

# **EH-MC60**

Professional *Bluetooth* Solution Provider

## VERSION HISTORY

Version	Comment	Date	Author
V1.0	First edition	2021-4-12	Maggie.Z
V1.1	Revise the antenna pattern, revise the known errors	2021-5-27	Maggie.Z
V1.2	Revise known errors, add development board kits and power consumption tests	2021-6-30	Maggie.Z
V1.3	Modify Pin definition	2021-7-03	Maggie.Z
V1.4	Increase the communication distance between the mobile phone and the module	2021-7-16	Maggie.Z

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## 1. Introduction

EH-MC60 is a low-power, cost-effective Bluetooth SOC module that supports Bluetooth 5 (5.2). 32-bit RISC-V microprocessor, 256KB RAM, support Bluetooth long-distance, big data ,BLE Mesh.

The module supports a variety of working modes, including master-slave integration, multi-master-slave (4 masters and 4 slaves), which can meet the needs of a variety of application scenarios.

The module provides up to 1MB of ROM space, supports various hardware interfaces, and can directly connect to external devices (such as sensors) without an external processor to meet customer customization requirements.

EH-MC60 supports customers to build terminal equipment and enter the market faster.

## 2. Quick Specifications

Bluetooth Version				
BLE Version	Bluetooth 5.2 Low Energy Bluetooth/SIG Mesh			
Radio				
Frequency	2402MHz-2480MHz			
Transmit power	7.26dBm@BLE mode			
Receiver sensitivity	-96dBm@BLE 1Mbps			
Modulations	GFSK at 1 Mbps, 2 Mbps data rates			
Antenna				
BLE Long range	Supported			
OTA	Supported			
Electrical Specifications				
Power supply	VBAT:1.8 VDC to 4.3 VDC, 3.3VDC typical			
Current consumption	Active TX mode( TX power:0dBm):6.6mA			
@3.3V DCDC	Active RX mode : 6.1mA Deep sleep(without SRAM retention): 0.9 $\mu$ A Deep sleep with 32K SRAM retention: 1.9 $\mu$ A			
Hardware				
Dimensions	17.8x12.8x2.20mm			
Temperature Range	-40°C to +85°C			
Interfaces	UART SPI	I2C PWM	GPIO*20 Swire	ADC

### 3. Applications

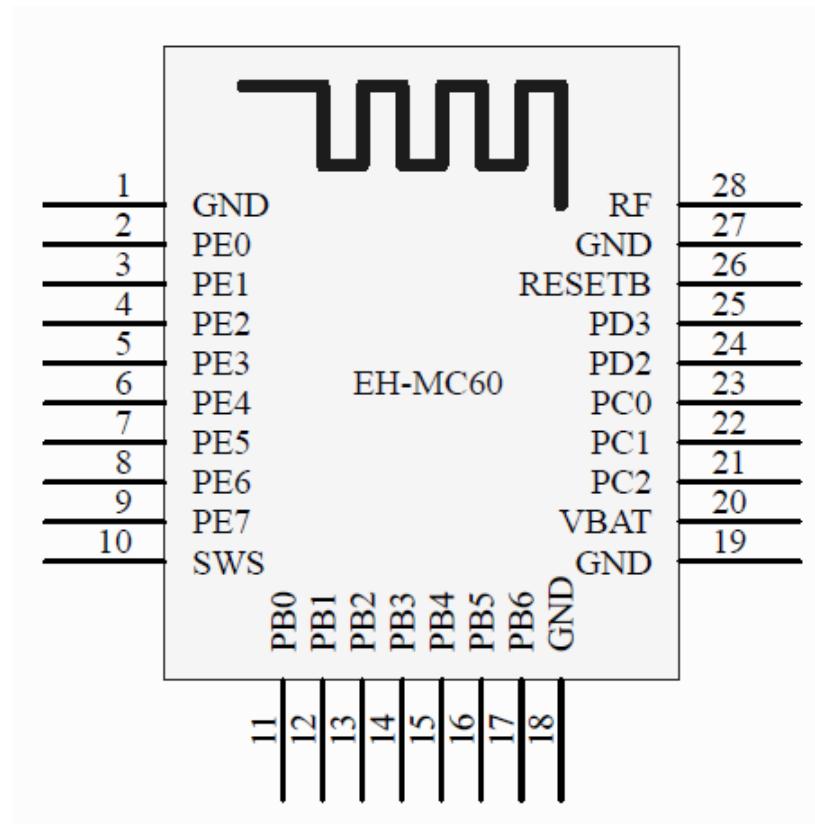
- Apple Home Kit
- Apple Find My Network
- Low-Power Sensor Networks
- Fitness / Sports / Health
- Smart Home
- Smart lighting systems
- iBeacons™ / Proximity
- BLE Mesh applications
- Smart Toys / accessories
- Internet of Things
- Hotel Automation
- Office Automation

