

# EH-MC33

# Ultra Low Power Bluetooth BLE5.3 Module Datasheet

July 2024 Version2.0 Professional IoT Grid Module Programme Provider Copyright © 2024 Shanghai Next Rainbow Information Technology Co.

## 1. Module overview

## 1.1 characterisation

element	(an official) standard	
processing unit	ARM Cortex M33 (64MHz) • 128kB RAM, 64kB ROM • 512kB Flash	
(an official) standard	• Bluetooth BLE 5.3	
BLE RF Parameters	<ul> <li>Maximum transmit power: +3 dBm</li> <li>Receiving sensitivity: - 95 dBm</li> </ul>	<ul> <li>RF power consumption in 3V supply mode</li> <li>Receiving Current (RX@-95dB):</li> <li>0.85mA</li> <li>Emission current (@0dB): 2.1mA</li> <li>Normal operation of PMU, power consumption under 3V supply condition: Receiving current (RX@- 95dB): 1.4mA</li> <li>Emission current (@0dB): 2.5mA</li> <li>Beacon broadcast power consumption: 7.15uA</li> <li>(Intermit interval: 2s, data: 23Byters, 0dBm)</li> </ul>
Sleep power consumption	Deep sleep: 400nA	Wakeable: 1.1uA
peripheral equipment	<ul> <li>21 x GPIO (maximum)</li> <li>2 x SPI (master or slave)</li> <li>2 x I2C (main)</li> <li>1 x I2S/PCM</li> </ul>	• 8 x PWM • 2 x UART • ADC (11-bit)
input voltage	Input Power: 1.1V~4.2V, 3V (	typical)
matrix	<ul> <li>Temperature.</li> <li>Working temperature: - 20°C ~ 85°C</li> <li>Storage Temperature: - 55°C ~ 150°C</li> </ul>	<ul> <li>Humidity:</li> <li>Relative humidity: &lt; 90% without condensation</li> <li>Storage humidity: &lt; 90% no condensation</li> </ul>

exterior condition	Size: 17.70x11.95x2.20mm	Pin: 27 stamp holes Antenna: PCB board mounted antenna
accreditation	BQB, FCC, CE, IC, SRRC, Roh	S

#### 1.2 descriptions

The EH-MC33 is an ultra-low-power module supporting Bluetooth 5.3. It is small in size, powerful in function, and has a rich set of interfaces that can be used in Apple FMN positioning, smart home, smart hardware, and other scenarios.

The modules use an Atomic 3325 chip with an ARM Cortex M33 processor at up to 64 MHz, 128 KB of Random Access Memory (RAM), 64 KB of Read-Only Memory (ROM), 512 KB of Non-Volatile Memory (NVM), and state-of-the-art power management to maximise the life of the battery used in the device.

The EH-MC33 has extremely low power consumption, with 0.85 mA radio receiver and 2.1 mA radio transmitter power consumption, which can greatly extend the battery life of Internet of Things (IoT) devices. Supports low duty cycle operation, allowing the system to run longer without battery replacement. Supports an innovative wake-up mechanism, providing an option to further reduce energy consumption.

The EH-MC33 also integrates a rich set of peripherals, including SPI, I2S, I2C, UART, PWM, and GPIO interfaces, along with a rich set of application software, and complete module certification, allowing customers to bring their products to market faster and at lower cost.

#### 1.3 use

- Apple Positioning (FMN)
- smart home
- Beacon
- intelligent building
- Intelligent Hardware

- Electronic Label
- intelligent agriculture
- Workplace automation
- smart toy
- Mesh Grid

# Project Name

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# 2. Pin definition



Picture : EH-MC33 Pin Layout (Top View)

Pin	Ю	typology	descriptions
Sequence		_	
1	GND	GND	earth (electric connection)
2	P0	GPIO	Use GPIO, default SWCLK.
3	P1	GPIO	Use GPIO, default SWDIO.
4	P3	GPIO	Using GPIOs
5	P4	GPIO	Using GPIOs
6	Р5	GPIO	Using GPIOs
7	P7	GPIO	Using GPIOs
8	P8	GPIO	Using GPIOs
9	PWD	GPIO	Use GPIO, burn PWD by default.
10	GND	GPIO	Using GPIOs
11	VBAT	VBAT	Module power supply in VBAT
12	VDDIO	VDDIO	VDDIO
13	VDDIOP	VDDIOP	Module power supply in VDDIOP
14	VDDPA	VDDPA	VDDPA
15	VAUX	VAUX	VAUX
16	P14	GPIO	Use GPIO, default UART0_RX.
17	P17	GPIO	Use GPIO, default UART0_TX.
18	P18	GPIO	Using GPIOs
19	P19	GPIO	Using GPIOs
20	P20	GPIO	Using GPIOs
21	P21	GPIO	Using GPIOs
22	P22	GPIO	Using GPIOs
23	P25	GPIO	Use GPIO, burn BOOT by default.
24	P27	GPIO	Use GPIO, default UART1_TX.
25	P29	GPIO	Using GPIOs
26	P30	GPIO	Using GPIOs
27	GND	GND	earth (electric connection)

