

Bluetooth Device ( **MHCB05P-B** )  
**Specification**

Rev 1.6

CMIIT ID (MHCB05P-B) : 2019DP6424

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## Version update instructions

Date	Version	Update contents
2019-05-06	1.0	Initial
2019-05-22	1.1	Modify product coding rules
2019-08-22	1.2	Modify the module pin diagram
2019-08-28	1.3	CMIIT ID added
2020-03-13	1.4	Modify the serial port ID and package size
2021-01-04	1.5	a. Modify pin definition diagram b. Electrostatic level description; c. Update time sequence requirements for power-on; d. Update the packaging content; e. Update module design considerations.
2021-11-03	1.6	The ram space has been fixed

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## Contents

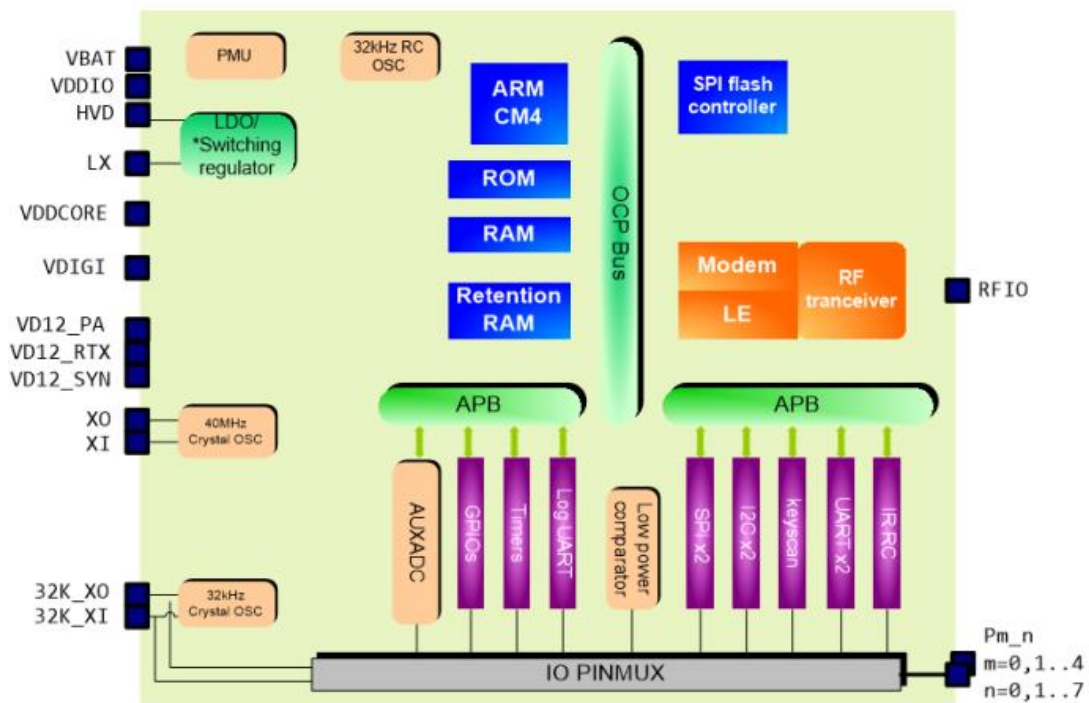
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# 1 Product description

## 1.1 Solution overview

MHCB05P-B is a high-performance BLE wireless module based on Realtek XMB1R(RTL8762CMF) solution, built-in ARM Cortex-M4F Core, High transmitting power. MHCB05P-B are suitable for many application scenarios such as smart home and smart wearable. The module provides the highest integration in the industry, has significant system performance, low power consumption and low cost, etc. MHCB05P-B an integrated PCB on-board antenna.

