SPBT4.0DP

Bluetooth® Smart Ready module

Features

- •Bluetooth® radio
  - o Fully embedded Bluetooth® v4.0 with SPP and Low Energy profiles
  - o Embedded support for MFI iAP2 profile
  - o Class 2 module
  - o Complete RF ready module
  - o 128-bit encryption security
  - o Integrated antenna

11.6 x 13.5 mm

- ST micro Cortex-M4 microprocessor
  - o up to 104 MHz
  - o 512 KB Flash
  - o 128 KB RAM memory

- Supported transmission speed with SPP
  - o Up to 800KBits

- General I/O
  - o 8 general purpose I/Os

- User interface
  - o AT command Data Package (DP)
  - o Firmware upgrade over UART

- ETSI, FCC, IC and Bluetooth® qualified

- Single voltage supply: 3.3 V typical

- Micro-sized form factor: 11.6 x 13.5 x 2.9 mm

- Operating temperature range: -40 °C to 85 °C

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1   Description

The SPBT4.0DP is an easy to use Bluetooth Smart Ready module, compliant with Bluetooth v4.0.

The module is among the smallest form factor available which provides a complete RF platform. The SPBT4.0DP enables electronic devices with wireless connectivity, not requiring any RF experience or expertise for integration into the final product. The SPBT4.0DP module, being a certified solution, optimizes the time to market of the final applications.

The module is designed for maximum performance in a minimal space including fast speed UART and 8 general purpose I/O lines, several serial interface options, and up to 800 kbps transmission speed with SPP service active, 250kbps with iAP2 service active.

Optimized design allows the integration of a complete working Bluetooth modem, including antenna, in the minimum possible size; only an additional external LPO (low power oscillator) is required to enable low power mode capability.

The SPBT4.0DP is a surface mount PCB module that provides fully embedded, ready to use Bluetooth wireless technology. The reprogrammable Flash memory contains embedded firmware for serial cable replacement using the Bluetooth SPP profile. Embedded Bluetooth DATA PACKAGE (DP) firmware is a friendly interface, which realizes a simple control for cable replacement. The SPBT4.0DP supporting SPP, iAP2 and Bluetooth Low Energy proprietary Data Exchange profiles, it provides communication with Android, smartphone, and the newest Apple$^®$ iOS Bluetooth enabled devices.

An Apple authentication IC is required to exchange data with an Apple device or access an Apple device application. The DP FW includes the Bluetooth iAP2 profile capable of recognizing the Apple authentication chip.

Customers using the Apple authentication IC must register as developers to become an Apple certified MFI member. License fees may apply, for additional information visit: http://developer.apple.com/programs/which-program/index.html.

Certified MFI developers developing electronic accessories that connect to the iPod$^®$, iPhone$^®$, and iPad$^®$ gain access to technical documentation, hardware components, technical support and certification logos.

Customized firmware for peripheral device interaction, power optimization, security, and other proprietary features may be supported and can be ordered pre-loaded and configured.

2   RoHS compliance

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

3   Applications

The SPBT4.0DP is suitable for a wide range of application like:

- Serial cable replacement
- M2M industrial control
- Service diagnostic
- Data acquisition equipment
- Machine control
- Sensor monitoring
- Security system
- Mobile health

4   Software architecture

4.1   BT stack layers

- Bluetooth v4.0
- Device power modes: active, sleep and deep sleep
- Wake on Bluetooth feature optimized power consumption of host CPU
- Authentication and encryption
- Encryption key length from 8 bits to 128 bits
- Persistent Flash memory for BD address and user parameter storage
- All ACL (asynchronous connection less) packet types
- Sniff mode: fully supported to maximum allowed intervals
- Master slave switch supported during connection and post connection
- Dedicated inquiry access code for improved inquiry scan performance
- Dynamic packet selection channel quality driven data rate to optimize link performance
- Dynamic power control
- Bluetooth radio natively supports 802.11b co-existence AFH
- RFCOMM, SDP, and L2CAP supported

4.2   Supported Profile

Bluetooth Classic:
- Serial Port Profile (SPP)
- iPOD Accessory Protocol 2 (iAP2)

Bluetooth Low Energy:
- Proprietary Data Exchange Profile (DEP)

4.3   AT Command DATA PACKAGE

The complete command list is reported in the AT Command DATA PACKAGE user manual.

