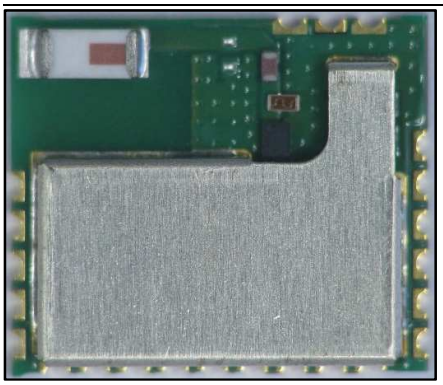
BlueNRG-M2SA

Preliminary Datasheet

Very low power BlueNRG module for Bluetooth® Low Energy v5.0



Features

- Bluetooth v5.0 compliant
  - Supports master and slave modes
  - Multiple roles supported simultaneously
- Based on BlueNRG-2, BLE SoC:
  - High performance, ultra-low power Cortex-M0 32-bit based core
  - Programmable embedded 256 KB Flash
  - 24 KB embedded RAM with data retention
- Interfaces:
  - 1 x UART, 1 x I2C, 1xSPI, 14 x GPIO, 2 x multifunction timer, 10-bit ADC, Watchdog & RTC, DMA controller, PDM stream processor, SWD debug Interface
- Bluetooth radio performance:
  - Max Tx power: + 8 dBm
  - Excellent link reliability
  - Embedding BALF-NRG-02D3 integrated matched balun with harmonic filter
- On-board chip antenna
- Small form factor: 11.5mmx13.5mm
- Complemented with Bluetooth low energy protocol stack library (GAP, GATT, SM, L2CAP, LL)
- AES security co-processor
- Bluetooth low energy SDK with wide range of profile available
- Certifications:
  - EU (RED) Type certificate
  - FCC, IC modular approval certification
  - BT SIG End Product QDID
- Pre-programmed UART bootloader
- Operating supply voltage: from 1.7 to 3.6 V
- Operating temperature range: -40 °C to 85 °C

Applications

- Internet of Things
- Smart Home
- Building and Industrial Automation
- Smart Lighting
- Remote and access control
- Fitness, wellness and sports
- Consumer medical
- Security and proximity
- Assisted living
- PC and smart phone peripherals

Description

The BLUENRG-M2SA is a Bluetooth® low Energy System-on-Chip application processor certified module, compliant with BT specifications v5.0 and BQE qualified. The BLUENRG-M2SA module supports multiple roles simultaneously and can act at the same time as Bluetooth Smart master and slave device.

The BLUENRG-M2SA is based on BlueNRG-2 system-on-chip and entire Bluetooth Low Energy stack and protocols are embedded into module.

The BLUENRG-M2SA module provides a complete RF platform in a tiny form factor. Radio, embedded antenna and high frequency oscillators are integrated to offer a certified solution to optimize the time to market of the final applications.

The BLUENRG-M2SA can be powered directly with a pair of AAA batteries or any power source from 1.7 to 3.6 V.

Contents

1 General description

The BLUENRG-M2SA is a Bluetooth Smart application processor module compliant with Bluetooth® specifications v5.0 with embedded ceramic antenna.

The BLUENRG-M2SA module has been designed around the ST BlueNRG-2 SoC where its Cortex-M0 core can execute both Bluetooth protocols and customer application. A complete power-optimized Bluetooth stack library provides:

- Master, slave, multiple roles support
- GAP: central, peripheral, observer or broadcaster roles
- simultaneous advertising and scanning
- capability of being slave of up to two masters simultaneously
- ATT/GATT: client and server
- SM: privacy, authentication and authorization
- L2CAP
- Link Layer: AES-128 encryption and decryption

The BLUENRG-M2SA has 160KB embedded Flash and 24KB embedded RAM memory.

In the module are available 32MHz and 32KHz crystal oscillators. It has been designed to leverage the BlueNRG-2 integrated DC-DC step down converter in order to achieve best power consumption in active mode.

It can be configured to support both application processor (host-less) and network processor (hosted) modes.

Being based on the BlueNRG-2 SoC, the BLUENRG-M2SA module leverages all the tools and documentation of its ecosystem: Development Kit, Application Notes, User Manuals, Design Notes & Tips. A wide set of sample programs are also available in C source code.

The BLUENRG-M2SA module has a wide set of peripherals available for customer application (1 x UART interface, 1 x SPI interface, 1 x I2C interface, 14 GPIO, 2 x multifunction timer, 10-bit ADC, Watchdog & RTC, DMA controller, PDM stream processor).

The BLUENRG-M2SA module enables wireless connectivity into electronic devices, not requiring any RF experience or expertise for integration into the final product. The BLUENRG-M2SA module provides a complete RF application platform in a tiny form factor (11.5 x 13.5 x 2.0 mm) and being a certified solution optimizes the time to market of the final applications.

The BLUENRG-M2SA module allows applications to meet the tight advisable peak current requirements imposed with the use of standard coin cell batteries. Optimized results are obtained with the embedded high-efficiency DC-DC step-down. BLUENRG-M2SA can be powered directly with a standard 3 V coin cell battery as with a pair of AAA batteries or any power source from 1.7 to 3.6 V.

