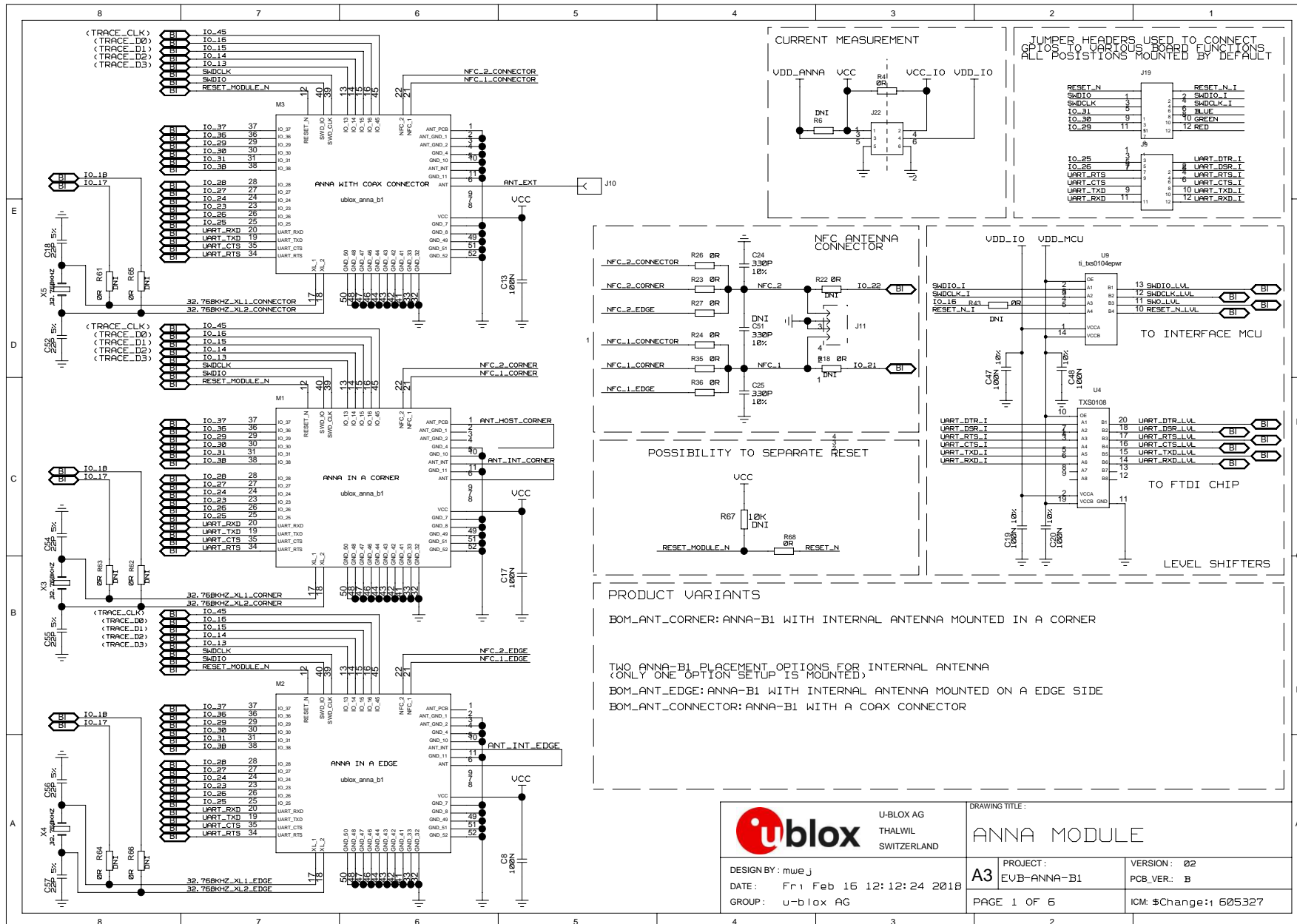See also the u-blox short range open CPU GitHub repository [6].

