



## **BL-M8800DS1**

**802.11a/b/g/n/ac/ax 287Mbps**

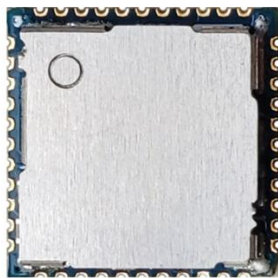
**WLAN +Bluetooth v5.0 SDIO/USB**

**Module**

**SHENZHEN BILIAN ELECTRONIC CO., LTD**

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( Top View )



( Bottom View )

|                                                                               |       |
|-------------------------------------------------------------------------------|-------|
| Module Name: BL-M8800DS1                                                      |       |
| Module Type: 802.11a/b/g/n/ac/ax 287Mbps WLAN +Bluetooth v5.0 SDIO/USB Module |       |
| Revision: V1.0                                                                |       |
| Customer Approval:                                                            |       |
| Company:                                                                      |       |
| Title:                                                                        |       |
| Signature:                                                                    | Date: |
| LB-link Approval:                                                             |       |
| Title:                                                                        |       |
| Signature:                                                                    | Date: |

## Revision History

| Revision | Summary              | Release Date | Revised By |
|----------|----------------------|--------------|------------|
| 0.1      | Initial release      | 2022-05-21   |            |
| 1.0      | official             | 2022-07-16   |            |
| 1.0      | Content optimization | 2023-3-21    | Qx         |

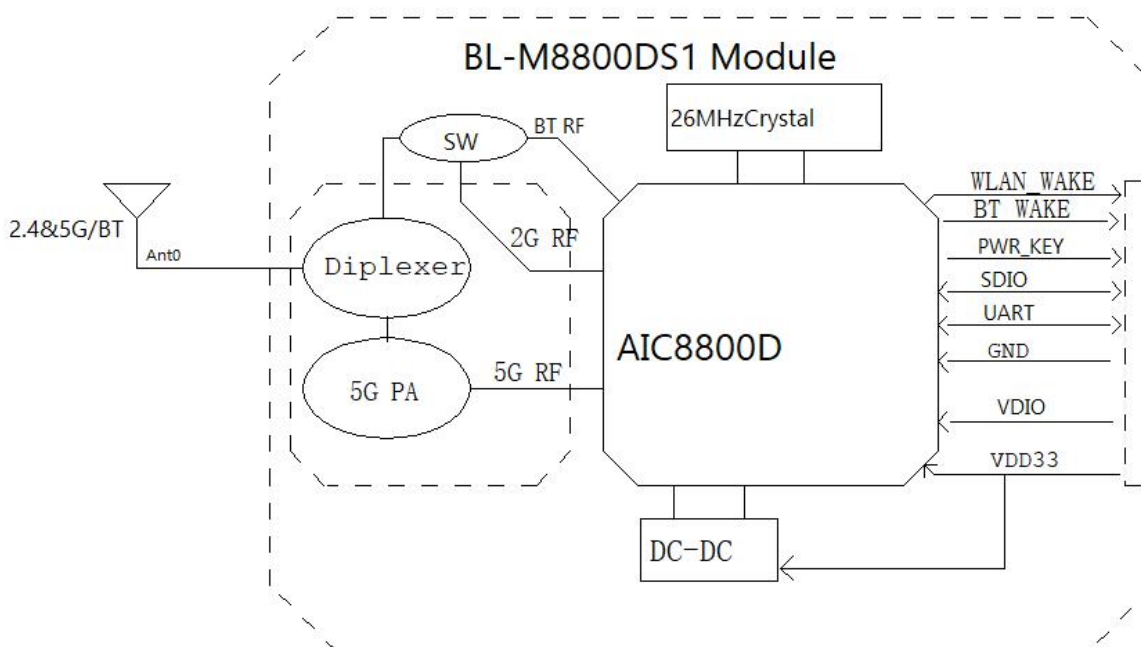
## 1. Introduction

BL-M8800DS1 is a highly integrated Dual-band WLAN + Bluetooth v5.0 Combo module. It combines a 1T1R Dual-band WLAN subsystem and a Bluetooth v5.0 subsystem, This module compatible IEEE 802.11 a/b/g/n/ac/ax standard and provides the maximum PHY rate up to 287Mbps, it supports BT / BLE dual mode with BT v5.0 /v4.2/v2.1 compliant, offering feature-rich wireless connectivity at high standards, and delivering reliable, cost-effective throughput from an extended distance.

### 1.1 Features

- Operating Frequencies: 2.4~2.4835GHz or 5.15~5.85GHz
- Wireless PHY rate can reach up to 287Mbps@TX and 230Mbps@RX with 20/40MHz bandwidth
- Host Interfaces ate SDIO 2.0 or USB2.0, those two interfaces are optional and cannot be used together
- Support STA, AP, WLAN Direct modes concurrently
- Support BT Classic / BT Low Energy dual mode

