

# Approval Sheet

## (產品承認書)

產品名稱 (Product): Bluetooth Low Energy Module

產品型號 (Model No.): **MDBT42T Series** (Chip Antenna)

**MDBT42T – P Series** (PCB Antenna)

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# 1. Overall Introduction

Raytac's MDBT42T & MDBT42T-P is a BT 5.1 stack (Bluetooth low energy or BLE) module designed based on **Nordic nRF52805 SoC solution**, which incorporates: **GPIO**, **SPI**, **UART**, **I2C**, and **ADC** interfaces for connecting peripherals and sensors.

Features:

1. Dual Transmission mode of BLE & 2.4Ghz RF upon customer preference.
2. Compact size with **(L) 11.2 x (W) 7.2 x (H) 2.05 or 1.80 mm**.
3. Low power requirements, ultra-low peak, average and idle mode power consumption.
4. Be compatible with a large installed base of mobile phones, tablets and computers.
5. Fully coverage of BLE software stack.
6. BLE & RF transmission switching helps products fit all operation system and most hardware.

## 1.1. Application

- Data bridge
- Proprietary protocol devices
- Network processor
- Beacons
- Smart Home sensors
- Presenters/Stylus
- Health monitoring
- Drug delivery
- Asset tags
- Toys
- Retail tags and labels

## 1.2. Features

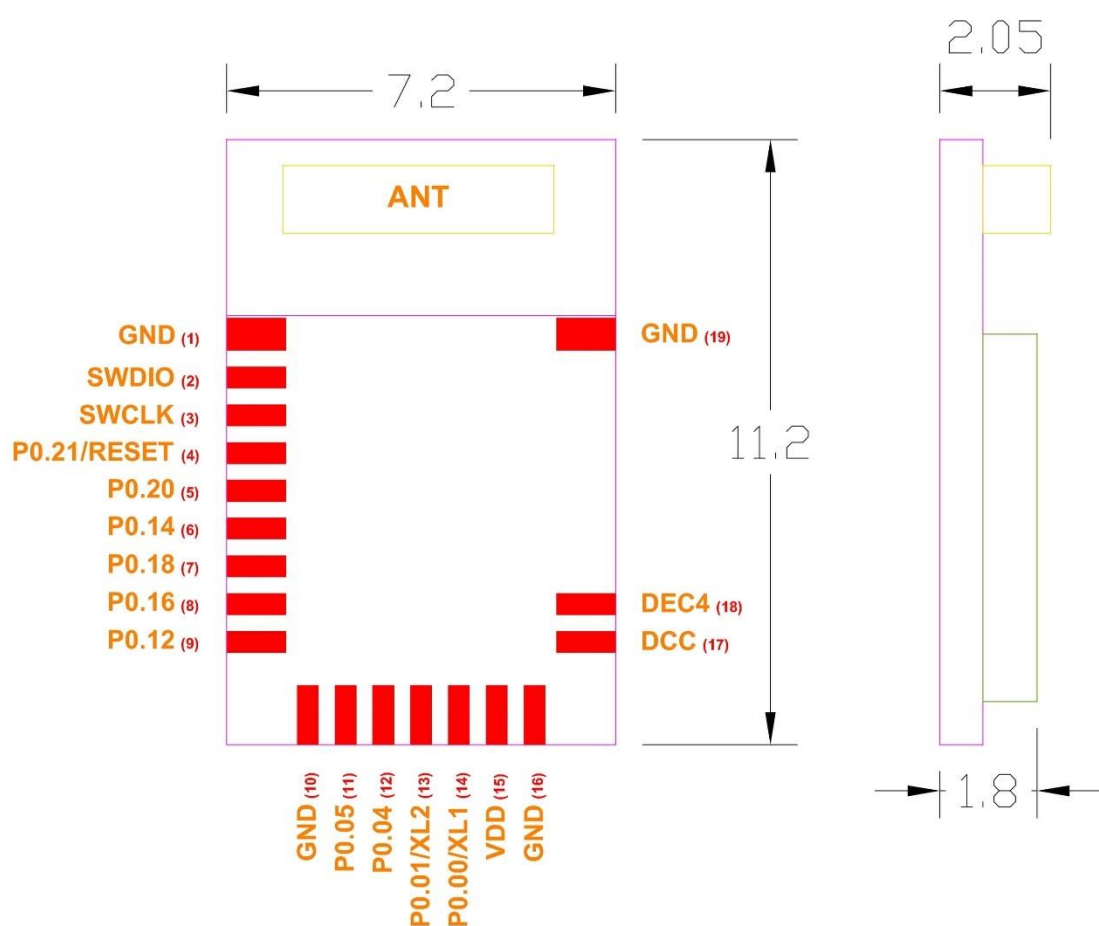
- Multi-protocol 2.4GHz radio
- 32-bit ARM Cortex – M4 processor
- 192KB flash programmed memory and 24KB RAM
- Software stacks available as downloads
- Application development independent from protocol stack
- On-air compatible with nRF51, nRF24AP and nRF24L series
- Programmable output power from +4dBm to -20dBm
- RSSI
- RAM mapped FIFOs using EasyDMA
- Flexible and configurable 10 pin GPIO
- Programmable peripheral interface - PPI
- Full set of digital interface all with Easy DMA including:
  - 1 x Hardware SPI master ; 1 x Hardware SPI slave
  - 1 x two-wire master ; 1 x two-wire slave
  - 1 x UART (CTS / RTS)
- 2 channel 12-bit / 200KSPS ADC
- 128-bit AES ECB / CCM / AAR co-processor
- Low power 32MHz crystal and RC oscillators
- Wide supply voltage range 1.7V to 3.6V
- On-chip DC/DC buck converter
- Individual power management for all peripherals
- Timer counter
  - 3x 32-bit
  - 2 x 24-bit RTC

