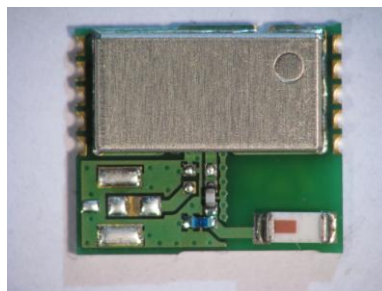


## Features

- **Bluetooth Radio**
  - Bluetooth specification v4.1 compliant
  - Master and slave Smart Bluetooth network processor module
  - Embedded Bluetooth low energy protocol stack: GAP, GATT, SM, L2CAP, LL, RF-PHY
  - Bluetooth low energy profiles provided separately
  - Operating temperature range: -40°C to 85°C
  
- **Host Interface**
  - SPI, IRQ, and RESET
  
- **Antenna on board**
  
- **CE, FCC, IC qualified**
  
- **BQE certified**



Preliminary module picture  
11.5 mm x 13.5 mm x 2.0 mm

## 1 Description

The SPBTLE-RF is an easy to use Bluetooth® module, compliant with Bluetooth® v4.1. The module provides a complete RF platform in a tiny form factor.

The SPBTLE-RF enables wireless connectivity into electronic devices, not requiring any RF experience or expertise for integration into the final product. The SPBTLE-RF module, being a certified solution, optimizes the time to market of the final applications.

The module has been designed for maximum performance in a minimal space.

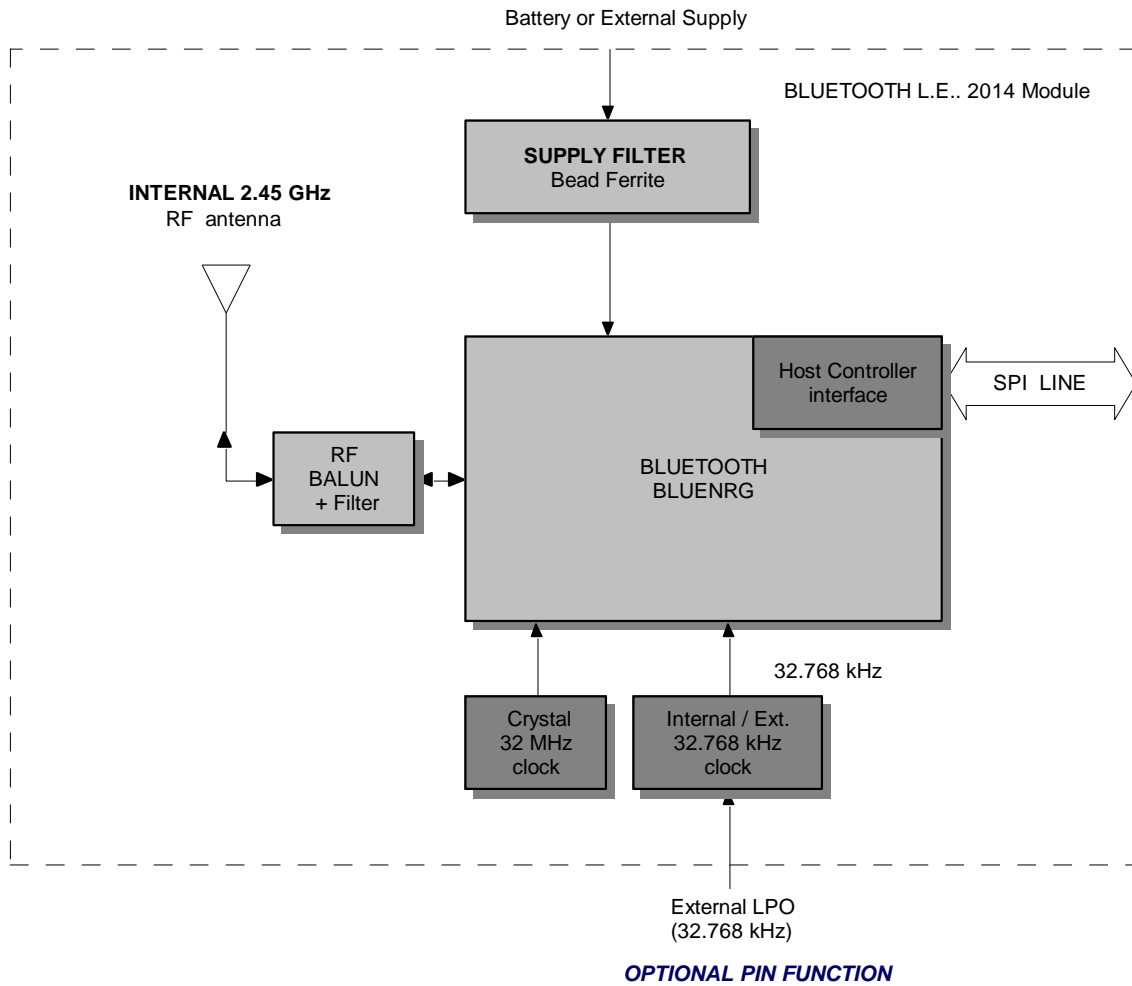
Optimized design allows the integration of a complete working Bluetooth® modem in the minimum possible size. Module interface is SPI serial interface.