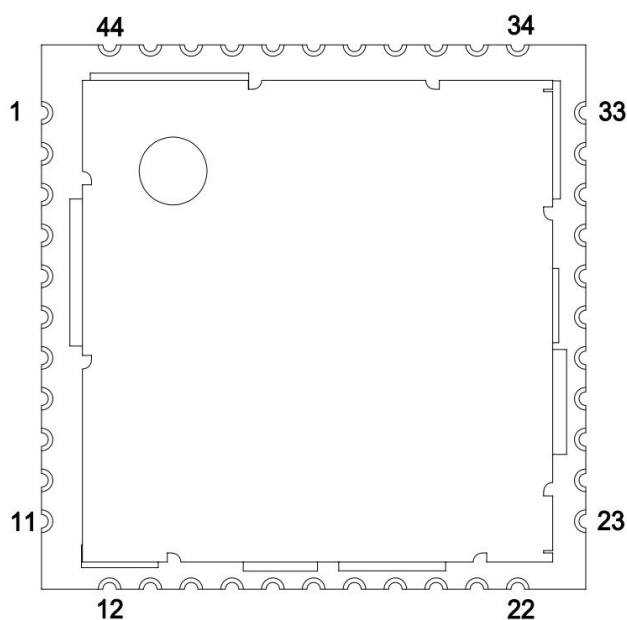
### 1.2 Block Diagram



## 1.3 General Specifications

|                       |                                                                                       |
|-----------------------|---------------------------------------------------------------------------------------|
| Module Name           | BL-M8800DS1                                                                           |
| Chipset               | AIC8800D                                                                              |
| WLAN Standards        | IEEE802.11a/b/g/n/ac/ax                                                               |
| BT Specification      | Bluetooth Core Specification v5.0 /4.2/2.1                                            |
| Host Interface        | SDIO for WLAN & UART for Bluetooth or USB for WLAN + Bluetooth                        |
| Antenna               | Connect to the external antenna through half hole pad                                 |
| Dimension             | 12.0*12.0*2.25mm (L*W*H) ±0.15MM                                                      |
| Power Supply          | 3.3V±0.2V main power supply @ 450 mA (Max)<br>3.3V±0.2V or 1.8V±0.1V I/O power supply |
| Operation Temperature | -20°C to +70°C                                                                        |
| Operation Humidity    | 10% to 95% RH (Non-Condensing)                                                        |

## 2. Pin Assignments



(Top view)

## 2.1 Pin Definition

| No | Pin Name     | Type | I/O Level | Module Pin Description                                                                                                                                                                                                                                                                                               |
|----|--------------|------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | GND          | RF   |           | RF Ground connections                                                                                                                                                                                                                                                                                                |
| 2  | ANT0         | RF   |           | RF Pad for 2.4G WLAN/5G WLAN/2.4G BT ANT                                                                                                                                                                                                                                                                             |
| 3  | GND          | RF   |           | RF Ground connections                                                                                                                                                                                                                                                                                                |
| 4  | NC           | /    |           | NC                                                                                                                                                                                                                                                                                                                   |
| 5  | NC           | /    |           | NC                                                                                                                                                                                                                                                                                                                   |
| 6  | HOST_WAKE_BT | I/O  | VIO       | 1.General Purpose Input / Output Pin GPIO5<br>2.Host to wake-up this Bluetooth device input                                                                                                                                                                                                                          |
| 7  | BT_WAKE_HOST | I/O  | VIO       | 1.General Purpose Input / Output Pin GPIOB3<br>2.Bluetooth device to wake-up Host output                                                                                                                                                                                                                             |
| 8  | NC           | /    |           | NC                                                                                                                                                                                                                                                                                                                   |
| 9  | VDD33        | P    |           | 3.3V Main power supply                                                                                                                                                                                                                                                                                               |
| 10 | USB_DM       | I/O  |           | USB 2.0 Device High Speed Interface differential pair                                                                                                                                                                                                                                                                |
| 11 | USB_DP       | I/O  |           | USB 2.0 Device High Speed Interface differential pair                                                                                                                                                                                                                                                                |
| 12 | PWRKEY       | I    | VIO       | enable signal input, it can externally shut down the module by pulled low. When VDD33 and VIO are ready, PWRKEY goes to high level exceeds 1.1V and lasts for 6mS, the module starts up,then the level of PWRKEY must be maintained at VIO. (internal pull up to VIO by 47K and pull down to GND by 200K resistors ) |
| 13 | WL_HOST_WAKE | I/O  | VIO       | 1.General Purpose Input / Output Pin GPIOB2<br>2.WLAN device to wake-up Host output                                                                                                                                                                                                                                  |
| 14 | SD_D2        | I/O  | VIO       | SDIO data line                                                                                                                                                                                                                                                                                                       |
| 15 | SD_D3        | I/O  | VIO       | SDIO data line                                                                                                                                                                                                                                                                                                       |
| 16 | SD_CMD       | I/O  | VIO       | SDIO command line                                                                                                                                                                                                                                                                                                    |
| 17 | SD_CLK       | I/O  | VIO       | SDIO clock line                                                                                                                                                                                                                                                                                                      |
| 18 | SD_D0        | I/O  | VIO       | SDIO data line                                                                                                                                                                                                                                                                                                       |
| 19 | SD_D1        | I/O  | VIO       | SDIO data line                                                                                                                                                                                                                                                                                                       |
| 20 | GND          | P    |           | Ground connections                                                                                                                                                                                                                                                                                                   |
| 21 | NC           | /    |           | NC                                                                                                                                                                                                                                                                                                                   |
| 22 | VIO          | P    |           | 1.8V or 3.3V power supply for digital I/O ( 3.3V I/O recommended for USB application )                                                                                                                                                                                                                               |
| 23 | GPIOB4       | I/O  | VIO       | General Purpose Input / Output GPIOB4                                                                                                                                                                                                                                                                                |
| 24 | NC           | /    |           | NC                                                                                                                                                                                                                                                                                                                   |
| 25 | NC           | /    |           | NC                                                                                                                                                                                                                                                                                                                   |

|    |           |     |     |                                       |
|----|-----------|-----|-----|---------------------------------------|
| 26 | NC        | /   |     | NC                                    |
| 27 | NC        | /   |     | NC                                    |
| 28 | NC        | /   |     | NC                                    |
| 29 | UART0_TX  | I   | VIO | High-Speed UART Data Out (Debug pin)  |
| 30 | UART0_RX  | O   | VIO | High-Speed UART Data In (Debug pin)   |
| 31 | GND       | P   |     | Ground connections                    |
| 32 | NC        | /   |     | NC                                    |
| 33 | GND       | P   |     | Ground connections                    |
| 34 | GPIOB7    | I/O | VIO | General Purpose Input / Output GPIOB7 |
| 35 | GPIOB6    | I/O | VIO | General Purpose Input / Output GPIOB6 |
| 36 | GND       | P   |     | Ground connections                    |
| 37 | NC        | /   |     | NC                                    |
| 38 | NC        | /   |     | NC                                    |
| 39 | NC        | /   |     | NC                                    |
| 40 | NC        | /   |     | NC                                    |
| 41 | UART1_RTS | O   | VIO | Bluetooth UART interface RTS          |
| 42 | UART1_TX  | O   | VIO | Bluetooth UART interface TX           |
| 43 | UART1_RX  | I   | VIO | Bluetooth UART interface RX           |
| 44 | UART1_CTS | I   | VIO | Bluetooth UART interface CTS          |

