



### FEATURES

- Integrated 2.4GHz , IEEE 802.15.4-compliant transceiver
  - 3 dBm nominal TX output power
  - -99 dBm RX sensitivity
  - RX filtering for co-existence with IEEE 802.11g and Bluetooth devices
  - Integrated VCO and loop filter
- Integrated IEEE 802.15.4 PHY and MAC
- 128kB Embedded flash and 8kB integrated RAM for program and data storage
- 22 GPIO with alternate functions:
  - GPIOs
  - UART
  - I2C
  - SPI
  - ADC
- 2 16-bit general purpose timers; one 16-bit sleep timer
- ADC , sigma-delta converter with 12 bit resolution
- On board 24 MHz stable Xtal
- Selectable Integrated RC oscillator ( typ 10KHz) or 32.768kHz Xtal for low power operation
- 0.8 uA typ power consumption in Deep sleep mode
- Watchdog timer and power on reset
- Pins available for Non-intrusive debug interface (SIF)
- Integrated Antenna (SPZB32W1A2.1) or integrated RF UFL connector for external antenna (SPZB32W1C2.1)
- Single voltage supply
- FCC and CE compliant
- Small Form Factor : 16.4 x 26.5 mm

### APPLICATIONS

- Industrial controls
- Sensor Networking
- Monitoring of remote systems
- Home/Building Automation
- Security systems
- Lighting controls

### DESCRIPTION

SPZB32W1A2.1 / SPZB32W1C2.1 are ready-to-use ZigBee® modules optimized for embedded applications requiring short range performances. These high-performance, very compact modules enable OEMs to easily add short range reach wireless capability to electronic devices by optimizing time-to-market, cost and size of their target applications.



The modules are based on STM32W single chip ZigBee® solution which integrates a 2.4GHz, IEEE 802.15.4-compliant transceiver together with an embedded processor.

24 MHz high stability Xtal is available aboard the modules to perform the timing requirements as per ZigBee® specifications; additionally a 32.768kHz Xtal is provided for low power operation.

A single supply voltage is requested to power the modules. An innovative 2.5 GHz RF design and the relevant internal RF Amplifier aboard ensure the optimal exploitation of the link budget, an excellent sensitivity and still low power consumption for battery powered operation.

The voltage supply also determines the I/O ports level allowing an easy interface with additional peripherals.

A 128kB of embedded flash memory and 8kB of RAM are available for data and program storage.

To support user defined applications, a number of peripherals such as GPIO, UART, I2C, ADC and general purpose timers are available and user selectable.

Modules are available with two different antenna options:

- **SPZB32W1A2.1** with integrated ceramic antenna aboard
- **SPZB32W1C2.1** with UFL RF connector for the connection of an external antenna.

(for details on STM32W refer to the related Datasheet )

## Contents

<b>1</b>	<b>Block diagram .....</b>	<b>3</b>
<b>2</b>	<b>Pin Configuration .....</b>	<b>3</b>
<b>3</b>	<b>Electrical Characteristics .....</b>	<b>4</b>
3.1	Absolute Maximum Ratings .....	4
3.2	Recommended Operating Conditions .....	4
3.3	DC Electrical characteristics .....	4
3.4	Digital I/O Specifications .....	4
3.5	RF Electrical characteristics .....	4
<b>4</b>	<b>Pins Description .....</b>	<b>5</b>
<b>5</b>	<b>Mechanical Dimensions .....</b>	<b>8</b>
<b>6</b>	<b>Soldering .....</b>	<b>9</b>
<b>7</b>	<b>Appendix A - FCC Statement .....</b>	<b>10</b>