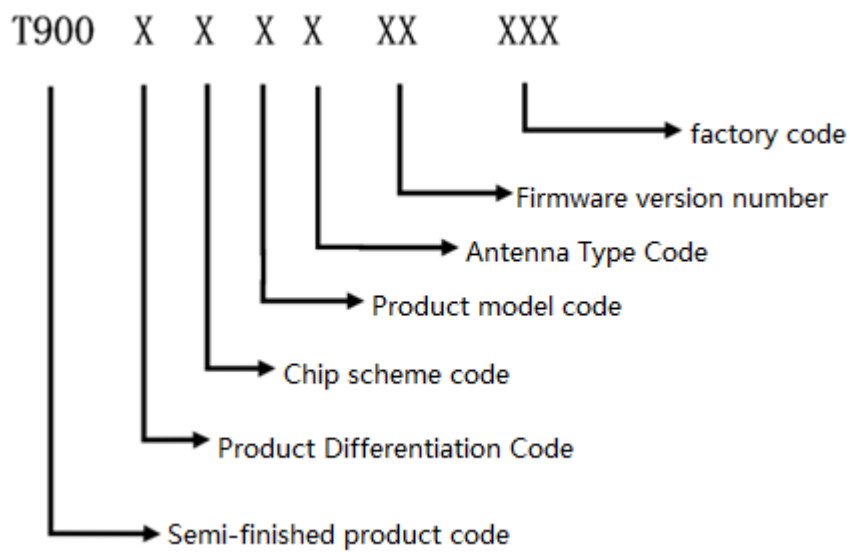
## 1.2 Functional block diagram



1-1 Functional block diagram

## 1.3 Product code

According to different customers, there will be different PN numbers, the rules are as follows:



Product Differentiation Code (X)	
H	MHCB05P-B model
06	on-board antenna
02	External antenna

## 2 System hardware advantage

Features of MHCB05P-B :

- Module size: 13mm\*23.5mm\*3.4mm
- High-performance 32-bit 40 MHz ARM Cortex®-M4
- 512KB flash, 160KB RAM
- Minimum receiving sensitivity: -97dBm
- 7.3mA current at RX

- 2.6uA current at DLSP (Wakeup by GPIO Timer)
- 450nA current at Power down (Wakeup by GPIO)

## 3 Pin description

### 3.1 Pin layout

MHCB05P-B pin distribution of the Chip is shown in Figure 3-1

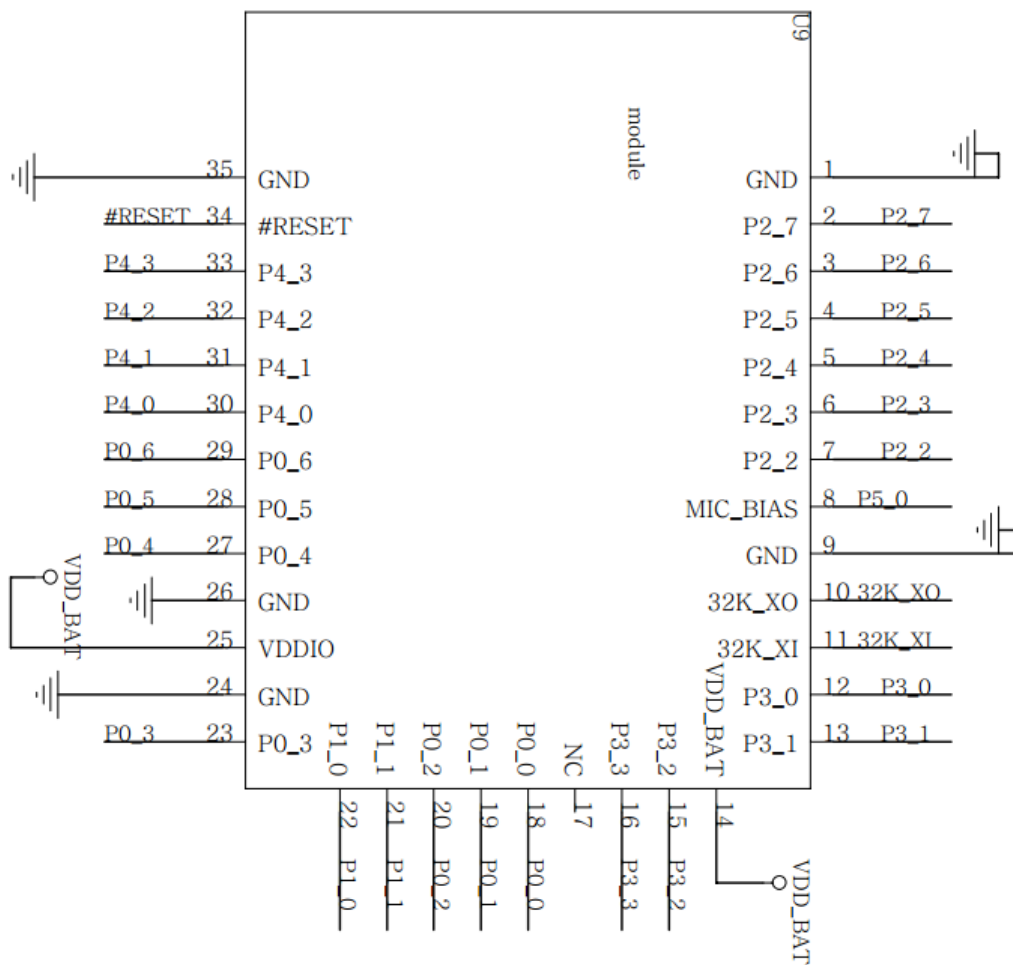
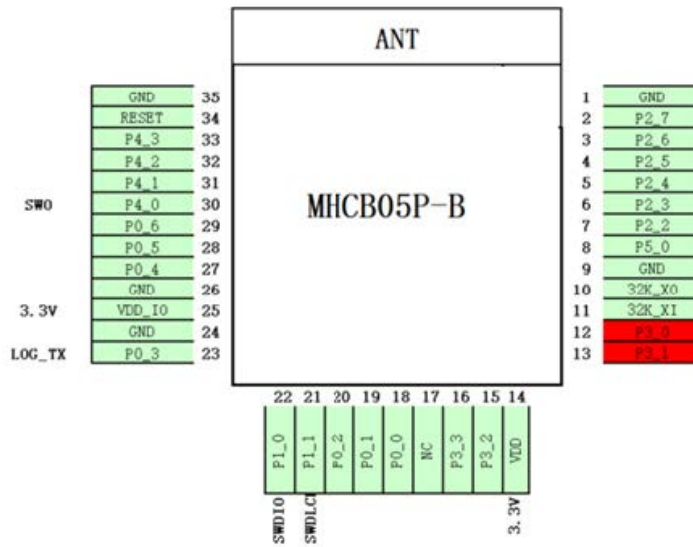