### 4. Ordering Information

Part number	description
EH-MC60	Onboard antenna module Support external antenna (externally led out by the pad hole)

## 6. Pin Descriptions

### 6.1 Pin-out



### 6.2 Pin Descriptions

No.	Pin	Default	Function 1	Function 2	Function 3	Function 4	Simulation function 5
1	GND	GND	-	-	-	-	-
2	PE0	GPIO	PWM3_O	FREQ_CHN_I	UART1_TX	I2C_SCK_IO	-
3	PE1	GPIO	PWM1_O	ADC_Q_DAT3	UART1_CTS_I	I2C_SCK_IO	-
4	PE2	GPIO	PWM2_O	ADC_Q_DAT4	UART1_RTX_I_O	I2C_SDA_IO	-
5	PE3	GPIO	PWM0_O	ADC_Q_DAT5	UART1_RTS	I2C_SDA_IO	-
6	PE4	GPIO	PWM4_O	ADC_Q_DAT6	RX_CYC2LNA	TDI_I	-
7	PE5	GPIO	PWM5_O	ADC_Q_DAT7	TX_CYC2PA	TDO	-
8	PE6	TMS	-	ADC_Q_DAT8	PWM2_N	TMS_IO	-
9	PE7	TCK	-	ADC_Q_DAT9	PWM3_N	TCK_I	-
10	SWS	SWS	Programming pin	-	-	SWS_IO	-

11	PB0	GPIO	PWM5_O	TX_EN_I	TX_CYC2PA	HSPI_HOLD_N_IO	lp_comp<0>/sar_in<0>
12	PB1	GPIO	PWM3_O	TX_ON_I	RX_CYC2LNA	CODEC_IRQ_O/HSPI_WP_N_IO	lp_comp<1>/sar_in<1>
13	PB2	GPIO	UART0_TX_O	DAC_I_DAT2_I	I2C_SCK_IO	DMIC_DAT_I/HSPI_DI_IO	lp_comp<2>/sar_in<2>
14	PB3	GPIO	TX_DAT0_I	UART0_RTX_I_O/DAC_I_DAT3_I	I2C_SDA_IO	DMIC_CLK1_O/HSPI_DO_IO	p_comp<3>/sar_in<3>
15	PB4	GPIO	TX_DAT2_I	UART0_RTS_O / DAC_I_DAT4_I	PWM0	DMIC_CLK2_O/HSPI_CK_IO	lp_comp<4>/sar_in<4>
16	PB5	GPIO	TX_DATA_VAL	PWM1_O/DAC_I_DAT5_I	CLK	CODEC_MCLK_I/ATSEL[0]	lp_comp<5>/sar_in<5>
17	PB6	GPIO	RATE0_I	UART0_CTS_I/DAC_I_DAT6_I	MISO_IO1	TX_CYC2PA_O/HSPI_CN_IO	lp_comp<6>/sar_in<6>
18	GND	GND	-	-	-	-	-
19	GND	GND	-	-	-	-	-
20	VBAT	3.3V	-	-	-	-	-
21	PC2	GPIO	ADC_I_DAT0	DMIC_CLK1_O/DAC_Q_DAT2_I	ATSEL[1]	I2C_SDA_IO	-
22	PC1	GPIO	DMIC_DA_T_I-	TX_CLK	ATSEL[0]	I2C_SCK_IO	-
23	PC0	GPIO	PWM0_O	RX_EN_I	CSN	SWM_IO	-
24	PD2	GPIO	PWM2_N	ADC_I_DAT4	MISO_IO1	UART0_TX	-
25	PD3	GPIO	PWM3_N_O	ADC_I_DAT5	MOSI_IO0	UART0_RTX_IO	-
26	RES ET	RESET	-	-	-	-	-
27	GND	GND	-	-	-	-	-
28	RF	-	-	-	-	-	-