2 Block diagram

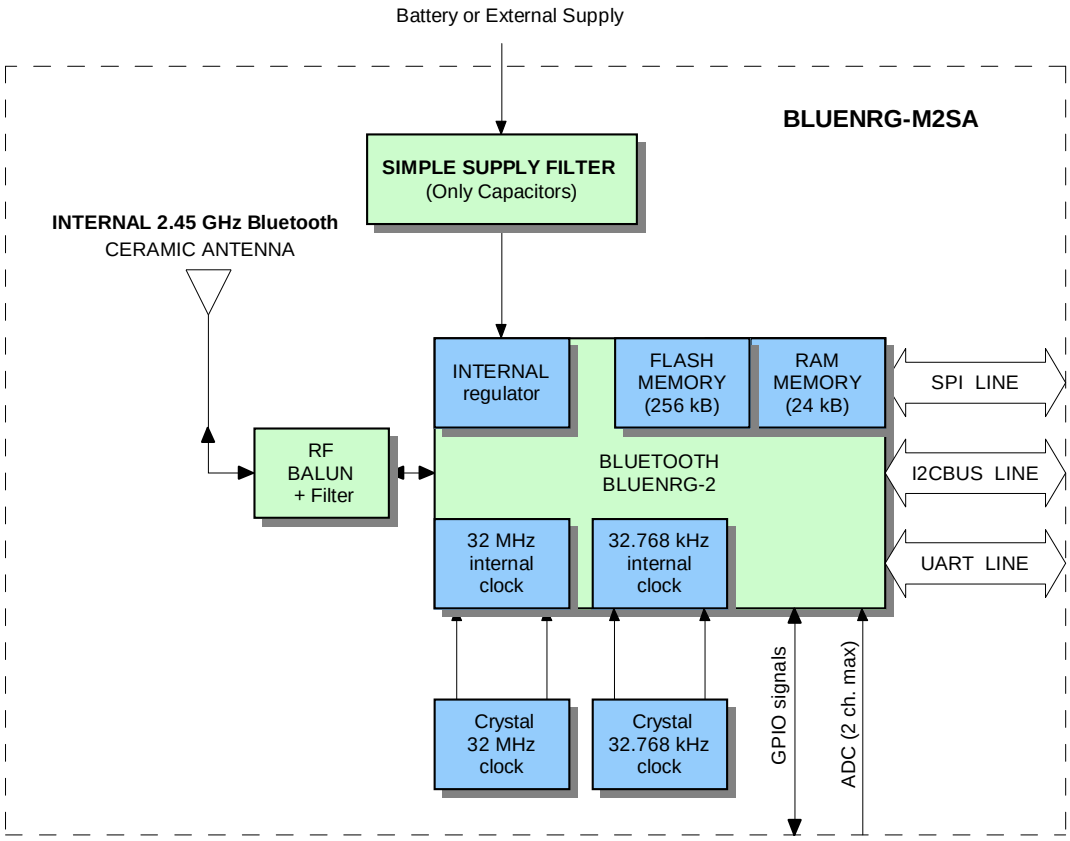


Figure 1: HW block diagram

3 Software Development

3.1 Software development Kit

The BLUENRG-M2SA module embeds the BlueNRG-2 application processor. Refer to the BlueNRG-2 web page (http://www.st.com/en/wireless-connectivity/BlueNRG-2.html) to get access to:

- BlueNRG-2 datasheet
- development kit
- application notes
- user manuals
- tools & software
- design note and tips

Software and firmware should be configured taking into account the BLUENRG-M2SA specific configuration as described in the block diagram chapter. In particular the BLUENRG-M2SA module has:

- 32 MHz crystal oscillator
- 32 KHz crystal oscillator
- SMPS DC-DC converter
- 10 µH SMPS inductor

The projects provided with the development kit should be customized defining as following:

- HS_SPEED_XTAL=HS_SPEED_XTAL_32MHZ
- LS_SOURCE=LS_SOURCE_EXTERNAL_32KHZ
- SMPS_INDUCTOR=SMPS_INDUCTOR_10uH

3.2 Software Architecture

There are two possible software architectures:

1. Host-less mode (application processor): customer application runs on the BLUENRG-M2SA module. Many sample projects are available in the Development Kit.

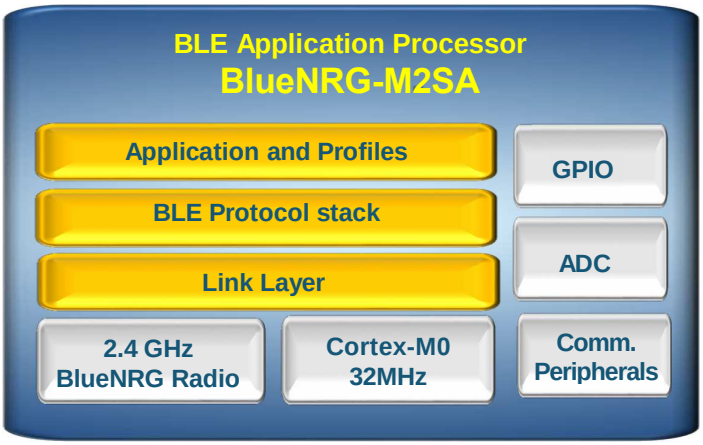


Figure 2: BLUENRG-M2SA - BLE Application Processor

2. Hosted mode (Network processor): the module is configured as network module controlled by an external host connected via SPI or UART. A project named DTM is available in the Development Kit that configures the BLUENRG-M2SA module as a network module.

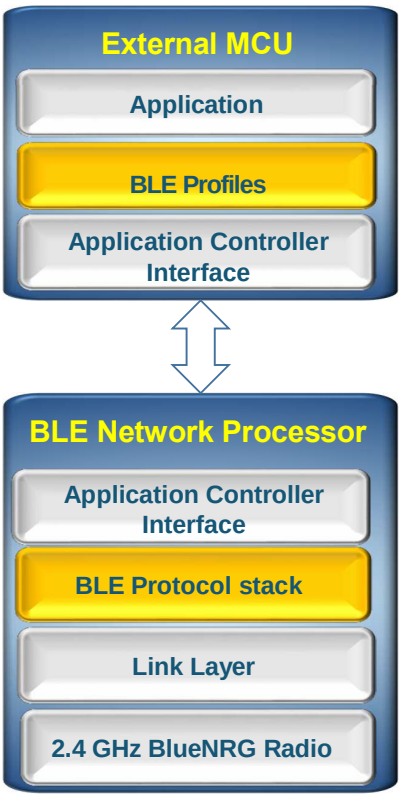


Figure 3:BLUENRG-M2SA as BLE Network Processor

4 Hardware specifications

General conditions (V_{IN}= 3.3 V and 25 °C)

4.1 Absolute maximum ratings

Rating	Min	Typ.	Max	Unit
Storage temperature range	-40	-	+85	°C
Supply voltage, V_{IN}	-0.3	-	3.9	V
I/O pin Voltage (V_{IO} five-volt tolerant pin)	-0.3	-	3.9	V
RF saturation input power	-	8	-	dBm

Table 1: Absolute maximum ratings

4.2 Recommended operating conditions

Rating	Min	Typ.	Max	Unit
Storage temperature range	-40	-	+85	°C
Supply voltage, V_{IN}	1.7	3.3	3.6	V
Signals & I/O pin voltage (according supply voltage)	1.7	-	3.6	V

Table 2: Recommended operating conditions

4.3 Radio Features

Rating	Min	Typ.	Max	Unit
Bluetooth version	-	5.0	-	
Radiated transmit power			+8	dBm
Receiver sensitivity		-88		dBm
RF Frequency	2402	-	2480	MHz
HS_Startup_Time (*)		512		µs

Table 3: Radio features

(*) The HS_Startup_Time has been measured according to the “Bringing up the BlueNRG-2 device” (AN4818). The HS_Startup_Time parameter is important because it permits minimization of the current consumption. A value that is too short prevents the BLUENRG-M2SA from correctly sending/receiving packets. Users should set the typical value as indicated in Table 3.

4.4 Current consumption

Characteristics measured over recommended operating conditions unless otherwise specified. Typical value are referred to T_A = 25 °C, V_{in} = 3.0 V

Current consumption values has been taken using the “BlueNRG current consumption estimation tool”, configured to match the BLUENRG-M2SA configuration.

The tool is available on ST.com at: http://www.st.com/en/embedded-software/stsw-bnrg001.html

Reported values have been taken configuring the tool as shown in the Figure 4.

