

NORA-B2 uCX series

u-connectXpress Bluetooth® modules

System integration manual



Abstract

Targeted towards hardware and software engineers, this document provides a functional overview combined with best-practice design guidelines for integrating NORA-B2 u-connectXpress stand-alone, Bluetooth® Low Energy modules in application products. It explains the u-connectXpress software, hardware design-in, component handling, regulatory compliance, and testing of the modules. It also describes the external antennas approved for use with the module.

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This document applies to the following products:

Product name	Document status	Comment
NORA-B261	Objective specification	
NORA-B266	Objective specification	
NORA-B271	Objective specification	
NORA-B276	Objective specification	
NORA-B281	Objective specification	
NORA-B286	Objective specification	

 For information about the related hardware, software, and status of listed product types, refer to the data sheet [\[2\]](#).

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1 Module overview

NORA-B2 with u-connectXpress software is a compact, high-performing, stand-alone Bluetooth Low Energy module. The u-connectXpress software provides support for u-blox Bluetooth Low Energy Serial Port Service, GATT client and server, beacons, Bluetooth long range and simultaneous peripheral and central roles. u-blox pre-flashed u-connectXpress software allows hosts to easily configure connectivity using AT commands over a UART interface.

NORA-B2 provides top-grade security, thanks to secure boot, which ensures that the modules only boot up with authenticated u-connectXpress software.

Leveraging Bluetooth long range feature, NORA-B2 also offers an extended communication range with reliable connections.

Key markets are industrial automation, smart cities and buildings, medical and healthcare, and telematics. Specific applications include asset tracking, indoor location, sensors, and wireless-connected and configurable equipment.

NORA-B2 comes with an internal chip antenna for ease of integration in the end-product as well as an antenna pin for use with an external antenna of choice.

All variants come designed for PSA Certified Level 3 IoT security making the modules ideal for security sensitive applications like point-of-sales terminals and medical devices.

NORA-B2 is globally certified for use with the internal or external antenna. This reduces time, cost, and effort for customers integrating NORA-B2 in their designs.

To ensure operation in professional environments, the module is designed and manufactured according to u-blox professional grade requirements.

2 Module integration

NORA-B2 modules with u-connectXpress must be integrated together with a host CPU, as shown in Figure 1.

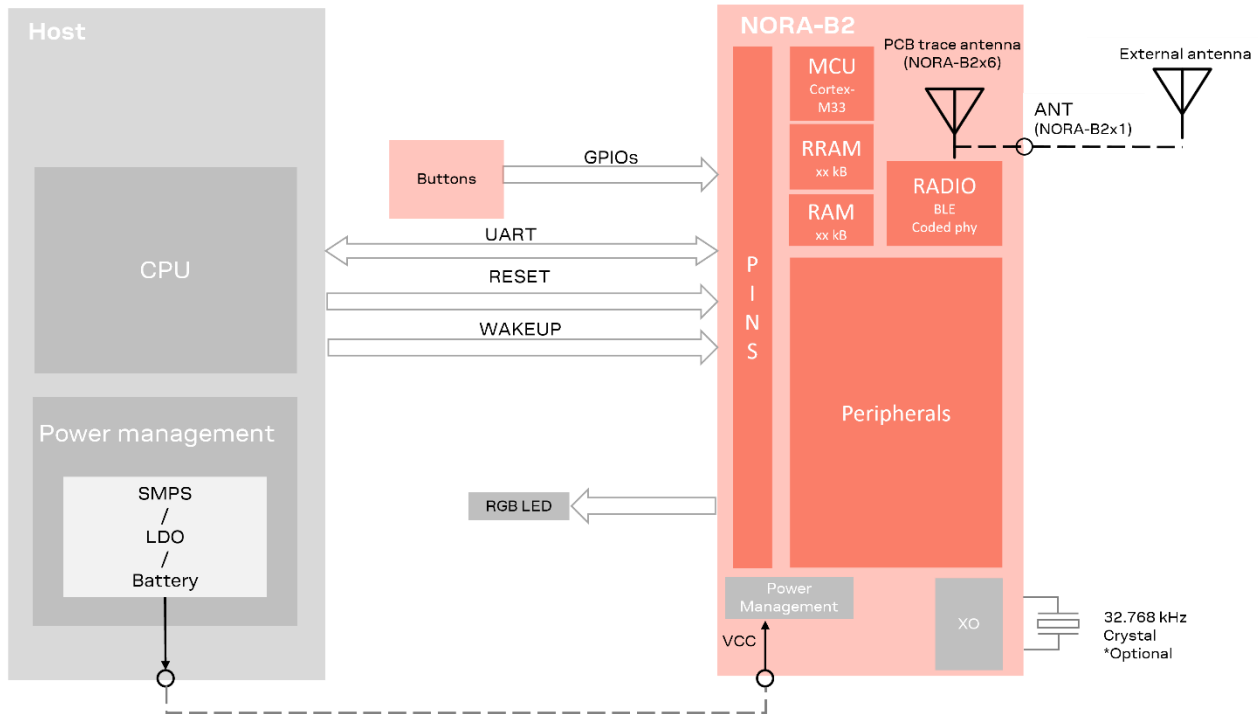


Figure 1: NORA-B2 integration in host system

The module is controlled by the host CPU using the **nRESET** and UART signals. The power supply is sourced from the **VCC** and **VIO** pins.

If LEDs, switches, or GPIO signals are not used in the host board design, adding test points should be considered in the integration.

2.1 Power supply

The power for NORA-B2 uCX series modules is supplied through the **VCC** pin.

The internal power and clock management system monitors the SoC's components power and clock requests to operate the lowest power consumption mode.

2.1.1 VCC application circuits

Although NORA-B2 includes a complete power management system and can be sourced from a battery, an external regulator might be required if the power source is outside NORA-B2's supply voltage tolerances or if the application product has a specific power distribution architecture. Then the supplies are taken from either of the following sources:

- Switching Mode Power Supply (SMPS)
- Low Drop Out (LDO) regulator

An SMPS is the ideal design choice when the available primary supply source is significantly higher than the operating supply voltage of the module. This offers the best power efficiency for the application design and minimizes the amount of current drawn from the main supply source.

-  When taking VCC supplies from an SMPS, make sure that the AC ripple voltage is kept as low as possible at the switching frequency. Design layouts should focus on minimizing the impact of any high-frequency ringing.

Use an LDO linear regulator for primary VCC supplies that have a relatively low voltage. As LDO regulators dissipate power linearly related to the step-down voltage, LDOs are not recommended for the step down of high voltages.

DC/DC efficiency should be regarded as a trade-off between the active and idle duty cycles of an application. Although some DC/DC devices achieve high efficiency at light loads, these efficiencies typically degrade as soon as the idle current drops below a few milliamps. This can have a negative impact on the life of the battery.

If decoupling capacitors are needed on the supply rails, it is best practice to position these as close as possible to the NORA-B2 uCX series module. The power routing of some host system designs makes decoupling capacitance unnecessary.

For electrical specifications, see also the appropriate NORA-B2 uCX series data sheet [\[2\]](#).

2.2 Module reset

NORA-B2 uCX series module is reset / rebooted through the **RESET_N** pin:

- **RESET_N** has an internal pull-up resistor that sets its default state to high. Setting the pin low triggers a “hardware reset” of the module.
- **RESET_N** is preferably driven by either an open-drain or open-collector output or a contact switch.

NORA-B2 uCX series modules can also be reset using other methods. For more information, see also NORA-B2 data sheet.

2.3 Global Real Time Clock (GRTC)

The LFCLK oscillator control, included in the module’s chip, manages the low frequency clock sources and requests.

When peripherals require a low frequency clock, LFCLK, for watchdog timer, or global real-time counter (GRTC). This is provided by the LFCLK control system. The LFCLK is generated from either of the following sources:

- RC oscillator, LFRC, included in the chip
- Crystal oscillator, LFXO, with an external oscillator connected to pin B6 and C6.
- Synthesized by the LFSYNT from the high frequency clock, HFCLK.

The LFCLK source is selected by the LFCLK.SRC register. If LFXO is selected, it initially starts with the LFRC and switch to LFXO once the oscillator is stable.

An external crystal provides the lowest sleep current consumption. Although the 32 kHz LFRC consumes slightly more sleep current, it provides a leaner Bill of Materials (BOM).

 For RTC pinout information, see also NORA-B2 data sheet.

2.4 Power saving modes

NORA-B2 with u-connectXpress supports different power saving modes for optimizing power consumption.

-  Not yet supported by NORA-B2 u-connectXpress.

2.4.1 Auto sleep

In Auto sleep mode, the module can maintain Bluetooth Low Energy connections. The u-connectXpress software automatically controls the power-saving capabilities of the module based on a configurable power-saving level and application activity. The power-saving level can be set to prioritize current consumption savings or module performance. For example, for improved throughput and latency.

Auto sleep mode is enabled, and power save level is configured using an AT command. When enabled, no further action is required by the host.

For more information about this and other commands, see also the u-connectXpress AT command manual [\[12\]](#).

2.4.2 Deep sleep

Deep sleep mode is used to minimize current consumption. In this mode, the UART interface is disabled, and no Bluetooth Low Energy connections are maintained.

The host needs to control when the module should enter and exit Deep sleep mode. After wake up, the module assumes the same state as it does after a reset.

To initiate Deep sleep mode, the host uses the AT command **AT+UPMDS**.

To wake up the module from Deep sleep mode, the host sets **GPIO_J9** to GND.

For more information about this and other commands, see also the u-connectXpress AT command manual [\[12\]](#).

2.5 Antenna integration

The modules support either an internal antenna or external antennas connected through a dedicated antenna pin.

2.5.1 Internal antenna

The module variants NORA-B2x6 have an internal antenna that is specifically designed and optimized for u-blox Bluetooth LE modules. With this variant, designers only need to consider the module placement and GND clearance in antenna area.

2.5.2 External antenna interface

The module variants NORA-B2x1 is equipped with an antenna signal (**ANT**) pin. The pin has a nominal characteristic impedance of 50 Ω and must be connected to the antenna through a 50 Ω transmission line.

Choose an antenna with optimal radiating characteristics for the best electrical performance and overall module functionality. An internal antenna, integrated on the application board or an external antenna connected to the application board through a proper 50 Ω connector, can be used.

When using an external antenna, the PCB-to-RF-cable transition must be implemented using either a suitable 50 Ω connector, or an RF-signal solder pad (including GND) that is optimized for 50 Ω characteristic impedance.

2.5.2.1 Antenna matching

The antenna return loss should be as low as possible across both bands to provide optimal performance. The enclosure, shields, other components, and surrounding environment might impact the return loss that is seen at the antenna port. Matching components are often required to retune the antenna to 50 Ω characteristic impedance.

It is difficult to predict the actual matching values for the antenna in the final form factor. Therefore, it is good practice to have a placeholder in the circuit with a “pi” network, with two shunt components and a series component in the middle. This allows maximum flexibility while tuning the matching to the antenna feed.