**Notice:**

1. General-purpose input/output; support wake-up function. All are internal pull-up and pull-down circuits.
2. The IO voltage range is 1.8V~3.6V, and the typical value is 3.3V.
3. For debugging, it is recommended to keep SWS test points.
4. If used with MCU chip, it is recommended to connect the reset pin.

## 7. Electrical Specifications

### 7.1 Recommended Operation Conditions

Operating Condition	Min	Typical	Max	Unit
Operating Temperature Range	-40	+20	+85	°C
Storage Temperature Range	-40	+20	+85	°C
Battery (VDD_BAT) operation	1.8	+3.7	+4.3	V
I/O Supply Voltage (VDD_PIO)	1.8	+3.3	+3.6	V
AIO input	0	-	+3.3	V
Frequency range	2402		2480	MHz

### 7.2 Module power consumption

- Working current: Condition: VBAT=3V, VDDIO=3V, ambient temperature: 25°C

Power mode	Current Consumption(Max)	Unit
Active RX mode, with DCDC	6.1	mA
Active RX mode, with LDO	11.5	mA
Active TX mode(@0dBm,with DCDC)	6.6	mA
Active TX mode(@0dBm,with LDO)	12.5	mA

Module average power consumption

- Minimum power consumption: Condition: VBAT=3V, VDDIO=3V, ambient temperature:25°C

Power Mode	Always on Registers	32k RCOSC/XTAL	Retention on SRAM	CPU	Wakeup Method	Current Consumption (typical)
						(typical)
suspend	ON	ON	Retention	OFF	GPIO 32kHz Timer	40~50 μ A
Deep sleep with retention	ON	ON	Retention 32K	OFF	GPIO 32kHz Timer	2~3 μ A
Deep sleep	OFF	ON	OFF	OFF	GPIO 32kHz Timer	1~2 μ A

Module minimum power consumption

Condition	Level	Max Rating
Human body contact discharge rate JEDEC EIA/JESD22-A114	1C	2000V (all pins)
Charge device type according to contact discharge JEDEC EIA/JESD22-C101	C1	500V (all pins)

