Annex II

S

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. 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). NINA-W15 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.

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1.5 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 1.

Wi-Fi	Bluetooth BR/EDR	Bluetooth Low Energy
IEEE 802.11b/g/n IEEE 802.11d	Bluetooth v4.2+EDR Maximum number of Peripherals: 5	Bluetooth 4.2 Bluetooth LE 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 1: NINA-W15 series Wi-Fi and Bluetooth characteristics

1.6 Software options

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. NINA-W15 modules provide top grade security, thanks to secure boot, which ensures the module boots up only with original u-blox 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 NINA-W15 ideal for critical IoT applications where security is important.

1.6.1 AT command support

You configure the NINA-W151, NINA-W152 and NINA-W156 modules with the u-blox s-center toolbox software using AT commands. See also the u-connectXpress AT commands manual [3].

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

1.6.2 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].

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Radio mode	Activity	Power mode	Role	Typ	Unit	Remarks
		SLEEP*	-	1.5	mA	
		STOP*	-	5	uA	
	Reset	Reset	-	35	uA	Module held in reset

Table 13: Current consumption during typical use cases

*AFA enabled, minimum allowed clock speed set to 80 MHz, and Wi-Fi Station beacon listen interval set to 10.

**AFA enabled, minimum allowed clock speed set to 80 MHz.

4.2.6 Wi-Fi radio characteristics

Parameter	Operation mode			Specification	Unit
RF Frequency Range	802.11b/g/n			2.400 – 2.4835	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
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
			MCS7	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 14: 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

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Parameter	Operation mode	Specification	Unit
	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 15: 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 16: Bluetooth Low Energy characteristics

4.2.9 Antenna radiation patterns

The radiation patterns displayed in Table 17 and Table 18 show the radiation patterns of the NINA-W152 with internal PIFA antenna and the NINA-W156 with internal PCB trace antenna.

Figure 6 gives an overview of the measurement procedure, and how the NINA-W152/NINA-W156 module is aligned to the XYZ-coordinate system. The procedure requires measurements to be taken in all positions shown as dots (left), with the subsequent measurements represented as grid points in the radiation pattern (right).