## 2. Product Dimension

### 2.1. PCB Dimensions & Pin Indication

- **MDBT42T**

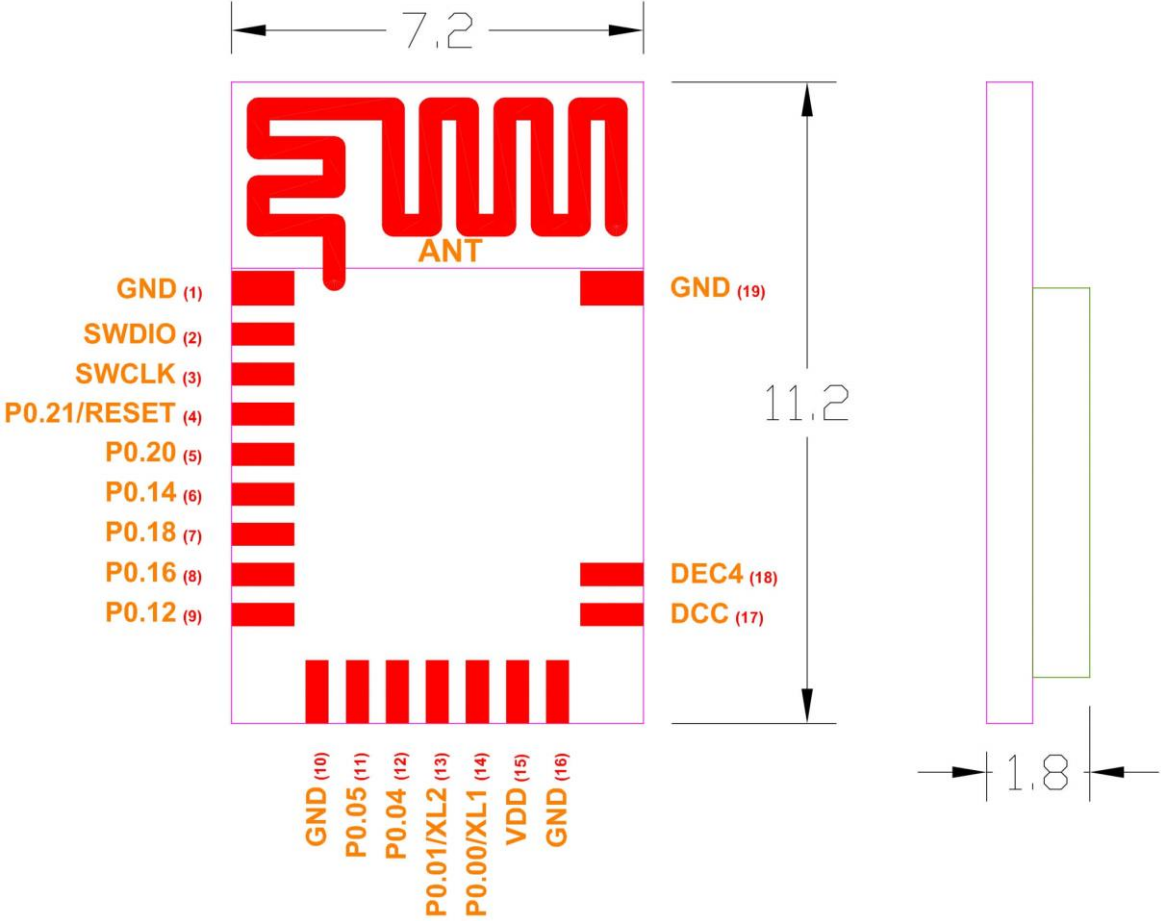
| PCB Size (in mm) |        |      |       |
|------------------|--------|------|-------|
|                  | Min.   | Norm | MAX.  |
| L                |        | 11.2 |       |
| W                | - 0.15 | 7.2  | + 0.2 |
| H                |        | 2.05 |       |



