ThinkFIT

MR_BLE001 BLE 透传模块
MR_BLE001 Bluetooth Module

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关于手册(About the Manual)

本规格书提供了 MR_BLE001 模块的基本功能介绍，包括模块的电气规格、射频性能、引脚尺寸、以及参考原理图设计等。读者可以参照此文档对模块的整体功能参数有详细的了解应用，有问题请登录 http://www.thinkfiter.com/联系我司或客服。

This specification provides a basic introduction to the MR_BLE001 module, including its electrical specifications, RF performance, pin dimensions, and reference schematic design. Readers can refer to this document for a detailed understanding of the module's overall functional parameters and applications. If you have any questions, please log in to http://www.thinkfiter.com/ to contact our company or customer service.

修订记录(Revision History)

版本号 Version	修订时间 Date	修订记录 Revision History	修订人 Reviser	审核人 Auditor
V1.0	2020.12.17	初始版本 OV		

目录 (Table of Contents)

1. 产品概述(Product Overview)

1.1 功能特点 (Features)

MR_BLE001 是智健互联研发的小尺寸、低成本的蓝牙 BLE 标准化透传模块。模块支持 BLE（Up to Bluetooth 5.0）。内置 512kB FLASH 支持动态堆栈和协议 Profile 配置，产品功能可以通过软件进行配置，提供了最终的灵活性。同时支持硬件 OTA 升级和多引导切换，允许方便的产品功能推出和升级。

MR_BLE001 is a small-sized, low-cost Bluetooth Low Energy (BLE) standardized transparent transmission module developed by ThinkFIT. The module supports BLE (up to Bluetooth 5.0) and features a built-in 512kB FLASH memory, which supports dynamic stack and protocol profile configurations. The product functionality can be configured through software, providing ultimate flexibility. Additionally, it supports hardware OTA upgrades and multiple boot switching, allowing for convenient product feature releases and upgrades.

模块特性如下：

The module features include:

▶ 内置高性能 32-bit MCU RSIC @48M ，512KB lash，F32KB SRAM

▶ High Performance 32-bit MCU RSIC @48M ，512KB Flash，32KB SRAM

▸ 符合蓝牙 5.0 标准，RF 链路数据高达 2Mbps

▸ Bluetooth 5.0 Standard,RF Data link up to 2Mbps

▸ -96dBm@BLE 1Mbps；-93dBm@ BLE 2Mbps mode

▸ -99dBm@ BLE 500kbps mode；-101dBm@ BLE 125kbps mode

▸ 支持 UART 接口 ，扩展了芯片所有 I/O 口

▸ Support UART Interface, I/O Port that has exte4

▸ 支持 APP 参数配置

▸ Support APP Parameter Configure

▸ 邮票孔管脚+4pin 端子接口，焊接容易可靠

▸ Snap off hole Pin + 4 PIN Terminal interface: Easy for Welding

▸ 超小封装：23x12.6mm ，板厚 1.0mm

▸ Compact Encapsulation:23x12.6mm　Board Thickness 1.0mm

▸ 工作温度：-40℃~+85℃

▸ Working Temperature：-40℃~+85℃

MR_BLE001 模块只需要连接 VCC,GND,TX,RX 四线即可完成数据透传功能；还可以通过邮票孔的方式应用到很多小尺寸配件或健身小件产品上。智健互联研发实力强劲，能够轻松实现用户蓝牙设备的互联、数据传输 以及其它各种应用。我司可以在 TFB0B02 标准版模块的基础上，根据客户要求，定制设计符合客户使用规范的蓝牙模块，并提供相应的软硬件支持。详情可联系我司 http://www.thinkfiter.com/或客服。

The MR_BLE001 module only requires the connection of four wires (VCC, GND, TX, RX) to achieve data transparent transmission functionality. It can also be applied to various small-sized accessories or fitness products through the use of Snap off holes. ThinkFIT has strong research and development capabilities, enabling seamless interconnection, data transmission, and various other applications for users' Bluetooth devices. Our company can customize Bluetooth modules that meet the customer's usage specifications based on the TFB0B02 standard version module and provide corresponding software and hardware support according to customer requirements. For more details, please contact our company at http://www.thinkfiter.com/ or reach out to customer service.

