

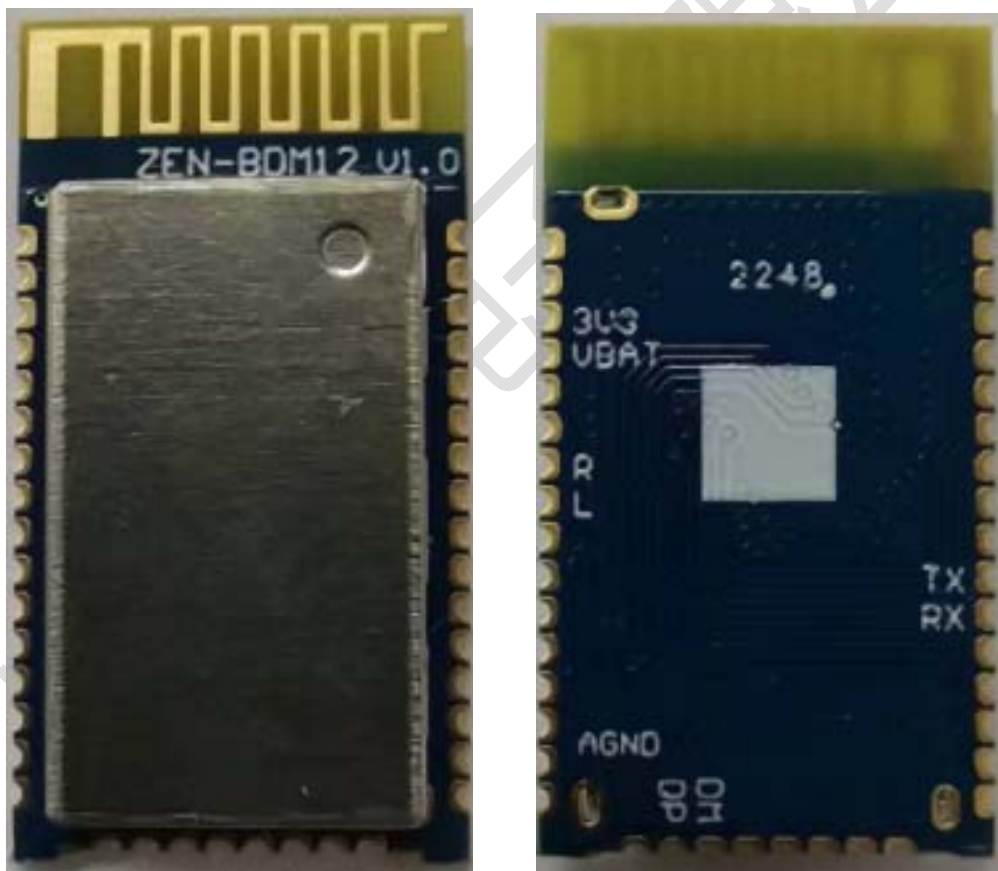


## MODULE SPECIFICATION

Model: ZEN-BDM12A

FCC:2AOC9-ZENBDM12A

IC:27631-ZENBDM12A



Shanghai Zenchant Electronics Co., LTD

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电话: 021-64837686 传真: 021-64822186  
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## 1. Overview

The ZEN-BDM10 Bluetooth module is based on the AC6956C chip design, working in the 2402MHz-2480MHz frequency band, the Power level is Class 2(-6 ~ +4dBm), and conforms to the Bluetooth 5.3 specification. The module has a built-in 24MHz crystal oscillator to supply the chip system clock, and the chip integrates RF. This module can realize Bluetooth BLE/SPP data transmission, voice transmission, Bluetooth music playback, U disk /TF card audio decoding, TF card reader and other functions. The module pins are drawn with stamp holes, which can easily connect peripheral circuits, greatly reducing the application difficulty and design time of customers, and reducing the bottom cost for enterprises. This module is an excellent solution for speaker system, smart home and other applications!