Figure 3-1 MHCB05P-B pin definition description



3-2 MHC B05P-B pin definition description

## 3.2 Pin definition

MHC B05P-B have 35 pins, the pin definitions are as follows:

No.	Pin	Function Description
1	GND	GND
2	P2_7	GPIO
3	P2_6	GPIO
4	P2_5	GPIO
5	P2_4	GPIO
6	P2_3	GPIO
7	P2_2	GPIO
8	P5_0	GPIO
9	GND	GND
10	32K_XO	32K_XO
11	32K_XI	32K_XI
12	P3_0	TX
13	P3_1	RX
14	VDD	3.3V
15	P3_2	GPIO
16	P3_3	GPIO
17	NC	NC
18	P0_0	GPIO
19	P0_1	GPIO

20	PO_2	GPIO
21	P1_1	JTAG (SWDLCK)
22	P1_0	JTAG (SWDIO)
23	PO_3	LOG output
24	GND	GND
25	VDD_IO	3.3V
26	GND	GND
27	PO_4	GPIO
28	PO_5	GPIO
29	PO_6	GPIO
30	P4_0	JTAG (SWO)
31	P4_1	GPIO
32	P4_2	GPIO
33	P4_3	GPIO
34	RESET	RESET
35	GND	GND

Instruction:

- suggest PO\_3 is used as NC or pull-up, If the level is low immediately after the power-on, the chip enters bypass flash mode;
- PIN12, PIN13 (UART0) Just used for Product Test, It is not recommended for use by users;
- If UART serial port communication is required, UART1 is recommended. Other GPIO can be used. For details, see the chip data manual.

## 4 Electrical parameters

Note: Unless otherwise specified, test conditions are as follows: VDD=3.3V, temperature 25 °C.

### 4.1 Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit.
Power supply voltage	VDD	1.8	3.3	3.6	V
Storage temperature	TST R	-55	-	125	°C
Operating temperature	TOP R	-40	-	85	°C