## 2 Applications

- Watches
- Fitness, wellness and sports
- Consumer medical
- Security/proximity
- Remote control
- Home and industrial automation
- Assisted living
- Mobile phone peripherals
- PC peripherals

### 3 Block Diagram

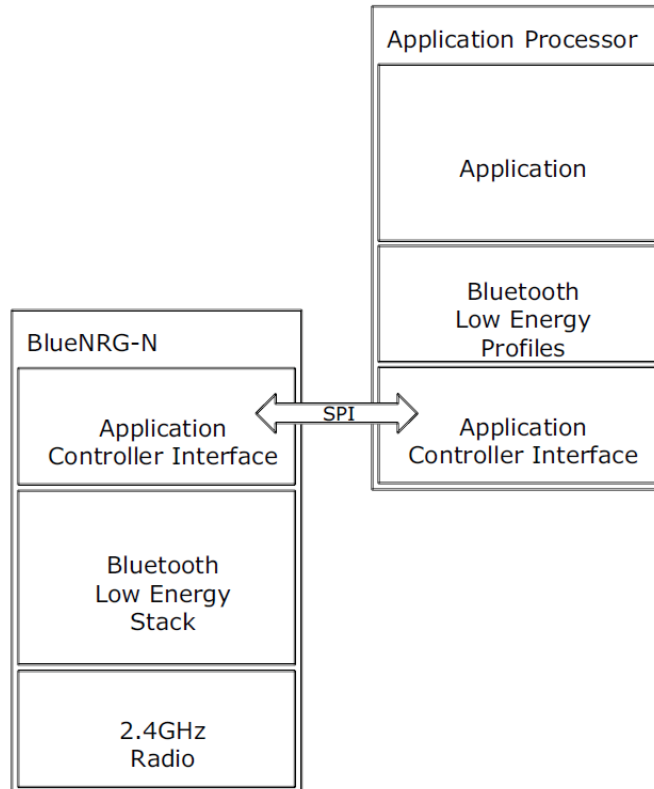
Figure 1. HW block diagram



## 4 Software Architecture

### Bluetooth Firmware implementation

Figure 2. SPBTLE-RF Application Block Diagram



## 5 Hardware Specifications

General Conditions ( $V_{IN}= 2.2V$  and  $25^{\circ}C$ )

### 5.1 Absolute Maximum Ratings

**Table 1. Absolute maximum rating**

Rating	Min	Typical	Max	Unit
Storage temperature range	-40	-	+85	$^{\circ}C$
Supply voltage, $V_{IN}$	-0.3	-	+ 3.9	Volts
I/O pin Voltage ( $V_{IO}$ five-volt tolerant pin)	-0.3	-	+ 3.9	Volts
RF saturation input power	-	8	-	dBm

### 5.2 Recommended Operating Conditions

**Table 2. Recommended operating conditions**

Rating	Min	Typical	Max	Unit
Operating Temperature Range	-40	-	85	$^{\circ}C$
Supply Voltage $V_{IN}$	2.0	3.3	3.6	Volts
Signals & I/O Pin Voltage (according Supply Voltage)	2.0	-	3.6	Volts
RF Frequency	2402	-	2480	MHz

