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FIBOCOM B830-GL Hardware User Manual

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Versions

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1 Preface

1.1 Introduction

The document describes the electrical characteristics, RF performance, dimensions and application environment, etc. of B830-GL (hereinafter referred to as B830). With the assistance of the document and other instructions, the developers can quickly understand the hardware functions of B830 modules and develop products.

1.2 Reference Standard

The design of the product complies with the following standards:

- Bluetooth Core Specification v5.0
- Bluetooth® 5, IEEE 802.15.4-2006, 2.4 GHz transceiver
- PCI_Express_M.2_Specification_Rev1.1

1.3 Related Documents

- RF Antenna Application Design Specification

2 Overview

2.1 Introduction

B830-GL is a BT 5.0 module which uses M.2 form factor interface.

2.2 Specification

Specification	
BT Version	5.0
Power Supply	DC 3.135V~3.6V, Typical 3.3V
Temperature	Normal Operating temperature: -10°C ~+55°C Extended Operating temperature: -30°C ~+65°C
	Storage temperature: -40°C ~+85°C
Physical characteristics	Interface: M.2 Key B-M
	Dimension: 30 x 42 x 2.3mm
	Weight: about 4.0 g
Interface	
Antenna Connector	BT Antenna x 1
Function Interface	BUTTON
	I2C
	Piezo(on board)
	GPIO



Note:

When the temperature exceeds normal operating temperature range of -10°C~+55°C, RF performance of module may be slightly out of Bluetooth Core Specification

2.3 Warnings

2.3.1 FCC Statement

Federal Communication Commission Interference 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.

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 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 Caution

- (1) Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.
- (2) This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This device is intended only for OEM integrators under the following conditions:

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and the Max allowed antenna gain is : (-2 dBi)
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains [FCC ID:ZMOB830GL](#)". The grantee's FCC ID can be used only when all FCC compliance

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

2.3.2 IC Statement

Industry Canada Statement

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

- (1) This device may not cause interference; and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement."

The final end product must be labeled in a visible area with the following: "Contains IC:21374-B830GL"

Radiation Exposure Statement

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance **20** cm between the radiator & your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20cm de distance entre la source de rayonnement et votre corps.

2.3.3 CE Statement

► EU Regulatory Conformance

Hereby, We, Manufacturer name declares that the radio equipment type B830-GL is in compliance with the Directive 2014/53/EU.

In all cases assessment of the final product must be mass against the Essential requirements of the Directive 2014/53/EU Articles 3.1(a) and (b), safety and EMC respectively, as well as any relevant Article 3.2 requirements.

The maximum antenna gain for is -2 dBi and the antenna separation distance is 20cm.

► Declaration of Conformity(should include manufacturer contact info.)

Please added certification standard in your user manual which depended on the test standards your device performed., If the DoC should be a simplified version, please take below as reference, The full text of the EU declaration of conformity is available at the following internet address:
<http://www.fibocom.com>.

B830-GL is in conformity with the relevant Union harmonization legislation: Radio Equipment directive 2014 / 53 / EU with reference to the following standards applied: Health (Article 3.1(a) of Directive 2014/53/EU)

Applied Standard(s): EN 62311 : 2008

Safety (Article 3.1(a) of Directive 2014/53/EU) Applied Standard(s):

EN 62368-1: 2018

Electromagnetic compatibility (Article 3.1 (b) of Directive 2014/53/EU) Applied Standard(s):

Draft EN 301 489-1 V2.2.1 /-17 V3.2.0

Radio frequency spectrum usage (Article 3.2 of Directive 2014/53/EU) Applied Standard(s):

EN 300328 V2.1.1

2.4 Application Block

The peripheral applications for B830 module are shown in Figure 2-1:

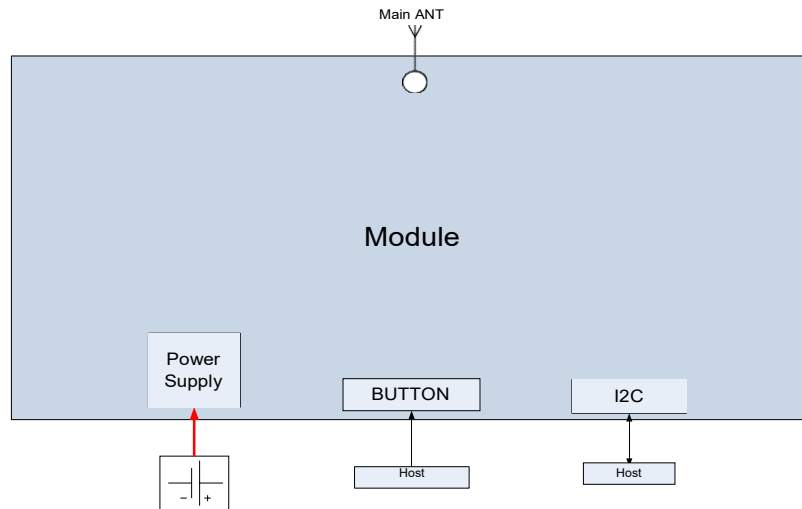


Figure2-1 Application Block

2.5 Hardware Block Diagram

The hardware block diagram in Figure 2-2 shows the main hardware functions of B830 module, including baseband and RF functions.