Top (Unit: mm)

• MDBT42T-P

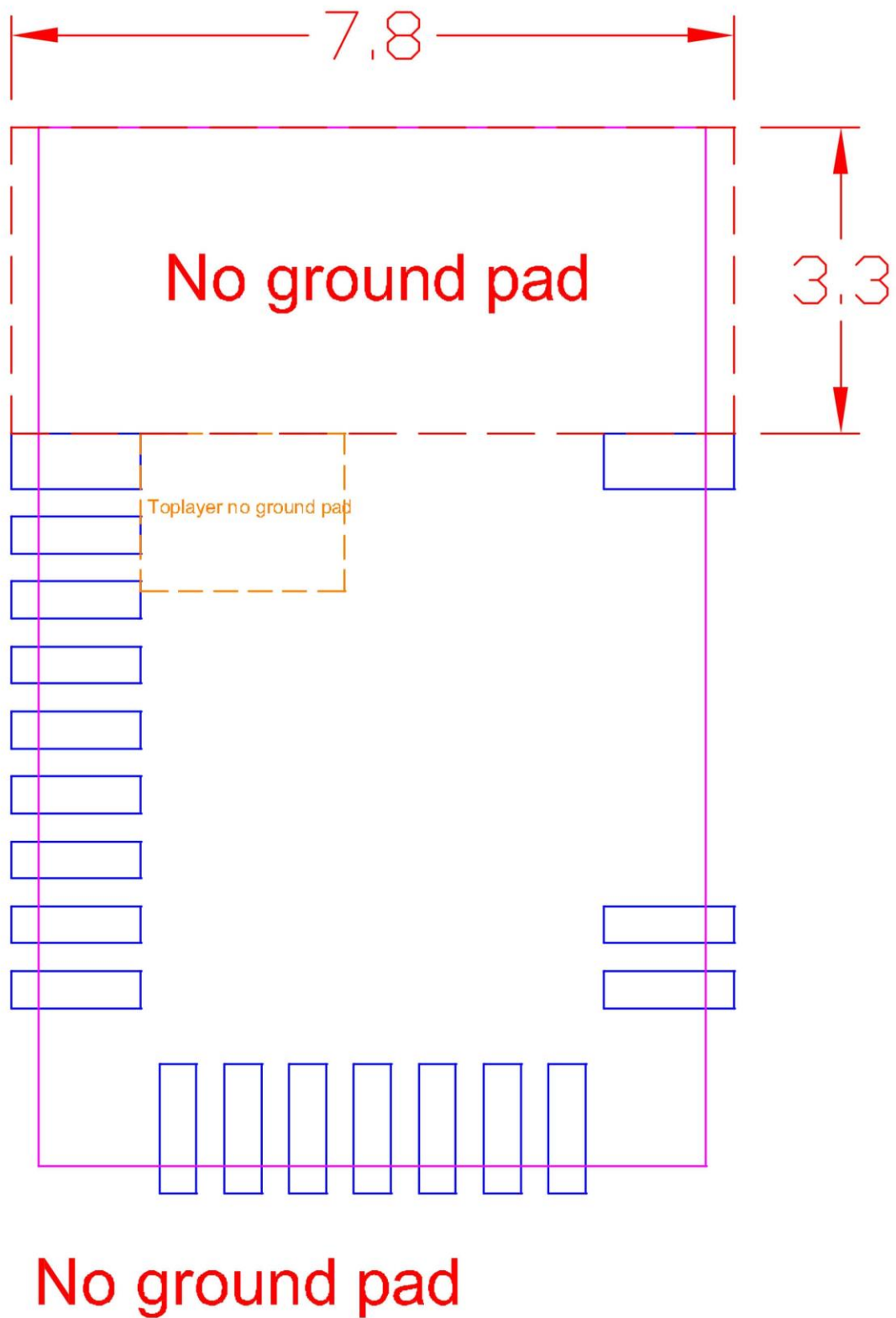
| PCB Size (in mm) |        |      |       |
|------------------|--------|------|-------|
|                  | Min.   | Norm | MAX.  |
| L                |        | 11.2 |       |
| W                | - 0.15 | 7.2  | + 0.2 |
| H                |        | 1.8  |       |