### 5.3 Pin assignment

**Figure 3. Pin connection**

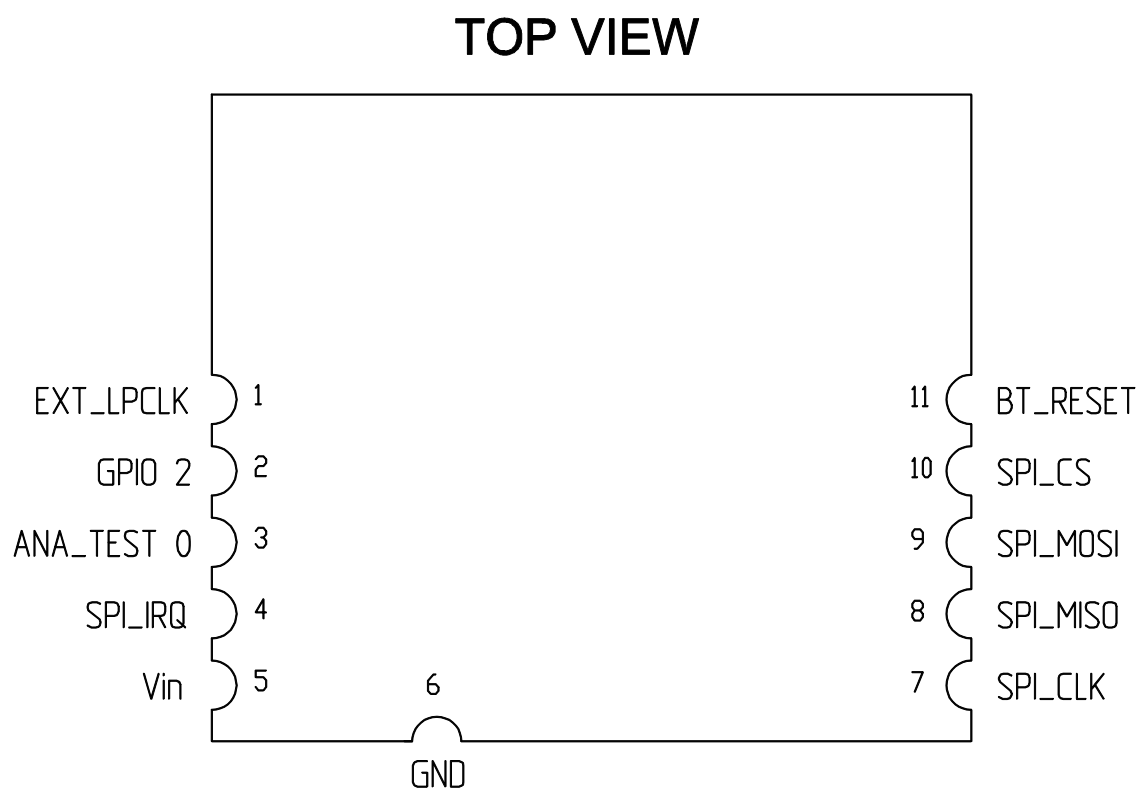


Table 3. Pin Assignment

Name	Type	Pin #	Description	ALT Function	V max. Tolerant	Initial State
<b>SPI Interface</b>						
SPI_IRQ	O	4	SPI IRQ(SLAVE has data for MASTER)		$V_{in}$	
SPI_CLK	I	7	SPI CLOCK (Max. 8 MHz)		$V_{in}$	
SPI_MISO	O	8	SPI MISO (MASTER in / SLAVE out)		$V_{in}$	
SPI_MOSI	I	9	SPI MOSI (MASTER out SLAVE in)		$V_{in}$	
SPI_CS	I	10	SPI "Chip Select" (SPI slave select)		$V_{in}$	
<b>Power and Ground</b>						
$V_{in}$		5	$V_{in}$		(2.0V + 3.6V max.)	
GND		6	GND			
<b>Reset</b>						
BT_RESET	I	11	Reset input (active low < 0.35 $V_{in}$ )		(2.0V + 3.6V max.)	
<b>LPO</b>						
EXT_LPCLK	I	1	Not connected / Optional pin function		(2.0V + $V_{in}$ max.)	
GPIO2	I/O	2	Not connected			
ANA TEST 0	I	3	Not connected			