1-BLOCK DIAGRAM

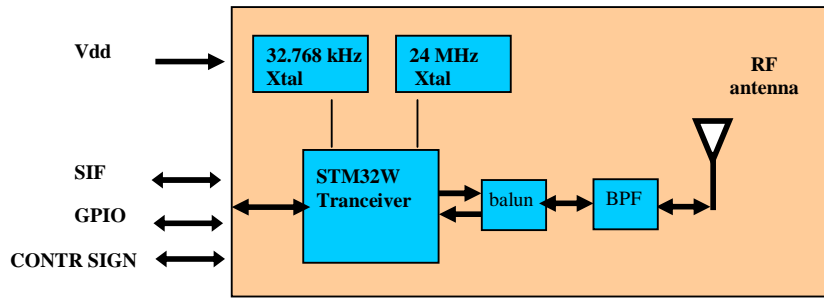


Figure 1. SPZB32W1A2.1 Block diagram

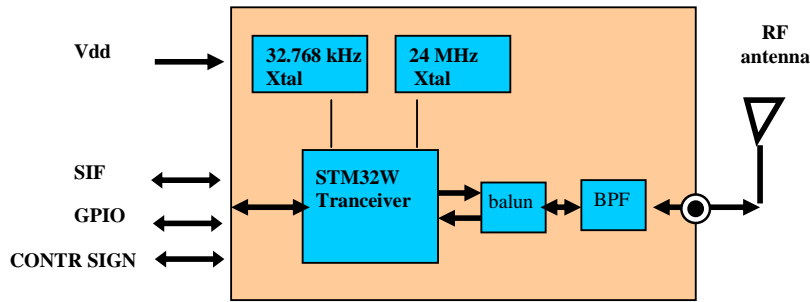


Figure 2. SPZB32W1C2.1 Block diagram

2-PIN CONFIGURATION

PIN CONFIGURATION

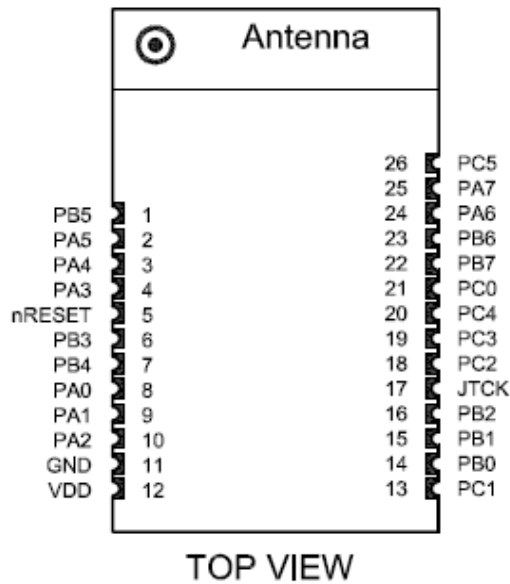


Figure3. Pin configuration

### 3 – ELECTRICAL CHARACTERISTICS

#### 3.1 - ABSOLUTE MAXIMUM RATINGS

Table 1. Absolute maximum ratings

Symbol	Parameter	Min	Max	Unit
VDD	Module supply voltage	- 0.3	3.6	V
Vin	Input voltage on any digital pin	- 0.3	Vdd + 0.3	V
Tstg	Storage temperature	-40	+85	°C
Tsold.	Soldering temperature < 10s		250	°C

#### 3.2 - RECOMMENDED OPERATING CONDITIONS

Table 2. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VDD	Module supply voltage	-40°C < T < +85 C	2.8	3.3	3.6	V
Tstg	Operating ambient temperature		-40		+85	°C

#### 3.3 - DC ELECTRICAL CHARACTERISTICS

Table3. DC Electrical Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
IRX	RX current	Vdd = 3.3 V T= 25 °C		28		mA
ITX	TX current	Po = 3 dBm Vdd = 3.3 V T= 25 °C F=2450 Mhz		32		mA
IDS	Deep Sleep Current (32.768kHz oscillator)	Vdd = 3.3 V T= 25°C		1.3		µA