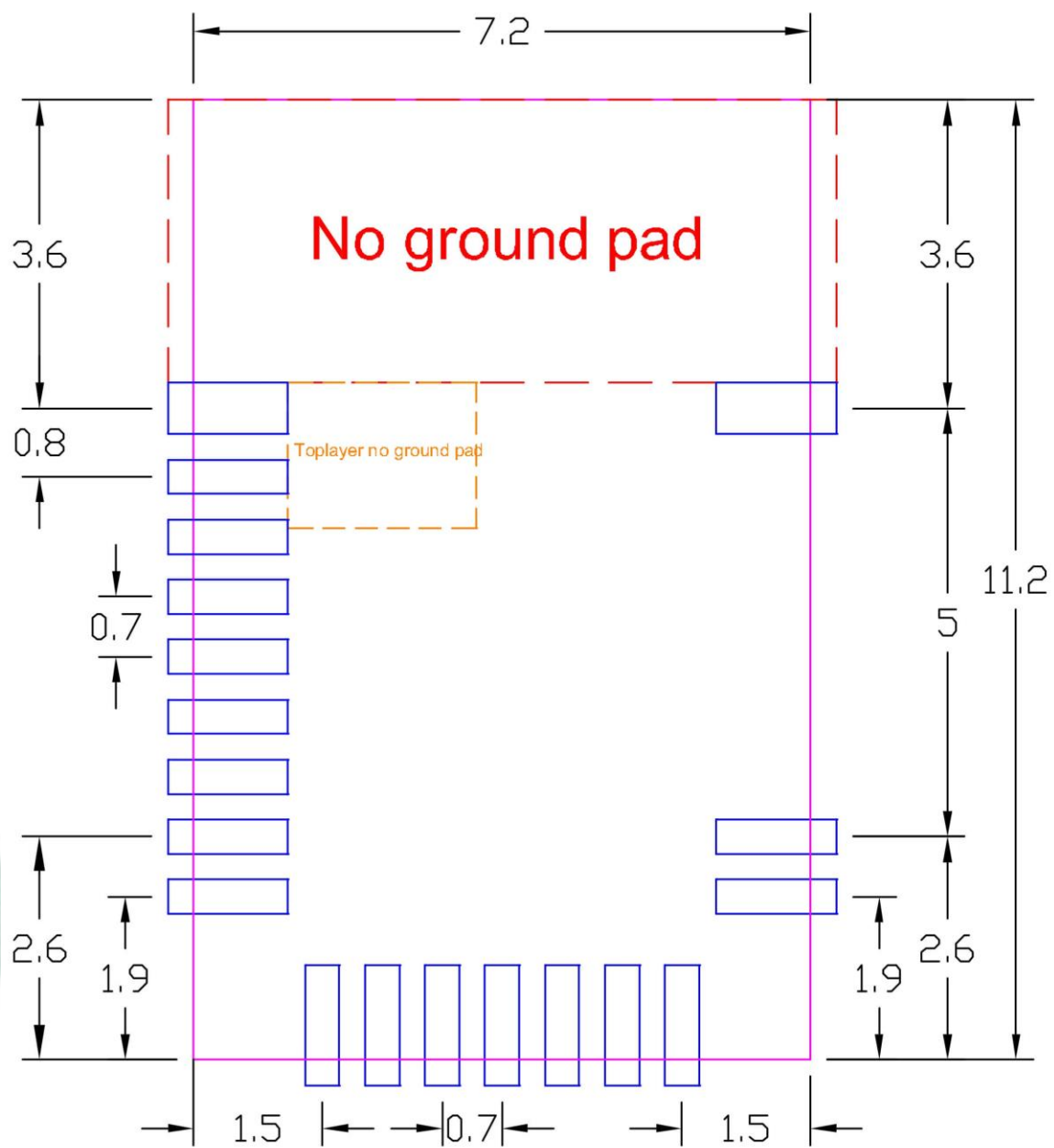


Top (Unit: mm)