5 Hardware specifications

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

5.1 Recommended operating conditions

Table 1. Recommended operating conditions

Rating	Min.	Typical	Max.	Unit
Operating temperature range	-40	-	+ 85	°C
Supply voltage V_{IN}	2.3	3.3	3.6	V
Signal pin voltage	-	2.1	-	V
RF frequency	2402	-	2480	MHz

5.2 Absolute maximum ratings

Table 2. Absolute maximum ratings

Rating	Min.	Typical	Max.	Unit
Storage temperature range	-40	-	+ 85	°C
Supply voltage, V_{IN}	-0.3	-	+ 5.5	V
I/O pin voltage, V_{IO}	-0.3	+2.1	+5	V
RF max. input power GFSK	-	-	10	dBm
RF max. input power DQPSK	-	-	6	dBm
RF max. input power DPSK	-	-	-3	dBm

5.3 Module current absorption (Average & Typical)

Table 3. Module average D.C. current absorption

Test Conditions	Min.	Typical	Max.	Unit
CPU = 84Mhz IDLE STATE **(WAIT FOR COMMANDS)**		**10.62**		**mA**
CPU = 84Mhz Tx (65500kb/s) **Transmission state** **(Continuos Transmission)**		**37**		**mA**
CPU = 84Mhz Rx (35500kb/s) **Receiving state**		**27**		**mA**

5.4 Pin assignment

Figure 1. Pin connection
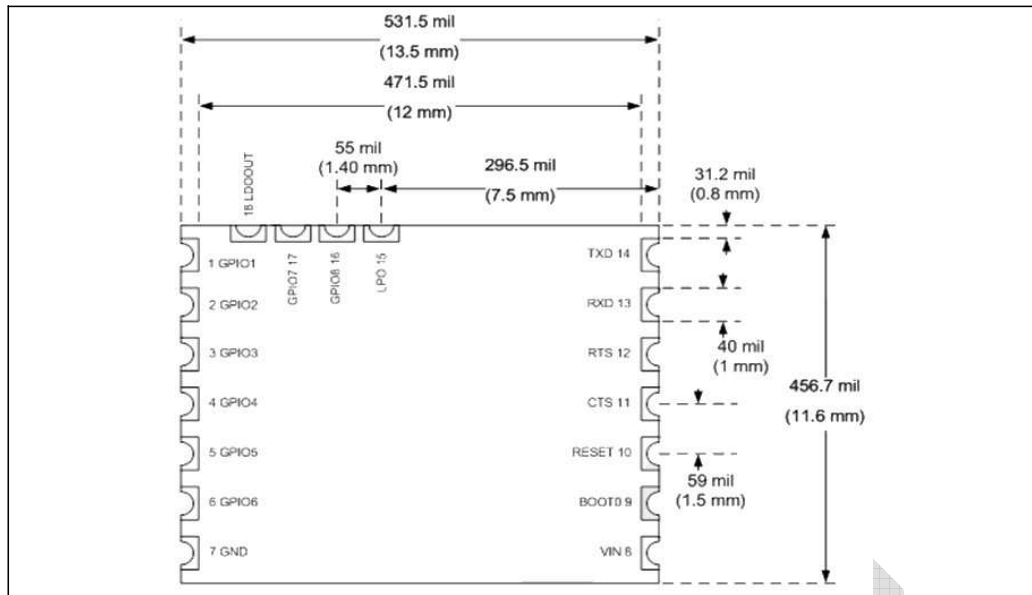
Table 4. Pin assignment