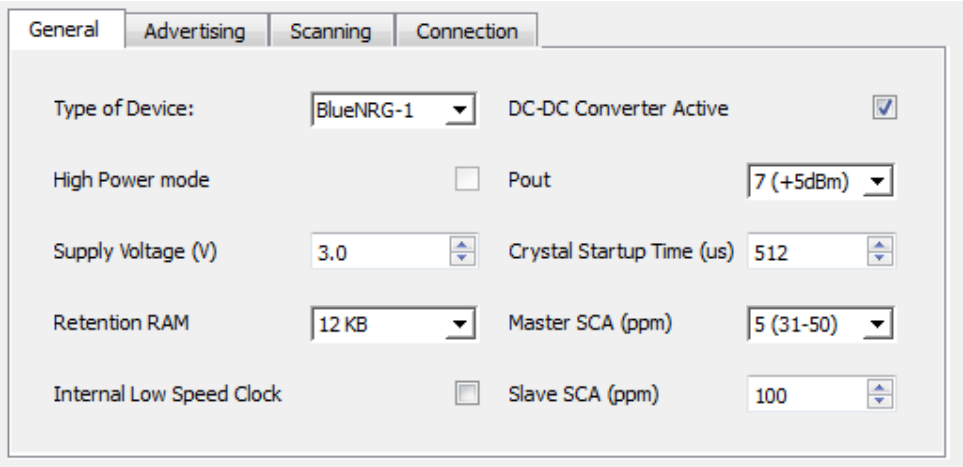


Figure 4: Configuration of the “BlueNRG Current Consumption Estimation Tool”

Symbol	Parameter	Test conditions	Typ.	Unit
I_{DD}	Supply current	Reset	5	nA
		Standby	500	nA
		Sleep mode	0.9	µA
		Active Mode	1.9	mA
		RX	7.7	mA
		TX: +8 dBm (programmed)	17	mA
		TX: 0 dBm	11	mA

