BB840F(S)

Ultra Low-Power Bluetooth 5.4 module

Introduction

BB840F is a high-performance,industrial,ultra low-power BLE 5.4 module,which based on Nordic SoC nRF52840.It provides rich interfaces such as UART, USB, SPI, I2S, I2C, ADC, PWM. At the same time,it adopts a small stamp package and convenient for engineers to develop.

Key features

■ **Frequency band**
  BLE: 2402～2480MHz

  ■ **Ultra low-power consumption**

    VDD 1.7～3.6V & VBUS 4.35~5.5V
    On-chip DC-DC buck converter
    < 4.8 mA peak current in TX (0dBm)
    < 14.8mA peak current in TX(+8dBm)
    0.4 μA at 3V in System OFF mode,
    no RAM retention
    1.5 μA at 3V in System ON mode,
    no RAM retention, wake on RTC
    High sensitivity
■ -95dBm sensitivity(1Mbps,PER<30.8%)
  -103dBm sensitivity(125kbps,PER<30.8%)
  -20 to +8 dBm TX power, configurable in 4 dB steps
  ARM®TrustZone® Cryptocell 310 security
■ subsystem

■ **Protocol support**
  BLE4.0 / 4.1 / 4.2 / 5.4 compatible
  BLE: 1Mbps/ 500kbps /125kbps
  Microprocessor & Memory
  ARM®Cortex®-M4 32-bit processor with FPU, 64 MHz
■ 1MB Flash and 256kB RAM
  Interface
  46*General purpose I/O pins
  1*USB2.0 full speed (12 Mbps) controller
■ 2* UART / 4*SPI / 2*I2C / 4*PWM
  1*I2S / 1*PDM
  1*high-speed 32MHz SPI
  8*12bits ADC
  1*WDT
  Dimension
  13.9mm×23mm×1.75mm(BB840F)
  13.9mm×23mm×2.1mm(BB840FS)
■

Applications

■ Advanced computer peripherals and I/O devices
  Mouse / keyboard / Multi-touch trackpad

■ Interactive entertainment devices
  Gaming controllers
  Remote controls

■ Internet of things (IoT)
  Smart home sensors and controllers
  Industrial IoT sensors and controllers

Ordering information

Part No.	Temperature	Package	MOQ	Shield	Antenna
BB840F	-40°C ~ +85°C	SMD	1000	No	ANT on Board
BB840FS	-40°C ~ +85°C	SMD	1000	Yes	ANT on Board

Contents

BB840F(S)

1. Introduction

1.1　Description

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1.2　Specifications

Specifications are shown in the following Table 1.1.

Table 1.1 Specifications of BB840F

Function	Description
Flash	1MB
RAM	256kB
Microprocessor	64MHz ARM®Cortex-M4F
Protocol support	BLE4.0/4.1/4.2/5.4 compatible
Frequency Band	2402MHz～2480MHz
TX power	-20～+8dBm
Sensitivity	-95dBm(1Mbps,PER<30.8%) / -103dBm(125kbps,PER<30.8%)
Power consumption	TX peak current: 14.8mA (+ 8dBm) TX peak current: 4.8mA (0dBm) 0.4 µA at 3V in System OFF mode, no RAM retention 1.5 µA at 3V in System ON mode, no RAM retention, wake on RTC
Digital interfaces	4*SPI / 2*I2C / 2*UART / 4*PWM / 1*I2S / 1*PDM
Analog interfaces	12 bit ADC (8 channels)
Timer	5*32-bit timer / 3*RTC / 1*WDT
Peripherals	AES/RNG/PPI
GPIO	46
Operation temperature	-40°C～85°C
Package	SMD (56 pins)
Dimension	13.9mm*23mm*1.75mm(BB840F) / 2.1mm(BB840FS)