## 4.2 BLE RF

### 4.2.1 Receiver

Parameter	Condition	Minimum	Typical	Maximum
Sensitivity (dBm)	PER $\leq$ 30.8%	-97	-	-
Maximum Input Level (dBm)	PER $\leq$ 30.8%	-	-1	-
C/I	C/I <sub>co-channel</sub> (dB)	21	-	-
	C/I <sub>+1MHz</sub> (dB)	15	-	-
	C/I <sub>-1MHz</sub> (dB)	15	-	-
	C/I <sub>+2MHz</sub> (dB)	-17	-	-
	C/I <sub>-2MHz</sub> (dB)	-15	-	-
	C/I <sub>+3MHz</sub> (dB)	-27	-	-
	C/I <sub>image</sub> (dB)	-9	-	-
	C/I <sub>image+1MHz</sub> (dB)	-15	-	-
Blocker Power (dBm)	30~2000MHz, Wanted signal level =-67dBm	-30	-	-
	2003~2399MHz, Wanted signal level =-67dBm	-35	-	-
	2484~2997MHz, Wanted signal level =-67dBm	-35	-	-
	3000MHz~12.75GHz, Wanted signal level =-67dBm	-30	-	-
Max PER Report Integrity	Wanted signal: -30dBm	-	50%	-
Max Intermodulation level (dBm)	Wanted signal (f <sub>0</sub> ): -64dBm Worst intermodulation level @2f <sub>1</sub> -f <sub>2</sub> =f <sub>0</sub> ,  f <sub>1</sub> -f <sub>2</sub>  =n MHz, n=3, 4, 5...	-50	-	-

### 4.2.2 Transmitter and emitter

Parameter	Condition	Minimum	Typical	Maximum
Maximum Output Power (dBm)	-	-	-	2
Adjacent Channel Power Ratio (dBm)	+2MHz	-	-	-20
	-2MHz	-	-	-20
	$\geq$ +3MHz	-	-	-30
	$\leq$ -3MHz	-	-	-30
Modulation Characteristics	$\Delta f_{1\text{avg}}$ (kHz)	-	250	-
	$\Delta f_{2\text{max}}$ (kHz)	185	-	-
	$\Delta f_{2\text{max}}$ Pass Rate (%)	-	100	-
	$\Delta f_{2\text{avg}} / \Delta f_{1\text{avg}}$	-	0.88	-
Carrier Frequency Offset and Drift	Average F <sub>n</sub> (kHz)	-	12.5	-
	Drift Rate (kHz/50 $\mu$ s)	-	10	-
	Avg Drift (kHz/50 $\mu$ s)	-	10	-
	Max Drift (kHz/50 $\mu$ s)	-	10	-
Output power of second harmonic(dBm)	-	-	-50(note)	-
Output power of third harmonic(dBm)	-	-	-50(note)	-

