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NINA-W15 series

Stand-alone multiradio modules with Wi-Fi and Bluetooth

Data sheet

Abstract

This technical data sheet describes the NINA-W15 series stand-alone multiradio modules. The NINA-W15 modules come with pre-flashed application software, Wi-Fi (802.11b/g/n) and Bluetooth dual-mode (Bluetooth BR/EDR and Bluetooth Low Energy). The module has a number of important security features embedded, including secure boot, which ensures that only authenticated software can run on the module. This makes NINA-W15 ideal for critical IoT applications where security is important.

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Mass Production / End of Life	Production Information	Document contains the final product specification.

This document applies to the following products:

Product name	**Type number**	**u-connectXpress software version**	**Hardware version**	**PCN reference**	**Product status**
NINA-W151	NINA-W151-00B-00	1.0.0	06	N/A	Initial production
	NINA-W151-00B-01	1.0.0	06	UBX-19051875	Initial production
	NINA-W151-02B-00	3.0.0	07	N/A	In Development
NINA-W152	NINA-W152-00B-00	1.0.0	06	N/A	Initial production
	NINA-W152-00B-01	1.0.0	06	UBX-19051875	Initial production
	NINA-W152-02B-00	3.0.0	07	N/A	In Development
NINA-W156	NINA-W156-02B-00	3.0.0	03	N/A	Functional Sample

Contents

1 Functional description

1.1 Overview

The NINA-W15 series stand-alone multiradio modules integrate Wi-Fi, Bluetooth BR/EDR and Bluetooth low energy in a compact form factor. The NINA-W15 modules support simultaneous operation on Wi-Fi and Bluetooth dual-mode and can thus serve as a gateway between Bluetooth and Wi-Fi or Ethernet.

The NINA-W15 modules come with pre-flashed application software, supporting Wi-Fi 802.11b/g/n and dual-mode Bluetooth (Bluetooth BR/EDR v4.2+EDR and Bluetooth Low Energy v4.2) in the 2.4 GHz ISM band. The host system can set up and control the module through the AT command interface.

Intended applications include telematics, industrial automation, connected buildings, wireless sensors, point-of-sales, and medical devices.

NINA-W15 is assessed to comply with RED and is certified as a modular transmitter in the following countries US (FCC), Canada (IC / ISED RSS), Japan (MIC), Taiwan (NCC), South Korea (KCC), Australia / New Zealand (ACMA), Brazil (Anatel), South Africa (ICASA). The modules are qualified for professional grade operation, supporting an extended temperature range of –40 °C to +85 °C.

1.2 Applications

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

1.3 Product features

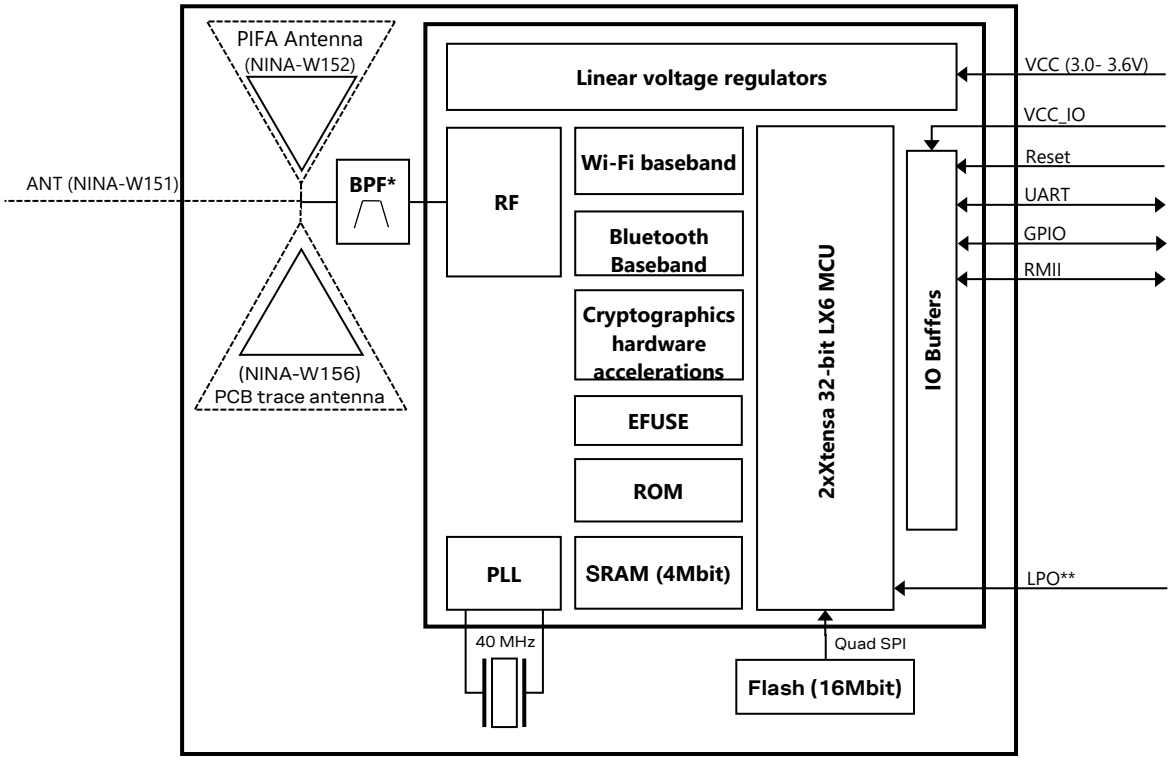
	NINA-W151	NINA-W152	NINA-W156
Grade			
Automotive			
Professional	•	•	•
Standard			
Radio			
Chip inside	ESP32	ESP32	ESP32
Bluetooth qualification	v4.2	v4.2	v4.2
Bluetooth low energy	•	•	•
Bluetooth BR/EDR	•	•	•
Bluetooth output power EIRP [dBm]	8	8	8
Antenna type (see footnotes)	pin	metal	pcb
Wi-Fi 2.4 / 5 [GHz]	2.4	2.4	2.4
Wi-Fi IEEE 802.11 standards	b/g/n	b/g/n	b/g/n
Wi-Fi output power EIRP [dBm]	18	18	18
Max Wi-Fi range [meters]	500	400	400
Application software			
u-connectXpress	•	•	•
Interfaces			
UART	1	1	1
RMII	1	1	1
GPIO pins	21	21	23
Features			
AT command interface	•	•	•
Point-to-Point Protocol	•	•	•
Low Energy Serial Port Service	•	•	•
MCU (see footnotes)	LX6	LX6	LX6
RAM [kB]	520	520	520
Flash [kB]	2048	2048	2048
Wi-Fi throughput [Mbit/s] *	13	13	13
Maximum Bluetooth connections	7	7	7
Micro Access Point [max stations]	10	10	10
Wi-Fi enterprise security	•	•	•
End-to-end security (TLS)	•	•	•
Secure boot	•	•	•
WPA/WPA2	•	•	•

pin = Antenna pin
metal = Internal metal PIFA antenna
pcb = Internal PCB trace antenna

LX6 = 240 MHz dual-core Xtensa LX6
* = User data throughput over RMII

Table 1: NINA-W15 series main features summary

1.4 Block diagram



* Only on NINA-W151 and NINA-W152.

** Only on NINA-W156.

Figure 1: Block diagram of NINA-W15 series

1.5 Product variants

The NINA-W15 series modules come with pre-flashed application software, supporting Wi-Fi 802.11b/g/n, Bluetooth BR/EDR and Bluetooth Low Energy v4.2 in the 2.4 GHz ISM band. The host system can set up and control the module through the AT command interface. See u-connect AT Commands Manual [3] for more information about AT commands.

1.5.1 NINA-W151

The NINA-W151 module has no internal antenna. Instead the RF signal is available at a module pin for routing to an external antenna or antenna connector. The module outline is smaller compared to the modules variants with antenna, only 10.0 x 10.6 mm. The module height is 2.2 mm.

1.5.2 NINA-W152

The NINA-W152 module has an internal PIFA antenna mounted on the module. The RF signal is not connected to any module pin. The module outline is 10.0 x 14.0 mm and the height 3.8 mm.

1.5.3 NINA-W156

The NINA-W156 module has an internal PCB trace antenna on the module. The RF signal is not connected to any module pin. The module outline is 10.0 x 14.0 mm and the height 2.2 mm.

1.6 Radio performance

NINA-W15 modules support Wi-Fi and conform to IEEE 802.11b/g/n single-band 2.4 GHz operation, Bluetooth BR/EDR and Bluetooth Low Energy, as explained in Table 2.

Wi-Fi	Bluetooth BR/EDR	Bluetooth Low Energy
IEEE 802.11b/g/n IEEE 802.11d	Bluetooth v4.2+EDR Maximum number of slaves: 5	Bluetooth 4.2 BLE dual-mode
Band support Station mode: 2.4 GHz, channel 1-13* Access Point mode: 2.4 GHz, channel 1-11	Band support 2.4 GHz, 79 channels	Band support 2.4 GHz, 40 channels
Typical conducted output power 15 dBm	Typical conducted output power - 1 Mbit/s: 5 dBm - 2/3 Mbit/s: 5 dBm	Typical conducted output power 5 dBm
Typical radiated output power 18 dBm EIRP**	Typical radiated output power - 1 Mbit: 8 dBm EIRP** - 2/3 Mbit/s: 8 dBm EIRP**	Typical radiated output power 8 dBm EIRP**
Conducted sensitivity -96 dBm	Conducted sensitivity -88 dBm	Conducted sensitivity -88 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)	Data rates: 1 / 2 / 3 Mbit/s	Data rates: 1 Mbit/s

* Maximum support for 802.11d depends on the region.
** RF power including maximum antenna gain (3 dBi).

Table 2: NINA-W15 series Wi-Fi and Bluetooth characteristics

1.7 Software options

The NINA-W15 series modules come with the pre-flashed application software, supporting IEEE 802.11b/g/n single-band 2.4 GHz operation, Bluetooth BR/EDR and dual-mode Bluetooth. The host system can set up and control the module through the AT command interface. The NINA-W15 modules provide top grade security, thanks to secure boot, which ensures the module boots up only with original u-blox software. In addition, they will provide end-to-end security on the wireless link with the latest 802.11i (WPA2) standard and enterprise security to provide a secure connection to the infrastructure. This makes NINA-W15 ideal for critical IoT applications where security is important.

1.7.1 AT command support

You can configure the NINA-W151, NINA-W152 and NINA-W156 modules with the u-blox s-center toolbox software using AT commands. See u-connect AT Commands Manual [3] for information about supported AT commands.

The s-center evaluation software supporting the AT commands is also available free of charge and can be downloaded from the u-blox website.

1.7.2 Software upgrade

Information on how to upgrade the software for the NINA-W15 series is provided in the NINA-W1 series System Integration Manual [1].

1.8 IEEE 802.11d and additional regulatory domains

The NINA-W15 series modules support IEEE 802.11d. IEEE 802.11d is an amendment to the IEEE 802.11 specification that adds support for “additional regulatory domains”. IEEE 802.11d allows NINA-W15 based devices to self-configure and operate according to the regulations of the country in which they operate. Its parameters include country name, channel quantity and maximum transmission level. The country information feature simplifies the creation of 802.11 wireless access points and client devices that meet the different regulations enforced in various parts of the world.

1.8.1 NINA-W15 IEEE 802.11d implementation description

When NINA-W15 is used as a Wi-Fi station, the scan is used to detect which regulatory domain it is currently in. Passive scan is used for channels that are not available in all regulatory domains. The device supports the following three domains, where WORLD means all channels that are supported both by FCC, ETSI and most other countries in the world:

- WORLD
- FCC
- ETSI

See Table 3 for detailed information on channels that are supported in the different regulatory domains. The state transition diagram below (Figure 2) describes the algorithm for selecting the current regulatory domain.

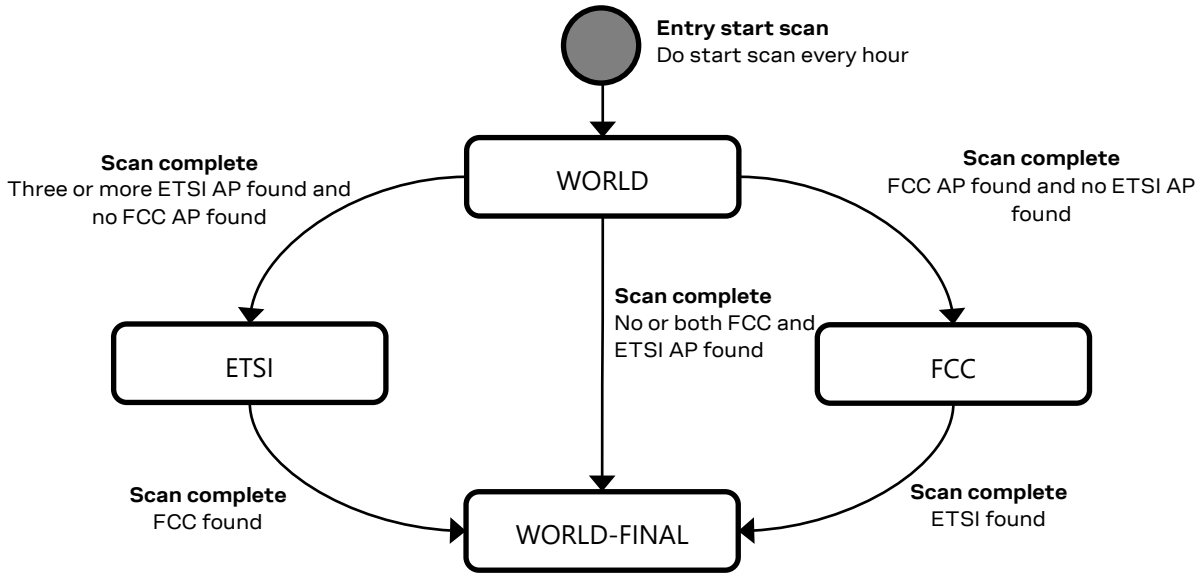


Figure 2: NINA-W15 series IEEE 802.11d state transition diagram

Initial regulatory domain is WORLD. At start up a scan is initiated to detect beacons containing country information IEs.