Appendix

A Placement and schematics

Top view

Bottom view

ANNA MODULE
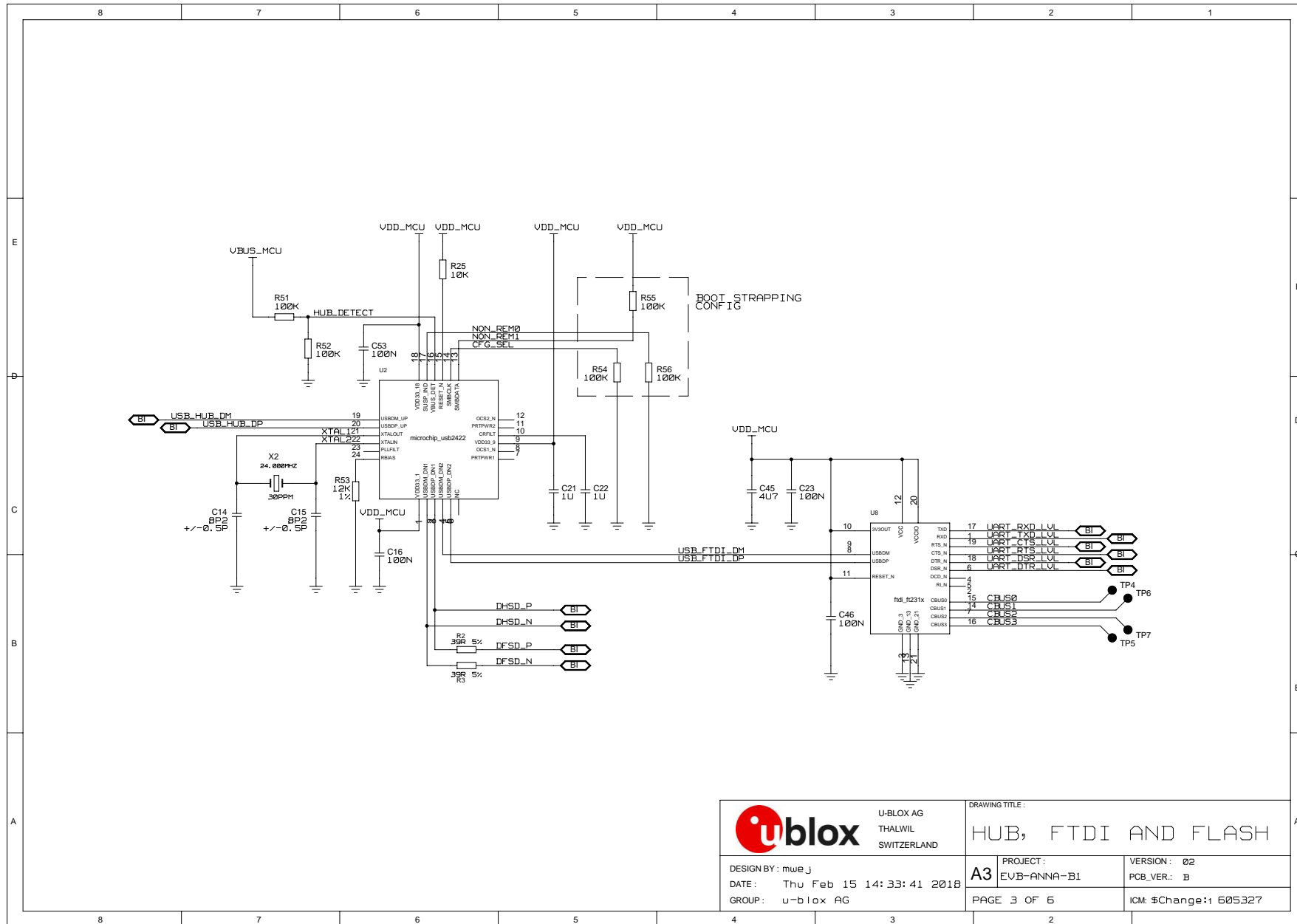
U-BLOX AG
THALWIL
SWITZERLAND