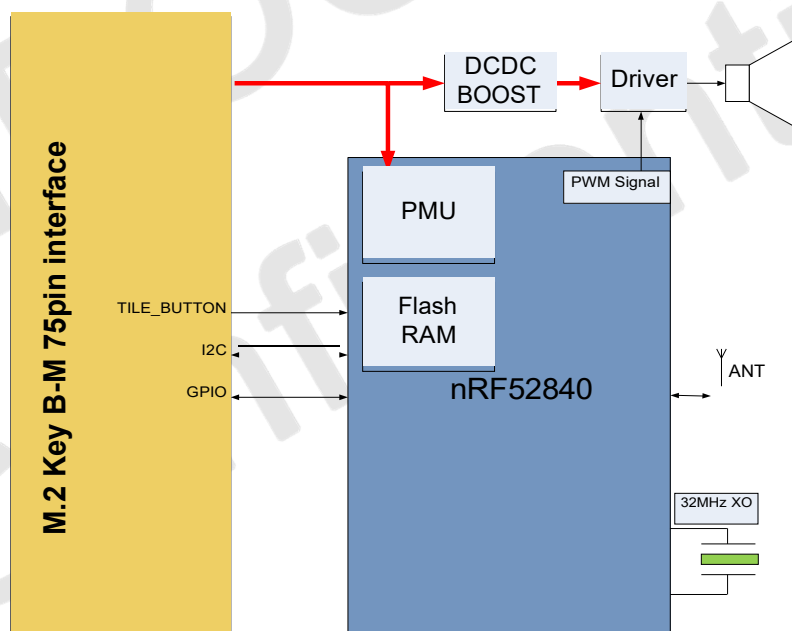


Figure 2-2 Hardware Block Diagram

3 Application Interface

3.1 M.2 Interface

The B830 module uses standard M.2 Key-B-M interface, with a total of 75 pins.

3.1.1 Pin Map

74	3.3 V	CONFIG_2	75
72	3.3 V	GND	73
70	3.3 V	GND	71
68	NC	CONFIG_1	69
	Notch(Key-M)	NC	67
	Notch(Key-M)	Notch(Key-M)	
	Notch(Key-M)	Notch(Key-M)	
	Notch(Key-M)	Notch(Key-M)	
58	NC	Notch(Key-M)	
56	NC	GND	57
54	NC	NC	55
52	NC	NC	53
50	NC	GND	51
48	NC	NC	49
46	NC	NC	47
44	NC	GND	45
42	NC	NC	43
40	NC	NC	41
38	NC	GND	39
36	NC	NC	37
34	NC	NC	35
32	NC	GND	33
30	NC	NC	31
28	I2C_INT#	NC	29
26	GPIO4(Reserved)	GND	27
24	I2C_DATA	NC	25
22	NC	NC	23
20	I2C_CLK	CONFIG_0	21
	Notch(Key-B)	Notch(Key-B)	
	Notch(Key-B)	Notch(Key-B)	
	Notch(Key-B)	Notch(Key-B)	
	Notch(Key-B)	Notch(Key-B)	
10	NC	GND	11
8	GPIO2(Reserved)	USB_D-	9
6	BUTTON	USB_D+	7
4	3.3 V	GND	5
2	3.3 V	GND	3
		CONFIG_3	1

Figure 3-1 Pin Map



Note:

Pin “Notch” represents the gap of the gold fingers.

3.1.2 Pin Definition

The pin definition is as follows:

Pin	Pin Name	I/O	Pin Description	Type
1	CONFIG_3	O	Connected to internal GND	
2	+3.3V	PI	Module main power input.	Power Supply
3	GND		GND	Power Supply
4	+3.3V	PI	Module main power input.	Power Supply
5	GND		GND	Power Supply
6	BUTTON	I	Wake up module, Low active	3.3V
7	USB D+	I/O	USB 1.1 D+ signal(Reserved)	0.3---3V
8	GPIO2(Reserved)	I/O	GPIO port(Reserved)	3.3V
9	USB D-	I/O	USB 1.1 D- signal(Reserved)	0.3---3V
10	NC		NC	
11	GND		GND	Power Supply
12	Notch		Notch	
13	Notch		Notch	
14	Notch		Notch	
15	Notch		Notch	
16	Notch		Notch	
17	Notch		Notch	
18	Notch		Notch	
19	Notch		Notch	
20	I2C_CLK	O	I2C serial data signal, internal 10KΩ pull-up.	3.3V
21	CONFIG_0	O	Connected to internal GND	
22	NC		NC	
23	NC		NC	
24	I2C_DATA	I/O	I2C serial data signal, internal 10KΩ pull-up.	3.3V
25	NC		NC	
26	GPIO4(Reserved)	I/O	GPIO port(Reserved)	3.3V

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Pin	Pin Name	I/O	Pin Description	Type
27	GND		GND	Power Supply
28	I2C_INT#	I/O	I2C serial data signal, internal 10KΩ pull-up.	3.3V
29	NC		NC	
30	NC		NC	
31	NC		NC	
32	NC		NC	
33	GND		GND	Power Supply
34	NC		NC	
35	NC		NC	
36	NC		NC	
37	NC		NC	
38	NC		NC	
39	GND		GND	Power Supply
40	NC		NC	
41	NC		NC	
42	NC		NC	
43	NC		NC	
44	NC		NC	
45	GND		GND	Power Supply
46	NC		NC	
47	NC		NC	
48	NC		NC	
49	NC		NC	
50	NC		NC	
51	GND		GND	Power Supply
52	NC		NC	
53	NC		NC	
54	NC		NC	
55	NC		NC	