2.5.2.2 Approved antenna designs

The NORA-B2x1 module variant comes with a pre-certified design that can significantly reduce costs and save time during the certification process. To leverage this benefit, customers must implement an antenna layout that fully complies with the u-blox reference design outlined in Appendix A. Reference design source files – available from u-blox on request. See also [Approved antennas](#) that can be used together with the reference design.

The designer integrating a u-blox reference design into an end-product is solely responsible for any unintentional RF emission generated by the end product.

 The module may be integrated with other antennas. In which case, the OEM installer must certify the design with respective regulatory agencies.

2.6 Data interfaces

NORA-B2 modules have four I/O pins assigned to the UART data interface described in this section.

2.6.1 UART (Universal Asynchronous Receiver Transmitter)

NORA-B2 u-connectXpress modules supports a high-speed UART interface with a maximum baud rate of 4 Mbps. The host application uses this interface to configure and control the module. Additionally, it can be used to upgrade the [Software](#).

The UART interface supports the following signals:

- Data lines (**RXD** as input, **TXD** as output)
- Hardware flow control lines (**CTS** as input, **RTS** as output)

You can use the UARTs in 4-wire mode with hardware flow control, or in 2-wire (default) mode with **TXD** and **RXD** only.

Default interface settings are 115 200 bps, 8 data bits, no parity, 1 stop bit, with no flow control.

 To avoid buffer overrun, UART operation in 2-wire mode is not recommended for speeds above 115 200 bps.

2.7 General purpose input/output

WAKE-UP on pin **J9** is used as the Deep sleep wake-up signal described in [Power saving modes](#).

Two GPIO pins **GPIO SWITCH_1** and **SWITCH_2** are used to enter bootloader, as shown in [Table 1](#).

Pin	Function	State during boot	Behavior
SWITCH_1, SWITCH_2	Input	Low (0), Low (0)	Enter bootloader. If this state is kept for more than 10 seconds without sending commands to bootloader over UART, the u-connectXpress application boots. The module settings are then restored to factory default values.
	Input	Low (0), High (1) High (1), Low (0) High (1), High (1)	Boots the u-connectXpress application.

Table 1: NORA-B2 uCX series boot mode pins

The internal pull up values are the default states for NORA-B2 on boot.

Three GPIO pins, **RED**, **GREEN** and **BLUE**, are used to show the state of the software, as shown in [Table 2](#).

Pin	Function	State	Behavior
LED_RED	Output	N/A	-
LED_GREEN	Output	N/A	-
LED_BLUE	Output	Low (0)	Connected
LED_RED, LED_GREEN (Yellow color)	Output	Low (0), Low (0)	Not connected
LED_RED, LED_BLUE (Magenta color)	Output	Low (0), Low (0)	Connecting

Table 2: NORA-B2 LED pins

The internal pull up values are the default states for **RED**, **GREEN**, and **BLUE**.

For information about updating the software, see also [u-connectXpress software](#).

2.8 No-connect pins

Do not connect No-Connect (NC) pins. These pins are allocated for future functionality.

2.9 Ground (GND) pins

For correct RF performance, a good electrical connection to all module GND pins, using the solid ground layer of the host application board, is necessary. Firm connections provide a thermal heat sink for the module and significantly reduce EMC issues.

3 Design-in

Follow the design guidelines stated in this chapter to optimize the integration of NORA-B2 uCX series modules in your application board.

3.1 Overview

Although all application circuits must be properly designed, there are several points that demand special attention during application design. A list of these points, in order of importance, follows:

- **Module antenna connection: ANT pad (NORA-B2x1 only)**
Antenna circuits affect the RF compliance of all applications that include the certification schemes related to the module. To maintain compliance and subsequent certification of the application design, it is important to observe the applicable parts of antenna schematic and layout design described in [Antenna interface](#).
- **Module supply: VCC and GND pins.**
Supply circuits can affect RF performance. It is important to observe the schematic and layout design for these supplies. See also . Modules normally include several supply pins described in the pin out of the NORA-B2 uCX data sheet [\[2\]](#).
- **High-speed data interfaces: UART.**
High-speed data interfaces are a potential source of radiated noise that can affect the regulatory compliance standards for radiated emissions. It is important to follow the schematic and layout design recommendations described in the [General high-speed layout guidelines](#).
- **System functions: nRESET, GPIO, and other System input and output pins**
Careful utilization of these pins in the application design is required to guarantee correct boot up and system operation. Ensure that the voltage level is correctly defined during module boot. It is important to follow the schematic and layout design recommendations described in [General high-speed layout guidelines](#).
- **Other pins: ADC and NC pins.**
Careful utilization of these pins is required to guarantee proper functionality. It is important to follow the schematic and layout design recommendations described in the [General high-speed layout guidelines](#).

3.2 Antenna interface

Designers should consider antenna integration from all perspectives during their product's feasibility design study. This is crucial because later changes to improve antenna performance can be time-consuming and costly. Placement of the module and the antenna should be carefully chosen to ensure that it is not exposed for radio interference or that the antenna becomes obstructed or detuned by other components in the application product.

NORA-B2x1 module is designed to be used with an external antenna. The antenna can be mounted in any position relative to the module and should be connected through an RF connector and coax cable. This allows both the module and the antenna to be placed in optimal positions based on the application product's design. SMD antennas connected through a PCB transmission line can also be used together with NORA-B2x1. Long coax cables and transmission lines are lossy and will degrade output power and sensitivity because of this it is recommended not to place the module and antenna too far apart.

NORA-B2x6 modules, including an internal PCB trace antenna, offers a cost and size efficient alternative for application products. Hence, the module must be placed on the edge of the application PCB with the antenna facing outwards. When using an embedded antenna no enclosure of metal, or plastics with metal flakes, or metallic-based paint or lacquer can be used.

Certification compliance depends on the antenna integration. Designers who wish to leverage u-blox's certification grants must use one of the "antenna reference designs" provided in this document and select an antenna from the approved antenna section. Deviations from these guidelines often necessitate additional testing.

- According to FCC regulations, the transmission line, from the module antenna pin to the antenna or antenna connector on the host PCB, is considered part of the approved antenna design. Therefore, module integrators must either follow exactly one of the antenna reference designs used in the module's FCC type approval or certify their own designs.

3.2.1 RF transmission line design (NORA-B2x1)

An external antenna must be connected with an impedance matched RF transmission line and an RF connector. SMD antennas are connected with RF transmission line only.

RF transmission lines can be implemented by any of the alternatives below:

- Microstrip: track separated with dielectric material and coupled to a single ground plane.
- Coplanar microstrip: track separated with dielectric material and coupled to both the ground plane and side conductor.
- Stripline: track separated by dielectric material and sandwiched between two parallel ground planes.

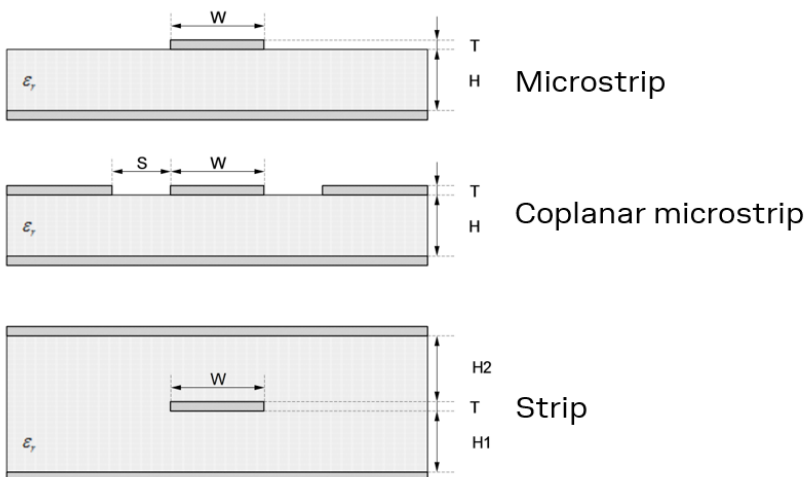


Figure 2: Transmission line trace design

Follow these recommendations to design a 50 Ω transmission line correctly:

- The designer should provide enough clearance from surrounding traces and ground in the same layer; in general, a trace to ground clearance of at least two times the trace width should be considered. The transmission line should also be "guarded" by ground plane area on each side.
- The characteristic impedance can be calculated as first iteration using tools provided by the layout software. It is advisable to ask the PCB manufacturer to provide the final values that are usually calculated using dedicated software and available stack-ups from production. It could also be possible to request an impedance coupon on panel's side to measure the real impedance of the traces.
- FR-4 dielectric material, although it has high losses at high frequencies, can be considered in RF designs provided that:

- RF trace length must be minimized to reduce dielectric losses.
- If traces longer than a few centimeters are needed, a coaxial cable with connector is recommended to reduce losses.
- Stack-up should allow for thick 50 Ω traces and at least 200 μm trace width is recommended to assure good impedance control over the PCB manufacturing process.
- FR-4 material exhibits poor thickness stability and gives less control of impedance over the trace length. Contact the PCB manufacturer for specific tolerance of controlled impedance traces.
- The transmission lines width and spacing to the GND must be uniform and routed as smoothly as possible: route RF lines in arcs (preferred) or 45° angles.
- Add GND stitching vias around transmission lines.
- Ensure solid metal connection of the adjacent metal layer on the PCB stack-up to main ground layer, providing enough vias on the adjacent metal layer.
- Route RF transmission lines far from any noise source, such as switching supplies, digital lines, and any sensitive circuit, to avoid crosstalk between RF traces and high impedance or analog signals.
- Avoid stubs on the transmission lines, any component on the transmission line should be placed with the connected pad over the trace. Also avoid any unnecessary components on RF traces.

3.2.2 Antenna design (NORA-B2x1)

NORA-B2x1 is suited for designs when an external antenna is needed due to mechanical integration or placement of the module. Consider the information in this section when selecting the antenna to use.

- External antennas such as those listed in the [Pre-approved antenna list](#):
 - External antennas don't imply physical restriction to the design of the PCB where the module is mounted.
 - The radiation performance mainly depends on the antennas. It is required to select antennas with optimal radiating performance in the operating bands.
 - RF cables should be carefully selected to achieve minimum insertion losses. Additional insertion loss is introduced by low-quality or long cable. Large insertion losses reduce radiation performance.
 - A high quality 50 Ω coaxial connector provides proper PCB-to-RF-cable transition.
- Integrated antennas such as patch-like antennas:
 - Internal integrated antennas imply physical restriction to the PCB design:

An integrated antenna excites RF currents on its counterpoise, so that the PCB ground plane of the device typically becomes part of the antenna. As the dimension of the antenna defines the minimum frequency that can be radiated, the ground plane can not be reduced to a size smaller than a quarter of the wavelength of the minimum frequency to be radiated. The orientation of the ground plane relative to the antenna element must also be considered.

$$\text{Frequency}=2.4 \text{ GHz} \rightarrow \text{Wavelength}=12.5 \text{ cm} \rightarrow \text{Quarter wavelength} = 3.125 \text{ cm}^1$$

Radiation performance depends on the complete product and antenna system design, including product mechanical design and usage. Antennas should be selected with optimal radiating performance in the operating bands according to the mechanical specifications of the PCB and the whole product.