## 6 Mechanical dimensions

Figure 4. Mechanical dimensions

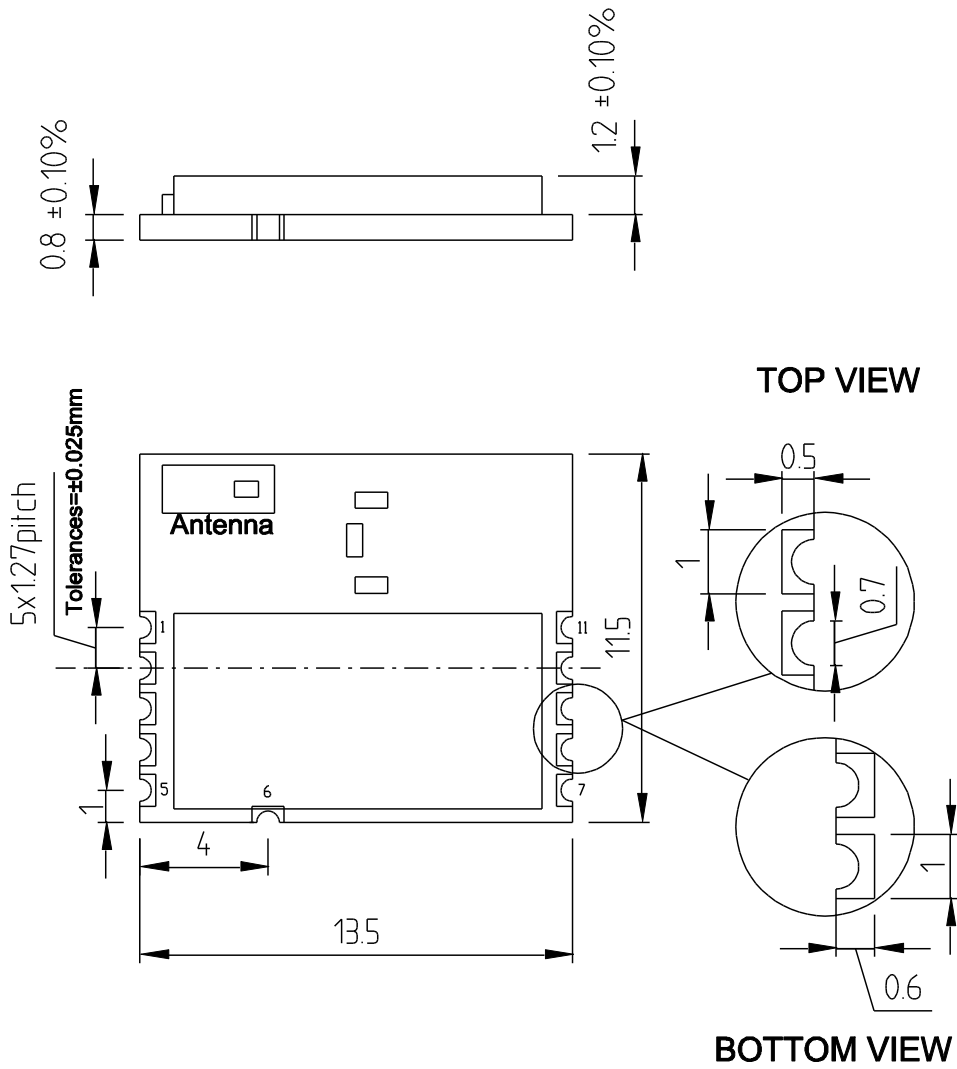
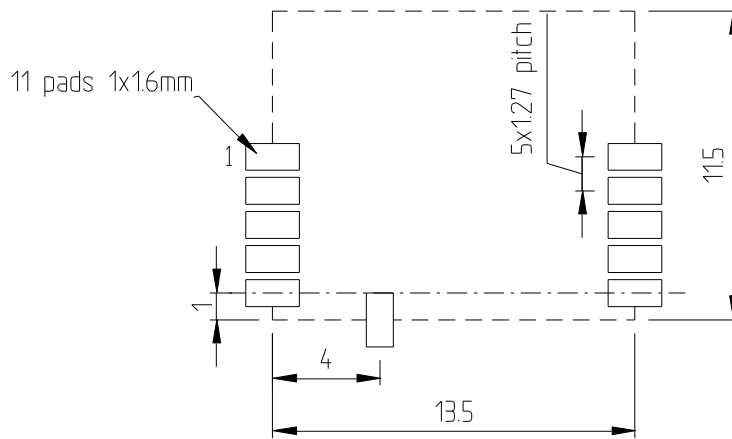


Figure 5. Recommend land pattern top view



RECOMMENDED LAND PATTERN TOP VIEW  
All Dimensions are in millimeters



## 7 Hardware design

SPBTLE-RF module supports SPI hardware interfaces.

### Notes

- All unused pins should be left floating; do not ground.
- All GND pins must be well grounded.
- 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.
- Traces should not be routed underneath the module.