ESD Protection

## 8. Software/ Firmware

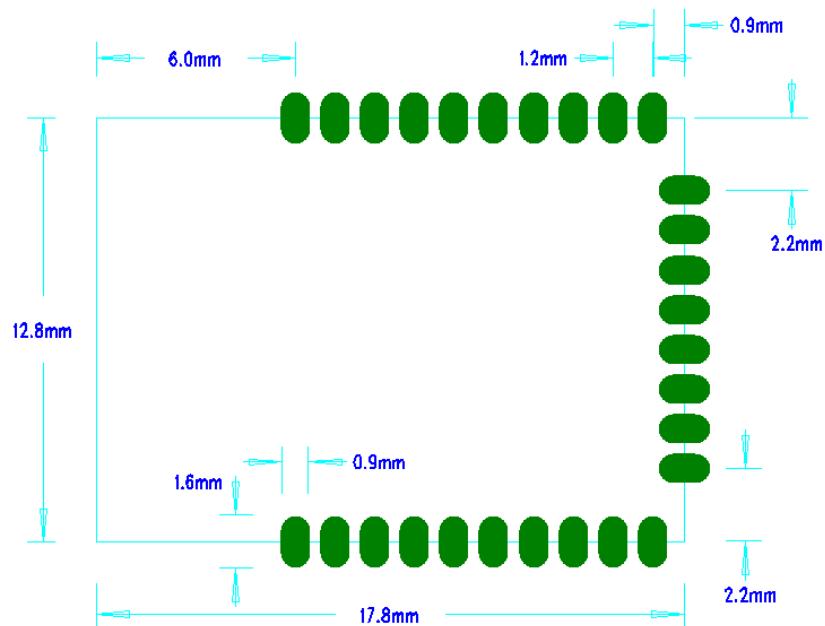
Software Support	
Standard Software	Ehong provide module with standard software for customer to develop. Support to make some modification and support customized MAC address
SDK development	Ehong provide SDK and description
Software encryption	Support software encryption for mass production

## 9. Mechanical Data

### 9.1 Dimensions

17.8\*12.8\*2.2mm

## 9.2 Recommended PCB Land Pads



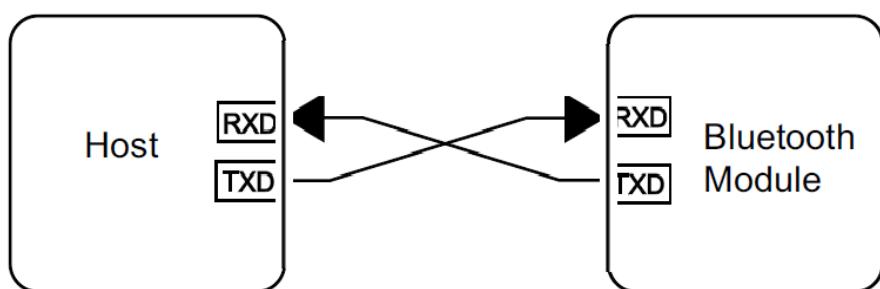
# 10. Physical Interfaces

## 10.1 GPIO

The General input/output can be set different function according the the pinmux configuration in the code including PWM, UART, i2C etc.

## 10.2 UART

EH-MC60 supports 2 UARTs, and the two interfaces support full-duplex transmission and reception. Support hardware flow control through RTS and CTS.



**Note:** Baud rate supports from 1200 bps from 2Mbps

### 10.3 I2C Master/ Slave

There is an independent hardware I2C interface in EH-MC60, which is composed of serial data line (SDA) and serial clock (SCL).

Support the configuration of master-slave mode.

Support 7/10 bit I2C address; configurable I2C address (slave mode); standard rate (1-100kHz), fast rate (100kHz-400kHz).

### 10.4 SPI

EH-MC60 has an independent SPI interface. Support master-slave mode, support two-wire and three-wire SPI interface, support DMA.

### 10.5 More interfaces

EH-MC60 has a single-bus SWS interface, supports single-wire communication, and the maximum rate can reach 2Mbps.

## 11. RF Design Notes

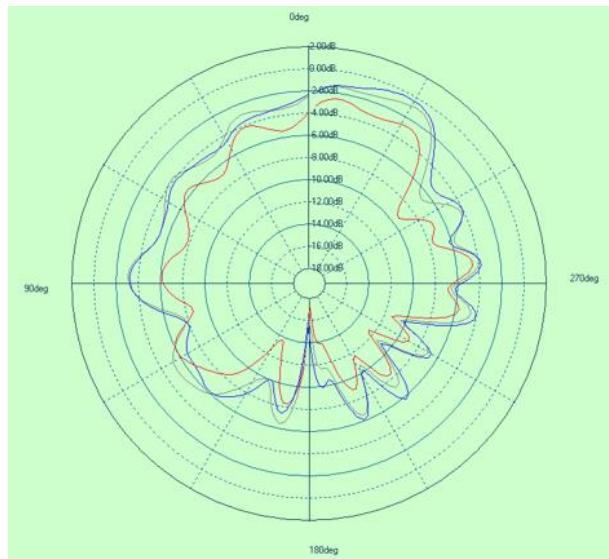
### 11.1 Recommended RF Layout & Ground Plane

For EH-MC60, the integrated antenna needs a suitable reference ground plane to improve radiation efficiency.