¹ Wavelength referred to a signal propagating over the air.

Table 3 summarizes the requirements for the antenna RF interface:

Item	Requirements	Remarks
Impedance	50 Ω nominal characteristic impedance	The impedance of the antenna RF connection must match the 50 Ω impedance of the ANT pin.
Frequency Range	2400 – 2500 MHz 5150 – 5850 MHz	Wi-Fi and Bluetooth Wi-Fi
Return Loss	$S_{11} < -10$ dB (VSWR < 2:1) recommended $S_{11} < -6$ dB (VSWR < 3:1) acceptable	The Return loss (S) as the VSWR refers to the amount of reflected power, measuring how well the primary antenna RF connection matches the 50 Ω characteristic impedance of the ANT pin. The impedance of the antenna termination must match as much as possible the 50 Ω nominal impedance of the ANT pin over the operating frequency range, thus maximizing the amount of power transferred to the antenna.
Efficiency	> -1.5 dB (> 70%) recommended > -3.0 dB (> 50%) acceptable	Radiation efficiency is the ratio of the radiated power to the power delivered to the antenna input. The efficiency is a measure of how well an antenna receives or transmits.
Maximum Gain	Refer to the gain values specified in the Pre-approved antenna list .	The maximum antenna gain must not exceed the value specified in type approval documentation to comply with the radiation exposure limits specified by regulatory agencies.

Table 3: Summary of antenna interface (ANT) requirements for NORA-B2x1

Observe the following recommendations while selecting external or internal antennas:

- Select antennas that provide optimal return loss, based on the Voltage Standing Wave Ratio (VSWR) figure, over all the operating frequencies.
- Select antennas that provide an optimal efficiency figure over all the operating frequencies.
- Select antennas that have an appropriate gain, with combined measures of antenna directivity and efficiency, so that the electromagnetic field radiation intensity does not exceed the regulatory limits specified in some countries – such as those set by FCC in the United States.

3.2.2.1 RF connector design

If an external antenna is required, designers should consider using a proper RF connector. It is the responsibility of the designer to verify the compatibility between plugs and receptacles used in the design.

Table 4 suggests several RF connectors that designers can use to connect RF coaxial cables - based on the declaration of the respective manufacturers. Hirose U.FL-R-SMT RF receptacles (or similar parts) require suitable mated RF plugs from the same connector series. Due to wide usage of this connector, several manufacturers offer compatible equivalents.

Manufacturer	Series	Remarks
Hirose	U.FL® Ultra Small Surface Mount Coaxial Connector	Recommended
I-PEX	MHF® Micro Coaxial Connector	
Tyco	UMCC® Ultra-Miniature Coax Connector	
Amphenol RF	AMC® Amphenol Micro Coaxial	
Lighthouse Technologies, Inc.	IPX ultra micro-miniature RF connector	

Table 4: U.FL compatible connectors

Typically, the RF plug is available as a cable assembly. Different types of cable assembly are available; the end product designer should select the cable assembly best suited to the application. The key characteristics of the assembly are:

- RF plug type: select U.FL or equivalent
- Nominal impedance: 50 Ω
- Cable thickness: Typically, from 0.8 mm to 1.37 mm. Select thicker cables to minimize insertion loss.
- Cable length: Standard length is typically 100 mm or 200 mm; custom lengths may be available on request. Select shorter cables to minimize insertion loss.
- RF connector on the other side of the cable: For example, another U.FL (for board-to-board connection) or SMA (for panel mounting).

Note that SMT connectors are typically rated for a limited number of insertion cycles. Additionally, the RF coaxial cable may be relatively fragile compared to other types of cables. To increase application ruggedness, connect the U.FL connector to a more robust connector, such as an SMA fixed panel connector.

Figure 3 shows layout of pads for the U.FL connector. Consider especially the GND clearance under the signal pad.

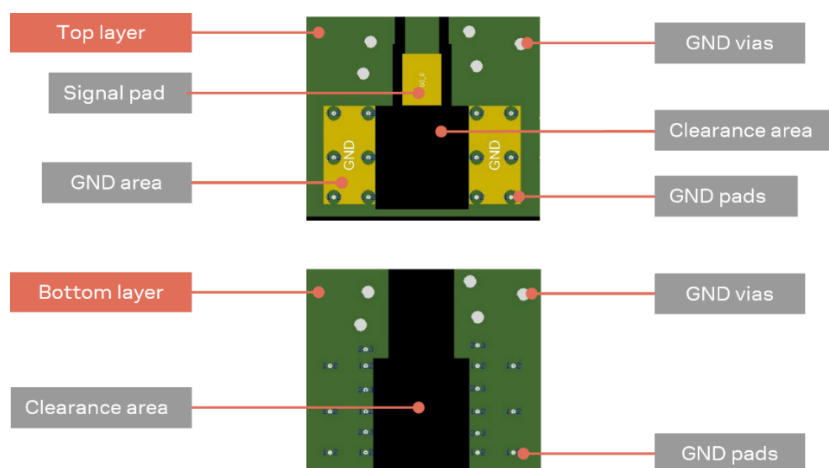


Figure 3: U.FL connector layout, top layer to the left and inner layer 1 to the right

To make it more difficult for end users to replace the antenna with higher gain versions that exceed the regulatory limits in some countries, it is now standard industry practice to use reverse polarity connectors (RP-SMA) on Wi-Fi and Bluetooth® end products.

For the proper layout of the connector, consider the following recommendations:

- Strictly follow the connector manufacturer's recommended layout:
 - SMA Pin-Through-Hole connectors require GND keep-out (that is, clearance, a void area) on all the layers around the central pin up to annular pads of the four GND posts.
 - U.FL. surface mounted connectors require no conductive traces (that is, clearance, a void area) in the area below the connector between the GND land pads.

If the RF pad of the connector is wider than the microstrip, remove the GND layer beneath the RF connector. This minimizes stray capacitance and maintains the RF line at 50 Ω . For instance, the active pad of the U.FL. connector must have a GND keep-out, which is a clearance or void area, on at least the first inner layer to reduce parasitic capacitance to ground.

3.2.2.2 Integrated antenna design

If integrated antennas are used, the transmission line is terminated by the integrated antennas themselves or by the antenna together with the connected coaxial cable and U.FL plug. Consider the following guidelines when designing the antenna:

- The antenna design process should start at the beginning of the whole product design process. Self-made PCBs and antenna assemblies are useful in estimating the overall efficiency and radiation path for the intended design.
- Use antennas designed by an antenna manufacturer to provide the best possible return loss (or VSWR).
- Provide a ground plane large enough according to the related integrated antenna requirements. The ground plane of the application PCB may be reduced to a minimum size that must be similar to one quarter of wavelength of the minimum frequency that has to be radiated. The overall antenna efficiency may benefit from larger ground planes.
- Proper placement of the antenna and its surrounding area is also critical for antenna performance. Avoid placing the antenna close to conductive or RF-absorbing parts, such as metal objects, ferrite sheets, and so on. These objects tend to absorb part of the radiated power, shift the resonant frequency of the antenna, or affect the antenna radiation pattern.
- Ensure that the installation and deployment of the antenna system, including PCB layout and matching circuitry, is done correctly. In this regard, it is recommended that you strictly follow the specific guidelines provided by the antenna manufacturer.
- Further to the custom PCB and product restrictions, antennas may require tuning/matching to comply with all applicable required certification schemes. It is strongly advised that you consult the antenna manufacturer for specific design-in guidelines and plan validation activities for the final prototypes, such as tuning, matching, and performance assessments. See also [Table 3](#).
- Avoid placing the antenna close to buses such as DDR or consider taking specific countermeasures like metal shields or ferrite sheets to reduce interference. Noise sources like hi-speed digital buses can affect the RF section.
- Give due consideration to the interaction between co-located RF systems like LTE sidebands on the 2.4 GHz band. Transmitted power can interact or disturb the performance of NORA-B2 modules.

3.2.3 On-board antenna design (NORA-B2x6)

If a plastic enclosure is used, it is possible to use NORA-B2x6 with the embedded antenna. For optimum operating performance, follow the instructions in this section.

- The module must be placed in the center of an edge of the host PCB.
- A large ground plane on the host PCB is a prerequisite for good antenna performance. It is advisable to have the ground plane extending at least 10 mm on the three non-edge sides of the module. See also [Figure 4](#).
- The host PCB must include a full GND plane underneath the entire module – with a ground cut out under the PCB trace antenna that agrees with the dimensions shown in .
- NORA-B2x6 has six extra GND pads under the antenna, which must be connected for good antenna performance. Detailed measurements of the footprint, including these extra GND pads, are given in the NORA-B2 series datasheet [\[2\]](#).
- Large parts or parts with a high physical profile that include metal must not be placed closer than 10 mm to the module antenna.
- At least 10 mm clearance between the antenna and the casing is recommended. If the clearance is less than 10 mm, the antenna performance can be adversely affected.
- The module must be placed so that the antenna faces outwards from the product, and the antenna must not be obstructed by any external items in close vicinity of the product.

- Keep a minimum clearance of 5 mm between the antenna and any casing. Also, keep at least 10 mm of free space around the metal antenna, including the area directly below it. If a metal enclosure is required, use NORA-B2x1 and an external antenna.
- It is beneficial to include a large solid ground plane on the host PCB with a good grounding on the module. The ground plane can have a minimum size of 24x30 mm, but over 50x50 mm are not recommended.

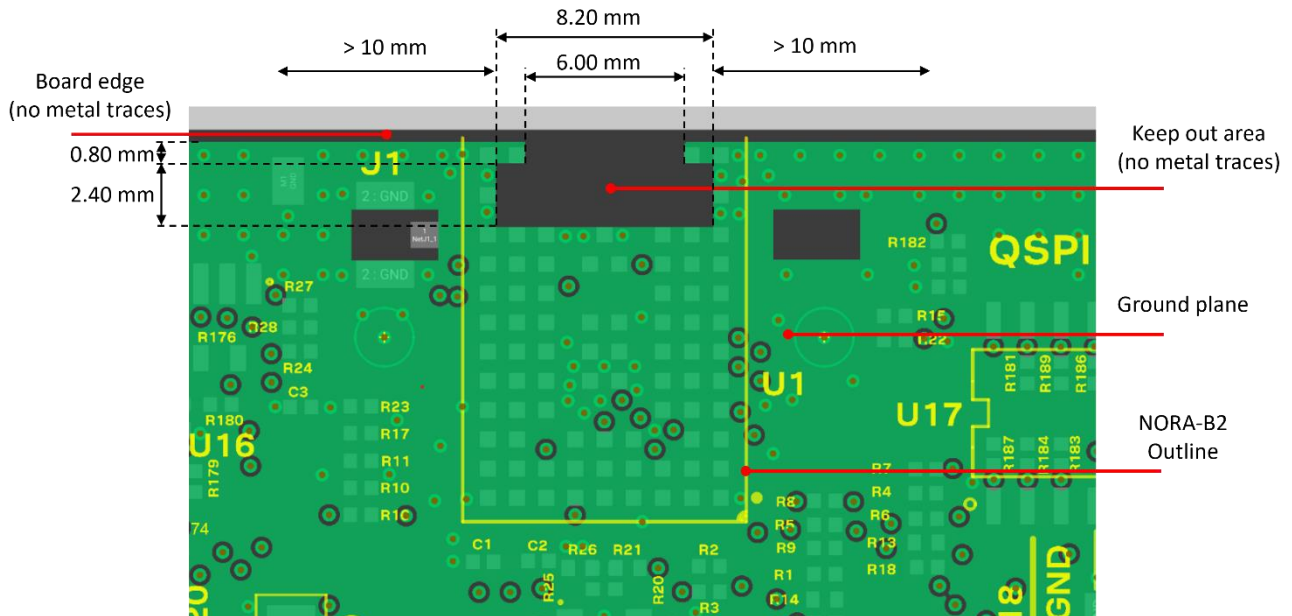


Figure 4: GND plane guard area enclosing NORA-B2x6

3.3 Data communication interfaces

3.3.1 Asynchronous serial interface (UART) design

The layout of the UART bus should be implemented so that noise injection and cross talk are avoided. It is advisable to use the hardware flow control with RTS/CTS to prevent temporary UART buffer overrun.