Pin	Name	Description	I/O	Note
1	GPIO1_BTCS	GPIO indicating BT Connection Status - When high, BT connection is active - When low, BT connection is not active	O	
2	GPIO2	General purpose I/O	I/O	5V tolerant
3	GPIO3	General purpose I/O	I/O	5V tolerant
4	GPIO4_MLPS	GPIO indicating Module Low Power Status - When high, device is in active mode - When low, device is in low power mode	O	
5	GPIO5	General purpose I/O	I/O	5V tolerant
6	GPIO6	General purpose I/O	I/O	5V tolerant
7	GND	Reference ground	NA	
8	Vin	Main power supply input	NA	
9	Boot 0	Boot 0 pin	I	5V tolerant
10	RESETn	Reset input (active low for 5ms)	I	
11	CTS / I2C SCL	Request to send (active low) or I2C_SCL line for MFI chip	I	
12	RTS / I2C SDA	Clear to send (active low) or I2C_SDA line for MFI chip	O	5V tolerant
13	RXD	Receive Data	I	5V tolerant
14	TXD	Transmit Data	O	
15	LPO	Low power 32KHz oscillator input	I	
16	GPIO7	General purpose I/O	I/O	5V tolerant
17	GPIO8	General purpose I/O	I/O	5V tolerant
18	+2.1V OUT	+2.1V out (max 10mA)	NA	

