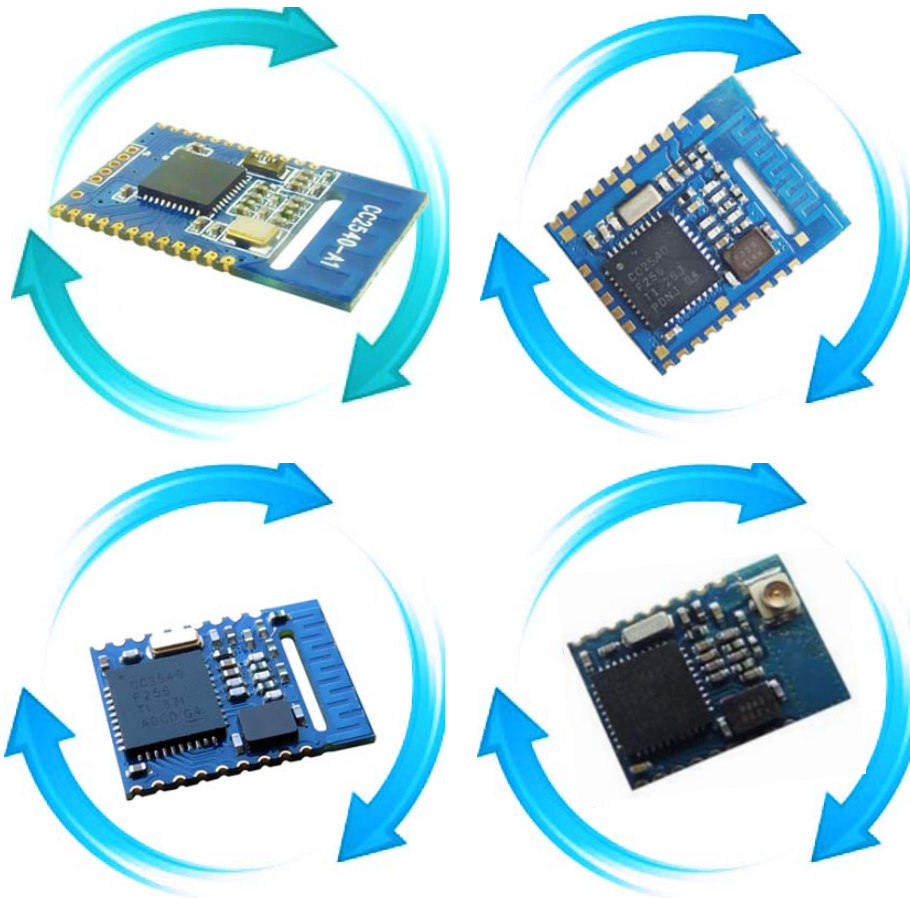# Bluetooth® 4.0 Low Energy Modules

RF-CC2540A1/RF-CC2541A1

RF-BM-S01/RF-BM-S01A

RF-BM-S02/RF-BM-S02A

RF-BM-S02I/RF-BM-S02IA

Shenzhen RF-Star Technology Co.,Ltd.

Summary

RF-star's single-mode Bluetooth® Modules is a high-performance and low-power Bluetooth 4.0 RF SOC module that incorporates the Texas Instruments CC2540 transceiver chip in the industry's smallest package (RF-CC2540A1:24.1x15.2x1.9 mm、RF-BM-S01:17.4x13.7x1.9 mm、RF-BM-S02: 15.1x 11.2x1.9 mm).

These embedded Bluetooth 4.0 modules incorporates a crystal, the required RF matching and filtering for regulatory compliance, plus the filtering on select digital lines for better noise reduction and sensitivity.

RF-star can provide customers with the integration the entire profiles, applications, radio and BLE protocol stack base on TI. With compliance to Bluetooth low energy standard, the RF-star modules enables the creation of a new market for tiny, cost-effective and power-efficient wireless consumer products such as watches, medical sensors, mice, TV remote controllers, fitness trainers, & etc.