If at least one scan result contains country information indicating FCC and no country information indicates ETSI, then the regulatory domain is set to FCC.

If at least three scan results contain country information indicating ETSI and no country information indicates FCC, then the regulatory domain is set to ETSI.

If the scan result contains country information indicating both FCC and country information indicating ETSI, then the regulatory domain is set to WORLD. In the state transition diagram this is the state WORLD-FINAL. This state will not be exited until the device is reset.

A new scan is performed every hour to update the regulatory domain.

If the current regulatory domain is ETSI and at least one scan result contains country information indicating FCC and then the regulatory domain is set to WORLD. In the state transition diagram this is the state WORLD-FINAL. This state will not be exited until the device is reset.

If the current regulatory domain is FCC and at least one scan result contains country information indicating ETSI and then the regulatory domain is set to WORLD. In the state transition diagram this is the state WORLD-FINAL. This state is will not be exited until the device is reset.

At restart of the device the algorithm is restarted. It is not possible to override the algorithm described by reconfiguration the device.

Regulatory Domain	Band	Tx Channels
WORLD	2.4 GHz	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
ETSI	2.4 GHz	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
FCC	2.4 GHz	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Table 3: Channel list for supported regulatory domains

The maximum output power is reduced on some channels depending on regulatory requirements. For example, frequency band edge requirements can limit the output power on channels close to band edges.

1.9 MAC addresses

The NINA-W15 module series has four unique consecutive MAC addresses reserved for each module and the addresses are stored in the configuration memory during production. The first Wi-Fi MAC address is available in the Data Matrix on the label (see section 9.1).

MAC address	Assignment	Last bits of MAC address	Example
Module 1, address 1	Wi-Fi	00	*D4:CA:6E:90:04:90*
Module 1, address 2	RMII/Ethernet	01	*D4:CA:6E:90:04:91*
Module 1, address 3	Bluetooth	10	*D4:CA:6E:90:04:92*
Module 1, address 4	Reserved	11	*D4:CA:6E:90:04:93*
Module 2, address 1	Wi-Fi	00	*D4:CA:6E:90:04:94*
Module 2, address 2	RMII/Ethernet	01	*D4:CA:6E:90:04:95*
Module 2, address 3	Bluetooth	10	*D4:CA:6E:90:04:96*
Module 2, address 4	Reserved	11	*D4:CA:6E:90:04:97*

Table 4: Example MAC addresses assignment for two modules

1.10 Power modes

The NINA-W15 series modules are power efficient devices capable of operating in different power saving modes and configurations. Different sections of the module can be powered off when not needed and complex wake up events can be generated from different external and internal inputs.

See the u-connect AT Commands Manual [3] and NINA-W1 series System Integration Manual [1] for more information about power modes.

2 Interfaces

2.1 Power supply

The power for NINA-W15 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 (add 20% as margin over the listed type current consumption), as during operation, the current drawn from **VCC** and **VCC_IO** can vary significantly based on the power consumption profile of the Wi-Fi technology.

2.1.1 Module supply input (VCC)

The NINA-W15 series modules use an integrated Linear Voltage converter to transform the supply voltage presented at the **VCC** pin into a stable system voltage.

2.1.2 Digital I/O interfaces reference voltage (VCC_IO)

All modules in the NINA-W15 series provide an additional voltage supply input for setting the I/O voltage level. The separate **VCC_IO** pin enables integration of the module in many applications with different voltage levels (for example, 1.8 V or 3.3 V) without any level converters. The NINA-W15 modules support only 3.3 V as IO voltage level currently.

2.2 Low Power Clock

External LPO is a planned feature not supported in the current firmware.

The NINA-W15 module does not have an internal low power oscillator (LPO), which is required for lowest power modes. An external 32.768 KHz LPO signal can be supplied externally via the **LPO_CLK** pin of the NINA-W156 module if low power modes are required. NINA-W152 and NINA-W151 does not support an external LPO clock.

2.3 Module reset

The NINA-W15 series modules can be reset (rebooted) in one of the following ways:

- Low level on the **RESET_N** pin, which is normally set high by an internal pull-up. This causes “hardware” reset of the module. The **RESET_N** signal should be driven by an open drain, open collector or contact switch. When **RESET_N** is low (off), the chip works at the minimum power.
- The NINA-W15 series modules can be reset using an AT command (see u-connect AT Commands Manual [3]). This causes a “software” reset of the module.

2.4 Boot strapping pins

There are several boot configuration pins available on the module that must have the correct settings during boot (see Table 5).

The boot strap pins are configured to the default state internally on the module and must NOT be configured externally. Pin 32 is an exception and can be connected to GND to turn off printouts during start-up.

Pin 27 is a boot strap pin, but also the RMII clock line, see NINA-W1 series System Integration Manual [1] for more information how to use the RMII interface.

Pin	State during boot	Default	Behavior	Description
27	0		ESP boot mode (factory boot)	ESP Factory boot Mode/RMII clock line.
	1	**Pull-up***	**Normal Boot from internal Flash**	

Pin	State during boot	Default	Behavior	Description
32	0		Silent	Printout on U0TXD during boot
	1	**Pull-up***	**U0TXD Toggling**	

*About 30 kΩ

Table 5: NINA-W15 series boot strapping pins

2.5 RF antenna interface

The RF antenna interface of the NINA-W15 series supports Wi-Fi, Bluetooth BR/EDR 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 exactly the same time in the module antenna.

The NINA-W15 series supports either an internal antenna (NINA-W152 and NINA-W156) or an external antenna connected through a dedicated antenna pin (NINA-W151).

2.5.1 Internal antenna

Both NINA-W152 and NINA-W156 have internal antennas specifically designed and optimized for the NINA module. The NINA-W152 module has a 2.4 GHz PIFA antenna and the NINA-W156 module has a 2.4 GHz PCB trace antenna.

It is recommended to place the NINA-W152 modules in such a way that the internal antenna is in the corner of the host PCB (the corner closest to Pin 16 should be in the corner). The antenna side (short side closest to the antenna), positioned along one side of the host PCB ground plane is the second best option.

For the NINA-W156 module place it in such a way that the PCB trace antenna is placed on the side edge of the host PCB and in the middle of the side.

For both NINA-W152 and NINA-W156 keep a minimum clearance of 5 mm between the antenna and the casing. Keep a minimum of 10 mm free space from the metal around the antenna including the area below. If a metal enclosure is required, use NINA-W151 and an external antenna. It is beneficial to have a large solid ground plane on the host PCB and have a good grounding on the module. Minimum ground plane size is 24x30 mm but recommended is more than 50x50 mm.

See the NINA-W1 Series System Integration Manual [1] for more information about antenna related design.

⚠ The ANT signal solder pin is available neither on the NINA-W152 nor the NINA-W156 module.

2.5.2 External RF antenna interface

The NINA-W151 module has an antenna signal (ANT) pin with a characteristic impedance of 50 Ω for external antenna usage. 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 via 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 (see NINA-W1 series System Integration Manual [1]) is available and must be followed to comply with the NINA-W1 FCC/IC modular approvals.

Also see the list of approved antennas (section 7.2).

2.6 IO signals

2.6.1 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. See u-connect AT Commands Manual [3] for more information about connectivity software signals IOs.

Mode	Status	RGB LED Color	GREEN	BLUE	RED
Data mode	IDLE	Green	LOW	HIGH	HIGH
Command mode	IDLE	Orange	LOW	HIGH	LOW
Data mode, Command mode	CONNECTING*	Purple	HIGH	LOW	LOW
Data mode, Command mode	CONNECTED*	Blue	HIGH	LOW	HIGH

*** = LED flashes on data activity**

Table 6: System status indication

☞ The **RED**, **GREEN** and **BLUE** signals are disabled when the RMII interface is enabled.

2.6.2 System control IO signals

The following input signals are used to control the system (see u-connect AT Commands Manual [3] for more information about connectivity software signals IOs):

- **RESET_N** is used to reset the system. See section 2.6 for detailed information.
- If **SWITCH_1** is driven low during start up, the UART serial settings are restored to their default values.
- **SWITCH_2** can be used to open a connection to a peripheral device.
- If both **SWITCH_1** and **SWITCH_2** are driven low during start up, the system will enter the bootloader mode.
- If both **SWITCH_1** and **SWITCH_2** are driven low during start up and held low for 10 seconds, the system will exit the bootloader mode and restore all settings to their factory defaults.

2.6.3 UART IO signals

In addition to the normal **RXD**, **TXD**, **CTS,** and **RTS** signals, the NINA-W15 software adds the **DSR** and **DTR** pins to the UART interface. Note that they are not used as originally intended, but to control the state of the NINA module. Depending on the current configuration, the **DSR pin** can be used to:

- Enter command mode
- Disconnect and/or toggle connectable status

2.7 Data interfaces

2.7.1 UART

The NINA-W15 modules include a 6-wire 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)
- Hardware flow control lines (**CTS** as input, **RTS** as output)
- Link status (**DTR** as output, **DSR** as input). The **DTR/DSR** signals behavior is adapted to the u-connectXpress software functionality and differs from the UART standard, see section 2.6.3 for additional information.

- Programmable baud-rate generator allows most industry standard rates, as well as non-standard rates up to 3 Mbit/s.
- Frame format configuration:
  - 8 data bits
  - Even or no-parity bit
  - 1 stop bit
- Default frame configuration is 8N1, meaning eight (8) data bits, no (N) parity bit, and one (1) stop bit.

2.7.2 RMII

The RMII (Reduced Media Independent Interface) Ethernet interface is intended for connecting to an external PHY. The flow control (**RTS** and **CTS**) of the UART interface is multiplexed with the RMII interface and cannot be used simultaneously. The **RED**, **GREEN** and **BLUE** signals are also disabled when the RMII interface is enabled because the **BLUE** signal is multiplexed with the RMII interface.

An MDIO (Management Data Input/Output) interface used for controlling the external PHY is also available.

See NINA-W1 series System Integration Manual [1] for more information about how to use the RMII interface.

3 Pin definition

3.1 Pin assignment

The pinout as shown in Figure 3 describes the pin configuration used in the NINA-W151 and NINA-W152 u-connectXpress software modules. The part below the dotted line in Figure 3 is the antenna area of NINA-W152 and the outline of the NINA-W151 module ends at the dotted line. In Figure 4 the NINA-W156 pinout is shown.

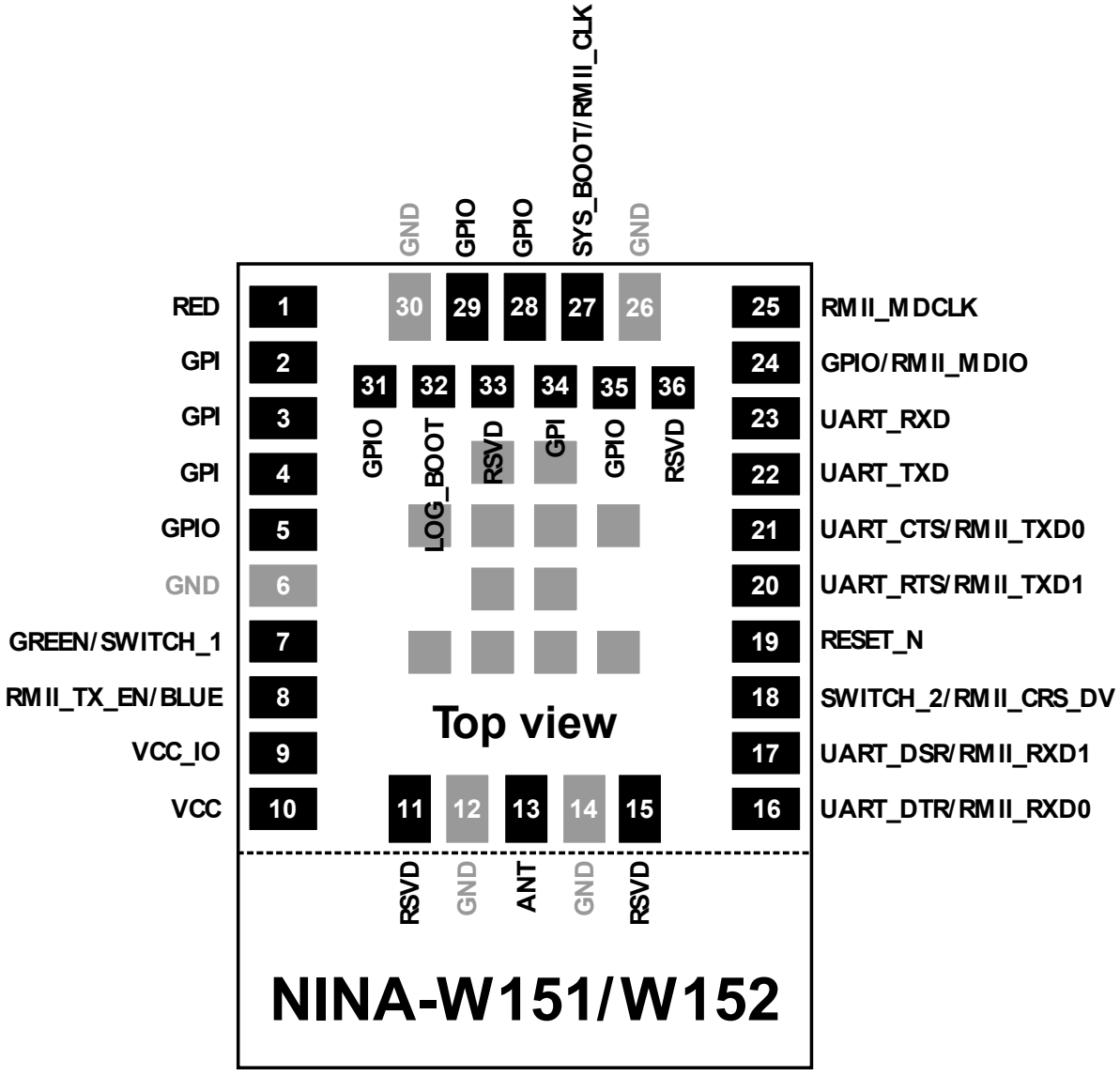


Figure 3: NINA-W151 and NINA-W152 pin assignment (top view)