2. Pin assignments

2.1 Top view

Top view of BB840F is shown in Figure 2.1.
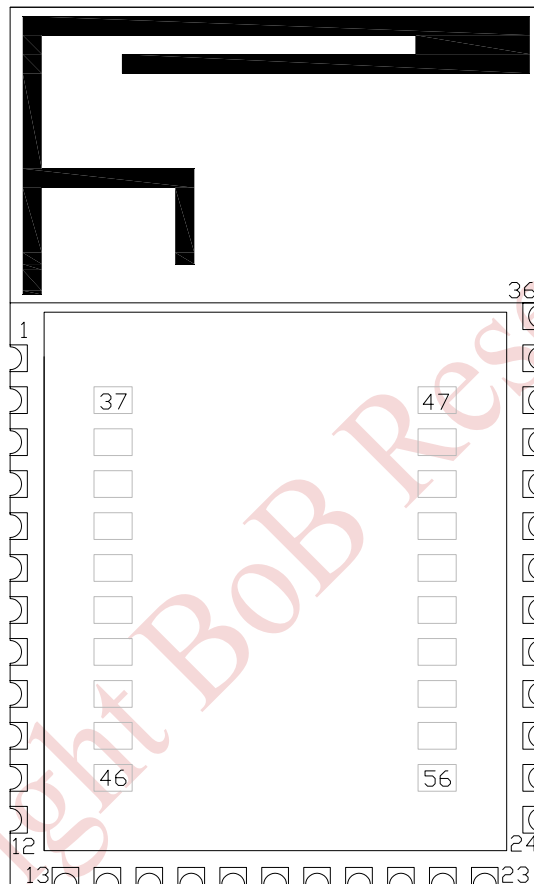
PIN37 ~ 46 are at the bottom.

Figure 2.1 BB840F pin assignments, top view

2.2 Pin assignments

The BB840F pin assignment is shown in Table 2.1.

Table 2.1 Pin assignment description

Pin No.	Pin name	Description
1	GND	Power ground
2	SWCLK	Serial wire debug clock input for debug and programming
3	SWDIO	Serial wire debug I/O for debug and programming
4	P0.03 / AIN1	Analog input / Digital I/O (low frequency I/O only) [Note]①,②
5	P0.28 / AIN4	Analog input / Digital I/O (low frequency I/O only)
6	P1.08	Digital I/O
7	P0.07	Digital I/O
8	P0.05 / AIN3	Analog input / Digital I/O
9	VDD	VDD Power supply, 1.7 ~ 3.6V (recommended voltage range)
10	P0.26	Digital I/O
11	P0.04 / AIN2	Analog input / Digital I/O
12	P0.06	Digital I/O
13	P0.08	Digital I/O
14	P1.09	Digital I/O
15	P0.12	Digital I/O
16	P0.25	Digital I/O
17	P0.23	Digital I/O / Options for QSPI-I/O
18	P0.21	Digital I/O / Options for QSPI-I/O
19	P0.19	Digital I/O / Options for QSPI-SCK
20	P0.18 / nRESET	Reset mode default(soft reset,active low) [Note]③ Digital I/O Options for QSPI-CSN
21	VBUS	USB 5V Power supply，4.35 ~ 5.5V (recommended voltage range)
22	DM	USB Data-
23	DP	USB Data+
24	P0.14	Digital I/O
25	P0.16	Digital I/O
26	P0.13	Digital I/O
27	P0.15	Digital I/O
28	P0.17	Digital I/O
29	P0.20	Digital I/O
30	P0.22	Digital I/O / Options for QSPI-I/O

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① Any GPIO can be mapped to a peripheral for layout flexibility，analog signal can be mapped to analog input pin only.

② Low frequency I/O is a signal with a frequency up to 10 kHz.

③ The nRESET pin of BB840F can be used according to the product requirements.

