

# 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

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This document applies to the following products:

<b>Product name</b>	<b>Type number</b>	<b>Software version</b>	<b>Hardware version</b>	<b>PCN ref.</b>	<b>Product status</b>
NORA-W251AWS	NORA-W251AWS-00B-00	0.99	03	N/A	Prototype
NORA-W256AWS	NORA-W256AWS-00B-00	0.99	03	N/A	Prototype

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# 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.

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  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ .

## 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
- Home/building automation apps
- Wireless gateways

## 1.3 Block diagram

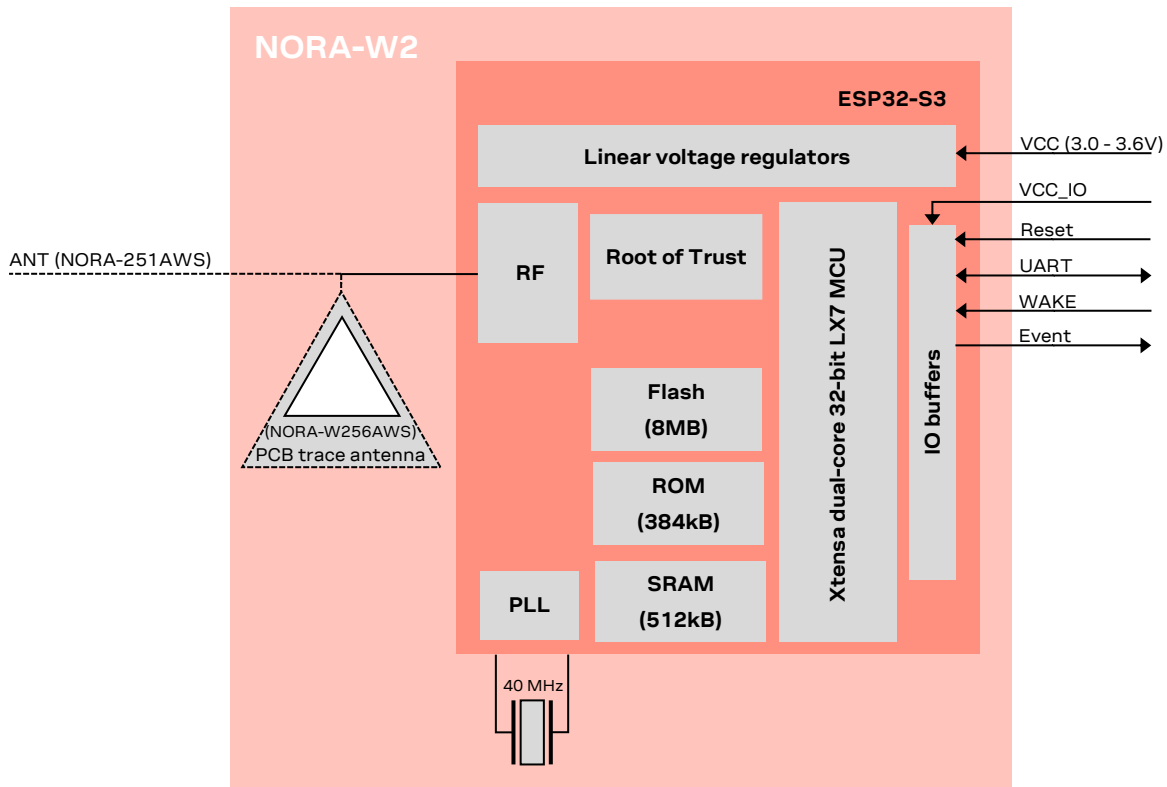


Figure 1: NORA-W2 series block diagram

## 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 [7].

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

Toggleing 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  $\Omega$  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.

Status	RGB LED color	GREEN	BLUE	RED
IDLE	TBD	-	-	-
CONNECTING*	TBD	-	-	-
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.