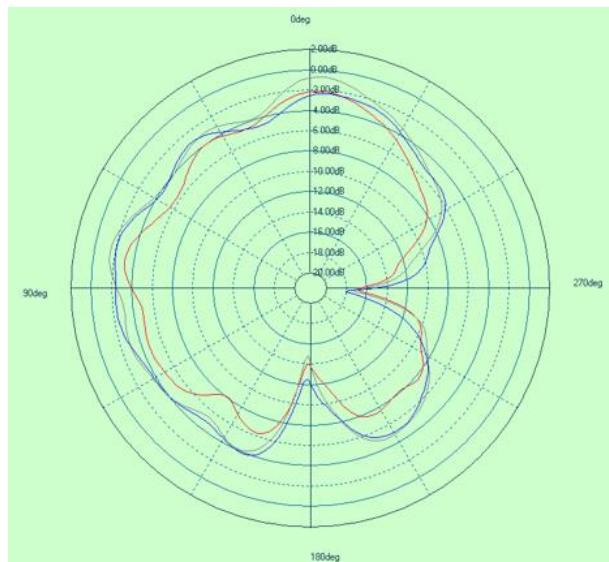
The area extending from under the antenna part of the module should be kept free of copper and other metals. The module should be placed on the edge of the PCB with the antenna edge facing outward.