31	P0.24	Digital I/O
32	P1.00	Digital I/O Serial wire output (SWO)
33	P1.06	Digital I/O (low frequency I/O only)
34	P0.09 / NFC IN1	Digital I/O (low frequency I/O only) [Note]④ NFC ANT input1
35	P0.10 / NFC IN2	Digital I/O (low frequency I/O only) NFC ANT input2
36	GND	Power ground
37	P1.11	Digital I/O (low frequency I/O only)
38	P1.10	Digital I/O (low frequency I/O only)
39	P1.12	Digital I/O (low frequency I/O only)
40	P1.13	Digital I/O (low frequency I/O only)
41	P1.15	Digital I/O (low frequency I/O only)
42	P1.14	Digital I/O (low frequency I/O only)
43	P0.31 / AIN7	Analog input / Digital I/O (low frequency I/O only)
44	P0.29 / AIN5	Analog input / Digital I/O (low frequency I/O only)
45	P0.02 / AIN0	Analog input / Digital I/O (low frequency I/O only)
46	P0.30 / AIN6	Analog input / Digital I/O (low frequency I/O only)
47	P1.04	Digital I/O (low frequency I/O only)
48	P1.02	Digital I/O (low frequency I/O only)
49	P1.07	Digital I/O (low frequency I/O only)
50	P1.05	Digital I/O (low frequency I/O only)
51	P1.01	Digital I/O (low frequency I/O only)
52	P1.03	Digital I/O (low frequency I/O only)
53	P0.11	Digital I/O
54	P0.27	Digital I/O
55	VDDH	High voltage power supply，NC default.
56	DCCH	DC/DC converter output，NC default.

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④ Refer to the nRF52840 datasheet for NFC hardware design.

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3. Specifications and parameters

3.1 Absolute maximum ratings

Table 3.1 Absolute maximum ratings

Item	Parameter		Description
	Min	Max	
VDD (V)	-0.3	3.9	Exposure to absolute maximum ratings for prolonged periods of time may affect the reliability of the device.[Note]⑤
VBUS (V)	-0.3	5.8	
I/O pin voltage (V)	-0.3	VDD+0.3	VDD voltage≤3.6V
RF input level (dBm)	-	10	
Reference transmission distance (m)	-	80	Module to module, @0dBm[Note]⑥
Operating temperature (°C)	-40	+85	
Storage temperature (°C)	-40	+125	Normal temperature storage is recommended

3.2 ESD parameters

Table 3.2 ESD parameters

Item		Minimum	Maximum
ESD	Human Body Model	-	2000V
	Human Body Model Class	-	2
	Charged Device Model	-	750V

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⑤ Either VBUS mode or VDD mode can be selected.

⑥ The reference communication distance is closely related to hardware construction, test site environment, etc, which is for reference only.

3.3 Operating conditions

Table 3.3 Recommended operating conditions

Item	Min	Typical	Max
Operating temperature (℃)	-40	+25	+85
VDD（V）	1.7	3.3	3.6
VBUS（V）	4.35	5	5.5
$t_{POR,10us}$（ms）[Note]⑦	-	1	-
$t_{POR,10ms}$（ms）	-	9	-
$t_{POR,60ms}$（ms）	-	23	-
t_{POR}（ms）@0→1.7V	-	-	60

3.4 Power consumption

Table 3.4 Reference power consumption

Item	Typical	Unit	Description	Conditions
$I_{tx,peak}$	14.8	mA	TX only run current (DC/DC),@ +8 dBm	VDD=3V,
$I_{tx,peak}$	4.8	mA	TX only run current (DC/DC),@0 dBm	temperature=25℃
				[Note]⑧
I_{Sleep}	2.4	μA	RF off,CPU WFI (wait for interrupt)/WFE (wait for event) sleep	
$I_{Deep\ sleep}$	1.5	μA	System OFF, no RAM retention, wake on RTC	
$I_{Power-down}$	0.4	μA	System OFF, no RAM retention, wake on reset	
$I_{Broadcast@1s}$	28	μA	DC-DC mode, +8dBm, 31 bytes, external 32.768kHz crystal/±20ppm	
$I_{Broadcast@1s}$	17	μA	DC-DC mode, 0dBm, 31 bytes, external 32.768kHz crystal/±20ppm	

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⑦ $t_{POR,10us}$ means the module power supply VDD to rise from 0V to 1.7V, the power-on reset active at 1ms. The module power-on reset circuitry may not function properly for rise times longer than the specified maximum.