DRAWING TITLE :

DESIGN BY : mwej
DATE : Fri Feb 16 12:12:24 2018
GROUP : u-blox AG

A3
PROJECT : EVB-ANNA-B1
VERSION : 02
PCB_VER.: B
PAGE 1 OF 6
ICM: $Change:1 605327

HUB, FTDI AND FLASH

U-BLOX AG
THALWIL
SWITZERLAND

DRAWING TITLE :

DESIGN BY: mwej
DATE: Thu Feb 15 14:33:41 2018
GROUP: u-blox AG

A3

PROJECT :
EVB-ANNA-B1

VERSION : 02
PCB_VER.: B

PAGE 3 OF 6

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HEADERS & BUTTONS

IF USED, THE 5V NET MUST BE SUPPLIED
BY AN EXTERNAL SOURCE, USB ETC.

3.3V REGULATED 3V3

5-12 V
EXTERNAL SUPPLY

TPS6213X

62132 3.3V VERSION

BATTERY PROTECTION:
NFC CAN CAUSE REVERSE
CURRENT FLOW

POWER SOURCE SELECTOR

COIN CELL BATTERY 3V

LOW CURRENT LEAKAGE CAPS FOR SUPPLY HIGH CURRENT PEAKS

USB

USBLC6 2SC6

'ZERO VOLT DIODE' - PROTECTS FROM BACK CURRENT ON VBUS LINES

P_CHANNEL_MOSFET
DMG2305UX

	U-BLOX AG THALWIL SWITZERLAND	DRAWING TITLE : POWER SUPPLY	
DESIGN BY : mwej		A3	PROJECT : EVB-ANNA-B1	VERSION : 02
DATE : Fri Feb 16 12:12:25 2018			PCB_VER.: B
GROUP : u-blox AG		PAGE 5 OF 6	ICM: $Change:1 605327

B Glossary

Name	Definition
API	Application Programming Interface
CTS	Clear To Send
DSR	Data Set Ready
DTR	Data Terminal Ready
EVB	Evaluation Board
EVK	Evaluation Kit
GND	Ground
IO	General-Purpose Input/Output
LED	Light-Emitting Diode
MCU	Micro Controller Unit
MSD	Mass Storage Device
NFC	Near Field Communication
U.FL	Coaxial RF connector
USB	Universal Serial Bus
RTS	Request To Send
RXD	Receive Data
SDK	Software Development Kit
SPA	Serial Port Application
TXD	Transmit Data
UART	Universal Asynchronous Receiver/Transmitter

Table 14: Explanation of abbreviations used

Related documents

[1] ANNA-B112 data sheet, UBX-18011707
[2] ANNA-B112 series system integration manual, UBX-18009821
[3] u-connect AT commands manual, UBX-14044127
[4] SEGGER J-Link software - https://www.segger.com/jlink-software.html
[5] u-connectXpress user guide, UBX-16024251
[6] https://github.com/u-blox/u-blox-sho-OpenCPU
[7] FTDI Chip home page: https://ftdichip.com/

☞ For regular updates to u-blox documentation and to receive product change notifications, register on our homepage (www.u-blox.com).

Revision history

Revision	Date	Name	Comments
R01	5-Jun-2018	hekf, mwej, kgom	Initial release.
R02	18-Dec-2020	mape, fbro, mhan	Updated description for RGB LED in Table 12. Added more info on the antennas delivered with the EVK. Clarified open CPU information. Added information about module variant ANNA-B112-70B.
R03	6-Dec-2021	mape	Added information about serial port driver installation.
R04	24-Mar-2025	hisa	Updated product status of pin variant in Document information.

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