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Table 2: Pin Descriptions

# 3. Electrohydraulic characteristics

## 3.1 Absolute Maximum Ratings

Exceeding the absolute maximum ratings may result in permanent damage to the device. This is an emphasis on ratings only and does not address the functional operation of the device under these or other conditions beyond those indicated in this technical specification. Prolonged exposure to absolute maximum rated conditions may affect module reliability.

notation	parametric	minimum value	Maximumvalue	unit (of measure)
VDD_BAT	Power Pin Voltage	1.1	4.2	V
Tstore	Storage temperature	-55	125	°C

Table 3: Absolute Maximum Ratings

## 3.2 Recommended Working Conditions

notation	minimum value	typical value	Maximumvalue	unit (of measure)
Working	-20	_	85	°C
temperature range				
VDD_BAT	1.1	3.0	4.2	V
I/O power supply	1.8	-	VDD_BAT	V
frequency range	2402	_	2480	MHz

Table 4: Recommended working conditions

## 3.3 Power consumption characteristics

Working Current of EH-MC33 in Active Mode: Condition: VBAT = 3V, VDDIO = 3V, Ambient Temperature: 25°C.

paradigm	descriptions		peak value
	RX	Sensitivity: -95dBm	0.85mA
Radio Frequency Work	ТХ	TX Power:0dBm	2.1mA
		TXPower:+3dBm	4mA
	Beacon	Intermit interval: 1S, Data: 23Bytes,	7.15uA
		0dBm	

Table 5: Power Consumption in RF Working Mode

Power consumption of EH-MC33 in sleep mode: VBAT/HVD = 3V, VDDIO = 3V, ambient temperature: 25°C.

Power Mode	32kHz RCOSC	SRAM hold	Wake-up mode	Power consumption
				(typical)
Power Down	Off	Off	Wake-up via	400nA
			GPIO	
Deep LPS	on	remain	Wake-up via GPIO and clock	1.6uA

Table 6: Power Consumption in Low Power Mode

## 3.4 Bluetooth Radio Frequency (RF)

parametric	bandwidths	Modulatio n Method	rate	typical value	unit (of measure)
firing power			1Mbps	+3	dBm
	2MHz	GFSK	2Mbps	+3	dBm
receiver			1Mbps	-97	dBm
sensitivity			2Mbps	-95	dBm

Table 7: BLE RF characteristics

# 4. ModulesizeandPCBpackagegraphics

## 4.1 ModuleSize



Figure 4: EH-MC33 Module Size

## 4.2 PCBPackageGraphics



Figure 5: EH-MC33 PCB Package Graphics

# 5. Development board



The EH-MC33 development board supports pushbutton functionality and comes with an USB port, which can satisfy the basic development and verification needs of customers. The EH-MC33 supports keypad functions and a built-in serial port to meet customers' basic development and verification needs, and adopts the standard 2.54 pin header for the module's usability io, which facilitates customers' use and enhances the efficiency of twostage development.

# 6. Product handling

- 6.1 storage condition
  - 3.4.1 Products sealed in Moisture Barrier Bags (MBB) should be stored in a non-condensing atmosphere of < 40 °C/90%RH.
  - 3.4.2 The moisture sensitivity class MSL of the module is 3.
  - 3.4.3 After unpacking the vacuum bag, it must be used within 168 hours at 25±5°C and 60% RH, otherwise it will need to be baked before it can be used.

A second second source is online.