Pin	Pin Name	I/O	Pin Description	Type
56	NC		NC	
57	GND		GND	Power Supply
58	NC		NC	
59	Notch		Notch	
60	Notch		Notch	
61	Notch		Notch	
62	Notch		Notch	
63	Notch		Notch	
64	Notch		Notch	
65	Notch		Notch	
66	Notch		Notch	
67	NC		NC	
68	NC		NC	
69	CONFIG_1	O	Connected to internal GND	
70	+3.3V	PI	Module main power input.	Power Supply
71	GND		GND	Power Supply
72	+3.3V	PI	Module main power input.	Power Supply
73	GND		GND	Power Supply
74	+3.3V	PI	Module main power input.	Power Supply
75	CONFIG_2	O	Connected to internal GND	



Note:

The unused pins can be left floating.

3.2 Power Supply

The power interface of B830 module is as shown in the following table:

Pin	Pin Name	I/O	Pin Description	DC Parameter (V)		
				Minimum Value	Typical Value	Maximum Value
2,4,70,72,74	+3.3V	PI	Power supply input	3.135	3.3	3.6

3.2.1 Power Supply

The B830 module should be powered through the +3.3V pins, and the power supply design is shown in Figure 3-2:

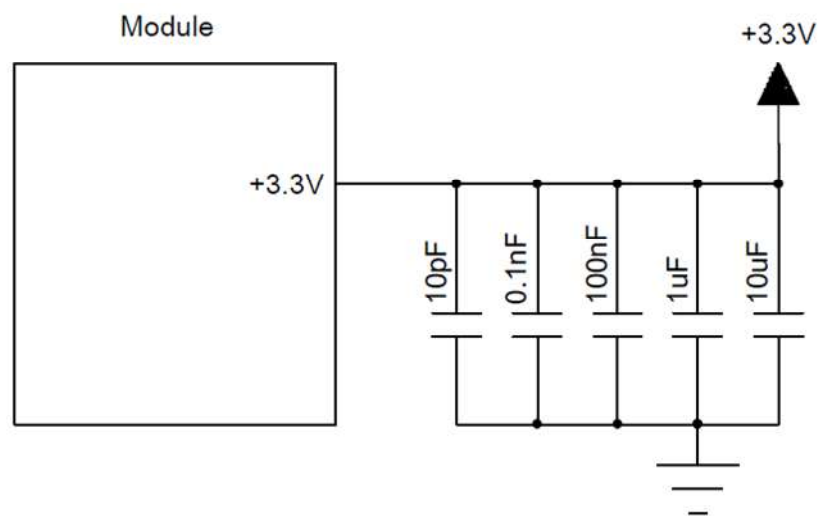


Figure 3-2 Power Supply Design

The filter capacitor design for power supply as shown in the following table:

Recommended capacitance	Application	Description
10uF	Voltage-stabilizing capacitors	Reduce power fluctuations of the module in operation, requiring capacitors with low ESR.
1uF, 100nF	Digital signal noise	Filter out the interference generated from the clock and digital signals
0.1nF	500MHz~2GHz signal noise	Filter out medium/high frequency band RF interference
10pF	2.4GHz frequency band	Filter out high frequency band RF interference

The stable power supply can ensure the normal operation of B830 module; and the ripple of the power supply should be less than 300mV in design. So the power source should be not lower than 3.135V, or the module may shut down or reboot. The power supply limits are shown in Figure 3-3:

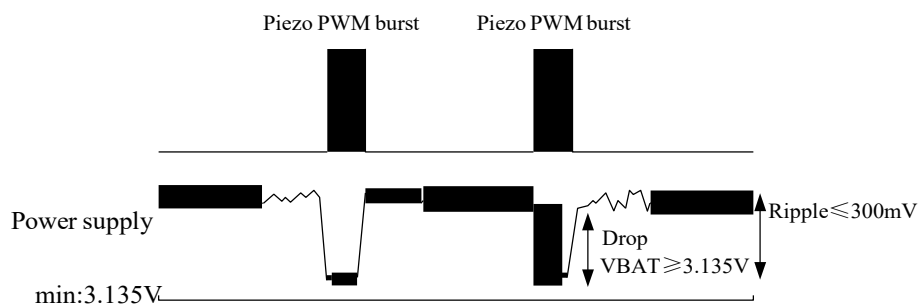


Figure 3-3 Power Supply Limit

3.2.2 GPIO Logic level

The B830 module GPIO logic level definition as shown in the following table:

Parameters	Minimum	Maximum
V_{IH}	$0.7 \times VDD$	VDD
V_{IL}	0V	$0.3 \times VDD$



Note:

VDD is module power supply.