P: Power or ground, I: Input, O: Output, I/O: In/Output, RF: Analog RF Port

## 3. Electrical and Thermal Specifications

### 3.1 Recommended Operating Conditions

| Parameters                    |          | Min | Typ | Max | Units |
|-------------------------------|----------|-----|-----|-----|-------|
| Ambient Operating Temperature |          | -20 | 25  | 70  | °C    |
| External Antenna VSWR         |          |     | 1.7 | 2.1 | /     |
| Supply Voltage                | VDD33    | 3.1 | 3.3 | 3.5 | V     |
|                               | VIO_3.3V | 3.1 | 3.3 | 3.5 | V     |
|                               | VIO_1.8V | 1.7 | 1.8 | 1.9 | V     |

### 3.2 DC Electrical Specification (Recommended Operation Conditions):

| Symbol | DESCRIPTION                   | Min     | Typ     | Max     | Units |
|--------|-------------------------------|---------|---------|---------|-------|
| VIL    | CMOS Low Level Input Voltage  | 0       | --      | 0.3*VIO | V     |
| VIH    | CMOS High Level Input Voltage | 0.7*VIO | --      | VIO     | V     |
| VTH    | CMOS Threshold Voltage        | --      | 0.5*VIO | --      | V     |

### 3.3 Current Consumption

| Conditions : SDIO,VDD33=3.3V ,VIO=3.3V; Ta:25°C; |                        |                         |       |
|--------------------------------------------------|------------------------|-------------------------|-------|
| Use Case                                         | VDD33 Current          |                         |       |
|                                                  | Typ(I <sub>RMS</sub> ) | Max(I <sub>Peak</sub> ) | Units |
| WLAN & BT Unassociated (Linux SDIO Driver)       | 30                     | 48                      | mA    |
| 2.4G WLAN throughput 100Mbps (Linux SDIO Driver) | 131                    | 210                     | mA    |
| 5G WLAN throughput 145Mbps (Linux SDIO Driver)   | 175                    | 301                     | mA    |
| 2.4G 11b 1Mbps TX @ (1TX RF test)                | 240                    | 256                     | mA    |
| 2.4G HT20 MCS0 TX@ (1TX RF test)                 | 174                    | 192                     | mA    |
| 2.4G HE_SU 40MHz MCS11 TX@ (1TX RF test)         | 122                    | 172                     | mA    |
| 2.4G HE_SU 40MHz MCS9 RX (1RX RF test)           | 32                     | 44                      | mA    |
| 5G 11a 6Mbps TX @ (1TX RF test)                  | 263                    | 280                     | mA    |
| 5G 11a 54Mbps TX @ (1TX RF test)                 | 233                    | 270                     | mA    |
| 5G VHT 40MHz MCS9 TX@ (1TX RF test)              | 195                    | 252                     | mA    |
| 5G HE_SU 40MHz MCS11 TX@ (1TX RF test)           | 185                    | 246                     | mA    |
| 5G HE_SU 40MHz MCS9 RX (1RX RF test)             | 43                     | 64                      | mA    |
| BT BR_1M TX@3dBm (BT RF test, WLAN disable)      | 24                     | 36                      | mA    |
| BT BR_1M RX Active (BT RF test, WLAN disable)    | 26                     | 30                      | mA    |
| BT EDR_3M TX@ (BT RF test, WLAN disable)         | 23                     | 36                      | mA    |
| BT LE_1M TX@ (BT RF test, WLAN disable)          | 30                     | 36                      | mA    |

## 4. WLAN & Bluetooth RF Specifications

### 4.1 2.4G RF Specification

| Conditions : VDD33=3.3V ; Ta:25°C |                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Features                          | Description                                                                                                                                                                                                                                                                                                                                                                                           |
| WLAN Standard                     | IEEE 802.11b/g/n/ax CSMA/CA                                                                                                                                                                                                                                                                                                                                                                           |
| Frequency Range                   | 2.4~2.4835GHz (2.4GHz ISM Band)                                                                                                                                                                                                                                                                                                                                                                       |
| Channels                          | Ch1~Ch13 (For 20MHz Channels)                                                                                                                                                                                                                                                                                                                                                                         |
| Modulation                        | 802.11b (DSSS): DBPSK, DQPSK, CCK;<br>802.11g (OFDM): BPSK, QPSK, 16QAM, 64QAM;<br>802.11n (OFDM): BPSK, QPSK, 16QAM, 64QAM;<br>802.11ax (OFDMA): BPSK, BPSK_DCM, QPSK, QPSK_DCM, QAM16, QAM16_DCM, QAM64, QAM256, QAM1024;                                                                                                                                                                           |
| Date Rate                         | 802.11b: 1, 2, 5.5, 11Mbps;<br>802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps;<br>802.11n (HT20): MCS0~MCS7(1T1R_SISO) 6.5~72.2Mbps;<br>802.11n (HT40): MCS0~MCS7(1T1R_SISO) 13.5~150Mbps;<br>802.11ax (HE_MU,OFDMA 26~242RU): MCS0~MCS11(1T1R) 0.4~143.4Mbps;<br>802.11ax (HE_SU, non-OFDMA 20MHz): MCS0~MCS11(1T1R) 3.6~143.4Mbps;<br>802.11ax (HE_SU, non-OFDMA 40MHz): MCS0~MCS11(1T1R) 7.3~286.8Mbps; |
| Frequency Tolerance               | ≤ ±20ppm                                                                                                                                                                                                                                                                                                                                                                                              |

