XPLR-IOT-1

Explorer application platform

User guide

Abstract

This document describes the hardware and software architecture and user programming of the XPLR-IOT-1 application platform. Providing a complete platform for developing various proof-of-concept IoT applications, the XPLR-IOT-1 showcases products from all u-blox product centers - including NORA-B106 and NINA-W156 short range radio modules, SARA-R510S cellular modules, MAX-M10S satellite positioning modules, and the Thingstream IoT service delivery platform.

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This document applies to the following products:

Product name	Ordering code	Product status
XPLR-IOT-1	XPLR-IOT-1	Engineering sample

Contents

1 Product description

The XPLR-IOT-1 IoT application platform allows developers to evaluate and explore the combined synergy of u-blox short-range radio, positioning, and cellular products in a single device.

Packaged within a silicone protective bumper, XPLR-IOT-1 comprises a Printed Circuit Board Assembly (PCBA) and rechargeable battery that allows portable operation. The bumper can be easily removed from the case without tools. See also Kit includes.

Figure 1: XPLR-IOT-1 case with protective silicone bumper

1.1 Kit includes

XPLR-IOT-1 comprises a single PCBA in an enclosure that includes:

- NORA-B106 Stand-alone dual-core Bluetooth® 5.2 Low Energy and IEEE 802.15.4 module with two Arm® Cortex® M33 cores. The NORA-B106 module acts as the main MCU for the platform.
- Four UARTs that connect the various u-blox technologies
- NINA-W156 stand-alone multi-radio module with Wi-Fi 4 and Bluetooth 5
- SARA-R510S cellular LTE-M / NB-IoT module for 1500 MHz spectrum with Secure Cloud[1]
- MAX-M10S standard-precision, Global Navigation Satellite System (GNSS) module
- Thingstream MQTT for IoT connectivity, security, enterprise-grade MQTT broker, simple enterprise integration visual programming, and support for u-blox global positioning hardware.
- NFC antenna with tag capability for Near Field Communication (NFC).

A USB connection provides UART connections to each of the modules. USB is also connected directly to the NORA-B1 and SARA-R5. For quick verification or configuration of the modules, the respective evaluation applications, s-center [13], m-center [14], and u-center [15], may be used when the connection to NORA-B1 is not active.

XPLR-IOT-1 also includes an accelerometer, gyroscope, magnetometer (each is 3-axis), battery, state-of-charge gauge, and temperature, humidity, and ambient light sensors. A Qwiic-compatible expansion port allows connection of other I2C devices. See also I2C sensors.

Pre-loaded firmware establishes internet connectivity, activates the sensors, and sends the sensor data over MQTT messages through Thingstream to a message flow. Output from the flow may be sent to a user-hosted dashboard example using Node-RED.

See also u-blox modules.

[1] Designed and tested for use in North America. Operation in other regions pending local M1 coverage.

2 Hardware architecture

Figure 2 shows block diagram of XPLR-IOT-1.

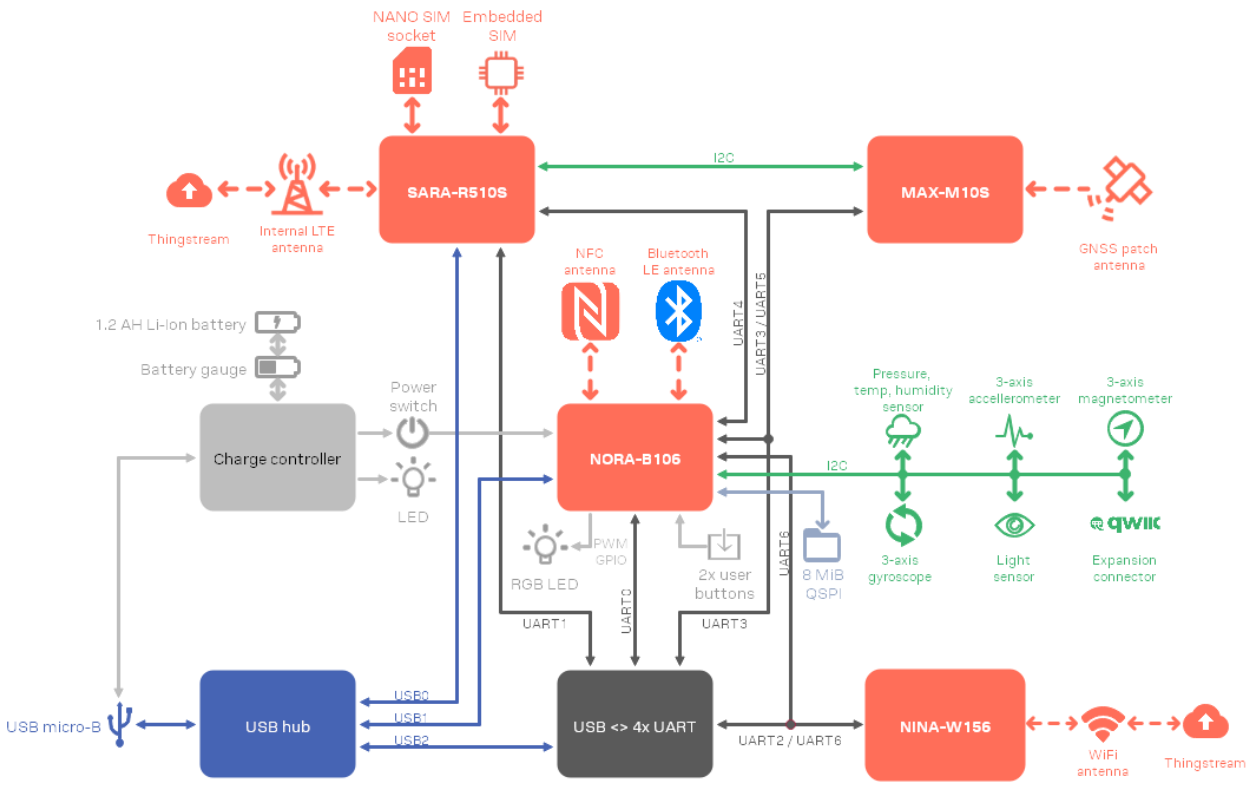

Figure 2: XPLR-IOT-1 block diagram

Table 1 describes the functions and color codes for the various technologies shown in Figure 2.

Identifying color	Technology	Function
u-blox “hero red”	u-blox module	MCU, Bluetooth, Wi-Fi, Cellular, GNSS
Green	I2C	Sensor bus, Qwiic-compatible expansion port
Dark Gray	Asynchronous serial	UART connections between modules
Blue	USB	Personal computer connection
Light Blue	Memory	Quad SPI flash
Gray	Power, buttons, indicators	Power switch, battery, charging circuit, user input and output

Table 1: Technology color coding

The XPLR-IOT-1 hardware design is available in PDF and Altium formats from the XPLR-IOT-1 hardware repository [2].

3 Platform description

Figure 3 provides a transparent view of the XPLR-IOT-1 with the location and orientation of the PCBA shown in relation to the product case. The component side of the PCBA faces the rear of the case, while the antenna side of the PCBA faces the front.

☞ The overlay on the front of the case may have a protective film. Remove this coating prior to use.

☞ Rev C PCBA images are shown throughout this guide. The revision is printed in silkscreen near the top of the component side. Functionality is identical except for the USB-UART COM port numbering. See USB connection and USB connection for Rev B PCB assembly.

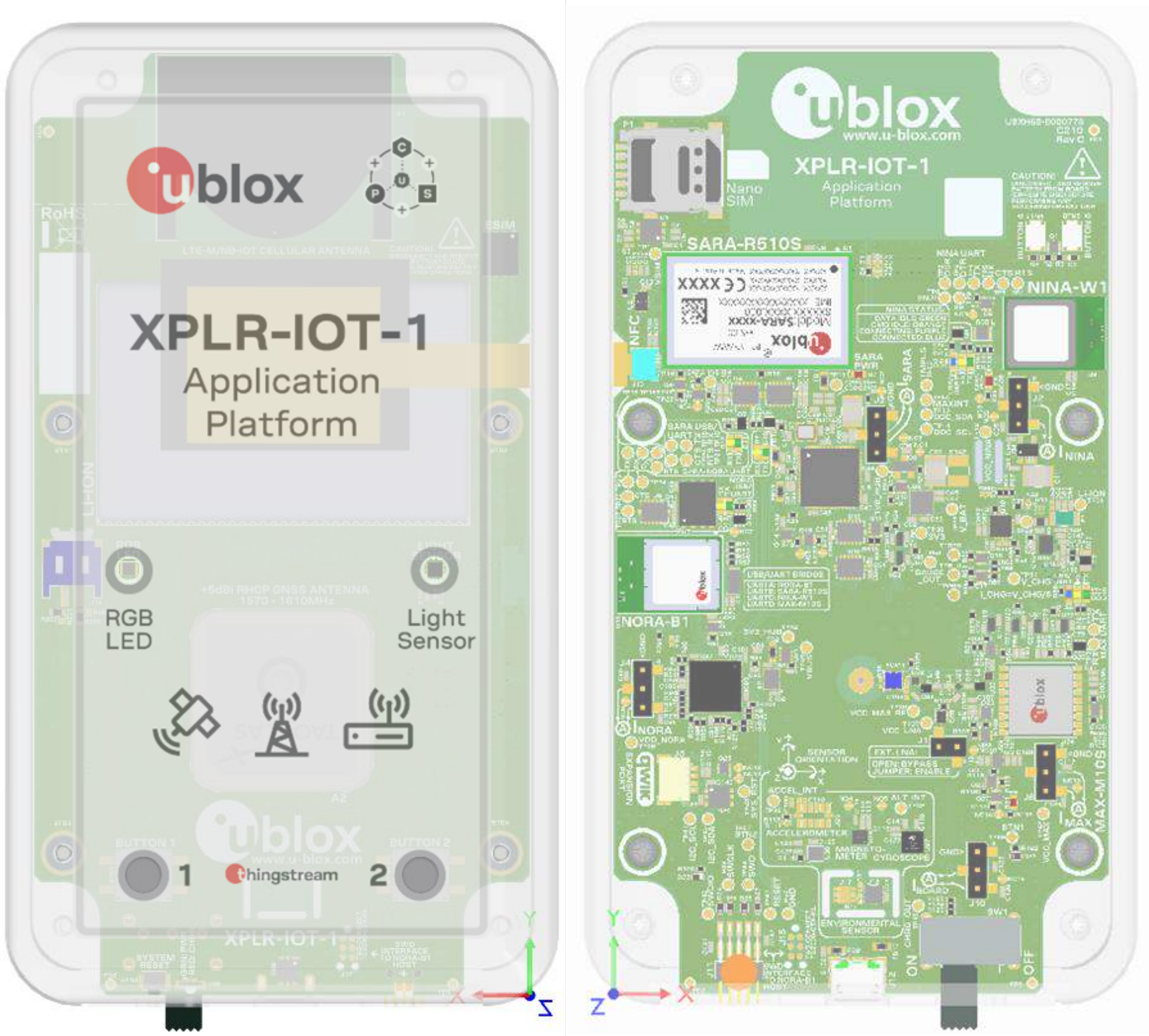

Figure 3: XPLR-IOT-1 case - transparent view

3.1 PCBA

All test points, current measurement jumpers, and debugging LEDs are accessible from the component side of the PCBA. To expose the PCBA, remove the protective rubber bumper and undo the four screws on the rear of the case[2]. The PCBA only needs to be removed if the battery requires unplugging or removal.

[2] Case screws are not installed by default, though provided with the kit.

⚠ XPLR-IOT-1 contains highly sensitive electronic circuitry and Electrostatic Sensitive Devices (ESD). Handling the XPLR-IOT-1 without proper ESD protection while the case is open may destroy or damage the unit permanently.

3.1.1 PCBA component side

The component side of the PCBA faces the rear of the case. Figure 4 shows the locations of components on the board.