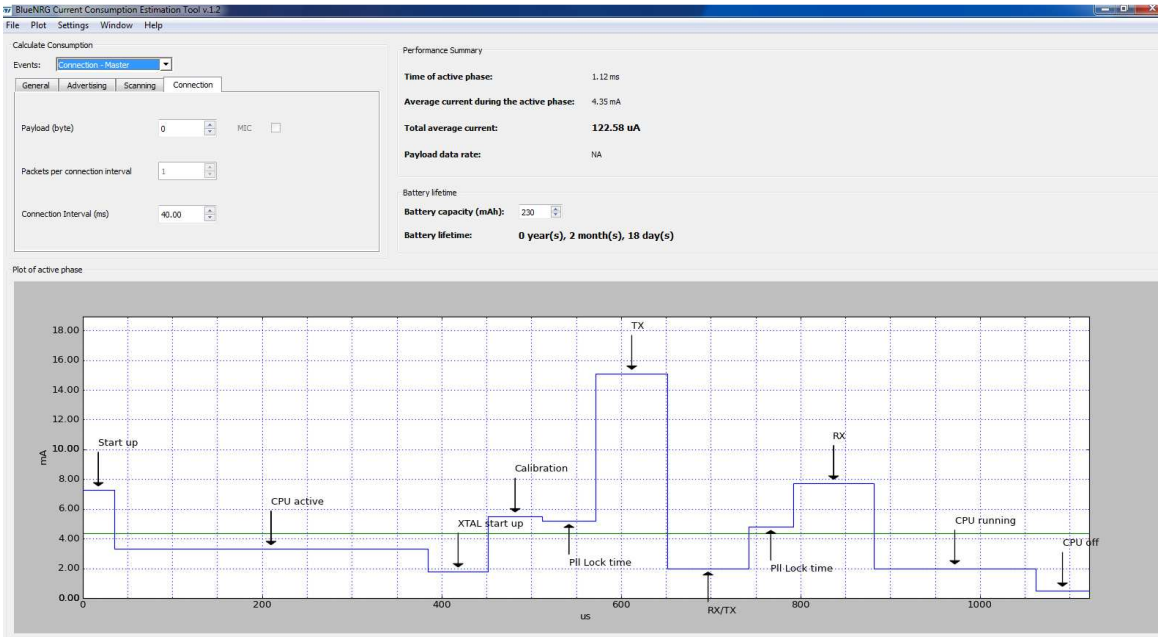


Figure 5: Typical current consumption profile at +5dBm

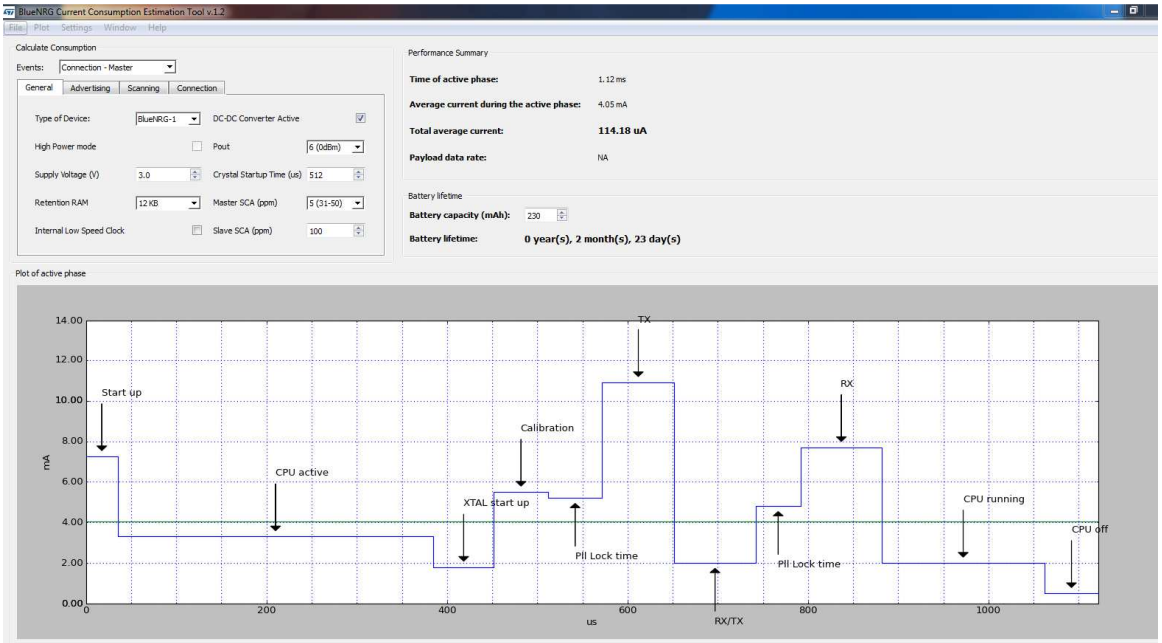


Figure 6: Typical current consumption profile at 0 dBm

4.5 Pin assignment

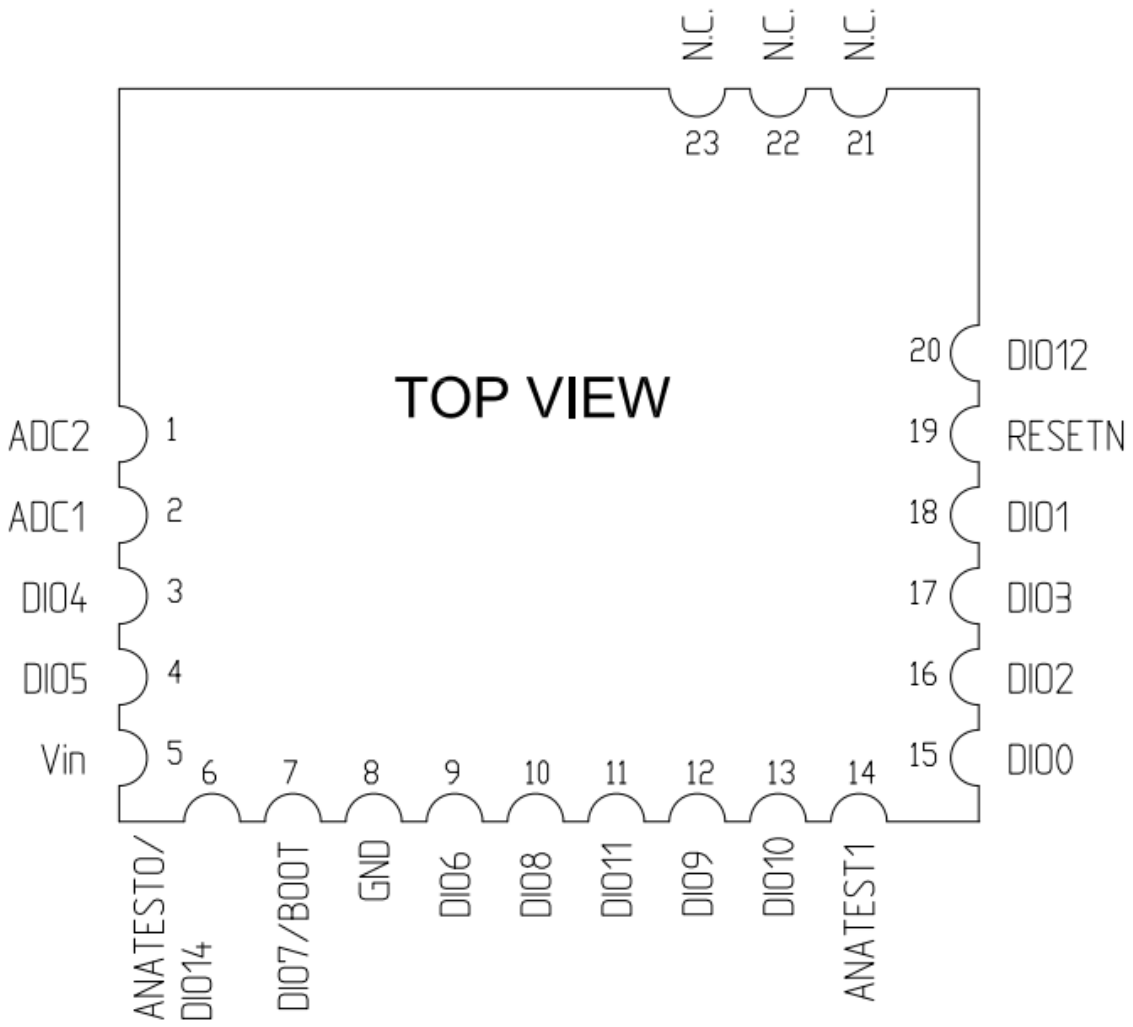


Figure 7: Pin assignment

As described in the previous picture the BLUENRG-M2SA module is using exposed pad in order to allow a full optical visual inspection in order to fulfill the needs of industrial grade applications.

The Table 4 provides the association between BLUENRG-M2SA module pin and the related BlueNRG-2 pin. Refer to the BlueNRG-2 datasheet for detailed description.

Module Pin #	Module Pin Name	BlueNRG-2 Pin (CSP package)	Function			
			Mode: "000"	Mode: "001"	Mode: "100"	Mode: "010"
1	ADC2	D5	ADC input 2			
2	ADC1	B4	ADC input 1			
3	DIO4	C3	GPIO4	UART_RXD	I2C2_CLK	PWM0

4	DIO5	C2	GPIO5	UART_TXD	I2C2_DAT	PWM1
5	Vin	A3, E6	Supply pin			
6	ANATEST0/ DIO14/	A5	GPIO14	I2C1_CLK	SPI_CLK	ADC_DATA
7	DIO7/BOOT(*)	D2	GPIO7	UART_CTS	I2C2_DAT	PDM_CLK
8	GND	A4, B6, C1, F5	Ground			
9	DIO6	D1	GPIO6	UART_RTS	I2C2_CLK	PDM_DATA
10	DIO8	D3	GPIO8	UART_TXD	SPI_CLK	PDM_DATA
11	DIO11	E2	GPIO11	UART_RXD	SPI_CS1	-
12	DIO9	E1	GPIO9	SWCLK	SPI_IN (***)	
13	DIO10	F1	GPIO10	SWDIO	SPI_OUT (**)	
14	ANATEST1	D4	Anatest1			
15	DIO0	A2	GPIO0	UART_CTS	SPI_CLK	-
16	DIO2	A1	GPIO2	PWM0	SPI_OUT (**)	PDM_CLK
17	DIO3	B1	GPIO3	PWM1	SPI_IN (***)	ADC_CLK
18	DIO1	B2	GPIO1	UART_RTS	SPI_CS1	PDM_DATA
19	RESETN	B3	Reset Pin			
20	DIO12	F2	GPIO12	-	I2C1CLK	
21	N.C	N/A	Must be left floating			
22	N.C	N/A	Must be left floating			
23	N.C	N/A	Must be left floating			

Table 4: Pinout description

(*) The pin DIO7/BOOT is monitored by bootloader after power up or hardware Reset and it should be low to prevent unwanted bootloader activation
(**) The function SPI_OUT indicates that the pin is always an output when configured for SPI. Thus in case of SPI master role, it acts as MOSI pin. In case of SPI slave role, this pin act as MISO. See Table 5.
(***)The function SPI_IN indicates that the pin is always an input when configured for SPI. Thus in case of SPI master role, it acts as MISO pin. In case of SPI slave role, this pin act as MOSI. See Table 5.