## 5 Reflow soldering temperature curve

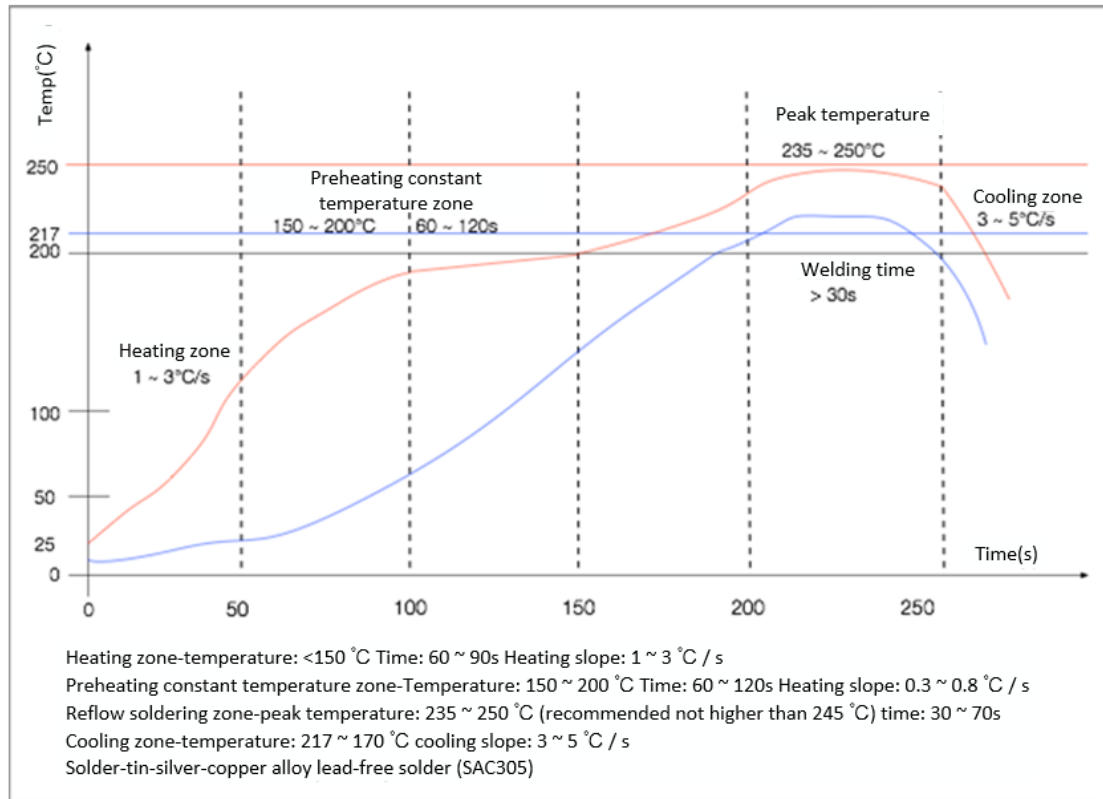


Figure 5-1 MHC05P-B Reflow temperature curve

Soldering instructions: In double-sided SMT, after the T-side (top side) components are reflowed for the first time, the circuit board needs to be flipped and reflow soldered on the other side. In the second reflow, the already soldered T-side components will be fixed by the surface tension of the solder paste to prevent the components from dropping under the effect of gravity. The design of the mother board and the yin and yang board are over-furnace (furnace temperature 240-260°C) and verified that there is no defect. To ensure its stability, it is recommended to dispense.

## 6 Electrostatic discharge voltage

Figure 6-1 : Electrostatic discharge parameters					
Name	symbol	Guideline	Level	Max	Unit
Electrostatic discharge voltage (Human body model)	VESD (HBM)	Temp: 23 ± 5 °C IEC 61000-4-2:2008	2	2000	V