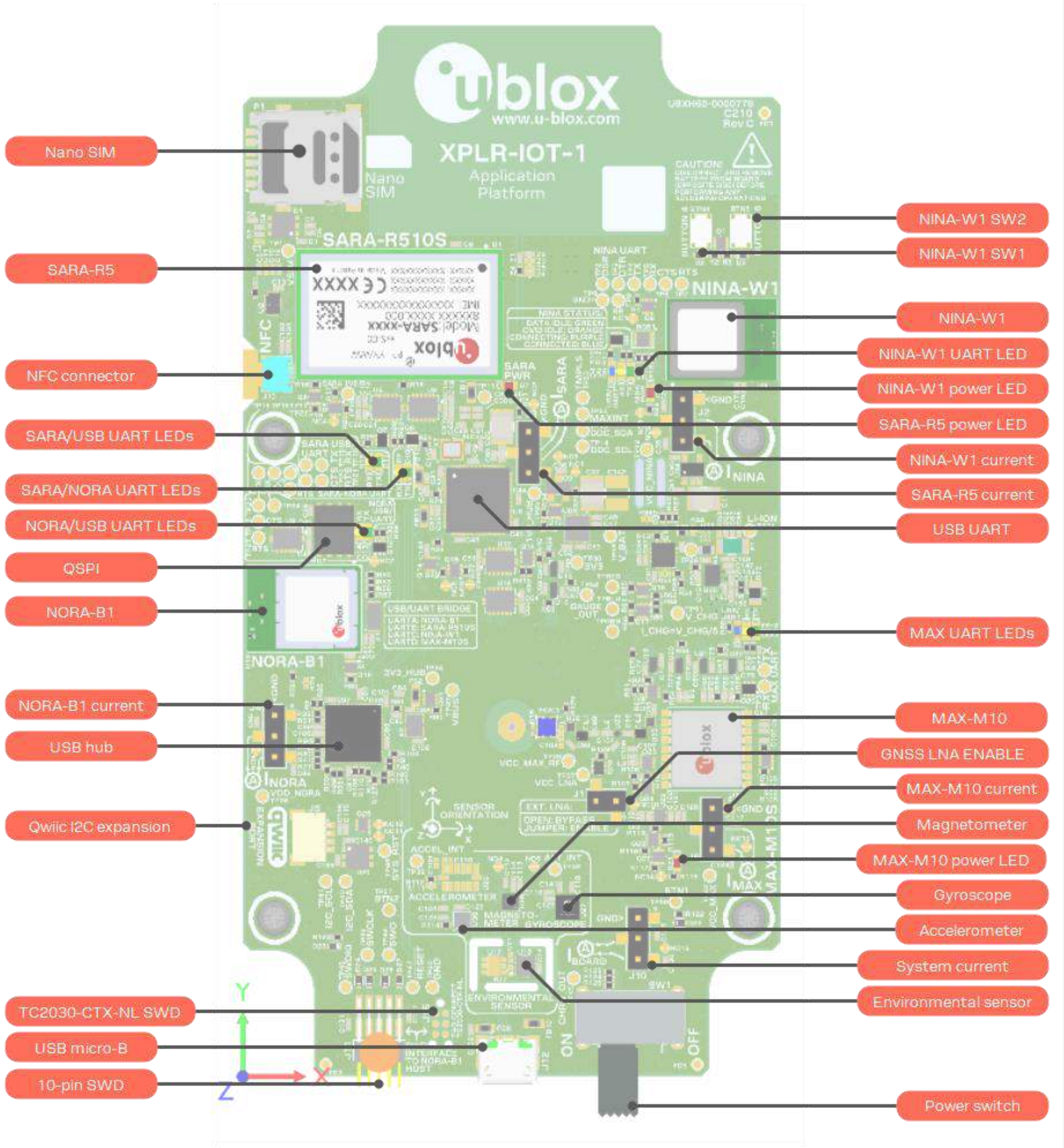

Figure 4: PCBA component side part locations – detailed view

3.1.2 PCBA antenna

The antenna side of the faces the front of the case. Figure 5 shows the locations of antennas, sensors, LEDs, and buttons on the board.

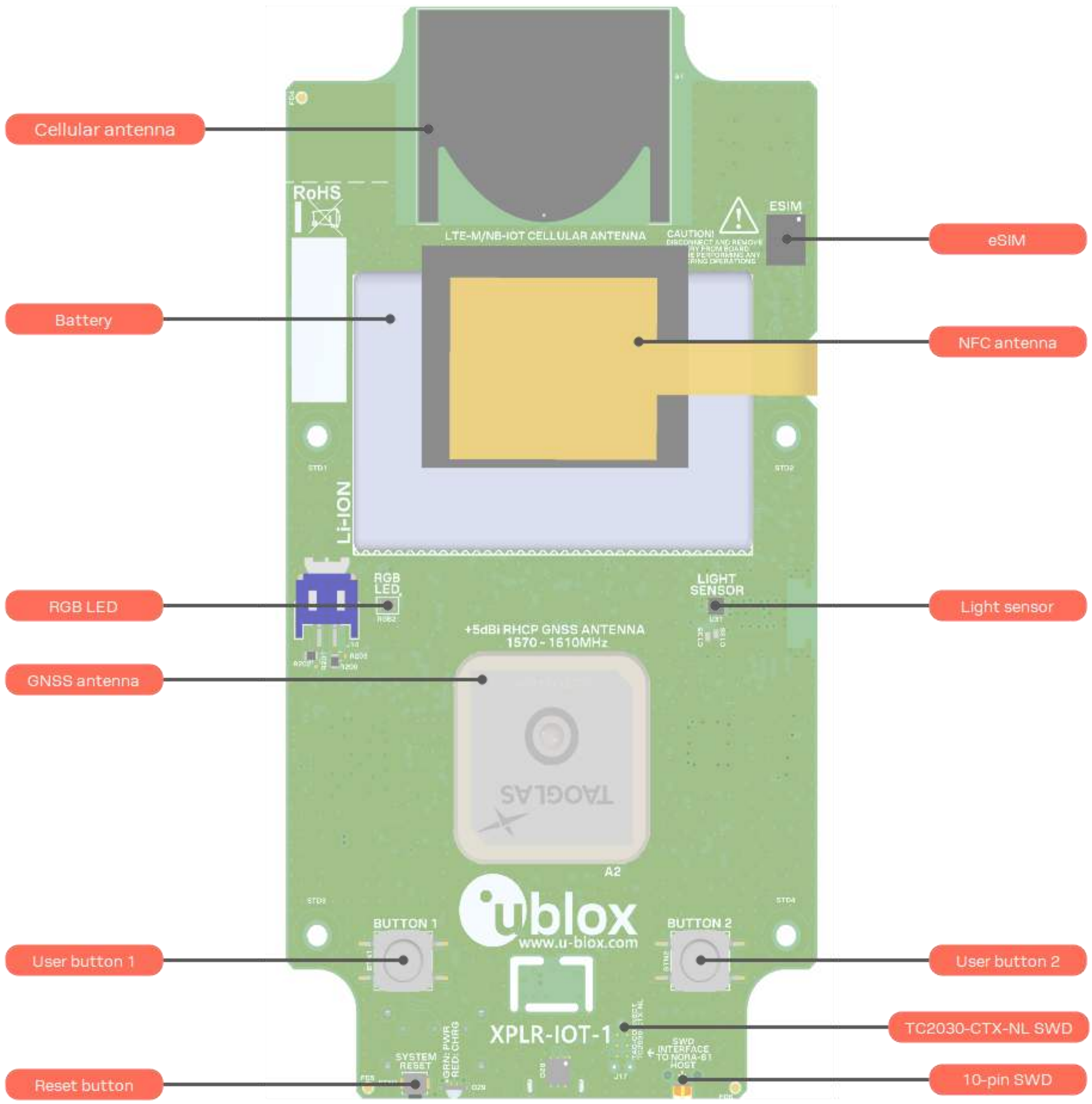

Figure 5: PCBA antenna side part locations

3.2 Power and reset subsystem

XPLR-IOT-1 is powered over USB through a micro-B connector. **VBUS** is filtered and connected to a Li-Po battery charger. The charger allows a maximum of 500 mA to be drawn from the upstream USB host or hub, which is the high-power limit for a USB 2.0 peripheral. Power is first allocated to the system with the remaining available for battery charging.

XPLR-IOT-1 contains a DTP 603450 style lithium-polymer (Li-Po) battery with a nominal voltage of 3.7 VDC and capacity of 1000 mAh. An integral battery protection system (BPS) protects against shorts, overcurrent, overcharging, and overloads. The battery is connected to the charger through a BQ27520YZFR-G4 Battery gauge. From the factory, the battery has an approximate 20% charge to allow for shipping.

⚠ Disconnect and remove battery from the PCBA before performing any soldering operations.

⚠ When first using XPLR-IOT-1, connect it to a USB host or a USB power supply to fully charge the battery after shipment.

3.2.1 Power and charging status

The bi-color LED, D29, shows power and charging status of XPLR-IOT-1. The LED is visible through the side panel of XPLR-IOT-1 case, as shown in Figure 3. Table 2 describes the CHG/PWR LED states.

USB power	Power switch	Charge state	CHG/PWR LED state
Disconnected	Off	Any charge or battery disconnected	Off
Disconnected	On	VBAT ≥ 3.2 VDC	Green
Disconnected	On	VBAT ≤ 3.2 VDC (discharged)	Off
Connected	Off	Charging	Red
Connected	Off	Fully charged or battery disconnected	Off
Connected	On	Charging	Amber
Connected	On	Fully charged or battery disconnected	Green

Table 2: CHG/PWR LED states

☞ XPLR-IOT-1 can be powered by USB alone if the battery is unplugged or removed.

⚠ To prevent an inrush of USB power current spikes, the battery must be present when using SARA.

3.2.2 Power supplies

When plugged in, USB power is always available to the charger and battery subsystem. SW1, located on the side panel of the PCBA, is the main power switch for the remainder of the system. The battery voltage is regulated down to 3.3 VDC and distributed to the remainder of the PCBA.

Module	Idle current (mA, avg.)[3]	Transmit current (mA, max)	Remarks
Base system with NORA-B1	61.1	n/a	Includes any LED current
NORA-B1	3.3	5.3 (3 dBm TX power)	
NINA-W15	33	120 (15 dBm TX power)	
SARA-R5	30	395 (23 dBm TX power)	
MAX-M10	13	n/a	

Table 3: Idle and transmit current at measurement jumpers

Available battery charging current = 500 – ($I_{\text{BASE with NORA-B1}}$ + $I_{\text{NINA-W15}}$ + $I_{\text{SARA-R5}}$ + $I_{\text{MAX-M10}}$) mA

[3] Idle current for all modules is not optimized at the time of publication.

3.2.3 Power and current measurement

System current from the **VBAT** supply rail is measured by cutting jumper NC15 and placing an ammeter or power analyzer across J10, pins 2 and 3, as shown in Figure 6. The expected current measurements are shown in Table 3.

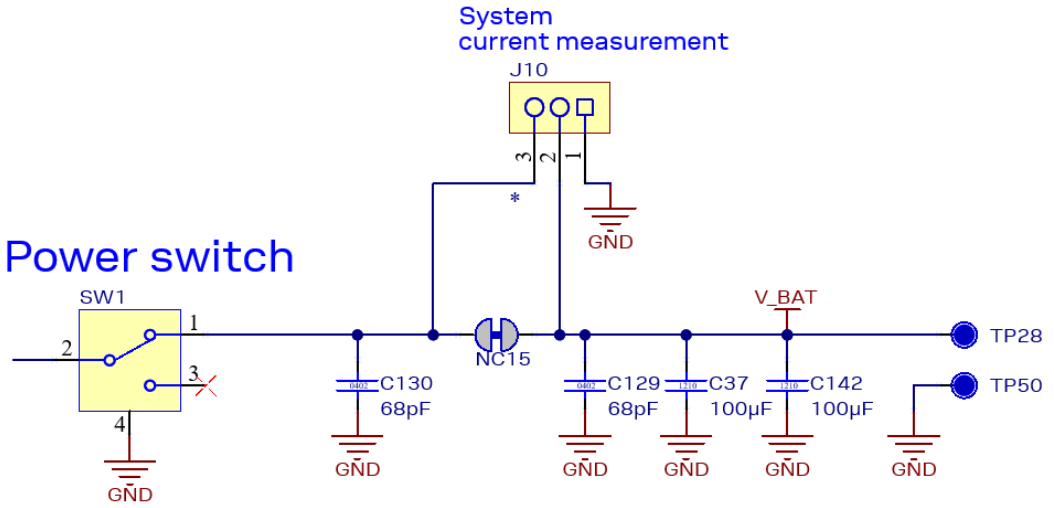

Figure 6: PCBA power switch and system current measurement test points

⚠ J10, pin 1, is connected to system ground.

☞ All current measurement jumpers within PCBA are compatible with the Nordic Semiconductor Power Profiler Kit II [31].

Figure 7 shows the power switch and current measurement location on the C10 assembly board.