The flow control signals **RTS/CTS** are active low. Consequently, 0 (ON state = low level) allows the UART to transmit.

- **CTS** is an input. If the host sets this input to 0 (ON state = low level) the module can transmit.
- **RTS** is an output. The module sets the output to 0 (ON state = low level) when it is ready to receive transmission.

3.4 General high-speed layout guidelines

These guidelines describe the best schematic and layout practices for integrating the module on a host PCB. Designers should prioritize the layout of higher speed buses. Low frequency signals, other than those with high-impedance traces, are generally not layout critical.

- ⚠ Low frequency signals with high-impedance traces (such as signals driven by weak pull resistors) can be affected by crosstalk. For these high-impedance traces, a supplementary isolation of $4 \cdot W$ from other buses is recommended.

3.4.1 Considerations for schematic design and PCB floor-planning

- Verify which signal bus requires termination and add series resistor terminations to the schematics.
- Carefully consider the placement of the module with respect to the antenna position.
- Verify with PCB manufacturer allowable stack-ups and controlled impedance dimensioning.
- Verify that the power supply design and power sequence are compliant with the specification of NORA-B2 series module. See also the NORA-B2 data sheet [\[2\]](#).

3.4.2 Component placement

- Place accessory parts, like bypass capacitors, as close as possible to the module to improve filtering capability. Prioritize the placement of the smallest size capacitor close to module pads.
- Do not place components close to the antenna area. Follow the recommendations given by the antenna manufacturer to determine the distance of the antenna in relation to other parts of the system. Designers should also maximize the distance between the antenna and high-frequency busses, like DDRs and related components. Alternatively, consider an optional metal shield to reduce interference that might otherwise be picked up by the antenna and subsequently reduce module sensitivity.
- An optimized module placement allows better RF performance. For more information about the module placement and other antenna considerations, see also [Antenna requirements](#).

3.4.3 Layout and manufacturing

- Avoid stubs on high-speed signals. Test points or component pads should be placed over the PCB trace.
- Verify the recommended maximum signal skew for differential pairs and length matching of busses.
- Minimize the routing length; longer traces degrade signal performance. Ensure that the maximum allowable length for high-speed busses is not exceeded.
- Be sure to track your impedance matched traces. Consult early with your PCB manufacturer for proper stack-up definition.
- RF, analog, and digital sections should have dedicated and clearly separated areas on the board.
- No digital routing is allowed in the GND reference plane area of RF traces (**ANT** pin and antenna).
- Designers are strongly recommended to avoid digital routing beneath all layers of RF traces.
- Ground cuts or separation are not allowed under the module.
- As a first priority, minimize the length of the RF traces. Then, minimize bus length to reduce potential EMI issues related to the radiation of digital busses.
- All traces, including low speed or DC traces, must couple with a reference plane (GND or power). High-speed busses should be referenced to the ground plane. If designers need to change the ground reference, some capacitors should be added and an adequate number of GND vias must be included in the area of transition. This facilitates a low-impedance path between the two GND layers for the return current.
- Trace routing should maintain a distance that is greater than $3 \cdot W$ from the edge of the ground plane routing.
- Don't route power planes or traces in loops.
- Route the power traces through both the bypass capacitor and bulk capacitor before connecting to the module pin.
- Power planes should maintain a safe distance from the edge of the PCB. The distance must be sufficient to route a ground ring around the PCB, and the ground ring must then be stitched to other layers through vias.

3.5 Module footprint and paste mask

Module footprint including mechanical dimensions of NORA-B2 uCX series modules are shown in [2]. The proposed land pattern layout complements the pin layout of the module. Both Solder Mask Defined (SMD) and Non-Solder Mask Defined (NSMD) pins can be used with adherence to the following considerations:

- All pins should be Non-Solder Mask Defined (NSMD)
- To help with the dissipation of the heat generated by the module, GND pads must have good thermal bonding to PCB ground planes.

The suggested stencil layout for the NORA-B2 module should follow the copper pad layout, as shown in [2]. The assembly house should determine the thickness of the solder paste stencil based on the entire host PCB, typically 100-120 µm.

 The RF keep-out area is not required for NORA-B2x1.

3.6 ESD guidelines

The immunity of devices, integrating NORA-B2 modules, against Electro-Static Discharge (ESD) is part of the Electro-Magnetic Compatibility (EMC) conformity. This immunity is required for products bearing the CE marking, compliant with the R&TTE Directive (99/5/EC), the EMC Directive (89/336/EEC) and the Low Voltage Directive (73/23/EEC) issued by the Commission of the European Community.

Compliance with these directives implies conformity to the following European Norms for device ESD immunity: ESD testing standard *CENELEC EN 61000-4-2* and the radio equipment standards *ETSI EN 301 489-1*, *ETSI EN 301 489-7*, *ETSI EN 301 489-24*. The requirements of these standards are summarized in Table 5.

The ESD immunity test is performed at the enclosure port, defined by *ETSI EN 301 489-1* as the physical boundary through which the electromagnetic field radiates. If the device implements an integral antenna, the enclosure port is seen as all insulating and conductive surfaces housing the device. If the device implements a removable antenna, the antenna port can be separated from the enclosure port. The antenna port includes the antenna element and its interconnecting cable surfaces.

The applicability of ESD immunity test to the whole device depends on the device classification, as defined by *ETSI EN 301 489-1*. Applicability of ESD immunity test to the related device ports or the related interconnecting cables to auxiliary equipment, depends on the device accessible interfaces and manufacturer requirements, as defined by the *ETSI EN 301 489-1*.

Contact discharges are performed at conductive surfaces, while air discharges are performed at insulating surfaces. Indirect contact discharges are performed on the measurement setup horizontal and vertical coupling planes as defined in the *CENELEC EN 61000-4-2*.

 The terms “integral antenna”, “removable antenna”, “antenna port”, “device classification” used in the context of this guideline are defined in *ETSI EN 301 489-1*. The terms “contact discharge” and “air discharge” are defined in *CENELEC EN 61000 4-2*.

Table 5 describes the ESD immunity requirements as defined by *CENELEC EN 61000-4-2*, *ETSI EN 301 489-1*, *ETSI EN 301 489-7*, *ETSI EN 301 489-24*.

Parameter	Min.	Typical	Max.	Unit	Remarks
ESD immunity. All exposed surfaces of the radio equipment and ancillary equipment in a representative configuration			8*	kV	Indirect discharge according to IEC 61000-4-2

ESD sensitivity, tested for all pins except ANT
and RSVD pins #11, #15, #33

2.0* kV

Human body model according to JEDEC JS001

* Test pending

Table 5: Electro-Magnetic Compatibility ESD immunity requirements as defined by CENELEC EN 61000-4-2, ETSI EN 301 489-1, ETSI EN 301 489-7, ETSI EN 301 489-24

NORA-B2 is manufactured with consideration to the specific standards for minimizing the occurrence of ESD events. The highly automated process complies with the IEC61340-5-1 (STM5.2-1999 Class M1 devices) standard. Consequently, the designer should implement proper measures to protect from ESD events on any pin that may be exposed to the end user.

Compliance with standard protection level specified in the EN61000-4-2 can be achieved by including the ESD protection in parallel to the line, close to areas accessible by the end user.

3.7 Design-in checklists

3.7.1 Schematic checklist

- ☐ All module pins have been properly numbered and designated in the schematic (including thermal pins).
- ☐ Power supply design complies with the specification. See [Power](#) .
- ☐ The power sequence has been properly implemented.
- ☐ Adequate bypassing has been included in front of each power pin.
- ☐ Each signal group is consistent with its own power rail supply or proper signal translation has been provided.
- ☐ Configuration pins, like **GPIO_J9**, **SWITCH_1** and **SWITCH_2**, are properly set and can be controlled from host or be accessed through test points to allow boot into Bootloader.
- ☐ Unused pins are properly terminated.
- ☐ A pi-filter is provided in front of each antenna for final matching. See [Reference trace design](#) .
- ☐ Additional RF co-location filters have been considered in the design.

3.7.2 Layout checklist

- ☐ PCB stack-up and controlled impedance traces follow the recommendations given by the PCB manufacturer. See [Reference trace design](#) .
- ☐ All pins are properly connected, and the footprint follows u-blox pin design recommendations.
- ☐ Proper clearance has been provided between the RF and digital sections of the design.
- ☐ Proper isolation has been provided between antennas (RF co-location, diversity, or multi-antenna design).
- ☐ Bypass capacitors have been placed close to the module.
- ☐ Low impedance power path has been provided to the module.
- ☐ Controlled impedance traces have been properly implemented in the layout (both RF and digital) and the recommendations provided by the PCB manufacturer have been followed.
- ☐ 50 Ω RF traces and connectors follow the rules described in [RF connector design](#).
- ☐ Antenna design has been reviewed by the antenna manufacturer.
- ☐ Proper grounding has been provided to the module for the low impedance return path and heat sink.
- ☐ Reference plane skipping has been minimized for high frequency buses.
- ☐ All traces and planes are routed inside the area defined by the main ground plane.

4 Software

4.1 NORA-B2 u-connectXpress software

NORA-B2 u-connectXpress stand-alone modules are delivered with embedded u-connectXpress software.

Typical examples of the applications and use cases supported include:

- Connection of Bluetooth Low Energy (LE) sensors
- Communication over serial to Bluetooth LE
- Device configuration using Bluetooth LE connected smartphones

Using industry-standard AT commands, the u-connectXpress software provides an easy approach to Bluetooth Low Energy connectivity. Some typical examples describing the handshaking of AT commands and events between the host and module are shown in [Figure 5](#) and .

For further information about the features, capabilities, and use of u-connectXpress software, see the NORA-B2 u-connectXpress AT commands manual [\[12\]](#) and the NORA-B2 u-connectXpress user guide [\[13\]](#).

[Figure 5](#) shows the structure of the embedded NORA-B2 u-connectXpress software in relation to the customer application software.