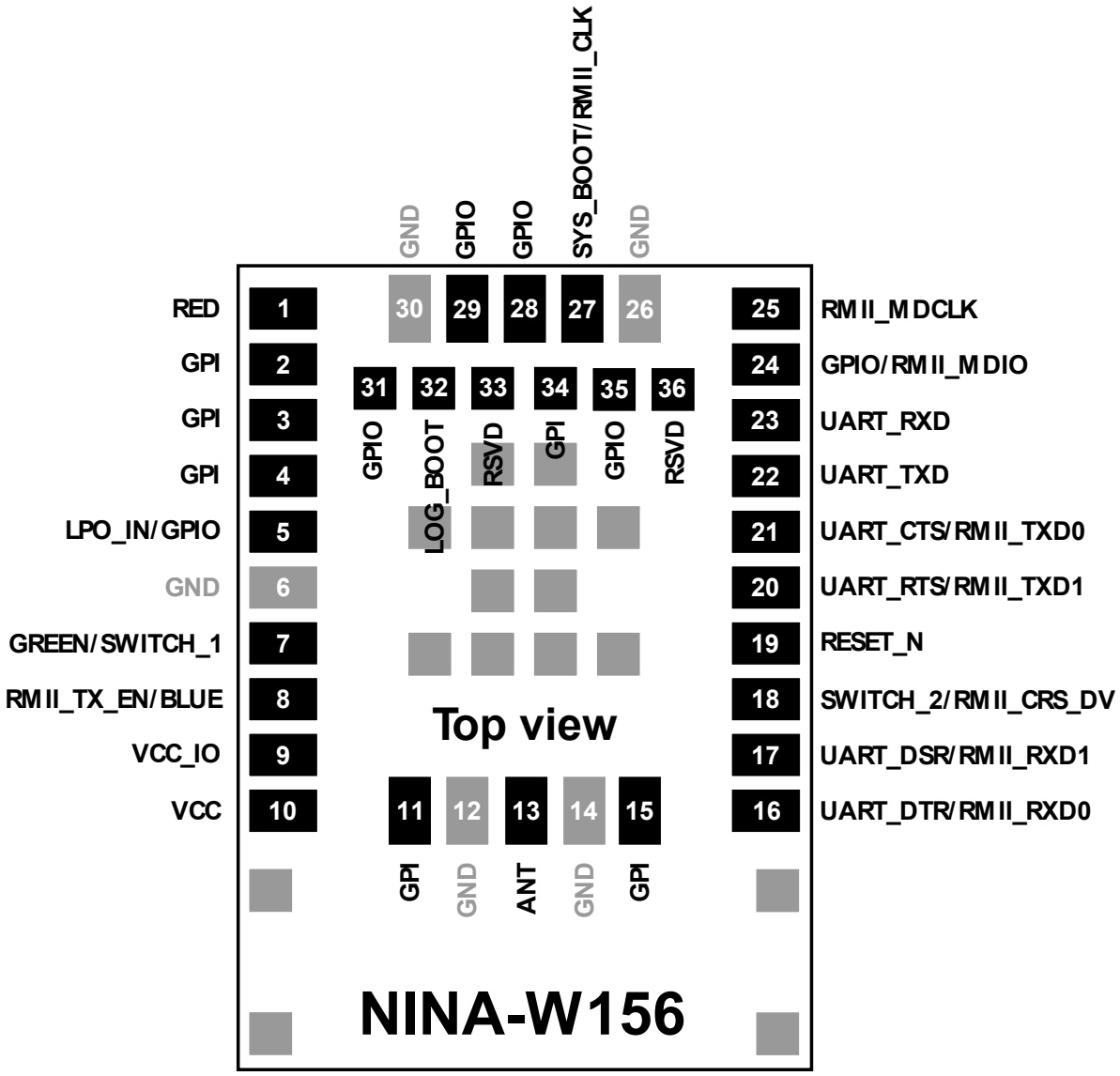


Figure 4: NINA-W156 pin assignment (top view).

The grey pins in the center of the modules are GND pins. The lower part is the antenna of NINA-W156 with four grey GND pins in the corners of the antenna.

Some of the signals are boot strap signals (see Table 7). It is important that these signals are in the correct state during startup (see section 2.3).

Pin	Name	I/O	Description	Alt. Function	Remarks
1	RED	O	Logic Red LED Signal	GPIO_1	See section 2.6 for more info about IO functionality.
2	RSVD		Reserved for future use.	GPI_2	Do not connect.
3	RSVD		Reserved for future use.	GPI_3	Do not connect.
4	RSVD		Reserved for future use.	GPI_4	Do not connect.
5	RSVD		Reserved for future use.	GPIO_5	**NINA-W151/NINA-W152:** Do not connect.
	LPO_IN	I	Low Power Oscillator Input	GPIO_5	**NINA-W156:** LPO_IN
6	GND		Ground		
7	GREEN/ SWITCH_1	I/O	GREEN: System status signal / SWITCH_1: Restore UART	GPIO_7	Active low.

			serial settings / Enter bootloader.		
8	BLUE/ RMII_TXEN	O	Logic Blue LED Signal/ RMII Transmit Enable output	GPIO_8	See section 2.6 for more info about IO functionality.
9	VCC_IO	I	Module I/O level voltage input		3.3 V IO voltage supply.
10	VCC	I	Module supply voltage input		3.0-3.6 V module voltage supply.
11	RSVD		Reserved for future use.		**NINA-W151/NINA-W152:** Do not connect.
				GPI_11	**NINA-W156:** Input only. Do not connect.
12	GND		Ground		
13	ANT	I/O	Antenna Tx/Rx interface		50 Ω nominal characteristic impedance
14	GND		Ground		
15	RSVD		Reserved for future use.		**NINA-W151/NINA-W152:** Do not connect.
				GPI_15	**NINA-W156:** Input only. Do not connect.
16	UART_DTR/ RMII_RXD0	I/O	UART Data Terminal Ready/ RMII Receive Data input 0	GPIO_16	The DTR signaling is not according to UART standard (see section 2.6.3).
17	UART_DSR/ RMII_RXD1	I	UART Data Set Ready/ RMII Receive Data input 1	GPIO_17	The DSR signaling is not according to UART standard (see section 2.6.3).
18	SWITCH_2/ RMII_CRSDV	I	Connect on external signal / Enter bootloader/ Carrier Sense/Receive Data Valid input	GPIO_18	Active low. See section 2.6 for more info about IO functionality.
19	RESET_N	I	External system reset input.		Active low.
20	UART_RTS/ RMII_TXD1	O	UART request to send/ RMII Transmit Data output 1	GPIO_20	Hardware flow control signal. Active low.
21	UART_CTS/ RMII_TXD0	I/O	UART clear to send/ RMII Transmit Data output 0	GPIO_21	Hardware flow control signal. Active low.
22	UART_TXD	O	UART data output.	GPIO_22	
23	UART_RXD	I	UART data input.	GPIO_23	
24	RMII_MDIO	I/O	RMII Management data	GPIO_24	
25	RMII_MDCLK	O	RMII Management data clock		Leave unconnected unless used for RMII
26	GND		Ground		
27	RMII_CLK/ SYS_BOOT	I	RMII clock line/ Boot Mode.	GPIO_27	Normal boot from flash/ESP Factory boot Mode/RMII clock line (see section 2.4).
28	RSVD		Reserved for future use.	GPIO_28	Do not connect.
29	RSVD		Reserved for future use.	GPIO_29	Do not connect.
30	GND		Ground		
31	RSVD		Reserved for future use.	GPIO_31	Do not connect.
32	LOG_BOOT		Reserved for future use.		Do not connect.
33	RSVD		Reserved for future use.		Do not connect.
34	RSVD		Reserved for future use.	GPI_34	Do not connect
35	RSVD		Reserved for future use.	GPIO_35	Do not connect.
36	RSVD		Reserved for future use.		Do not connect.

Table 7: NINA-W151/NINA-W152/NINA-W156 pinout

4 Electrical specifications

⚠ Stressing the device above one or more of the ratings listed in the Absolute maximum rating section may 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 section of this document should be avoided. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

☞ Operating condition ranges define those limits within which the functionality of the device is guaranteed. 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 8: Absolute maximum ratings

⚠ The product is not protected against overvoltage or reversed voltages. If necessary, voltage spikes exceeding the power supply voltage specification, given in table above, must be limited to values within the specified boundaries by 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			2.5	kV	Human body model according to JEDEC JS001

Table 9: Maximum ESD ratings

⚠ NINA-W15 series modules are Electrostatic Sensitive Devices and require special precautions while handling. See section 8.4 for ESD handling instructions.

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 lowest temperature range in section 4.2.2.

Table 10: 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 11: Input characteristics of voltage supply pins

4.2.3 RESET_N pin

Pin name	Parameter	Min	Typ	Max	Unit
RESET_N	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		2.6		s

Table 12: 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	
		0		0.4	V	
	Output characteristic: High-level output	VCC_IO-0.4		VCC_IO	V	
		VCC_IO-0.4		VCC_IO	V	
	Drive capability			12	mA	Push and pull
	Pull-up/pull-down resistance		30		kΩ.	
Signals rerouted via the IO MUX	Output signal speed			20	MHz	
	Input signal speed			10	MHz	The GPIO-Matrix delays the input-signals by 2 cycles of the AHB-clock typical 80MHz -> 25 ns delay

Table 13: Digital pin characteristics

4.2.5 Current consumption

Typical current consumption (VCC+VCC_IO) of a NINA-W15 module is provided in Table 14. ODIN-W2 is used as a companion device.

Power mode	Activity	Role	Typ	Max	Unit	Remarks
Wi-Fi to UART (Bluetooth low energy disabled)	Transmitting (15 dBm), channel 6	AP	122	350	mA	UART baud rate 3Mbit/s, Throughput 0.9 Mbit/s.
		Station	117	350	mA	UART baud rate 3Mbit/s, Throughput 1.4 Mbit/s.
	Receiving, channel 6	AP	116	350	mA	UART baud rate 3Mbit/s, Throughput 1.4 Mbit/s
		Station	117	350	mA	UART baud rate 3Mbit/s, Throughput 1.6 Mbit/s.
	Connected idle	AP	106	350	mA	
		Station	38	350	mA	
Wi-Fi to RMII (Bluetooth low energy disabled)	Transmitting (15 dBm)	Station	125	350	mA	Throughput 3-4 Mbit/s.
	Receiving	Station	112	350	mA	Throughput 6-8 Mbit/s.
	Connected idle	Station	45	350	mA	
Bluetooth BR/EDR (Bluetooth low energy disabled)	Transmitting	Master	166	250	mA	UART baud rate 3Mbit/s, Throughput UART 1.18 Mbit/s.
		Slave	166	250	mA	
	Receiving	Master	110	250	mA	UART baud rate 3Mbit/s, Throughput UART 0.7 Mbit/s.
		Slave	110	250	mA	
	Bluetooth connected	Master	102	250	mA	
		Slave	102	250	mA	
	Inquiry	-	100	250	mA	
Bluetooth Low Energy	Transmitting	Peripheral	67	250	mA	Throughput 30 kbit/s
	Receiving	Peripheral	54	250	mA	Throughput 25 kbit/s
	Transmitting	Central	73	250	mA	Throughput 28 kbit/s
	Receiving	Central	49	250	mA	Throughput 14 kbit/s
	Connected listening	Peripheral	42	250	mA	
	Connected listening	Central	42	250	mA	
	Advertising	Peripheral	41	250	mA	
	Scanning	Central	36	130	mA	
CPU idle mode	Radio off	-	33	130	mA	

Table 14: Current consumption during typical use cases

4.2.6 Wi-Fi radio characteristics

Parameter	Operation Mode	Specification	Unit
RF Frequency Range	802.11b/g/n	2.400 – 2.500	GHz
Channels		1-13*	
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

Parameter	Operation Mode			Specification	Unit
Conducted Transmit Power (typical)	802.11b	Channel 6	1 Mbit/s	13** ± 1	dBm
			11 Mbit/s	13** ± 1	dBm
	802.11g	Channel 6	6 Mbit/s	15** ± 1	dBm
			54 Mbit/s	12** ± 1	dBm
	802.11n	Channel 6	MCS0	15** ± 1	dBm
			MCS07	11** ± 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

Characteristics assume VCC = 3.3 V, Tamb = 25 °C
* Maximum support for 802.11d depends on the region.
** There is lower output power on band edge channels and also on the highest data rates.