#### 3.4 - DIGITAL I/O SPECIFICATIONS

Table 4. Digital I/O Specifications

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VIL	Low Level Input Voltage	2.8 < Vdd < 3.6 V	0		0.5 x Vdd	V
VIH	High level input voltage	2.8 < Vdd < 3.6 V	0.62 x Vdd		Vdd	V
Iil	Input current for logic 0	2.8 < Vdd < 3.6 V			-0.5	µA
Iih	Input current for logic 1	2.8 < Vdd < 3.6 V			0.5	µA
Ripu	Input pull-up resistor			30		kΩ
Ripd	Input pull-down resistor			30		kΩ
VOL	Low level output voltage		0		0.18 x Vdd	V
VOH	High level output voltage		0.82 x Vdd		Vdd	V
IOHS	Output source current (standard )				4	mA
IOLS	Output sink current (standard)				4	mA
IOHH	Output source current (high current)				8	mA
IOLH	Output sink current (high current)				8	mA
IOTot	Total output current for I/O				40	mA

#### 3.5 - RF ELECTRICAL CHARACTERISTICS

Table 5. RF Electrical Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
	Frequency range	Vdd = 3.3 V T= 25 °C	2405		2480	MHz
TX	Output power	Vdd = 3.3 V T= 25 °C		3	6	dBm
RX	Sensitivity	Vdd = 3.3V 1% PER		-95	-97	dBm
CFE	Carrier frequency error	Vd d= 3.3V -40 / + 85 °C	-	t.b.d.	t.b.d.	ppm
	Adjacent channel rejection	+/- 5 MHz +/- 10 MHz		35 40		dBm

## 4 – PIN DESCRIPTION

Table 6. Pin Description

Module Pin Number	PIN Name	Direction	STM32W pin	Description
<b>1</b>	PB5	I/O	43	Digital I/O
	ADC0	Analog	43	ADC Input 0
	TIM2CLK	I	43	Timer 2 external clock input
	TIM1MSK	I	43	Timer 1 external clock mask input
<b>2</b>	PA5	I/O	27	Digital I/O
	ADC5	Analog	27	ADC Input 1
	PTI_DATA	O	27	Frame signal of PTI (Packet Trace Interface)
	nBOOTMODE	I	27	Embedded serial bootloader activation out of reset
	TRACEDATA3	0	27	Synchronous CPU trace data bit 3
<b>3</b>	PA4	I/O	26	Digital I/O
	ADC4	Analog	26	ADC Input 0
	PTI_EN	O	26	Frame signal of PTI (Packet Trace Interface)
	TRACEDATA2	O	26	Synchronous CPU trace data bit 2
<b>4</b>	PA3	I/O	25	Digital I/O
	SC2nSSEL	I	25	SPI SLAVE SELECT of Serial Controller 2
	TIM2_CH2	I/O	25	Timer 2 channel 2 output (or input - Disable remap with TIM2_OR[5])
	TRACECLK	O	25	Synchronous CPU trace clock
<b>5</b>	nRESET	I	12	Active low reset ( an internal pull-up of 30 kohm typ. is provided)
<b>6</b>	PB3	I/O	19	Digital I/O
	UART_CTS	I	19	UART CTS handshake of Serial Controller 1
	SC1SCLK	I/O	19	SPI slaver clock of Serial Controller SC1 / SPI master clock of Serial Controller SC1
	TIM2_CH3	I/O	19	Timer 2 channel 3 input / Timer 2 channel 3 output
<b>7</b>	PB4	I/O	20	Digital I/O
	UART_RTS	O	20	UART RTS handshake of Serial Controller 1
	TIM2_CH4	I/O	20	Timer 2 channel 4 input / Timer 2 channel 4 output
	SC1nSSEL	I	20	SPI slave select of Serial Controller 1
<b>8</b>	PA0	I/O	21	Digital I/O
	SC2MOSI	O	21	SPI Master data out of Serial Controller 2
	SC2MOSI	I	21	SPI Slave data in of Serial Controller 2
	TIM2_CH1	I/O	21	Timer 2 channel 1 input / Timer 2 channel 1 output
<b>9</b>	PA1	I/O	22	Digital I/O
	SC2MISO	I	22	SPI Master data in of Serial Controller 2
	SC2MISO	O	22	SPI Slave data out of Serial Controller 2
	SC2SDA	I/O	22	TWI (I2C) data of Serial Controller 2
	TIM2_CH3	I/O	22	Timer 2 channel 3 input / Timer 2 channel 3 output
<b>10</b>	PA2	I/O	24	Digital I/O
	SC2SCLK	O	24	SPI Master clock of Serial Controller 2
	SC2SCLK	I	24	SPI Slave clock of Serial Controller 2
	SC2SCL	I/O	24	TWI (I2C) clock of Serial Controller 2