#### 2.4G Receiver Specifications

| RX Rate                 | Min Input Level (dBm) | Max Input Level (dBm) | PER   |
|-------------------------|-----------------------|-----------------------|-------|
| 802.11b@1Mbps           | -94                   | -10                   | < 8%  |
| 802.11b@11Mbps          | -88                   | -10                   | < 8%  |
| 802.11g@6Mbps           | -92                   | -15                   | < 10% |
| 802.11g@54Mbps          | -73                   | -15                   | < 10% |
| 802.11n@HT20_MCS0       | -91                   | -15                   | < 10% |
| 802.11n@HT20_MCS7       | -70                   | -15                   | < 10% |
| 802.11n@HT40_MCS0       | -89                   | -15                   | < 10% |
| 802.11n@HT40_MCS7       | -69                   | -15                   | < 10% |
| 802.11ax@HE_SU 20M_MCS0 | -90                   | -15                   | < 10% |
| 802.11ax@HE_SU 20M_MCS7 | -69                   | -15                   | < 10% |
| 802.11ax@HE_SU 40M_MCS0 | -87                   | -15                   | < 10% |
| 802.11ax@HE_SU 40M_MCS9 | -65                   | -15                   | < 10% |

## 4.2 5G WLAN RF Specification

| Conditions: VDD33=3.3V; Ta:25°C |                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Features                        | Description                                                                                                                                                                                                                                                                                                                                                                      |
| WLAN Standard                   | IEEE 802.11a/n/ac/ax                                                                                                                                                                                                                                                                                                                                                             |
| Frequency Range                 | 5.15~5.25GHz; 5.25~5.35GHz; 5.47~5.73GHz;<br>5.735~5.835GHz (5GHz ISM Band)                                                                                                                                                                                                                                                                                                      |
| Channels                        | Ch36, Ch40, Ch44, Ch48; Ch52~Ch64;<br>Ch100~Ch140; Ch149~Ch165(For 20MHz Channels)                                                                                                                                                                                                                                                                                               |
| Modulation                      | 802.11a (OFDM): BPSK, QPSK, QAM16, QAM64;<br>802.11n (OFDM): BPSK, QPSK, QAM16, QAM64;<br>802.11ac (OFDM): BPSK, QPSK, QAM16, QAM64, QAM256;<br>802.11ax (OFDMA): BPSK, BPSK_DCM, QPSK, QPSK_DCM, QAM16,<br>QAM16_DCM, QAM64, QAM256, QAM1024;                                                                                                                                   |
| Date Rate                       | 802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps;<br>802.11n (HT20): MCS0~MCS7 6.5~72.2Mbps;<br>802.11n (HT40): MCS0~MCS7 13.5~150Mbps;<br>802.11ac (VHT20): MCS0~MCS8(1T1R) 6.5~86.7Mbps;<br>802.11ac (VHT40): MCS0~MCS9(1T1R) 13.5~200Mbps;<br>802.11ax (HE_MU,OFDMA 26~242RU): MCS0~MCS11(1T1R) 0.4~143.4Mbps;<br>802.11ax (HE_SU, non-OFDMA 20MHz): MCS0~MCS11(1T1R) 3.6~143.4Mbps; |

|                            |                                                                    |                       |       |
|----------------------------|--------------------------------------------------------------------|-----------------------|-------|
|                            | 802.11ax (HE_SU, non-OFDMA 40MHz): MCS0~MCS11(1T1R) 7.3~286.8Mbps; |                       |       |
| Frequency Tolerance        | ≤ ±20ppm                                                           |                       |       |
| 5G Receiver Specifications |                                                                    |                       |       |
| RX Rate                    | Min Input Level (dBm)                                              | Max Input Level (dBm) | PER   |
| 802.11a@6Mbps              | -88                                                                | -5                    | < 10% |
| 802.11a@54Mbps             | -72                                                                | -5                    | < 10% |
| 802.11n@HT20_MCS0          | -90                                                                | -5                    | < 10% |
| 802.11n@HT20_MCS7          | -70                                                                | -5                    | < 10% |
| 802.11n@HT40_MCS0          | -89                                                                | -5                    | < 10% |
| 802.11n@HT40_MCS7          | -69                                                                | -5                    | < 10% |
| 802.11ac@VHT40_MCS0        | -79                                                                | -5                    | < 10% |
| 802.11ac@VHT40_MCS9        | -63                                                                | -5                    | < 10% |
| 802.11ax@HE_SU 40_MCS0     | -79                                                                | -5                    | < 10% |
| 802.11ax@HE_SU 40_MCS9     | -65                                                                | -5                    | < 10% |

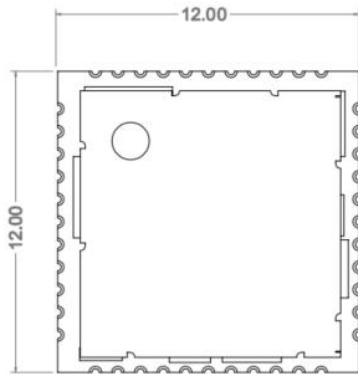
### 4.3 Bluetooth RF Specification

| Conditions: VDD33 =3.3V; Ta:25°C                |                                                                                                         |          |        |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------|----------|--------|
| Features                                        | Description                                                                                             |          |        |
| Bluetooth Specification                         | Bluetooth Core Specification v5.0 /4.2/2.1                                                              |          |        |
| Frequency Range                                 | 2.4~2.4835GHz(2.4GHz ISM Band)                                                                          |          |        |
| Channels                                        | Bluetooth Classic: Ch0~Ch78 (For 1MHz Channels);<br>Bluetooth Low Energy: Ch0~Ch39 (For 2MHz Channels); |          |        |
| Power Classes                                   | Bluetooth Classic: Class1;<br>Bluetooth Low Energy: Class1.5;                                           |          |        |
| Date Rate & Modulation                          | BR_1Mbps: GFSK;<br>EDR_2Mbps: π/4-DQPSK;<br>EDR_3Mbps: 8DPSK;<br>LE_1Mbps: GFSK (Uncoded);              |          |        |
| BR_1M (DH1) Modulation Characteristics          |                                                                                                         |          |        |
| Δf1avg                                          | 140KHz                                                                                                  | 153.5KHz | 175KHz |
| Δf2avg                                          | 140KHz                                                                                                  | 153.2KHz | 175KHz |
| Δf2max                                          | 115KHz                                                                                                  | 165.5KHz | /      |
| Δf2avg/Δf1avg                                   | 0.8                                                                                                     | 1        | /      |
| BR_1M (DH1) Initial Carrier Frequency Tolerance |                                                                                                         |          |        |
| Init Freq Error                                 | -75kHz                                                                                                  | -4.3kHz  | +75kHz |