Features

◇ Bluetooth 4.0 single mode Compliant ISM 2.4GHz module.
◇ Utilizing the TI CC2540/1 SoC with 256K Flash, 8K RAM.
◇ Supporting master and slave modes
◇ Integrated Bluetooth Low Energy stack including ATT,GATT, SMP, L2CAP, GAP
◇ Over 70 meter (230 ft) line of site (LOS) distance with integrated antenna.
◇ Can be externally controlled via simple ASCII AT commands over the UART or programmed with custom applications embedded in the module.
◇ RSSI monitoring for proximity applications
◇ 10-bit ADC
◇ Serial Interface (UART / SPI)
◇ Wake-up interrupt & Watchdog Timer
◇ AES Security Coprocessor
◇ FCC, RoHS, and Bluetooth®

Applications

- Telemedicine / Telehealth
- Medical Patient Monitoring
- Human Interface Devices (Keyboard, Mouse, Remote control)
- Sports and leisure equipment
- Mobile phone accessories
- Remote controls

- Consumer Electronics

- Remote monitoring and control

- Health Care and Medical

- Smart Grid

- Automated Meter Reading (AMR)

- Home/Building Automation

- Machine-to-Machine (M2M)

- Wireless Sensor Networks

- Wireless Alarms and Security

- Lighting and HVAC control

  - Proximity and out of range detection (iBeacon)

Specifications

Operating Conditions Summary

Item	Specifications
Supply voltage	2.0 – 3.6V
VDD ripple	100 mV Max
Max voltage on any pin	VDD + 3 V (Not 5V Tolerant)
Supply Temperature Range	-20 – +60 °C
Ambient Temperature Range	–40 – +85 °C

RF Specifications Summary

| Item	Specifications
Frequency	2402 – 2483.5 MHz in 20 Khz steps
Data Rate and Modulation	1 Mbps, GFSK
Number of Channels	40: 37 data / 3 advertising (0,12,39)
Output Power	-23 to 4 dBm
Receive Sensitivity (w/chip antenna)	-93dBm/-87dBm

Current Consumption Summary

Measurements done at TA = 25°C, VDD = 3 V

Item	Specifications	
	CC2540	CC2541
Power Mode 3 (External Interrupts)	0.4uA	0.5uA
Power Mode 2 (SleepTimerOn)	0.9uA	1uA
Power Mode 1 (3-µs Wake-Up)	235uA	270uA
RX Standard Gain	19.6mA	17.9mA
TX -6 dBm	24mA	-
TX 0 dBm	-	18.2mA