## 2.2. Recommended Layout of Solder Pad

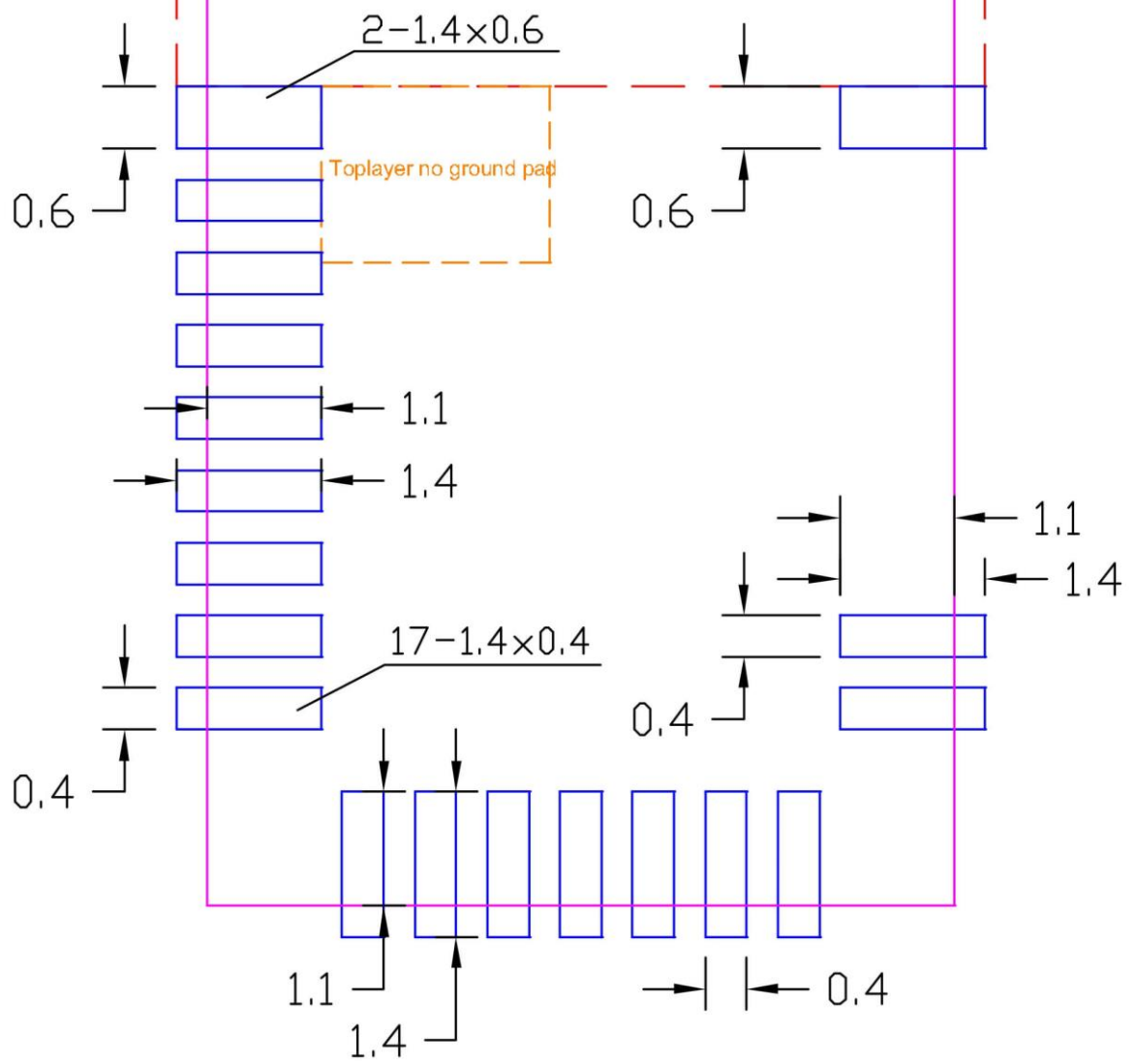
*Graphs are all in Top View, Unit in mm.*