⑧ The dynamic power consumption of BB840F may be affected by the software operating mode, sleeping mode and RF activity interval,etc. Users can use the official simulation tool (Online Power Profiler) to calculate the current caused by software modification or configuration for special requirements. （https://devzone.nordicsemi.com/nordic/power）

3.5 RF parameters

<p align="center">Table 3.5 RF parameters of BB840F</p>

Item	Typical	Unit	Conditions
Frequency band	2402~2480	MHz	BLE mode
TX Power	-20~+8	dBm	Configurable in 4 dB steps
Receiving sensitivity	-95	dBm	BLE mode, 1Mbps, PER≤ 30.8%
Receiving sensitivity	-103	dBm	BLE mode, 125kbps, PER≤ 30.8%
Maximum RF input level	10	dBm	Exposure to absolute maximum ratings for prolonged periods of time may damaging it permanently

4. Typical application

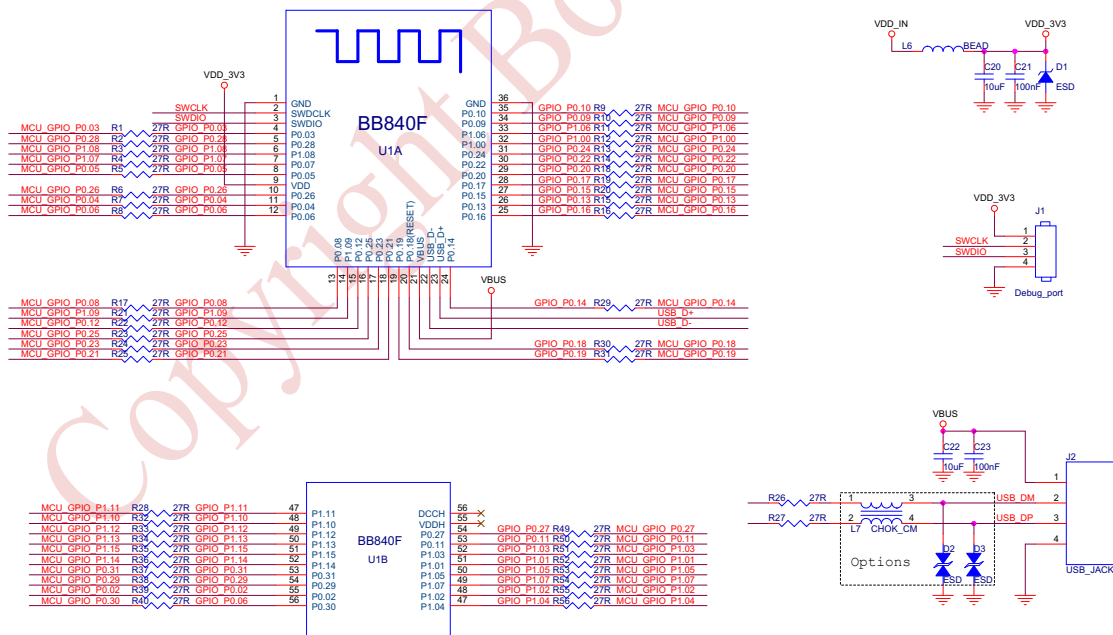The typical application circuit of BB840F is shown in Figure 4.1.

<p align="center">Figure 4.1 Typical application circuit</p>

5. Mechanical specifications

5.1 Dimensions

The dimensions of BB840F & BB840FS is shown in the Figure 5.1 & Figure 5.2.

Figure 5.1 Dimensions of BB840F(top view)

Figure 5.2 Dimensions of BB840FS(top view)

Unit: mm

Table 5.1 Dimensions of BB840F(S)

Model	Length	Width	Height	PCB Thickness	PAD Size	PIN Spacing
BB840F	23mm	13.9mm	1.75mm	0.8mm	1mm×0.7mm	1.1mm
BB840FS	23mm	13.9mm	2.1mm	0.8mm	1mm×0.7mm	1.1mm