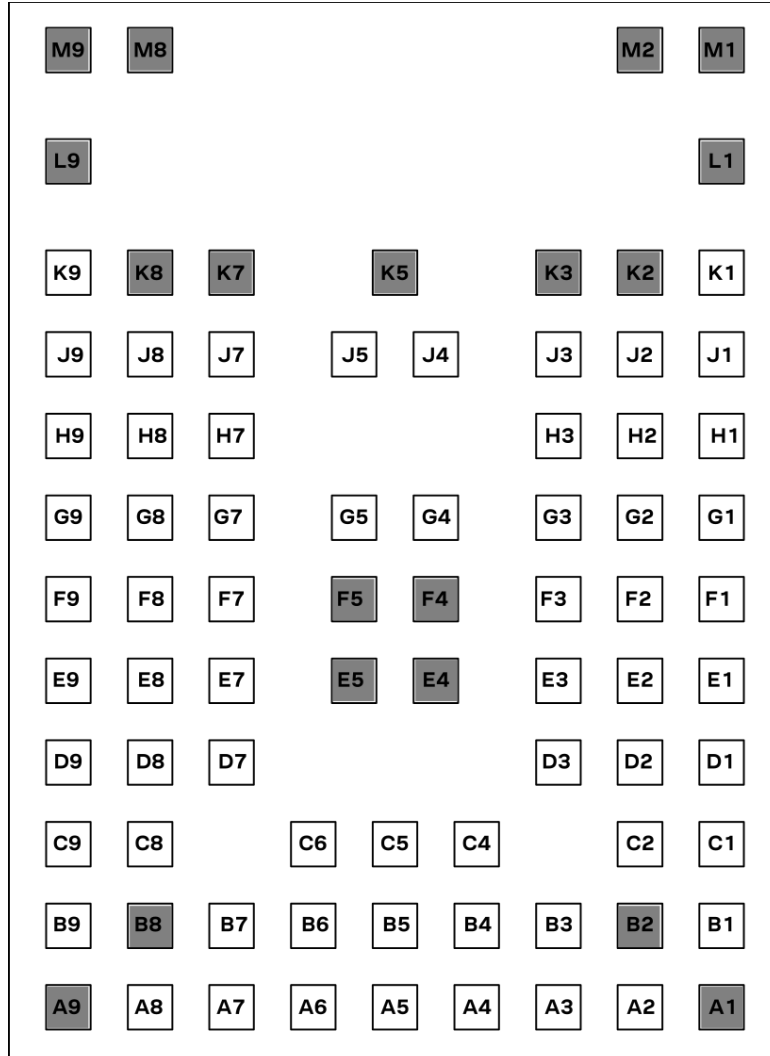


Figure 2: NORA-W251AWS/W106 pin assignment (top view)

- 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](#).

## 3.2 Pinout

Table 4 describes the common pinout for all NORA-W2 series modules.

No.	NORA Function	I/O	Description	ESP32-S3 pin	Remarks
A3	EXPRESSLINK_I2C_SDA	I/O	General Purpose I/O	GPIO17	Reserved
A5	EXPRESSLINK_RST	I/O		FSPIDQS / GPIO14	
A6	EXPRESSLINK_WAKE	I/O	SPI2 IO7 / General Purpose I/O	FSPIIO7 / GPIO13	
A7	VCCIO	I	Module I/O level voltage input		VIO voltage supply
A8	VCC	I	Module supply voltage input		3.0-3.6 V module voltage supply
B1	EXPRESSLINK_SPI_SCK	I/O	SPI2 clock / General Purpose I/O	FSPICLK / GPIO36	Reserved
B3	EXPRESSLINK_SPI_SS	I/O	SPI2 Chip select / General Purpose I/O	FSPICS0 / GPIO34	Reserved
B4	EXPRESSLINK_I2C_SCL	I/O	General Purpose I/O	GPIO18	Reserved
C1	EXPRESSLINK_SPI_MISO	I/O	SPI2 Controller Input Peripheral Output / General Purpose I/O	FSPIQ / GPIO37	Reserved
C2	EXPRESSLINK_SPI_MOSI	I/O	SPI2 Controller Output Peripheral Input / General Purpose I/O	FSPID / GPIO35	Reserved
D8	EXPRESSLINK_SPARE1	I/O	General Purpose I/O	GPIO4	Reserved
E7	EXPRESSLINK_SPARE2	I/O	General Purpose I/O	GPIO9	Reserved
F7	BOOT	I/O	General Purpose I/O	GPIO0/ Boot	No Connect. Disabled for NORA-W2
G3	EXPRESSLINK_EVENT	I/O	SPI2 IO5 / General Purpose I/O	FSPIIO5 / GPIO11	
G8	EXPRESSLINK_TXD	I/O	UART data output / General Purpose I/O	U0TXD / GPIO43	
G9	EXPRESSLINK_RXD	I/O	UART data input / General Purpose I/O	U0RXD / GPIO44	
H8	LED2	I/O	General Purpose I/O	GPIO2	Reserved
H9	LED1	I/O	General Purpose I/O	GPIO8	Reserved
J3	RESET_N	I	External system reset input.	RESET	Active low
J8	LED3	I/O	General Purpose I/O	GPIO5	Reserved
K9	ANT	I/O	Antenna Tx/Rx interface	LNA_IN	50 Ω nominal characteristic impedance, only used with NORA-W251 modules. NC for NORA-W256
	EGP	-	Exposed Ground Pins		Exposed scattered grey pins on the module should be connected to GND
L1- M9	EAGP	-	Exposed Antenna Ground Pins		Exposed pins underneath the antenna area should be connected to GND