1.2 应用领域 (Application Areas)

▶ 智能跳绳、健腹轮等健身小件

▶ Smart Jump Robes\ Ab Rollers etc.

▶ 智能跑步机、动感单车等健身设备

▶ Fitness Equipment like Treadmills\Exercise Bikes etc.

▶ 智能家居产品

▶ Smart Home Products

▶ 工业控制设备

▶ Industrial Control Equipment

2.电气规格(Electrical Specifications)

■额定参数(Rated Parameter)

Item	Symbol	Min	Typical	Max	Unit
输入电压（4pin 端子） Input Voltage (4pin terminal)	VCC1	3.1	3.3	12.5	V
输入电压（邮票孔） Input Voltage (Snap off Hole)	VCC2	2.8	3.0	3.6	V
串口电压 Serial Voltage	TX/RX		3.0	3.3	V

存储温度 Storage Temperature	T-STR	-65	25	150	℃
焊接温度 Welding Temperature	T-SLD			260	℃

注意：（Cautions）

所列电气特性为目标规范，仅供参考。有些数据可能会根据实际测试进行更新。

The data listed about is only for reference purpose.Some of the data listed above may be updated based on new testing carried out.

所示电压值以模块内 GND 为基准。任何超过"最大额定值"的电压可能会对设备造成永久性损害.

The showed voltage listed above is subject to the GND in the module.Voltage that surpass the "Maximum Rated Value"will cause permanent damage to the device

■工作电流(Working Current)

Item	Symbol	Min	Typical	Max	Unit

|			
RX 电流 RX Current	Irx	5.3	mA
TX 电流 TX Current	Itx	4.8	mA
睡眠状态 Sleep	Istandby	1.2	uA

注意: 功耗测试条件：Whole Module Working　@0dBm With DCDC enable

Note:Power consumption test conditions:Whole Module Working　@0dBm With DCDC enable

■射频参数(RF Parameter)

| Item	Symbol	Min	Typical	Max	Unit
频率范围 (Frequency Range)	Freq.	2380	-	2500	MHz
数据速率 (Data Rate)	BLE/2.4G Proprietary 1Mbps, ±250kHz deviation BLE/2.4G Proprietary 2Mbps, ±500kHz deviation BLE 125kbps, ±250kHz deviation BLE 500kbps, ±250kHz deviation				