## 11.2 Antenna Patterns

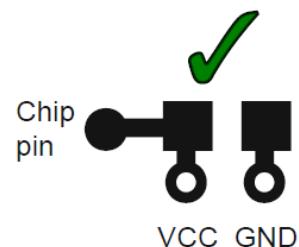
### 11.2.1 90 degree direction



### 11.2.2 0 degree direction



## 12. Layout and Soldering



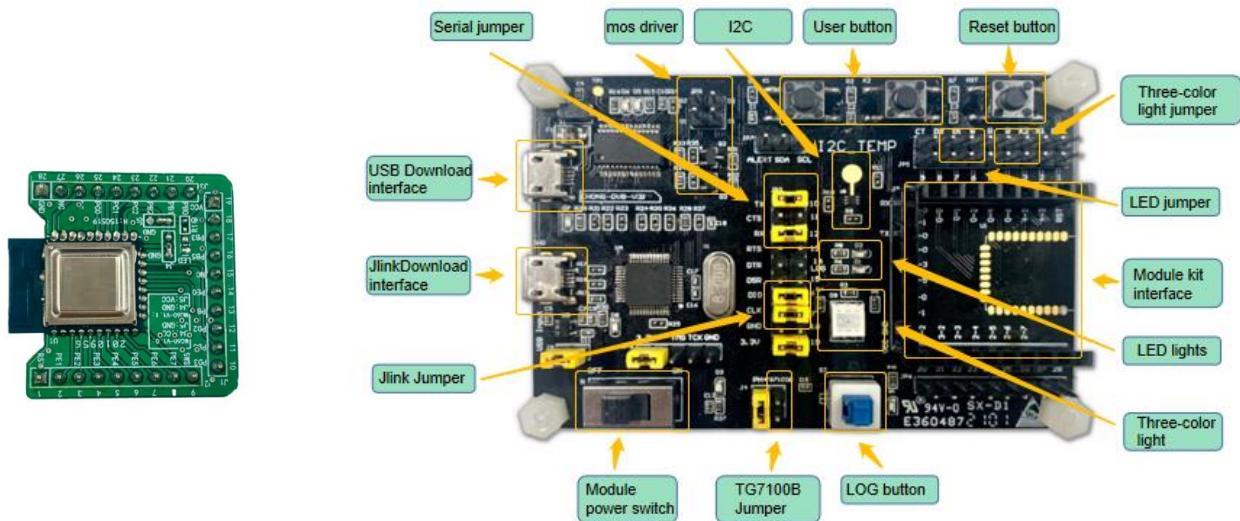
### 12.1 Layout

- Module power supply: 3v button battery or DC 3.3v
- Power pin connection capacitor is as close as possible to chip and pin
- Decoupling the power supply from the chip using a capacitor
- Use capacitors to prevent noise from coupling back to the power plane.

### 12.2 Layout Guidelines

To optimize antenna performance, place the module in the corner of the PCB as shown in Figure 6. Do not cover copper and trace the antenna clearance area. Keep the antenna area as far away as possible from the power supply and metal components. Connect all GND pins directly to a solid GND plane. Place GND vias as close as possible to the GND pin. Use a good layout method to avoid excessive noise coupling with signal lines or supply voltage lines

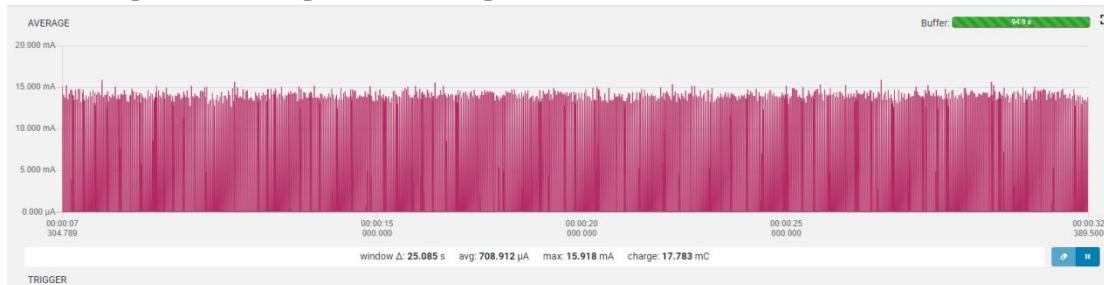
## 13. Development Kit



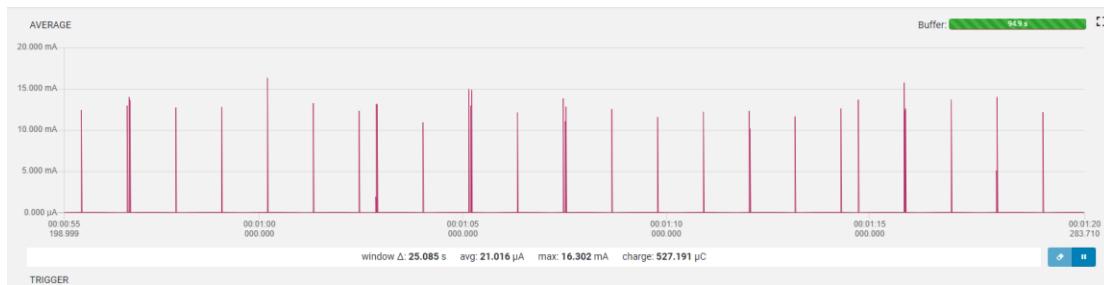
Note: For the use of development boards and kits, please refer to Ehong Development Board datesheets.

## 14. Module power consumption test

Broadcast power consumption (transmit power: 2.8; broadcast interval: 30ms): about 708 uA;



Power consumption when connected to mobile phone: about 21uA;



Enter low power consumption mode: about 0.944uA;



## 15. Communication distance

Test method: connect the mobile phone to the module, connect to the communication 20 times, and send 20 bytes each time;

Communication distance: about 200 meters;

## 16. Related Documents

### **Ehong Documents:**

Visit website and download: <http://www.ehonglink.com>

Supports: [support@ehonglink.com](mailto:support@ehonglink.com) phone: +0086 21-64769993-203

Sales: [sales@ehonglink.com](mailto:sales@ehonglink.com)

## FCC Statement

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

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 Radiation Exposure Statement:

This equipment complies with FCC 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.

