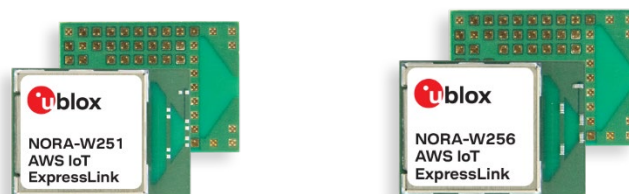# NORA-W2 series

## Stand-alone multiradio modules

**Data sheet**

## Abstract

This technical data sheet describes the NORA-W2 series stand-alone multiradio modules. NORA-W2 modules come with pre-flashed application software, Wi-Fi (802.11b/g/n). NORA-W2 has several important embedded security features, including secure boot which ensures that only authenticated software can run on the module. The modules are ideal for critical IoT applications where security is important

# Document information

| Title | NORA-W2 series | |
|---|---|---|
| Subtitle | Stand-alone multiradio modules | |
| Document type | Data sheet | |
| Document number | UBX-21046925 | |
| Revision and date | R01 | 19-Nov-2021 |
| Disclosure restriction | C1 – Public | |

| Product status | Corresponding content status | |
|---|---|---|
| Functional sample | Draft | For functional testing. Revised and supplementary data will be published later. |
| In development / Prototype | Objective Specification | Target values. Revised and supplementary data will be published later. |
| Engineering sample | Advance Information | Data based on early testing. Revised and supplementary data will be published later. |
| Initial production | Early Production Information | Data from product verification. Revised and supplementary data may be published later. |
| Mass production / End of life | Production Information | Document contains the final product specification. |

This document applies to the following products:

| Product name | Type number | Software version | Hardware version | PCN reference | Product status |
|---|---|---|---|---|---|
| NORA-W251AWS | NORA-W251AWS-00B-00 | TBD | 01 | N/A | Functional sample |
| NORA-W256AWS | NORA-W256AWS-00B-00 | TBD | 01 | N/A | Functional sample |

# Contents

# 1 Functional description

## 1.1 Overview

The NORA-W2 series are stand-alone multiradio modules integrating a powerful 32-bit, dual-core microcontroller unit (MCU) and a radio for wireless communication. The radio supports Wi-Fi 802.11b/g/n in the 2.4 GHz ISM band and Bluetooth Low Energy 5.

The embedded AWS IoT ExpressLink compliant software includes secured certificates that are pre-flashed in the modules. This allows the module to provide "out of the box" connectivity with Amazon Web Services (AWS) with no effort from the customer. It also supports secure over-the air (OTA) updates of both the module firmware and the host application. Control and data communication is done via the module with stateless AT-commands over a serial interface.

The NORA-W2 AWS IoT ExpressLink grants OEM ownership of the end-product when activated in the field via the AWS Multi Account Registration (MAR) process. Fleet management, monitoring, and security auditing are supported by AWS IoT Device Management and AWS IoT Device Defender.

NORA-W2 includes a wireless MCU, flash memory, crystal, and components for antenna matching, filtering, and decoupling, making it a very compact stand-alone multiradio module. The module is designed with secure boot, which ensures the module boots up only in the presence of authenticated software. The small size and the embedded security capabilities make NORA-W2 ideal for critical IoT applications where security is important. Intended applications include consumer products, telematics, low power sensors, connected factories, connected buildings (appliances and surveillance), point-of-sales, and health devices.

The NORA-W2 series is globally certified, which reduces time to market for the end-product. To ensure operation in harsh professional environments, the modules are industrial grade and qualified according to ISO 16750, supporting an extended temperature range of –40 °C to +85 °C.

## 1.2 Applications

NORA-W2 series are suitable for a wide range of applications, including:

- Wi-Fi networks
- Internet of Things (IoT)
- Telematics
- Point-of-sales
- Medical and industrial networks
- Access to laptops, mobile phones, and similar consumer devices
- Home/building automation apps
- Wireless gateways

## 1.3 Block diagram
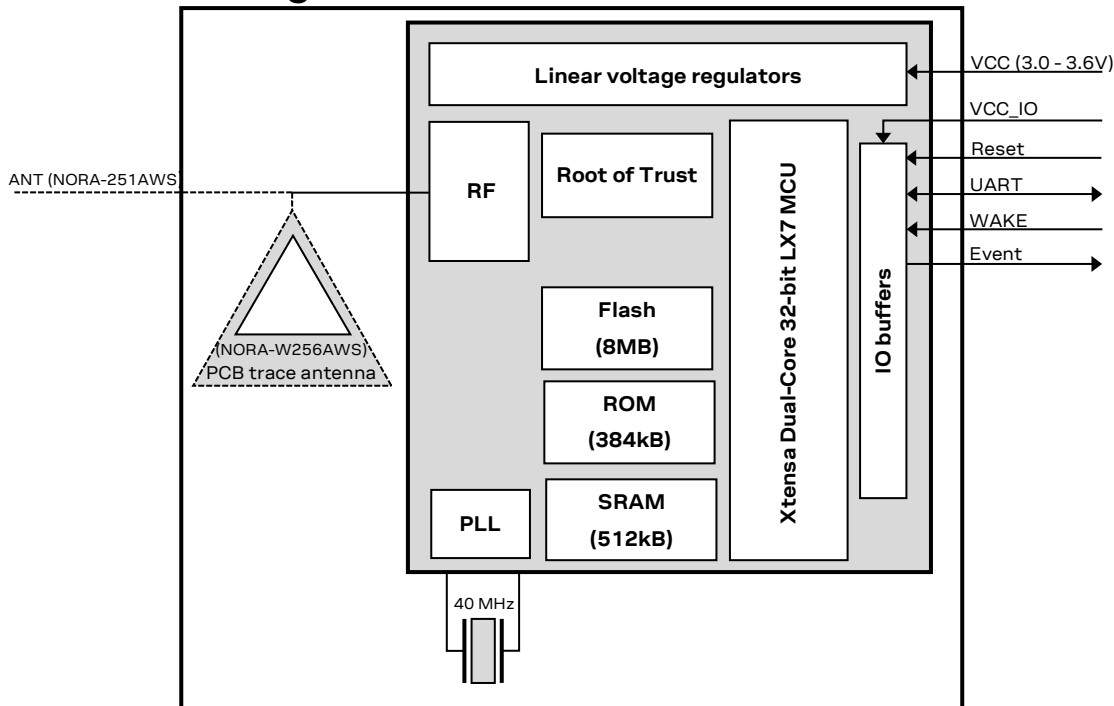


**Figure 1: NORA-W2 series block diagram**

# 1.4 Product variants

NORA-W2 series modules come with pre-flashed application software, supporting Wi-Fi 802.11b/g/n 2.4 GHz ISM band. The host system can set up and control the module through the AT command interface. See also the AWS IoT ExpressLink AT commands manual available from the AWS developer page [8].

## 1.4.1 NORA-W251AWS

The NORA-W251AWS module has no internal antenna, but the RF signal for routing to an external antenna or antenna connector signal is exposed through a dedicated module pin instead. The module outline is 10.4 x 14.3 mm with a height of 1.8 mm.