3. 引脚说明(Pin Description)
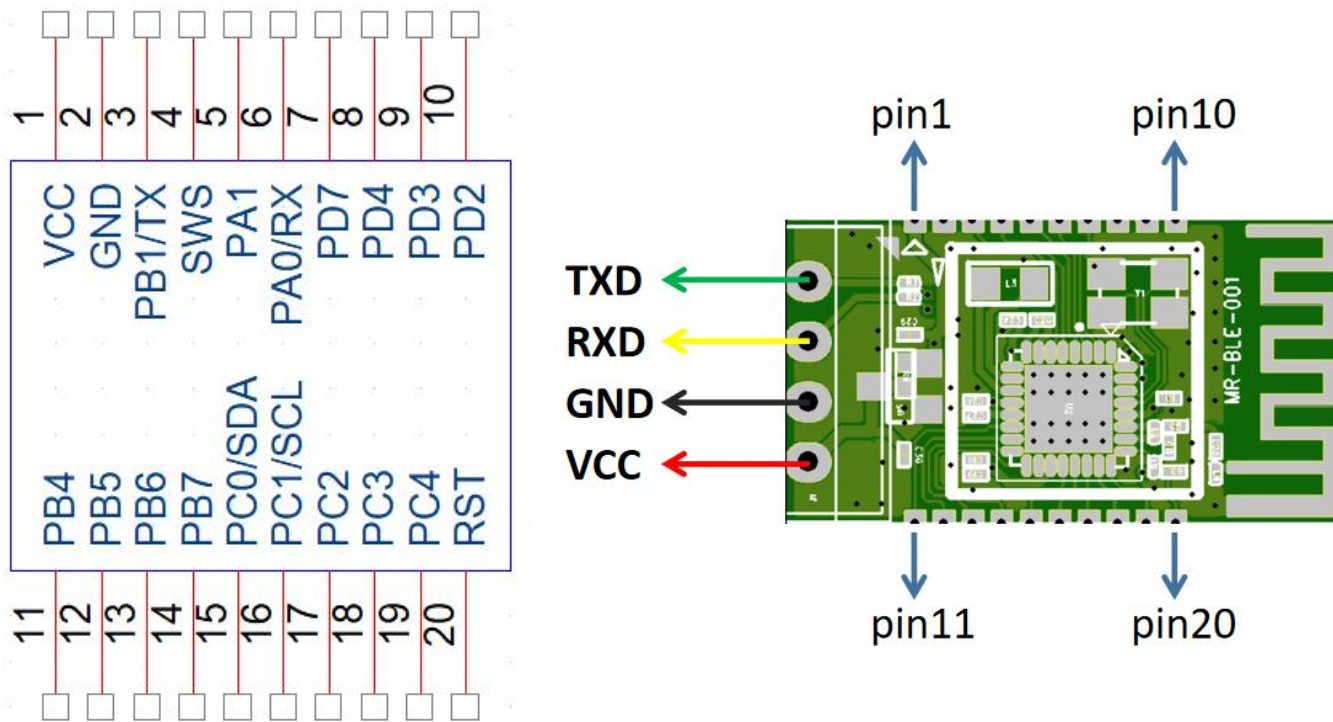
■接口说明(Port Description)

| Pin #	Name	Type	Description
1	VCC2	PWR	3.0V 供电
2	GND	PWR	接地脚
3	PB1_UTX	I/O	PWM4 output / UART_TX / Antenna select pin 2 / Low power comparator input / SAR ADC input / GPIO PB[1]
4	SWS	I/O	Single wire slave/ UART_RTS / GPIO PA[7]
5	PA1	I/O	DMIC clock / UART 7816 clock / I2S clock / GPIO PA[1]
6	PA0_URX	I/O	DMIC data input / PWM0 inverting output / UART_RX / GPIO PA[0]
7	PD7	I/O	SPI clock (I2C_SCK) / I2S bit clock / UART 7816 TRX (UART_TX) / GPIO PD[7]

| 8	PD4	I/O	Single wire master / I2S serial data output / PWM2 inverting output / GPIO PD[4]
9	PD3	I/O	PWM1 inverting output / I2S serial data input / UART 7816 TRX (UART_TX) / GPIO PD[3]
10	PD2	I/O	SPI chip select (Active low) / I2S left right channel select / PWM3 output / GPIO PD[2]
11	PB4	I/O	SDM positive output 0 / PWM4 output / Low power comparator input / SAR ADC input / GPIO PB[4]
12	PB5	I/O	SDM negative output 0 / PWM5 output / Low power comparator input / SAR ADC input / GPIO PB[5]
13	PB6	I/O	SDM positive output 1 / SPI data input (I2C_SDA) / UART_RTS / Low power comparator input / SAR ADC input / GPIO PB[6]
14	PB7	I/O	SDM negative output 1 / SPI data output / UART_RX / Low power comparator input / SAR ADC input / GPIO PB[7]
15	PC0_SDA	I/O	I2C serial data / PWM4 inverting output / UART_RTS / PGA left channel positive input / GPIO PC[0]
16	PC1_SCL	I/O	I2C serial clock / PWM1 inverting output / PWM0 output / PGA left channel negative input / GPIO PC[1]
17	PC2	I/O	PWM0 output / UART 7816 TRX (UART_TX) / I2C serial data / (optional) 32kHz crystal output / PGA right channel positive input / GPIO PC[2]
18	PC3	I/O	PWM1 output / UART_RX / I2C serial clock / (optional)32kHz crystal input / PGA right channel negative input / GPIO PC[3]
19	PC4	I/O	PWM2 output / UART_CTS / PWM0 inverting output / SAR ADC input / GPIO PC[4]
20	RST	RESET	Power on reset, active low