5.2 PCB footprint

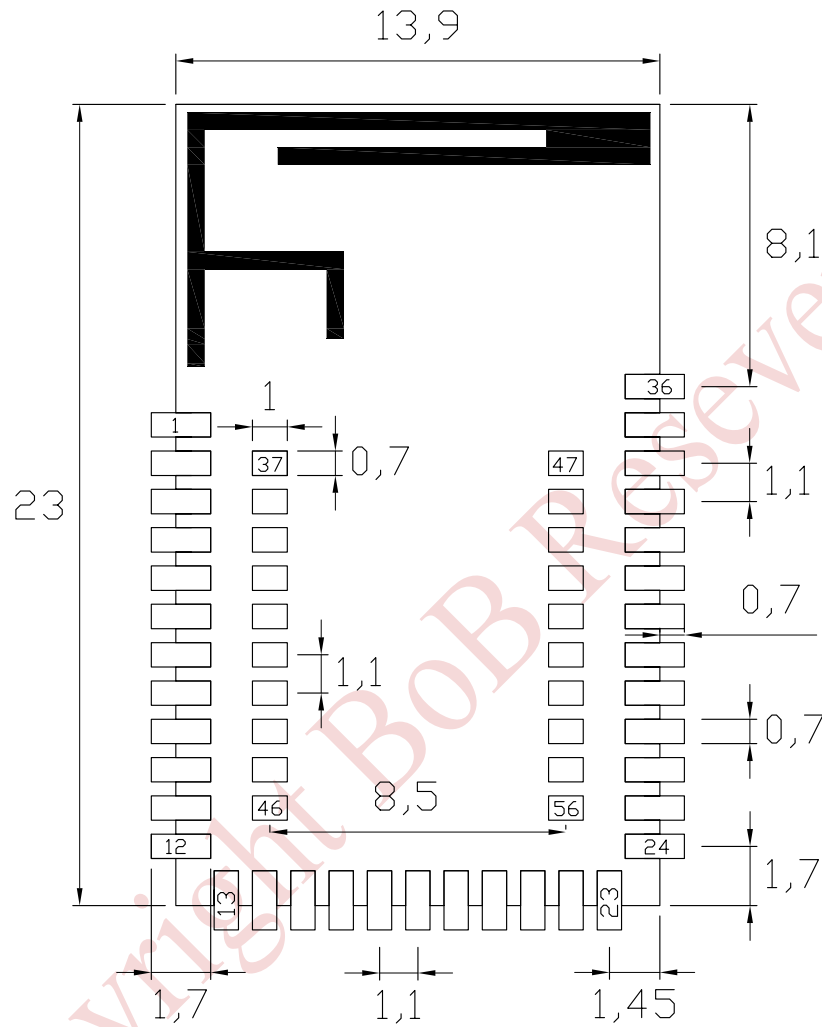The recommended PCB footprint of BB840F(S) is shown in Figure 5.3.

Figure 5.3 Recommended PCB footprint

Unit: mm

6. Welding instructions

6.1 Recommended temperature reflow profile

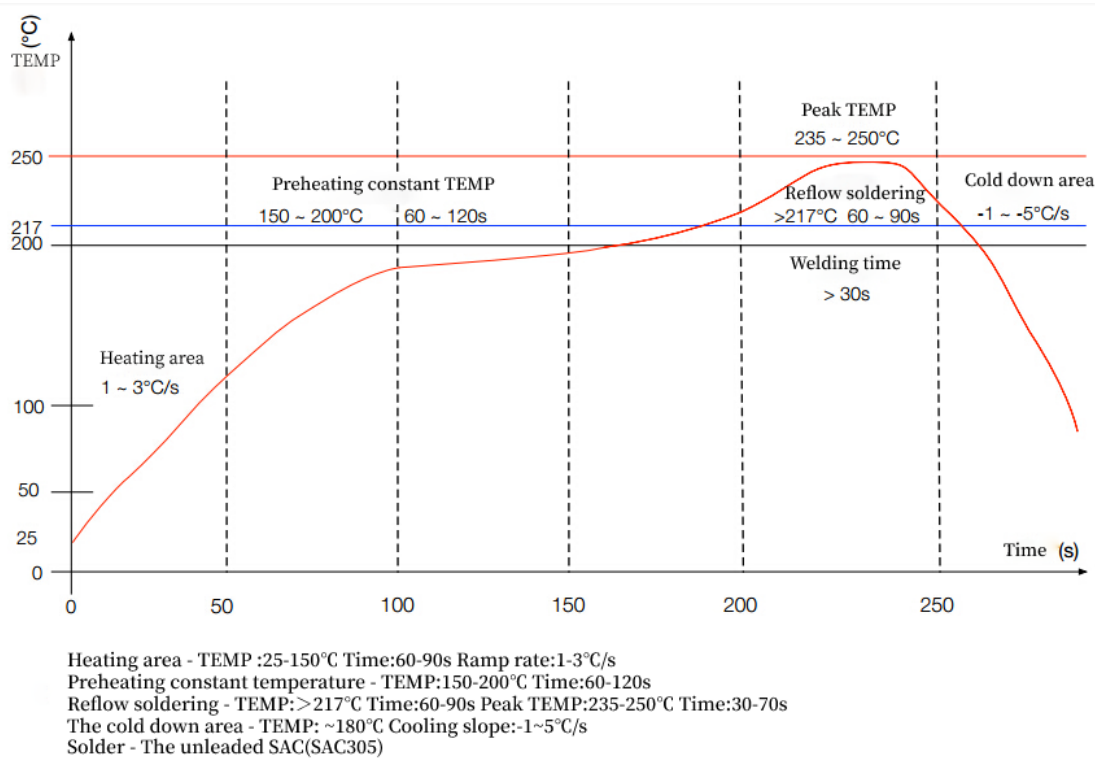The recommended SMT temperature reflow profile of BB840F is shown in Figure 6.1.