## 1.4.2 NORA-W256AWS

The NORA-W256AWS module is equipped with an internal PCB trace antenna, using antenna technology licensed from ProAnt AB. The RF signal is not connected to any module pin. The module outline is 10.4 x 14.3 mm with a height of 1.8 mm.

# 1.5 Radio performance

NORA-W2 series (NORA-W251AWS and NORA-W256AWS) modules support Wi-Fi and are conformant with IEEE 802.11b/g/n single-band 2.4 GHz operation and Bluetooth Low Energy specifications, as shown in Table 1.

| Wi-Fi | Bluetooth Low Energy*** |
|---|---|
| IEEE 802.11b/g/n | Bluetooth 5.0 |
| Band support<br>Station mode:<br>2.4 GHz, channel 1-13*<br>Access Point mode:<br>2.4 GHz, channel 1-13* | Band support<br>2.4 GHz, 40 channels |
| Typical conducted output power:<br>20 dBm | Typical conducted output power<br>0 dBm |
| Typical radiated output power:<br>20 dBm EIRP** | Typical radiated output power<br>3 dBm EIRP** |
| Conducted sensitivity<br>-96 dBm | Conducted sensitivity<br>-105 dBm |
| Data rates:<br>IEEE 802.11b:<br>1 / 2 / 5.5 / 11 Mbit/s<br>IEEE 802.11g:<br>6 / 9 / 12 / 18 / 24 / 36 / 48 / 54 Mbit/s<br>IEEE 802.11n:<br>MCS 0-7, HT20 (6.5-72 Mbit/s), HT40 | Data rates:<br>1 / 2 Mbit/s<br>125 / 500 Kbps |

* Maximum support for 802.11d depends on the region.

** RF power including maximum antenna gain (3 dBi).

*** Not supported for current version.

**Table 1: NORA-W2 series Wi-Fi and Bluetooth characteristics**

# 1.6  CPU

NORA-W2 series modules have a dual-core system with two Harvard Architecture Xtensa LX7 CPUs operating at a maximum 240 MHz internal clock frequency.

The main features of the internal NORA-W2 memory include:

- 384 Kbyte ROM for booting and core functions
- 512 Kbyte SRAM for data and instruction
- 8 Mbyte FLASH for code storage, including hardware encryption to protect programs.
- 4 kbit EFUSE (non-erasable memory) for MAC addresses, module configuration, flash encryption, and chip ID

NORA-W2 series modules can be used to design solutions with top-grade security. Including integrated cryptographic hardware accelerators, the modules feature secure boot functionality that ensures that the module can only be restarted with authenticated software.

## 1.6.1  Software options

NORA-W2 series modules come with the pre-flashed application software, supporting IEEE 802.11 b/g/n single-band 2.4 GHz operation. The host system can set up and control the module through the AT command interface. NORA-W2 modules provide top grade security, thanks to secure boot, which ensures the module boots up only with original AWS IoT Expresslink software. The modules additionally provide end-to-end security on the wireless link with the latest 802.11i (WPA2/WPA3) standard and enterprise security that provides a secure connection to the infrastructure. This makes NORA-W2 ideal for critical IoT applications where security is important.

# 2    Interfaces

## 2.1    Power supply

The power for NORA-W2 series modules is supplied through **VCC** and **VCC_IO** pins by DC voltage.

⚠️    The system power supply circuit must be able to support peak power. As the current drawn from **VCC** and **VCC_IO** can vary significantly based on Wi-Fi power consumption profiles.

### 2.1.1    Module supply input (VCC)

NORA-W2 series modules use an integrated Linear Voltage converter to transform and stabilize the supply voltage applied to the **VCC** pin.

### 2.1.2    Digital I/O interfaces reference voltage (VCC_IO)

NORA-W2 series modules support an additional supply input for setting the I/O voltage level.

The separate **VCC_IO** pin enables integration of the module into applications with different voltage levels (1.8 V or 3.3 V for example) without any level converters. NORA-W2 modules currently support a 3.3 V IO voltage level only.

## 2.2    System functions

NORA-W2 series modules are power efficient devices capable of operating in power saving mode. The following system power modes are available:

- Low power sleep mode
- Wake mode

Toggling the **WAKE** on NORA-W2 module will allow the module to enter low power sleep mode for active wake mode and vice versa.

### 2.2.1    Module reset

NORA-W2 series modules can be reset (rebooted) in any of the following ways:

- **RESET_HW** low. Normally set high by an internal pull-up, a logical low state on this signal low causes a "hardware reset" of the module. **RESET_HW** should be driven by an open drain, open collector, or contact switch.
- **RESET_SW**, NORA-W2 modules can be reset using software `AT` command.

## 2.3    Boot strapping pins

Boot strap pins are configured to their default state internally on the module and generally must NOT be set externally.

Table 2 shows boot configuration pins on the module that must be set correctly during boot.

| Pin | State during boot | Default | Behavior | Description |
| --- | --- | --- | --- | --- |
| TBD | 0 | | ESP boot mode (factory boot) | ESP Factory boot Mode. |
| | 1 | Pull-up* | Normal boot from internal flash | |

*About 45 kΩ

**Table 2: NORA-W2 series boot strapping pins**

## 2.4 RF antenna interface

The RF antenna interface of NORA-W2 modules supports Wi-Fi, and Bluetooth Low Energy on the same antenna. The different communication protocols are time divided on the antenna to switch between the Bluetooth and Wi-Fi data. Although communication using these different protocols is (more or less) transparent in the application, these protocols are never active at the same time in the module antenna.

NORA-W2 series modules support either an internal antenna (NORA-W256AWS) or external antennas connected through a dedicated antenna pin (NORA-W251AWS).

### 2.4.1 Internal antenna

NORA-W256AWS modules have internal antennas that are specifically designed and optimized for NORA modules. NORA-W256AWS module is equipped with a 2.4 GHz PCB trace antenna.

The suggestion for the PCB trace antenna in NORA-W256AWS modules is to place it in the middle – along the side edge of the host PCB.

For NORA-W256AWS designs, keep a minimum clearance of 5 mm between the antenna and the 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-W251AWS and an external antenna.

It is beneficial to have a large solid ground plane on the host PCB with a good grounding on the module. Minimum ground plane size is 24x30 mm but more than 50x50 mm is recommended.

For more information about antenna-related design, see also the NORA-W2 series system integration manual [1].

⚠ The ANT signal solder pin is not available on the NORA-W256AWS module.

### 2.4.2 External RF antenna interface

The NORA-W251AWS module has an antenna signal (**ANT**) pin with a characteristic impedance of 50 Ω for using an external antenna. The antenna signal supports both Tx and Rx.

The external antenna, for example, can be an SMD antenna (or PCB integrated antenna) on the host board. An antenna connector for using an external antenna through a coaxial cable could also be implemented. A cable antenna might be necessary if the module is mounted in a shielded enclosure such as a metal box or cabinet.

An external antenna connector (U.FL. connector) reference design is available and must be followed to comply with the NORA-W2 FCC/IC modular approvals. See also the NORA-W2 series system integration manual [1].