SPI function	BLUENRG-M2SA SPI Role = Master	BLUENRG-M2SA SPI Role = Slave
SPI_IN	SPI MISO	SPI MOSI
SPI_OUT	SPI MOSI	SPI MISO

Table 5: SPI pin function

4.6 Mechanical dimensions

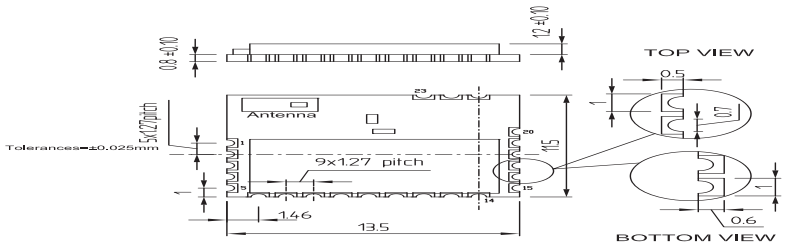


Figure 8: Mechanical dimensions

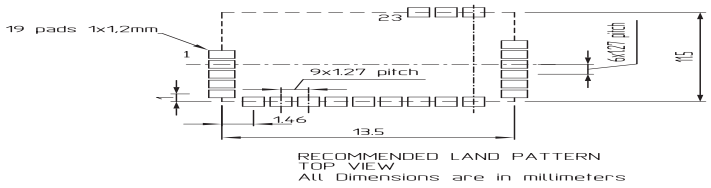


Figure 9: Recommend land pattern top view

5 Hardware design

Note:

- All unused pins should be left floating; do not ground.
- GND pin must be well grounded.
- Traces should not be routed underneath the module.
- **The area around the module should be free of any ground planes, power planes, trace routings, or metal for 6 mm from the module antenna position, in all directions.**

5.1 Reset Circuitry

The BLUENRG-M2SA module requires an external pull-up reset circuitry to ensure proper operation at power on. Refer to the “Reset management” chapter of the BlueNRG-2 datasheet for details.

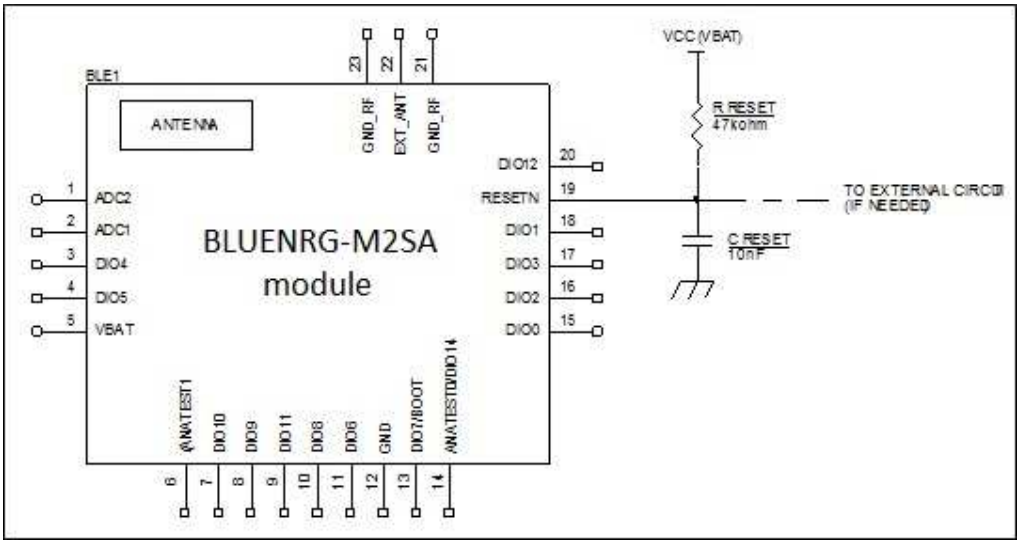


Figure 10: Reset Circuitry

If reset pin is controlled by an external host, there is no need to have RC circuit on the RESETn line.

5.2 Debug Interface

The BLUENRG-M2SA embeds the ARM serial wire debug (SWD) port. It is two pins (clock and single bi-directional data) debug interface, providing all the debug functionality plus real time access to system memory without halting the processor or requiring any target resident code.

Pin Functionality	Module PIN	Pin description
SWCLK	12	SWD clock signal
SWDIO	13	SWD data signal

Table 6: Debug interface pin

For more information refer to the BlueNRG-2 technical documentation
(http://www.st.com/en/wireless-connectivity/BlueNRG-2.html)

5.3 Reflow soldering

The BLUENRG-M2SA is a high temperature strength surface mount Bluetooth® module supplied on a 23 pin, 4-layer PCB.

Module is assembled with special soldering paste that allow to make the additional reflow with no changes in the module original characteristic. It's important to respect the parameter listed in table 6.

The final assembly recommended reflow profiles are indicated here below.

Soldering phase has to be executed with care: in order to avoid undesired melting phenomenon, particular attention has to be taken on the set up of the peak temperature.

Here following some suggestions for the temperature profile based on following recommendations.

Table 6. Soldering

Profile feature	PB-free assembly
Average ramp up rate (T_{SMAX} to T_p)	3°C/ sec max
Preheat Temperature min (T_S mn) Temperature max (T_S max) Time (t_S min to t_S max) (t_S)	 150 °C 200 °C 60-100 sec
Time maintained above: Temperature T_L Time t_L	 217 °C 60-70 sec
Peak temperature (T_P)	240 + 0 °C
Time within 5 °C of actual peak temperature (T_P)	10-20 sec
Ramp down rate	6 °C/sec
Time from 25 °C to peak temperature	8 minutes max

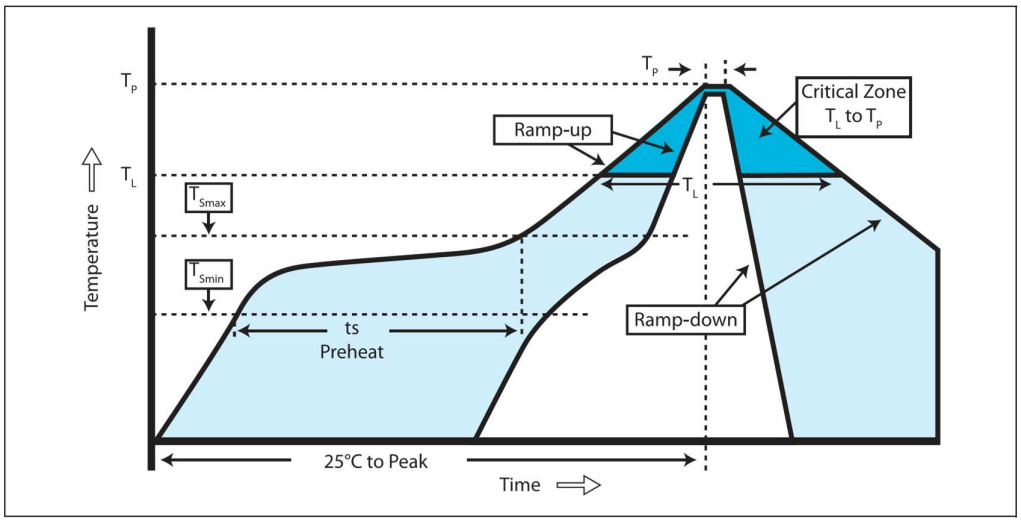


Figure 11: Soldering profiles

6 Regulatory compliance

6.1 FCC certification

This module has been tested and found to comply with the FCC part 15 rules. These limits are designed to provide reasonable protection against harmful interference in approved installations. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference may not occur in a particular installation.