Heating area - TEMP :25-150℃ Time:60-90s Ramp rate:1-3℃/s
Preheating constant temperature - TEMP:150-200℃ Time:60-120s
Reflow soldering - TEMP:＞217℃ Time:60-90s Peak TEMP:235-250℃ Time:30-70s
The cold down area - TEMP: ~180℃ Cooling slope:-1~5℃/s
Solder - The unleaded SAC(SAC305)

Figure 6.1 Temperature reflow profile

7. Part number & Selections

The selection list related to BB840F is shown in Table 7.1.

Part No.	SoC	Frequency band	Transmission power	Bluetooth protocol	Dimensions	Shield	Antenna type
BB840F	nRF52840	2.4GHz	+8dBm	BLE5.4	13.9 ×23×1.75mm	No	On board / PCB
BB840FS	nRF52840	2.4GHz	+8dBm	BLE5.4	13.9 ×23×2.1mm	Yes	On board / PCB

Table 7.1 List of selections

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8. Sales channel & Service

Shenzhen Best of Best Holdings Co., Ltd.

Add：Rm.1501A,East Tower,FIYTA Tech. Bldg.,Southern District of High-

tech Industrial Park,Nanshan District,Shenzhen 518057,P.R.China

Tel：86-755-86018818

Fax：86-755-86018808

Web：www.bobholdings.com

Beijing office

Add：Room 1006 Quantum Plaza，No.23 Zhi Chun

Road，Hai Dian District，Beijing

Tel：86-10-82358601/2/3/4

Fax：86-10-82358605

Shanghai office

Add：Room 2003-2004, Mingshen Center Bldg., No.

3131 Kaixuan Rd.,Xuhui District, Shanghai, P.R.C.

Tel：86-21-54071701

Fax：86-21-54071702

Chengdu office

Add：Room 1402, Bldg#2, Shudu Center, No.138,

Tianfu No.2 Street, Mid Section, Tianfu Avenue, High-

Tech District, Chengdu City, Sichuan Province, China

Tel：86-28-85355677

Fax：86-28-85350890

Guangzhou office

Add：Room 620 6 floor,ao yuan city plaza,hanxi

avenueGuangzhou,China.

Tel：86-20-34776690

9. Revision history

Version	Date	Description	Reviser
V1.0	2024/01/05	Initial version	Wesley/Damon

FCC Statement
FCC standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247
Device is equipped with PCB antenna , Antenna gain -0.03dBi
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.
Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
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.
FCC Radiation Exposure Statement
This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: " Contains Transmitter Module FCC ID: 2A6CI-BB840FS Or Contains FCC ID: 2A6CI-BB840FS"
When the module is installed inside another device, the user manual of the host must contain below warning statements;
1. 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;
(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.
2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.
Any company of the host device which install the modular with modular approval should perform the test of radiated & conducted emission and spurious emission, etc. according to FCC part 15C : 15.247 and 15.209 & 15.207 ,15B Class B requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 & 15.207 ,15B Class B requirement then the host can be sold legally.