**Table 4: NORA-W2 pinout**

## 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.

All given application information is only advisory 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 <sub>VCC_MAX</sub> + I <sub>VCC_IO_MAX</sub>	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 5: 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 5](#) 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 6: 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 7: Temperature range**

### 4.2.2 Supply/Power pins

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

Table 8: 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 9: 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 10: Digital pin characteristics

### 4.2.5 Current consumption

The typical current consumption of a NORA-W2 module is shown in [Table 11](#). The current consumption is highly dependent on the application implementation. All measurements taken with 3.3 V supply at 25 °C.

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 11: Current consumption during typical use cases**

## 4.2.6 Wi-Fi radio characteristics

 $V_{CC} = 3.3 \text{ V}$ ,  $T_{amb} = 25 \text{ °C}$ 

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	$20^{\circ} \pm 1$	dBm
			11 Mbit/s	$20^{\circ} \pm 1$	dBm
	802.11g	Channel 6	6 Mbit/s	$20^{\circ} \pm 1$	dBm
			54 Mbit/s	$18^{\circ} \pm 1$	dBm
	802.11n	Channel 6	MCS0	$19^{\circ} \pm 1$	dBm
			MCS7	$17.5^{\circ} \pm 1$	dBm
Receiver Sensitivity (typical)	802.11b		1 Mbit/s	$-96 \pm 2$	dBm
			11 Mbit/s	$-88 \pm 2$	dBm
	802.11g		6 Mbit/s	$-92 \pm 2$	dBm
			54 Mbit/s	$-74 \pm 2$	dBm
	802.11n	20 MHz	MCS0	$-91 \pm 2$	dBm
			MCS7	$-72 \pm 2$	dBm

\* The maximum output 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 12: Wi-Fi radio characteristics**

## 4.2.7 Bluetooth Low Energy characteristics\*\*

 $V_{CC} = 3.3 \text{ V}$ ,  $T_{amb} = 25 \text{ °C}$ 

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 output power varies depending upon the region of operation.

\*\* RF Not supported for current version.

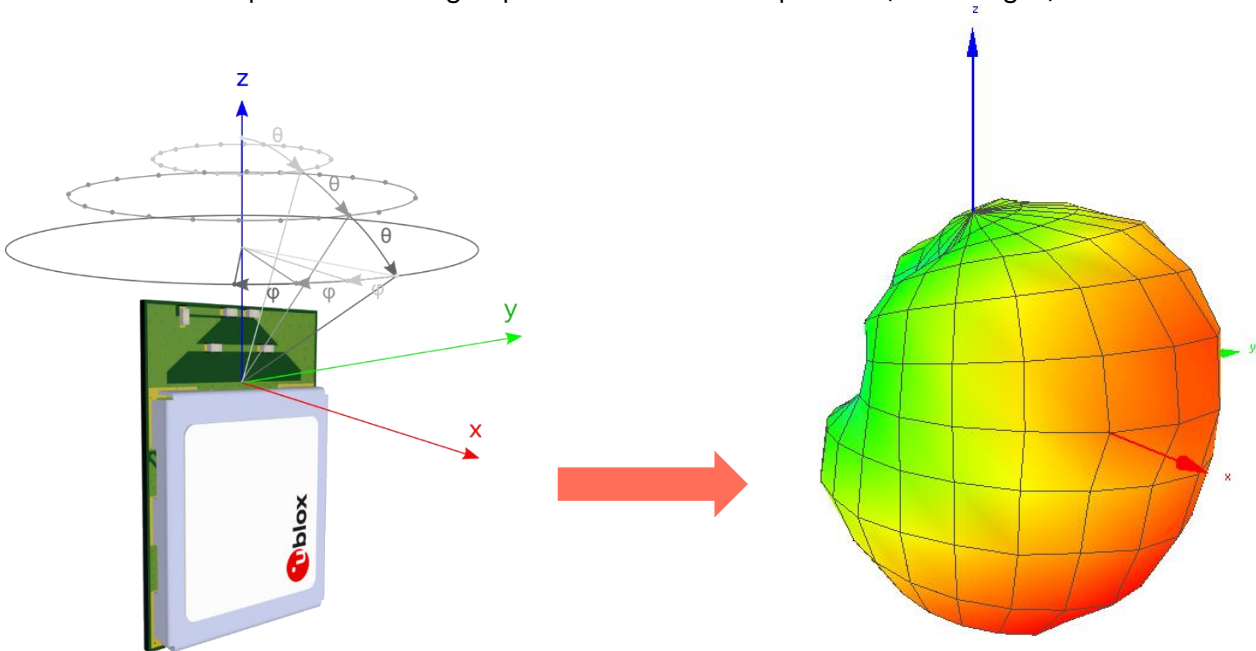
**Table 13: Bluetooth Low Energy characteristics**