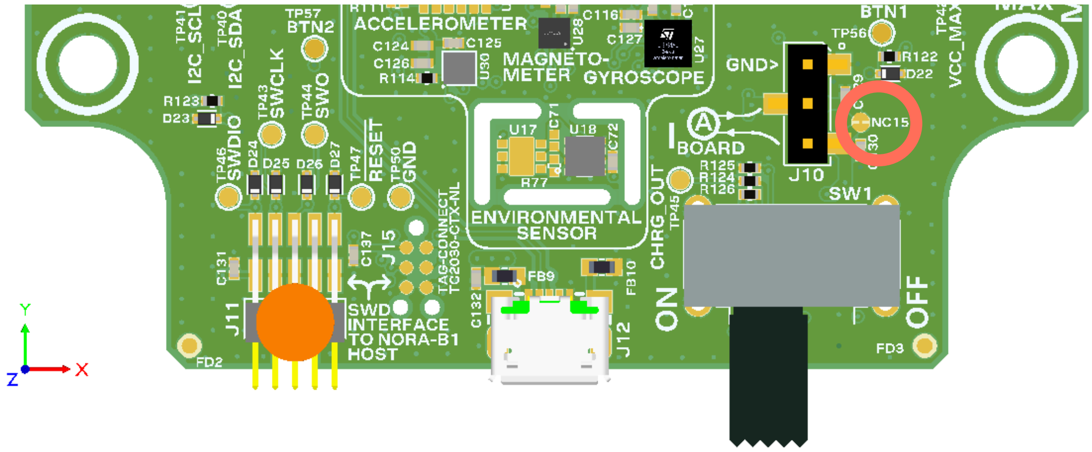

Figure 7: Power switch and current measurement location – bottom view

3.2.4 System reset

Behind the hole marked **RST** is the System reset button. When pressed, all modules are reset by hardware. Applications can also control the NORA-B1 GPIO pins to reset the SARA-R5 and NINA-W15 modules independently with **SARA_RST** and **NINA-RST**. See also GPIO assignments.

Table 4 shows the signals and possible reset options for each module and USB IC.

Signal	State	NORA-B1	SARA-R5	NINA-W15	MAX-M10	USB hub IC	USB-UART IC
SYS_RST	High	Reset	Reset	Reset	Reset	Reset	Reset
SARA_RST	High	-	Reset	-	-	-	-
NINA_RST	High	-	-	Reset	-	-	-

Table 4: Reset states

System reset can be isolated from each module by cutting the associated jumper, noted in Table 5. This can be useful to independently reset each major component when developing applications. See also the XPLR-IOT-1 schematic in the XPLR-IOT-1 hardware repository [2].

Module or IC	Reset isolation jumper
USB hub IC	NC11
USB-UART bridge IC	NC8
NORA-B1	NC12
NINA-W15	NC1
SARA-R5	NC4
MAX-M10	NC10

Table 5: System reset isolation jumpers

☞ Cutting NC8 and NC11 isolates the system reset signal so that any active transition resets the u-blox modules but not the USB hub and USB-UART virtual COM port. This allows a terminal program or u-blox utilities to receive module boot messages when the reset button is pressed.

3.3 Serial subsystem

The Serial subsystem within XPLR-IOT-1 provides a flexible scheme that allows either a PC host or NORA-B1 to connect to each of the modules through software control.

Figure 8 shows the USB and serial port subsystem connections. Blue lines indicate USB connections. Black lines indicate logical UARTE connections.

NINA-W156 and SARA-R510S UART signals are connected to independent GPIO pads on NORA. UARTE assignments to GPIO pads are configured by the application at the time of connection to the respective module. See Table 7 and the schematic at [2] for GPIO assignments.

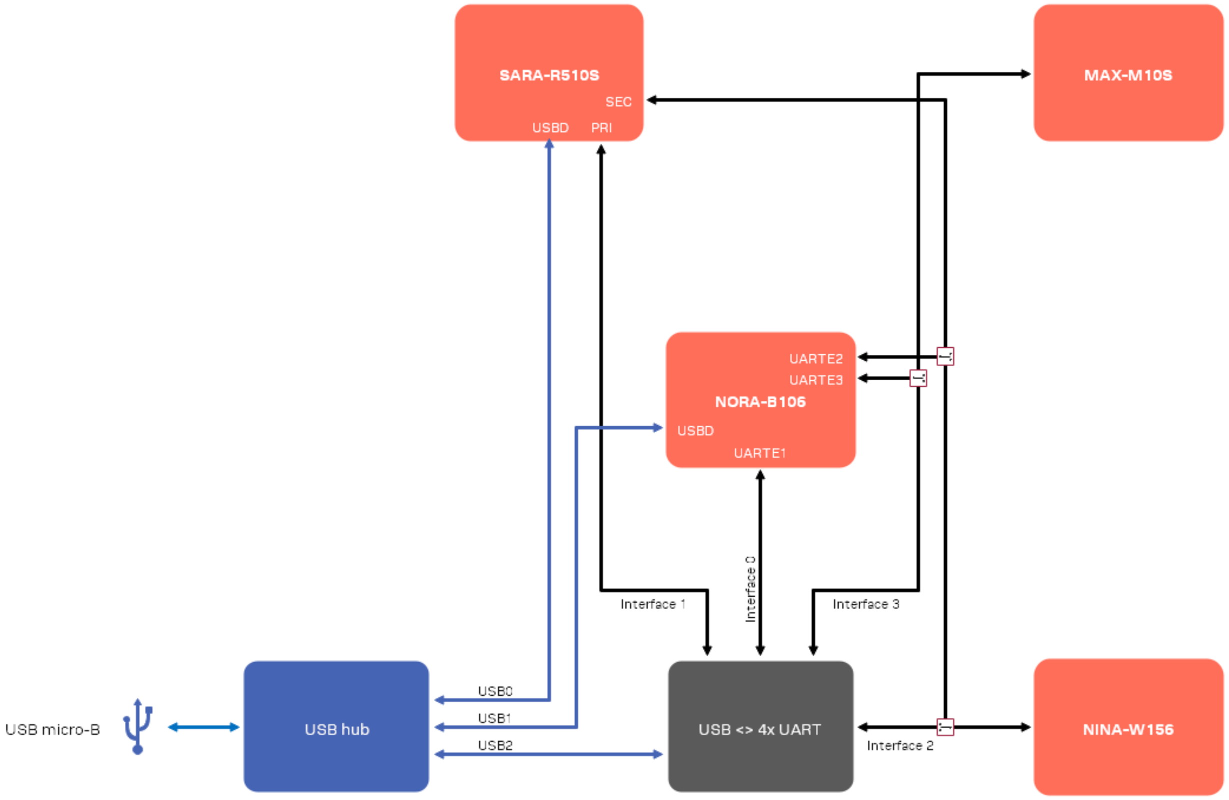

Figure 8: Serial subsystem

NORA-B1 outputs GPIO control signals to select whether NORA-B1 or the USB-UART port connects to either NINA-W15 or MAX-M10 – defaults are to the USB-UART ports. NORA-B1 has a dedicated connection to SARA-R5.

This configuration allows each of the product center control programs, including s-center [13], m-center [14], and u-center [15], to bypass NORA-B1 and communicate directly to the respective module.

Table 6 describes the UART control signals and states for NINA-W15 and MAX-M10 modules.

Signal	State	NINA-W15	MAX-M10
NORA_MAX_COM_EN	Low (default)	USB-UART port B	-
NORA_MAX_COM_EN	High	NORA-B1 UARTE2	-
NORA_NINA_COM_EN	Low (default)	-	USB-UART port C
NORA_NINA_COM_EN	High	-	NORA-B1 UARTE3

Table 6: UART selection for NINA-W15 and MAX-M10

3.4 u-blox modules

3.4.1 NORA-B106 – short range radio

Central to the XPLR-IOT-1 is NORA-B106 with its Nordic Semiconductor nRF5340 System on Chip (SoC). Within the nRF5340 are two Arm Cortex M33 processor cores – application and network.

The application core runs the main program and communicates with the other u-blox modules over UART connections. It also communicates with the QSPI memory, GPIO for the buttons and LEDs, the sensors on the I2C bus, and as a USB peripheral to the USB hub. An interprocessor communication (IPC) bus exchanges information between the application and network cores for Bluetooth communication. See also the NORA-B1 data sheet [8] and system integration manual [9].

The network core provides Bluetooth LE connectivity and utilizes a PCBA Niche antenna licensed from Abracon, LLC for Bluetooth in the 2.4 GHz ISM band [21].

NORA-B1 is powered when the Power Switch is on.

3.4.1.1 GPIO assignments

NORA-B1 is the central processor of XPLR-IOT-1. Its GPIO signals are used for communication and control of the other u-blox modules, sensors, and interfaces.

GPIO	Signal	Direction	Description
P0.00	XL1	IO	Low frequency clock
P0.01	XL2	IO	Low frequency clock
P0.02	P0.02/NFC1	IO	NFC tag
P0.03	P0.03/NFC2	IO	NFC tag
P0.04	NORA_EN_MAX	O	MAX-M10 power control
P0.05	NORA_BTN1	I	Application button 1
P0.06	LED_BLUE	O	Application RGB LED – blue color
P0.07	MAX_SAFEBOOT/NINA_SW2	O	MAX-M10 safe boot and NINA-W15 SW2 function
P0.08	NINA_EN	O	NINA-W15 power control
P0.09	nSARA_POWER_ON	O	SARA-R5 startup sequence, pulse high after NORA_EN_SARA is high
P0.10	NORA_EN_SARA	O	SARA-R5 power control
P0.11	SWO	O	Serial wire output - debug message output
P0.12	GAUGE_OUT	I	Low battery indicator signal
P0.13	QSPI0	IO	Quad SPI interface, bit 0
P0.14	QSPI1	IO	Quad SPI interface, bit 1
P0.15	QSPI2	IO	Quad SPI interface, bit 2
P0.16	QSPI3	IO	Quad SPI interface, bit 3
P0.17	QSPI_CLK	O	Quad SPI interface, clock
P0.18	QSPI_CS	O	Quad SPI interface, chip select
P0.19	RTS4	O	System UART4, RTS flow control
P0.20	RTS6	O	System UART6, RTS flow control
P0.21	SARA_RST	O	Reset SARA-R5 module
P0.22	ACCEL_INT	I	Accelerometer interrupt
P0.23	LED_GREEN	O	Application RGB LED – green color
P0.24	CTS0	I	System UART0, CTS flow control
P0.25	TX0	O	System UART0, TX data
P0.26	RX0	I	System UART0, RX data
P0.27	RTS0	O	System UART0, RTS flow control

GPIO	Signal	Direction	Description
P0.28	NORA_BTN2	I	Application button 2
P0.29	DSR6	I	System UART6, DSR flow control
P0.30	CTS6	I	System UART6, CTS flow control
P0.31	TX6	O	System UART6, TX data
P1.00	ALT_INT	I	Sensor interrupt input, ambient light sensor default
P1.01	SARA_INT/NINA_SW1	IO	SARA-R510 interrupt and NINA-W15 SW1 function
P1.02	SENSE_I2C_SCL	O	Sensor I2C bus clock
P1.03	SENSE_I2C_SDA	IO	Sensor I2C bus data
P1.04	TX4	O	System UART4, TX data
P1.05	MAX_BACKUP_EN	O	MAX-M10 backup power enable
P1.06	CTS4	I	System UART4, CTS flow control
P1.07	LED_RED	O	Application RGB LED – red color
P1.08	RX4	I	System UART4, RX data
P1.09	NINA_RST	O	NINA-W15 reset
P1.10	NORA_NINA_COM_EN	O	System UART2/UART6 selection
P1.11	RX6	I	System UART6, RX data
P1.12	DTR6	O	System UART6, DTR flow control
P1.13	TX5	O	System UART5, TX data
P1.14	RX5	I	System UART5, RX data
P1.15	NORA_MAX_COM_EN	O	System UART3/UART5 selection

Table 7: NORA-B1 GPIO assignments

3.4.1.2 Serial Wire Debug (SWD)

As an open CPU module, NORA-B1 may be reprogrammed with other applications. The SWD port is provided by two connections: A 2x5, 1.27 mm, center-keyed header that is accessible without opening the case, and a Tag-Connect TC2030-CTX-NL footprint on both sides of the PCBA. See also Known issues.

The three SWD connections are in parallel. Only one SWD connection may be used at a time. Figure 4 and Figure 5 show the positions of both interfaces. Figure 9 shows the SWD schematic and measurement test points.

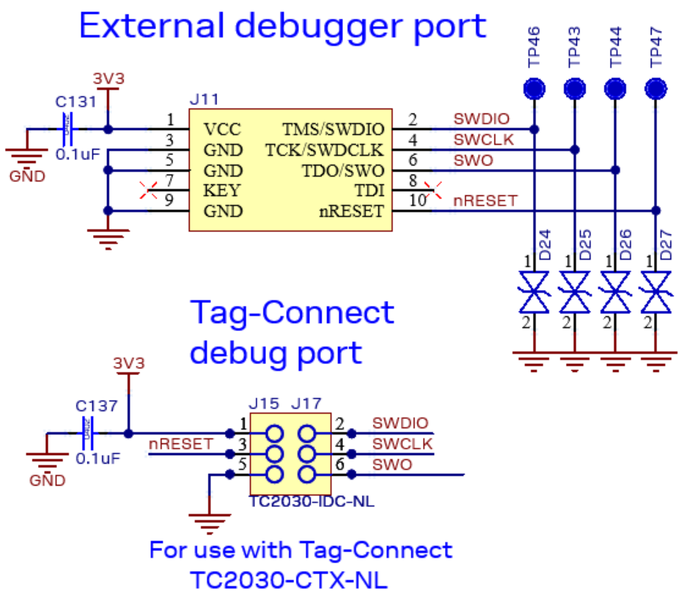

Figure 9: PCBA SWD schematic showing measurement test points

The other u-blox modules are pre-loaded with u-blox AT command firmware and can be updated with u-blox provided firmware updates over the respective UART connections.