Table 15: Wi-Fi radio characteristics

4.2.7 Bluetooth radio characteristics

Parameter	Operation Mode	Specification	Unit
RF Frequency Range		2.400 – 2.4835	GHz
Supported Modes		Bluetooth v4.2+EDR	
Number of channels		79	
Modulation	1 Mbit/s	GFSK (BDR)	
	2 Mbit/s	π/4-DQPSK (EDR)	
	3 Mbit/s	8-DPSK (EDR)	
Conducted Transmit Power (typical)	1 Mbit/s	5 ± 1	dBm
	2 / 3 Mbit/s	5 ± 1	dBm
Receiver Sensitivity (typical)	1 Mbit/s	-88 ± 2	dBm
	2 Mbit/s	-86 ± 2	dBm
	3 Mbit/s	-80 ± 2	dBm

Characteristics assume VCC = 3.3 V, Tamb = 25 °C

Table 16: Bluetooth radio characteristics

4.2.8 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 v4.2	
Number of channels	40	
Modulation	GFSK	
Transmit Power (typical)	5 ± 1	dBm
Receiver Sensitivity (typical)	-88 ± 2	dBm

Table 17: Bluetooth Low Energy characteristics

4.2.9 Antenna radiation patterns

The radiation patterns displayed in Table 18 and Table 19 show the antenna gain of the NINA-W152 with internal PIFA antenna and the NINA-W156 with internal PCB trace antenna. Figure 5 gives an overview of the measurement procedure, and how the NINA-W152/NINA-W156 module is aligned to the XYZ-coordinate system.

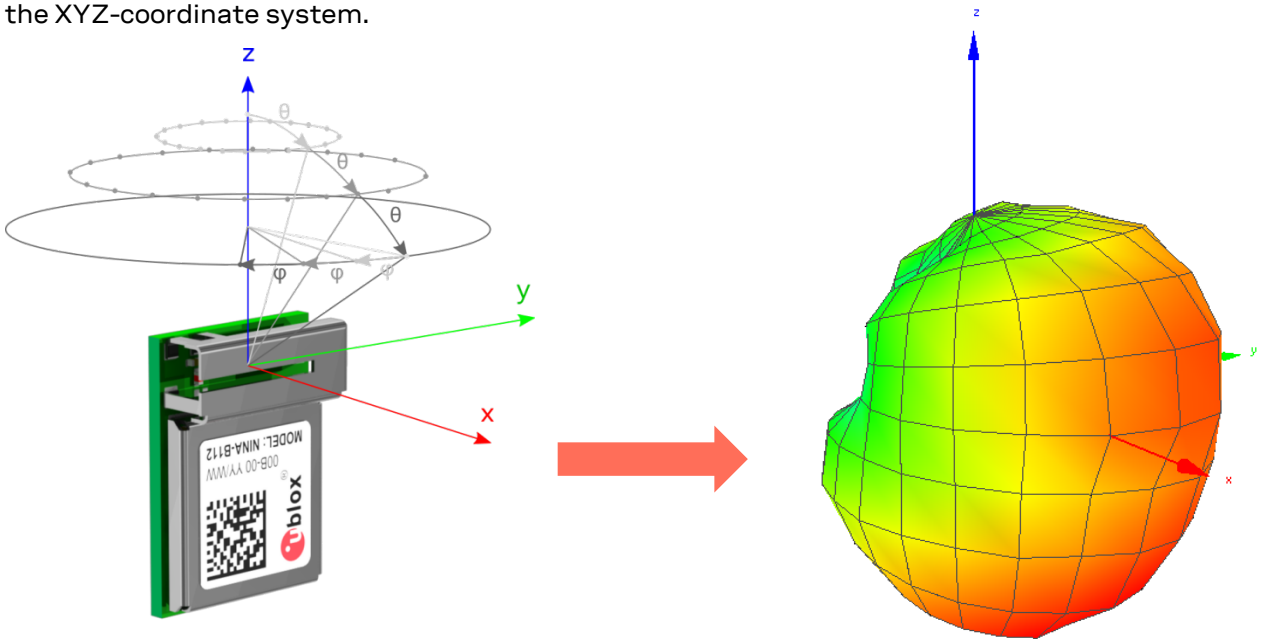


Figure 5: Measurement procedure for determining radiation patterns. A measurement is taken at every dot in the figure to the left, and is represented as a grid point in the radiation pattern to the right.