### 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.

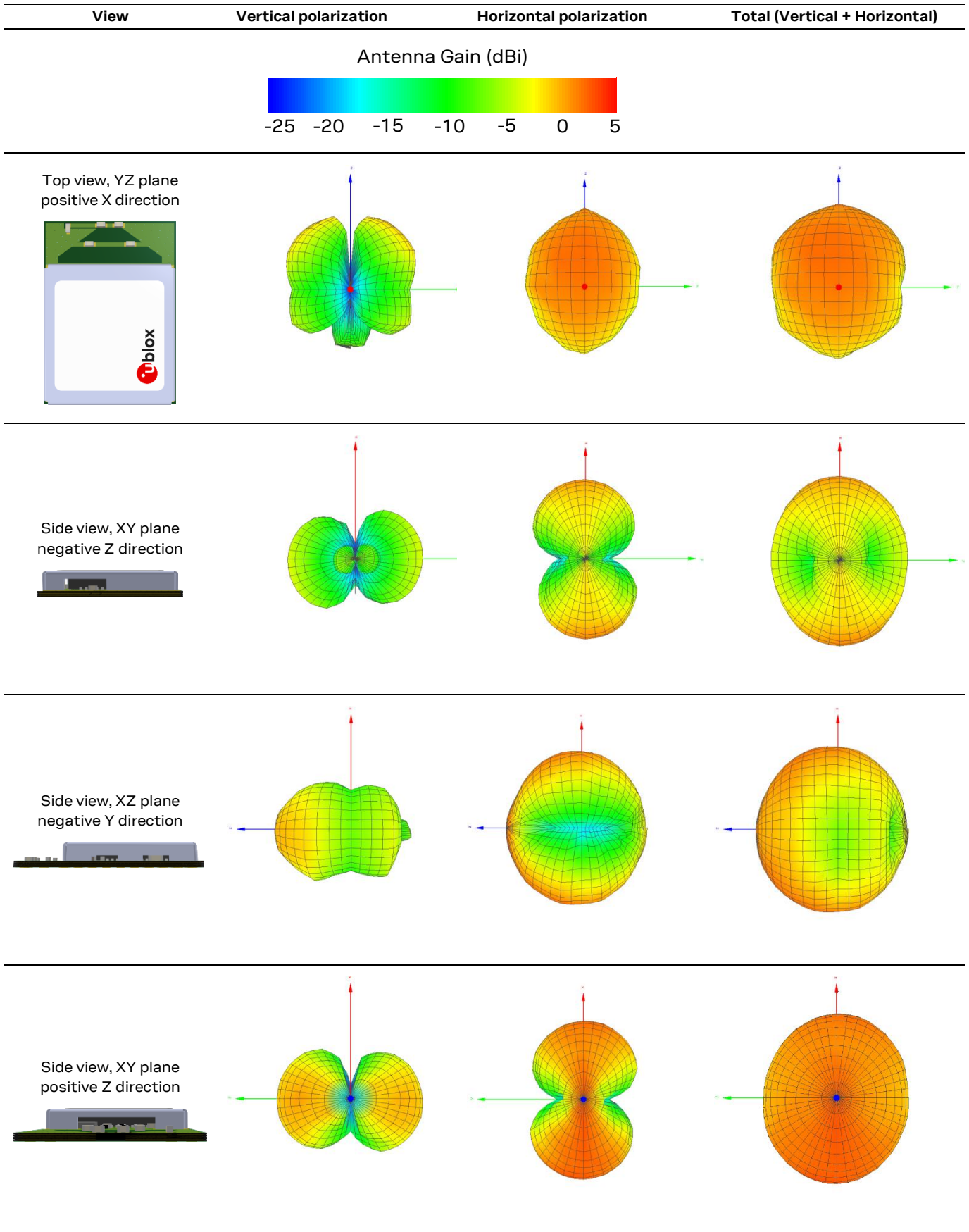
Figure 3 provides an overview of the measurement procedure and describes how the NORA-W256AWS module is aligned to the XYZ-coordinate system.

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 14 shows the radiation patterns and antenna gain of the NORA-W256AWS module variant that includes an internal PCB trace antenna.