### 1.1 Features

- ◇ Comply with Bluetooth 5.3 specification
- ◇ Support Bluetooth BR/EDR(A2DP/AVRCP/AVDPT/AVCTP/HFP/SPP/SDP /L2CAP/HID...)
- ◇ Support BLE data transfer(LE 1M/2M PHY)
- ◇ 16 bit stereo audio DAC output
- ◇ 12-bit precision 1-channel stereo audio ADC with MIC amplifier circuit
- ◇ Support IIS digital audio output
- ◇ External audio input interface
- ◇ Three way high speed UART interface
- ◇ USB 2.0 Full Speed OTG control interface
- ◇ Support U disk, card reader, USB sound card, and other applications
- ◇ SDIO read-write SD/MMC CARDS are supported.
- ◇ The module is equipped with 2.4G(2.4000~2.4835GHz) PCB antenna

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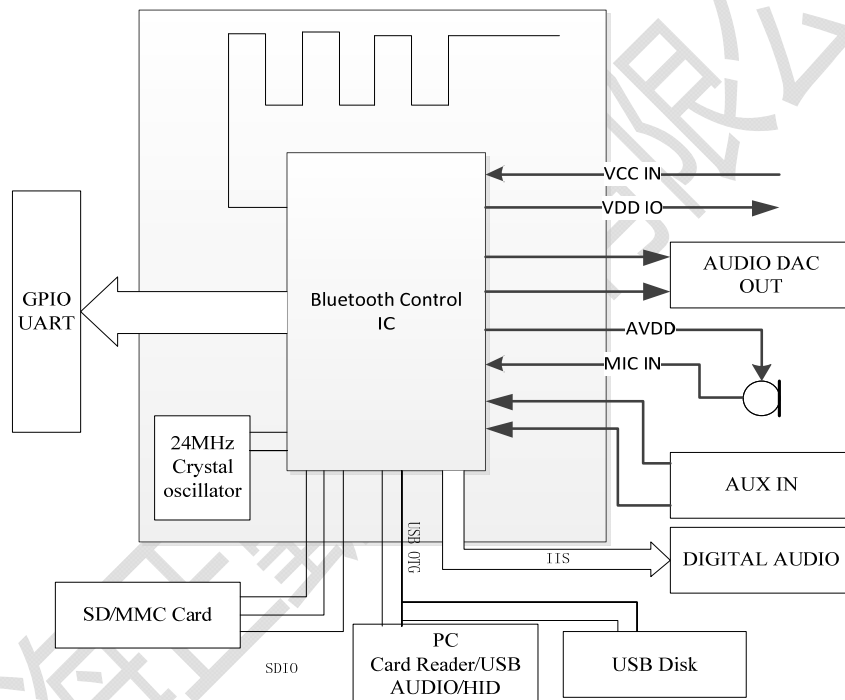


- ◇ BLE supports multiple master and multiple slave applications
- ◇ Supports multi source digital mixed output.

### 1.2 Applications

- ◇ Bluetooth speaker
- ◇ Smart home
- ◇ The data transfer

## 2. Functional Block Diagram



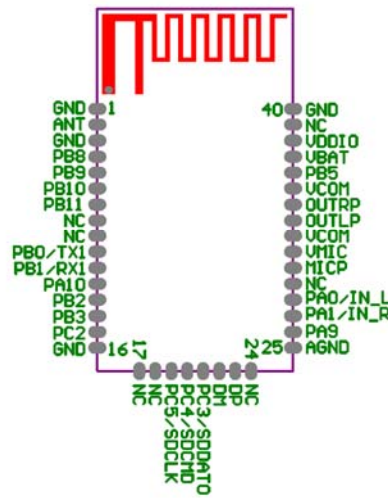
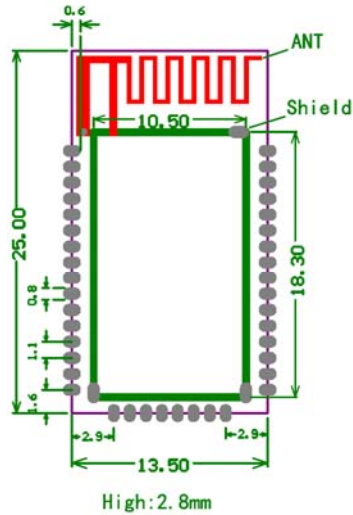
## 3. Product size and pin description

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PIN NO.	NAME	I/O Type	Function	Other Function
1	GND	P	Ground	
2	ANT	P	Test RF ANT	
3	GND	P	Ground	
4	PB8	I/O	GPIO	AMUX1R: Analog Channel1 Right; SPI2_DIA: SPI2 Data In(A); ADC8: ADC Input Channel 8;
5	PB9	I/O	GPIO	AMUX2L: Analog Channel2 Left; SPI2CLKA: SPI2 Clk(A); UART2TXC: Uart2 Data Out(C);
6	PB10	I/O	GPIO	AMUX2R: Analog Channel2 Right; SPI2DOA: SPI2 Data Out(A); ADC9: ADC Input Channel 9; UART2RXC: Uart2 Data In(C);
7	PB11	I/O	GPIO	SDPG:SDC Power Gate;
8	NC			
9	NC			
10	PB0	I/O	GPIO	SPI1CLKA: SPI1 Clock(A); UART1TXA: Uart1 Data Out(A);
11	PB1	I/O	GPIO(pull up)	Long Press Reset; SPI1DOA: SPI1 Data Out(A); ADC5: ADC Input Channel 5; UART1RXA: Uart1 Data In(A);