## 2.5 IO signals

### 2.5.1 Drive capability

All GPIO pins are normally configured for medium current consumption. Using this standard drive capability, a pin configured as output can source and an input sink a certain amount of current.

## 2.5.2   System status IO signals

The **RED**, **GREEN** and **BLUE** pins are used to signal the status. They are active low and are intended to be routed to an RGB LED.

| Mode | Status | RGB LED color | GREEN | BLUE | RED |
|---|---|---|---|---|---|
| Data mode | IDLE | TBD | - | - | - |
| Command mode | IDLE | TBD | - | - | - |
| Data mode, Command mode | CONNECTING* | TBD | - | - | - |
| Data mode, Command mode | CONNECTED* | TBD | - | - | - |

* = LED flashes on data activity

**Table 3: System status indication**

## 2.5.3   UART

NORA-W2 modules include a UART for communication with an application host processor (AT commands, data communication, and software upgrades).

The following UART signals are available:

- Data lines (**RXD** as input, **TXD** as output)
- Frame format configuration:
  - 8 data bits
  - Even or no-parity bit
  - 1 stop bit
  - 115200 bits/s baud rate
- Default frame configuration is 8N1 means eight (8) data bits, no (N) parity bit, and one (1) stop bit.

# 3 Pin definition

## 3.1 NORA-W2 pin assignment

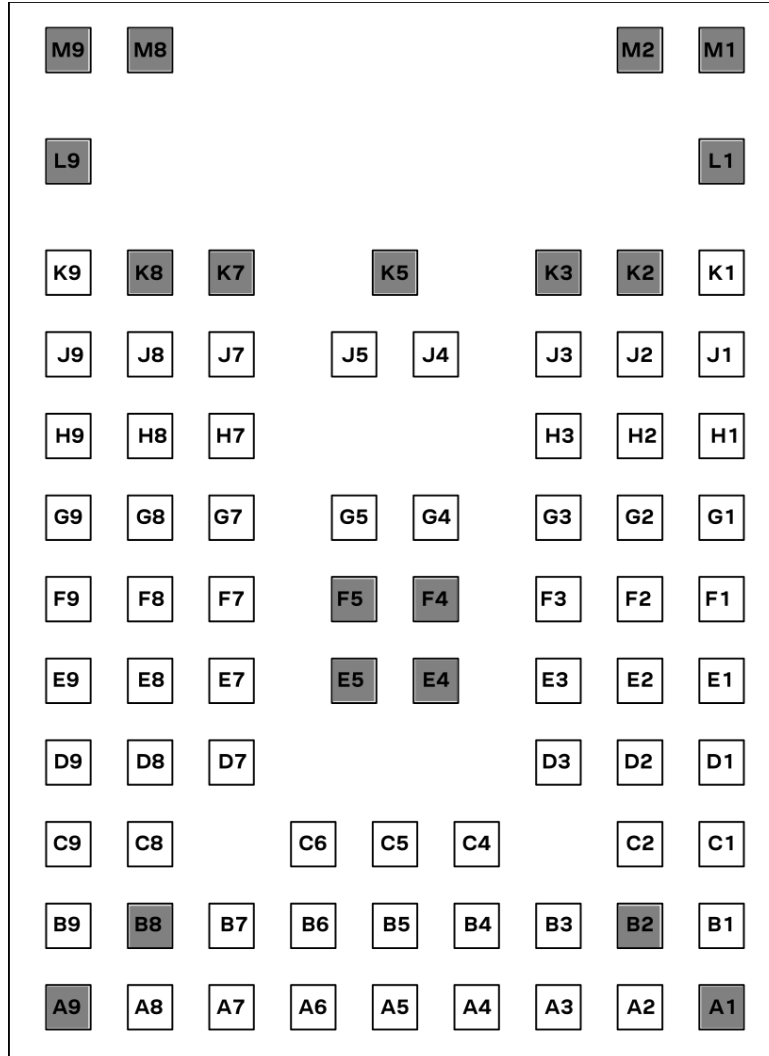Figure 2 shows the pinout for NORA-W2 modules.



**Figure 2: NORA-W251AWS/W106 pin assignment (top view)**

☞ All grey pins located on the module are GND pins.

The signals for some pins are bootstrapped. It is important that these signals, shown in Table 2, have the correct state during startup. See also Boot strapping pins.

# 4 Electrical specifications

⚠️ Stressing the device above one or more of the ratings listed in the Absolute maximum ratings can cause permanent damage. These are stress ratings only. Operating the module at these or at any conditions other than those specified in the Operating conditions should be avoided. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

☞ Where application information is given, it is advisory only and does not form part of the specification.

## 4.1 Absolute maximum ratings

| Symbol | Description | Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| VCC/ VCC_IO | Module supply voltage | Input DC voltage at VCC and VCC_IO pins | -0.3 | 3.6 | V |
| $I_{VCC\ MAX}$ + $I_{VCC\_IO\ MAX}$ | Absolute maximum power consumption | | | 500 | mA |
| DPV | Digital pin voltage | Input DC voltage at any digital I/O pin | -0.3 | 3.6 | V |
| P_ANT | Maximum power at receiver | Input RF power at antenna pin | | 0 | dBm |
| Tstr | Storage temperature | | -40 | +85 | °C |

**Table 4: Absolute maximum ratings**

⚠️ The product is not protected against overvoltage or reversed voltages. If necessary, voltage spikes exceeding the power supply voltage specifications shown in Table 4 must be limited to values within the specified boundaries using appropriate protection devices.

### 4.1.1 Maximum ESD ratings

| Parameter | Min. | Typical | Max. | Unit | Remarks |
|---|---|---|---|---|---|
| ESD immunity | | | ±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 |

**\*** Preliminary values tested on EVK-NINA-W1 evaluation board.

**Table 5: Maximum ESD ratings**

⚠️ NORA-W2 series modules are Electrostatic Sensitive Devices, which means that some special precautions must be observed when handling them. See also ESD precautions.

## 4.2 Operating conditions

⚠️ Operation beyond the specified operating conditions is not recommended and extended exposure beyond them may affect device reliability.

☞ Unless otherwise specified, all operating condition specifications are at an ambient temperature of 25 °C and at a supply voltage of 3.3 V.

### 4.2.1 Operating temperature range

| Parameter | Min | Max | Unit |
|---|---|---|---|
| Operating temperature | -40* | +85 | °C |

* See voltage supply condition for the lowest temperature range shown in Supply/Power pins.