## 7 Mechanical Dimension

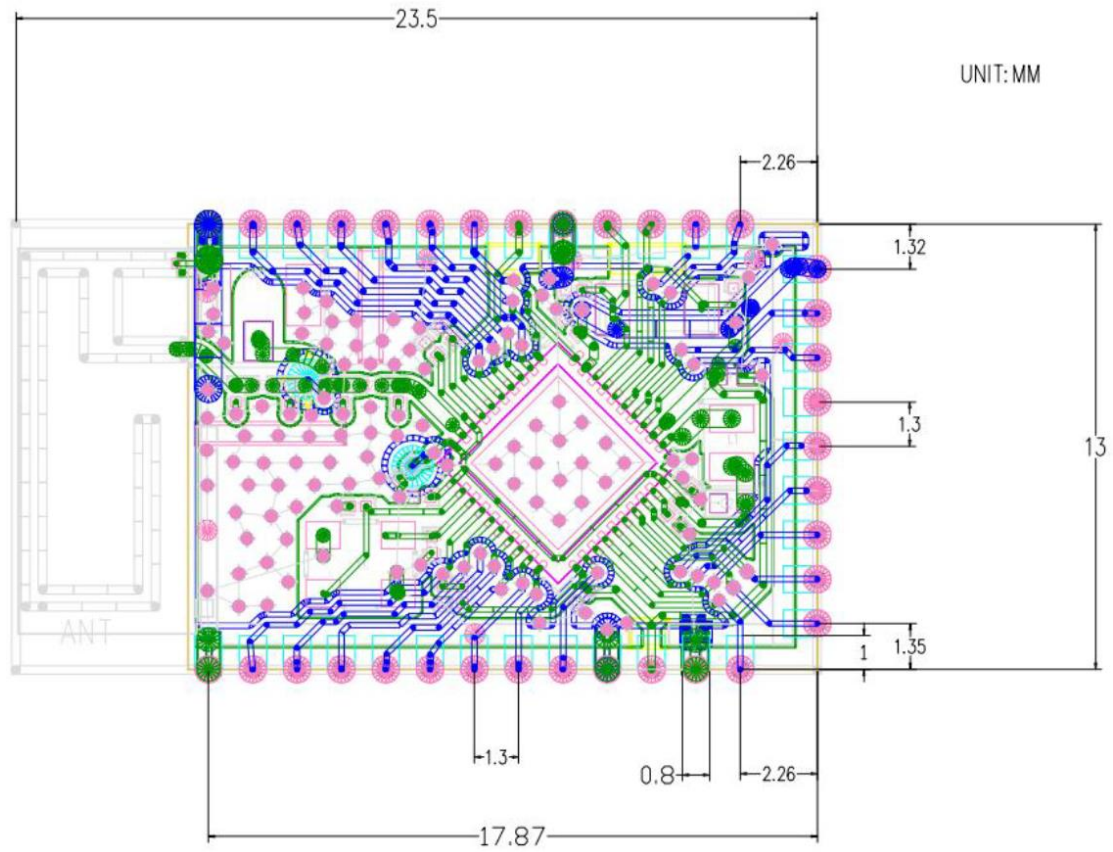


Figure 9-1 MHC B05P-B Mechanical Dimension

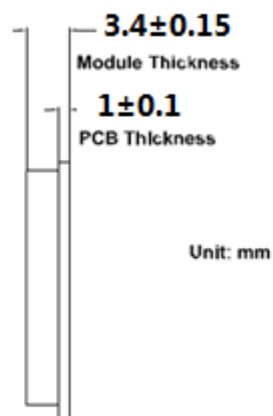


Figure 9-2 MHC B05P-B Mechanical Dimension

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## 8 MSL level / Storage conditions

- MSL level: Level 3-less than or equal to 30°C / 60% RH 168 hours workshop life.
- Storage conditions: The products should be handled carefully during transportation, And they should not be squeezed against each other to avoid being impacted and Strongly vibrated. The storage environment should be kept dry and ventilated. The ambient temperature should be between 5°C and 35°C. It should not be stored with Items that can generate corrosive gases.

## 9 Delivery Checklist

- Complete packaging
- Evaluation tool (SPI / UART / JTAG interface)
- The software supports customer integration and performance test certification.
- Unit test / Qualification report
- Product specifications
- Complete and clear identification, such as production serial number, MAC, etc.
- Agency certification report

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## Module design considerations

- For the layout of the module antenna part, please refer to "Xiaomi module selection and application environment suggestions".
- The module is recommended to be placed at the corner of the bottom board with the antenna facing outwards. The antenna should be far away from metal devices, sensors, high-frequency signal transmission devices and high-frequency signal traces; increasing the distance from the position makes the energy of the interference source increase with the increase in distance Attenuation, and then reduce the coupling of noise, improve the overall performance of the antenna.
- For the selection of the power supply chip for the module power supply, it is recommended that the output current be at least 500mA.
- An independent power supply is recommended for the power supply of the module.
- It is forbidden for any object to interfere with the antenna.
- It is forbidden for below PCB antenna banned walk the line, but do the clearance process.
- Please use the same power supply network for all power interfaces and pull-up power supplies that need to be supplied by the module to ensure that the power-on sequence of the power interface of the module is consistent.
- Power supply ripple requirement for the module: When sending data packets, the power supply ripple must be less than 100mV.
- When communicating between the module and the CPU through SDIO and UART, it is best to connect a 200 ohm resistor in series with the signal line (the resistance can be adjusted according to actual needs) to reduce the drive current, reduce interference, and eliminate the interference. Timing problems caused by inconsistent line lengths.
- Avoid high-speed signals around and below the module. If it cannot be avoided, it is recommended to strictly follow the high-frequency signal processing rules to route the high-speed signals as far as possible. When the data or addr lines are involved, the ground will be packaged in groups handle.
- If high-power devices such as motors are involved in the system design, the circuit return path (GND) of the module must be separated from the return path (GND) of other high-power devices, and the two return paths ( GND ) are connected
- When selecting the module, try not to use the PCB onboard antenna, because the PCB onboard antenna is more interference, and it is easy to couple the interference source to affect the performance of the antenna. It is best to use an external antenna, which can lead out the PCB through the cable. In this way, the influence of high-frequency interference signals on the board on the antenna performance of the module will be weakened.
- After the product design is completed, it is recommended to test the antenna performance of the whole machine according to the product definition to confirm whether the antenna performance meets the requirements of the whole machine.
- Module reference design circuit, please refer to the module schematic diagram.

### **FCC compliance 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:** 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.

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 FCC RF exposure limits set forth for an uncontrolled environment. This device should be installed and operated with minimum distance 20cm (8 inches) between the device and user body.