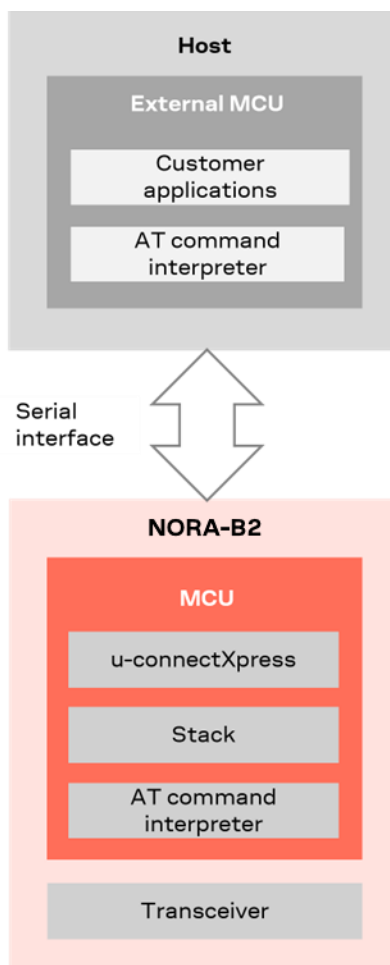


Figure 5: NORA-B2 u-connectXpress software structure

4.2 Data transfer

The module can use AT commands and events to send and receive data. See also [AT command mode](#). Alternatively, data can be seamlessly transferred over the serial interface to and from the selected remote device in [Transparent mode](#).

 A pre-requisite for configuring any of the modes described in this section is that the link and connection must already have been set up. For further details and examples, see the NORA-B2 u-connectXpress AT command manual [\[12\]](#) and NORA-B2 u-connectXpress user guide [\[13\]](#).

4.2.1 AT command mode

Using AT commands, choose either of the two data formats to send or receive data:

String – compatible only with printable ASCII characters (0x21-0x7E, 0xA1-0xFF)

Binary – accepts all ASCII characters (0x00 - 0xFF) and includes a three-byte header in the data packet.

4.2.1.1 Sending data

Using AT commands, send string or binary data using your preferred protocol, as described in [Table 6](#).

Command	Description
AT+USPSWS	SPS Write String
AT+USPSWB	SPS Write Binary

Table 6: AT commands for sending data

4.2.1.2 Receiving data

In addition to selecting between Binary or String format, there is another configuration option for the read operation:

Buffered receive mode (default)

Direct receive mode

Use the AT commands **AT+USPSRM** (SPS Receive Mode) and **AT+USORM** (Socket Receive Mode) to select the mode suitable for your application.

4.2.1.2.1 Buffered receive mode

In this mode, the module sends an event when data is received from a remote end point. The event includes the number of available bytes for the host to read.

Event / Unsolicited Response Code	Description
+UESPSDA	SPS Data Available event

Table 7: Unsolicited Response Codes for Buffered receive mode

When data is available it is up to the host to read out the number of bytes it can handle. It is not required to read all available bytes in one operation.

When receiving data in Buffered mode, the selection of String or Binary format is done by using the appropriate AT command for the read operation. Similar to the send operation, there are different commands for the protocol you use.

Command	Description
AT+USPSRS	SPS Read String
AT+USPSRB	SPS Read Binary

Table 8: AT commands for reading data in Buffered receive mode

4.2.1.2.2 Direct receive mode

In this mode, the module sends an event when data is received from a remote end point. Received data is included in the event. This makes the receive data transfer slightly faster compared to Buffered mode but requires that the host application is always ready to receive data.

Event / Unsolicited Response Code	Description
+UESPSDS	SPS Data String event
+UESPSDB	SPS Data Binary event

Table 9: Unsolicited Response Codes for direct receive mode

4.2.2 Transparent mode

To enter Transparent mode, use the AT command **AT+UTM**.

In this mode, the link and connection must be setup before entering the mode. Alternatively, the memory-persistent command variant (**AT+UTMP**) can be used to automatically set up links at startup.

In Transparent mode, data is sent to and from the module and seamlessly transferred on the serial interface to the selected remote device. Unmodified data is sent and received to the remote device. All ASCII characters (0x00 - 0xFF) can be sent and received.

Transparent data transfer mode offers the fastest communication, but it is limited to Point-to-Point links between two devices.

To exit Transparent mode, send an escape sequence (+++) to the module. For further information about the escape sequence settings, see **AT+UTMES** in the u-connectXpress AT command manual for NORA-B2 [12].

4.3 Software update

NORA-B2 u-connectXpress software includes a bootloader for flashing the module over the UART interface. The file download uses standard XMODEM protocol. You update the software using the u-blox s-center 2 [13] or using third-party Terminal software like TeraTerm.

u-connectXpress software can be downloaded at speeds of up to 3 Mbps over the UART interface. The XMODEM-1K mode is recommended for maximum download speed.

 Currently only 1 Mbps second update rate is supported.

 Always use the latest software version to leverage new functionality in your application and benefit from bug fixes and security improvements. Download the latest software version at <http://www.u-blox.com> and [NORA-B2 series](#) product page.

Use s-center 2 [13] or third-party Terminal software like Tera Term to update the software.

4.3.1 Updating with s-center2

s-center 2 [13] client software provides a convenient tool with which to configure u-blox standalone modules. It runs on PCs running Windows 10 or later and is available for download here [13].

To flash the module using s-center 2:

1. Start **s-center 2**
2. Select **your workspace** and **your device** like **NORA-B2**
3. Click on **Configure** and select the software binary file.
4. Click on **Start** to begin the software update.

4.3.2 Updating with Terminal

It is possible to start the XMODEM protocol used for file transfer with an AT command or using the bootloader.

Updating using AT command

1. Connect to the module using Tera Term, for example, and set the port to 115 200 baud rate, 8-bit data without parity, 1 stop bit, and no flow control.
2. Enter the AT command **AT+USYFWU=0,115200**. The module responds with **OK** and enters the bootloader.
3. When the bootloader displays "> cccc..." the module is ready to receive the software binary file.
4. Send the file using XMODEM protocol.
5. The module restarts with **+STARTUP** when the file transfer is complete.

Updating using the bootloader

1. Enter the bootloader by either:
 - a) Entering AT command **e**
 - b) Setting GPIO pins, **SWITCH_1** and **SWITCH_2**, low during power up or module reset. The bootloader prompt ">" is displayed in the Terminal when the bootloader mode has started, as shown in [Figure 6](#). The bootloader times out after 10 seconds if no command is sent.
2. Enter the command **"x"** to start XMODEM and set the bootloader in file transfer mode.
3. When the bootloader displays "cccc..." the module is ready to receive the software binary file.
4. Send the file using XMODEM protocol.
5. An OK response indicates a successful file transfer.
6. Enter command **"q"** to restart the module.

Figure 6 shows a typical software download session using XMODEM.

```
NORA-B26 bootloader: 1.0.0-001
u-blox
> ?
?
r <baud_rate> [ <flowctrl>]]      Help
q                                  Set baud rate and flow control on/off
x                                  SoC reset
v                                  Start Xmodem Rx
OK                                 Get version information
> x
CCCCCCCCCCCCC                     // Terminal sends the file using XMODEM protocol
OK
> q
+STARTUP
```

Figure 6: Software download using XMODEM

4.4 RF output power

The output power is by default configured to the maximum value allowed by regulatory approvals.

It is possible to lower output power using AT commands.

4.5 Bluetooth device addresses

NORA-B2 series modules are assigned a default MAC address. The MAC address is encoded in the Data Matrix on the label. For data matrix details, see the NORA-B2 datasheet [2] and product labelling requirements for each region. See [Regulatory compliance](#).

The address can be read using AT command (**AT+USYLA=0**).

It is also possible to change Address by adding the address to the command, for example:

AT+USYLA=0,112233445566

5 Handling and soldering

⚠ NORA-B2 series modules are Electrostatic Sensitive Devices that demand the observance of special handling precautions against static damage. Failure to observe these precautions can result in severe damage to the product.



5.1 ESD handling precautions

As the risk of electrostatic discharge in the RF transceivers and patch antennas of the module is of particular concern, standard ESD safety practices are prerequisite. See also [Figure 7](#).

Consider also:

- When connecting test equipment or any other electronics to the module (as a standalone or PCB-mounted device), the first point of contact must always be to local GND.
- Before mounting an antenna patch, connect the device to the ground.
- When handling the RF pin, don't touch any charged capacitors. Be especially careful when handling materials like patch antennas (~10 pF), coaxial cables (~50-80 pF/m), soldering irons, or any other materials that can develop charges.
- To prevent electrostatic discharge through the RF input, don't touch any exposed antenna area. If there is any risk of the exposed antenna being touched in an unprotected ESD work area, be sure to implement proper ESD protection measures in the design.
- When soldering RF connectors and patch antennas to the RF pin on the receiver, be sure to use an ESD-safe soldering iron (tip).

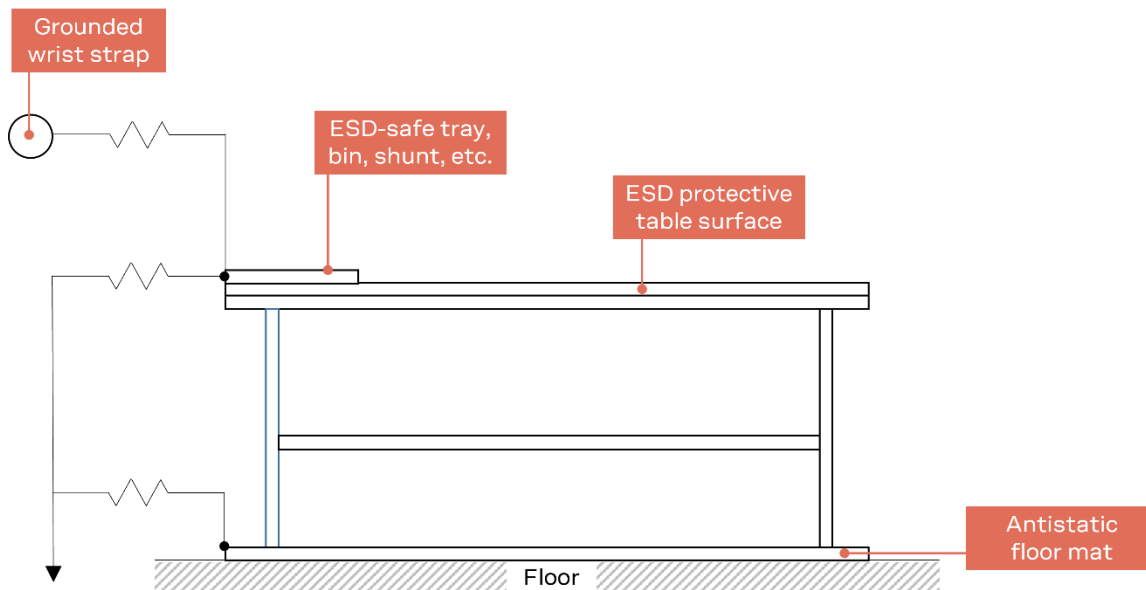


Figure 7: Standard workstation setup for safe handling of ESD-sensitive devices

5.2 Packaging, shipping, storage, and moisture preconditioning

For information pertaining to reels, tapes or trays, moisture sensitivity levels (MSL), shipment and storage, as well as drying for preconditioning, refer to the NORA-B2 uCX series data sheet [\[2\]](#) and Packaging information reference guide [\[1\]](#).