**Table 6: Temperature range**

## 4.2.2 Supply/Power pins

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| VCC | Input supply voltage | Ambient temperature -20 ℃ to +85 ℃ | 3.00 | 3.30 | 3.60 | V |
| | | Ambient temperature -40 ℃ to +85 ℃ | 3.00 | 3.30 | 3.45 | V |
| VCC_IO | I/O reference voltage | Ambient temperature -20 ℃ to +85 ℃ | 3.00 | 3.30 | 3.60 | V |
| | | Ambient temperature -40 ℃ to +85 ℃ | 3.00 | 3.30 | 3.45 | V |

**Table 7: Input characteristics of voltage supply pins**

## 4.2.3 RESET_HW pin

| Pin name | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| RESET_HW | Low-level input | 0 | | 0.3*VCC | V |
| | Internal pull-up resistance | | 100 | | kΩ |
| | Internal capacitance | | 10 | | nF |
| t_Startup | Startup time after release of reset | | TBD | | s |

**Table 8: RESET_N pin characteristics**

## 4.2.4 Digital pins

| Pin name | Parameter | Min | Typ | Max | Unit | Remarks |
|---|---|---|---|---|---|---|
| Any digital pin | Input characteristic: Low-level input | 0 | | 0.3*VCC_IO | V | |
| | Input characteristic: high-level input | 0.7*VCC_IO | | VCC_IO | V | |
| | Output characteristic: Low-level output | 0 | | 0.4 | V | |
| | Output characteristic: High-level output | VCC_IO-0.4 | | VCC_IO | V | |
| | Drive capability | | | 12 | mA | Source/Sink |
| | Pull-up/pull-down resistance | | 45 | | kΩ. | |
| Signals rerouted through the IO MUX | Output signal speed | | | 20 | MHz | |
| | Input signal speed | | | 10 | MHz | The GPIO-Matrix delays the input signals by two cycles of the AHB-clock typical 80 MHz -> 25 ns delay |

**Table 9: Digital pin characteristics**

## 4.2.5 Current consumption

The typical current consumption of a NORA-W2 module is shown in Table 10. The current consumption is highly dependent on the application implementation. All measurements taken with 3.3 V supply at 25 ℃.

| Power mode | Activity | Typ | Unit | Remarks |
|---|---|---|---|---|
| Wi-Fi | Wi-Fi Tx packet POUT 16 dBm | TBD | mA | 50% duty cycle, transmit 802.11g, OFDM 54 Mbit/s |
| | Wi-Fi Rx and listening | TBD | mA | |
| Bluetooth Low Energy | Bluetooth Tx Pout 0 dBm | TBD | mA | 50% duty cycle |
| | Bluetooth Rx and listening | TBD | mA | |
| Modem-sleep mode | CPU speed 240 MHz, dual core | TBD | mA | Immediate wake-up |
| | CPU speed 160 MHz, dual core | TBD | mA | |
| | CPU speed 80 MHz The CPU is operational. The radio is turned off. | TBD | mA | |

| Power mode | Activity | Typ | Unit | Remarks |
|---|---|---|---|---|
| Light-sleep mode | The CPU is paused. The RTC memory and RTC peripherals, as well as the ULP co-processor is running. Any wake-up events (MAC, host, RTC timer, or external interrupts) will wake up the chip. | TBD | µA | |
| Deep-sleep mode | The ULP co-processor is powered on | TBD | µA | |
| | ULP sensor-monitored pattern | TBD | µA | @ 1% duty cycle |
| | RTC timer and RTC memory | TBD | µA | |
| Hibernate mode | RTC timer only | TBD | µA | |

**Table 10: Current consumption during typical use cases**

## 4.2.6　Wi-Fi radio characteristics

$V_{CC}$ = 3.3 V, $T_{amb}$ = 25 °C

| Parameter | Operation mode | | | Specification | Unit |
|---|---|---|---|---|---|
| RF Frequency Range | 802.11b/g/n | | | 2.400 – 2.4835 | GHz |
| Modulation | 802.11b | | | CCK and DSSS | |
| | 802.11g/n | | | OFDM | |
| Supported Data Rates | 802.11b | | | 1, 2, 5.5, 11 | Mbit/s |
| | 802.11g | | | 6, 9, 12, 18, 24, 36, 48, 54 | Mbit/s |
| | 802.11n | | | MCS0 – MCS7 | |
| Supported Bandwidth | 802.11n | | | 20 | MHz |
| Supported Guard Interval | 802.11n | | | 400, 800 | ns |
| Conducted Transmit Power (typical) | 802.11b | Channel 6 | 1 Mbit/s | 20* ± 1 | dBm |
| | | | 11 Mbit/s | 20* ± 1 | dBm |
| | 802.11g | Channel 6 | 6 Mbit/s | 20* ± 1 | dBm |
| | | | 54 Mbit/s | 18* ± 1 | dBm |
| | 802.11n | Channel 6 | MCS0 | 19* ± 1 | dBm |
| | | | MCS7 | 17.5* ± 1 | dBm |
| Receiver Sensitivity (typical) | 802.11b | | 1 Mbit/s | -96 ± 2 | dBm |
| | | | 11 Mbit/s | -88 ± 2 | dBm |
| | 802.11g | | 6 Mbit/s | -92 ± 2 | dBm |
| | | | 54 Mbit/s | -74 ± 2 | dBm |
| | 802.11n | 20 MHz | MCS0 | -91 ± 2 | dBm |
| | | | MCS7 | -72 ± 2 | dBm |

* The maximum ouput power varies depending upon the region of operation. There is lower output power on band edge channels and also on the highest data rates.

**Table 11: Wi-Fi radio characteristics**

## 4.2.7　Bluetooth Low Energy characteristics**

$V_{CC}$ = 3.3 V, $T_{amb}$ = 25 °C

| Parameter | Specification | Unit |
|---|---|---|
| RF Frequency Range | 2.400 – 2.4835 | GHz |
| Supported Modes | Bluetooth v5.0 | |
| Number of channels | 40 | |
| Modulation | GFSK | |

| Parameter | Specification | Unit |
|---|---|---|
| Transmit Power (typical) | 15* ± 1 | dBm |
| Receiver Sensitivity (typical) | -95.5 ± 2 | dBm |

* The maximum ouput power varies depending upon the region of operation.

** RF Not supported for current version.

**Table 12: Bluetooth Low Energy characteristics**

## 4.2.8 Antenna radiation patterns

⚠ After limited testing of PCB trace antenna implemented in NORA-W256 modules, the radiation patterns featured in this section are only preliminary. The final radiation patterns for the NORA-W256AWS module will be included here as soon as the performance of the module antenna has been fully verified.

Figure 3 provides an overview of the measurement procedure and describes how the NORA-W256AWS module is aligned to the XYZ-coordinate system.