RF-CC2540A1 / RF-CC2541A1
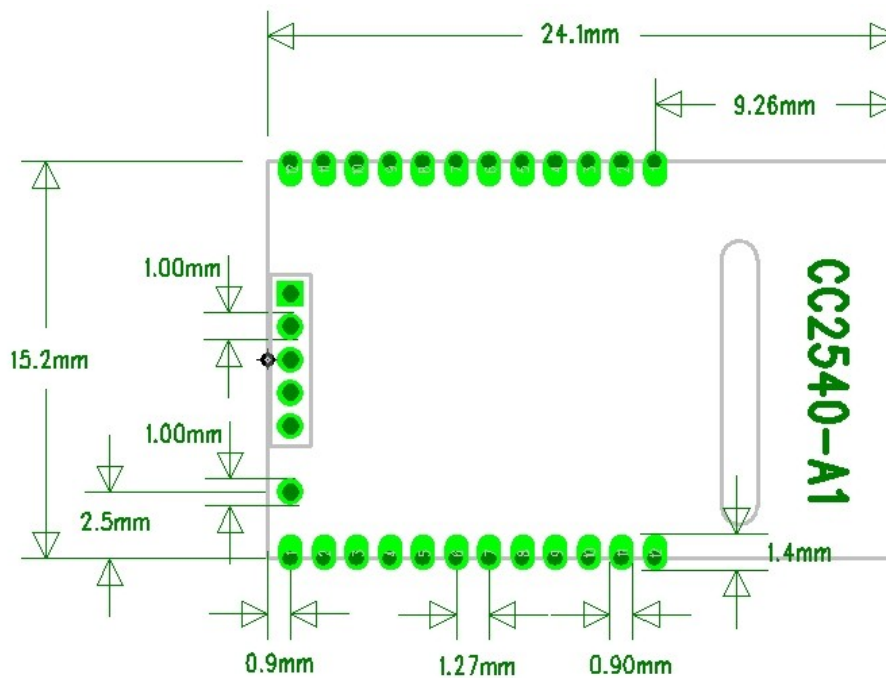
STANDARD LAND DIMENSIONS (WITH ANTENNA)
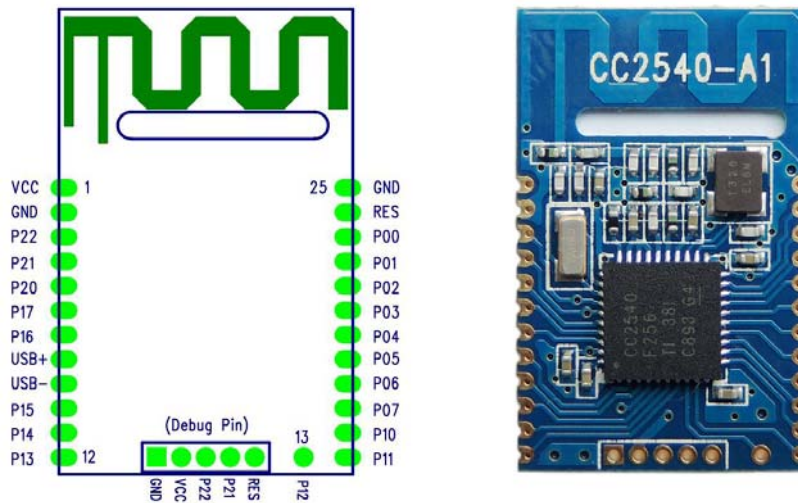
PIN	PIN name	Description	Remarks
Pin1	VCC	Power-supply connection	2V-3.6V
Pin2,Pin25	GND	The ground pad must be connected to a solid ground plane.	
Pin3	P22	I/O	DEBUG_DC
Pin4	P21	I/O	DEBUG_DD
Pin5	P20	I/O	
Pin6	P17	I/O	
Pin7	P16	I/O	
Pin8	USB_P/I2C_SCL	USB+/I2C clock line	CC2540 USB_P; CC2541 I2C_SCL;
Pin9	USB_N/I2C_SDA	USB-/I2C data line	CC2540 USB_N; CC2541 I2C_SDA;
Pin10	P15	I/O	
Pin11	P14	I/O	
Pin12	P13	I/O	
Pin13	P12	I/O	
Pin14	P11	I/O	
Pin15	P10	I/O	
Pin16	P07	I/O	

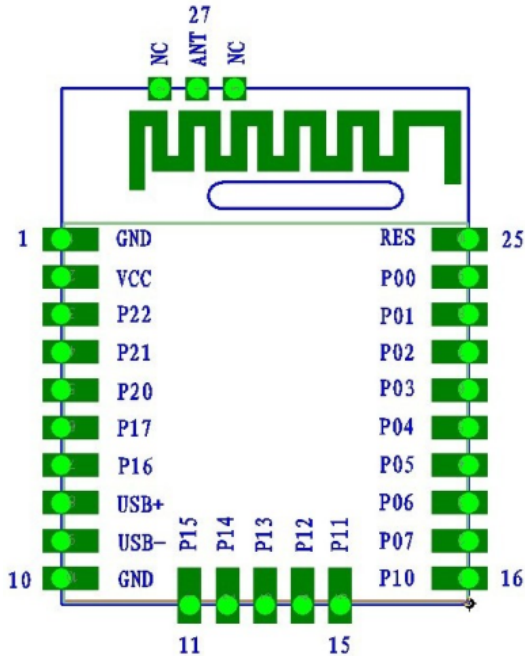| Pin17	P06	I/O	
Pin18	P05	I/O	
Pin19	P04	I/O	
Pin20	P03	I/O	
Pin21	P02	I/O	
Pin22	P01	I/O	
Pin23	P00	I/O	
Pin24	RESET	Reset, active-low	