3.4.1.3 Current measurements

Current flowing into NORA-B1 from the **3V3** supply rail is measured by cutting jumper NC9 and placing an ammeter or power analyzer across J4, pins 2 and 3, as shown in Figure 10. Current sunk by the GPIO pins is not measured through J4.

⚠ J4, pin 1, is connected to system ground.

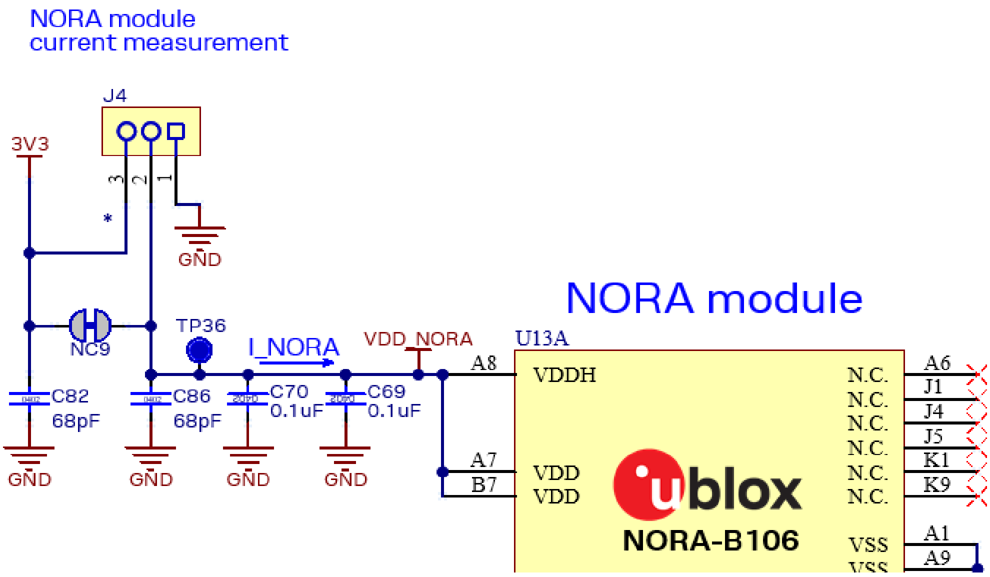

Figure 10: NORA-B1 current measurement

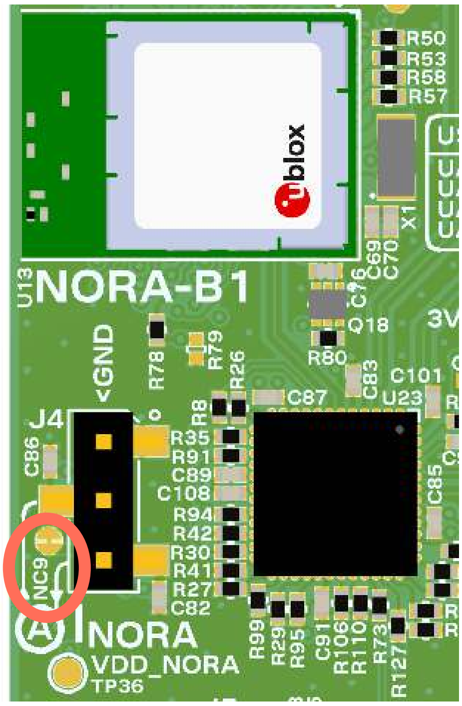

Figure 11: NORA-B1 module showing current measurement location

See Table 3 for expected current measurements.

3.4.2 NINA-W156 – short range

NINA-W156 provides Wi-Fi connectivity through its UART and u-connectXpress AT command set. Wi-Fi is one method of providing a network connection that is available for sending MQTT messages through Thingstream to process environmental data. NINA-W156 also contains a Abracon Niche antenna for Wi-Fi in the 2.4 GHz ISM band.

3.4.2.1 NINA-W15 power supply and current measurement

Current flowing into NINA-W15 from the **3V3** supply rail is measured by cutting jumper NC5 and place an ammeter or power analyzer across J2, pins 2 and 3, as shown in Figure 12.

⚠ J2, pin 1 is connected to system ground.

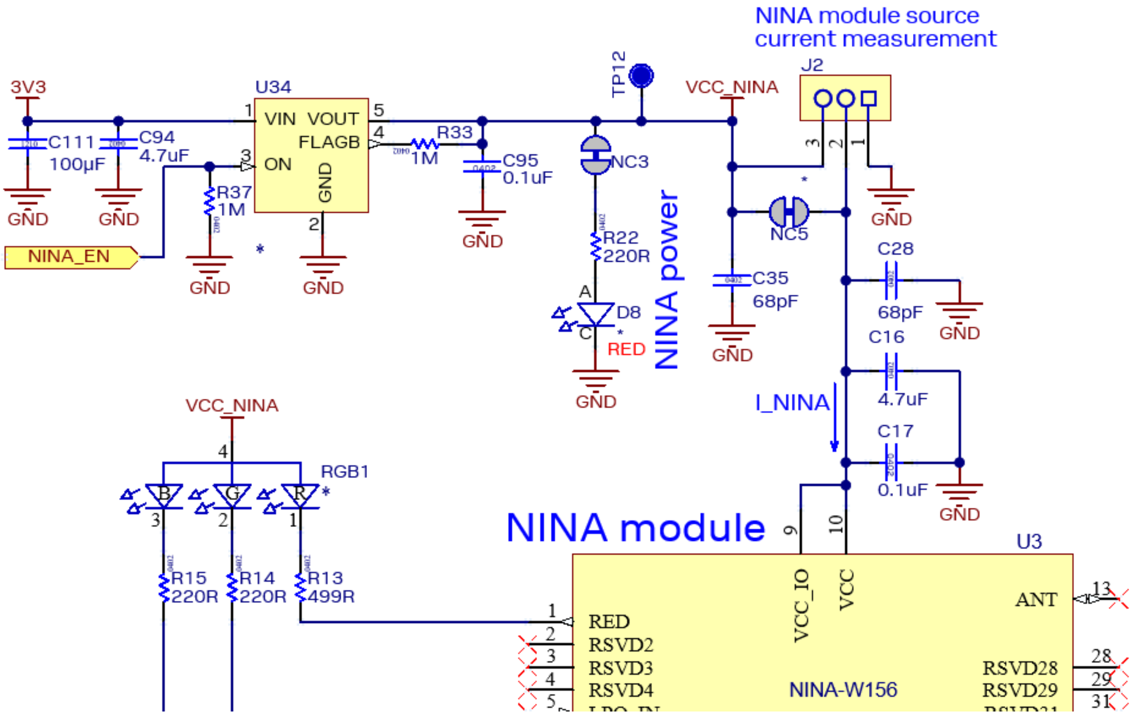

Figure 12: NINA-W15 power supply and current measurement

Figure 13 shows the current measurement location for the NINA-W15 module on the PCBA. See Table 3 for expected current measurements.

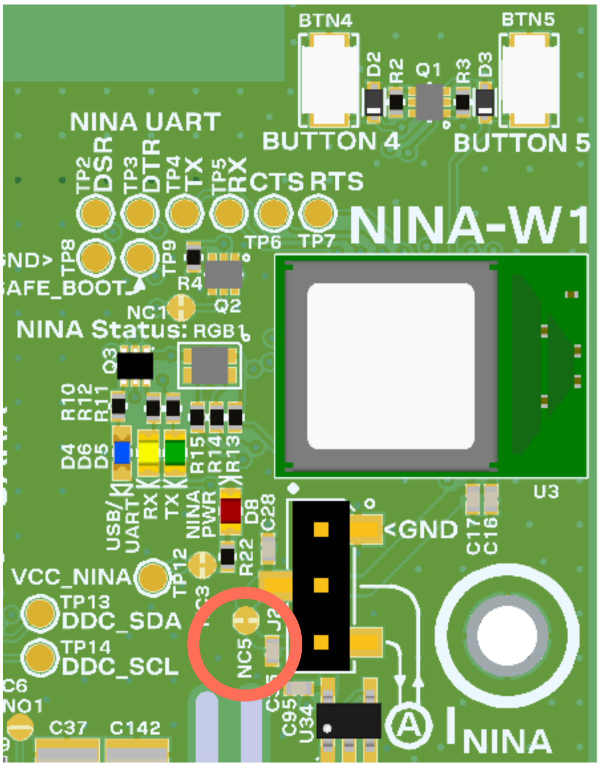

Figure 13: NINA-W15 module and current measurement

Table 8 describes the power and LED states for the NINA-W15 module.

Signal	LED	State	NINA-W15 status	LED state
NINA_EN	D8	High	Powered	On
		Low	Not powered	Off

Table 8: NINA-W15 power states

3.4.2.2 NINA-W15 UART and other signals

Table 9 describes the LEDs that indicate the UART activity.

Signal	LED	State	NINA-W15 status	LED state
NINA_TXD	D5	High	UART idle	Off
		Toggling with data	TX data from module	Follows NINA_TXD
NINA_RXD	D6	High	UART idle	Off
		Toggling with data	RX data into module	Follows NINA_RXD
NINA_COM_CTRL	D4	Low	USB-UART bridge active	On
		High	NORA_B10 active	Off

Table 9: NINA-W15 UART LEDs

LED RGB1 is connected to the red, green, and blue LED signals of NINA-W15, and functions as described in the system integration manual [11].

Table 10 describes the **SWITCH_1** and **SWITCH_2** signals that are connected to pushbutton switches and control signals from NORA-B1. This allows NINA-W15 system functions, as described in the data sheet and system integration manual.

NINA-W15 pin	PCBA button	Control signal from NORA-B1
GREEN/SWITCH_1	BTN4	SARA_INT/NINA_SW1
SWITCH_2	BTN5	MAX_SAFEBOOT/NINA_SW2

Table 10: NINA-W15 switch signals

See also the NINA-W15 data sheet [10] and system integration manual [11].

3.4.3 SARA-R510S – cellular

SARA-R510S provides LTE-M and NB-IoT connectivity through its UART and AT command set. Cellular is a second method of providing a network connection for the MQTT messages. A wide-band cellular antenna from Taoglas (PCS.66.A) is mounted on the PCBA for cellular connectivity in supported bands from 600 MHZ to 6 GHz [22]. See also the SARA-R5 data sheet [16] and system integration manual [17].

Figure 14 shows the LTE antenna and eSIM. An I2C connection between SARA-R5 and MAX-M10 provides direct communication of GNSS data without involving NORA-B1.

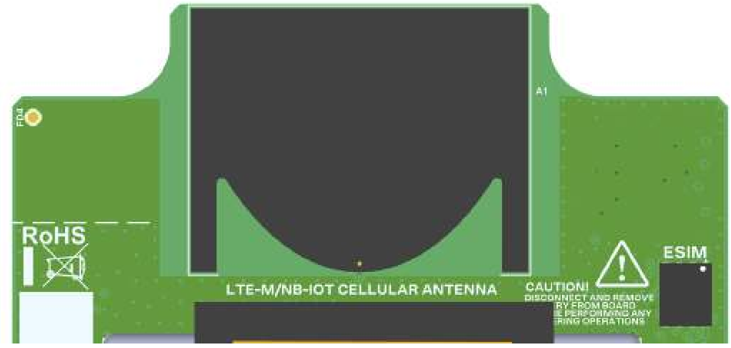

Figure 14: LTE antenna and eSIM

3.4.3.1 SARA-R5 power supply and current measurement

To measure the current flowing into SARA-R5 from the VBAT supply rail, cut jumper NC6 and place an ammeter or power analyzer across J3, pins 2 and 3, as shown in Figure 15.

⚠ J3, pin 1, is connected to system ground.