A measurement is taken at every dotted position above the module image (shown left). Each measurement is represented as a grid point in the radiation pattern (shown right).
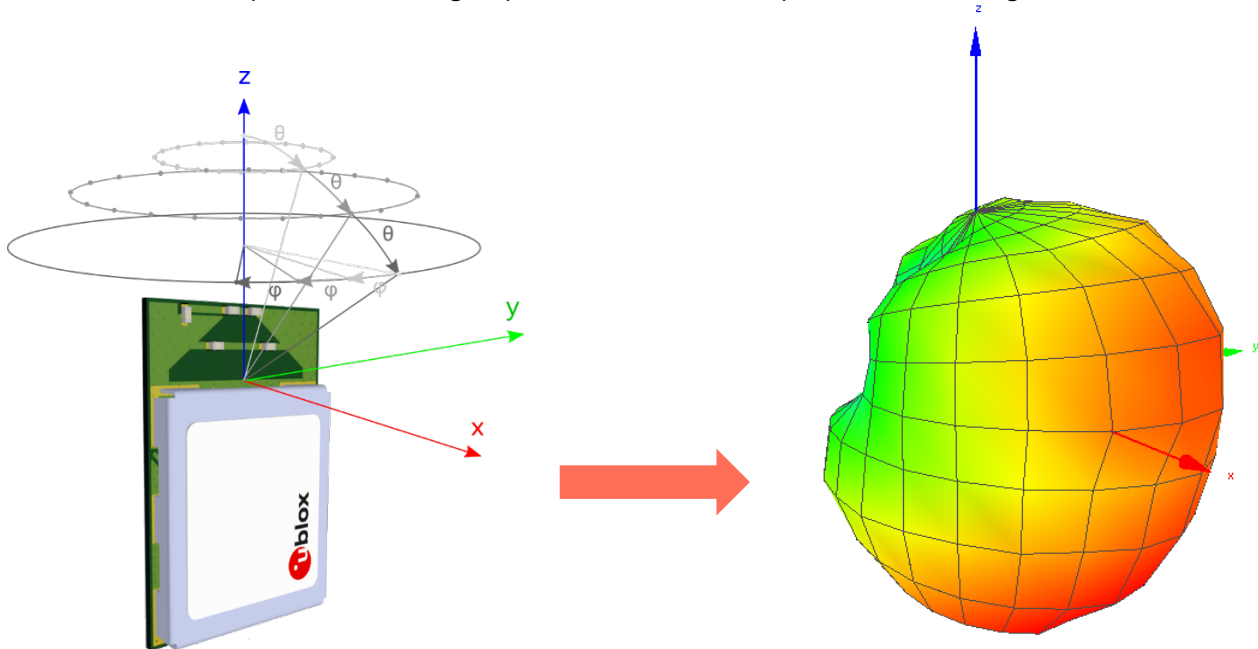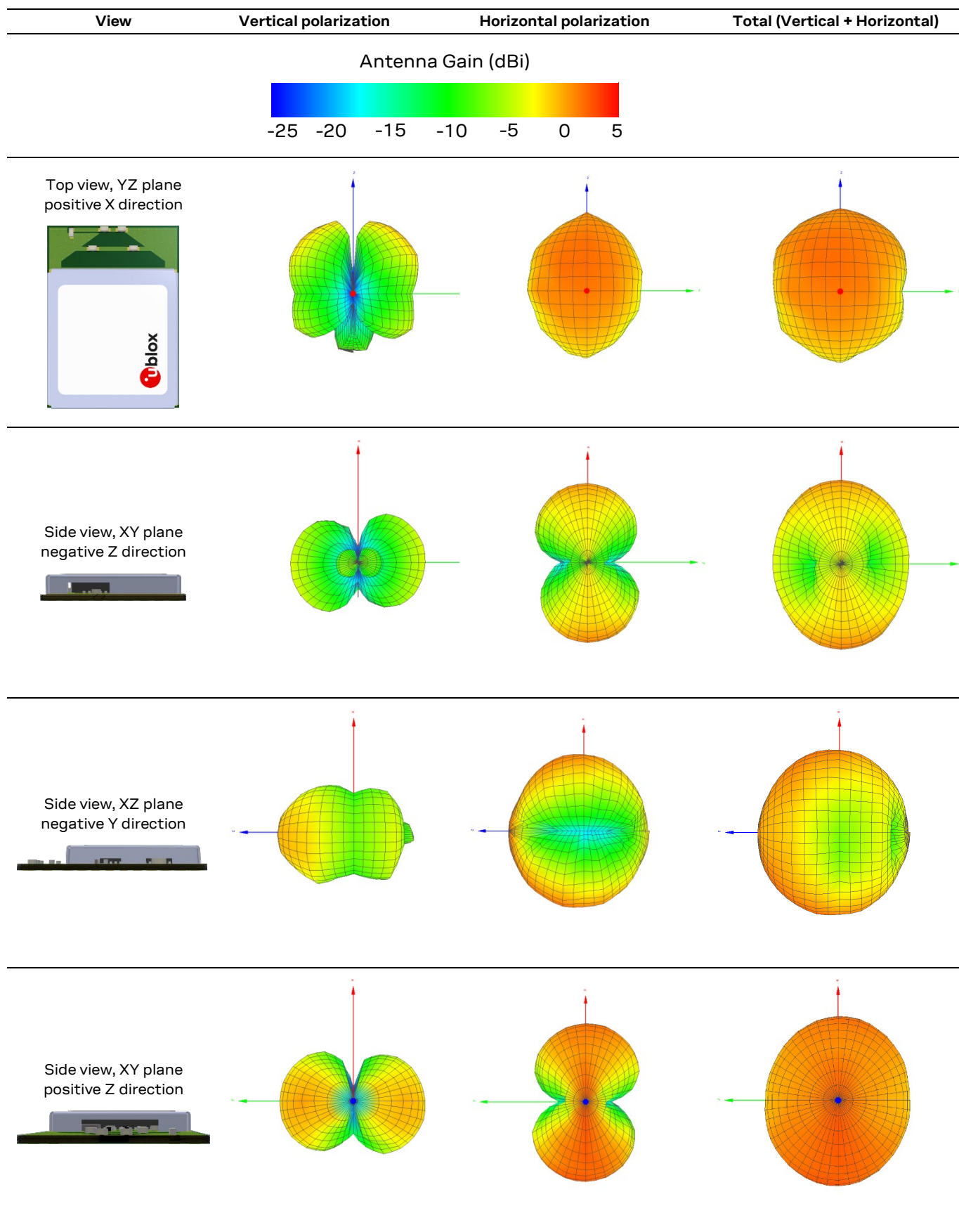