5.5 Mechanical dimensions

Figure 2. Mechanical dimensions

Figure 3. Recommend land pattern top view
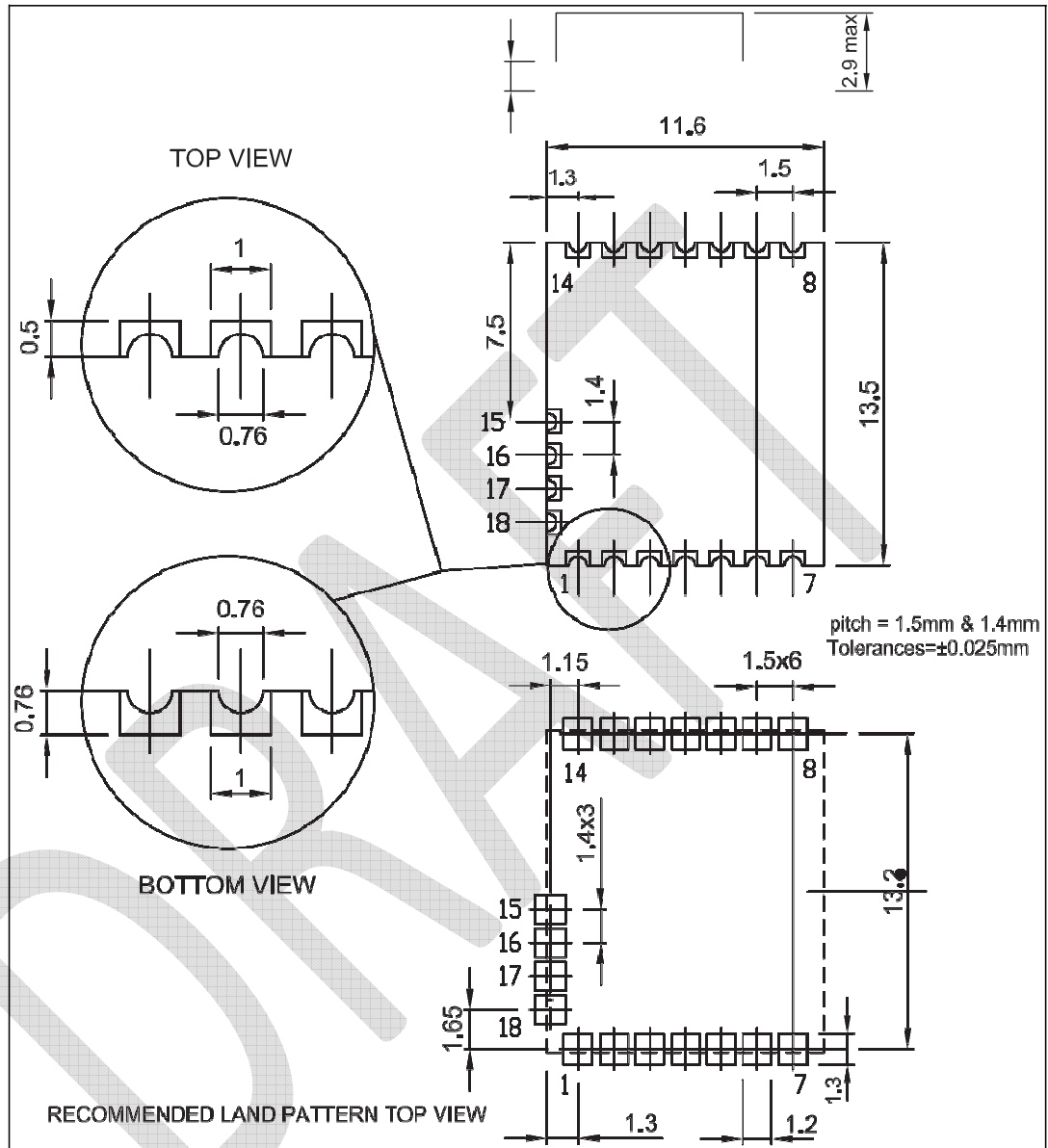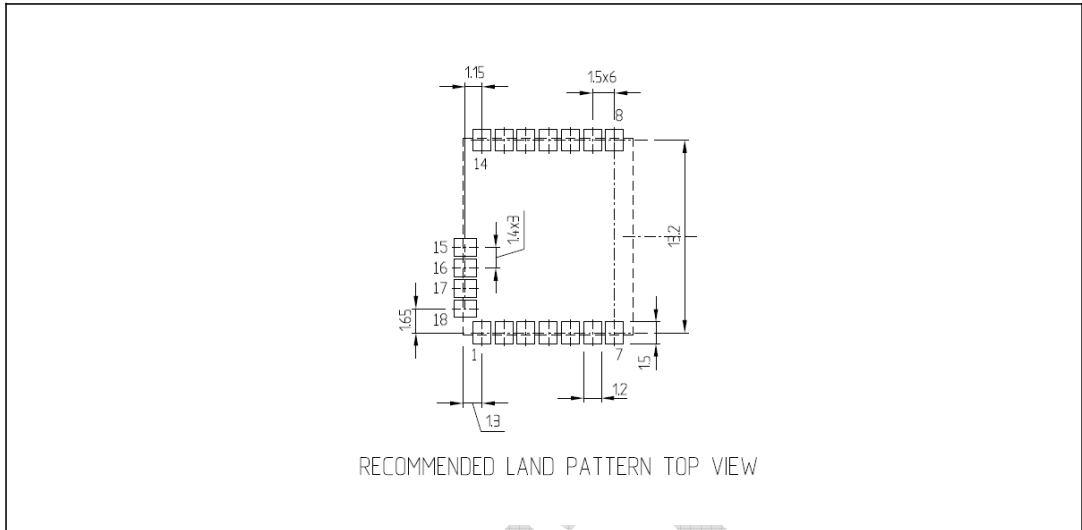

RECOMMENDED LAND PATTERN TOP VIEW

6 Hardware design

SPBT4.0DP module with DP command embedded FW supports UART, I^{2}C and GPIO hardware interfaces.

Note: - 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.*

6.1 Reflow soldering

The SPBT4.0DP is a high temperature strength surface mount Bluetooth$^®$ module supplied on an 18 pin, 6-layer PCB. The final assembly recommended reflow profiles are indicated here below.