### **ISED compliance statement**

This device complies with Innovation, Science and Economic Development Canada (ISED) licence-exempt RSS standard(s). 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 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 and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet appareil est conforme à la ou aux normes RSS exemptées de licence pour Innovation, Science et développement économique Canada. Le fonctionnement est soumis aux deux conditions suivantes: (1) ce dispositif ne peut pas causer d'interférence nocive, et (2) ce dispositif doit accepter toute interférence reçue, y compris les interférences pouvant causer un fonctionnement indésirable.

Cet équipement respecte les limites d'exposition aux rayonnements ionisants fixées pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec une distance minimale de 20cm entre le radiateur et votre corps. Cet émetteur ne doit pas être localisé ou fonctionner en conjonction avec une autre antenne ou un autre émetteur.

## Important Note

This module contains one radio transmitter. It must not be installed to co-locate and operating simultaneously with other radios in the host system except following FCC multi-transmitter product procedures. Additional testing and device authorization may be required to operate simultaneously with other radios.

The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination. The firmware setting is not accessible by the end-user.

The host product manufacturer is responsible for compliance with any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

The end-user manual shall include all required regulatory information/warnings as shown in this manual, including "This product must be installed and operated with a minimum distance of 20 cm between the radiator and user body".

This device has got an FCC ID: 2A4GZ-MHCB05PB and IC: 28570-MHCB05PB. The end product must be labeled in a visible area with the following: "Contains FCC ID: 2A4GZ-MHCB05PB" and/or "Contains IC: 28570-MHCB05PB".

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

The antenna must be installed such that 20cm is maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna.

As long as the 2 conditions above are met, further transmitter tests 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.

## Note importante

Ce module contient un émetteur radio. Il ne doit pas être installé de façon à se localiser et à fonctionner simultanément avec d'autres radios dans le système hôte, sauf en suivant les procédures de produit FCC multi-émetteur. Des essais supplémentaires et une autorisation de l'appareil peuvent être nécessaires pour fonctionner simultanément avec d'autres radios.

La disponibilité de certains canaux spécifiques et/ou bandes de fréquences opérationnelles dépendent du pays et sont programmés à l'usine pour correspondre à la destination prévue. Le paramètre du micrologiciel n'est pas accessible par l'utilisateur final.

Le fabricant du produit hôte est responsable du respect de toute autre règle de la FCC qui s'applique à l'hôte non couvert par l'octroi de la certification de l'émetteur modulaire. Le produit hôte final nécessite toujours des essais de conformité de la partie 15 sous-partie B avec l'émetteur modulaire installé.

Le manuel de l'utilisateur final doit comprendre toutes les informations/avertissements réglementaires requis, comme indiqué dans le présent manuel, y compris «ce produit doit être installé et utilisé à une distance minimale de 20 cm entre le radiateur et le corps de l'utilisateur».

Cet appareil a une identification FCC: 2A4GZ-MHCB05PB et IC: 28570-MHCB05PB. Le produit final doit être étiqueté dans une zone visible avec la mention suivante: «contient l'id FCC: 2A4GZ-MHCB05PB» et/ou «contient IC: 28570-MHCB05PB».

Cet appareil est destiné uniquement aux intégrateurs OEM dans les conditions suivantes:

L'antenne doit être installée de telle sorte que 20cm soit maintenu entre l'antenne et les utilisateurs, et le module émetteur ne peut pas être co-situé avec un autre émetteur ou antenne.

Tant que les 2 conditions ci-dessus sont remplies, d'autres tests d'émetteur ne seront pas nécessaires. Cependant, l'intégrateur OEM est toujours responsable de tester leur produit final pour toute exigence de conformité supplémentaire requise avec ce module installé.



## OEM instructions

(Reference KDB 996369 D03 OEM Manual v01, 996369 D04 Module Integration Guide v02)

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 1.8~3.6V<sub>DC</sub>. The operational ambient temperature of the module is -20 °C ~ +45 °C. The external antenna is NOT allowed.
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.
6. Antenna  
Antenna type: PCB antenna; Peak antenna gain:0.2 dBi
7. Label and compliance information  
An exterior label on OEM's end product can use wording such as the following: "Contains FCC ID: 2A4GZ-MHCB05PB" and/or "Contains IC: 28570-MHCB05PB"
8. Information on test modes and additional testing requirements
  - 1) 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).
  - 2) 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.

3) 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 .

4) Additional testing, Part 15 Sub part B disclaimer:

The device is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, 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. 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. 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 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.