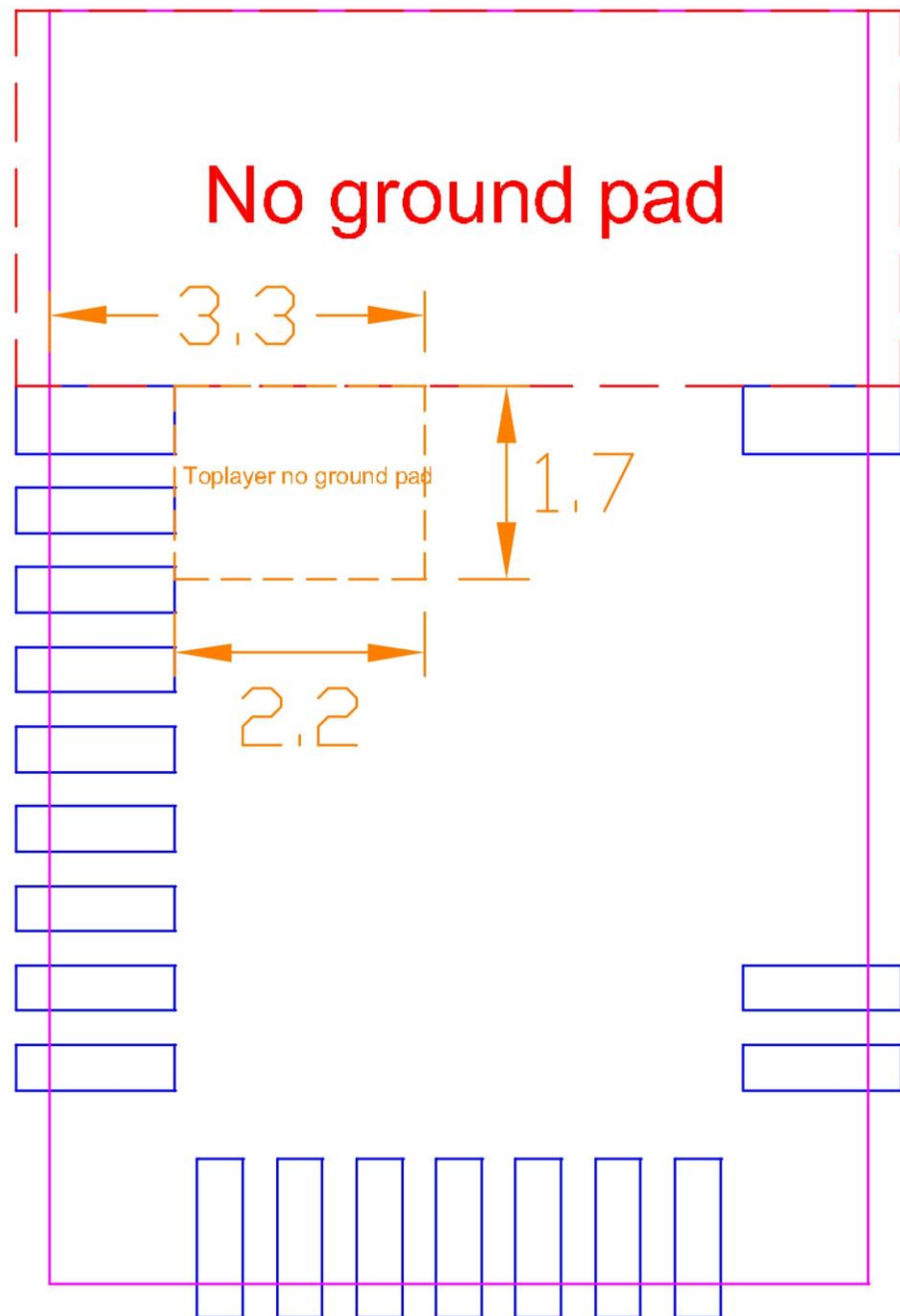




Top View (Unit: mm)  
recommended solder pad layout

No ground pad





Toplayer no ground pad

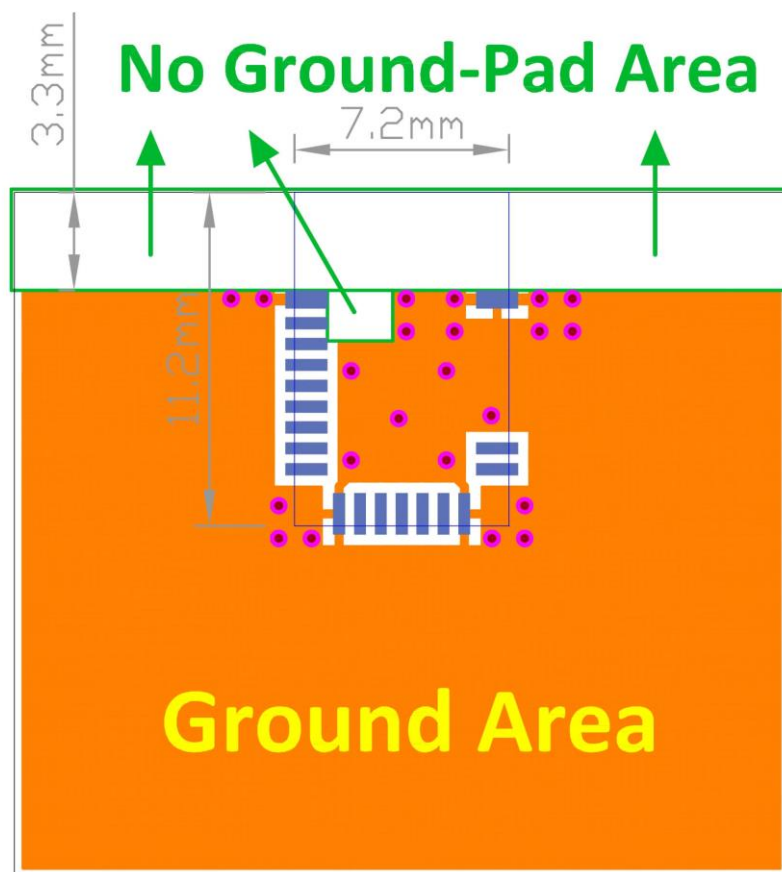
## 2.3. RF Layout Suggestion (aka Keep-Out Area)

Please follow below instruction to have better wireless performance. Make sure to keep the “No-Ground-Pad” as wider as possible when there is no enough space in your design.