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

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

Table 5. Soldering

Profile feature	PB-free assembly
Average ramp-up rate (T_{SMAX} to T_P)	3 °C/sec max
Preheat: – Temperature min. (T_S min.) – 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 – Temperature 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 4. Soldering profile
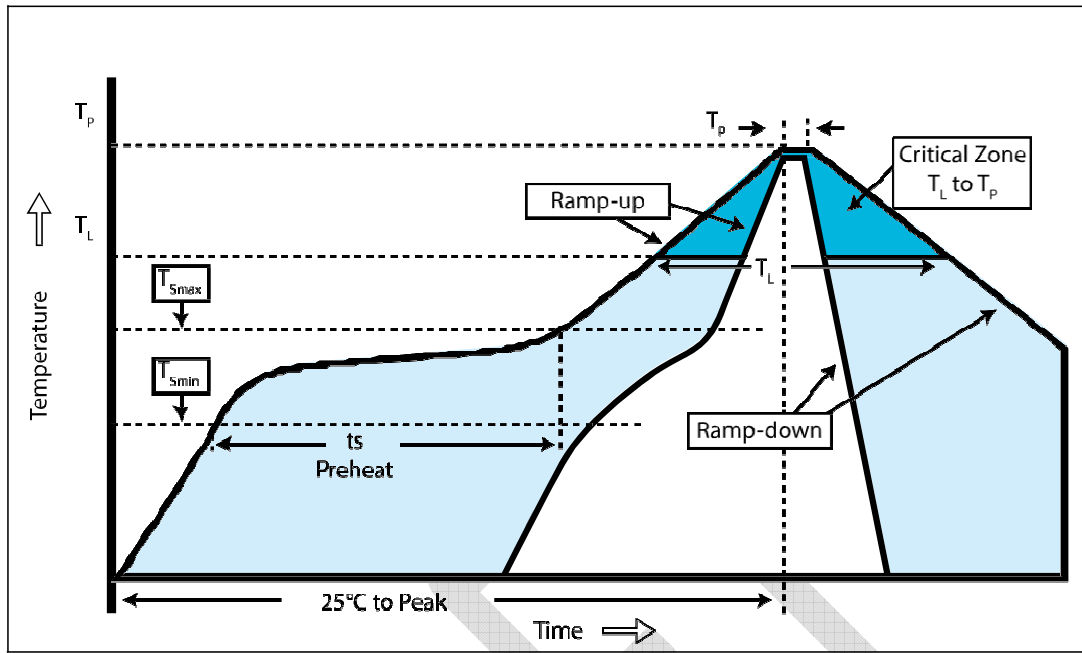
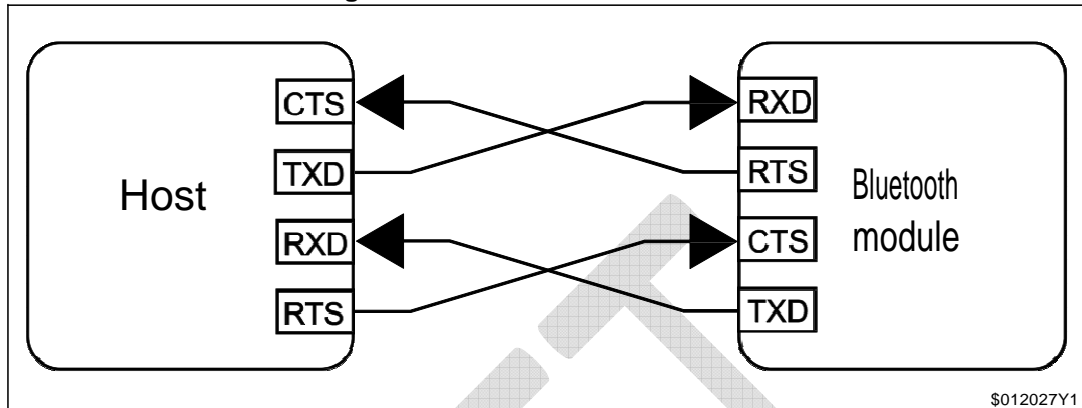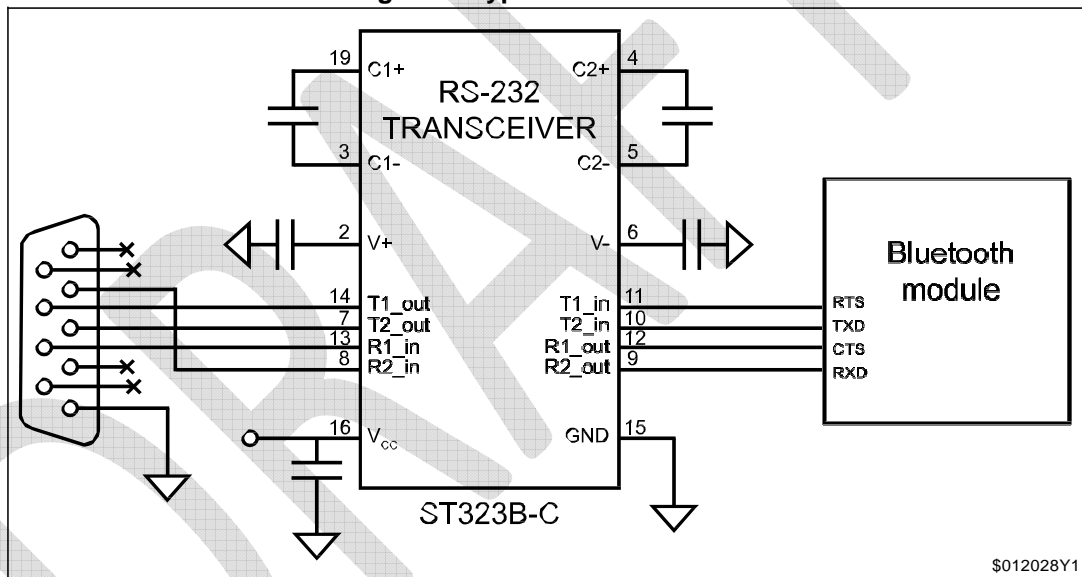$012026Y1