5.3 Reflow soldering process

NORA-B2 uCX series modules are surface mounted devices supplied in a Land Grid Array (LGA) package with gold-plated solder lands. The modules are manufactured in a lead-free process with lead-free soldering paste.

The thickness of solder resist between the host PCB top side and the bottom side of the NORA-B2 uCX series module must be considered for the soldering process.

NORA-B2 modules are compatible with the industrial reflow profile for common SAC type RoHS solders. No-clean soldering paste is strongly recommended. The reflow profile is dependent on the thermal mass over the entire area of the fully populated host PCB, the heat transfer efficiency of the oven, and the type of solder paste that is used. The optimal soldering profile that is used must be trimmed for each case depending on the specific soldering process and PCB layout.

The target parameter values shown in [Table 10](#) and [Figure 8](#) are only general guidelines for a Pb-free process. The values given are tentative and subject to change. For further information, see also the JEDEC J-STD-020C standard [\[3\]](#).

Process parameter		Unit	Target
Pre-heat	Ramp up rate to T_{SMIN}	K/s	3
	T_{SMIN}	°C	150
	T_{SMAX}	°C	200
	t_s (from +25 °C)	s	150
	t_s (Pre-heat)	s	60 to 120
Peak	T_L	°C	217
	t_L (time above T_L)	s	40 to 60
	T_P (absolute max)	°C	245
Cooling	Ramp-down from T_L	K/s	4
	Allowed soldering cycles	-	2

Table 10: Recommended reflow profile

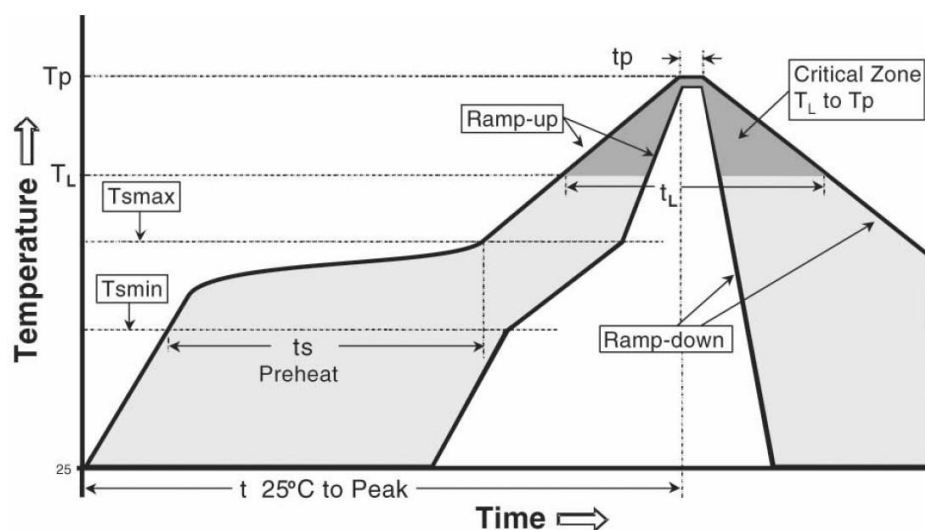


Figure 8: Reflow profile

Lower value of T_P and slower ramp down rate (2–3 °C/sec) is preferred.

5.3.1 Repeated reflow soldering

For application boards with components on both sides, a two-reflow process may be required. In such cases, NORA-B2 can be mounted in both reflow cycles. To reduce the risk of detachment due to its relatively higher weight compared to other components on the board, it is advisable to place the module on the side of the board that undergoes the final cycle. This reduces the risk of detachment due to its relatively higher weight compared to other components.

Mounting the module in an upside-down position (with the module on the underside of the board during reflow) is not recommended, as this increases the likelihood of detachment.

-  u-blox does not provide warranty coverage for damages to NORA-B2 modules caused by performing more than two total reflow soldering processes (one for mounting the module and one for mounting other components).

5.3.2 Cleaning

Cleaning the modules is not recommended. Residues underneath the modules cannot be easily removed with a washing process.

- Cleaning with water will lead to capillary effects where water is absorbed in the gap between the baseboard and the module. The combination of residues of soldering flux and encapsulated water leads to short circuits or resistor-like interconnections between neighboring pins. Water will also damage the sticker and the text produced by the ink-jet printer.
- Cleaning with alcohol or other organic solvents can result in soldering flux residues flooding into the housing, areas that are not accessible for post-wash inspections. The solvent will also damage the label and the ink-jet printed text.
- Ultrasonic cleaning will permanently damage the module and the crystal oscillators in particular.

For best results use a “no-clean” soldering paste and circumvent the need for a cleaning stage after the soldering process.

5.3.3 Other notes

- Only a single-reflow soldering process³ is allowed for boards with a module populated on it.
- Boards with combined through-hole technology (THT) components and surface-mount technology (SMT) devices may require wave soldering to solder the THT components. Only a single wave-soldering process is allowed for boards populated with the modules. Miniature Wave Selective Solder processes are preferred over traditional wave soldering processes.
- Hand-soldering is not recommended.
- Rework is not recommended.
- Conformal coating can affect the performance of the module, which means that it is important to prevent the liquid from flowing into the module. The RF shields don't provide protection for the module from coating liquids with low viscosity; therefore, care is required while applying the coating. Conformal Coating of the module will void the warranty.
- Grounding metal covers: Attempts to improve grounding by soldering ground cables, wick, or other forms of metal strips directly onto the EMI covers is done so at the customer's own risk and will void the module warranty. The numerous ground pins are adequate to provide optimal immunity to interferences.
- The modules contain components which are sensitive to Ultrasonic Waves. Use of any Ultrasonic Processes (cleaning, welding, etc.) may damage the module. The use of ultrasonic processes during the integration of the module into an end product will void the warranty.

³ Two reflow soldering processes are planned to be supported.

6 Regulatory compliance

This chapter describes the current approval status of certification in each country and the regulatory requirements that must be met when using NORA-B2 modules in an end product.

-  Some approvals for NORA-B2 uCX series modules are currently pending. For further information about the current approval status, see Qualifications and approvals in the NORA-B2 data sheet.

6.1 General requirements

NORA-B2 uCX series modules are designed to comply with the regulatory demands of Federal Communications Commission (FCC), Innovation, Science and Economic Development Canada (ISED) and the CE mark. This chapter contains instructions on the process needed for an integrator when including the NORA-B2 module into an end-product.

- Any deviation from the process described may cause the NORA-B2 uCX series modules not to comply with the regulatory authorizations of the module and thus void the user's authority to operate the equipment.
- Any changes to hardware, hosts or co-location configuration may require new radiated emission and SAR evaluation and/or testing.
- The regulatory compliance of NORA-B2 does not exempt the end-product from being evaluated against applicable regulatory demands; for example, FCC Part 15B criteria for unintentional radiators.
- The end-product manufacturer must follow all the engineering and operating guidelines as specified by the grantee (u-blox).
- NORA-B2 is for OEM integrators only.
- Only authorized antenna(s) may be used. For the list of authorized antennas, see the [Pre-approved antennas](#).
- In the end-product, the NORA-B2 module must be installed in such a way that only authorized antennas can be used.
- The end-product must use the specified antenna reference design as described in [Error! Reference source not found.](#) and [Reference trace design](#) . A custom trace design can be approved and submitted through a C2PC. See [Adding a new antenna for authorization](#).
- Any notification to the end user about how to install or remove the integrated radio module is NOT allowed.
- Electromagnetic interference compatibility (EMI / EMC) and spurious emissions tests are required for end-products targeted for most world regions.
- Region codes must be properly set to comply with regulatory RF output power requirements.

-  If these conditions can't be met or any of the operating instructions are violated, the u-blox regulatory authorization will be considered invalid. Under these circumstances, the integrator is responsible for re-evaluating the end-product including the NORA-B2 module. The integrator is then also responsible for obtaining their own regulatory authorization, or u-blox may be able to support updates of the u-blox regulatory authorization.

6.2 European Union (CE)

For information about the regulatory compliance of NORA-B2 uCX series modules against requirements and provisions in the European Union, see also the NORA-B2 Declaration of Conformity.

6.2.1 CE end-product regulatory compliance

6.2.1.1 Safety standard

In order to fulfil the safety standard EN 62368-1, the NORA-B2 module must be supplied by an external power supply classified ES1, PS1 according to EN 62368-1.

6.2.2 ETSI Equipment classes

In accordance with Article 1 of Commission Decision 2000/299/EC¹⁰, NORA-B2 is defined as either Class-1 or Class-2 radio equipment, the end-product integrating NORA-B2 inherits the equipment class of the module.

 Guidance on end product marking, according to the RED, can be found at: <http://ec.europa.eu/>

6.2.3 Radio Equipment Directive (RED) 2014/53/EU

NORA-B2 series modules comply with the essential requirements and other relevant provisions of Radio Equipment Directive (RED) 2014/53/EU.

6.2.4 Compliance with the RoHS directive

NORA-B2 series modules comply with the Directive 2011/65/EU (EU RoHS 2) and its amendment Directive (EU) 2015/863 (EU RoHS 3).

6.2.5 UK Conformity Assessed (UKCA)

 The United Kingdom is made up of the Great Britain (including England, Scotland, and Wales) and the Northern Ireland. Northern Ireland continues to accept the CE marking. The following notice is applicable to Great Britain only.

NORA-B2 series modules have been evaluated against the essential requirements of the Radio Equipment Regulations 2017 (SI 2017 No. 1206, as amended by SI 2019 No. 696).

For guidance about using the UKCA marking: <https://www.gov.uk/guidance/using-the-ukca-marking>

¹⁰ 2000/299/EC: Commission Decision of 6 April 2000 establishing the initial classification of radio equipment and telecommunications terminal equipment and associated identifiers.

6.3 US / Canada (FCC / ISED)

u-blox represents that the modular transmitter fulfills the FCC/ISED regulations when operating in authorized modes on any host-product given that the integrator follows the instructions as described in this document. Accordingly, the host-product manufacturer acknowledges that all host-products referring to the FCC ID or ISED certification number of the modular transmitter and placed on the market by the host-product manufacturer need to fulfil all of the requirements mentioned below. Non-compliance with these requirements may result in revocation of the FCC approval and removal of the host products from the market.

 The modular transmitter approval of NORA-B2, or any other radio module, does not exempt the end product from being evaluated against applicable regulatory demands.

The evaluation of the end product shall be performed with the NORA-B2 module installed and operating in a way that reflects the intended end product use case. The upper frequency measurement range of the end product evaluation is the 5th harmonic of 2.4 GHz as described in KDB 996369 D04.