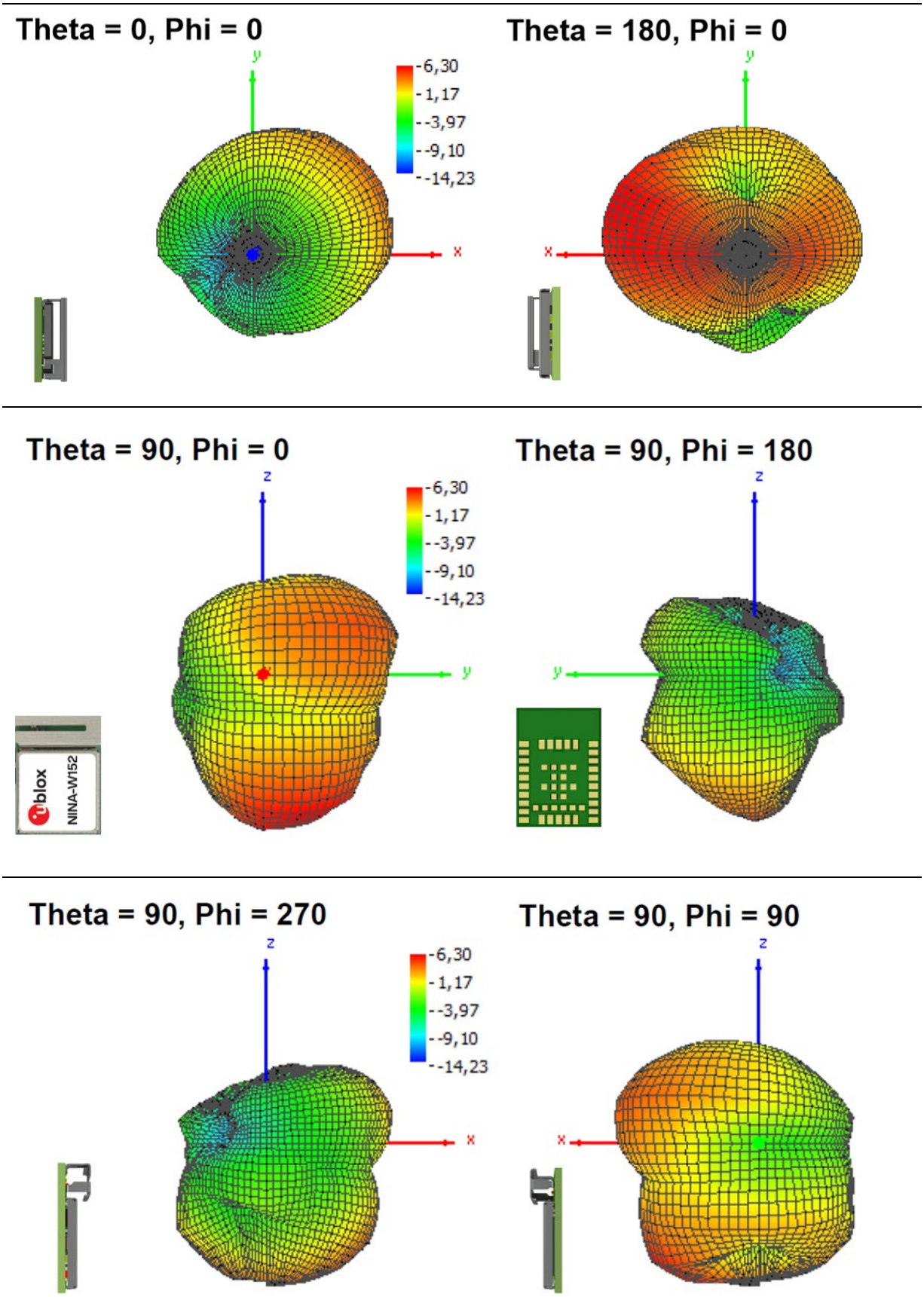


Table 18: NINA-W152 antenna radiation patterns

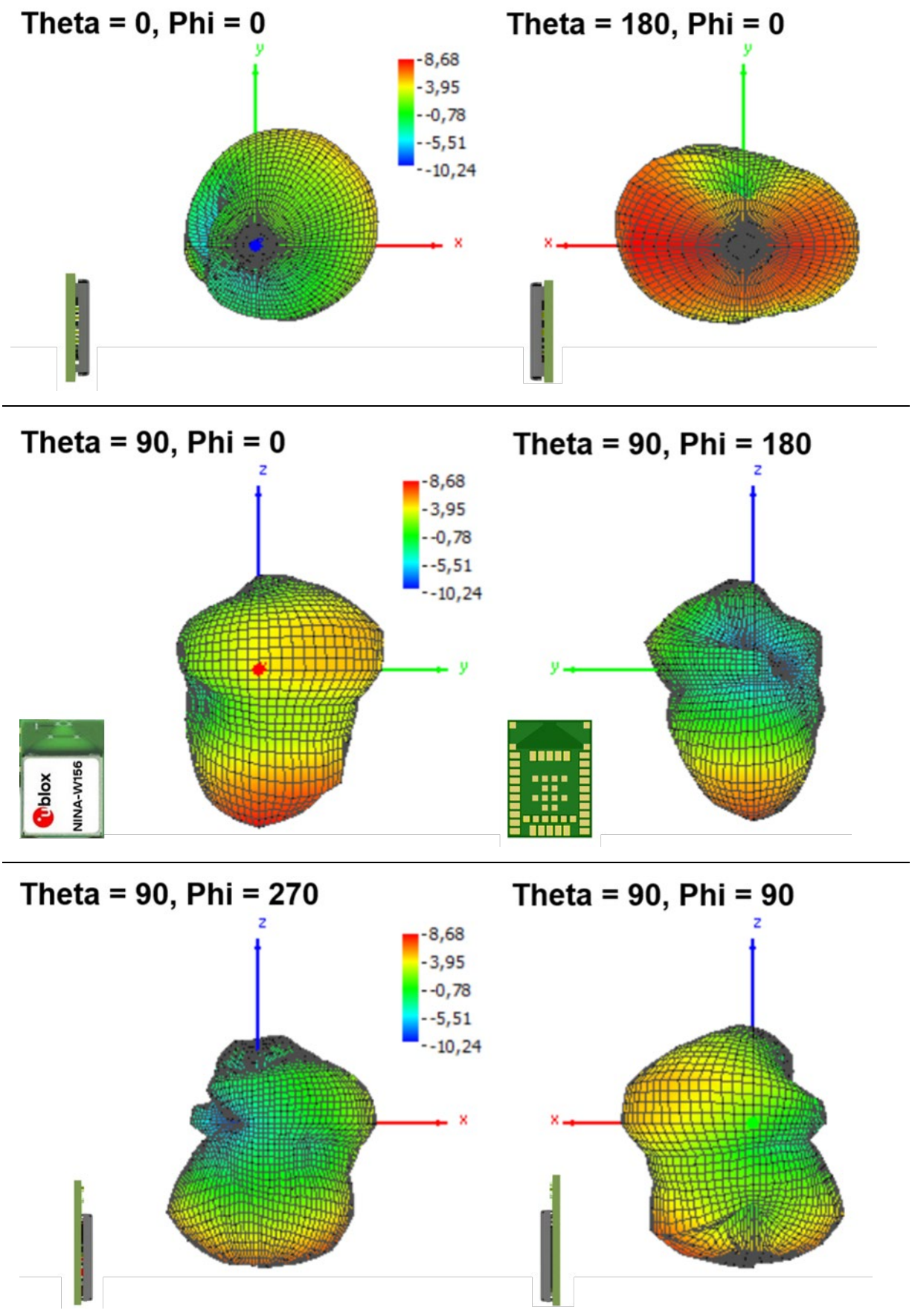


Table 19: NINA-W156 antenna radiation patterns

5 Mechanical specifications

5.1 NINA-W151 Mechanical specification

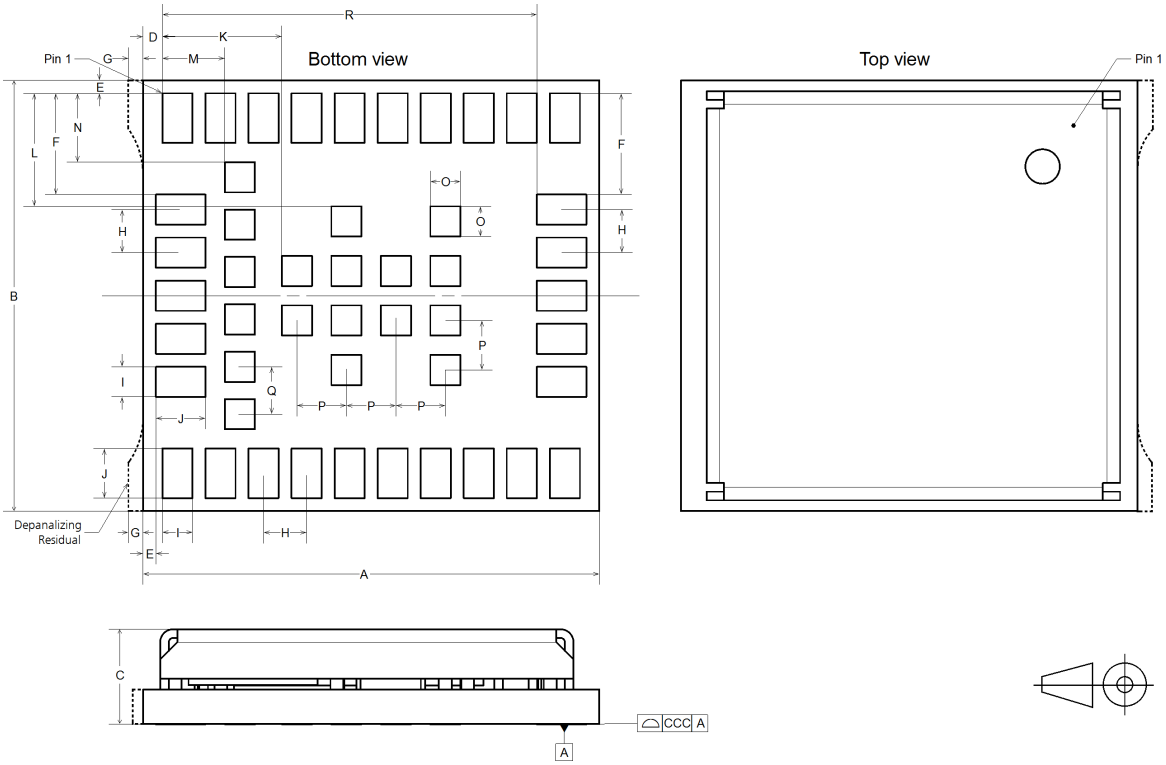


Figure 6: NINA-W151 mechanical outline

Parameter	Description	Typical		Tolerance	
A	Module PCB Length [mm]	10.6	(417.3 mil)	+0.20/-0.10	(+7.9/-3.9 mil)
B	Module PCB Width [mm]	10.0	(393.7 mil)	+0.20/-0.10	(+7.9/-3.9 mil)
C	Module Thickness [mm]	2.2	(86.6 mil)	+0.40/-0.20	(+15.8/-7.9
ccc	Seating Plane Coplanarity [mm]	0.10	(3.9 mil)	+0.02/-0.10	(+0.8/-3.9 mil)
D	Horizontal Edge to Lateral Pin No 1 Edge [mm]	0.45	(17.7 mil)	+0.10/-0.10	(+3.9/-3.9 mil)
E	Vertical and Horizontal Edge to Lateral Pin No 1 Edge	0.30	(11.8 mil)	+0.10/-0.10	(+3.9/-3.9 mil)
F	Vertical Pin No1 Edge to Lateral Pin Edge [mm]	2.35	(92.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
G	Depanalizing Residual [mm]	0.10	(3.9 mil)	+0.25/-0.10	(+9.8/-3.9 mil)
H	Lateral and Antenna Row Pin to Pin Pitch [mm]	1.0	(39.4 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
I	Lateral and Antenna Row Pin Width [mm]	0.70	(27.6 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
J	Lateral and Antenna Row Pin Height [mm]	1.15	(45.3 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
K	Horizontal Pin No1 Edge to Central Pin Edge [mm]	2.78	(109.4 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
L	Vertical Pin No1 Edge to Central Pin Edge [mm]	2.63	(103.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
M	Horizontal Pin No1 Edge to Inner Row Pin Edge [mm]	1.45	(57.1 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
N	Vertical Pin No1 Edge to Inner Row Pin Edge [mm]	1.6	(63.0 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
O	Central Pin and Inner Row Width and Height [mm]	0.70	(27.6 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
P	Central Pin to Central Pin Pitch [mm]	1.15	(45.3 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
Q	Inner Row Pin to Pin Pitch [mm]	1.1	(43.3 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
R	Horizontal Pin No1 Edge to Antenna Row Pin Edge [mm]	8.7	(342.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
	Module Weight [g]	<1.0			

Table 20: NINA-W151 mechanical outline data

5.2 NINA-W152 Mechanical specification

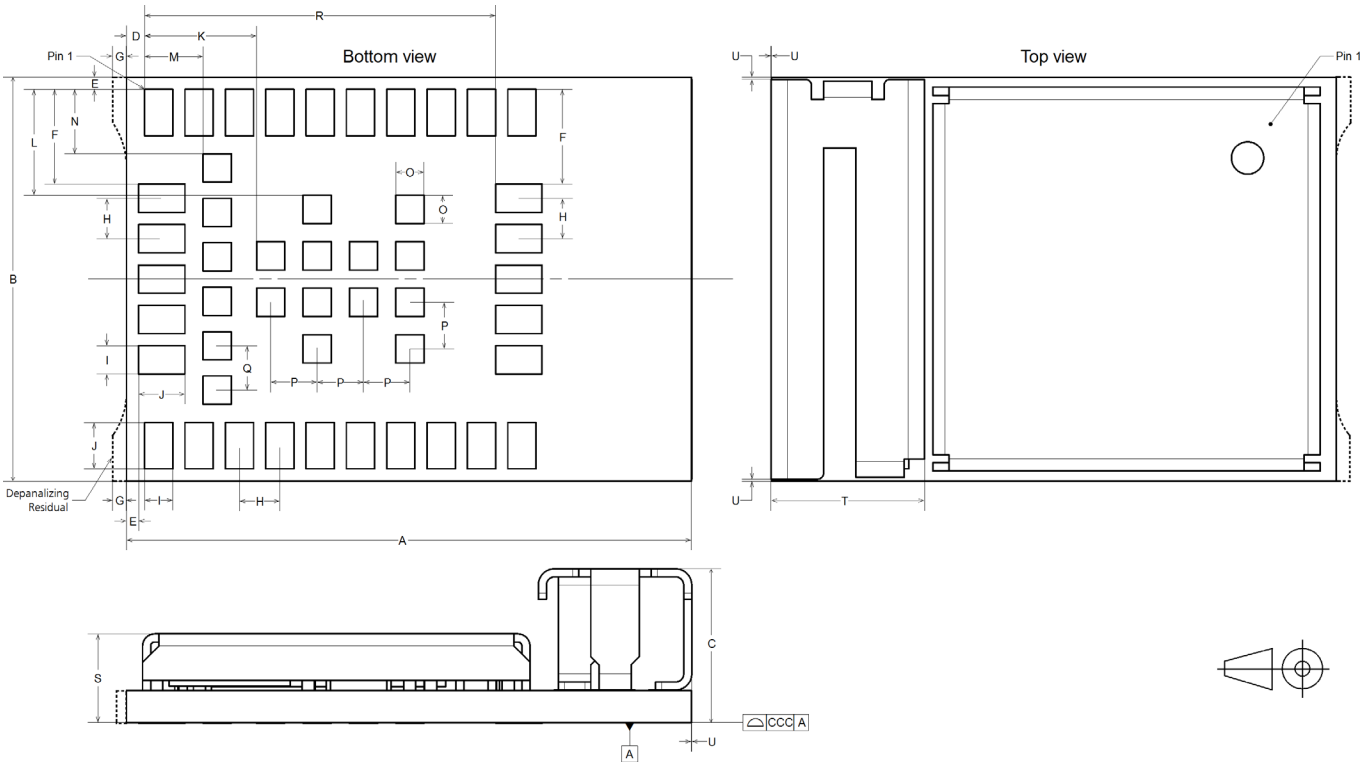


Figure 7: NINA-W152 mechanical outline

Parameter	Description	Typical		Tolerance	
A	Module PCB Length [mm]	14.0	(551.2 mil)	+0.20/-0.10	(+7.9/-3.9 mil)
B	Module PCB Width [mm]	10.0	(393.7 mil)	+0.20/-0.10	(+7.9/-3.9 mil)
C	Module Thickness [mm]	3.8	(149.6 mil)	+0.40/-0.20	(+15.8/-7.9
ccc	Seating Plane Coplanarity [mm]	0.10	(3.9 mil)	+0.02/-0.10	(+0.8/-3.9 mil)
D	Horizontal Edge to Lateral Pin No 1 Edge [mm]	0.45	(17.7 mil)	+0.10/-0.10	(+3.9/-3.9 mil)
E	Vertical and Horizontal Edge to Lateral Pin No 1 Edge	0.30	(11.8 mil)	+0.10/-0.10	(+3.9/-3.9 mil)
F	Vertical Pin No1 Edge to Lateral Pin Edge [mm]	2.35	(92.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
G	Depanalizing Residual [mm]	0.10	(3.9 mil)	+0.25/-0.10	(+9.8/-3.9 mil)
H	Lateral and Antenna Row Pin to Pin Pitch [mm]	1.0	(39.4 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
I	Lateral and Antenna Row Pin Width [mm]	0.70	(27.6 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
J	Lateral and Antenna Row Pin Height [mm]	1.15	(45.3 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
K	Horizontal Pin No1 Edge to Central Pin Edge [mm]	2.78	(109.4 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
L	Vertical Pin No1 Edge to Central Pin Edge [mm]	2.63	(103.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
M	Horizontal Pin No1 Edge to Inner Row Pin Edge [mm]	1.45	(57.1 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
N	Vertical Pin No1 Edge to Inner Row Pin Edge [mm]	1.6	(63.0 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
O	Central Pin and Inner Row Width and Height [mm]	0.70	(27.6 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
P	Central Pin to Central Pin Pitch [mm]	1.15	(45.3 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
Q	Inner Row Pin to Pin Pitch [mm]	1.1	(43.3 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
R	Horizontal Pin No1 Edge to Antenna Row Pin Edge	8.7	(342.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
S	PCB and Shield Cover Thickness [mm]	2.2	(86.6 mil)	+0.40/-0.20	(+15.8/-7.9
T	Module Antenna Width [mm]	3.8	(149.6 mil)	+0.20/-0.20	(+7.9/-7.9 mil)
U	Antenna overhang outside module outline on any side	0.0	(0.0 mil)	+0.60	(+23.6 mil)
	Module Weight [g]	<1.0			