**SPZB32W1A2.1 / SPZB32W1C2.1**

	TIM2_CH4	I/O	24	Timer 2 channel 4 input / Timer 2 channel 4 output
<b>11</b>	GND	--	49	Ground
<b>12</b>	VDD	Power	16,23,28,37	Input power supply
<b>13</b>	PC1	I/O	38	Digital I/O
	ADC3	Analog	38	ADC Input 3
	SWO	O	38	Serial Wire Output asynchronous trace output to debugger
	TRACEDATA0	O	38	Synchronous CPU trace data bit 0
<b>14</b>	PB0	I/O	36	Digital I/O
	VREF (O/I)	Analog	36	ADC reference output / ADC reference input
	TIM1CLK	I	36	Timer 1 external clock input
	TIM2MSK	I	36	Timer 2 external clock mask input
	IRQA	I	36	External interrupt source A
	TRACECLK	O	36	Synchronous CPU trace clock
<b>15</b>	PB1	I/O	30	Digital I/O
	SC1TXD	O	30	UART transmit data of Serial Controller 1
	SC1MOSI / SC1MISO	O	30	SPI master data out of Serial Controller 1 / SPI slave data out of Serial Controller 1
	SC1SDA	I/O	30	TWI (I2C) data of Serial Controller 1
	TIM2_CH1	I/O	30	Timer 2 channel 1 input / Timer 2 channel 1 output
<b>16</b>	PB2	I/O	31	Digital I/O
	SC1RXD	I	31	UART receive data of Serial Controller 1
	SC1MISO / SC1MOSI	I	31	SPI master data in of Serial Controller SC1 / SPI slave data in of Serial Controller 1
	SC1SCL	I/O	31	TWI (I2C) clock of Serial Controller 1
	TIM2_CH2	I/O	31	Timer 2 channel 2 input / Timer 2 channel 2 output
<b>17</b>	JTCK	I	32	JTAG clock input from debugger
	SWCLK	I/O	32	Serial Wire clock input/output with debugger
<b>18</b>	PC2	I/O	33	Digital I/O
	JTDO	O	33	JTAG data out to debugger
	SWO	O	33	Serial Wire Output asynchronous trace output to debugger
<b>19</b>	PC3	I/O	34	Digital I/O
	JTDI	I	34	JTAG data in from debugger
<b>20</b>	PC4	I/O	35	Digital I/O
	JTMS	I	35	JTAG mode select from debugger
	SWDIO	I/O	35	Serial Wire bidirectional data to/from debugger
<b>21</b>	PC0	I/O	40	Digital I/O (high current)
	JRST	I	40	JTAG reset input from debugger
	TRACEDATA1	O	40	Synchronous CPU trace data bit 1
	IRQD	I	40	External interrupt source D
<b>22</b>	PB7	I/O	41	Digital I/O
	TIM1_CH2	O	41	Timer 1 channel 2 output
	TIM1_CH2	I	41	Timer 1 channel 2 input
	IRQC	I	41	External interrupt source C
	ADC2	I	41	ADC input 2
<b>23</b>	PB6	I/O	42	Digital I/O