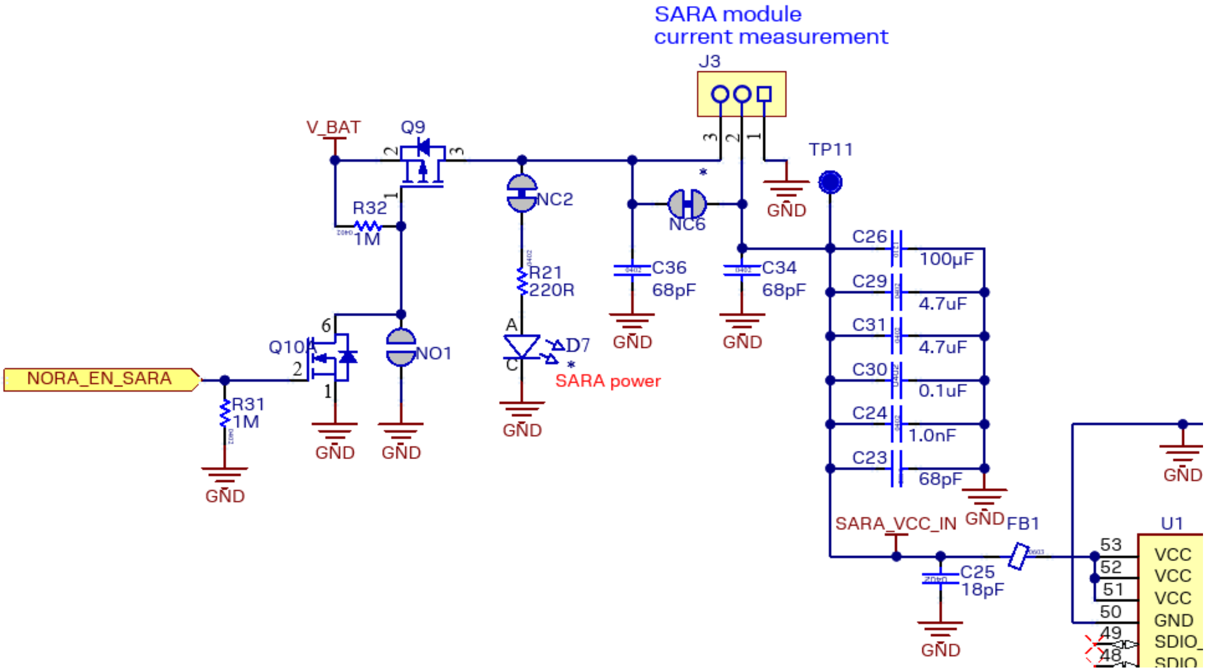

Figure 15: SARA-R5 power supply and current measurement

Figure 14 shows the current measurement location and position of the nano SIM in SARA-R5. See Table 3 for expected current measurements.

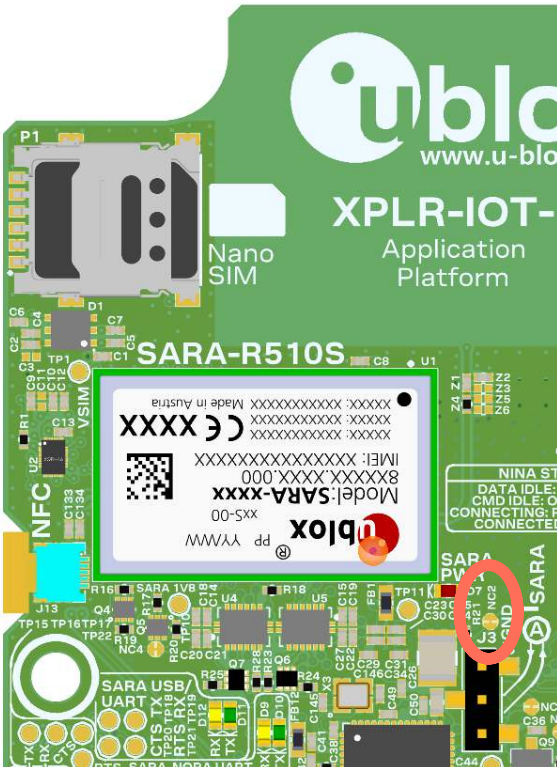

Figure 16: SARA-R5 module, nano SIM, and current measurement

Table 11 shows the power and LED states for the NINA-W15 module.

Signal	LED	State	SARA-R5 status	LED state
NORA_EN_SARA	D7	High	Powered	On
		Low	Not powered	Off

Table 11: NINA-W15 power states

SARA-R5 power is normally controlled by the GPIO signal **NORA_EN_SARA**. SARA-R5 can be configured to be always on when the power switch is on by shorting jumper NO1.

3.4.3.2 SARA-R5 UART and other signals

Table 12 describes the four LEDs that indicate UART activity in SARA-R5.

Signal	LED	State	SARA-R5 status	LED state
RX1/SARA_PRI_TX to USB_UART port B	D11	High	UART idle	Off
		Toggling with data	TX data from module	Follows RX1/SARA_PRI_TX
TX1/SARA_PRI_RX from USB_UART port B	D12	High	UART idle	Off
		Toggling with data	RX data into module	Follows TX1/SARA_PRI_RX
RX4/SARA_SEC_TX to ORA-B1	D10	High	UART idle	Off
		Toggling with data	TX data from module	Follows RX4/SARA_SEC_TX
TX4/SARA_SEC_RX from NORA-B1	D9	High	UART idle	Off
		Toggling with data	RX data into module	Follows TX4/SARA_SEC_RX

Table 12: SARA-R5 UART LEDs

USB Port 0 from the USB hub is connected to the SARA diagnostic USB port. Default state is disabled. To enable USB diagnostic logging, short jumper NO3.

☞ Enabling USB on SARA-R5 will increase current consumption. Ensure jumper NO3 is returned to the open state once diagnostics are complete.

3.4.3.3 SARA-R5 subscriber information module

An embedded SIM (eSIM) and a nano-SIM socket are provided to allow flexibility with cellular network connections. Figure 16 shows the location of the nano SIM in the upper left corner.

The eSIM is located on the opposite side of the PCBA from the nano SIM. To insert a nano SIM card, insert the card and press until a click is heard. To remove the card, push the card in until a click is heard. Release and pull the card out of the socket. Figure 14 shows the location of the eSIM.

☞ When present, the nano SIM card takes precedence over the on-board eSIM.

3.4.4 MAX-M10S – positioning

MAX-M10S provides position information from up to four GNSS constellations (GPS, GLONASS, Galileo, and BeiDou) through its UART or directly to the SARA module over the I2C bus interface. The default UART output is an NMEA compliant ASCII stream at 9600 Baud. A Taoglas CGGP.25.4.E.02 patch antenna is connected to the MAX-M10 module. See also the MAX-M10 data sheet [19] and system integration manual [20].

Figure 17 shows the location of the GNSS antenna. An I2C connection between SARA-R5 and MAX-M10 provides direct communication between the two modules without involving NORA.

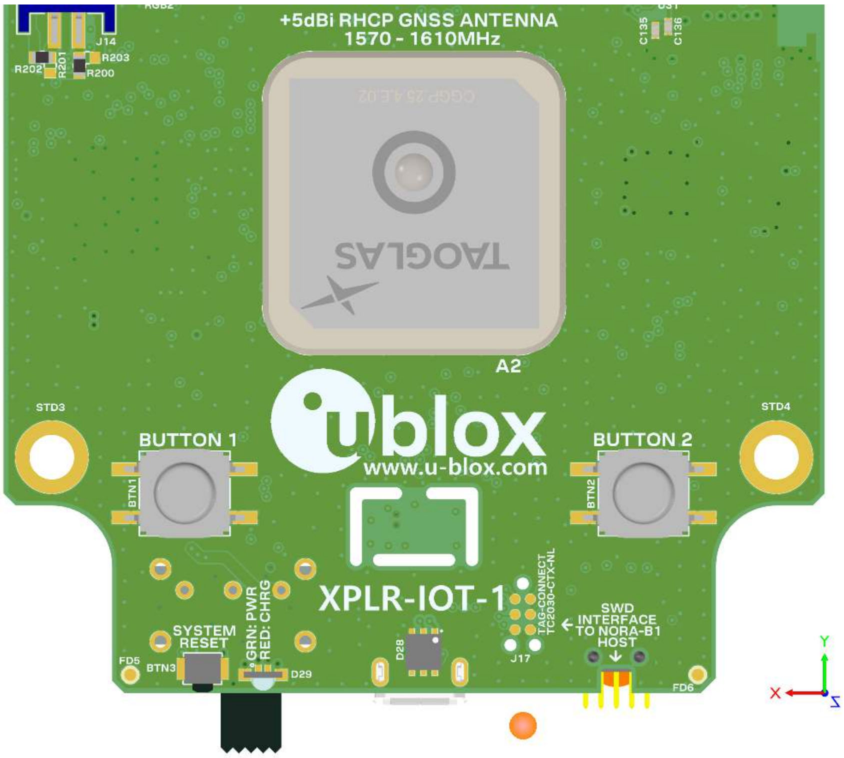

Figure 17: GNSS antenna

3.4.4.1 GNSS receive path

MAX-M10 is connected to the receive antenna through one of two paths – a straight-connection or through a SAW/LNA/SAW combination. The RF path is selected through jumper J1. See also Known issues.

Jumper J1	RF path
Open (default)	Bypass
Closed with 2-pin shunt	SAW/LNA/SAW

Table 13: GNSS RF receive path

3.4.4.2 MAX-M10 power supply and current measurement

MAX-M10 operates at 3 VDC. The main **3V3** power supply is connected to an LDO to provide this voltage. The enable input of the LDO is used to switch power to MAX-M10 with control signals from NORA-B1 or SARA-M510. The RAM and RTC can be maintained by enabling the **V_BCKP** power rail.

NORA_EN_MAX	SARA_EN_MAX	MAX_BACKUP_EN	MAX-M10 state
Low	Low	Low	Off, no backup
High	Low	Low	Normal operation, no backup
Low	High	Low	Normal operation, no backup
High	High	Low	Normal operation, no backup
Low	Low	High	Off, RAM and RTC backed up
High	Low	High	Normal operation, RAM and RTC backed up
Low	High	High	Normal operation, RAM and RTC backed up
High	High	High	Normal operation, RAM and RTC backed up

Figure 18: MAX-M10 power modes

Current flowing into MAX-M10 from the **VCC_MAX** (3.0 VDC) supply rail is measured by cutting jumper NC13 and placing an ammeter or power analyzer across J6, pins 2 and 3, as shown in Figure 19. See Table 3 for the expected current measurements.

⚠ J6, pin 1, is connected to system ground.

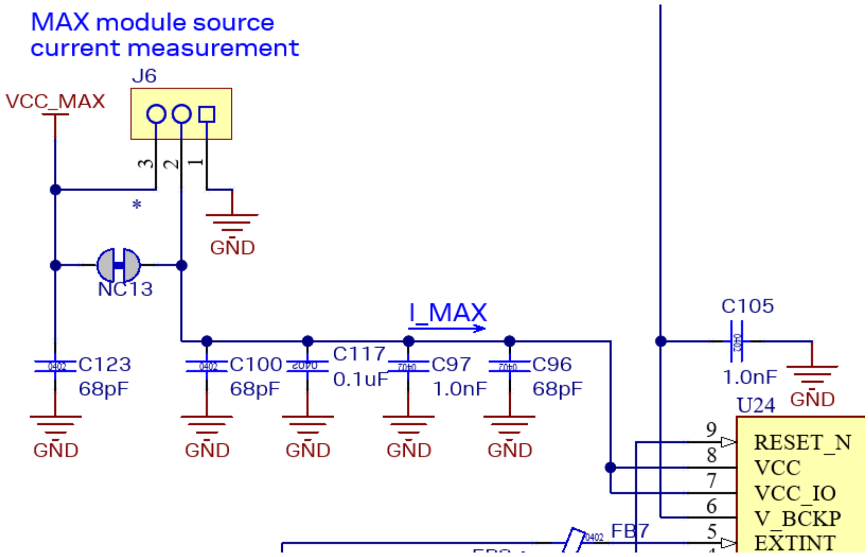

Figure 19: MAX-M10 current measurement

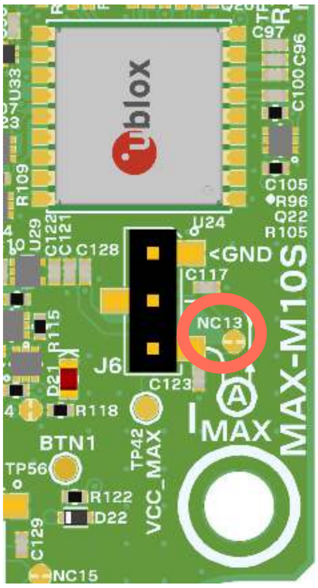

Figure 20: MAX-M10S and current measurement

3.4.4.3 MAX-M10 UART and other signals

Table 14 describes the three LEDs that indicate UART activity in MAX-M10.

Signal	LED	State	NINA-W15 status	LED state
MAX_TXD	D16	High	UART idle	Off
		Toggling with data	TX data from module	Follows MAX_TXD
MAX_RXD	D17	High	UART idle	Off
		Toggling with data	RX data into module	Follows MAX_RXD
MAX_COM_CTRL	D15	Low	USB-UART bridge active	On
		High	NORA_B10 active	Off

Table 14: MAX-M10 UART LEDs

3.5 I2C sensors

Several sensors are connected through a single I2C bus.

3.5.1 Environmental sensor

A BME280 environmental sensor from Bosch measures relative humidity, barometric pressure, and ambient temperature. On the I2C bus, it is assigned the address 0x76. The BME280 data sheet is available at reference [24].

3.5.2 Accelerometer

A LIS2DH12TR accelerometer from ST Microelectronics measures movement in three axes. Scales of ±2, ±4, ±8, and ±16 gauss may be selected. One interrupt output is connected to NORA-B1. On the I2C bus, it is assigned the address 0x19. The LIS2DH12TR data sheet is available at reference [25].