- **RF-CC2540A1 and RF-CC2541A1 are pin-to-pin.**

DIMENSIONS

(Without Antenna, SMD Output) – 24.1 x 15.2 x 1.9 mm

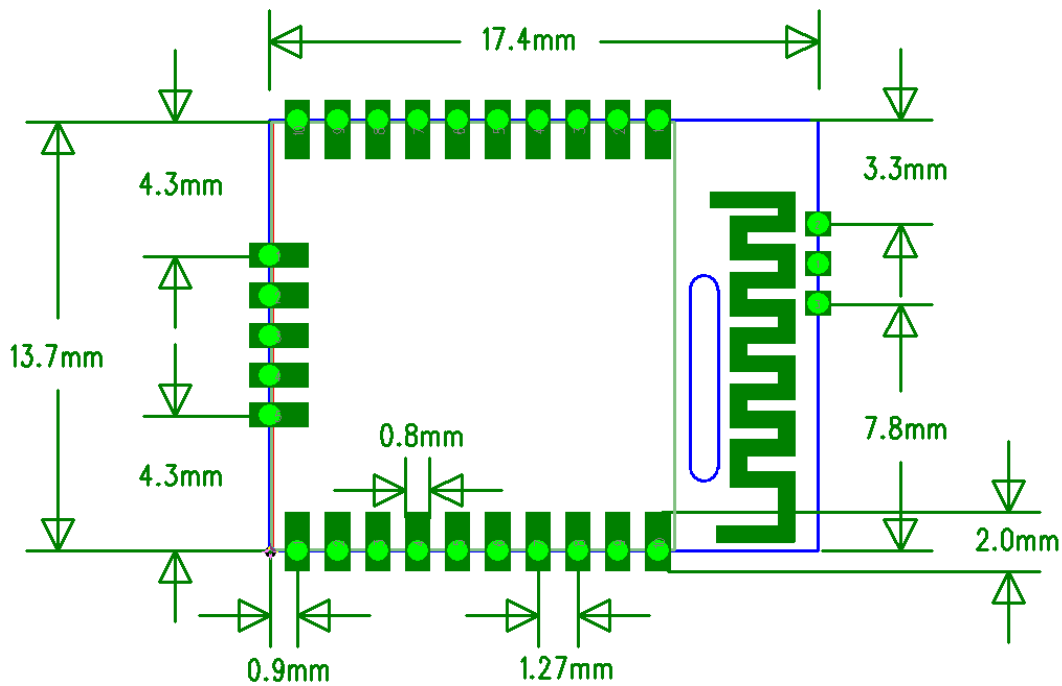**RF-BM-S01 / RF-BM-S01A**

STANDARD LAND DIMENSIONS (WITH ANTENNA)

PIN	PIN name	Description	Remarks
Pin1,Pin10	GND	The ground pad must be connected to a solid ground plane.	
Pin2	VCC	Power-supply connection	2V-3.6V
Pin3	P22	I/O	DEBUG_DC
Pin4	P21	I/O	DEBUG_DD
Pin5	P20	I/O	
Pin6	P17	I/O	
Pin7	P16	I/O	
Pin8	USB_P/I2C_SCL	USB+/I2C Clock line	CC2540 USB_P；CC2541I2C_SCL；
Pin9	USB_N/I2C_SDA	USB-/I2CData line	CC2540 USB_N；CC2541 I2C_SDA；
Pin11	P15	I/O	
Pin12	P14	I/O	
Pin13	P13	I/O	
Pin14	P12	I/O	
Pin15	P11	I/O	
Pin16	P10	I/O	

Pin17	P07	I/O	
Pin18	P06	I/O	
Pin19	P05	I/O	
Pin20	P04	I/O	
Pin21	P03	I/O	
Pin22	P02	I/O	
Pin23	P01	I/O	
Pin24	P00	I/O	
Pin25	RESET	Reset, Active Low	
Pin26	NC	-	
Pin27	ANT	Antenna Interface	Used for external antenna
Pin28	NC	-	