## 8 Reflow soldering

The SPBTLE-RF is a high temperature strength surface mount Bluetooth® module supplied on a 11 pin, 4-layer PCB. 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.

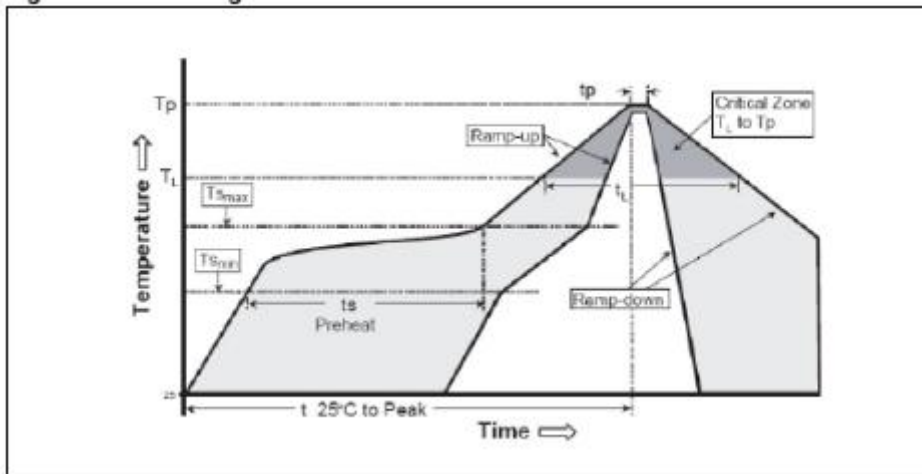
Here following some suggestions for the temperature profile based on IPC/JEDEC J-STD-020C, July 2004 recommendations.

**Table 4. Soldering**

Profile feature	PB-free assembly
Average ramp up rate ( $T_{S_{MAX}}$ to $T_p$ )	3°C/ sec max
Preheat	
Temperature min ( $T_S$ mn)	150 °C
Temperature max ( $T_S$ max)	200 °C
Time ( $t_S$ min to $t_S$ max) ( $t_S$ )	60-100 sec
Time maintained above:	
Temperature $T_L$	217 °C
Time $t_L$	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 6. Soldering profiles



## 9 RoHS compliance

ST Bluetooth modules comply with the ECOPACK2 level of RoHS compliance grade.

## 10 Ordering Information

Table 5. Ordering information

Order code	Description	Packing	MOQ
SPBTLE-RF	Bluetooth® V4.0 Smart module	Jedec tray	2'448 pcs

## 11 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:

WW YY D FF NNN

where

WW = week

YY = year

D = product ID family

FF = production panel coordinate identification

NNN = progressive serial number.

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.

## 12 Regulatory compliance

### 12.1 *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.

#### **Modular approval**

FCC ID: S9NSPBTLERF

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

This module is evaluated for stand-alone use only. Finished products incorporating multiple transmitters must comply with collocation and RF exposure requirements in accordance with FCC 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.

#### ***Labeling instructions***

When integrating the SPBTLE-RF 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: S9NSPBTLERF*

**OR**     *This product contains FCC ID: S9NSPBTLERF*

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.*

## ***Product manual instructions***

This section applies to OEM final products containing the SPBTLE-RF 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.*



## 12.2 IC certification

The SPBTLE-RF module has been tested and found compliant with the IC RSS-210 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 RSS-210 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 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.

### Modular approval

IC: 8976C-SPBTLERF

In accordance with IC RSS-210, the SPBTLE-RF 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.

### 12.2.1 Labeling instructions

When integrating the SPBTLE-RF 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-SPBTLERF*

**OR**     *This product contains IC: 8976C-SPBTLERF*

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-210 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.*

### 12.2.2 Product manual instructions

This section applies to OEM final products containing the SPBTLE-RF 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-210)*

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-210 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-210 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.*

## ***CE certification for SPBTLE-RF module***

The SPBTLE-RF module has been certified according to the following standards:

EN 60950-1:2006 + A11:2009 + A12:2011 + A1:2010 + A2:2013 + AC:2011  
ETSI EN 301 489-1 V1.9.2:2011  
ETSI EN 301 489-17 V2.2.1  
ETSI EN 300 328 V1.8.1 :2012  
ETSI EN 300 328 V1.9.1 (2015)  
EN62479 :2010

The module is CE certified:

**CE0051**



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