3.5.3 Magnetometer

A LIS3MDL magnetometer from ST Microelectronics measures magnetic fields in three axes. Scales of ±4, ±8, ±12, and ±16 gauss may be selected. An optional interrupt may be connected to NORA-B1 by soldering across the jumper NO4 and cutting jumper NC7. On the I2C bus, it is assigned address 0x1E. The LIS3MDL data sheet is available at reference [26].

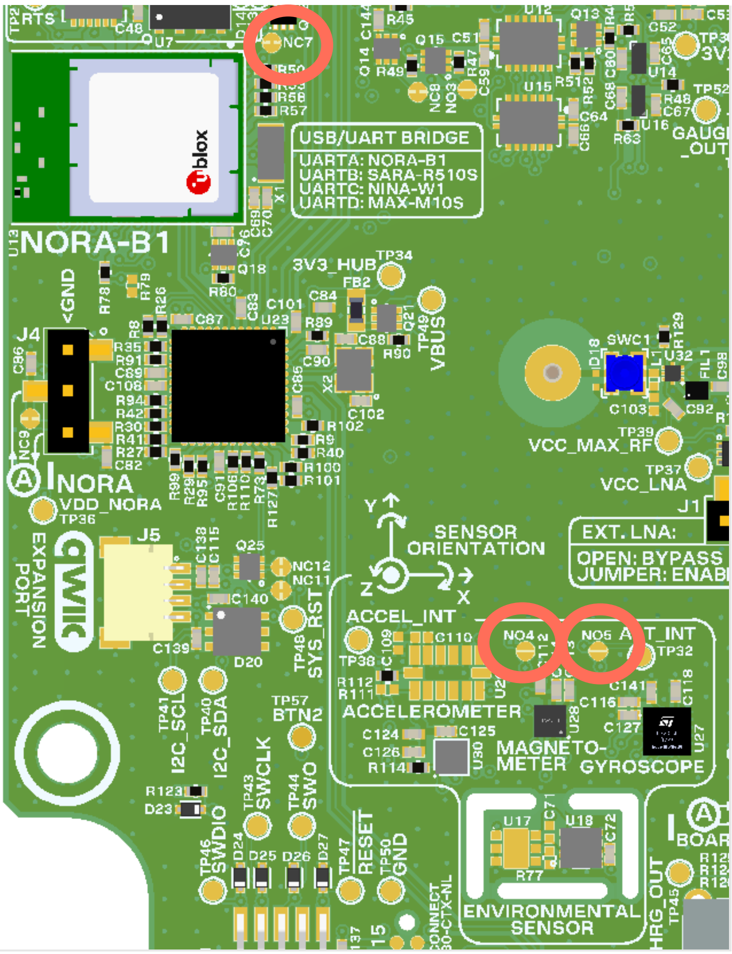

Figure 21: I2C sensors and interrupt jumpers NC7, NO4, NO5

3.5.4 Gyroscope

An ICG-20330 gyroscope from TDK senses yaw, pitch, and roll of the XPLR-IOT-1. Full scale ranges are adjustable from ±31.25°/s. to ±250°/sec. An optional interrupt may be connected to NORA-B1 by soldering across the jumper NO5 and cutting jumper NC7. On the I2C bus, it is assigned address 0x68. The ICG-20330 data sheet is available at reference [27].

3.5.5 Ambient light sensor

An LTR-303ALS-01 ambient light sensor from Lite-On provides a linear response over a wide dynamic range from 0.01 Lux to 64k Lux. An interrupt output is connected to NORA-B1. This interrupt output can be disabled by cutting jumper NC7. On the I2C bus, it is assigned address 0x29. The LTR-303ALS-01 data sheet is available at reference [28].

3.5.6 Battery gauge

A BQ27520YZFR-G4 battery gauge is included with XPLR-IOT-1 to monitor the charge state of the internal Li-Po battery. Measurements for battery capacity (mAh), state-of-charge (%), and battery voltage (mV) are available. A low battery indicator is connected to an interrupt input of NORA-B1. On the I2C bus, it is assigned address 0x55. The BQ27520YZFR-G4 data sheet is available at reference [29].

3.5.7 Qwiic connector

To further expand the I2C bus, J5 is compatible with the Qwiic connect system defined by SparkFun Electronics. This allows additional I2C devices operating at 3.3 V to be connected in a daisy-chain configuration. Table 15 shows the Qwiic pin-out. The definition of the Qwiic connect system is available at reference [30].

Signal	J5 pin	Qwiic color assignment
GND	1	Black
3.3 VDC	2	Red
SDA	3	Blue
SCL	4	Yellow

Table 15: Qwiic connector

3.6 NFC

XPLR-IOT-1 includes NFC tag capability. A flexible circuit NFC antenna, like that shown in Figure 22, is mounted against the battery and connected to J13. The antenna functionality is compliant with the NFC Forum definition of an NFC-A listening device. The circuit is tuned to 13.56 MHz with a bit rate of 106 kbps. XPLR-IOT-1 can be awakened by an NFC field.

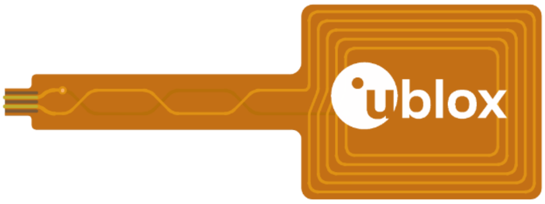

Figure 22: NFC antenna

Figure 23 shows the NFC circuit connections.

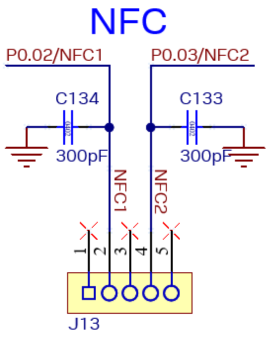

Figure 23: NFC connection

3.7 Test points

The PCBA includes test points throughout the layout to facilitate system monitoring and application debugging. Table 16 describes the test points. Figure 24 shows the test point locations. All test points are located on the component side of the PCBA.

Test point	Signal	Description
TP1	VSIM	1.8 VDC nominal nano SIM socket power rail, source = SARA-R5 when enabled
TP2	NINA_DSR	NINA-W15 UART, DSR flow control
TP3	NINA_DTR	NINA-W15 UART, DTR flow control
TP4	NINA_TXD	NINA-W15 UART, TX data
TP5	NINA_RXD	NINA-W15 UART, RX data
TP6	NINA_CTS	NINA-W15 UART, CTS flow control
TP7	NINA_RTS	NINA-W15 UART, RTS flow control
TP8	GND	System ground
TP9	ROM_BOOT	NINA-W15 ESP boot mode
TP10	SARA_1V8	1.8 VDC nominal power rail, source = SARA-R5 when powered
TP11	SARA_VCC_IN	SARA-R5 power rail, source = VBAT
TP12	VCC_NINA	3.3 VDC nominal power rail, source = 3V3 when enabled
TP13	DDC_SDA	I2C data, interface between SARA-R5 and MAX-M10
TP14	DDC_SCL	I2C clock, interface between SARA-R5 and MAX-M10
TP15	TX4/SARA_SEC_RX	System UART4, TX data
TP16	RX4/SARA_SEC_TX	System UART4, RX data
TP17	CTS4	System UART4, CTS flow control
TP18	RX1/SARA_PRI_TX	System UART1, RX data
TP19	TX1/SARA_PRI_RX	System UART1, TX data
TP20	CTS1	System UART1, CTS flow control
TP21	RTS1	System UART1, RTS flow control
TP22	RTS4	System UART4, RTS flow control
TP23	TX0	System UART0, TX data
TP24	RX0	System UART0, RX data
TP25	1V8	1.8 VDC VCORE power rail, source = USB-UART bridge
TP26	CTS0	System UART0, CTS flow control
TP27	RTS0	System UART0, RTS flow control
TP28	V_BAT	3.6 VDC nominal, source = battery charger when SW1 is on
TP29	CHRG_BATT	Battery charger battery connection (to fuel gauge)

Test point	Signal	Description
TP30	3V3	3.3 VDC nominal power rail, source = V_BAT through U8
TP31	BATTERY	Li-Po battery, positive terminal
TP32	ALT_INT	Ambient light sensor interrupt
TP33	MAX_TXD	MAX-M10 UART, TX data
TP34	3V3_HUB	3.3 VDC nominal power rail, source = 3V3 when VBUS is present
TP35	MAX_RXD	MAX-M1-S UART, RX data
TP36	VDD_NORA	3.3 VDC nominal power rail, source = 3V3
TP37	VCC_MAX_LNA	2.9 VDC nominal power rail, source = VCC_MAX_RF, switched by MAX-M10
TP38	ACCEL_INT	Accelerometer interrupt
TP39	VCC_MAX_RF	2.9 VDC nominal power rail, source = MAX-M10
TP40	SENSE_I2C_SDA	I2C data, sensor bus
TP41	SENSE_I2C_SCL	I2C clock, sensor bus
TP42	VCC_MAX	3.0 VDC nominal power rail, source = 3V3 through LDO when enabled
TP43	SWCLK	NORA-B1 SWD clock
TP44	SWO	NORA-B1 serial wire output
TP45	CHRG_OUT	Battery charger output
TP46	SWDIO	NORA-B1 SWD data
TP47	nRESET	NORA-B1 reset
TP48	SYS_RST	System reset
TP49	VBUS	5.0 VDC nominal power rail, source = USB connector
TP50	GND	System ground
TP51	ISET	Battery charger current setting
TP52	GAUGE_OUT	Battery gauge interrupt output
TP53	MAX_TIME_PULSE	SARA external GNSS time signal
TP54	MAX_EXT_INT	MAX-M10 external interrupt
TP55	N/A	Not used
TP56	NORA_BTN_1	NORA-B1 button 1
TP57	NORA_BTN_2	NORA-B1 button 2
TPBLU	LED_BLUE	User LED, blue element
TPGRN	LED_GREEN	User LED, green element
TPRED	LED_RED	User LED, red element

Table 16: Test point list

Figure 24 shows all test point locations. All test points are on the component side of the PCBA.

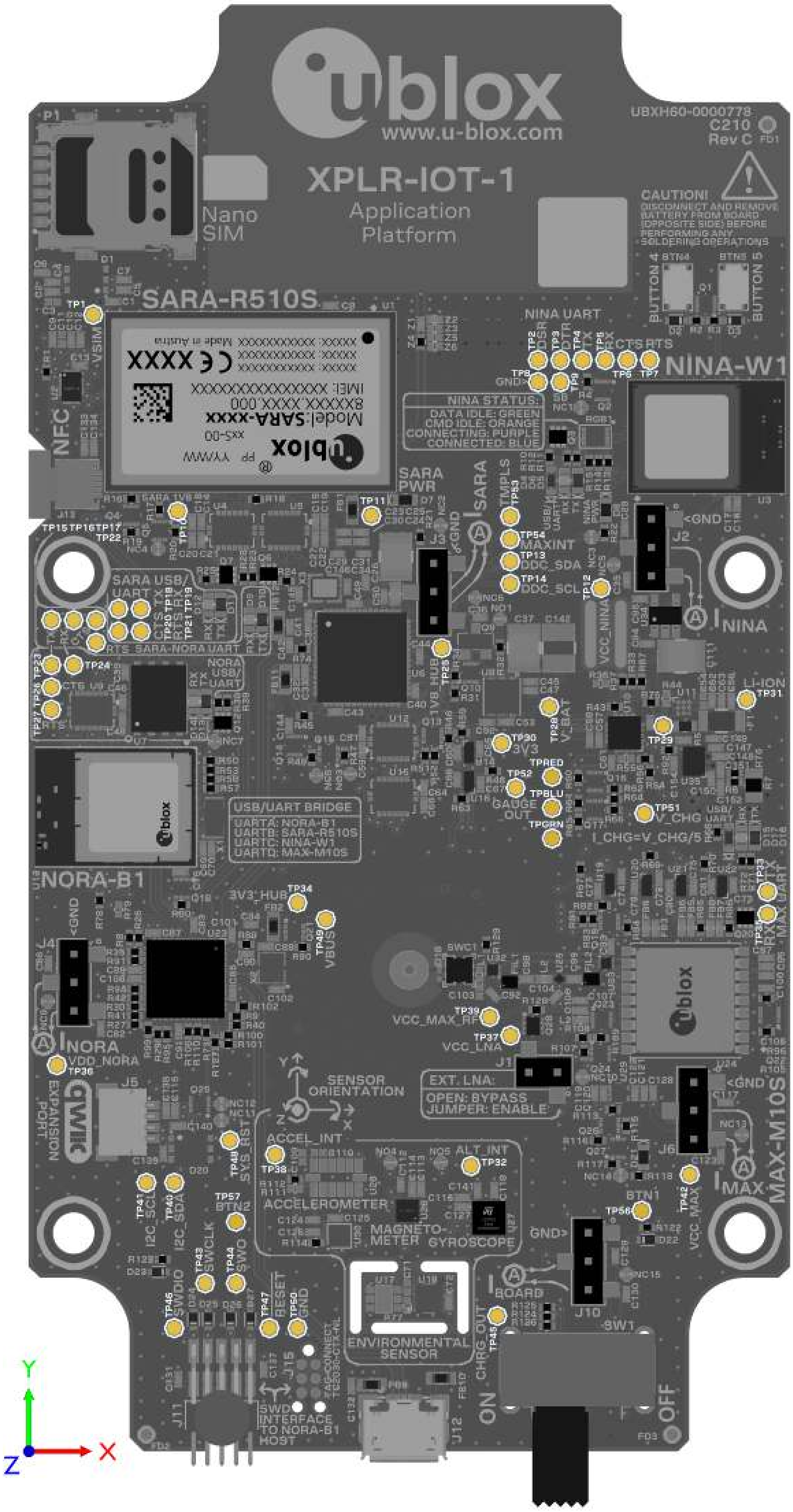

Figure 24: Test point locations

3.8 Jumpers

The PCBA includes several jumpers to select features and for current measurement. Normally open jumpers can be closed by creating a solder bridge across the terminals.