Table 21: NINA-W152 mechanical outline data

5.3 NINA-W156 Mechanical specification

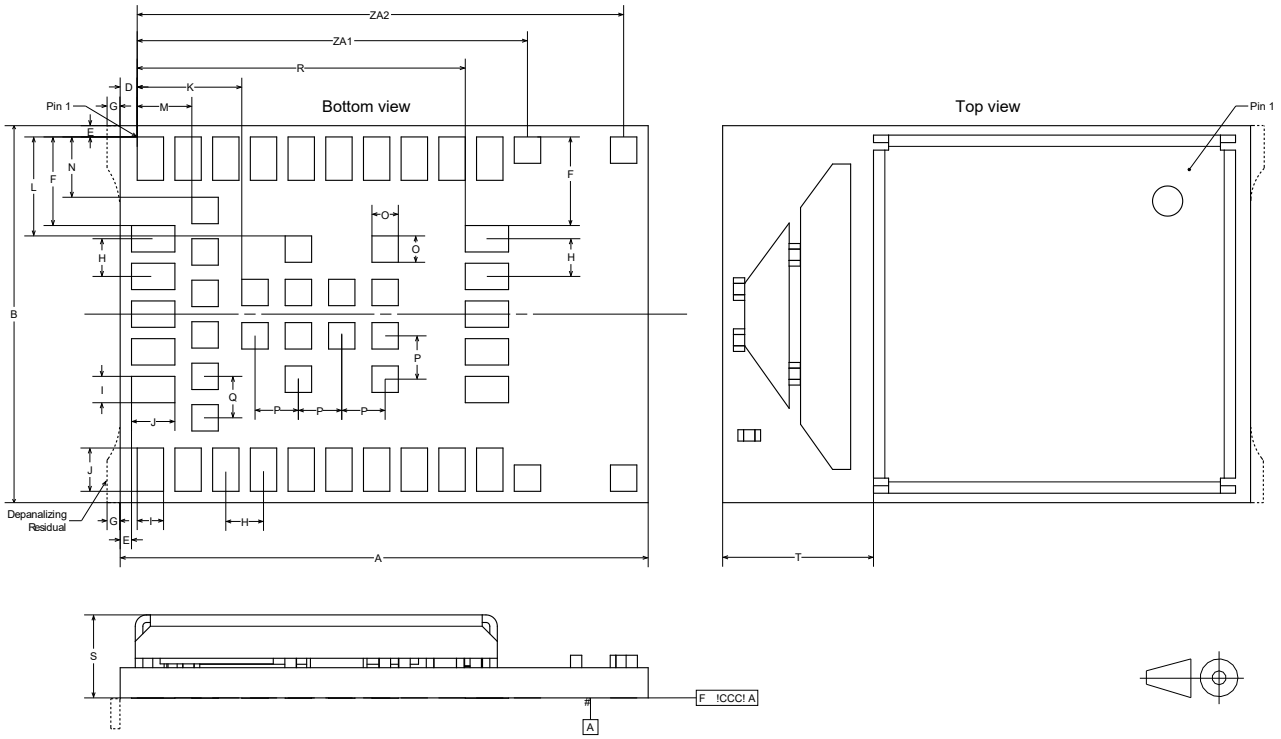


Figure 8: NINA-W156 mechanical outline

Parameter	Description	Typical		Tolerance	
A	Module PCB Length [mm]	14.0	(551.2 mil)	+0.20/-0.10	(+7.9/-3.9 mil)
B	Module PCB Width [mm]	10.0	(393.7 mil)	+0.20/-0.10	(+7.9/-3.9 mil)
ccc	Seating Plane Coplanarity [mm]	0.10	(3.9 mil)	+0.02/-0.10	(+0.8/-3.9 mil)
D	Horizontal Edge to Lateral Pin No 1 Edge [mm]	0.45	(17.7 mil)	+0.10/-0.10	(+3.9/-3.9 mil)
E	Vertical and Horizontal Edge to Lateral Pin No 1 Edge [mm]	0.30	(11.8 mil)	+0.10/-0.10	(+3.9/-3.9 mil)
F	Vertical Pin No1 Edge to Lateral Pin Edge [mm]	2.35	(92.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
G	Depanalizing Residual [mm]	0.10	(3.9 mil)	+0.25/-0.10	(+9.8/-3.9 mil)
H	Lateral and Antenna Row Pin to Pin Pitch [mm]	1.0	(39.4 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
I	Lateral and Antenna Row Pin Width [mm]	0.70	(27.6 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
J	Lateral and Antenna Row Pin Height [mm]	1.15	(45.3 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
K	Horizontal Pin No1 Edge to Central Pin Edge [mm]	2.78	(109.4 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
L	Vertical Pin No1 Edge to Central Pin Edge [mm]	2.63	(103.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
M	Horizontal Pin No1 Edge to Inner Row Pin Edge [mm]	1.45	(57.1 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
N	Vertical Pin No1 Edge to Inner Row Pin Edge [mm]	1.6	(63.0 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
O	Central Pin and Inner Row Width and Height [mm]	0.70	(27.6 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
P	Central Pin to Central Pin Pitch [mm]	1.15	(45.3 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
Q	Inner Row Pin to Pin Pitch [mm]	1.1	(43.3 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
R	Horizontal Pin No1 Edge to Antenna Row Pin Edge	8.7	(342.5 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
S	PCB and Shield Cover Thickness [mm]	2.2	(86.6 mil)	+0.40/-0.20	(+15.8/-7.9
T	Module PCB Antenna Width [mm]	4.0	(157.5 mil)	+0.20/-0.20	(+7.9/-7.9 mil)
ZA1	Horizontal pin no. 1 corner to first set of antenna GND pins pin center [mm]	10.35	(407.8 mil)	+0.20/-0.10	(+7.9/-3.9 mil)
ZA2	Horizontal pin no. 1 corner to second set of antenna GND pins pin center [mm]	12.90	(507.9 mil)	+0.20/-0.10	(+7.9/-3.9 mil)
	Module Weight [g]	<1.0			

Table 22: NINA-W156 mechanical outline data

6 Qualification and approvals

⚠ Country approval for NINA-W156 is pending.

6.1 Country approvals

The NINA-W15 module series is certified for use in the following countries/regions:

- Europe (RED)*
- USA (FCC)*
- Canada (IC)*
- Japan (MIC)*
- Taiwan (NCC)*
- South Korea (KCC)*
- Brazil (ANATEL)*
- Australia and New Zeeland (ACMA)*
- South Africa (ICASA)*

* Country approval for NINA-W156 is pending

See the following sections for additional information.

6.2 European Union regulatory compliance

⚠ Approval for NINA-W156 is pending.

Information about regulatory compliance of the European Union for NINA-W15 series modules is available in the NINA-W15 Declaration of Conformity [5].

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

The NINA-W15 series modules comply with the essential requirements and other relevant provisions of Radio Equipment Directive (RED) 2014/53/EU.

6.2.2 Compliance with the RoHS directive

The NINA-W15 series modules comply with the Directive 2011/65/EU (EU RoHS 2) and its amendment Directive (EU) 2015/863 (EU RoHS 3).

6.3 FCC/IC Compliance

⚠ Approval for NINA-W156 is pending.

This device complies with Part 15 of the FCC Rules and with Industry Canada license-exempt RSS standard(s).

⚠ Any changes or modifications NOT explicitly APPROVED by u-blox AG may cause the module to not comply with the FCC rules part 15 thus void the user's authority to operate the equipment.

6.3.1 FCC Compliance

The NINA-W15 modules are for OEM integrations only. The end-product will be professionally installed in such manner that only the authorized antennas can be used.

For NINA-W151, an external antenna connector (U.FL. connector) reference design (see the NINA-W1 series System Integration Manual [1]) is available and must be followed to comply with the NINA-W15 FCC/IC modular approval.

6.3.2 FCC statement

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

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

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 the 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.

6.3.3 RF exposure statement

6.3.3.1 IC Compliance

This equipment complies with the requirements of IC RSS-102 issue 5 radiation exposure limits set forth for an uncontrolled environment.

Having a separation distance of minimum 30 mm between the user and/or bystander and the antenna and /or radiating element ensures that the output power (e.i.r.p.) of NINA-W151 and NINA-W152 is below the SAR evaluation Exemption limits defined in RSS-102 issue 5.

6.3.3.2 FCC Compliance

This device complies with the FCC radiation exposure limits set forth for an uncontrolled environment.

Having a separation distance of minimum 25 mm between the user and/or bystander and the antenna and /or radiating element ensures that the maximum output power of NINA-W151 and NINA-W152 is below the SAR test exclusion limits presented in KDB 447498 D01v06.

6.3.4 End-product user manual instructions

6.3.4.1 IC Compliance

User manuals for license-exempt radio apparatus shall contain the following text, or an equivalent notice that shall be displayed in a conspicuous location, either in the user manual or on the device, or both:

This device complies with Industry Canada's license-exempt RSSs. Operation is subject to the following two conditions:

(1) This device may not cause interference; and

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

Under Industry Canada regulations, this radio transmitter can only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be chosen in such a way that the equivalent isotropically radiated power (e.i.r.p.) is not more than that is necessary for successful communication.

☞ Le manuel d'utilisation des appareils radio exempts de licence doit contenir l'énoncé qui suit, ou l'équivalent, à un endroit bien en vue dans le manuel d'utilisation ou sur l'appareil, ou encore aux deux endroits.

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

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

Conformément aux réglementations d'Industry Canada, cet émetteur radio ne peut fonctionner qu'à l'aide d'une antenne dont le type et le gain maximal (ou minimal) ont été approuvés pour cet émetteur par Industry Canada. Pour réduire le risque d'interférences avec d'autres utilisateurs, il faut choisir le type d'antenne et son gain de telle sorte que la puissance isotrope rayonnée équivalente (p.i.r.e) ne soit pas supérieure à celle requise pour obtenir une communication satisfaisante.

6.3.5 End-product labeling requirements

6.3.5.1 IC Compliance

The host product shall be properly labelled to identify the modules within the host product.

The Innovation, Science and Economic Development Canada certification label of a module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labelled to display the Innovation, Science and Economic Development Canada certification number for the module, preceded by the word "Contains" or similar wording expressing the same meaning, as shown in Figure 9.

Le produit hôte devra être correctement étiqueté, de façon à permettre l'identification des modules qui s'y trouvent.

L'étiquette d'homologation d'un module d'Innovation, Sciences et Développement économique Canada devra être posée sur le produit hôte à un endroit bien en vue, en tout temps. En l'absence d'étiquette, le produit hôte doit porter une étiquette sur laquelle figure le numéro d'homologation du module d'Innovation, Sciences et Développement économique Canada, précédé du mot « contient », ou d'une formulation similaire allant dans le même sens et qui va comme suit:

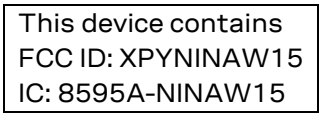


Figure 9 Example of an end product label

6.3.5.2 FCC Compliance

For an end product that uses the NINA-W151, NINA-W152 or NINA-W156 modules, there must be a label containing, at least, the information shown in Figure 9:

The label must be affixed on an exterior surface of the end product such that it will be visible upon inspection in compliance with the modular approval guidelines developed by the FCC.

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

"This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions;
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation."

When the device is so small or for such use that it is not practicable to place the statement 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.

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

Model	FCC ID	IC Certification Number
NINA-W151	XPYNINAW15	8595A-NINAW15
NINA-W152	XPYNINAW15	8595A-NINAW15
NINA-W156		

Table 23: FCC and IC IDs for the NINA-W15 series modules

6.3.6 End product compliance

6.3.6.1 General requirements

- Any changes to hardware, hosts or co-location configuration may require new radiated emission and SAR evaluation and/or testing.
- The regulatory compliance of NINA-W151 and NINA-W152 does not exempt the end product from being evaluated against applicable regulatory demands; for example, FCC Part 15B criteria for unintentional radiators.
- Only authorized antenna(s) may be used.
- Any notification to the end user about how to install or remove the integrated radio module is NOT allowed.

6.3.6.2 Co-location (simultaneous transmission)

If the module is to be co-located with another transmitter, additional measurement for simultaneous transmission is required.

6.4 Japan radio equipment compliance

Figure 10: Giteki mark, R and the NINA-W151/NINA-W152 MIC certification number

⚠ Approval for NINA-W156 is pending.

☞ The required minimum size of the Giteki mark is Ø3.0 mm.

For information about compliance of the NINA-W151/NINA-W152 modules with the Giteki certification, see the NINA-W1 series System Integration Manual [1].

6.5 NCC Taiwan compliance

⚠ Approval for NINA-W156 is pending.

6.5.1 Taiwan NCC Warning Statement

- 經型式認證合格之低功率射頻電機，非經許可，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。
- 低功率射頻電機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。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機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。

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 devices.
- The low power radio frequency devices shall not influence aircraft security and interfere legal communications; if found, the user shall cease operating immediately until no interference is achieved. 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.

6.5.2 NINA-W151 labeling requirements for end product

When a product integrated with an NINA-W151 module is placed on the Taiwan market, the product must be affixed with a label marking as shown below. The label can use wording such as the following:

Contains Transmitter Module

□含發射器模組: **CCAJ18LP0B43T4**

or any similar wording that expresses the same meaning may be used. The marking must be visible for inspection.

6.5.3 NINA-W152 labeling requirements for end product

When a product integrated with an NINA-W152 module is placed on the Taiwan market, the product must be affixed with a label marking as shown below. The label can use wording such as the following:

Contains Transmitter Module

□含發射器模組: **CCAJ18LP0B53T7**

or any similar wording that expresses the same meaning may be used. The marking must be visible for inspection.

6.6 KCC South Korea compliance

⚠ Approval for NINA-W156 is pending.

The NINA-W15 series modules are certified by the Korea Communications Commission (KCC).

When a product containing a NINA-W151 or NINA-W152 module is placed on the South Korean market, the product must be affixed with a label or marking containing the KCC logo and certification number as shown in the figure below. NINA-W151 and NINA-W152 has the same certification number. This information must also be included in the product user manuals.

R-C-ULX-NINA-W151

☞ The height of the KCC logo must be at least 5 mm.

6.7 Brazil compliance

⚠ Approval for NINA-W156 is pending.

When a product containing NINA-W151 or NINA-W152 module is placed on the Brazilian market, the product must be affixed with a label or marking containing the Anatel logo, NINA-W151/ NINA-W152 Homologation number: 06870-18-05903 and a statement claiming that the device may not cause harmful interference but must accept it (Resolution No 506).

ANATEL
06870-18-05903

"Este equipamento opera em caráter secundário, isto é, não tem direito a proteção contra interferência prejudicial, mesmo de estações do mesmo tipo, e não pode causar interferência a sistemas operando em caráter primário."

Statement translation:

"This equipment operates on a secondary basis and, consequently, must accept harmful interference, including from stations of the same kind, and may not cause harmful interference to systems operating on a primary basis."

When the device is so small or for such use that it is not practicable to place the statement 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.

In case, where the final product will be installed in locations where the end user is unable to see the Anatel logo, NINA-W151/NINA-W152 Homologation number and/or this statement, the Anatel logo, NINA-W151/NINA-W152 Homologation number, and the statement shall also be included in the end product manual.