**Figure 3: Measurement procedure for determining radiation patterns**

Table 13 shows the radiation patterns and antenna gain of the NORA-W256AWS module variant that includes an internal PCB trace antenna.
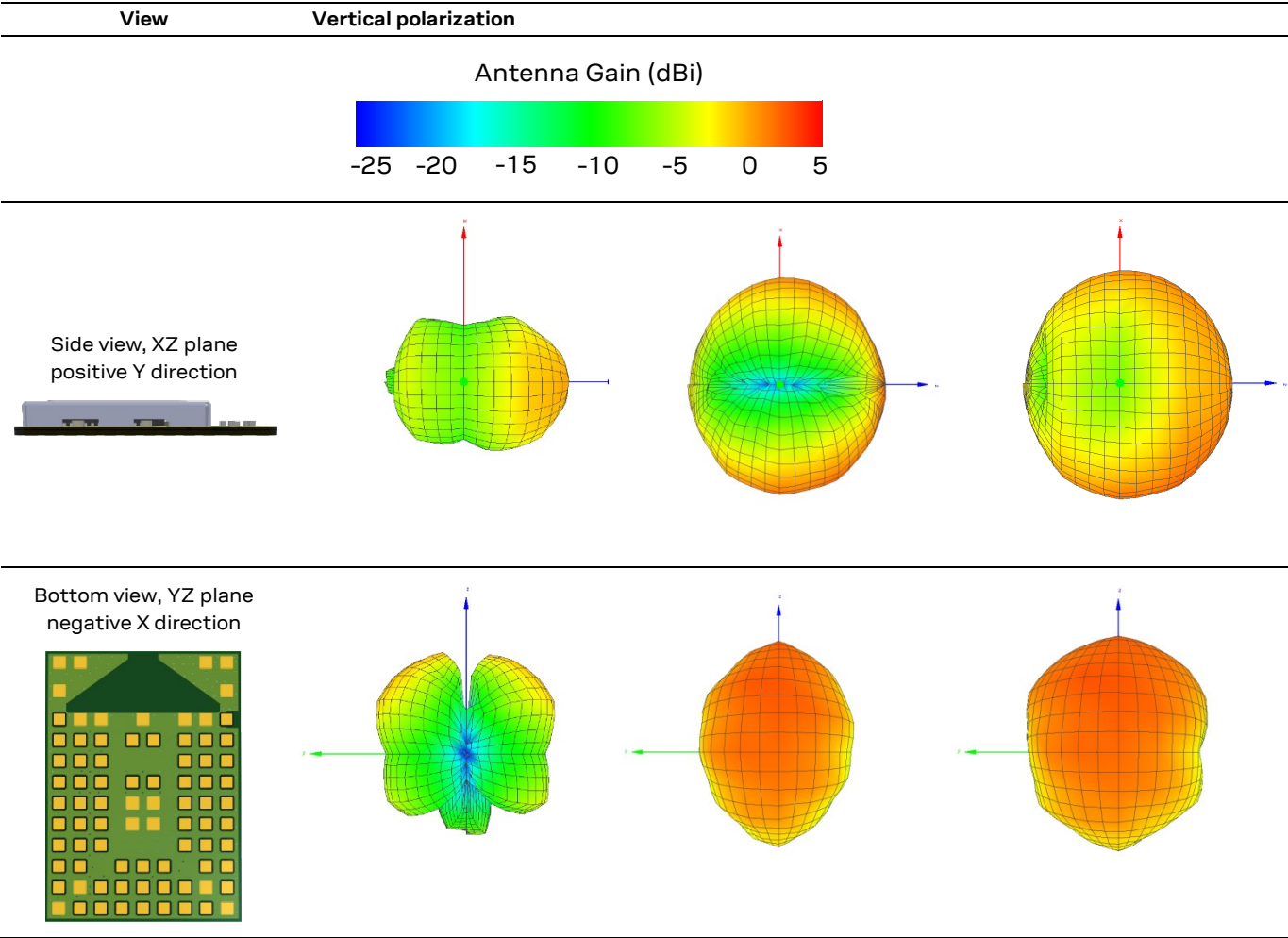
| View | Vertical polarization | Horizontal polarization | Total (Vertical + Horizontal) |
|---|---|---|---|

Antenna Gain (dBi)



| View | Vertical polarization | Horizontal polarization | Total (Vertical + Horizontal) |
|---|---|---|---|
| Top view, YZ plane positive X direction | | | |
| Side view, XY plane negative Z direction | | | |
| Side view, XZ plane negative Y direction | | | |
| Side view, XY plane positive Z direction | | | |

| View | Vertical polarization |
|------|----------------------|

Antenna Gain (dBi)

-25  -20  -15  -10  -5  0  5

Side view, XZ plane
positive Y direction

Bottom view, YZ plane
negative X direction

**Table 13: NORA-W256AWS antenna radiation patterns**

# 5   Mechanical specifications

## 5.1   NORA- W256AWS mechanical specifications

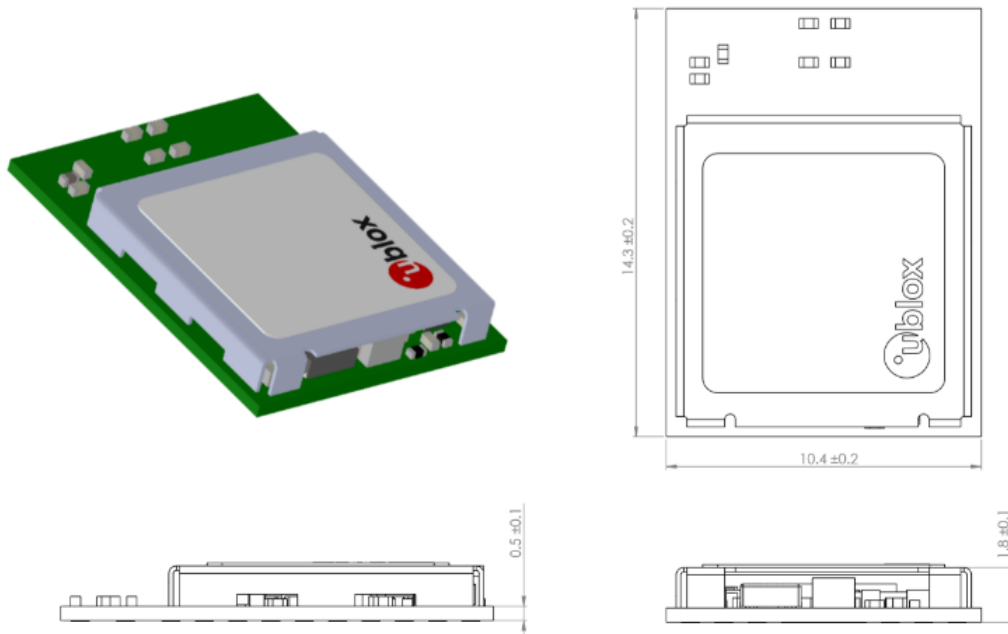Figure 4 shows the critical dimensions of the NORA-W256AWS package.



**Figure 4: NORA-W256AWS dimensions**

## 5.2   NORA-W251AWS mechanical specifications

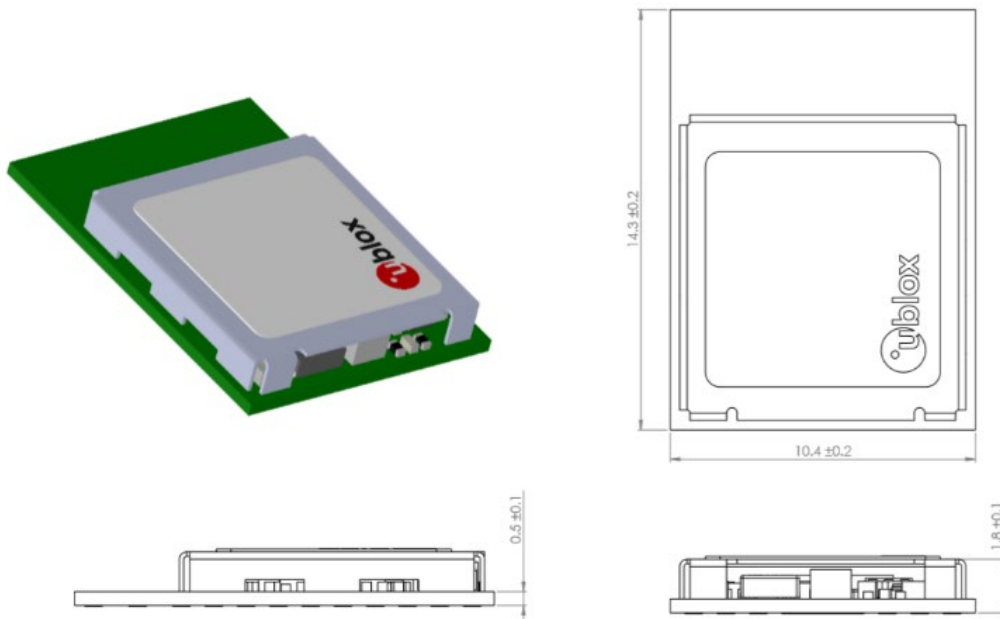Figure 5 shows the critical dimensions of the NORA-W256AWS package.