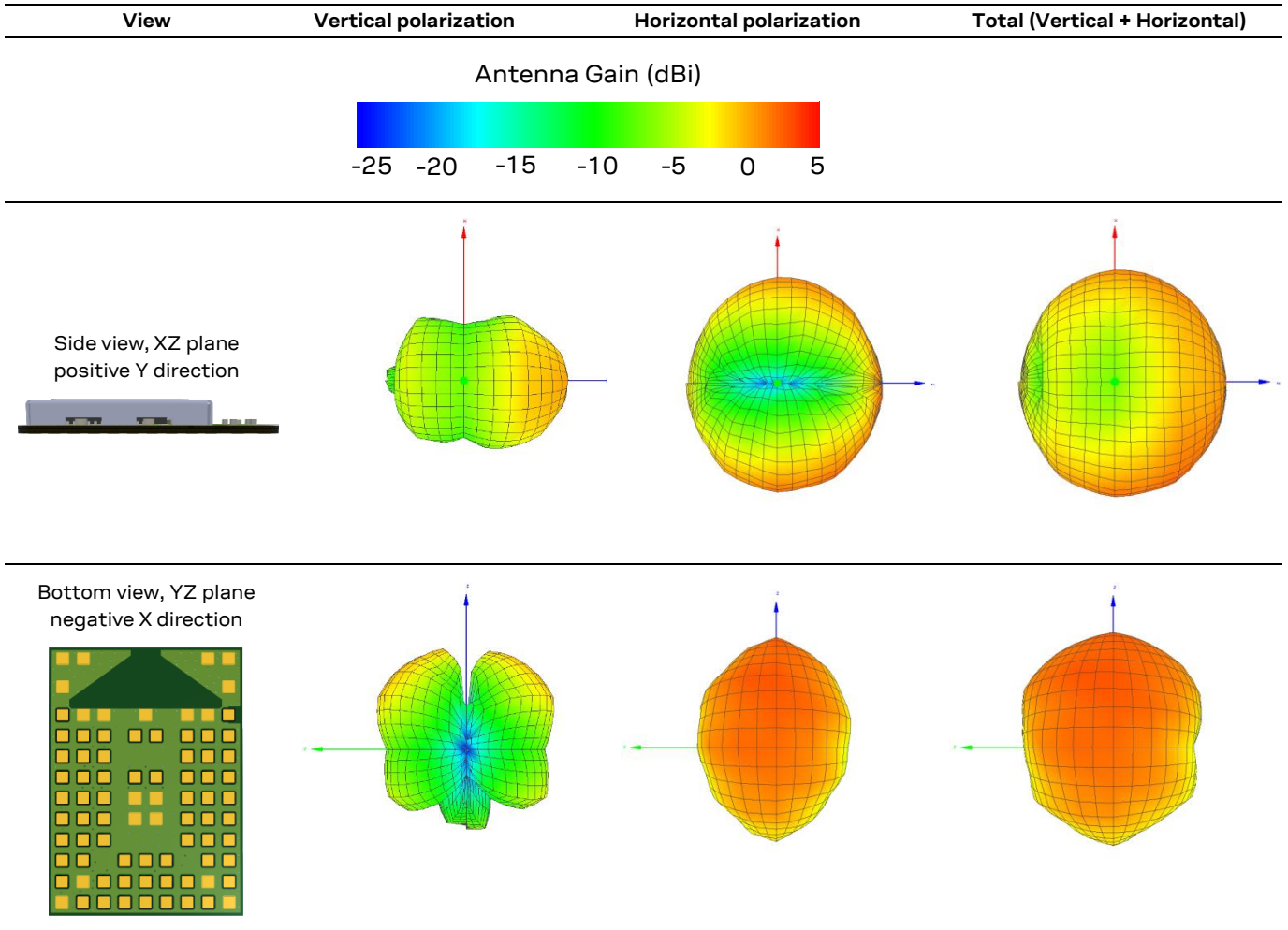


Table 14: NORA-W256AWS antenna radiation patterns

## 5 Mechanical specifications

### 5.1 NORA-W256AWS mechanical specifications

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

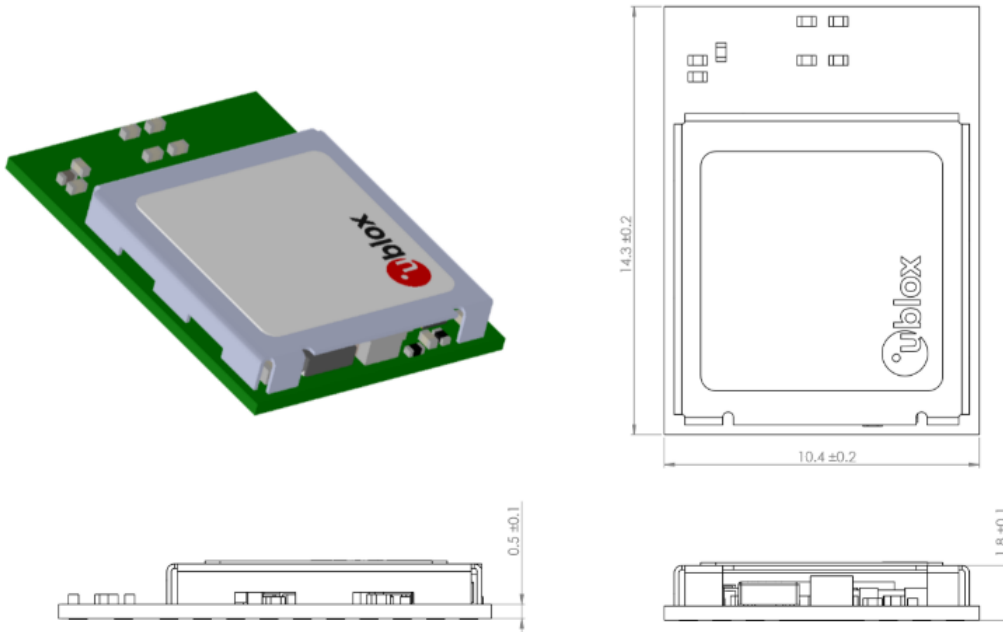


Figure 4: NORA-W256AWS dimensions