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12	PA10	I/O	GPIO	ADC3: ADC Input Channel 3; Touch9: Touch Input Channel 9; UART2RXB: Uart2 Data In(B);
13	PB2	I/O	GPIO	SPI1DIA: SPI1 Data In(A);
14	PB3	I/O	GPIO	PWM2: Timer2 PWM Output; ADC6: ADC Input Channel 6;
15	PC2	I/O	GPIO(PULL DN)	ALNK1_DAT0: Audio Link Data0; Touch12: Touch Input Channel 12;
16	GND	P	Ground	
17	NC			
18	NC			
19	PC5	I/O	GPIO	SD1CLKA: SD1 Clock(A); SPI1DOB: SPI1 Data Out(B); UART2RXD: Uart2 Data In(D); ADC13: ADC Input Channel 13;
20	PC4	I/O	GPIO	SD1CMDA: SD1 Command(A); SPI1CLKB: SPI1 Clock(B); UART2TXD: Uart2 Data Out(D); ADC10: ADC Input Channel 10;
21	PC3	I/O	GPIO	SD1DAT0A: SD1 Data0(A); SPI1DIB: SPI1 Data In(B);
22	DM	I/O	USB Negative Data	UART1RXD: Uart1 Data In(D);
23	DP	I/O	USB Positive Data	UART1TXD: Uart1 Data Out(D); ADC12: ADC Input Channel 12;
24	NC			
25	AGND	P	Ground	
26	PA9	I/O	GPIO	ALNK0_SCLKB : Audio Link Serial Clock(B); Touch8: Touch Input Channel 8; UART2TXB: Uart2 Data Out(B);
27	PA1	I/O	GPIO	AMUX0R: Analog Channel0 Right; Touch1: Touch Input Channel 1; ADC0: ADC Input Channel 0; UART1RXC: Uart1 Data In(C);
28	PA0	I/O	GPIO	AMUX0L: Analog Channel0 Left; Touch0: Touch Input Channel 0; UART1TXC: Uart1 Data Out(C);

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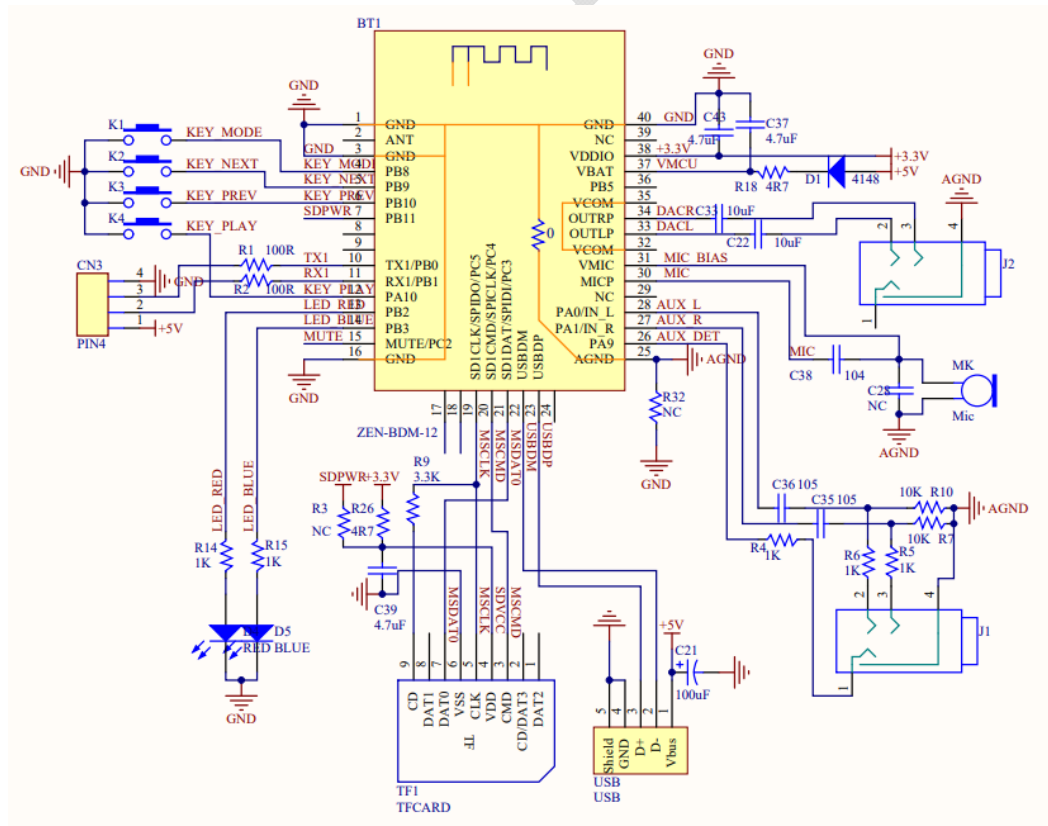
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29	NC			
30	MIC	I	MIC Input Channel	MIC: MIC Input Channel;
31	PC7	I/O	GPIO	MIC_BIAS: Microphone Bias Output
32	VCOM	P	DAC Reference	
33	OUTLP	O	DAC Left Channel	
34	OUTRP	O	DAC Right Channel	
35	VCOM	P	DAC Reference	
36	LDOIN	P		Battery Charge Input
	PB5	I/O	GPIO (High Voltage Resistance)	PWM3: Timer3 PWM Output; UART0TXC: Uart0 Data Out(C); UART0RXC: Uart0 Data In(C);
37	VBAT	P	LDO Power	
38	VDDIO	P	IO Power 3.3v	
39	NC			
40	GND	P	Ground	