**Figure 5: NORA-W251AWS dimensions**

Figure 6 shows the mechanical outline of NORA-W2 modules.



**Figure 6: NORA-W2 mechanical outline**

Contents

# 6    Qualification and approvals

## 6.1    Country approvals

NORA-W2 modules are certified for use in the following countries/regions:

| Country/region | NORA-W251AWS | NORA-W256AWS |
|---|---|---|
| Europe | Pending | Pending |
| USA | Pending | Pending |
| Canada | Pending | Pending |
| Japan | Pending | Pending |
| Taiwan | Pending | Pending |
| South Korea | Pending | Pending |
| Brazil | Pending | Pending |
| Australia | Pending | Pending |
| New Zealand | Pending | Pending |
| South Africa | Pending | Pending |

☞    For detailed information about the regulatory requirements that must be met when using NORA-W2 modules in an end product, see the NORA-W2 series certification application note [6].

## 6.2    Bluetooth qualification

®    NORA-W2 module series are qualified as an end product in accordance with the Bluetooth 5.0 specification.

| Product type | QD ID | Listing date |
|---|---|---|
| End product | TBD | - |

**Table 14: NORA-W2 series Bluetooth qualified design ID**

# 7   Product handling

## 7.1   Packaging

NORA-W2 modules are delivered as hermetically sealed, reeled tapes that enable efficient production, production lot set-up, and tear-down. For more information about packaging, see also the Packaging information reference [2].

⚠️   NORA-W2 series modules are in functional sample status, as described in the Document information. Consequently, the information is valid and available only after the module is fully tested and approved during the Initial Production stage.

### 7.1.1   Reels

NORA-W2 series modules are deliverable in quantities of 500 pieces on a reel. Table 16 describes the reel types for each module variant.

| Model | Reel type |
|---|---|
| NORA-W251AWS | A3 |
| NORA-W256AWS | A3 |

**Table 15: Reel types for different NORA-W2 series modules**

For further information about the reel types, see also the Packaging information reference [2].

### 7.1.2   Tapes

Figure 7 shows the position and orientation of NORA-W2 series modules as they are delivered on tape.
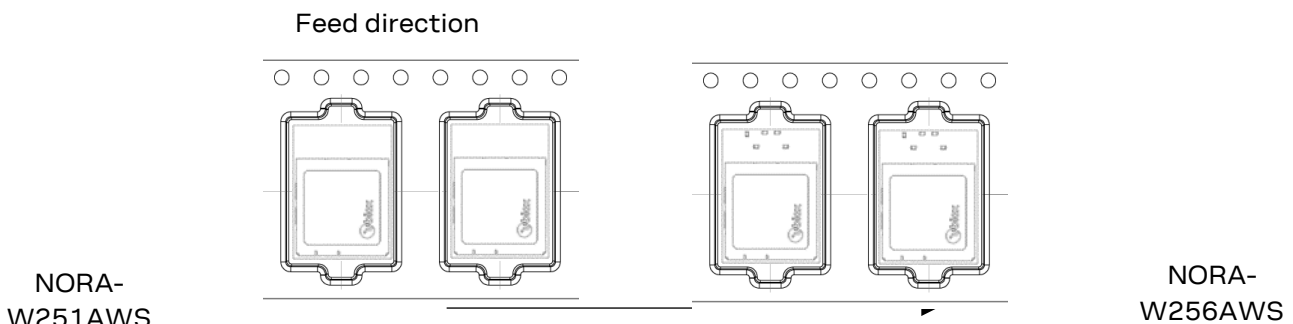


**Figure 7: Orientation of NORA-W2 modules on tape**

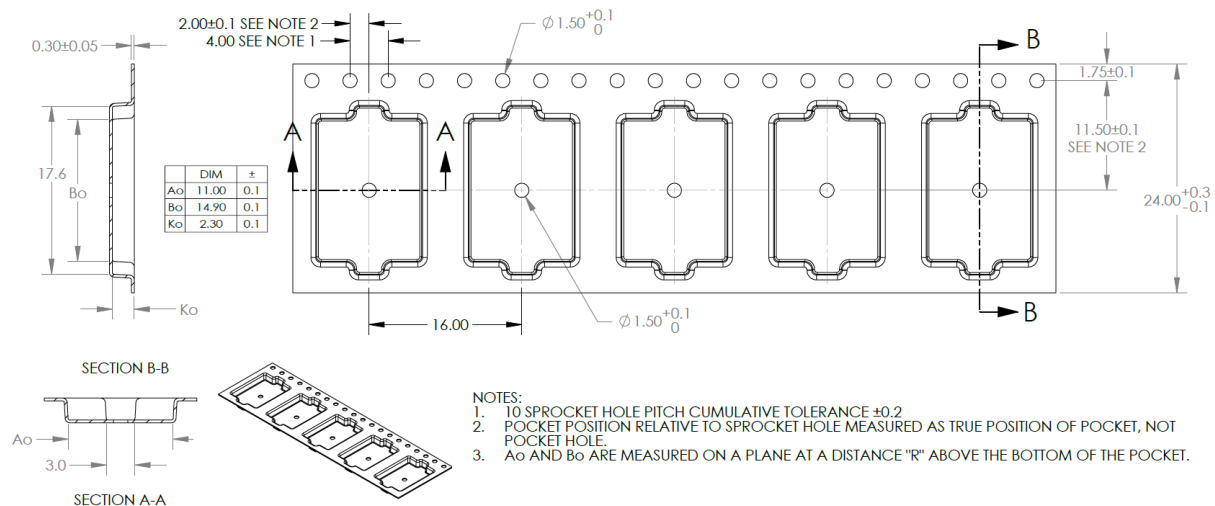Figure 8 shows the tape and pocket dimensions of the module.



**Figure 8: NORA-W2 tape dimensions**

# 7.2 Moisture sensitivity levels

⚠ NORA-W2 series modules are rated as MSL Level 4 devices in accordance with the IPC/JEDEC J-STD-020 standard. For detailed information, see the moisture sensitive warning label on the MBB (Moisture Barrier Bag).

After opening the dry pack, the modules must be mounted within 168 hours in factory conditions of maximum 30 °C/60%RH or must be stored at less than 10%RH. The modules require baking if the humidity indicator card shows more than 10% when read at 23±5 °C or if the conditions mentioned above are not met. For information about the bake procedure, see also the J-STD-033B standard.