6.2   UART interface

The UART is compatible with the 16550 industry standard. Four signals are provided with the UART interface. The TXD and RXD pins are used for data while the CTS and RTS pins are used for flow control.

Figure 5. Connection to host device

Figure 6. Typical RS232 circuit

7 Regulatory compliance

7.1 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: S9NSPBT40DP

In accordance with FCC part 15, the SPBT4.0DP 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.

7.1.1 Labeling instructions

When integrating the SPBT4.0DP 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: S9NSPBT40DP

OR

This product contains FCC ID: S9NSPBT40DP

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.

7.1.2 Product manual instructions

This section applies to OEM final products containing the SPBT4.0DP 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.*

7.2 IC certification

The SPBT4.0DP 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-SPBT40DP

In accordance with IC RSS-210, the SPBT4.0DP 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.

7.2.1 Labeling instructions

When integrating the SPBT4.0DP 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-SPBT40DP   OR   This product contains IC: 8976C-SPBT40DP

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.

7.2.2 Product manual instructions

This section applies to OEM final products containing the SPBT4.0DP 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.*

7.3 Bluetooth certification

Module with embedded stack and profile has been qualified according to SIG qualification rules:

- – Bluetooth SIG Declaration ID: zzzzzz
- – Product type: End Product
- – Core spec version: 4.0
- – Product descriptions: Bluetooth module, spec V4.0

7.4   CE certification

Module has been certified according to following certification rules:

- – CE Expert opinion: 0564-ARSP00100
- – Measurements have been performed in accordance with (report available on request):
- – EN 300 328 v 1.8.1 (2012-06) ; v1.9.1 (2015-02)
- – EN 301 489-17 V 2.2.1 (2012-09)
- – EN 62479 (2010-09)
- – EN60950- 1:2006 + A11:2009 + A1:2010 + A12:2011 + A2:2013

CE certified:

$C\,€0051$

8   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

Table 5. Traceability information

Letter	Meaning
WW	week
YY	year
D	Product ID number
FF	Production panel coordinate identification
NN	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.

9   Ordering information

Table 6. Ordering information

Order code	Description	Packing	MOQ
SPBT4.0DP	Class 2 OEM Bluetooth antenna module	Jedec tray	2448 pcs

10   Revision history

Table 7. Document revision history

Date	Revision	Changes
07-July- 2015	0.14	First release.
31 – July - 2015	0.15	Modified table 3

IMPORTANT NOTICE - PLEASE READ CAREFULLY:

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