**SPZB32W1A2.1 / SPZB32W1C2.1**

	TIM1_CH1	O	42	Timer 1 channel 1 output
	TIM1_CH1	I	42	Timer 1 channel 1 input
	IRQB	I	42	External interrupt source B
	ADC1	Analog	42	ADC input 1
<b>24</b>	PA6	I/O	29	Digital I/O
	TIM1_CH3	O	29	Timer 1 channel 3 output
	TIM1_CH3	I	29	Timer 1 channel 3 input
<b>25</b>	PA7	I/O	18	Digital I/O
	TIM1_CH4	O	18	Timer 1 channel 4 output
	TIM1_CH4	I	18	Timer 1 channel 4 input
	REG_EN	O	18	External regulator open drain output (enabled after reset)
<b>26</b>	PC5	I/O	11	Digital I/O
	TX_ACTIVE	O	11	Logic level control for external Rx/Tx switch

5 - MECHANICAL DIMENSIONS

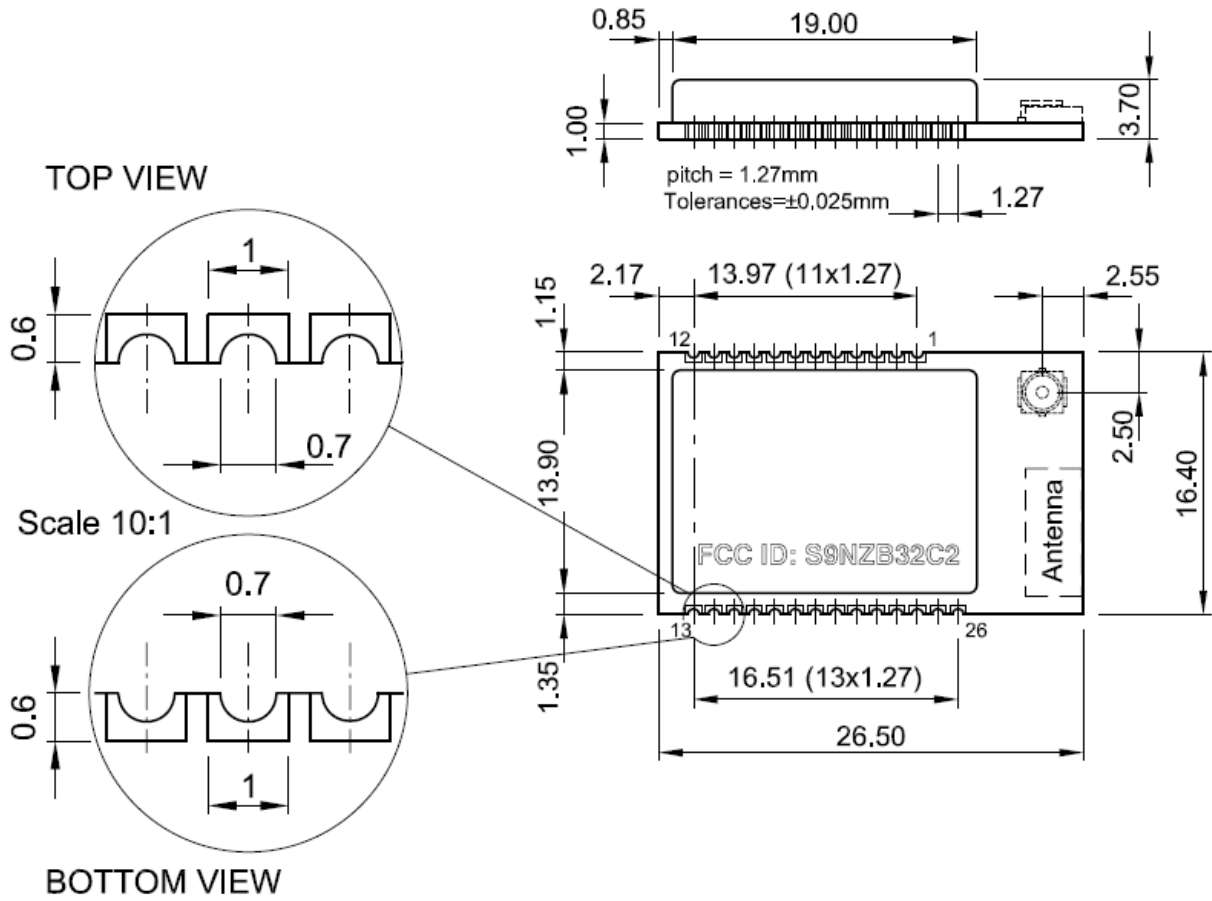
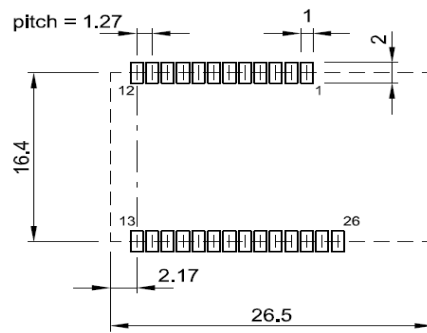