6.8 Australia and New Zealand regulatory compliance

The NINA-W151 and NINA-W152 modules are compliant with the standards made by the Australian Communications and Media Authority (ACMA).

⚠ Approval for NINA-W156 is pending.

The modules are compliant with AS/NZS 4268:2012 standard – Radio equipment and systems – Short range devices – Limits and methods of standard measurement. The NINA-W151/NINA-W152 modules test reports can be used as part of the product certification and compliance folder. For more information on the test reports, send an email to the respective support team mail address as mentioned in the Contact section based on your location.

To meet overall Australian and/or New Zealand end product compliance, the integrator must create a compliance folder containing all the relevant compliance test reports such as RF, EMC, electrical safety and DoC (Declaration of Conformity) and so on. It is the responsibility of the integrator to know what is required in the compliance folder for ACMA compliance.

For more information on Australia compliance, refer to the Australian Communications and Media Authority web site http://www.acma.gov.au/.

For more information on New Zealand compliance, refer to the New Zealand Radio Spectrum Management Group web site www.rsm.govt.nz.

6.9 South Africa regulatory compliance

⚠ Approval for NINA-W156 is pending.

The NINA-W151 and NINA-W152 modules are compliant and certified by the Independent Communications Authority of South Africa (ICASA). End products that are made available for sale or lease or is supplied in any other manner in South Africa shall have a legible label permanently affixed to its exterior surface. The label shall have the ICASA logo and the ICASA issued license number as shown in the figure below. The minimum width and height of the ICASA logo shall be 3 mm. The approval labels must be purchased by the customer's local representative directly from the approval authority ICASA. A sample of an NINA-W151/NINA-W152 ICASA label is included below:

More information on registration as a Responsible Integrator and labeling requirements can be found at the following website:

Independent Communications Authority of South Africa (ICASA) web site - https://www.icasa.org.za

6.10 Safety Compliance

In order to fulfill the safety standard EN 60950-1, the NINA-W15 series modules must be supplied with a Class-2 Limited Power Source.

6.11 Bluetooth qualification information

The NINA-W151/NINA-W152 modules have been qualified as a controller subsystem according to the Bluetooth 4.2 specification.

Product type	QD ID	Listing Date
Controller Subsystem	107058	14-Mar-2018
Host Subsystem	110883	30-Apr-2018

Table 24: NINA-W151/NINA-W152 Bluetooth QD ID.

For information on how to list and declare your product, see the NINA-W1 series System Integration Manual [1].

7 Antennas

This chapter gives an overview of the different external antennas that can be used together with the module.

⚠ This radio transmitter IC: 8595A-NINAW15 has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type 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.

⚠ Cet émetteur radio IC: 8595A-NINAW15 été approuvé par Industry Canada 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'antenne ne figurant pas dans cette liste et ayant un gain supérieur au gain maximum indiqué pour ce type-là sont strictement interdits d'utilisation avec cet appareil.

For each antenna, the "Approvals" field defines in which test reports the antenna is included. Definitions of the «Approvals» field are:

- FCC - The antenna is included in the FCC test reports and thus approved for use in countries that accept the FCC radio approvals, primarily US.
- IC - The antenna is included in the IC (Industrie Canada) test reports and thus approved for use in countries that accept the IC radio approvals, primarily Canada.
- RED - The antenna is included in the ETSI test reports and thus approved for use in countries that accept the Radio Equipment Directive, primarily the European countries.
- MIC - The antenna is included in the Japanese government affiliated MIC test reports and thus approved for use in the Japanese market.
- NCC - The antenna is included in the Taiwan NCC test reports and thus approved for use in Taiwan.
- KCC - The antenna is included in the Korea KCC test reports and thus approved for use in Korea.
- ANATEL – The antenna is included in the Brazil Anatel test reports and thus approved for use in Brazil.
- ACMA – The antenna is included in the Australia and New Zeeland test reports and thus approved for use in Australia and New Zeeland.
- ICASA – The antenna is included in the South Africa ICASA test reports and thus approved for use in South Africa.

In general, antennas with SMD connection, Reverse Polarity SMA connector or U.FL connector are included in FCC, IC, RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA radio tests. The antennas with SMA connector are included in RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA radio tests but not in the FCC or IC due to FCC/IC regulations.

The external antennas are connected to the board through U.FL connectors. Some antennas are connected directly to the U.FL connector of the board while some are connected using an SMA or reversed polarity SMA connector through a short U.FL to SMA or reversed polarity SMA adapter cable.

7.1 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. See NINA-W1 series System Integration Manual [1] for information how to integrate the U.FL connector.
Approval	RED, MIC, NCC and KCC

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. See NINA-W1 series System Integration Manual [1] for information how to integrate the U.FL connector. It is required to followed this reference design to comply with the NINA-W15 FCC/IC modular approvals.
Approval	FCC, IC, RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA

7.2 Approved antennas

7.2.1 Single band antennas

NINA-W152	
Manufacturer	ProAnt
Gain	+3 dBi
Impedance	50 Ω
Size (HxWxL)	3.0 x 3.8 x 9.9 mm
Type	PIFA
Comment	SMD PIFA antenna on NINA-W152. Should not be mounted inside a metal enclosure, see section for more info 2.5.1.
Approval	FCC, IC, RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA

NINA-W156	
Manufacturer	ProAnt
Gain	+3 dBi
Impedance	N/A
Size (HxWxL)	1.1 x 3.4 x 10 mm
Type	PCB trace
Comment	PCB antenna on NINA-W156. Should not be mounted inside a metal enclosure, see section for more info 2.5.1.
Approval	*To be approved*

GW.26.0111	
Manufacturer	Taoglas
Polarization	Vertical
Gain	+2.0 dBi
Impedance	50 Ω
Size	Ø 7.9 x 30.0 mm
Type	Monopole
Connector	SMA (M) .
Comment	To be mounted on the U.FL to SMA adapter cable.
Approval	RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA

ANT-2.4-CW-RH-RPS	
Manufacturer	Linx
Polarization	Vertical
Gain	-1.0 dBi
Impedance	50 Ω
Size	Ø 7.4 x 27.0 mm
Type	Monopole
Connector	Reverse Polarity SMA plug (inner thread and pin receptacle).
Comment	To be mounted on the U.FL to Reverse Polarity SMA adapter cable. An SMA version antenna is also available but not recommended for use (ANT-2.4-CW-RH-SMA).
Approval	FCC, IC, RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA

Ex-IT 2400 RP-SMA 28-001	
Manufacturer	ProAnt
Polarization	Vertical
Gain	+3.0 dBi
Impedance	50 Ω
Size	Ø 12.0 x 28.0 mm
Type	Monopole
Connector	Reverse Polarity SMA plug (inner thread and pin receptacle).
Comment	This antenna requires to be mounted on a metal ground plane for best performance. To be mounted on the U.FL to Reverse Polarity SMA adapter cable. An SMA version antenna is also available but not recommended for use (Ex-IT 2400 SMA 28-001).
Approval	FCC, IC, RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA

Ex-IT 2400 MHF 28	
Manufacturer	ProAnt
Polarization	Vertical
Gain	+2.0 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 on a U.FL connector. See NINA-W1 series System Integration Manual [1] for information how to integrate the U.FL connector. It is required to followed this reference design to comply with the NINA - W13 FCC/IC modular approvals.
Approval	FCC, IC, RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA

Ex-IT 2400 RP-SMA 70-002

Manufacturer	ProAnt
Polarization	Vertical
Gain	+3.0 dBi
Impedance	50 Ω
Size	Ø 10 x 83 mm
Type	Monopole
Connector	Reverse Polarity SMA plug (inner thread and pin receptacle)
Comment	To be mounted on the U.FL to Reverse Polarity SMA adapter cable. An SMA version antenna is also available but not recommended for use (Ex-IT 2400 SMA 70-002).
Approval	FCC, IC, RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA

Ex-IT 2400 MHF 70-001

Manufacturer	ProAnt
Polarization	Vertical
Gain	+3.0 dBi
Impedance	50 Ω
Size	Ø 9.4 x 70.5 mm
Type	Monopole
Cable length	100 mm
Connector	U.FL. connector
Comment	To be mounted on a U.FL connector. See NINA-W1 series System Integration Manual [1] for information how to integrate the U.FL connector. It is required to followed this reference design to comply with the NINA-W1 FCC/IC modular approvals.
Approval	FCC, IC, RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA

InSide-2400

Manufacturer	ProAnt
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 on a U.FL connector.

	See NINA-W1 series System Integration Manual [1] for information about how to integrate the U.FL connector. It is required to followed this reference design to comply with the NINA-W15 FCC/IC modular approvals.
Approval	FCC, IC, RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA

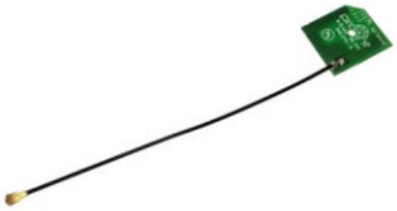
FlatWhip-2400	
Manufacturer	ProAnt
Gain	+3.0 dBi
Impedance	50 Ω
Size	Ø 50.0 x 30.0 mm
Type	Monopole
Connector	SMA plug (inner thread and pin)
Comment	To be mounted on the U.FL to SMA adapter cable.
Approval	RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA

Outside-2400	
Manufacturer	ProAnt
Gain	+3.0 dBi
Impedance	50 Ω
Size	36.0 x 18.0 x 16.0 mm
Type	Patch
Cable length	70 mm
Connector	U.FL. connector
Comment	To be mounted on a U.FL connector. See NINA-W1 series System Integration Manual [1] for information about how to integrate the U.FL connector. It is required to followed this reference design to comply with the NINA-W15 FCC/IC modular approvals.
Approval	FCC, IC, RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA

7.2.2 Dual-band antennas

InSide-WLAN	
Manufacturer	ProAnt
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. Dual-band (2.4 GHz / 5 GHz) antenna to be mounted on a U.FL connector. See NINA-W1 series System Integration Manual [1] for information about how to integrate the U.FL connector. It is required to followed this reference design to comply with the NINA-W15 FCC/IC modular approvals.
Approval	FCC, IC, RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA

InSide-WLAN Square (InSide™ WLAN P.No 403-100)	
Manufacturer	ProAnt
Gain	+3.0 dBi
Impedance	50 Ω
Size	24x22x1 mm with mounting hole
Type	Patch
Cable length	100 mm
Connector	U.FL. connector
Comment	Should be attached to a plastic enclosure or part for best performance. Dual-band (2.4 GHz / 5 GHz) antenna to be mounted on a U.FL connector. See NINA-W1 series System Integration Manual [1] for information on how to integrate the U.FL connector. It is required to followed this reference design to comply with the NINA-W15 FCC/IC modular approvals.
Approval	FCC, IC, RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA



Ex-IT WLAN RPSMA	
Manufacturer	ProAnt
Type	½ wave dipole dual-band antenna
Polarization	Vertical
Gain	+3 dBi
Impedance	50 Ω
Size	107 mm (Straight)
Type	Monopole
Connector	Reverse Polarity SMA plug (inner thread and pin receptacle)
Comment	To be mounted on the U.FL to Reverse Polarity SMA adapter cable.
Approval	FCC, IC, RED, MIC, NCC, KCC, ANATEL, ACMA and ICASA

8 Product handling

8.1 Packaging

⚠ The NINA-W15 series modules are in development status as mentioned in the table on page 2. Hence, the information in this section will be valid and available only when the module is fully tested and approved in the Initial Production stage.

8.1.1 Reels

The NINA-W15 series modules are delivered as hermetically sealed, reeled tapes to enable efficient production, production lot setup and tear-down. For more information about packaging, see the u-blox Package Information Guide [2].

NINA-W15 modules are deliverable in quantities of 500 pieces on a reel. The reel types for the NINA-W15 modules are provided in Table 25 and detailed information about the reel types are described in u-blox Package Information Guide [2].

Model	Reel Type
NINA-W151	B
NINA-W152	A
NINA-W156	A

Table 25: Reel types for different models of the NINA-W15 series

8.1.2 Tapes

Figure 11 and Figure 12 shows the position and orientation of the NINA-W15 modules as they are delivered on tape. The dimensions of the tapes are specified in Figure 13 and Figure 14.