4. 参考设计(Design Reference)

4.1 参考原理图(Schematic Diagram)
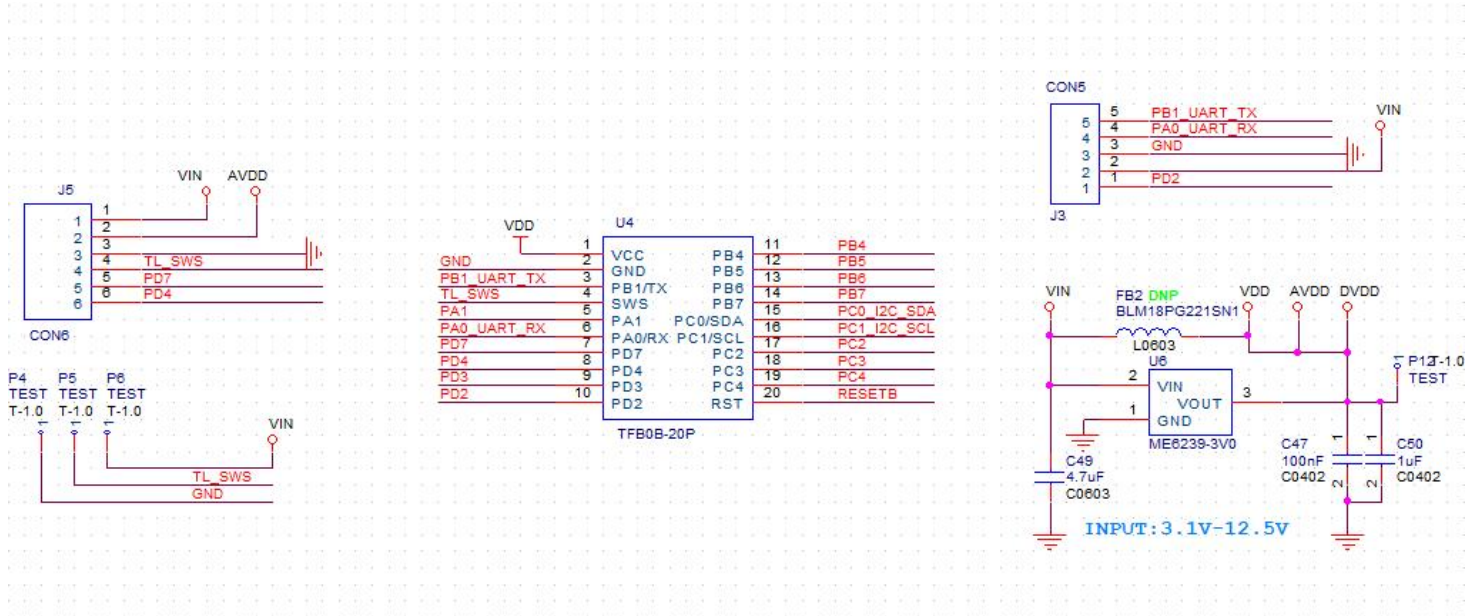
4.2 模块尺寸(Module Dimensions)
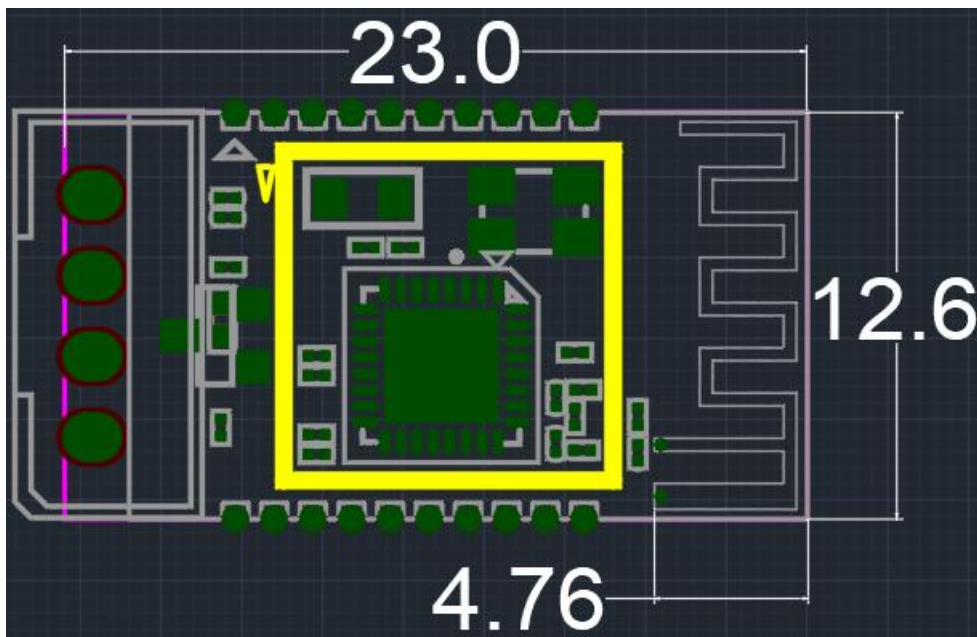
4.3 参考 PCB 封装 (PCB Encapsulation)
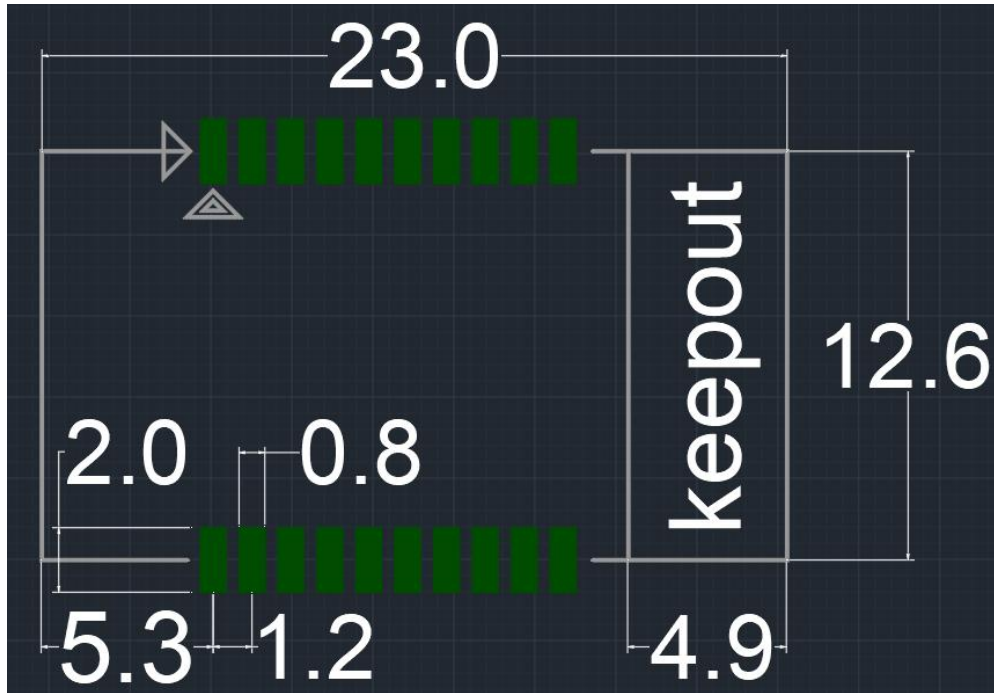
4.4 注意事项(Cautions)

蓝牙工作频率 2.4GHz ，应尽量避免各种因素对无线收发的影响。

The blue-tooth working frequency should be 2.4GHZ and It is suggested to use the device in a environment where interference factor can be minimized.