### 5.2 NORA-W251AWS mechanical specifications

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

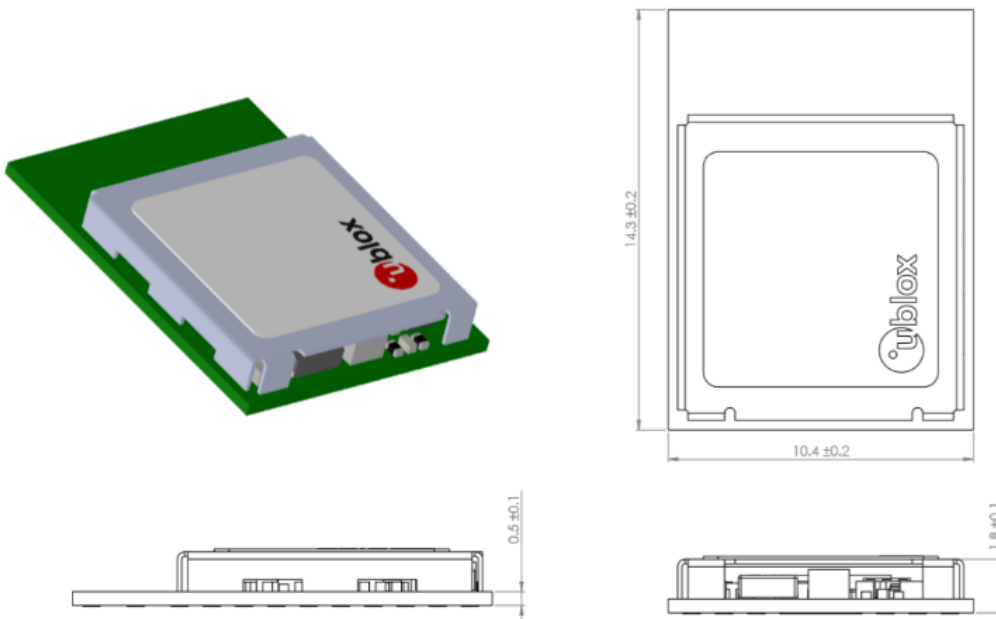


Figure 5: NORA-W251AWS dimensions

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

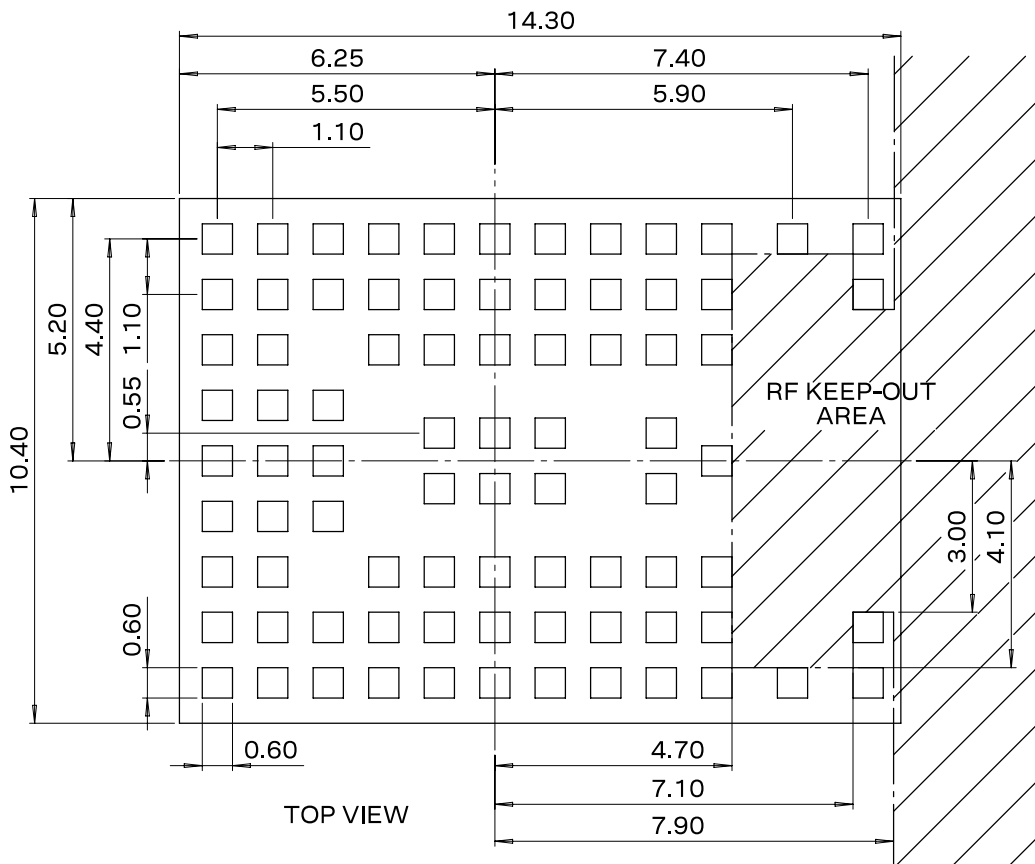