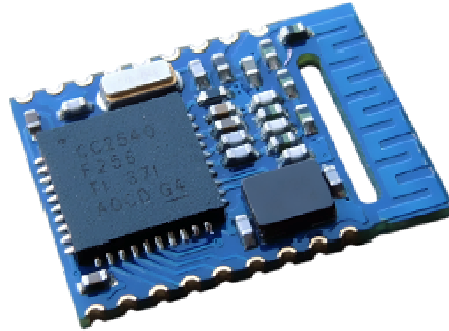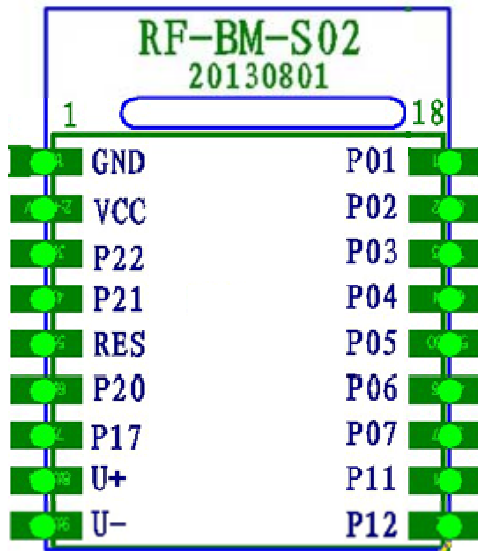- **RF-BM-S01 is with CC2540 on-board and RF-BM-S01A is with CC2541 on-board. They are pin-to-pin.**

DIMENSIONS

(Without Antenna, SMD Output) – 17.4 x 13.7 x 1.9 mm

RF-BM-S02 / RF-BM-S02A

STANDARD LAND DIMENSIONS (WITH ANTENNA)

PIN	PIN name	Description	Remarks
Pin1	GND	The ground pad must be connected to a solid ground plane.	
Pin2	VCC	Power-supply connection	2V-3.6V
Pin3	P22	I/O	DEBUG_DC
Pin4	P21	I/O	DEBUG_DD
Pin5	RESET	Reset, Active Low	
Pin6	P20	I/O	
Pin7	P17	I/O	
Pin8	USB_P/I2C_SCL	USB+/I2CClock line	CC2540 USB_P; CC2541 I2C_SCL;
Pin9	USB_N/I2C_SDA	USB-/I2CData line	CC2540 USB_N; CC2541 I2C_SDA;
Pin10	P12	I/O	
Pin11	P11	I/O	
Pin12	P07	I/O	
Pin13	P06	I/O	
Pin14	P05	I/O	
Pin15	P04	I/O	
Pin16	P03	I/O	
Pin17	P02	I/O	

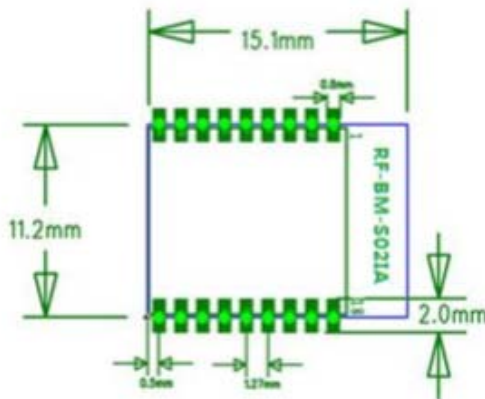| Pin18	P01	I/O	

- **RF-BM-S02 / RF-BM-S02A is a compact size edition, so parts of the IO are not pinned, the corresponding function cannot be used.**
- **RF-BM-S02 is with CC2540 on-board and RF-BM-S02A is with CC2541 on-board. They are pin-to-pin.**