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.

Modifications or changes to this equipment not expressly approved by STMicroelectronics may render void the user's authority to operate this equipment.

In addition, the RF exposure compliance distance of the BLUENRG-M2SA is set equal to 15 mm, as shown in the following Tables.

Evaluation of Exemption Limit (separation distance 15mm)				
Modulation	Max. Frequency (MHz)	Max. level measured at 3m. distance (dBm)	Max. measured e.i.r.p. (mW)	Exemption Limit (obtained by linear interpolation) (mW)
01	2402	5.27	3.365	**15.15**
20	2440	6.10	4.074	**14.94**
40	2480	5.12	3.251	**15.15**

Evaluation of Exemption Limit (separation distance 15mm)					
Max. Frequency (MHz)	Max. radiated power (dBm)	Max. antenna gain (peak) (dBi)	Max. level.		Exemption Limit (obtained by linear interpolation) (mW)
			(dBm)	(mW)	
2402	8	+0.5	8.5	7.079	**15.15**
2440	8	+0.5	8.5	7.079	**14.94**
2480	8	+0.5	8.5	7.079	**15.15**

Modular approval

FCC ID: S9NBNRGM2SA

In accordance with FCC part 15, the BLUENRG-M2SA is listed as a modular transmitter device.

This module is evaluated for stand-alone use only. Finished products incorporating multiple transmitters must comply with colocation and RF exposure requirements in accordance with FCC multi-transmitter product procedures. Collocated transmitters operating in portable RF Exposure conditions (e.g. <20 cm from persons including but not limited to body worn and hand held devices) may require separate approval.

6.1.1 Labeling instructions

When integrating the BLUENRG-M2SA into the final product, the OEM must ensure that the FCC labeling requirements are satisfied. A statement must be included on the exterior of the final product which indicates the product includes a certified module. The label should state the following (or similar wording that conveys the same meaning):

Contains FCC ID: S9NBNRGM2SA

OR

This product contains FCC ID: S9NBNRGM2SA

The OEM must include the following statements on the exterior of the final product unless the product is too small (e.g. less than 4 x 4 inches):

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 any interference that may cause undesired operation.

6.1.2 Product manual instructions

This section applies to OEM final products containing the BLUENRG-M2SA module, subject to FCC compliance. The final product manual must contain the following statement (or a similar statement that conveys the same meaning):

Warning: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. (Part. 15.21)

In the case where an OEM seeks Class B (residential) limits for the final product, the following statement must be included in the final product manual:

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

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

In the case where an OEM seeks the lesser category of a Class A digital device for the final product, the following statement must be included in the final product manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his expense.

6.2 IC certification

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

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

In addition, accordingly to RSS-102 clause 2.6, the RF exposure compliance distance of the BLUENRG-M2SA is set equal to 15 mm, as shown in the following Tables.

Evaluation of Exemption Limit (separation distance 15mm)				
Modulation	Max. Frequency (MHz)	Max. level measured at 3m. distance (dBm)	Max. measured e.i.r.p. (mW)	Exemption Limit (obtained by linear interpolation) (mW)
01	2402	5.27	3.365	**15.15**
20	2440	6.10	4.074	**14.94**
40	2480	5.12	3.251	**15.15**

Evaluation of Exemption Limit (separation distance 15mm)					
Max. Frequency (MHz)	Max. radiated power (dBm)	Max. antenna gain (peak) (dBi)	Max. level.		Exemption Limit (obtained by linear interpolation) (mW)
			(dBm)	(mW)	
2402	8	+0.5	8.5	7.079	**15.15**
2440	8	+0.5	8.5	7.079	**14.94**
2480	8	+0.5	8.5	7.079	**15.15**

Modular approval

IC: 8976C-BNRGM2SA

In accordance with IC RSS-247, the BLUENRG-M2SA is listed as a modular transmitter device.

This module is evaluated for stand-alone use only. Finished products incorporating multiple transmitters must comply with colocation and RF exposure requirements in accordance with IC multi-transmitter product procedures. Collocated transmitters operating in portable RF Exposure conditions (e.g. <20cm from persons including but not limited to body worn and hand held devices) may require separate approval.

6.2.1 Labeling instructions

When integrating the BLUENRG-M2SA into the final product, the OEM must ensure that the IC labeling requirements are satisfied. A statement must be included on the exterior of the final product which indicates that the product includes a certified module. The label should state the following (or similar wording that conveys the same meaning):

Contains IC: 8976C-BNRGM2SA

OR

This product contains IC: 8976C-BNRGM2SA

The OEM must include the following statements on the exterior of the final product unless the product is too small (e.g. less than 4 x 4 inches):

This device complies with RSS-247 of the IC 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 any interference that may cause undesired operation.

6.2.2 Product manual instructions

This section applies to OEM final products containing the BLUENRG-M2SA module, subject to IC compliance. The final product manual must contain the following statement (or a similar statement that conveys the same meaning):

Warning: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. (RSS-247)

In the case where an OEM seeks Class B (residential) limits for the final product, the following statement must be included in the final product manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to RSS-247 of the IC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

In the case where an OEM seeks the lesser category of a Class A digital device for the final product, the following statement must be included in the final product manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to RSS-247 of the IC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his expense.

6.3 EU Type approval for BLUENRG-M2SA module

The BLUENRG-M2SA module has been certified in conformity with the essential requirements of the RED Directive (Radio Equipment Directive) 20174/53/EU based on the tests done according to the following standards:

- ETSI EN 300 328 V2.1.1 (2016:11) ETSI EN 301 489-17 V3.1.1 (2017-02)
- ETSI EN 301 489-1 V2.1.1 (2017-02)
- EN 60950-1:2006 + A11:2009 + A12:2011 + A1:2010 + A2:2013 + AC:2011
- ETSI EN 300 328 V2.1.1 (2016-11)
- EN62479:2010

The module is provided by CE marking:

CE

For additional information please refer to:

STMicroelectronics Via C. Olivetti , 2 Agrate Brianza 20864 (ITALY)

The BLUENRG-M2SA module current production firmware release is: SDK3.0.0

6.4 Bluetooth certification

The module with embedded stack and profile has been qualified in accordance with SIG qualification rules:

- Declaration ID: D034470
- Qualified design ID: 92838
- Product type: End Product
- Core spec version: 5.0
- Product description: Bluetooth Smart v5.0 module

(Please see APPENDIX A for the French translation)

Appendix A

Déclaration de conformité

A.1 Certification FCC

Le module BLUENRG-M2SA a été testé et déclaré conforme avec la section 15 de la Règlementation FCC. Ces limitations sont stipulées afin de procurer une protection raisonnable contre les interférences gênantes dans les installations approuvées. Cet appareil génère, utilise et diffuse des ondes radio et, s'il n'est pas installé et utilisé en conformité avec les instructions dont il fait l'objet, peut causer des interférences gênantes sur les communications radio.