3.2.3 Power Consumption

In the condition of 3.3V power supply, the B830 power consumption as shown in the following table:

Parameter	Mode	Condition	Max Current(mA)	Typical Current(mA)
$I_{Deep\ sleep}$	Deep sleep	Deep sleep	1	TBD
I_{Idle}	Idle	Idle	2	TBD
I_{1LE}	RMS	1LE @+8dBm	100	TBD
	Peak	1LE @+8dBm	150	TBD
I_{2LE}	RMS	2LE @+8dBm	100	TBD
	Peak	2LE @+8dBm	150	TBD
I_{S2}	RMS	S2 @+8dBm	100	TBD
	Peak	S2@+8dBm	150	TBD
I_{S8}	RMS	S8 @+8dBm	100	TBD
	Peak	S8 @+8dBm	150	TBD

Parameter	Mode	Condition	Max Current(mA)	Typical Current(mA)
I _{sound}	RMS	Max sound	500	TBD
	Peak	Max sound	1200	TBD



Note:

The data above is an average value obtained by testing some samples.

3.3 Button#

B830 provides an interrupt signal use to wake up module, the definition of Button# signal is as follows:

Pin	Pin Name	I/O	Pin Description	Type
6	Button#	I	Wake up module, Low active	3.3V

3.4 I2C Interface Description

The B830 module supports I2C interface, which is configured as I2C slave.

Pin	Pin Name	I/O	Pin Description	Type
20	I2C_CLK	I	I2C serial data signal, internal 10KΩ pull-up.	3.3V
24	I2C_DATA	I/O	I2C serial data signal, internal 10KΩ pull-up.	3.3V
28	I2C_INT#	I	I2C serial data signal, internal 10KΩ pull-up.	3.3V

External host can controls module with I2C interface, the connection schematic design is as Figure 3-4:

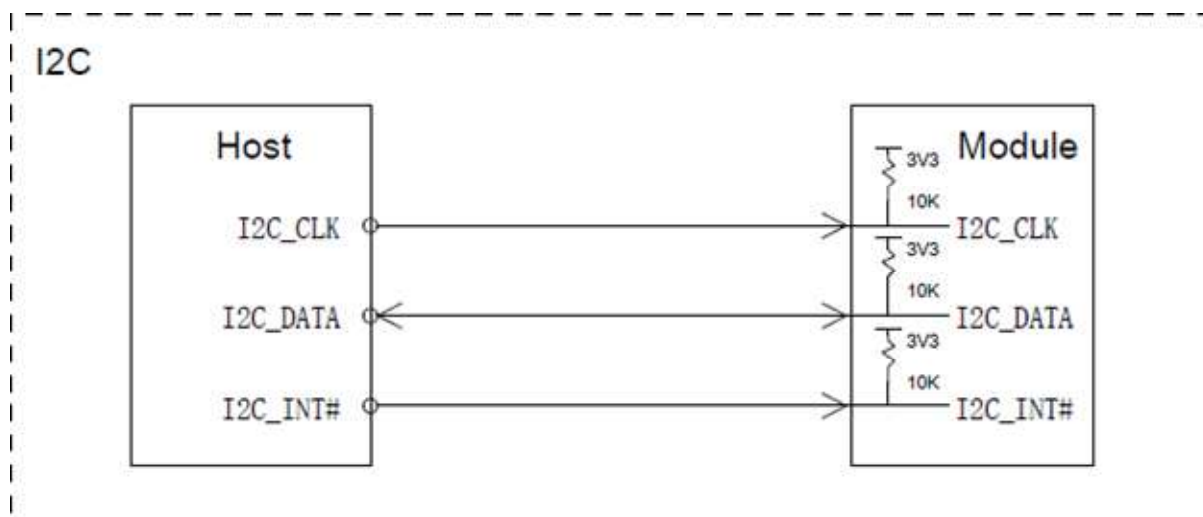


Figure 3-4 I2C Signal Connection



Note:

I2C interface can be left floating if not used.

3.5 Piezo

The B830 has a piezoelectric element that can be used to output simply sounds.

nRF52840 pin	Pin Name	I/O	Pin Description	Type
P0.08	PIEZO_PWM_NEG	O	Bridge output signal(Phase difference of 180°), output PWM signal to drive piezo buzzer	3.3V
P1.08	PIEZO_PWM_POS	O	Bridge output signal(Phase difference of 180°), output PWM signal to drive piezo buzzer	3.3V

Module has a built-in DCDC boost circuit which has 4 level V_{PP} voltage, then it can drives buzzer output four volume level.

Volume Level	nRF52840 Pin			V_{PP} Voltage
	P0.07	P1.15	P1.14	
1(Mute)	H	NC	NC	-0.3~0.3V, typical 0V
2(Normal)	H	H	L	13.5~17.5V, typical 15.5V
3(Medium)	H	L	H	20.5~24.5V, typical 22.5V
4(Loud)	H	H	H	28~32V, typical 30V

The volume of piezo on module is about 100dB@Level 4(background noise is lower than 40dB). The sound test environment is as Figure 3-5:

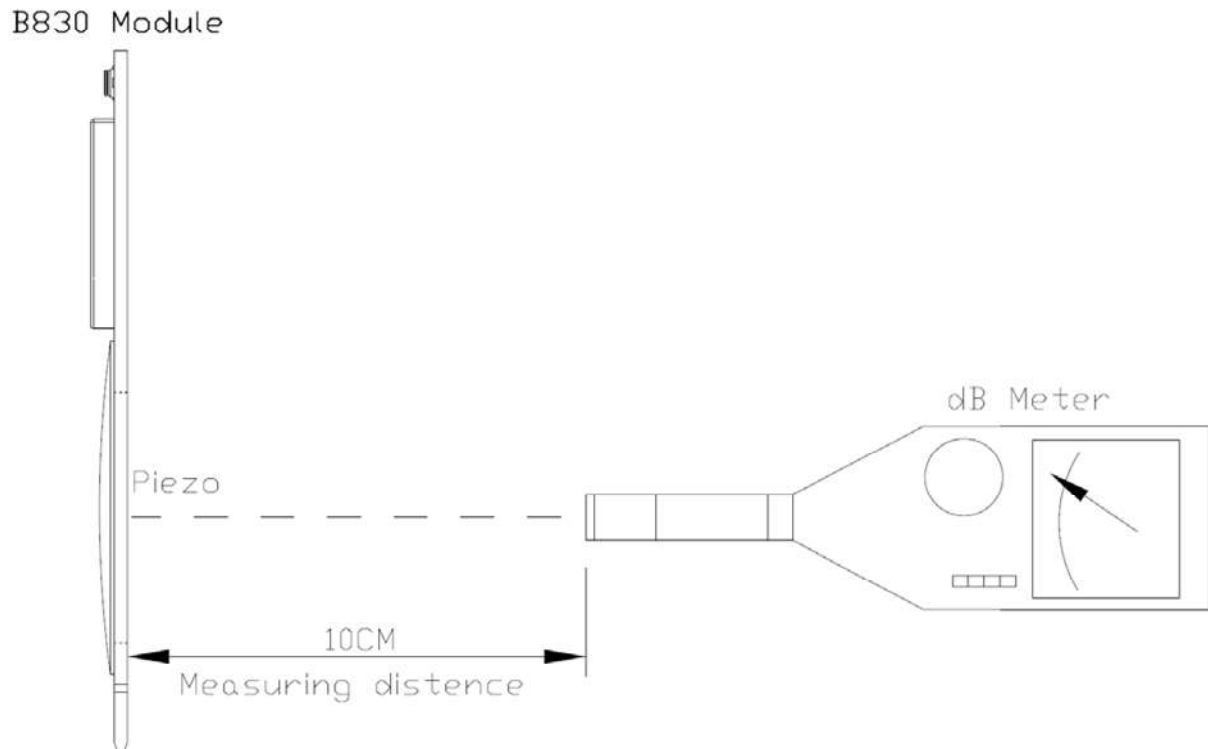


Figure 3-5 Sound Test Environment

4 Radio Frequency

4.1 RF Interface

4.1.1 RF Interface Functionality

The B830 module supports RF connector used for external antenna connection, as the Figure 4-1 shows.

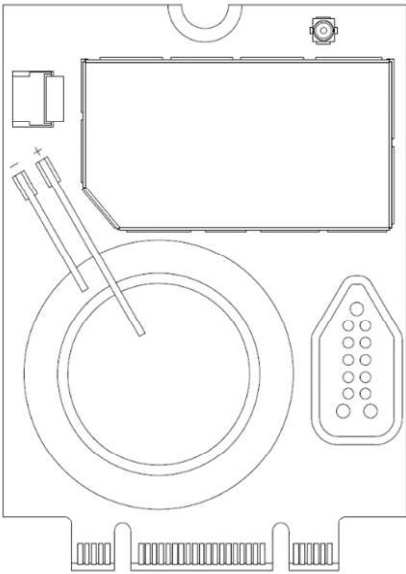


Figure 4-1 RF connectors

4.1.2 RF Connector Characteristic

Rated Condition		Environment Condition
Frequency Range	DC to 6GHz	Temperature Range
Characteristic Impedance	50Ω	−40°C to +85°C

4.1.3 RF Connector Dimension

The B830 module adopts standard M.2 module RF connector, the model name is 818004607 from ECT Corporation, and the connector size is 2*2*0.6m. The connector dimension is shown as following picture:

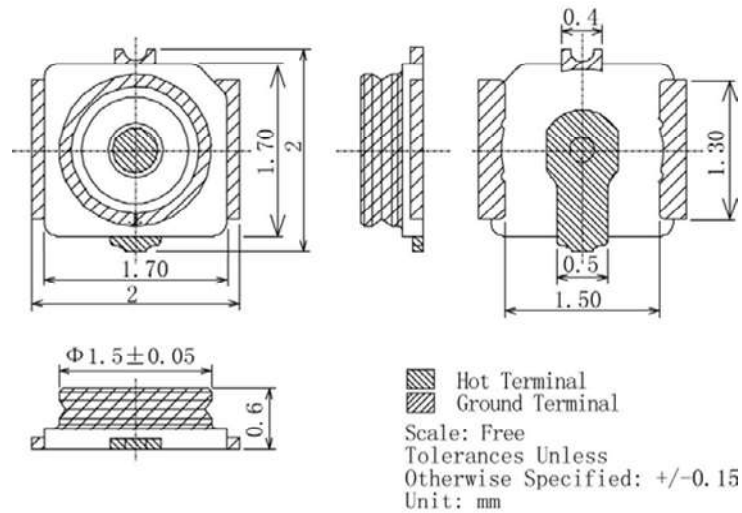


Figure 4-2 RF connector dimensions

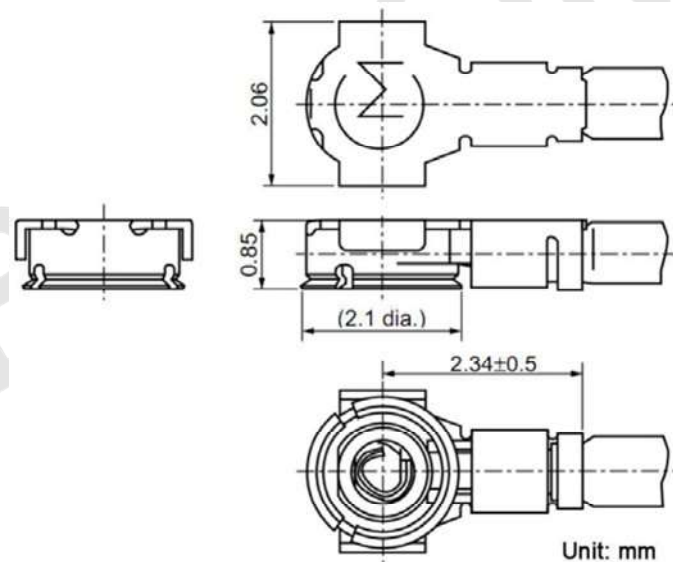


Figure 4-3 0.81mm coaxial antenna dimensions

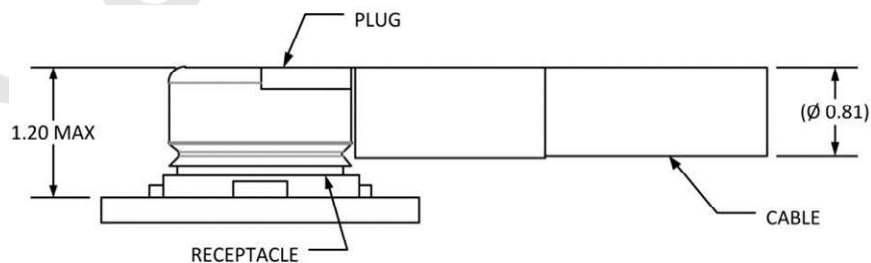


Figure 4-4 Schematic diagram of 0.81mm coaxial antenna connected to the RF connector

4.2 Operating Mode

The B830 module operating mode of the antenna is as follows:

Mode	Operation Mode	Tx (MHz)	Rx (MHz)
Bluetooth	LE	2400 – 2483.5	2400 – 2483.5

4.3 Transmitting Power

The transmitting power of the B830 module is as shown in the following table:

Mode	Operation Mode	BT SIG Requirement	Tx Power(dBm)	Note
Bluetooth	LE	$-20 \leq \text{Power} \leq 10$	7.5+2.5/-4.5	

4.4 Receiver Sensitivity

The receiver sensitivity of the B830 module is as shown in the following table:

Mode	PHY	BT SIG Requirement	Rx Sensitivity(dBm) Typical	Note
BLE	1LE	-70	TBD	PER<30.8%
	2LE	-70	TBD	PER<30.8%
	S2	-75	TBD	PER<30.8%
	S8	-82	TBD	PER<30.8%

4.5 Antenna Design

The B830 module antenna design requirements as shown in the following table:

B830 module Main antenna requirements	
Frequency range	The most proper antenna to adapt the frequencies should be used.
Bandwidth	BT: 2.400 – 2.4835GHz
Impedance	50 Ohm
Input power	> 13dBm BT power
Recommended standing-wave ratio (SWR)	$\leq 2:1$

5 Structure Specification

5.1 Product Appearance

The product appearance for B830 module is shown in Figure 5-1:



Figure 5-1 Module Appearance

5.2 Dimension of Structure

The structural dimension of the B830 module is shown in Figure 5-2:

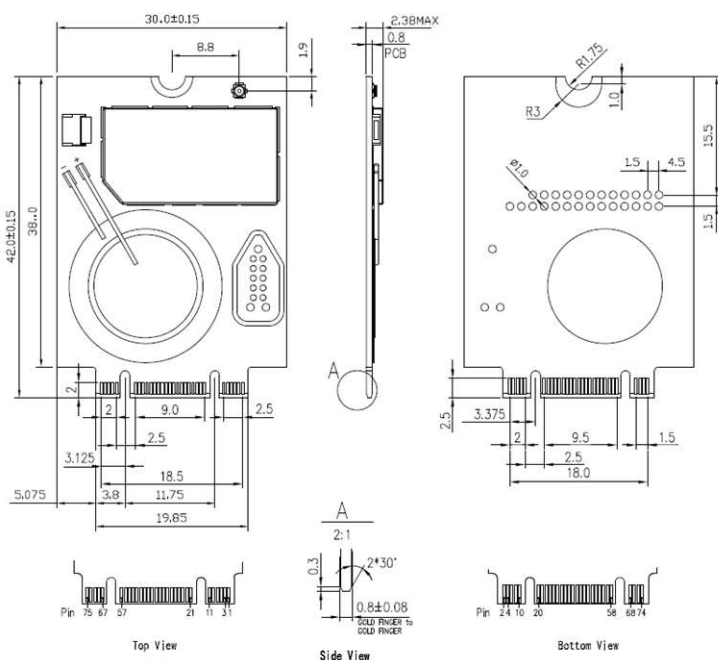


Figure 5-2 Dimension of Structure

5.3 M.2 Interface Model

The B830 M.2 module adopts 75-pin gold finger as external interface, where 59 pins are signal pins and 16 pins are notch pins as shown in Figure7-1. For module dimension, please refer to chapter 7.2 Dimension of Structure. Based on the M.2 interface definition, B830 module adopts Type 3042-S3-B-M interface (30x42mm, the component maximum height on t top layer is 1.5mm, PCB thickness is 0.8mm, and KEY ID is B-M).