DIMENSIONS

(Without Antenna, SMD Output) – 15.1 x 11.2 x 1.9 mm
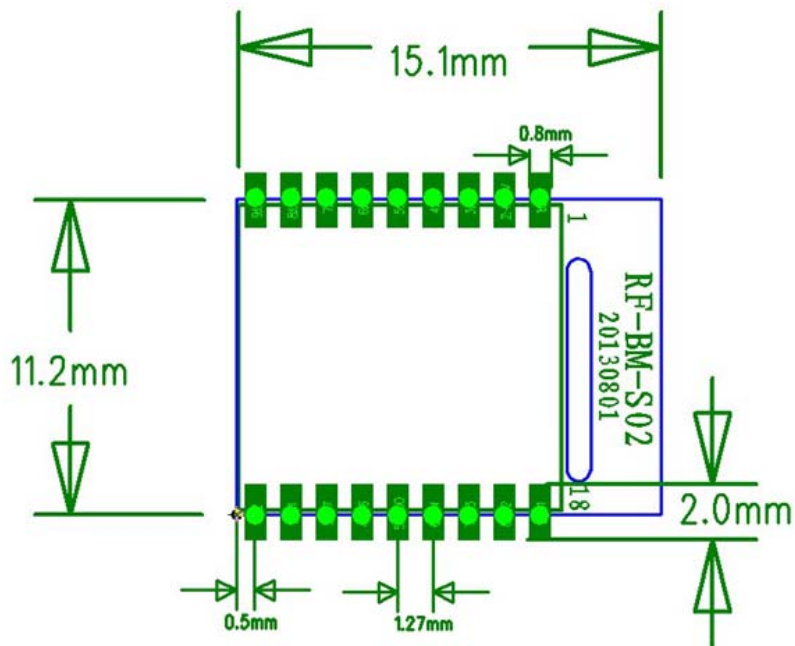
RF-BM-S02I / RF-BM-S02IA

- **RF-BM-S02I / RF-BM-S02IA shares the same pin definitions as RF-BM-S02/ RF-BM-S02A.**
- **RF-BM-S02I / RF-BM-S02IA is a compact size edition, so parts of the IO are not pinned, the corresponding function cannot be used.**
- **RF-BM-S02I is with CC2540 on-board and RF-BM-S02IA is with CC2541 on-board. They are pin-to-pin.**

Application Notes

1 Safety Precautions

These specifications are intended to preserve the quality assurance of products as individual components.

Before use, check and evaluate their operation when mounted on your products. Abide by these specifications, without deviation when using the products. These products may shortcircuit. If electrical shocks, smoke, fire, and/or accidents involving human life are anticipated when a short circuit occurs, then at least, provide the following failsafe functions, as a minimum:

(1) Ensure the safety of the whole system by installing a protection circuit and a protection device.

(2) Ensure the safety of the whole system by installing a redundant circuit or another system to prevent a single fault causing an unsafe status.

2 Design Engineering Notes

(3) Heat is the major cause of shortening the life of these products. Avoid assembly and use of the target equipment in conditions where the product's temperature may exceed the maximum allowable.

(4) Failure to do so may result in degrading of the product's functions and damage to the product.

(5) If pulses or other transient loads (a large load applied in a short time) are applied to the products, before use, check and evaluate their operation when assembled onto your products.

(6) These products are not intended for other uses, other than under the special conditions shown below. Before

using these products under such special conditions, check their performance and reliability under the said special conditions carefully, to determine whether or not they can be used in such a manner.

(7) In liquid, such as water, salt water, oil, alkali, or organic solvent, or in places where liquid may splash.

(8) In direct sunlight, outdoors, or in a dusty environment

(9) In an environment where condensation occurs.

(10) In an environment with a high concentration of harmful gas (e.g. salty air, HCl, Cl2, SO2, H2S, NH3, and NOx)

(11) If an abnormal voltage is applied due to a problem occurring in other components or circuits, replace these products with new products because they may not be able to provide normal performance even if their electronic characteristics and appearances appear satisfactory.

(12) Mechanical stress during assembly of the board and operation has to be avoided.

(13) Pressing on parts of the metal cover or fastening objects to the metal cover is not permitted.

3 Storage Conditions

These modules must not be stressed mechanically during storage. Do not store these products in the following conditions or the performance characteristics of the product, such as RF performance, may well be adversely affected:

(1) Storage in salty air or in an environment with a high concentration of corrosive gas, such as Cl2, H2S, NH3, SO2, or NOX

(2) Storage in direct sunlight

(3) Storage in an environment where the temperature may be outside the range of 5°C to 35°C range, or where the humidity may be outside the 45 to 85% range.