注意：(Cautions)

▶包围旋钮的产品外壳部分避免使用金属。

▶Avoid using metal materials in the shell of the knob.

▶产品内部金属螺钉等应远离模块的射频部分。

▶Avoid placing metal screws and other parts too close to the radio frequency part.

▶ 为了使射频性能最大化，用户主板布局应遵循以下建议：

▶ To maximize RF performance, users should follow the following recommendations for PCB layout:

1）天线净空区域：位于模块天线区域正下方的用户主板不能有任何铜箔（包括电源、地、信号层）。

（Antenna Clearance Area:）The user's main board, located directly below the antenna area of the module, should not have any copper foil (including power, ground, and signal layers).

2）模块位置：模块理想情况下应布置在用户主板的一角，PCB 天线位于主板的远端。此位置可将天线的净空区域减至最低

Module placement:Ideally, the module should be placed in one corner of the user's main board, with the PCB antenna positioned at the far end of the board. This placement helps minimize the antenna clearance area to the lowest possible extent.

5.过炉参数(Furnace Parameter)

■过炉参数参考如下设置：(Refer to the following parameter)
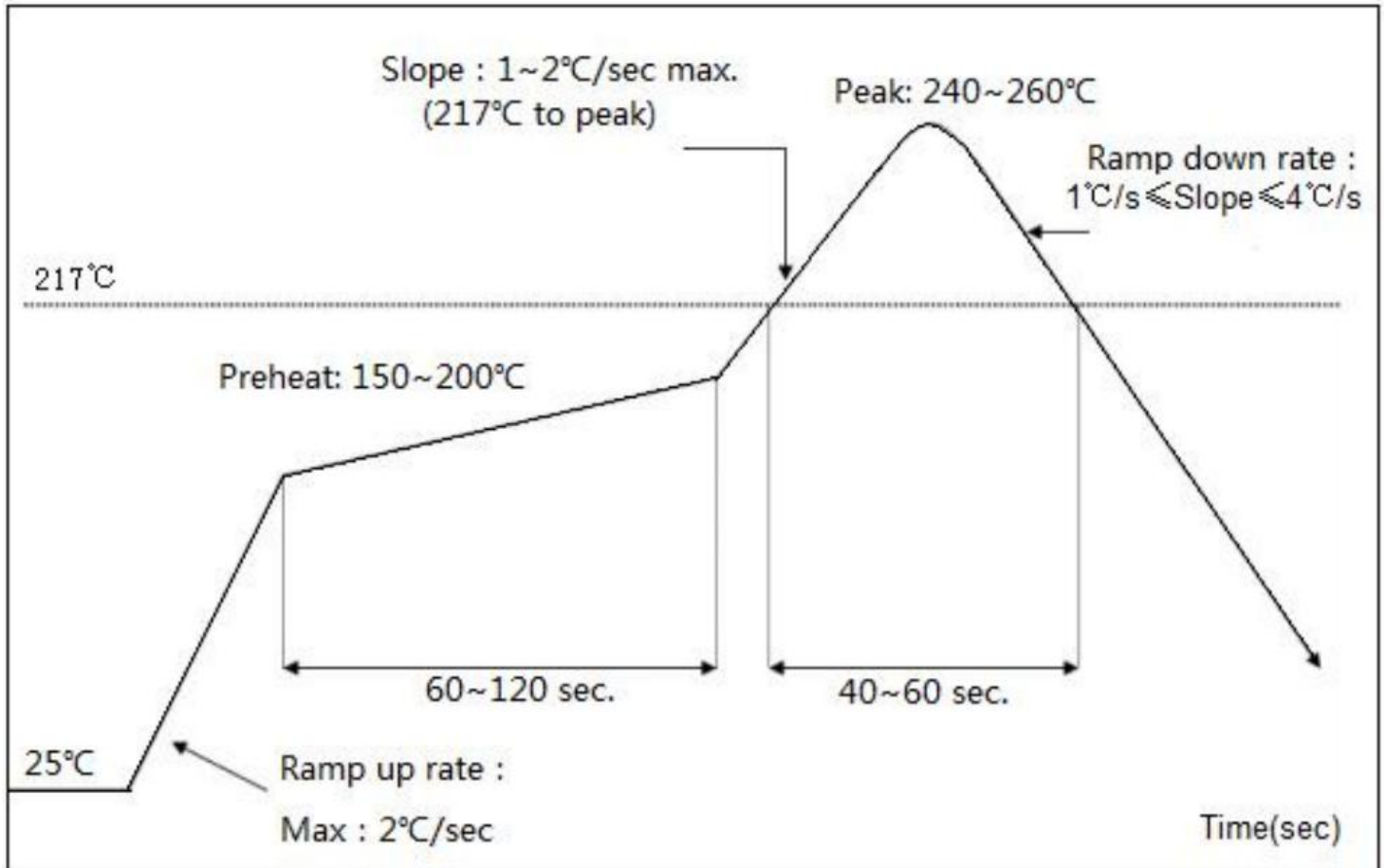
Temperature range	Time	Key parameters
Preheat zone(<150℃)	60-120S	Ramp up rate:≤2S
Uniform temperature zone(150-200℃)	60-120S	Ramp up rate:<1S
Recirculation zone(>217℃)	40-60S	Peak:240-260℃
Cooling zone	Ramp down rate:1℃/s≤Slope≤4℃/s	