For more information regarding MSL (Moisture Sensitivity Level), labeling, and storage, see also the Packaging information reference [2].

# 7.3 Reflow soldering

⚠ Reflow soldering profiles must be selected in accordance with u-blox soldering recommendations described in the NORA-W2 system integration manual [1]. Failure to observe these recommendations can result in severe damage to the product.

# 7.4 ESD precautions

⚠ NORA-W2 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. See also Maximum ESD ratings.

Proper ESD handling and packaging procedures must be applied throughout the processing, handling, and operation of any application that incorporates the NORA-W2 series module. ESD precautions are particularly relevant when handling the application board on which the module is mounted.

For further information about the handling of NORA-W2 series modules, see also the NORA-W2 system integration manual [1] .

# 8 Labeling and ordering information

## 8.1 Product labeling

The labels (8 x 8 mm) on NORA-W2 series modules described in this section include important product information.

Figure 9 shows the label applied to all the NORA-W2 series modules. Each of the given label references are described in Figure 9. All units are given in mm.
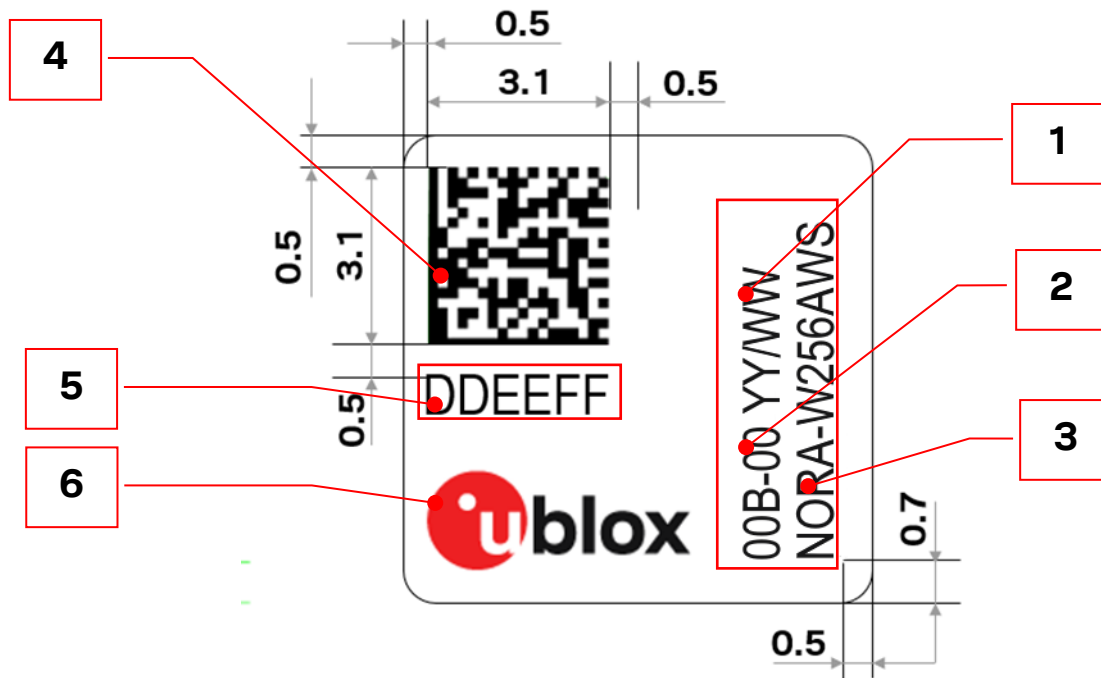


**Figure 9: Location of product type number on the NORA-W2 series module label**

| Reference | Description |
|---|---|
| 1 | Date of unit production encoded YY/WW (year, week) |
| 2 | Major and minor product version information |
| 3 | Model name (NORA-W251AWS or NORA-W256AWS). This is the same as the product name. |
| 4 | Data Matrix with unique serial number comprising 19 alphanumeric symbols:<br>- The first 3 symbols are used for production tracking and are an abbreviated representation of the Type number that is unique to each module variant.<br>- The following 12 symbols represent the unique hexadecimal Bluetooth address of the module AABBCCDDEEFF, and<br>- The last 4 symbols represent the hardware and firmware version encoded HHFF. |
| 5 | Second half of the device address |
| 6 | u-blox logo with the red dot to indicates pin 1. |

**Table 16: NORA-W2 series label description**

## 8.2 Ordering information

| Ordering code | Product |
|---|---|
| NORA-W251AWS-00B | Wi-Fi IEEE802.11 b/g/n module with antenna pin. Includes AWS IOT Expresslink software with secure boot |
| NORA-W256AWS-00B | Wi-Fi IEEE802.11 b/g/n module with internal PCB trace antenna. Includes AWS IOT Expresslink software with secure boot |

**Table 17: Product ordering codes**

# Appendix

# A Glossary

| Abbreviation | Definition |
|---|---|
| ADC | Analog to Digital Converter |
| AWS | Amazon Web Services |
| BLE | Bluetooth low energy |
| BPF | Band Pass Filter |
| BR/EDR | Basic rate/Enhanced data rate |
| CAN | Controller Area Network |
| CTS | Clear To Send |
| DAC | Digital to Analog Converter |
| DC | Direct Current |
| DSR | Data Set Ready |
| ESD | Electro Static Discharge |
| FCC | Federal Communications Commission |
| GATT | Generic ATTribute profile |
| GND | Ground |
| GPIO | General Purpose Input/Output |
| I2C | Inter-Integrated Circuit |
| IC | Industry Canada |
| IEEE | Institute of Electrical and Electronics Engineers |
| IoT | Internet of Things |
| LPO | Low Power Oscillator |
| MCU | Micro Controller Unit |
| MDIO | Management Data Input / Output |
| MII | Media-Independent Interface |
| MIMO | Multi-Input Multi-Output |
| MRD | Market Requirement Document |
| MSD | Moisture Sensitive Device |
| N/A | Not Applicable |
| PCN | Product Change Notification |
| PIFA | Planar Inverted IF Antenna |
| QSPI | Quad Serial Peripheral Interface |
| RMII | Reduced Media Independent Interface |
| RTS | Request To Send |
| RXD | Receive Data |
| SDIO | Secure Digital Input Output |
| SDK | Software Development Kit |
| SPI | Serial Peripheral Interface |
| TBD | To Be Defined |
| TXD | Transmit Data |
| UART | Universal Asynchronous Receiver/Transmitter |

**Table 18: Explanation of the abbreviations and terms used**

# Related documents

[1] NORA-W2 series system integration manual, TBD

[2] Packaging information reference, UBX-14001652

[3] NORA-W2 declaration of conformity, TBD

[4] NORA-W2 series product summary, UBX-21044252

[5] NORA-B1 data sheet, UBX-20027119

[6] NORA-W2 series certification application note, TBD

[7] AWS IoT ExpressLink developer page, https://docs.aws.amazon.com/expresslink

☞ 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 | 19-Nov-2021 | asoh | Initial release of the data sheet for NORA-W2 series modules with open CPU architecture. |

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