Il n'y a cependant pas de garantie qu'une interférence ne se produira pas dans une installation particulière.

Cet appareil est en conformité avec la section 15 des règlements FCC. L'utilisation est soumise aux deux conditions suivantes: (1) cet appareil ne doit pas causer d'interférences nocives, et (2) Cet appareil doit supporter toute interférence reçue, y compris des interférences qui peuvent provoquer un fonctionnement non désiré.

Tout changement ou modification fait(e) à cet appareil et non expressément approuvé(e) par STMicroelectronics peut annuler l'autorisation pour l'utilisateur de faire fonctionner l'appareil.

En outre, la distance de conformité d'exposition RF du BLUENRG-M2SA est fixée à 15 mm, comme indiqué dans les tableaux suivants.

Evaluation of Exemption Limit (separation distance 15mm)				
Modulation	Max. Frequency (MHz)	Max. level measured at 3m. distance (dBm)	Max. measured e.i.r.p. (mW)	Exemption Limit (obtained by linear interpolation) (mW)
01	2402	5.27	3.365	**15.15**
20	2440	6.10	4.074	**14.94**
40	2480	5.12	3.251	**15.15**

Approbation du module

Evaluation of Exemption Limit (separation distance 15mm)					
Max. Frequency (MHz)	Max. radiated power (dBm)	Max. antenna gain (peak) (dBi)	Max. level.		Exemption Limit (obtained by linear interpolation) (mW)
			(dBm)	(mW)	
2402	8	+0.5	8.5	7.079	**15.15**
2440	8	+0.5	8.5	7.079	**14.94**
2480	8	+0.5	8.5	7.079	**15.15**

FCC ID: S9NBNRGM2SA

Conformément à la section 15 des règlements FCC, le module BLUENRG-M2SA est répertorié comme un dispositif émetteur modulaire.

Ce module n'est évalué que pour une utilisation autonome. Les produits finis incorporant plusieurs émetteurs doivent être conformes à la colocation et aux exigences d'exposition RF en concordance avec les procédures FCC multi-émetteurs. D'autres émetteurs fonctionnant dans des dispositifs portables exposés aux RF (par exemple, situés à moins de 20 cm des personnes avec dispositifs portatifs ou portés contre le corps) peuvent nécessiter d'une approbation séparée.

A.1.1 Instructions d'étiquetage

Lors de l'intégration du module BLUENRG-M2SA dans le produit final, le fabricant doit s'assurer que les exigences en matière d'étiquetage de la FCC sont satisfaites. Une déclaration doit être placée sur l'étiquette extérieure du produit final indiquant que le produit comprend un module certifié. L'étiquette doit comporter les informations suivantes (ou une mention analogue que recouvre la même notion):

Contient FCC ID: S9NBNRGM2SA

OU Ce produit contient FCC ID: S9NBNRGM2SA

Le sous-traitant doit inclure les énoncés suivants sur l'étiquette extérieure du produit final à moins que le produit ne soit trop petit (par exemple moins de 4 x 4 pouces):

Cet appareil est en conformité avec la section 15 des règlements FCC. L'utilisation est soumise aux deux conditions suivantes:

(1) cet appareil ne doit pas causer d'interférences nocives, et

(2) Cet appareil doit supporter toute interférence reçue, y compris des interférences qui peuvent provoquer un fonctionnement non désiré.

A.1.2 Instructions pour l'utilisation du produit

La présente section concerne les produits finis contenant le module BLUENRG-M2SA, assujettis aux normes FCC. Le manuel du produit final doit contenir la déclaration suivante (ou une mention analogue que recouvre la même notion):

" Avertissement: Les changements ou modifications non expressément approuvés par la partie responsable de la conformité pourraient annuler l'autorisation de l'utilisateur de faire fonctionner cet équipement. (Section 15.21)"

Dans le cas où le produit finis d'un fabriquant OEM rentre dans les limites de la Classe B (résidentiel), les énoncés suivants doivent être inclus dans le manuel du produit finis:

"Remarque : Cet équipement a été testé et déclaré conforme aux limitations prévues dans le cadre de la classe B des appareils numériques, définies par la section 15 du règlement de la FCC. Ces limites sont conçues pour fournir une protection raisonnable contre toute interférence dangereuse issue d'une installation résidentielle. Cet équipement produit, utilise et peut émettre de l'énergie radio électrique et, s'il n'est pas installé et utilisé conformément aux présentes instructions, peut causer des interférences nuisibles aux communications radio. Cependant, il se peut que des interférences se produisent dans une installation particulière. Si cet appareil cause des interférences nuisibles à la réception des signaux de radio ou de télévision, ce qui peut être déterminé en allumant et en éteignant l'appareil, on encourage l'utilisateur d'essayer de corriger ces interférences par l'un des moyens suivants:

- *Réorienter ou repositionner l'antenne de réception.*
- *Augmenter la distance séparant l'équipement du récepteur.*
- *Connecter l'équipement à une prise appartenant à un circuit différent de celui sur lequel le récepteur est connecté.*
- *Consulter le revendeur ou un technicien radio/TV expérimenté pour obtenir de l'aide."*

Dans le cas où le produit fini d'un sous-traitant rentre dans les limites imposées aux appareils numériques de classe A, les énoncés suivants doivent être inclus dans le manuel du produit finis:

"REMARQUE : Cet appareil a été testé et certifié conforme aux spécifications d'un appareil électronique de classe A (class A digital device), conformément à la partie 15 du règlement de la FCC. Ces contraintes sont destinées à fournir une protection raisonnable contre les interférences nuisibles quand l'appareil est utilisé dans une installation commerciale. Cet équipement produit, utilise et peut émettre de l'énergie radio électrique et, s'il n'est pas installé et utilisé conformément aux présentes instructions, peut causer des interférences nuisibles aux communications radio. L'utilisation de cet appareil dans une installation résidentielle peut entraîner des interférences nuisibles et l'utilisateur devra corriger les interférences à ses propres frais."

A.2 CertificationIC [(a)]

Cet appareil contient des émetteurs / récepteurs exemptés de licence conformes aux CNR (CNR) d'Innovation, Sciences et Développement économique Canada.