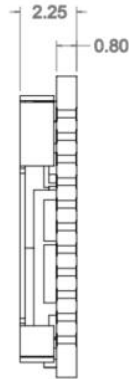
| EDR_3M(3DH5) EDR Carrier Frequency Stability and Modulation Accuracy |                   |        |                     |        |
|----------------------------------------------------------------------|-------------------|--------|---------------------|--------|
| wi                                                                   |                   | -75KHz | -5.3KHz             | +75KHz |
| wi+wo                                                                |                   | -75KHz | -5.4KHz             | +75KHz |
| wo                                                                   |                   | -10KHz | 0.8KHz              | +10KHz |
| 8DPSK RMS DEVM                                                       |                   | /      | 0.06                | 0.13   |
| 8DPSK DEVM                                                           |                   | /      | 0.12                | 0.25   |
| LE_1M Modulation Characteristics                                     |                   |        |                     |        |
| Δf1avg                                                               |                   | 225KHz | 250.7KHz            | 275KHz |
| Δf2avg                                                               |                   | 225KHz | 252.9KHz            | 275KHz |
| Δf2max                                                               |                   | 185KHz | 245.5KHz            | /      |
| Δf2avg/Δf1avg                                                        |                   | 0.8    | 0.98                | /      |
| Bluetooth Receiver Specifications                                    |                   |        |                     |        |
| Items                                                                | Sensitivity       |        | Maximum Input Level |        |
|                                                                      | Input Level(Typ)  | BER    | Input Level(Typ)    | BER    |
| BR_1M                                                                | -88dBm            | ≤0.1%  | -5dBm               | ≤0.1%  |
| EDR_2M/3M                                                            | -80dBm            | ≤0.01% | -5dBm               | ≤0.1%  |
|                                                                      | Input Level (Typ) | PER    | Input Level (Typ)   | PER    |
| LE_1M                                                                | -90dBm            | ≤5%    | -5dBm               | ≤5%    |

## 5. Mechanical Specifications

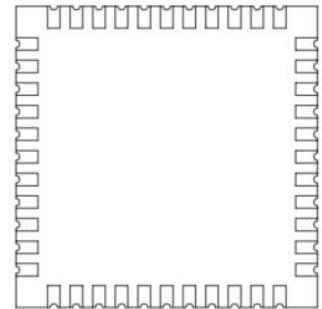
### 5.1 Module Outline Drawing (units:mm)



(Top View)

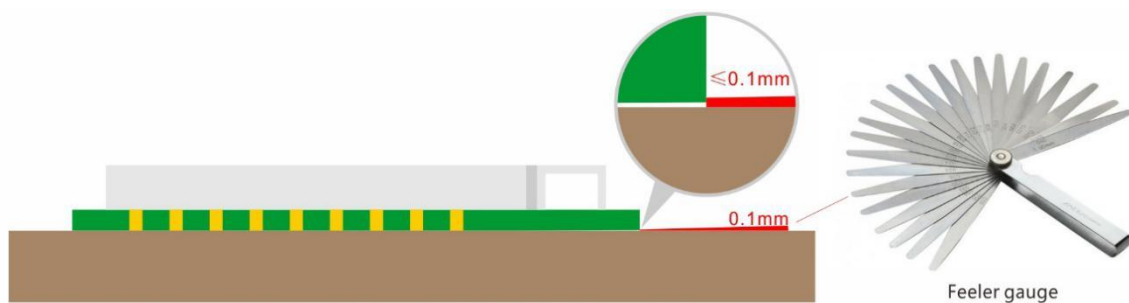


(Side View)



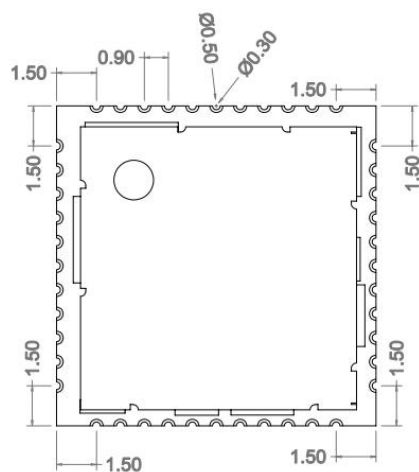
(Bottom View)

Module dimension: 12.0\*12.0\*2.25mm (L\*W\*H; Tolerance:  $\pm 0.15\text{mm}$ )