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.

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.

This modular has been tested and found to comply with part 15 requirements for Modular Approval.

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

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01r01

2.2 List of applicable FCC rules

CFR 47 FCC Part 15 Subpart C and Subpart F has been investigated. It is applicable to the modular transmitter

2.3 Specific Operational Use Conditions - Antenna Placement Within the Host Platform

The module is tested for standalone mobile RF exposure use condition.

● The antenna must be installed such that 20cm is maintained between the antenna and users,

● The transmitter module may not be co-located with any other transmitter or antenna.

In the event that these conditions cannot 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 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.

2.4 Limited Module Procedures

Not applicable

2.5 Trace Antenna Designs

Not applicable

2.6 RF Exposure Considerations

This device 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.

2.7 Antenna Type and Gain

The following antennas have been certified for use with this module.

Only antennas of the same type with equal or lower gain may also be used with this module.

Other types of antennas and/or higher gain antennas may require the additional authorization for operation.

Antenna Specification list below:

Antenna Type	Antenna Model No.	Maximum Antenna Gain (dBi)	Frequency Range
PCB Antenna	MR_BLE001	3.65	2400 – 2500 MHz

2.8 End Product Labelling Compliance Information

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily removed. If not, a second label must be placed on the outside of the final device that contains the following text: "Contains FCC ID: **2BGXU-MR-BLE001**". The FCC ID can be used only when all FCC compliance requirements are met.

2.9 Information on Test Modes and Additional Testing Requirements

This transmitter is tested in a standalone mobile RF exposure condition and any co-located or simultaneous transmission with other transmitter(s) class II permissive change re-evaluation or new FCC authorization.

Host manufacturer installed this modular with single modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C, 15.209, 15.207 requirement, only if the test result comply with FCC part 15C, 15.209, 15.207 requirement, then the host can be sold legally.

2.10 Additional testing, Part 15 Subpart B Disclaimer

This transmitter modular us tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B rules requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rules requirements if applicable.

As long as all 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 modular installed.

2.11 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 host integrator must follow the integration instructions provided in this document and ensure that the composite system end product complies with the requirements by a technical assessment or evaluation to the rules and to KDB Publication 996369.

The host integrator installing this module into their product must ensure that the final composite product complies with the requirements by a technical assessment or evaluation to the rules, including the transmitter operation and should refer to

guidance in KDB Publication 996369.

OEM/Host Manufacturer Responsibilities

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and RF Exposure essential requirements of the FCC rules.

2.12 How to Make Changes - Important Note

In the event that these conditions cannot 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 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.