Module Nomenclature
Sample type 3042-S3-B-M

Type XX XX - XX - X - X^{II}

Width (mm)	Length (mm)		Component Max Ht (mm)	
			Top Max ^{III}	Bottom Max ^{III}
	16	S1	1.2	0****
12	26	S2	1.35	0****
16	30	S3	1.5	0****
22	38	D1	1.2	1.35
30	42	D2	1.35	1.35
	60	D3	1.5	1.35
	80	D4	1.5	0.7
	110	D5	1.5	1.5

Key ID	Pin	Interface
A	8-15	2x PCIe x1 / USB 2.0 / I2C / DP x4
B	12-19	PCIe x2/SATA/USB 2.0/USB 3.0/HSIC/SSIC/Audio/UIM/I2C
C	16-23	Reserved for Future Use
D	20-27	Reserved for Future Use
E	24-31	2x PCIe x1 / USB 2.0 / I2C / SDIO / UART / PCM
F	28-35	Future Memory Interface (FMI)
G	39-46	Generic (Not used for M.2)***
H	43-50	Reserved for Future Use
J	47-54	Reserved for Future Use
K	51-58	Reserved for Future Use
L	55-62	Reserved for Future Use
M	59-66	PCIe x4 / SATA

- ☒ Use ONLY when a double slot is being specified
- ☒☒ Label included in height dimension
- ☒☒☒ Key G is intended for custom use. Devices with this key will not be M.2-compliant. Use at your own risk!
- ☒☒☒☒ Insulating label allowed on connector-based designs

5.4 M.2 Connector

The B830 module connects to AP via M.2 connector, it is recommended to use M.2 connector from LOTES Corporation with the model APCI0026-P001A as shown in Figure 5-3. The package of connector, please refer to the specification.

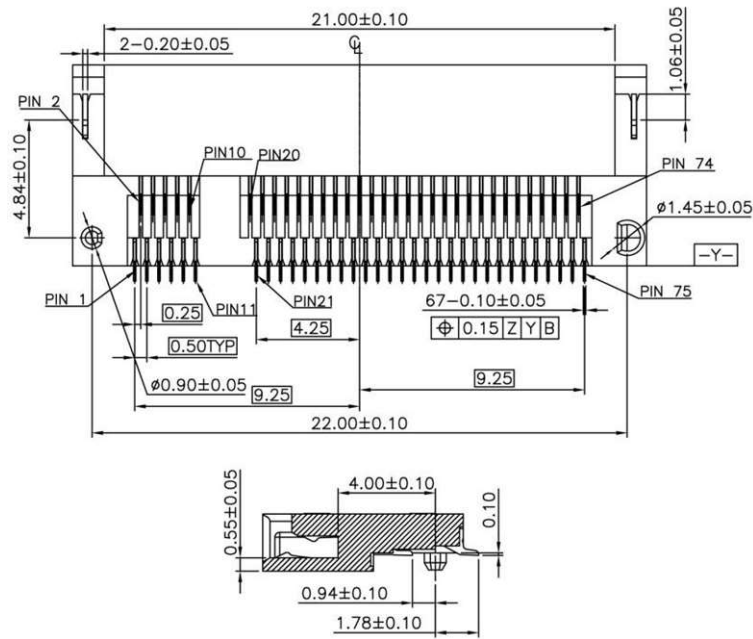


Figure 5-3 M.2 Dimension of Structure

5.5 Storage

5.5.1 Storage Life

Storage Conditions (recommended): Temperature is 23 ± 5 °C, relative humidity is less than RH 60%.

Storage period: Under the recommended storage conditions, the storage life is 12 months.

5.6 Packing

The B830 module uses the tray sealed packing, combined with the outer packing method using the hard cartoon box, so that the storage, transportation and the usage of modules can be protected to the greatest extent.



Note:

The module is a precision electronic product, and may suffer permanent damage if no correct electrostatic protection measures are taken.

5.6.1 Tray Package

The B830 module uses tray package, 20 pcs are packed in each tray, with 5 trays including one empty tray on top in each box and 5 boxes in each case. Tray packaging process is shown in Figure 5-4:

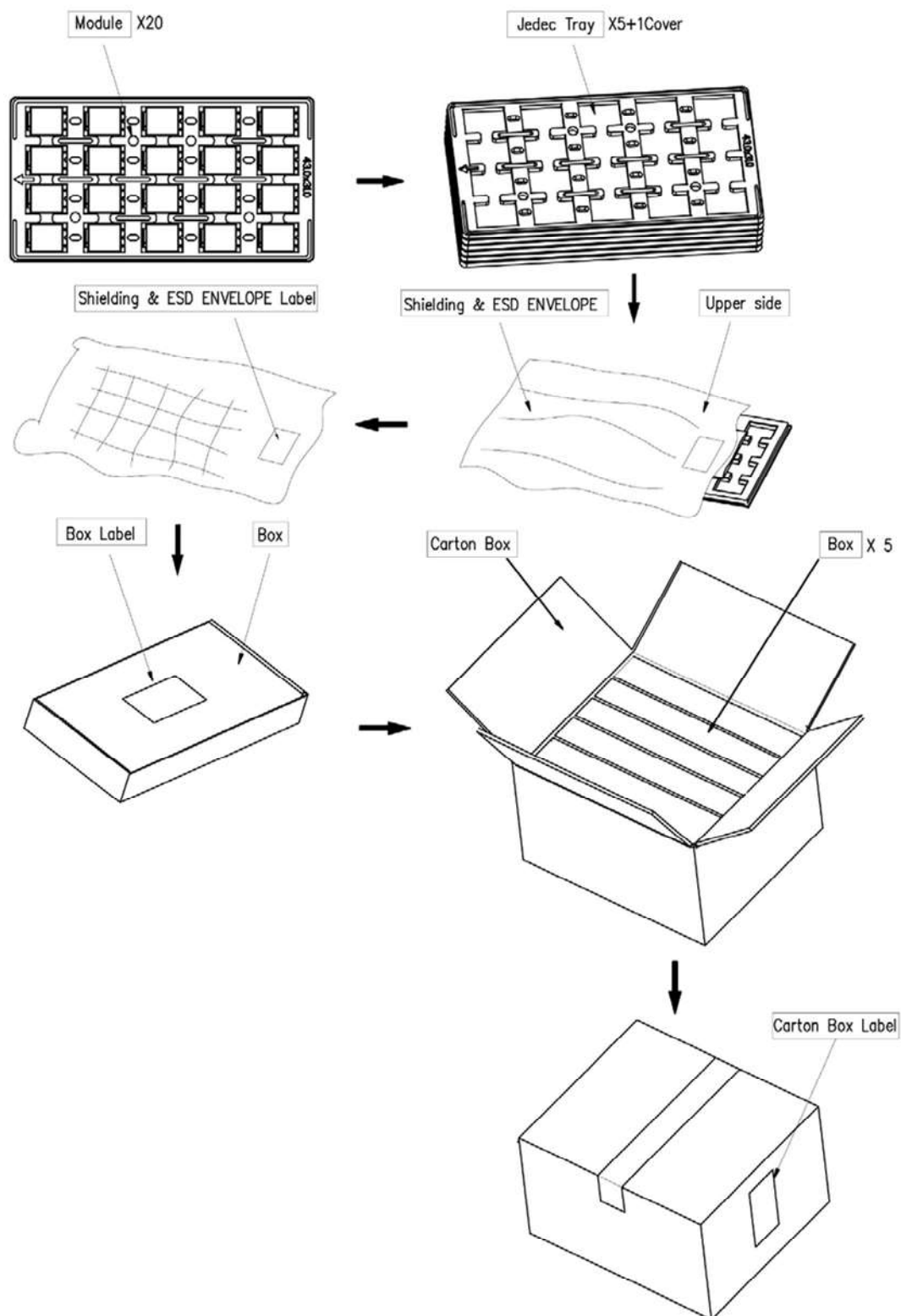


Figure 5-4 Tray Packaging Process

5.6.2 Tray size

The pallet size of B830 serial module is 315*170*6.5mm, as shown in Figure 5-5:

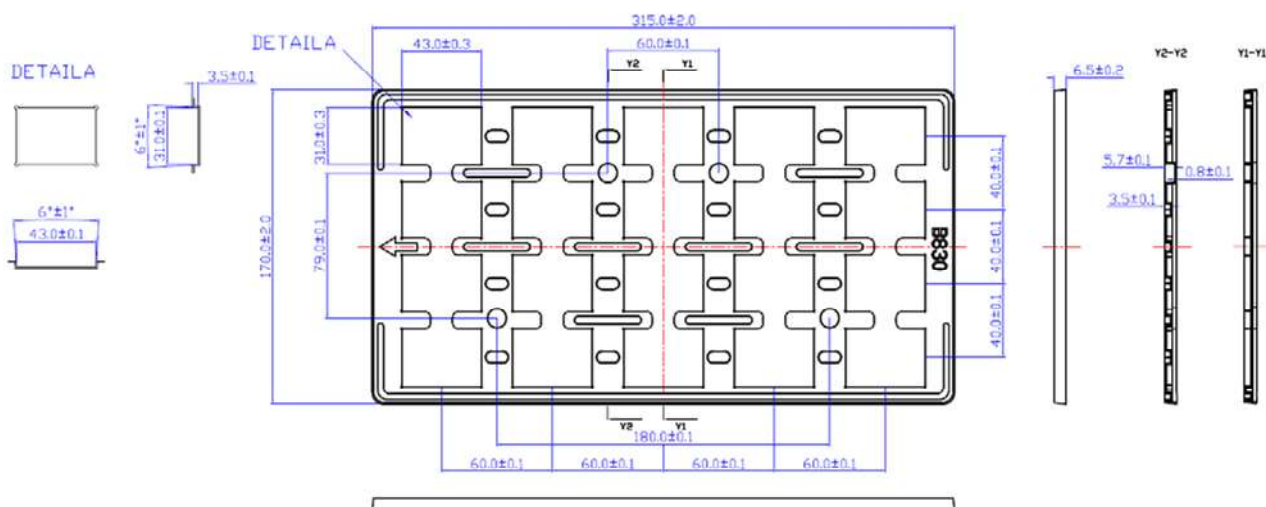


Figure 5-5 Tray Size