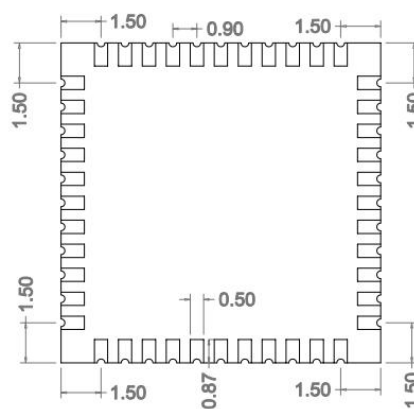


Module Bow and Twist:  $\leq 0.1\text{mm}$

## 5.2 Mechanical Dimensions (units:mm)



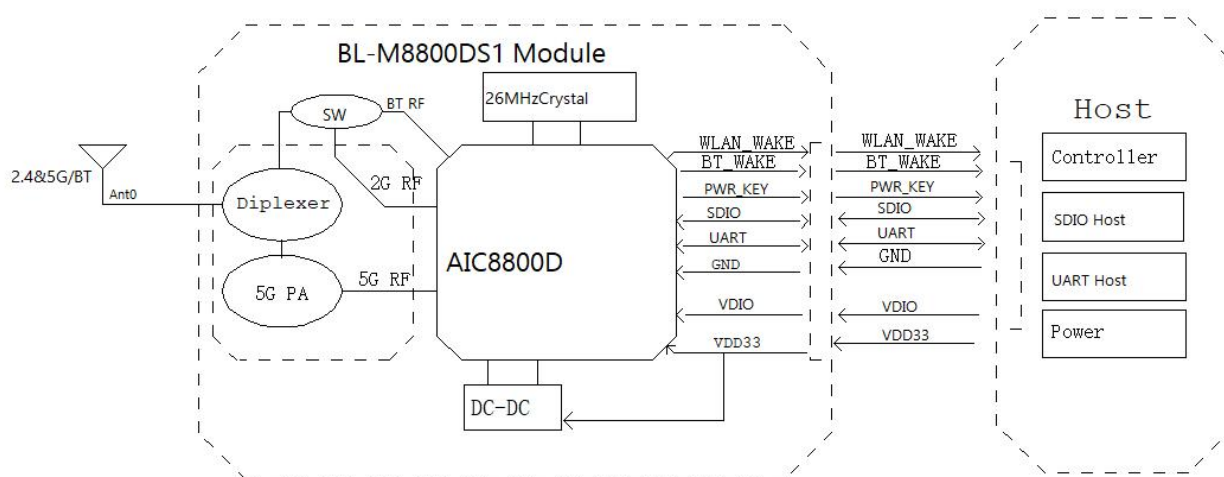
(Top View)



(Bottom View)

## 6. Application Information

### 6.1 Typical Application Circuit

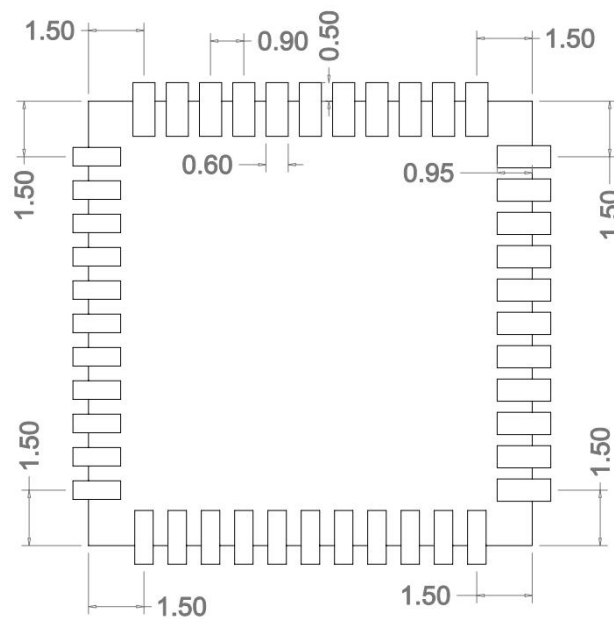


## 6.2 HW Application Note

### NOTE:

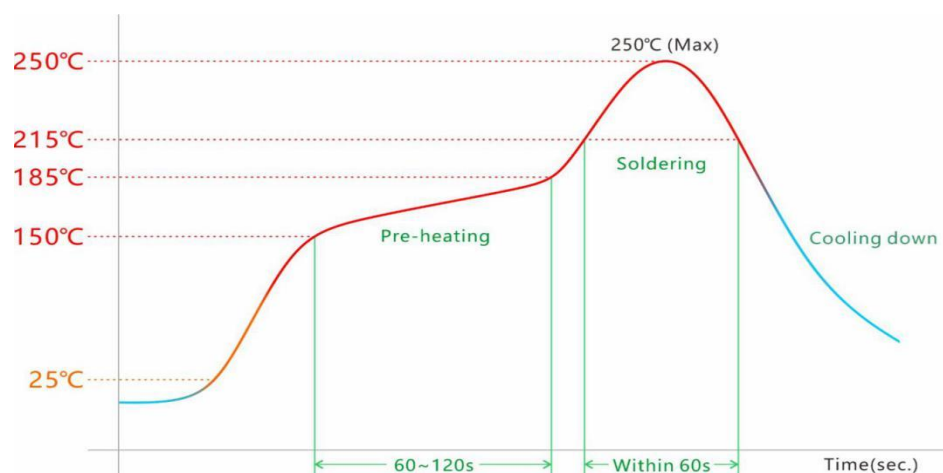
- a. RF path needs to maintain 50 ohm impedance.
- b. The module UART\_TX is connected to the RX of the reference circuit, and the UART\_RX is connected to the TX of the reference circuit.
- c. Keep the SDIO lines as equal as possible and minimize the distance between the host and the module. Make sure SD\_CLK has a good ground reference.
- d. Main power supply voltage: DC 3.1 ~ 3.5V, ripple voltage <80mV
- e. Maximum RMS current  $\geq 450\text{mA}$  and maximum peak current  $\geq 700\text{mA}$
- f. For fast transient response, a current mode buck converter is recommended.
- g. The USB high speed differential pair should be maintain  $90\Omega \pm 5\Omega$  differential impedance.
- h. USB signal pairs as short as possible, avoid interference from Power and other signals.

## 6.3 Recommend PCB Layout Footprint(units:mm)



(Design Unit: mm)

## 6.4 Reflow Soldering Standard Conditions



Please use the reflow within 2 times.