The following requirements apply to all products that integrate a radio module:

- Subpart B - UNINTENTIONAL RADIATORS
To verify that the composite device of host and module comply with the requirements of FCC part 15B, the integrator shall perform sufficient measurements using ANSI 63.4-2014.
- Subpart C - INTENTIONAL RADIATORS
It is required that the integrator carries out sufficient verification measurements using ANSI 63.10-2013 to validate that the fundamental and out of band emissions of the transmitter part of the composite device complies with the requirements of FCC part 15C.

When the items listed above are fulfilled, the end product manufacturer can use the authorization procedures mentioned in Table 1 of 47 CFR Part 15.101, before marketing the end product. This means the customer has to either market the end product under a Suppliers Declaration of Conformity (SDoC) or to certify the product using an accredited test lab.

The description is a subset of the information found in applicable publications of FCC Office of Engineering and Technology (OET) Knowledge Database (KDB). We recommend the integrator read the complete document of the referenced OET KDB's.

- KDB 178919 D01 Permissive Change Policy
- KDB 447498 D01 General RF Exposure Guidance
- KDB 784748 D01 Labelling Part 15 18 Guidelines
- KDB 996369 D01 Module certification Guide
- KDB 996369 D02 Module Q&A
- KDB 996369 D04 Module Integration Guide

6.3.1 United States compliance statement (FCC)

NORA-B2 uCX series modules have modular approval and comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

7. This device may not cause harmful interference, and
8. This device must accept any interference received, including interference that may cause undesired operation.

 Any changes or modifications NOT explicitly APPROVED by u-blox could cause the NORA-B2 uCX series module to cease to comply with FCC rules part 15 thus void the user's authority to operate the equipment.

The internal / external antenna(s) used for this module must provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

shows the FCC IDs allocated to NORA-B2 uCX series modules.

Model	FCC ID
NORA-B261	XPYNORAB2
NORA-B266	XPYNORAB2
NORA-B271	XPYNORAB2
NORA-B276	XPYNORAB2
NORA-B281	XPYNORAB2
NORA-B286	XPYNORAB2

Table 11: FCC IDs for different variants of NORA-B2 uCX series modules

 For FCC end-product labeling requirements, see [End product labeling requirements](#).

6.3.2 Canada compliance statement (ISED)

NORA-B2 uCX series modules are certified for use in accordance with Innovation, Science and Economic Development Canada (ISED) Radio Standards Specification (RSS) RSS-247 Issue 2 and RSS-Gen. shows the ISED certification IDs allocated to NORA-B2 uCX series modules.

Model	ISED certification ID
NORA-B261	8595A-NORAB2
NORA-B266	8595A-NORAB2
NORA-B271	8595A-NORAB2
NORA-B276	8595A-NORAB2
NORA-B281	8595A-NORAB2
NORA-B286	8595A-NORAB2

Table 12: ISED IDs for different variants of NORA-B2 uCX series modules

NORA-B2 complies with ISED (Innovation, Science and Economic Development Canada)¹¹ license-exempt RSS(s). Operation is subject to the following two conditions:

9. This device may not cause interference, and
10. This device must accept any interference, including interference that may cause undesired operation of the device.

 Any notification to the end user of installation or removal instructions about the integrated radio module is NOT allowed. Unauthorized modification could void authority to use this equipment.

This equipment complies with ISED RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

This radio transmitter IC: 8595A-NORAB2 has been approved by ISED to operate with the antenna types listed in [Pre-approved antennas](#) with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

¹¹ Formerly known as IC (Industry Canada).

Le présent appareil est conforme aux CNR d'ISED applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Cet émetteur radio, IC: 8595A-NORAB2 été approuvé par ISED pour fonctionner avec les types d'antenne énumérés ci-dessous avec le gain maximum autorisé et l'impédance nécessaire pour chaque type d'antenne indiqué. Les types d'antennes non inclus dans la liste des antennes approuvées et ayant un gain supérieur au gain maximum indiqué pour ce type sont strictement interdits pour une utilisation avec cet appareil.

For ISED end-product labeling requirements, see [End product labeling requirements](#).

6.3.3 RF exposure statement

6.3.3.1 ISED compliance

All transmitters regulated by ISED must comply with RF exposure requirements listed in RSS-102 - Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands). This module is approved for installation into mobile and/or portable host platforms and must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with Innovation, Science and Economic Development Canada (ISED) multi-transmitter guidelines. End-users must be provided with transmitter operating conditions to satisfy RF Exposure compliance.

To fulfil the requirements of the SAR evaluation Exemption limits defined in RSS-102 issue 5, an OEM integrator implementing NORA-B2 series modules into an end-product must ensure a separation distance of **XX mm** between the user (or bystander) and the antenna (or radiating element).

6.3.3.2 FCC compliance

All transmitters regulated by FCC must comply with RF exposure requirements. [KDB 447498 General RF Exposure Guidance](#) provides guidance in determining whether proposed or existing transmitting facilities, operations or devices comply with limits for human exposure to Radio Frequency (RF) fields adopted by the Federal Communications Commission (FCC).

NORA-B2 modules are approved for installation into mobile and/or portable host platforms and must not be co-located or operating in conjunction with any other antenna or transmitter – except in accordance with FCC multi-transmitter guidelines. To ensure that the max output power of NORA-B2 series modules remains below the SAR Test Exclusion Threshold defined in KDB 447498 D01v06, an OEM integrator integrating NORA-B2 series modules into an end-product must ensure a separation distance of **XX** mm between the user (or bystander) and the antenna (or radiating element).

6.3.4 Referring to the u-blox FCC/ISED certification ID

If the [General requirements](#), [US / Canada \(FCC / ISED\)](#) requirements and [Antenna requirements](#) all are met, the u-blox modular FCC/ISED regulatory authorization is valid and the end-product may refer to the u-blox FCC ID and ISED certification number. u-blox may be able to support updates to the u-blox regulatory authorization by adding new antennas to the u-blox authorization for example.

6.3.5 Obtaining own FCC/ISED certification ID

Integrators who do not want to refer to the u-blox FCC/ISED certification ID, or who do not fulfil all requirements to do so may instead obtain their own certification. With their own certification, the integrator has full control of the grant to make changes.

Integrators who want to base their own certification on the u-blox certification can do so via a process called “Change in ID” (FCC) / “Multiple listing” (ISED). With this, the integrator becomes the grantee of a copy of the u-blox FCC/ISED certification. u-blox will support with an approval letter that shall be filed as a Cover Letter exhibit with the application.

 It is the responsibility of the integrator to comply with any upcoming regulatory requirements.

6.3.6 Antenna requirements

In addition to the general requirement to use only authorized antennas, the u-blox grant also requires a separation distance of at least 20 cm from the antenna(s) to all persons. The antenna(s) must not be co-located with any other antenna or transmitter (simultaneous transmission) as well. If this cannot be met, a Permissive Change as described in [Adding a new antenna for authorization](#) must be made to the grant.

6.3.6.1 Separation distance

If the required separation distance of 20 cm cannot be fulfilled, a SAR evaluation must be performed. This consists of additional calculations and/or measurements. The result must be added to the grant file as a Class II Permissive Change.

6.3.6.2 Co-location (simultaneous transmission)

If the module is to be co-located with another transmitter, additional measurements for simultaneous transmission are required. The results must be added to the grant file as a Class II Permissive Change.

6.3.6.3 Adding a new antenna for authorization

If the authorized antennas and/or antenna trace design cannot be used, the new antenna and/or antenna trace designs must be added to the grant file. This is done by a Class I Permissive Change or a Class II Permissive Change, depending on the specific antenna and antenna trace design.

- Antennas of the same type and with less or same gain as those included in the list of [Pre-approved antennas](#) can be added under a Class I Permissive Change.
- Antenna trace designs deviating from the u-blox reference design and new antenna types are added under Class II Permissive Change.

 Integrators intending to refer to the u-blox FCC ID / ISED certification ID must [contact](#) their local support team to discuss the Permissive Change Process. Class II Permissive Changes are subject to NRE costs.

6.3.7 End product labeling requirements

For an end-product using the NORA-B2, there must be a label containing, at least, the following information:

This device contains
FCC ID: XPYNORAB2
IC: 8595A-NORAB2

“XPY” represents the FCC “Grantee Code” for u-blox AG, this code may consist of Arabic numerals, capital letters, or other characters, the format for this code will be specified by the Commission's Office of Engineering and Technology¹². “8595A” is the Company Number for u-blox AG registered at ISED. “NORA-B2” is the Unique Product Number decided by the grant owner.

The label must be affixed to an exterior surface of the end product such that it will be visible upon inspection in compliance with the modular labeling requirements of OET KDB 784748. The host user

¹² 47 CFR 2.926

manual must also contain clear instructions on how end users can find and/or access the FCC ID of the end product.

The label on the NORA-B2 module containing the original FCC ID acquired by u-blox can be replaced with a new label stating the end-product's FCC/ISED ID in compliance with the modular labeling requirements of OET KDB 784748.

FCC end product labeling

In accordance with 47 CFR § 15.19, the end product shall bear the following statement in a conspicuous location on the device:

Contains FCC ID: XPYNORAB2

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

3. This device may not cause harmful interference, and
4. This device must accept any interference received, including interference that may cause undesired operation.

The following statement must be included in the end-user manual or guide:

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

ISED end product labeling

The end product shall bear the following statement in both English and French in a conspicuous location on the device:

Contains transmitter module IC: 8595A-NORAB2

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Contient le module émetteur IC: 8595A-NORAB2

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

3. L'appareil ne doit pas produire de brouillage;
4. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

When the device is so small or for such use that it is not practicable to place the statements above on it, the information shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC/ISED ID label must be displayed on the device as described above.

In cases where the final product will be installed in locations where the end-consumer is unable to see the FCC/ISED ID and/or this statement, the FCC/ISED ID and the statement shall also be included in the end-product manual.

6.4 Taiwan (NCC)

6.4.1 Taiwan NCC Warning Statement

取得審驗證明之低功率射頻器材，非經核准，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

低功率射頻器材之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前述合法通信，指依電信管理法規定作業之無線電通信。低功率射頻器材須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

系統廠商應於平台上標示「本產品內含射頻模組：XXXyyyLPDzzzz-x」字樣

Statement translation:

- Without permission granted by the NCC, any company, enterprise, or user is not allowed to change frequency, enhance transmitting power, or alter original characteristic as well as performance to an approved low power radio-frequency device.
- The low power radio-frequency devices shall not influence aircraft security and interfere legal communications; If any interference is found or suspected, the user shall immediately cease operating the equipment until the interference has been prevented. The said legal communications means radio communications is operated in compliance with the Telecommunications Act. The low power radio-frequency devices must be susceptible with the interference from legal communications or ISM radio wave radiated devices.

應避免影響附近雷達系統之操作。

Statement translation:

The operations near the radar system shall not be influenced.

6.4.2 Labeling requirements for end product

End products based on NORA-B2 uCX series modules and targeted for distribution in Taiwan must carry labels with the textual and graphical elements shown in [Figure 9](#).

Contains Transmitter Module

內含發射器模組:  CCAK25Y10070T8

Figure 9: Labeling of end-products containing NORA-B2

Other wording can be used, but only if the meaning of original messaging remains unchanged. The label must be physically attached to the product and made clearly visible for inspection.