Normally open solder jumper	Description	Remarks
NO1	SARA-R5 power	Close to power SARA-R5 when SW1 is on
NO2	N/A	Not used
NO3	SARA-R5 USB	Close to enable diagnostic USB interface
NO4	Magnetometer interrupt	Close to enable interrupt (also open NC7)
NO5	Gyroscope interrupt	Close to enable interrupt (also open NC7)
NO6	N/A	Not used

Table 17: Normally open solder jumpers

Normally, closed jumpers can be opened by cutting the trace between the two pads. They may be closed again by creating a solder bridge across the terminals.

Normally closed solder jumper	Description	Remarks
NC1	NINA-W15 reset	Open to isolate from system reset
NC2	SARA-R5 power indicator	Open to disable LED D7
NC3	NINA-W15 power indicator	Open to disable LED D8
NC4	SARA-R5 reset	Open to isolate from system reset
NC5	NINA-W15 current measurement	Open to allow use of J2
NC6	SARA-R510 current measurement	Open to allow use of J3
NC7	Ambient light sensor interrupt	Open to disable interrupt
NC8	USB-UART reset	Open to isolate from system reset
NC9	NORA-B1 current measurement	Open to allow use of J4
NC10	MAX-M10 reset	Open to isolate from system reset
NC11	USB hub reset	Open to isolate from system reset
NC12	NORA-B1 reset	Open to isolate from system reset
NC13	MAX-M10 current measurement	Open to allow use of J6
NC14	MAX-M10 power indicator	Open to disable LED D21
NC15	System current measurement	Open to enable use of J10

Table 18: Normally closed solder jumpers

Table 19 indicates the current measurement and other feature jumpers.

Jumper	Description
J1	MAX-M10 LNA enable
J2	NINA-W15 current measurement
J3	SARA-R5 current measurement
J4	NORA-B1 current measurement
J5	Qwiic expansion connector
J6	MAX-M10 current measurement
J7	Reference designator not used
J8	Reference designator not used
J9	Reference designator not used
J10	System current measurement
J11	2x5 SWD header

Jumper	Description
J12	USB micro-B connector
J13	NFC antenna connector
J14	Li-Po battery connector
J15	Tag-Connect TC2030-CTX-NL pad set, component side
J16	Reference designator not used
J17	Tag-Connect TC2030-CTX-NL pad set, antenna side

Table 19: Jumpers

4 USB connection

XPLR-IOT-1 Rev C PCBA uses a FTDI FT4232 USB to quad UART interface. Device drivers will automatically download from Windows Update when XPLR-IOT-1 is powered and connected to a host PC.

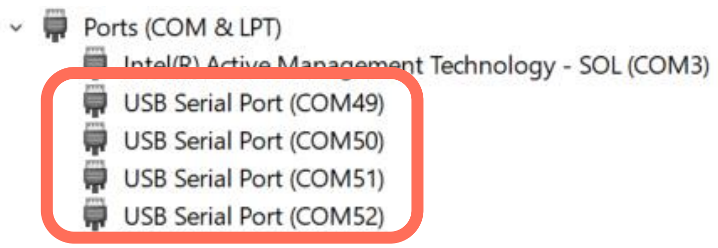

Figure 25: FTDI FT4232H COM port enumeration

☞ For Rev B PCBA, see USB connection for Rev B PCB.

With the FT4232H, COM port assignments are always in order. Port A will have the lowest port number, and assignments increment by one for each port. Table 20 shows the USB-UART COM port assignments associated with Figure 25.

Module	USB-UART port	COM port from Figure 25	Initial data rate (bits/sec)
NORA-B106	A	COM49	115,200
SARA-R510S	B	COM50	115,200
NINA-W156	C	COM51	115,200
MAX-M10S	D	COM52	9,600

Table 20: USB-UART port assignments

Open a terminal program, such as Putty [32] or TeraTerm [33], to the virtual COM port (VCP) for NORA-B1 (port A) with the settings 115,200 bps, no parity, 8 data bits, 1 stop bit. Set terminal line endings to carriage return only (CR, or hex 0x0d).

NINA-W15, SARA-R5, and MAX-M10 are powered off by default. To use s-center, u-center, or m-center, enter the following commands at the XPLR-IOT-1 command line interface:

- Turn on NINA-W15 and direct UART prior to opening s-center [13].
```
modules NINAW156 power_on
```
- Turn on and enable SARA-R5 prior to opening m-center [14].
```
modules SARAR5 power_on
```
- Turn on MAX-M10 and direct UART prior to opening u-center [15].
```
modules MAXM10S power_on
```

Figure 26 shows s-center [13], m-center [14], and u-center [15] connected to the respective VCPs on XPLR-IOT-1.

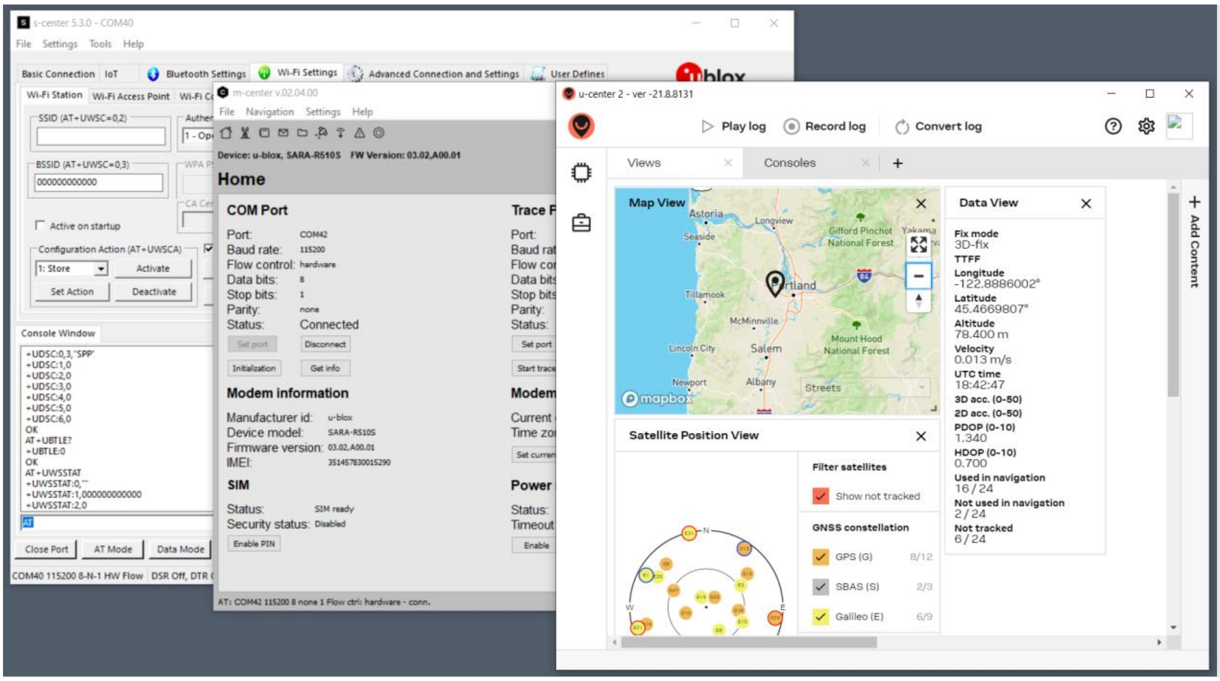

Figure 26: XPLR-IOT-1 communicating with s-center, m-center, and u-center

5 Module firmware updates

5.1 NORA-B1

The application on NORA-B1 can be updated through the MCUboot bootloader over UART. Each new image is uploaded to the XPLR-IOT-1 QSPI flash prior to writing it to the NORA-B1 flash.

5.1.1 Bootloader – batch file

1. Download the new application core and network core firmware images and the `newtmgr` utility from the main XPLR-IOT-1 main repository [1].

☞ If there are no updates to the network core, there will only be an application core file.

2. Start bootloader mode by pressing and holding button 1 while resetting or power-cycling XPLR IOT-1.
3. Determine the COM port number for NORA-B1 on port A of the USB-UART interface (e.g., COM 19). This example assumes the example COM port enumeration of port A shown at USB connection.
4. Open a file browser and navigate to the folder containing the firmware images.
5. Double-click on the batch file `Update_XPLR-IOT-1.bat`
6. When prompted, enter the COM port number (e.g., COM49).
7. When the update completes, press any key to close the window.
8. Reset XPLR-IOT1 (reset button, power switch, or command line: `nrfjprog --reset`)

5.1.2 Bootloader – manual update

1. Download the new application core and network core firmware images and the `newtmgr` utility from the main XPLR-IOT-1 main repository [1].

☞ If there are no updates to the network core, there will only be an application core file.

2. Start bootloader mode by pressing and holding button 1 while resetting or power-cycling XPLR-IOT-1.
3. Determine the COM port number for NORA-B1 on port A of the USB-UART interface. This example assumes the example COM port enumeration of port A shown at USB connection.
4. Open a Windows command prompt.
5. Navigate to the folder containing the firmware images.
6. Update the network core (optional, depending on the requirements of the update)
   ```
   newtmgr.exe --conntype=serial --connstring="COM49,baud=115200" image upload
   net_core_update.bin
   ```
   Replace `net_core_update.bin` with the actual filename of the downloaded network core update. Replace `COM49` with the actual COM port on port A.
7. Update the application core
   ```
   newtmgr.exe --conntype=serial --connstring="COM49,baud=115200" image upload
   app_core_update.bin
   ```
   Replace `app_core_update.bin` with the actual filename of the downloaded application core update. Replace `COM49` with the actual COM port on port A.
8. Reset XPLR-IOT1 (reset button, power switch, or command line: `nrfjprog --reset`)

⚠ If updating the network core, both the network and application cores must be updated during the same bootloader session. If updating only the application core, the network core update can be bypassed.

☞ The update sequence listed here assumes the availability of pre-configured binary files. Custom application code may also be updated through the bootloader. Additional details may be found in the XPLR-IOT-1 software repository [3] for creation of custom binary files for use with the bootloader.

5.1.3 SWD

NORA-B1 may also be updated through the SWD port while developing new applications. A SEGGER J-Link debug interface is required. Either J-Link Base model or higher or an EVK-NORA-B1 debug-out (J-Link-OB) connector may be used. Connect the SWD interface shown in Figure 4 or Figure 5 to the debug probe. See also Known issues/errata.

Source code for the application provided from the factory may be used as an example for further code development. See also the XPLR-IOT-1 software repository [3].

⚠ Programming NORA-B1 through the SWD port may erase the default bootloader or Bluetooth device address in addition to the provided application. See the XPLR-IOT-1 hardware repository [2] for instructions about restoring the original bootloader. See the NORA-B1 system integration manual [9] for instructions to save and restore the Bluetooth device address.

5.2 NINA-W15

At the time of publication of this guide, NINA-W15 is loaded with firmware v4.0.0. Future application releases may require an updated firmware version.

NINA-W15 may be updated over the USB-UART interface. The module must first be enabled through the application.

1. Follow the instructions at USB connection to connect XPLR-IOT-1 to a host PC running Windows.
2. Open a terminal program, such as Putty [32] or TeraTerm [33], to the virtual COM port (VCP) for NORA-B1 (port A) with the settings 115,200 bps, no parity, 8 data bits, and 1 stop bit. Set the terminal line endings to carriage return only (CR, or hex 0x0d).
3. Type the following command to enable NINA-W15 over the USB-UART port C:
```
modules NINAW156 power_on
```
4. Download the latest firmware from the u-blox website [12].
5. Open s-center and connect to NINA-W15 on USB-UART port C.
6. At this point, NINA-W15 may be updated through s-center [13].

☞ MQTT and Wi-Fi credentials must be reentered through the NORA command line interface. See also [4].