#### 4. Typical application circuits



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**5. Module hardware function specifications**

## 6.1 PMU Characteristics

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
VBAT	Voltage Input	2.2	3.7	5.5	V	
LDOIN	Charge Voltage		4.5	5.5	V	
VDDIO	Voltage output	--	3.3	--	V	VBAT = 5V,100mA
I <sub>VDDIO</sub>	Loading current	--	--	150	mA	VBAT =5V

## 6.2 IO Input/Out Electrical Logical Characteristics

IO Input Characteristics						
Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
V <sub>IL</sub>	Low-Level Input Voltage	-0.3	--	0.3* VDDIO	V	VDDIO = 3.3V
V <sub>IH</sub>	High-Level Input Voltage	0.7* VDDIO	3.3	--	V	VDDIO = 3.3V
IO output characteristics						
V <sub>OL</sub>	Low-Level Output Voltage	--	--	0.33	V	VDDIO = 3.3V
V <sub>OH</sub>	High-Level Output Voltage	2.7	--	--	V	VDDIO=3.3V

## 6.3 Internal Resistor Characteristics

Port	General Output	High Drive	Internal Pull-Up Resistor	Internal Pull-Down Resistor	Comment	
PA0,PA1 PA9,PA10 PB1,PB3 PB8~PB10 PC2~PC5	8mA	24mA	10K	10K	1. PB1 default pull up 2. USBDM & USBDP default pull down 3. PB0, PB2, PB5 can pull-up resistance to 5V 4.internal pull-up/pull-down resistance   accuracy $\pm 20\%$	
PB11	L	8mA	24mA	10K		
PC7	H	8mA	64mA	10K		
USB DP		4mA	--	1.5K		15K
UDBDM		4mA	--	180K		15K

## 6.4 DAC Characteristics

Parameter	Min	Typ	Max	Unit	Test Conditions
Frequency Response	20	--	20K	Hz	1KHz/0dB 10Kohm Loading With A-Weighted Filter
THD+N	--	-75	--	dB	
S/N	--	95	--	dB	

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Crosstalk	--	-90	--	dB	
Output Swing		1		Vrms	
Dynamic Range		90		dB	1KHz/-60dB 10Kohm Loading With A-Weighted Filter
DAC Output Power	11			mW	32 ohm Loading

## 6.5 ADC Characteristics

Parameter	Min	Typ	Max	Unit	Test Conditions
Dynamic Range		80		dB	1KHz/-60dB 10Kohm Loading With A-Weighted Filter
S/N		90		dB	1KHz/-60dB 10Kohm Loading With A-Weighted Filter
THD+N		-70		dB	
Crosstalk		-80		dB	