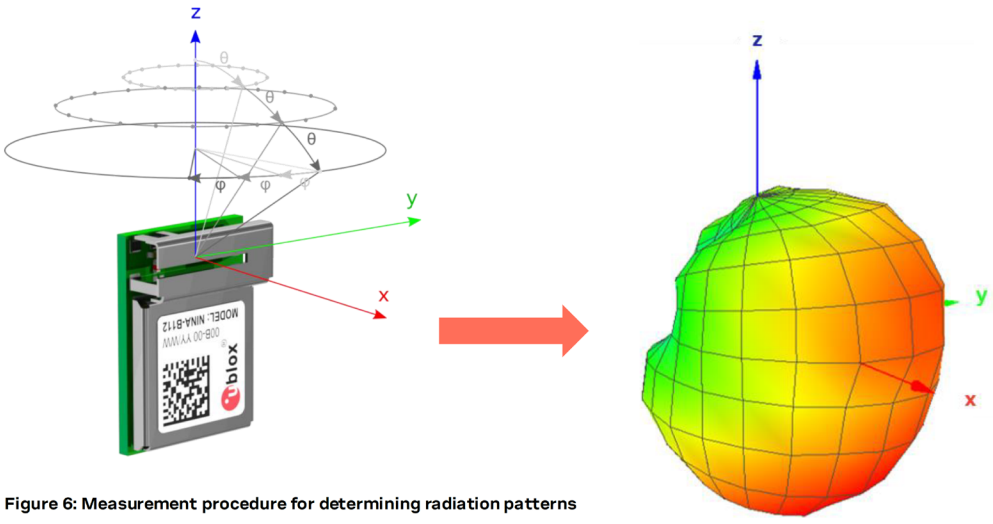

Figure 6: Measurement procedure for determining radiation patterns

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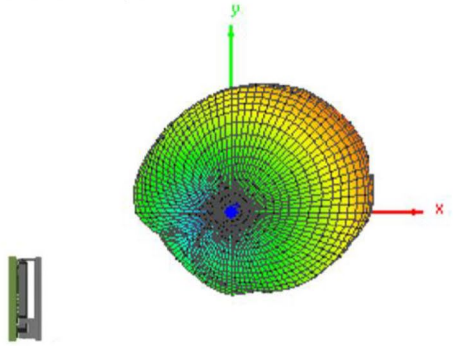
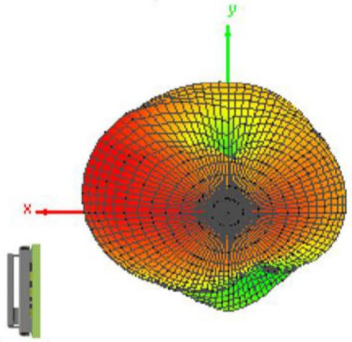
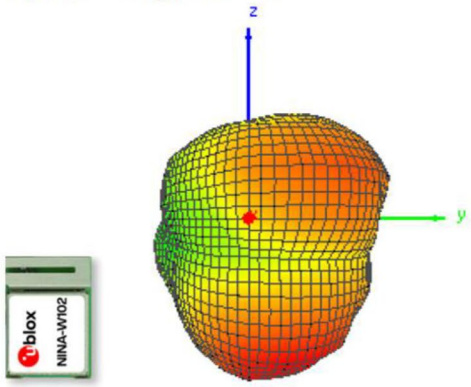
Theta = 0, Phi = 0



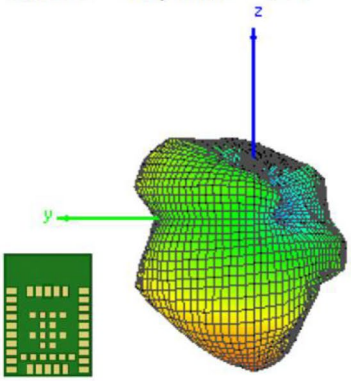
Theta = 180, Phi = 0



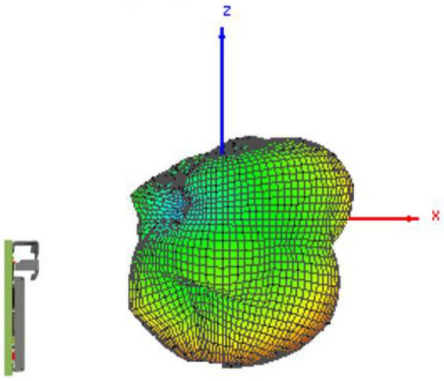
Theta = 90, Phi = 0



Theta = 90, Phi = 180



Theta = 90, Phi = 270



Theta = 90, Phi = 90

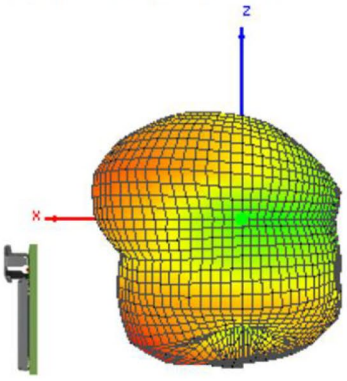


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Table 17: NINA-W152 antenna radiation patterns