Figure 6: NORA-W2 mechanical outline

## 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 15: 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 17](#) describes the reel types for each module variant.

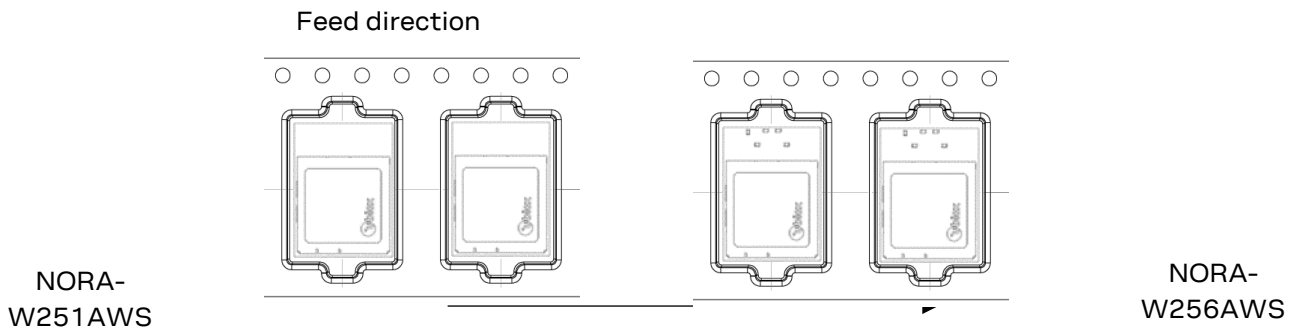
Model	Reel type
NORA-W251AWS	A3
NORA-W256AWS	A3