Figure 4 Mechanical dimensions



RECOMMENDED LAND PATTERN TOP VIEW

Figure 5 Pin land pattern

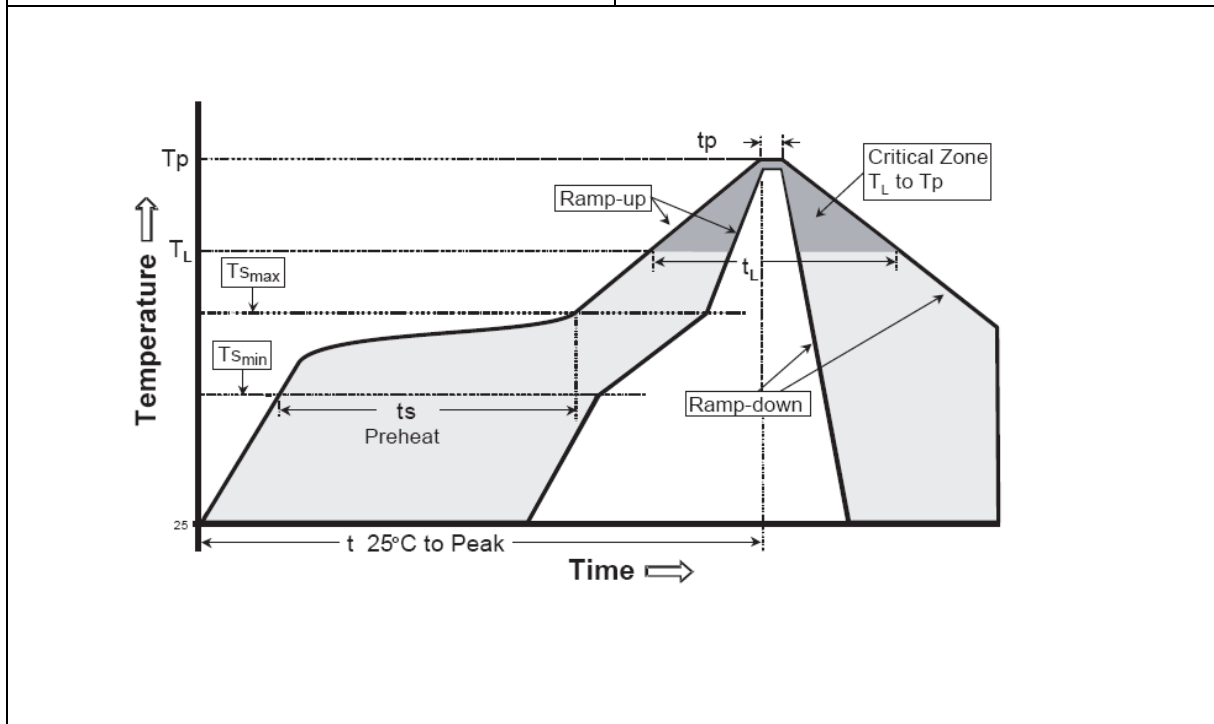


**6 - SOLDERING**

Soldering phase has to be carefully executed: 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 IPC/JEDEC J-STD-020C, July 2004 recommendations