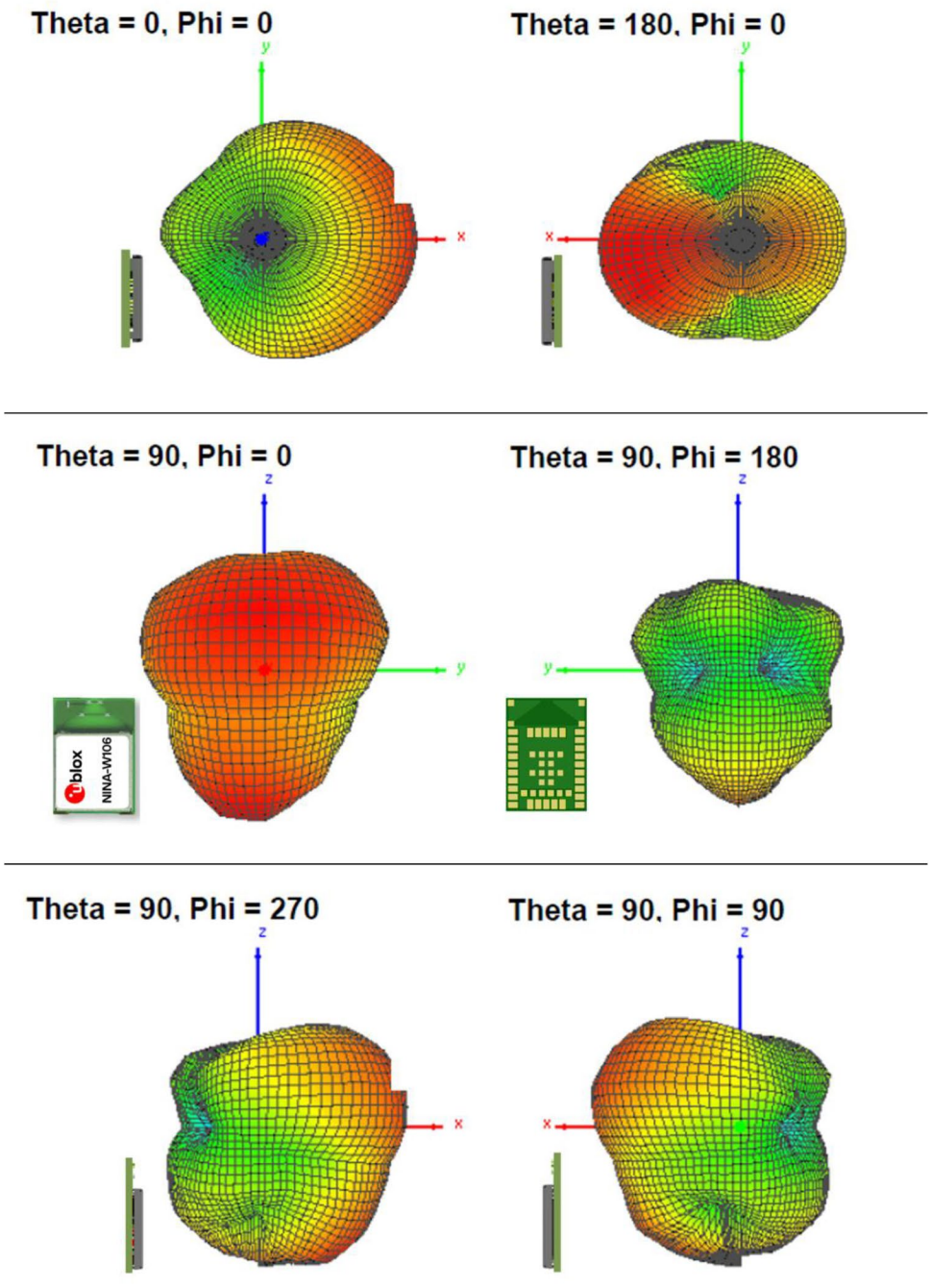

Table 18: NINA-W156 antenna radiation patterns

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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.
- UKCA – The antenna is included in the UKCA test reports and thus approved for use in Great Britain.
- 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, UKCA, 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.

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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. For information about integration the U.FL connector, see also the NINA-W1 series system integration manual [1].	
Approval	RED, UKCA, MIC, NCC, KCC, ANATEL, ACMA and ICASA	

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. For information about integration the U.FL connector, see also the NINA-W1 series system integration manual [1]. It is necessary to follow this reference design to comply with the NINA-W15 FCC/IC modular approvals.	
Approval	FCC, IC, RED, UKCA, MIC, NCC, KCC, ANATEL, ACMA and ICASA	

7.2 Approved antennas

7.2.1 Single band antennas

NINA-W152		
Manufacturer	Abracon	
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. The antenna should not be mounted inside a metal enclosure. See also Internal antenna.	
Approval	FCC, IC, RED, UKCA, MIC, NCC, KCC, ANATEL, ACMA, and ICASA	

NINA-W156		
Manufacturer	Abracon	
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. The antenna should not be mounted inside a metal enclosure. See also Internal antenna.	
Approval	FCC, IC, RED, UKCA, MIC, NCC, KCC, ANATEL and ACMA	

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