**Table 16: 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.

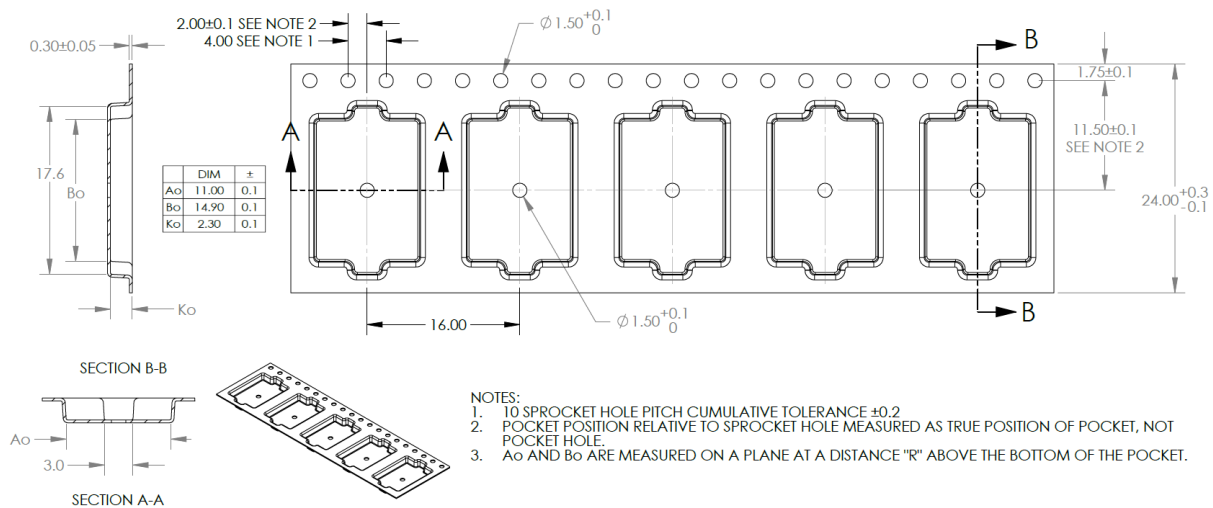


Figure 8: NORA-W2 tape dimensions

## 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 given in millimeters [mm].

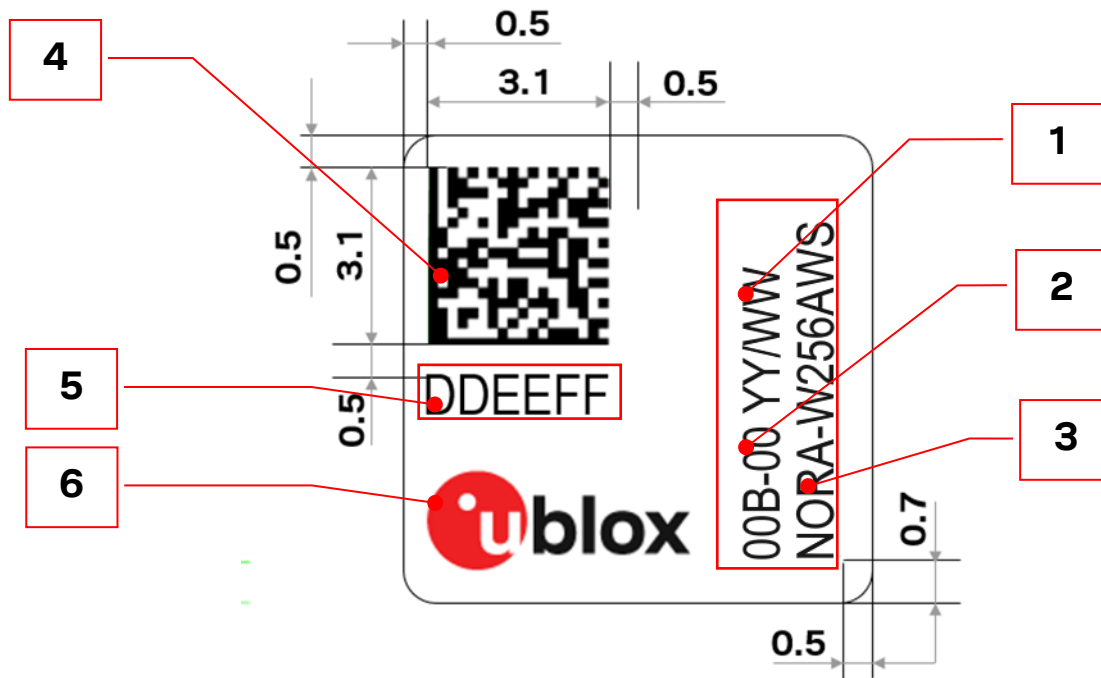


Figure 9: Location of product type number on the NORA-W2 series module label

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: <ul style="list-style-type: none"> <li>- 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.</li> <li>- The following 12 symbols represent the unique hexadecimal Bluetooth address of the module AABCCDDEEFF, and</li> <li>- The last 4 symbols represent the hardware and firmware version encoded HHFF.</li> </ul>
5	Second half of the device address
6	u-blox logo with the red dot to indicates pin 1.

Table 17: 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 18: 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 19: Explanation of the abbreviations and terms used**

## Related documents

- [1] NORA-W2 series system integration manual, [UBX-22005177](#)
- [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](http://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.
R02	15-Jul-2022	asoh	Added boot pin mapping, assigned boot pin to NC and LED3 function to the GPIO5 pin, and included other significant changes in the module <a href="#">Pinout</a> . Clarified currently support for 3.3 V IO voltage level only in section <a href="#">Digital I/O interfaces reference voltage</a> .

## Contact

For further support and contact information, visit us at [www.u-blox.com/support](http://www.u-blox.com/support).