5.3 SARA-R5

At the time of publication of this guide, SARA-R5 is loaded with firmware v3.14 or v3.15. Future application releases may require an updated firmware version.

SARA-R5 may be updated over the USB-UART interface. The module must first be enabled through the application.

⚠ Updating the firmware on SARA-R5 erases all settings in the module.

1. Request a copy of the EasyFlash firmware update utility and firmware binary (DOF file) from u-blox support.
2. Install EasyFlash and copy the DOF file to the EasyFlash directory as noted in section 6 of the SARA-R5 firmware update application note [18].
3. Follow the instructions at USB connection to connect XPLR-IOT-1 to a host PC running Windows.
4. Start EasyFlash firmware update utility. Select the product (SARA-R5), port (COM port associated with port B), and baud rate (3,000,000 or slower) from the drop-down menus.

5. Open a terminal program, such as Putty [32] or TeraTerm [33], to the virtual COM port (VCP) for NORA-B1 (port A) with the settings 115,200 bps, no parity, 8 data bits, 1 stop bit. Set terminal line endings to carriage return only (CR, or hex 0x0d).
6. **NORA-B1 terminal:** Type the following command to enable SARA-R5 over the USB-UART port B:
```
modules SARAR5 power_on
```
7. Start the update with EasyFlash.
8. When the update is complete, close EasyFlash.
9. **NORA-B1 terminal:** Power-cycle SARA-R5 to activate the new firmware.
```
Modules SARAR5 power_off
modules SARAR5 power_on
```
10. Start m-center. Connect to SARA-R5 and start an AT command terminal from m-center on the VCP associated with port B.
11. **m-center terminal:** reset NVM to factory defaults
```
AT+UFACTORY=0,2
```
12. **NORA-B1 terminal:** activate reset by power cycling SARA-R5 with
```
modules SARAR5 power_off
modules SARAR5 power_on
```
13. **m-center terminal:** disable RF activity
```
AT+CFUN=0
```
14. **m-center terminal:** register with carrier
```
AT+CEREG=2;+CGEREP=1,1
AT+CGDCONT?
AT+CGDCONT=1, "IP","TSUDP"
AT+CFUN=1
```
15. **m-center terminal:** wait for:
```
+CEREG: 5,"xxxx","xxxxxxxx",7
+CGEV: ME PDN ACT 1
```

⚠ Step 13 may take several minutes since global scanning is enabled

16. **m-center terminal:** activate registration
```
AT+CGREG=2
AT+CGREG?
AT+CEREG?
```
17. **m-center terminal:** wait for:

`+CGREG: n,5` –or– `+CEREG: n,5`

18. **m-center terminal:** check for AT+CGATT completion
```
AT+CGATT?
```
19. **m-center terminal:** check automatic activation
    19.1. If `AT+CGATT?` Above returned `+CGATT: 0` then activate explicitly.
    19.2. DO NOT do this STEP if `+CGATT: 1` was returned.
```
AT+CGATT=1
AT+CGATT?
```
20. **m-center terminal:** check activation
```
AT+CGACT?
```
21. **m-center terminal:** activate explicitly only if needed
    21.1. If `AT+CGACT?` Above returned `+CGACT: x,0` then activate explicitly
    21.2. DO NOT do this STEP if `+CGACT: x,1` was returned.
    This is for GPRS. For LTE this should not be required.
```
AT+CGACT=1
AT+CGACT?
```
22. **m-center terminal:** set same context type (IPV4) for internal context as reported in `+CGDCONT` when the module radio is OFF `(+CFUN=0)`
```
AT+UPSD=0,0,0
```
23. **m-center terminal:** map the existing external context on `<cid>=1` configuration to the internal context on `<profile>=0`
```
AT+UPSD=0,100,1
```
24. **m-center terminal:** activate the internal context on `<profile>=0`

```
AT+UPSDA=0,3
```

25. **m-center terminal:** if `AT+UPSDA=0,3` above failed then de-activate context & retry
    25.1. De-activate the PDP context associated with profile zero
    ```
    AT+UPSDA=0,4
    ```
    25.2. Now repeat from STEP 20.
26. **m-center terminal:** obtain socket number
    ```
    AT+USOCR=17
    ```
    26.1. The `AT+USOCR=17` above will return `+USOCR: <N>` where `<N>` is the socket number.
27. **m-center terminal:** enable the secondary UART on SARA-R5
    ```
    AT+USIO=2
    ```
28. **m-center terminal:** set SARA-R5 to airplane mode
    ```
    AT+CFUN=4
    ```
29. **NORA-B1 terminal:** save settings by power cycling SARA-R5 with
    ```
    modules SARAR5 power_off
    modules SARAR5 power_on
    ```

☞ MQTT-SN credentials must be reentered through the NORA command line interface. See also [4].

5.4 MAX-M10

MAX-M10 firmware resides in ROM and does not require updates.

6 Application development

6.1 NORA-B1

The sensor aggregation demonstration and bootloader example code programmed at the factory on XPLR-IOT-1 can be used as a starting point for custom application development.

The source code is located at the u-blox XPLR-IOT-1 software repository [3] and developed using the Nordic Semiconductor nRF Connect SDK (NCS) [34]. Build instructions are located within the repository readme.

NCS is installed through the Toolchain Manager of the Nordic Semiconductor utility nRF Connect for Desktop.

1. Download and install Microsoft Visual Studio Code [35]
2. Follow the "Getting Started" instructions from the NCS documentation [36].

☞ When installing NCS, select the version that corresponds to the one noted at the XPLR-IOT-1 software repository [3].

3. Follow the instructions from the GitHub repository to build the example application.

☞ Additional applications for XPLR-IOT-1 will be published at GitHub. See [4].

7 Known issues/errata

7.1 Hardware

7.1.1 PCBA revision B

1. The GNSS LNA path is not functional with Rev B PCBAs. Ensure jumper **NO5** is open to select the direct antenna connection (bypass).
2. Some units have a misalignment between the SWD connector, J11, and the end panel. If a misalignment is observed, open the case, and move the end-panel so the opening is centered around the J11.
3. Virtual COM ports may not enumerate if XPLR-IOT-1 is powered on prior to connecting to an upstream USB hub or host. If this is observed, power cycle or reset XPLR-IOT-1 with the USB cable connected.

7.1.2 PCBA revision C

4. No known issues

7.2 Software

7.2.1 Sensor aggregation example v0.3

Version 0.3 is the first released code base.

1. MAX-M10 is powered on at boot. Power can be turned off with the command:
   ```
   modules MAXM10S power_off
   ```
2. ICG-20330 gyroscope is not enabled. A future release will enable this sensor.
3. NINA-W15 remains powered on after a Wi-Fi connection is terminated. Power can be turned off with the command:
   ```
   modules NINAW156 power_off
   ```

7.2.2 Sensor aggregation example v1.0

1. When sending isolated sensor topic MQTT messages over Wi-Fi, the topic name length is limited to 23 characters. The environmental, accelerometer, and magnetometer sensor topics exceed this limit.
2. At the initial boot-up on a new unit, the filesystem may require additional time to be formatted and mounted. This may cause a system halt. If this happens, reboot or power-cycle the unit.
3. Connectionless MQTTSN QoS=3 is not supported.

Appendix

A Glossary

Abbreviation	Definition
ARM	Arm (Advanced RISC Machines) Holdings
BPS	Battery Protection System
CPU	Central Processing Unit
DC	Direct Current
eSIM	Embedded Subscriber Identity Module
GNSS	Global Navigation Satellite System
GPIO	General Purpose Input / Output
GPS	Global Positioning System
I2C	Inter-IC Communication
IPC	InterProcessor Communication
ISM	Industrial Scientific Medical (frequency bands)
LDO	Low Drop Out (voltage regulator)
LE	Low Energy
LED	Light Emitting Diode
Li-Po	Lithium-Polymer (battery)
LNA	Low Noise Amplifier
MCU	MicroController Unit
MQTT	Message Queuing Telemetry Transport
NC	Normally Closed
NCS	nRF Connect SDK
NFC	Near Field Communication
NO	Normally Open
PCBA	Printed Circuit Board Assembly
RAM	Random Access Memory
SAW	Surface Acoustic Wave (filter)
SDK	Software Development Kit
SIM	Subscriber Identity Module System Integration Manual (for u-blox modules)
SoC	System on Chip
SPI	Serial Peripheral Interface
SWD	Serial Wire Debug
UART	Universal Asynchronous Receiver Transmitter
UARTE	Enhanced UART with EasyDMA
USART	Universal Synchronous Asynchronous Receiver Transmitter
USB	Universal Serial Bus

Table 21: Explanation of the abbreviations and terms used

B USB connection for Rev B PCB assembly

☞ Before plugging in XPLR-IOT-1 the first time, install the USB-UART device drivers. The drivers only need to be installed once on a host PC.

1. Download the USB-UART device drivers from Silicon Labs [7].
2. Unzip the file to a convenient location.
3. Run the installer for your operating system.
4. Connect XPLR-IOT-1 to a host PC using a USB A to micro-B cable.
5. Turn on XPLR-IOT-1. Four virtual COM ports (VCP) will enumerate.
6. Open Device Manager to view the installed ports.

Figure 27: Silicon Labs UART Interface COM port assignments

Interface 0 through 3 correspond to USB-UART ports A through D. Note that the COM port assignments are not always in ascending order with Rev B PCB assemblies, as seen in Figure 27.

☞ If an update to the SARA-R5 firmware is required, select a baud rate of 921,600 bps or slower in EasyFlash.

C Regulatory limitations

⚠ XPLR-IOT-1 is an application development platform. It has not been RF certified with worldwide agencies. It may not be offered for sale as an end-user product.

XPLR-IOT-1 contains the modules described in Table 22.

Module	FCC ID	IC ID
NORA-B106	XPYNORAB1	8595A-NORAB1
NINA-W156	XPYNINAW15	8595A-NINAW15
SARA-R510S	XPYUBX19KM01	8595A-UBX19KM01
MAX-M10S	N/A	N/A

Table 22: Regulatory IDs

Related documentation

[1] GitHub, XPLR-IOT-1 main repository
[2] GitHub, XPLR-IOT-1 hardware repository
[3] GitHub, XPLR-IOT-1 software repository
[4] GitHub, XPLR-IOT-1 other applications
[5] XPLR-IOT-1 Getting Started guide
[6] Bootloader Manager
[7] Silicon Laboratories USB-UART device drivers
[8] NORA-B1 data sheet, UBX-20027119
[9] NORA-B1 system integration manual, UBX-20027617
[10] NINA-W15 data sheet, UBX-18006647
[11] NINA-W15 system integration manual, UBX-17005730
[12] NINA-W15 firmware binary files (click on Documentation & resources)
[13] s-center webpage
[14] m-center webpage
[15] u-center webpage
[16] SARA-R5 data sheet, UBX-19016638
[17] SARA-R5 system integration manual, UBX-19041356
[18] SARA-R5 EasyFlash firmware update utility, UBX-20033314
[19] MAX-10S data sheet, UBX-20035208
[20] MAX-10S system integration manual, UBX-20053088
[21] Abracon, Niche antenna
[22] Taoglas, wideband cellular antenna
[23] Taoglas, GNSS antenna
[24] Bosch humidity, pressure, temperature sensor, BME280
[25] ST Microelectronics Accelerometer, LIS2DH12
[26] ST Microelectronics magnetometer, LIS3MDL
[27] TDK gyroscope, ICG-20330
[28] Lite-On light sensor, LTR-303ALS-01
[29] Texas Instruments, BQ27520YZFR-G4
[30] SparkFun, Qwiic connect system
[31] Nordic Semiconductor, PPK2
[32] Putty terminal program
[33] TeraTerm terminal program
[34] Nordic Semiconductor, nRF Connect SDK
[35] Microsoft, Visual Studio Code (VS Code)
[36] Nordic Semiconductor, NCS getting started

☞ For product change notifications and regular updates of u-blox documentation, register on our website, www.u-blox.com.

Revision history

Revision	Date	Name	Comments
R01	01-Jun-2022	brec	Initial release
R02	20-Jun-2022	brec	Added Application development chapter. Revised formatting and related references in the block diagram, serial subsystem, and PCBA images. Other minor editorial changes.
R03	13-Jul-2022	brec	Added cellular coverage area footnote, corrected jumper highlighting on Figure 13 and Figure 16, corrected gyroscope part for rev B hardware, updated firmware update sections for NORA-B1 and SARA-R5, added Known issues/errata section
R04	14-Oct-2022	brec	Updated throughout for Rev C PCBA, corrected SARA-R5 flash update application note link, added NINA-W15 flash update link, corrected ranges and I2C address of ICG-20330
R05	21-Dec-2022	brec	Added information regarding Rev C PCBA and Sensor aggregation application v1.0. Added link to u-blox GitHub search for “XPLR-IOT” to list additional repositories.

Contact

For further support and contact information, visit us at www.u-blox.com/support.