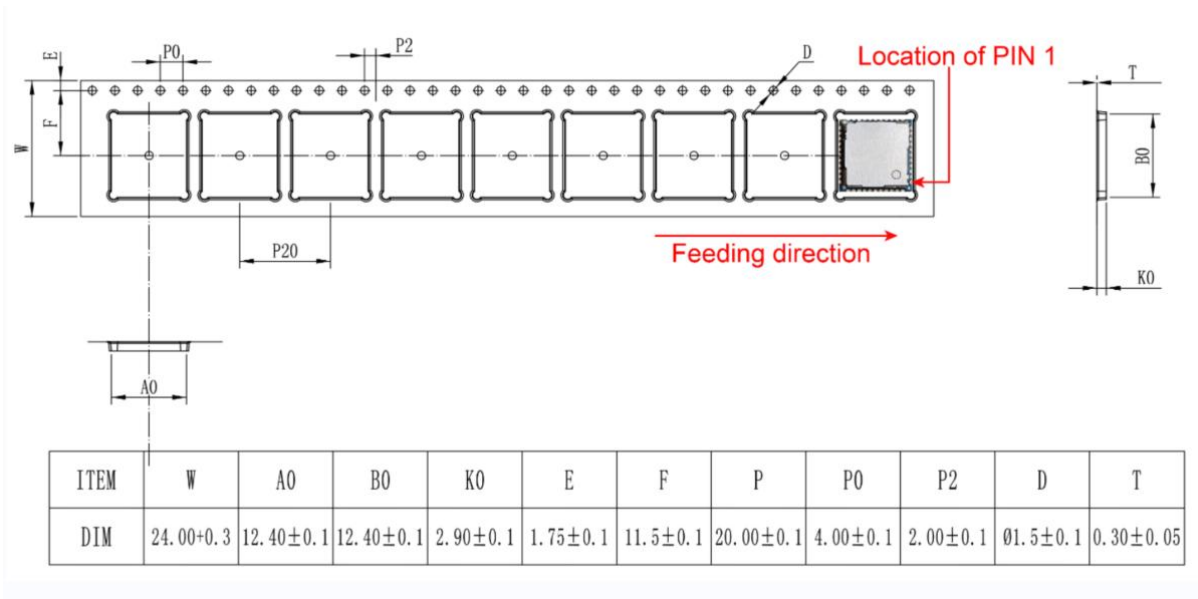
Set up the highest temperature within 250°C.

## 7. Key Components Of Module

| No. | Parts    | Specification | Manufacturer                                                | Note |
|-----|----------|---------------|-------------------------------------------------------------|------|
| 1   | Chipset  | AIC8800D      | AIC Semiconductor (Shanghai) CO.,LTD                        |      |
| 2   | PCB      | BL-M8800DS1   | SHEN ZHEN QILI ELECTRON CO.,LTD                             |      |
|     |          |               | Quzhou Sunlord Electronics Co.,Ltd                          |      |
|     |          |               | ShenZhen Tie Fa Technology Limited                          |      |
| 3   | Crystal  | 26MHz-2016    | LUCKI CM ELECTRONICS CO.,LTD                                |      |
|     |          |               | Chengde oscillator Electronic Technology CO.,LTD            |      |
|     |          |               | JinHua East Crystal Electronic CO.,LTD                      |      |
|     |          |               | HUBEI TKD CRYSTAL ELECTRONIC SCIENCE AND TECHNOLOGY CO.,LTD |      |
| 4   | PA       | CB5717        | Chipbetter Microelectronics Inc.                            |      |
|     |          | KCT8525       | Kangxi Communication Technologies (Shanghai) Co., Ltd.      |      |
| 5   | Diplexer | DIP1608       | Shenzhen Sunlord Electronics Co.,Ltd                        |      |
|     |          |               | Dongguan Hekang Electronics Co.,LTD                         |      |
|     |          |               | Advanced Ceramic X Corp.                                    |      |
|     |          |               | Walsin Technology Corporation                               |      |

## 8. Package and Storage Information

### 8.1 Package Dimensions



Package specification:

- 1,000 modules per roll and 5,000 modules per box.
- Outer box size: 37.5\*36\*29cm.
- The diameter of the blue environment-friendly rubber plate is 13 inches, with a total thickness of 28mm (with a width of 24mm carrying belt).
- Put 1 package of dry agent (20g) and humidity card in each anti-static vacuum bag.
- Each carton is packed with 5 boxes.

## 8.2 Storage Conditions

### Absolute Maximum Ratings:

Storage temperature: -40°C to +85°C

Storage humidity: 10% to 95% RH (Non-Condensing)

### Recommended Storage Conditions:

Storage temperature: 5°C to +40°C

Storage humidity: 20% to 90% RH

Please use this Module within 12month after vacuum-packaged.

The Module shall be stored without opening the packing.

After the packing opened, the Module shall be used within 72hours.

When the color of the humidity indicator in the packing changed, the Module shall be baked before soldering.

Baking condition: 60°C, 24hours, 1time.

### ESD Sensitivity:

ESD Protection: 2KV(HBM, Maximum rating)

The Module is a static-sensitive electronic device.

Do not operate or store near strong electrostatic fields.

Take proper ESD precautions!



**ESD CAUTION**

### **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

Users should connect antennas to half hole pad through copper tube structure or FP

types of RF trace and the trace impedance must be controlled in 50Ω.recommends

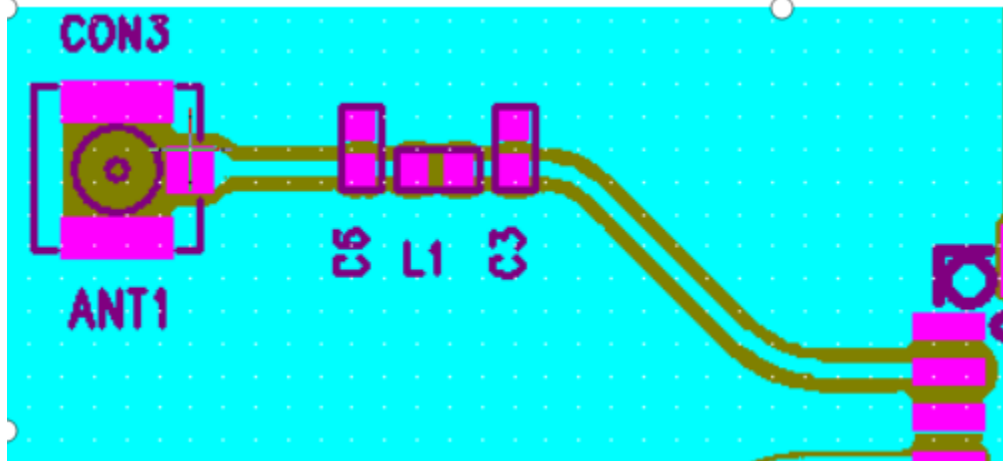
that the total insertion loss between the antenna pads and antennas should meet

the following requirements:

Trace loss

| Frequency       | Loss   |
|-----------------|--------|
| 2400MHz-2500MHz | <1.2dB |
| 5150MHz-5850MHz | <1.2dB |

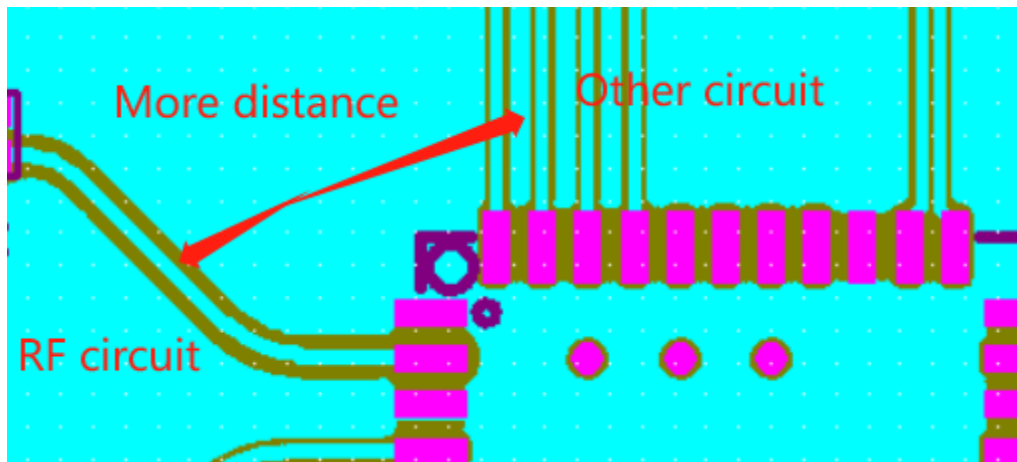
To facilitate the antenna tuning and certification test, a RF connector and an antenna matching circuit should be added. The following figure is the recommended circuit.



The module needs to be attached to the PCB board and connected to the external antenna through the solder joint of the circuit on the PCB. The gain of the external antenna is 2dB( Max. ), the internal structure is copper tube structure or FPC. A resistance of 0R is added between the module and the antenna at L1 to ensure that the impedance of the connection between the module and the antenna reaches 50R. The ANT1 position on the PCB is where the external antenna is connected.

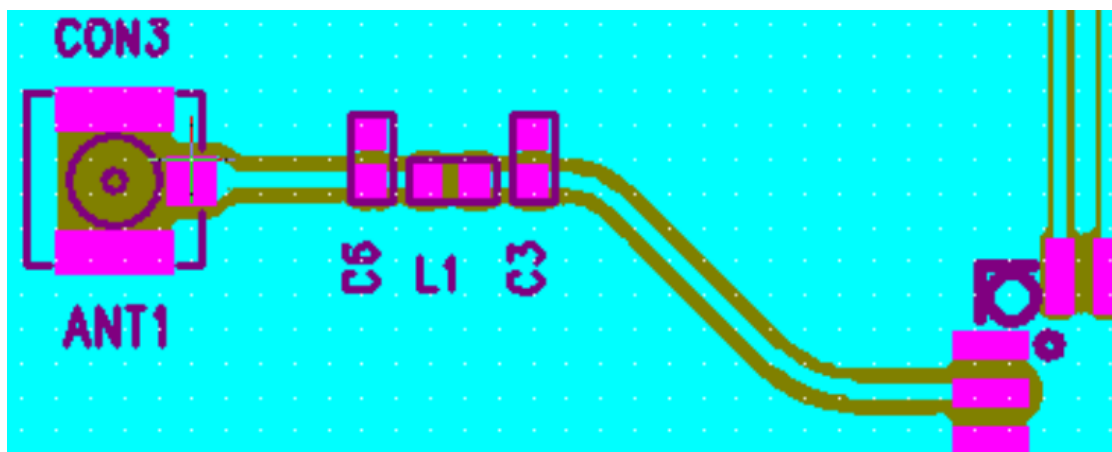
#### RF traces layout

1. Keep the RF trace from module ant pin to antenna as short as possible
2. RF trace should be 50  $\Omega$  either on the top layer or in the inner layer
3. RF trace should be avoided right angle and sharp angle.
4. Put enough GND vias around RF traces.
5. RF trace should be far away from other high speed signal lines.



Avoiding the paroling rout of other system antennas nearby.

There should be some distance from The GND to the inner conductor of the IPEX connector. It is better to keep out all the layers from inner to the outer conductor.



External Antenna VSWR

| Parameters            | Min | Typ | Max | Units |
|-----------------------|-----|-----|-----|-------|
| External Antenna VSWR |     | 1.7 | 2.0 | /     |

## 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:

| Model       | Type                | Connector | Peak gain ( dBi )  |                  |                  |                  |                  |
|-------------|---------------------|-----------|--------------------|------------------|------------------|------------------|------------------|
|             |                     |           | 2400-2483.5<br>MHz | 5150-5250<br>MHz | 5250-5350<br>MHz | 5470-5725<br>MHz | 5725-5850<br>MHz |
| BL-M8800DS1 | External<br>Antenna | /         | 2.00dBi            | 2.00dBi          | 2.00dBi          | 2.00dBi          | 2.00dBi          |

## 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: **2AL6KBL-M8800DS1**”. 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, Part 15E, 15.209, 15.207 requirement, only if the test result comply with FCC part 15C, Part 15E, 15.209, 15.207 requirement, then the host can be sold legally.

### **2.10 Additional testing, Part 15 Subpart B Disclaimer**

This transmitter module is 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 module 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.