## 6.2 electrostatic discharge

- 3.4.4 My body discharge mode (HBM): ±2000 V
- 3.4.5 Charging Device Mode (CDM): ±500 V

## 6.3 Reflow temperature profile

#### It is recommended that the module be reflowed only once.



Figure 6: Reflow temperature profile

## 8.1 ultrasonic vibration

Avoid exposing the Next Sense module to vibration from ultrasonic equipment such as ultrasonic welders or ultrasonic cleaners. Vibration from ultrasonic equipment may resonate with the crystal inside the module, causing the crystal to malfunction or even fail, rendering the module inoperable or degrading its performance.

# 9. Relevant files and information

## 9.1 Related files of Next Rainbow Information

Please click the following web link to view or download more information:

http://www.ehonglink.com/en/h-pd-35.html#\_pp=118\_1336Support Email:support@ehonglink.comSales Email:sales@ehonglink.comContact:021-64769993-201

## 9.2 revision history

date	releases	Updates
2023-05-06	V1.0	Initial release
Version V2.0	Status: Released	www.ehonalink.com 13/14

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01r01 List of applicable FCC rules: FCC Part 15 Subpart C 15.247 & 15.207 & 15.209

Specific operational use conditions:

The module is a Bluetooth module with BLE function. Operation Frequency: 2402-2480MHz

Number of Channel: 40 Modulation: GFSK

Type: EH-MC33 Model PCB Antenna(1.20dBi)

The module can be used for mobile or portable applications with a maximum 1.20dBi antenna. The host manufacturer installing this module into their product must ensure that the final composit product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

#### Limited module procedures

Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212.

#### Trace antenna designs

Not applicable. The module has its own antenna, and doesn't need a host's printed board microstrip trace antenna etc.

#### RF exposure considerations

The module must be installed in the host equipment such that at least 20cm is maintained between the antenna and users' body; and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

#### Antennas

Antenna Specification are as follows: Type: EH-MC33 (PCB Antenna: 1.20dBi) This device is intended only for host manufacturers under the following conditions: The transmitter module may not be co-located with any other transmitter or antenna;

The module shall be only used with the internal antenna(s) that has been originally tested and certified with this module. The antenna must be either permanently attached or employ a 'unique' antenna coupler.

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.)

#### Label and compliance information

Host product manufacturers need to provide a physical or e-label stating "Contains FCC ID: 2ACCRMC33" with their finished product.

Information on test modes and additional testing requirements Operation Frequency: 2402-2480MHz Number of Channel: 40 Modulation: GFSK

Host manufacturer must perform test of radiated & conducted emission and spurious emission, etc according to the actual test modes for a stand-alone modular Version V2.0 Status: Released www.ehonglink.com 14/14 transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 & 15.207 & 15.209 and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Federal Communication Commission Statement (FCC, U.S.)

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.

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.

FCC Caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

#### **IMPORTANT NOTES**

Co-location warning:

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

OEM integration instructions:

This device is intended only for OEM integrators under the following conditions: The transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the external antenna(s) that has been originally tested and certified with this module.

As long as the 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 (for example, digital device emissions, PC peripheral requirements, etc.).

#### Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot 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. Version V2.0

End product labeling:

The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID: 2ACCRMC33".

Information that must be placed in the end user manual:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

#### ISED Statement

English: This device complies with Industry Canada license-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. The digital apparatus complies with Canadian CAN ICES-3 (B)/NMB-3(B).

French: Le présentappareilest conforme aux CNR d'Industrie Canada applicables aux appareils

radio exempts de licence. L'exploitationestautorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareildoit accepter tout brouillageradioélectriquesubi, mêm esi le brouillageest susceptible d'encompromettre le fonctionnement.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

#### Radiation Exposure Statement

This equipment complies with Canada 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.

Déclaration d'exposition aux radiations

Cet équipement est conforme Canada limites d'exposition aux radiations dans un environnement non contrôlé. Cet équipement doit être installé et utilisé à distance minimum de 20cm entre le radiateur et votre corps.

This device is intended only for OEM integrators under the following condition: The transmitter module may not be co-located with any other transmitter or antenna.

As long as the condition above is 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. Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les 1 condition ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

Important Note:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the IC cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for reevaluating the end product (including the transmitter) and obtaining a separate Canada authorization. Note Importante:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l' IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling

The final end product must be labeled in a visible area with the following: Contains IC: 20625-MC33. Plaque signalétique du produit final

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: Contient des IC: 20625-MC33

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual. Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

Mesh self-organizing network type communication equipment, can efficiently and quickly form a non-central wireless broadband network; BLE Wearable Devices, Fitness trackers and smartwatches that monitor heart rate, sleep patterns, steps taken, and other health metrics.