## 6.6 BT Characteristics

## 6.6.1 Transmitter

## Basic Data Rate

Parameter	Min	Typ	Max	Unit	Test Conditions
RF Transmit Power		4	6	dBm	25°C, Power Supply Voltage=5V 2441MHz
RF Power Control Range		20		dB	
20dB Bandwidth		950		KHz	
Adjacent Channel Transmit Power	+2MHz	-40		dBm	
	-2MHz	-38		dBm	
	+3MHz	-44		dBm	
	-3MHz	-35		dBm	

## Enhanced Data Rate

Parameter	Min	Typ	Max	Unit	Test Conditions
Relative Power		-1		dBm	25°C, Power Supply Voltage=5V 2441MHz
$\pi/4$ DQPSK Modulation Accuracy	DEVM RMS	6		%	
	DEVM 99%	10		%	
	DEVM Peak	15		%	
Adjacent Channel Transmit Power	+2MHz	-40		dBm	
	-2MHz	-38		dBm	
	+3MHz	-44		dBm	
	-3MHz	-35		dBm	

## 6.6.2 Receive

## Basic Data Rate

Parameter	Min	Typ	Max	Unit	Test Conditions
Sensitivity		-90		dBm	25°C, Power Supply

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Co-channel Interference Rejection		-13		dB	Voltage=5V 2441MHz
Adjacent Channel Transmit Power	+1MHz	+5		dBm	
	+1MHz	+2		dBm	
	+2MHz	+37		dBm	
	-2MHz	+36		dBm	
	+3MHz	+40		dBm	
	-3MHz	+35		dBm	

Enhanced Data Rate

Parameter	Min	Typ	Max	Unit	Test Conditions
Sensitivity		-90		dBm	25°C, Power Supply Voltage=5V 2441MHz
Co-channel Interference Rejection		-13		dB	
Adjacent Channel Transmit Power	+1MHz	+5		dBm	
	+1MHz	+2		dBm	
	+2MHz	+37		dBm	
	-2MHz	+36		dBm	
	+3MHz	+40		dBm	
	-3MHz	+35		dBm	

**6. Product Options**

型号	说明	照片
ZEN-BDM12A	With a mask version	

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## 7. Release notes

Date	Version	Instructions
2023.03.30	V1.0	New document

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**FCC 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.

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications or changes to this equipment. Such modifications or changes 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.

The device has been evaluated to meet general RF exposure requirement, The device can be used in portable exposure condition without restriction.

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**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.
2. The transmitter module may not be co-located with any other transmitter or antenna. As long as the two conditions above are met, additional transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required for the installed module.

**Important Note:**

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Federal Communications Commission of the U.S. Government (FCC) and the Canadian Government authorizations are no longer considered valid and the FCC ID and IC ID cannot be used on the final product. In these circumstances, the OEM integrator shall be responsible for re-evaluating the end-product (including the transmitter) and obtaining a separate FCC and IC authorization in the U.S. and Canada.

**OEM Integrators - End Product Labeling Considerations:**

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: 2AOC9-ZENBDM12A or IC:27631-ZENBDM12A . The grantee's FCC ID can be used only when all FCC compliance requirements are met.

**OEM Integrators - End Product Manual Provided to the End User:**

The OEM integrator shall not provide information to the end user regarding how to install or remove this RF module in end product user manual. The end user manual must include all required regulatory information and warnings as outlined in this document.

The module only includes RF shielding cover, OEM integrators shall evaluate the RSE when installing this module to ensure that the module still meets regulatory requirements when installed into their system.

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## IC Statements

This device complies with Industry Canada licence-exempt RSS standard(s). 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.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

### 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 20cm between the radiator & your body.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radioexempts 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.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

### Déclaration d'exposition aux radiations:

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

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Shanghai Zenchant Electronics Limited

上海正勤电子有限公司 ZEN-BDM12A Bluetooth Module Spec V1.0

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#### **CE Statement**

This device is a low-power radio transmitter and receiver. As recommended by international guidelines, the device meets applicable national SAR limits of 2.0W/kg (10g). 10g SAR: meets low-power exclusion level, SAR test is not required.

Do not use the device in the environment at too high or too low temperature, never expose the device under strong sunshine or too wet environment.

The suitable temperature for the product and accessories is 0°C-70°C.

#### **Operating Frequency Range, Max Output Power**

Bluetooth: 2402MHz ~ 2480MHz, 7.96dBm

**This product can be used across EU member states.**

#### **EU Regulatory Conformance**

Hereby, Shanghai Zenchant Electronic CO.,LTD. declares that this device is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.

For the declaration of conformity, visit the Web site <https://www.zenchant.com>



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