Le fonctionnement est soumis aux deux conditions suivantes:

1. Cet appareil ne doit pas causer d'interférences.
2. Cet appareil doit accepter toutes les interférences, y compris celles susceptibles de provoquer un fonctionnement indésirable de l'appareil.

En outre, conformément à la clause 2.6 de la norme RSS-102, la distance de conformité d'exposition RF du BLUENRG-M2SA est fixée à 15 mm, comme indiqué dans les tableaux suivants.

Evaluation of Exemption Limit (separation distance 15mm)				
Modulation	Max. Frequency (MHz)	Max. level measured at 3m. distance (dBm)	Max. measured e.i.r.p. (mW)	Exemption Limit (obtained by linear interpolation) (mW)
01	2402	5.27	3.365	**15.15**
20	2440	6.10	4.074	**14.94**
40	2480	5.12	3.251	**15.15**

Evaluation of Exemption Limit (separation distance 15mm)					
Max. Frequency (MHz)	Max. radiated power (dBm)	Max. antenna gain (peak) (dBi)	Max. level.		Exemption Limit (obtained by linear interpolation) (mW)
			(dBm)	(mW)	
2402	8	+0.5	8.5	7.079	**15.15**
2440	8	+0.5	8.5	7.079	**14.94**
2480	8	+0.5	8.5	7.079	**15.15**

Approbation du module

IC: 8976C-BNRGM2SA

Conformément à IC CNR-247, le module BLUENRG-M2SA est répertorié comme un dispositif émetteur modulaire

Ce module n'est évalué que pour une utilisation autonome. Les produits finis incorporant plusieurs émetteurs doivent être conformes à la colocation et aux exigences d'exposition RF en concordance avec les procédures FCC multi-émetteurs. D'autres émetteurs fonctionnant dans des dispositifs portables exposés aux RF (par exemple, situés à moins de 20 cm des personnes avec dispositifs portatifs ou portés contre le corps) peuvent nécessiter d'une approbation séparée.

A.2.1 Instructions d'étiquetage

Lors de l'intégration du module BLUENRG-M2SA dans le produit final, le fabricant doit s'assurer que les exigences en matière d'étiquetage de la IC sont satisfaites. Une déclaration doit être placée sur l'étiquette extérieure du produit final indiquant que le produit comprend un module certifié.

L'étiquette doit comporter les informations suivantes (ou une mention analogue que recouvre la même notion):

Contient IC ID: 8976C-BNRGM2SA

OU Ce produit contient IC ID: 8976C-BNRGM2SA

Le sous-traitant doit inclure les énoncés suivants sur l'étiquette extérieure du produit final à moins que le produit ne soit trop petit (par exemple moins de 4 x 4 pouces):

Cet appareil est en conformité aux normes IC. L'utilisation est soumise aux deux conditions suivantes:

(1) cet appareil ne doit pas causer d'interférences nocives, et

(2) Cet appareil doit supporter toute interférence reçue, y compris des interférences qui peuvent provoquer un fonctionnement non désiré

A.2.2 Instructions pour l'utilisation du produit

La présente section concerne les produits finis contenant le module BLUENRG-M2SA, assujettis aux normes IC. Le manuel du produit final doit contenir la déclaration suivante (ou une mention analogue que recouvre la même notion):

"Avertissement: Les changements ou modifications non expressément approuvés par la partie responsable de la conformité pourraient annuler l'autorisation de l'utilisateur de faire fonctionner cet équipement. (CNR-247)"

Dans le cas où le produit finis d'un fabriquant OEM rentre dans les limites de la Classe B (résidentiel), les énoncés suivants doivent être inclus dans le manuel du produit finis:

" Remarque : Cet équipement a été testé et déclaré conforme aux limitations prévues dans le cadre de la classe B des appareils numériques, définies par la norme CNR-247 d'Industrie Canada.

Ces limites sont conçues pour fournir une protection raisonnable contre toute interférence dangereuse issue d'une installation résidentielle. Cet équipement produit, utilise et peut émettre de l'énergie radio électrique et, s'il n'est pas installé et utilisé conformément aux présentes instructions, peut causer des interférences nuisibles aux communications radio. Cependant, il se peut que des interférences se produisent dans une installation particulière. Si cet appareil cause des interférences nuisibles à la réception des signaux de radio ou de télévision, ce qui peut être déterminé en allumant et en éteignant l'appareil, nous encourageons l'utilisateur à essayer de corriger ces interférences par l'un des moyens suivants:

- *Réorienter ou repositionner l'antenne de réception.*
- *Augmenter la distance séparant l'équipement du récepteur.*
- *Connecter l'équipement à une prise appartenant à un circuit différent de celui sur lequel le récepteur est connecté.*
- *Consulter le revendeur ou un technicien radio/TV expérimenté pour obtenir de l'aide."*

Dans le cas où le produit finis d'un fabriquant OEM rentre dans le cadre des limites imposées aux appareils numériques de classe A, les énoncés suivants doivent être inclus dans le manuel du produit finis:

" REMARQUE: Cet appareil a été testé et certifié conforme aux spécifications d'un appareil électronique de classe A (class A digital device), conformément à la norme CNR-247 d'Industrie Canada. Ces contraintes sont destinées à fournir une protection raisonnable contre les interférences nuisibles quand l'appareil est utilisé dans une installation commerciale. Cet équipement produit, utilise et peut émettre de l'énergie radio électrique et, s'il n'est pas installé et utilisé conformément aux présentes instructions, peut causer des interférences nuisibles aux communications radio. L'utilisation de cet appareil dans une installation résidentielle peut entraîner des interférences nuisibles et l'utilisateur devra corriger les interférences à ses propres frais."

A.3 Certification CE

Le module BLUENRG-M2SA a obtenu une certification de conformité aux normes suivantes:-

- EN 62479:2010
- EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + A2:2013
- ETSI EN 301 489-17 V3.1.1 (2017-02)
- ETSI EN 301 489-1 V2.1.1 (2017-02)
- ETSI EN 300 328 v 2.1.1 (2016-11)

Le module est certifié CE:

CE

7 Ordering information

Order code	Description	Packing	MOQ
BlueNRG-M2SA	Bluetooth® V5.0 module	TBD	TBD

Figure 12: Ordering information

8 ECOPACK®

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

9 Traceability

Each module is univocally identified by serial number stored in a 2D data matrix laser marked on the bottom side of the module itself.

The serial number has the following format:

Letter	Meaning
WW	Week
YY	Year
D	Product ID family
FF	Production panel coordinate identification
NNN	Progressive serial number.

Figure 13: Traceability information

Each module bulk is identified by a bulk ID.

BULK ID and module 2D data matrix are linked by a reciprocal traceability link.

The module 2D data matrix traces the lot number of any raw material used.

10 Revision history

Date	Revision	Changes
October 19, 2018	1	Initial release.

Figure 14: Document revision history

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