6.5 Pre-approved antennas

This section describes the external antennas that are pre-approved for use together with NORA-B2 series modules. The currently limited list of antennas is to be extended once the scope of the module certification is decided.



Note that not all antennas and accessories are approved for use in all markets/regions.

6.5.1 Antenna accessories

Name	U.FL to SMA adapter cable	
Connector	U.FL and SMA jack (outer thread and pin receptacle)	
Impedance	50 Ω	
Minimum cable loss	0.5 dB, The cable loss must be above the minimum cable loss to meet the regulatory requirements. Minimum cable length 100 mm.	
Comment	The SMA connector can be mounted in a panel. For information describing how to integrate the U.FL connector,	
Approval	RED, UKCA, MIC, KCC and RCM	

Name	U.FL to Reverse Polarity SMA adapter cable	
Connector	U.FL and Reverse Polarity SMA jack (outer thread and pin)	
Impedance	50 Ω	
Minimum cable loss	0.5 dB. The cable loss must be above the minimum cable loss to meet the regulatory requirements. Minimum cable length 100 mm.	
Comment	The Reverse Polarity SMA connector can be mounted in a panel. This reference design must be followed to comply with the FCC/IC modular approvals.	
Approval	FCC, ISSED, RED, UKCA, MIC, KCC, RCM and NCC	

6.5.2 Antennas

NORA-B266, NORA-B276, NORA-B286		
Applicable module	NORA-B2x6	
Manufacturer	u-blox (Abracon license)	
Gain	+3 dBi	
Impedance	N/A	
Size	Integrated into module	
Type	PCB trace	
Comment	PCB antenna on NORA-B206, NORA-B216, and NORA-B226. This antenna is not suitable for mounting inside a metal enclosure.	
Approval	FCC, ISSED, RED, UKCA, MIC, KCC, RCM and NCC	

PN PRO-EX-296

Manufacturer	Abracon
Gain	+3.0 dBi
Impedance	50 Ω
Size	Ø 12.0 x 28.0 mm
Type	Monopole
Cable length	100 mm
Connector	U.FL. connector
Comment	This antenna requires to be mounted on a metal ground plane for best performance. To be mounted with a U.FL connector. For information on how to integrate the U.FL connector, see Reference trace design . This reference design must be followed to comply with the FCC/IC modular approvals.
Approval	FCC, ISED, RED, UKCA, MIC, KCC, RCM and NCC


Wi-Fi / Bluetooth / Bluetooth LE board antenna, PN PRO-IS-237

Manufacturer	Abracon
Gain	+3.0 dBi
Impedance	50 Ω
Size	27 x 12 mm (triangular)
Type	Patch
Cable length	100 mm
Connector	U.FL. connector
Comment	Should be attached to a plastic enclosure or part for best performance. To be mounted with a U.FL connector. For information on how to integrate the U.FL connector, see Reference trace design . This reference design must be followed to comply with the FCC/IC modular approvals.
Approval	FCC, ISED, RED, UKCA, MIC, KCC, RCM and NCC


PRO-IS-299

Manufacturer	Abracon
Gain	+2.5 dBi
Impedance	50 Ω
Size	27 x 12 mm (triangular)
Type	Patch
Cable length	100 mm
Connector	U.FL. connector
Comment	Should be attached to a plastic enclosure or part for best performance. Antenna to be mounted with a U.FL connector. For information on how to integrate the U.FL connector, see Reference trace design . This reference design must be followed to comply with the FCC/IC modular approvals.
Approval	FCC, ISED, RED, UKCA, MIC, KCC, RCM and NCC



7 Product testing

7.1 u-blox in-line production testing

As part of our focus on high quality products, u-blox maintain stringent quality controls throughout the production process. This means that all units in our manufacturing facilities are fully tested and that any identified defects are carefully analyzed to improve future production quality.

The Automatic test equipment (ATE) deployed in u-blox production lines logs all production and measurement data – from which a detailed test report for each unit can be generated. [Figure 10](#) shows the ATE typically used during u-blox production.

u-blox in-line production testing includes:

- Digital self-tests (firmware download, MAC address programming)
- Measurement of voltages and currents
- Functional tests (host interface communication)
- Digital I/O tests
- Measurement and calibration of RF characteristics in all supported bands, including RSSI calibration, frequency tuning of reference clock, calibration of transmitter power levels, etc.
- Verification of Wi-Fi and Bluetooth RF characteristics after calibration, like modulation accuracy, power levels, and spectrum, are checked to ensure that all characteristics are within tolerance when the calibration parameters are applied.



Figure 10: Automatic test equipment for module test

7.2 OEM manufacturer production test

As all u-blox products undergo thorough in-series production testing prior to delivery, OEM manufacturers don't need to repeat any firmware tests or measurements that might otherwise be necessary to confirm RF performance. Testing over analog and digital interfaces is also unnecessary during an OEM production test.

OEM manufacturer testing should ideally focus on:

- Module assembly on the device; it should be verified that:
 - Soldering and handling process did not damage the module components
 - All module pins are well soldered on the application board
 - There are no short circuits between pins
- Component assembly on the device; it should be verified that:
 - Communication with host controller can be established
 - The interfaces between module and device are working
 - Overall RF performance test of the device including antenna

In addition to this testing, OEMs can also perform other dedicated tests to check the device. For example, the measurement of module current consumption in a specified operating state can identify a short circuit if the test result deviates that from that taken against a "Golden Device".

The standard operational module firmware and test software on the host can be used to perform functional tests (communication with the host controller, check interfaces) and perform basic RF performance testing. Special manufacturing firmware can also be used to perform more advanced RF performance tests.

7.3 "Go/No go" tests for integrated devices

A "Go/No go" test compares the signal quality of the Device under Test (DUT) with that of "Golden Device" in a location with a known signal quality. This test can be performed after establishing a connection with an external device.

A very simple test can be performed by just scanning for a known Bluetooth low energy device and checking that the signal level (Received Signal Strength Indicator (RSSI)) is acceptable.

 Tests of this kind may be useful as a "go/no go" test but are not appropriate for RF performance measurements.

Go/No go tests are suitable for checking communication between the host controller and the power supply. The tests can also confirm that all components on the DUT are well soldered.

A basic RF functional test of the device that includes the antenna can be performed with standard Bluetooth low energy devices configured as remote stations. In this scenario, the device containing NORA-B2 and the antennas should be arranged in a fixed position inside an RF shield box. The shielding prevents interference from other possible radio devices to ensure stable test results.

Appendix

A Reference trace design

Designers can take full advantage of NORA-B1 Single-Modular Transmitter certification approval by integrating the u-blox reference design into their products. This approach requires compliance with the following rules:

- Only [pre-approved antennas](#) can be used.
- Schematics and parts used in the design must be identical to the reference design, please use u-blox-validated parts for antenna matching.
- PCB layout must be identical to the one provided by u-blox. Implement one of the reference designs included in this section or contact u-blox.
- The designer must use the PCB stack-up provided by u-blox. RF traces on the carrier PCB are part of the certified design.

The [Pre-approved antennas list](#) may be used with the **NORA-B2**.

Antenna trace dimensions	Dimension	unit
Length	1.47	mm
Width	0.378	mm

Table 13: RF trace dimension

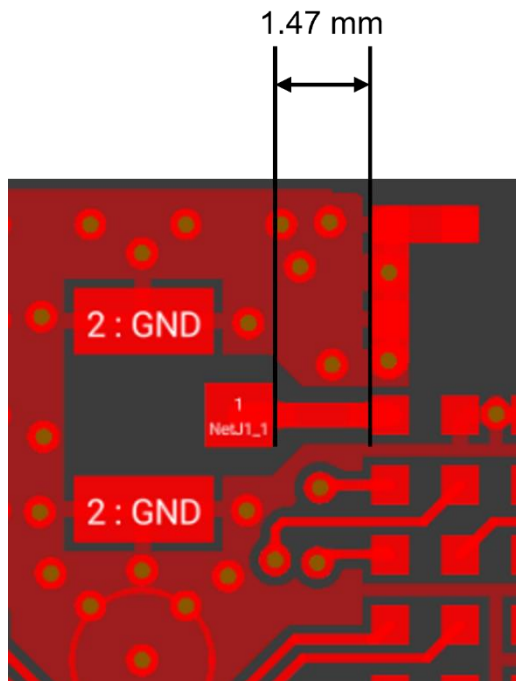


Figure 11: NORA-B2 U.FL PCB layout.

B Glossary

Abbreviation	Definition
ADC	Analog to Digital Converter
ARM	Arm (Advanced RISC Machines) Holdings
ATE	Automatic Test Equipment
CPU	Central Processing Unit
DCE	Data Circuit-terminating Equipment* / Data Communication Equipment*
DUT	Device Under Test
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
ESD	ElectroStatic Discharge
FCC	Federal Communications Commission (United States)
GATT	Generic Attribute
GPIO	General Purpose Input / Output
I2C	Inter-Integrated Circuit
ISED	Innovation, Science, and Economic Development (Canada)
KDB	Knowledge DataBase (of the FCC)
LDO	Low Drop-Out
LE	Low Energy
LGA	Land Grid Array
MAC	Media Access Control
MCU	MicroController Unit
MSL	Moisture Sensitivity Level
NMSD	Non-Solder Mask Defined
OEM	Original Equipment Manufacturer
OET	Office of Engineering and Technology (of the FCC)
OTP	One-Time Programmable
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
RAM	Random Access Memory
RF	Radio Frequency
RTC	Real-Time Clock
SMPS (also SPS)	Switch Mode Power Supply
SMA	SubMiniature version A connector
SMT	Surface Mount Technology
THT	Through-Hole Technology
TLS	Transport Layer Security
UART	Universal Asynchronous Receiver Transmitter
VSWR	Voltage Standing Wave Ratio
WPA	Wi-Fi Protected Access

Table 14: Explanation of the abbreviations and terms used

Related documentation

- [1] Package information guide, [UBX-14001652](#)
- [2] NORA-B2 data sheet, [UBX-22021118](#)
- [3] JEDEC: Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices, [J-STD-020E](#)
- [4] IEC: Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test, [IEC 61000-4-2:2008](#)
- [5] IEC: Electrostatics - Part 5-1: Protection of electronic devices from electrostatic phenomena - General requirements, [IEC 61340-5-1:2016](#)
- [6] ETSI: Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements, [EN 301 489-1 v2.2.3](#)
- [7] ETSI: Audio/video, information, and communication technology equipment - Part 1: Safety requirements, [IEC 62368-1:2018](#)
- [8] FCC guidance [594280 D01 Configuration Control v02 r01](#),
- [9] FCC guidance [594280 D02 U-NII Device Security v01r03](#)
- [10] NORA-B2 EU Declaration of conformity (EU DoC), UBXDOC-46541970-4101
- [11] NORA-B2 UKCA Declaration of conformity (UKCA DoC), UBXDOC-465451970
- [12] u-connectXpress AT command manual for NORA-B26
- [13] u-connectXpress user guide for NORA-B26
- [14] s-center 2, [s-center 2 product page](#)

 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	27-Mar-2025	mhan	Initial draft

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