(4) Storage (before assembly of the end product) of the modules for more than one year after the date of delivery at your company even if all the above conditions (1) to (3) have been met, should be avoided.

Contact Information

Shenzhen RF-star Technology Co.,Ltd.

8/2F. Internet Industry Base

Baoyuan Road, Bao'an District, Shenzhen, P.R. China

Tel: +86 (0755)8632 9829

Fax: +86 (0755)8632 9413

Website: http://en.szrfstar.com/

E-mail sales@szrfstar.com

Appendix A: FCC Certification

TCB

GRANT OF EQUIPMENT AUTHORIZATION

Certification

Issued Under the Authority of the

Federal Communications Commission

By:

TCB

Nemko Canada Inc.
303 River Road
Ottawa, Ontario, K1V 1H2
Canada

Date of Grant: 01/17/2014

Application Dated: 01/17/2014

ShenZhen RF-STAR Technology CO.,LTD
2F,BLDG.8,Zone A,BaoAn Internet Industry Base,
BaoYuan Road,XiXiang, BaoAn DIST,
ShenZhen,
China

Attention: Aroo woo

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: 2ABN2-RFBMS01
Name of Grantee: ShenZhen RF-STAR Technology CO.,LTD
Equipment Class: Digital Transmission System
Notes: Bluetooth 4.0 (BLE) Module
Modular Type: Limited Single Modular

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Tolerance	Emission Designator
	15C	2402.0 - 2480.0	0.00216		

Limited modular approval. Power output listed is conducted.

Appendix B: RoHS Certification

TEST REPORT

REPORT No.: BTS201312302663   Date: 2014-01-09   Page 1 of 8

Client Company:

Shenzhen RF-STAR Technology Co., LTD

Client Address:

2F,BLDG.8, Zone A, BaoAn Internet Industry Base,
BaoYuan Road, XiXiang, BaoAn DIST, ShenZhen

Report on the submitted samples said to be:

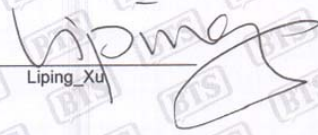|		
Sample Name	:	Bluetooth 4.0 (BLE) Module
Style/ Item No.	:	RF-BM-S01; RF-BM-S01_V1.1
Product Rating	:	DC3.3V, Max40mA; Max0.132w; 2483.5MHz
Operating Frequency Range	:	2402-2483.5MHz
RF Output Power		-23dBm-4dBm
Sample Receiving Date	:	December 30, 2013
Testing Period	:	December 30, 2013 to January 09, 2014
Results	:	See next pages

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Summary of Test Results:

TEST REQUEST	CONCLUSION
A EU RoHS Directive 2011/65/EU and its amendment directives	Pass

****

Signed for and on behalf of
BTS

Liping_Xu

Bestow Technology Service Co., LTD (BTS) 深圳市贝恩特技术服务有限公司   716# of General Building, Bantian Hi-tech. industry park, Longgang District, Shenzhen City, Guangdong Province,P.R.China 中国广东省深圳市龙岗区坂田高新技术工业园综合楼716#   传真/fax: 0755-89589101   chaxun@bestow.cn   邮编/post lode: 518129   电话/telephone: 0755-89500120-8015

Appendix C: End Product Listing

EPL Bluetooth® End Product Listing

The Bluetooth SIG Hereby Recognizes

ShenZhen RF STAR Technology CO.,LTD.
Member Company

RF-BM-S01_v1.1
Qualified Design Name

Qualified Design ID(s): B016552

Contact Person: Aroo Wong

Series: V1.1

Publish Date: 13 November 2013

EPL Type: Other

This certificate acknowledges the Bluetooth® Specifications declared by the member were achieved in accordance with the Bluetooth Qualification Process as specified within the Bluetooth Specifications and as required within the current PRD

Bluetooth®
SPECIAL INTEREST GROUP