## ISED RSS Warning/ISED RF Exposure Statement

### ISED RSS Warning:

This device complies with Innovation, Science and Economic Development 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.

Le présent appareil est conforme aux CNR d'ISED 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.

### ISED RF exposure statement:

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

Le rayonnement de la classe b repecte ISED fixaient un environnement non contrôlés. Installation et mise en œuvre de ce matériel devrait avec échangeur distance minimale entre 20 cm ton corps. Lanceurs ou ne peuvent pas coexister cette antenne ou capteurs avec d'autres.

## FCC/ISED Label Instructions:

If using a permanently affixed label, the modular transmitter must be labeled with its own FCC or ISED identification number, and, if the FCC or ISED 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 FCC ID: 2ACCRMC60, IC:20625-MC60".

Any similar wording that expresses the same meaning may be used. The Grantee may either provide such a label, an example of which must be included in the application for equipment authorization, or, must provide adequate instructions along with the module which explain this requirement.

This radio transmitter has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below 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.

## OEM Guidance

### 1. Applicable FCC rules

This device complies with part 15.247 of the FCC Rules.

### 2. The specific operational use conditions

This module can be used in IoT devices. The input voltage to the module is nominally 3.3 V DC. The operational ambient temperature of the module is -40 °C ~ 85 °C. the embedded PCB antenna is allowed. Any other external antenna is prohibited.

### 3. Limited module procedures

N/A

### 4. Trace antenna design

N/A

### 5. RF exposure considerations

The equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body. If the equipment built into a host as a portable usage, the additional RF exposure evaluation may be required as specified by 2.1093.

## 6. Antenna

Antenna type: PCB antenna Peak gain : 1.55dBi

## 7. Label and compliance information

An exterior label on OEM's end product can use wording such as the following: "Contains Transmitter Module FCC ID: 2ACCRMC60" or "Contains FCC ID: 2ACCRMC60"

## 8. Information on test modes and additional testing requirements

- a)The modular transmitter has been fully tested by the module grantee on the required number of channels, modulation types, and modes, it should not be necessary for the host installer to re-test all the available transmitter modes or settings. It is recommended that the host product manufacturer, installing the modular transmitter, perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits (e.g., where a different antenna may be causing additional emissions).
- b)The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufacturers should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.
- c)If the investigation indicates a compliance concern the host product manufacturer is obligated to mitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as well as to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to not cause interference. The operator of the host product will be obligated to stop operating the device until the interference have been corrected .

## 9. Additional testing, Part 15 Sub part B disclaimer

The final host / module combination need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device.

The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369. For host products with certified modular transmitter, the frequency range of investigation of the composite system is specified by rule in Sections 15.33(a)(1) through (a)(3), or the range applicable to the digital device, as shown in Section 15.33(b)(1), whichever is the higher frequency range of investigation

When testing the host product, all the transmitters must be operating. The transmitters can be enabled by using publicly-available drivers and turned on, so the transmitters are active. In certain conditions it might be appropriate to use a technology-specific call box (test set) where accessory 50 devices or drivers are not available. When testing for emissions from the unintentional radiator, the transmitter shall be placed in the receive mode or idle mode, if possible. If receive mode only is not possible then, the radio shall be passive (preferred) and/or active scanning. In these cases, this would need to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the unintentional radiator circuitry is enabled. Testing laboratories may need to add attenuation or filters depending on the signal strength of any active beacons (if applicable) from the enabled radio(s). See ANSI C63.4, ANSI C63.10 and ANSI C63.26 for further general testing details.

The product under test is set into a link/association with a partnering device, as per the normal intended use of the product. To ease testing, the product under test is set to transmit at a high duty cycle, such as by sending a file or streaming some media content.