Profile feature	PB free assembly
Average ramp up rate ( TSMAX to TP)	3°C / sec max
Preheat Temperature min ( TS MIN) Temperature max ( TS MAX) Time (TS MIN to TS MAX) ( ts )	150 ° C 200 ° C 60 – 100 sec
Time maintained above : Temperature TL Time tL	217 ° C 40 – 70 sec
Peak Temperature (Tp)	240 + 0 ° C
Time within 5°C of actual peak temperature (tP)	10 – 20 sec
Ramp down rate	6 °C / sec
Time from 25° C to peak temperature	8 minutes max



## Appendix A - 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.

**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

### Antenna

Our module type SPZB32W1x2.1 is for OEM integrations only. The end-user product will be professionally installed in such a manner that only the authorized antennas are used.

### Caution

Any changes or modifications not expressed approved by the part responsible for compliance could cause the module to cease to comply with FCC rules part 15, and thus void the user's authority to operate the equipment.

## A.1 - LABEL INSTRUCTION

### INSTRUCTION MANUAL FOR FCC ID LABELING

Module type : ZigBee® module *SPZB32W1A2.1 / SPZB32W1C2.1*

FCC-ID : S9NZB32C2

This intends to inform you how to specify the FCC ID of our ZigBee module *SPZB32W1A2.1 / SPZB32W1C2.1* on your final product.

Based on the Public Notice from FCC, the product into which our transmitter module is installed must display a label referring to the enclosed module.

The label should use wording such as “Contains Transmitter module FCC ID: S9NZB32C2 or “Contains FCC ID: S9NZB32C2 , any similar wording that expressed the same meaning may be use.

It shows an example below

Contains FCC ID: S9NZB32C2

---

## A.2 - Special requirement for Modular application

The following requirements are fulfilled:

- 1) The modular transmitter must have its own RF shielding:

The RF module used on the board fulfils the emission requirements of the FCC rules without additional shielding.

- 2) The modular transmitter must have buffered modulation/data inputs:

The module has a memory management unit inside of the IC. The processor interfacing with the external application by means general purpose I/O ( GPIO) , Uart, SPI. The processor interfaces also the RF part of the module exchanging data and command with it. Inside the processor a flash memory is available to download the customer application and the ZigBee profiles.

- 3) The modular transmitter must have its own power supply regulation:

The IC contains an own voltage regulation. In case of changes in the supply voltage VCC (for example caused by temperature changes or other effects), the internal voltage will be stabilized.

- 4) The modular transmitter must comply with the antenna requirements of Section 15.203 and 15.204:

The RF module is for OEM (Original Equipment Manufacturer) integration only. The end-user product will be professionally installed in such a manner that only the authorized antenna is used.

- 5) The modular transmitter must be tested in a stand-alone configuration:

The RF module was tested in a stand-alone configuration.

- 6) The modular transmitter must be labelled with its own FCC ID number:

The RF module will be labelled with its own FCC ID number. When the module is installed inside the end-product, the label is not visible. The OEM manufacturer is instructed how to apply the exterior label.

- 7) The modular transmitter must comply with any specific rule or operating requirements applicable to the transmitter and the manufacturer must provide adequate instructions along with the module to explain any such requirements:

The EUT is compliant with all applicable FCC rules. Detail instructions are given in the product Users Guide.

- 8) The modular transmitter must comply with any applicable RF exposure requirements.

- Maximum measured power output: 1.90 mW (2.77 dBm )
- Maximum antenna gain: 2.2 dBi (see also FCC test report)

Maximum permissible exposure defined in 47 CFR 1.1310: 1 mW/cm<sup>2</sup>.

The RF module operates at low power level so it does not exceed the Commission's RF exposure guidelines limits; furthermore, Spread spectrum transmitters operate according to the Section 15.247 are categorically excluded from routine environmental evaluation.

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such a third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

**UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.**

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

St and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2010 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia – Belgium - Brazil – Canada - China – Czech Republic - Finland - France - Germany - Hong Kong - India – Israel - Italy - Japan - Malaysia - Malta – Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom – United States of America

<http://www.st.com>