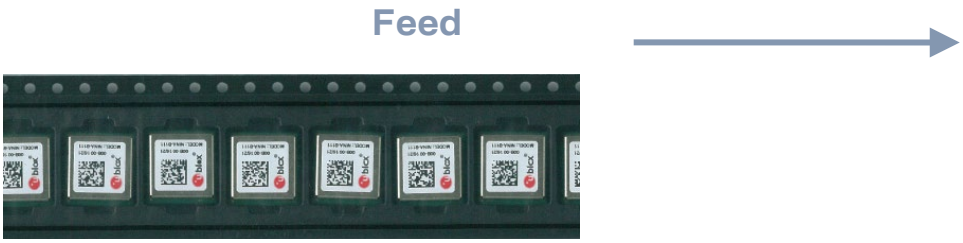
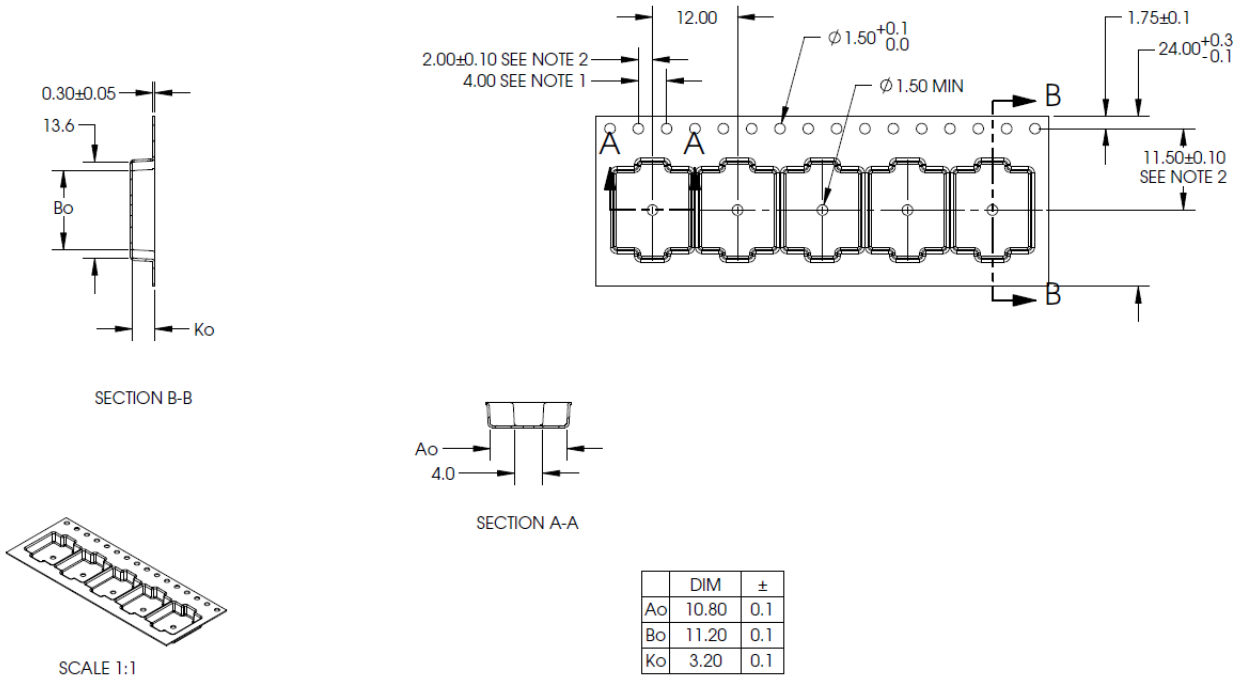


Figure 11: Orientation of NINA-W151 module on tape

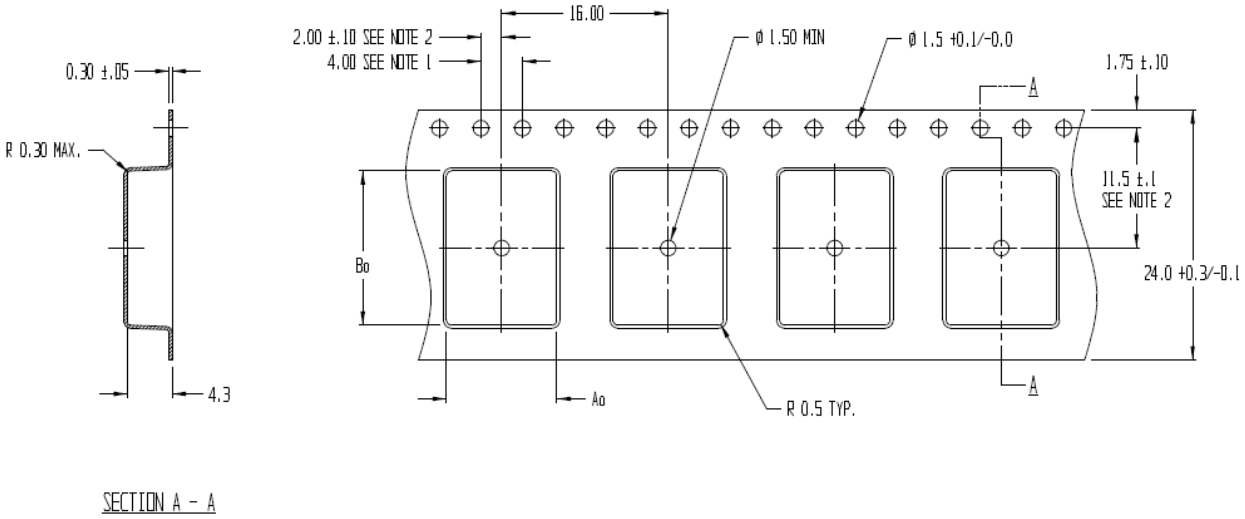
Figure 12: Orientation of NINA-W152/NINA-W156 module on tape



	DIM	±
Ao	10.80	0.1
Bo	11.20	0.1
Ko	3.20	0.1

NOTES:
1. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ±0.2
2. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE.
3. Ao AND Bo ARE MEASURED ON A PLANE AT A DISTANCE "R" ABOVE THE BOTTOM OF THE POCKET.

Figure 13: NINA-W151 tape dimension



Ao = 10.6
Bo = 14.8
Ko = 4.3

NOTES:
1. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ±0.2
2. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE
3. Ao AND Bo ARE CALCULATED ON A PLANE AT A DISTANCE "R" ABOVE THE BOTTOM OF THE POCKET.

Figure 14: NINA-W152 tape dimension

8.2 Moisture sensitivity levels

⚠ The NINA-W15 series modules are Moisture Sensitive Devices (MSD) in accordance with the IPC/JEDEC specification.

The Moisture Sensitivity Level (MSL) relates to the required packaging and handling precautions. The NINA-W15 series modules are rated at MSL level 4. For more information regarding moisture sensitivity levels, labeling and storage, see the u-blox Package Information Guide [2].

☞ For MSL standards, see IPC/JEDEC J-STD-020, which can be downloaded from www.jedec.org.

8.3 Reflow soldering

Reflow profiles are to be selected according to u-blox recommendations. See NINA-W1 series System Integration Manual [1] for more information.

⚠ Failure to observe these recommendations can result in severe damage to the device.

8.4 ESD precautions

⚠ The NINA-W15 series modules contain highly sensitive electronic circuitry and are Electrostatic Sensitive Devices (ESD). Handling the NINA-W15 series modules without proper ESD protection may destroy or damage them permanently.

The NINA-W15 series modules are electrostatic sensitive devices (ESD) and require special ESD precautions typically applied to ESD sensitive components. Section 4.1.1 provides the maximum ESD ratings of the NINA-W15 series modules.

Proper ESD handling and packaging procedures must be applied throughout the processing, handling, and operation of any application that incorporates the NINA-W15 series module. The ESD precautions should be implemented on the application board where the module is mounted as described in the NINA-W1 series System Integration Manual [1].

⚠ Failure to observe these recommendations can result in severe damage to the device.

9 Labeling and ordering information

9.1 Product labeling

The labels (7.5 x 7.5mm) of the NINA-W15 series modules include important product information as described in this section.

Figure 15 illustrates the label of NINA-W15 series modules, which includes product type number and revision, production date, Data Matrix with unique serial number (MAC address) and the u-blox logo.

Figure 15: Location of product type number on the NINA-W15 series module label

Reference	Description
1	Date of unit production encoded YY/WW (year, week)
2	Major and minor product version info
3	Product model name (NINA-W151, NINA-W152 or NINA-W156)
4	Data Matrix with unique serial number of 19 alphanumeric symbols. The first 3 symbols represent a unique module type number. The next 12 symbols represent the unique hexadecimal Wi-Fi MAC address of the module AABBCCDDEEFF, and the last 4 symbols represent the hardware and software version encoded HHFF. See section 1.9 for more information about MAC addresses.
5	u-blox logo. The red dot is also indicating pin no 1.

Table 26: NINA-W15 series label description

9.2 Explanation of codes

Three different product code formats are used. The **Product Name** is used in documentation such as this data sheet and identifies all u-blox products, independent of packaging and quality grade. The **Ordering Code** includes options and quality, while the **Type Number** includes the hardware and software versions. Table 27 below details these three different formats:

Format	Structure
Product Name	PPPP-TGVV
Ordering Code	PPPP -TGVV-TTQ
Type Number	PPPP -TGVV-TTQ-XX

Table 27: Product code formats

Table 28 explains the parts of the product code.

Code	Meaning	Example
PPPP	Form factor	NINA
TG	Platform (Technology and Generation) T – Dominant technology, For example, W: Wi-Fi, B: Bluetooth G - Generation	W1: Wi-Fi Generation 1
VV	Variant based on the same platform; range [00…99]	51: u-connectXpress software product with antenna pin
TT	Major Product Version	00: first revision
Q	Quality grade A: Automotive B: Professional C: Standard	B: professional grade
XX	Minor product version (not relevant for certification)	Default value is 00

Table 28: Part identification code

9.3 Ordering information

Ordering Code	Product
NINA-W151-00B	Wi-Fi IEEE802.11b/g/n module with antenna pin. With u-connectXpress software including secure boot. Using ESP32-D0WDQ6.
NINA-W151-02B	Wi-Fi IEEE802.11b/g/n module with antenna pin. With u-connectXpress software including secure boot. Using ESP32-D0WDQ6-V3.
NINA-W152-00B	Wi-Fi IEEE802.11b/g/n module with internal PIFA antenna. With u-connectXpress software including secure boot. Using ESP32-D0WDQ6.
NINA-W152-02B	Wi-Fi IEEE802.11b/g/n module with internal PIFA antenna. With u-connectXpress software including secure boot. Using ESP32-D0WDQ6-V3.
NINA-W156-02B	Wi-Fi IEEE802.11b/g/n module with internal PCB trace antenna. With u-connectXpress software including secure boot. Using ESP32-D0WD-V3.

Table 29: Product ordering codes

Appendix

A Glossary

Abbreviation	Definition
ADC	Analog to Digital Converter
BLE	Bluetooth Low Energy
BPF	Band Pass Filter
CTS	Clear To Send
DAC	Digital to Analog Converter
DC	Direct Current
DSR	Data Set Ready
DTR	Data Terminal Ready
ESD	Electro Static Discharge
FCC	Federal Communications Commission
GND	Ground
GPIO	General Purpose Input/Output
I	Input (means that this is an input port of the module)
I2C	Inter-Integrated Circuit
IC	Industry Canada
IEEE	Institute of Electrical and Electronics Engineers
IoT	Internet of Things
L	Low
LPO	Low Power Oscillator
MCU	Micro Controller Unit
MDIO	Management Data Input / Output
MII	Media-Independent Interface
MRD	Market Requirement Document
MSD	Moisture Sensitive Device
N/A	Not Applicable
O	Output (means that this is an output port of the module)
PCN	Product Change Notification
PIFA	Planar Inverted F Antenna
PD	Pull-Down
PU	Pull-Up
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 30: Explanation of the abbreviations and terms used

Related documents

[1] NINA-W1 Series System Integration Manual, document number UBX-17005730
[2] u-blox Package Information Guide, document number UBX-14001652
[3] u-connect AT Commands Manual, document number UBX-14044127
[4] NINA-W15 series Product Summary, document number UBX-18052290
[5] NINA-W15 Declaration of Conformity, document number UBX-19027744

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

Revision history

Revision	Date	Name	Comments
R01	11-Dec-2018	mwej, kgom	Initial release.
R02	4-Jan-2019	mwej, kgom	Removed LPO functionality. Updated the information for pin 5 (Table 7). Modified the ordering code (Table 29).
R03	12-Jul-2019	mwej	Modified the product status to Initial Production. Corrected information about restoring UART setting to default (section 2.6.2). Updated description of DSR signal usage in section 2.6.3. Updated voltage supply range (section 4.2.2) and Absolute maximum module supply voltage and maximum RF input ratings (section 4.1). Updated maximum ESD ratings (section 4.1.1). Updated current consumption (section 4.2.5). Updated Bluetooth output power and sensitivity (section 4.2.7 and 4.2.8). Included RoHS 3 compliance (section 6.2.2). Added certification information for Brazil, Australia, New Zealand, and South Africa (sections 6.7 to 6.9). Updated information about approved antennas (chapter 7).
R04	14-Aug-2019	mwej	Corrected information about BLUE signal in connected mode (Table 6). Added information that the RED, GREEN and BLUE signals are disabled when using the RMII interface (sections 2.6.1 and 2.7.2).
R05	09-Jan-2020	mlju, mwej,	Updated type numbers in the second table on page 2 with NINA-W15x-00B-01. Clarified that Wi-Fi and Bluetooth are time divided on the antenna and not active at the same time (section 2.5).
R06	17 Apr-2020	hekf	Added IEEE 802.11d and additional regulatory domains in chapter 1.8. Included product NINA-W156 and new variants of NINA-W151 and W152. Antenna radiation pattern is added in Chapter 4.2.9. Boot strap information is changed in chapter 2.4. Note that pins 25, 32 and 36 have ceased to be boot strap and GPIO pins. Pins 32 and 36 must be left unconnected. ESD ratings in chapter 4.1.1 is changed, GPIO drive capability current in chapter 4.2.4 is added. Access Point Mode added in chapter 1.6 Radio Performance. Changed the number of available GPIOs.

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