No-Ground Pad should be included in the corresponding position of the antenna in **EACH LAYER**.

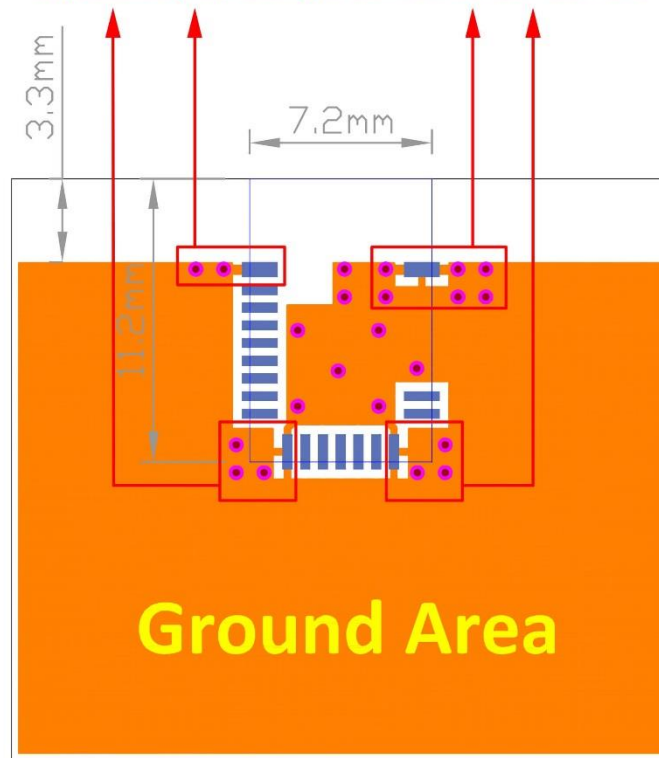
Place the module towards the edge of PCB to have better performance than placing it on the center.

Welcome to send us your layout in PDF for review at [service@raytac.com](mailto:service@raytac.com) or your contact at Raytac with title “Layout reviewing –Raytac model no.–YOUR company’s name”.

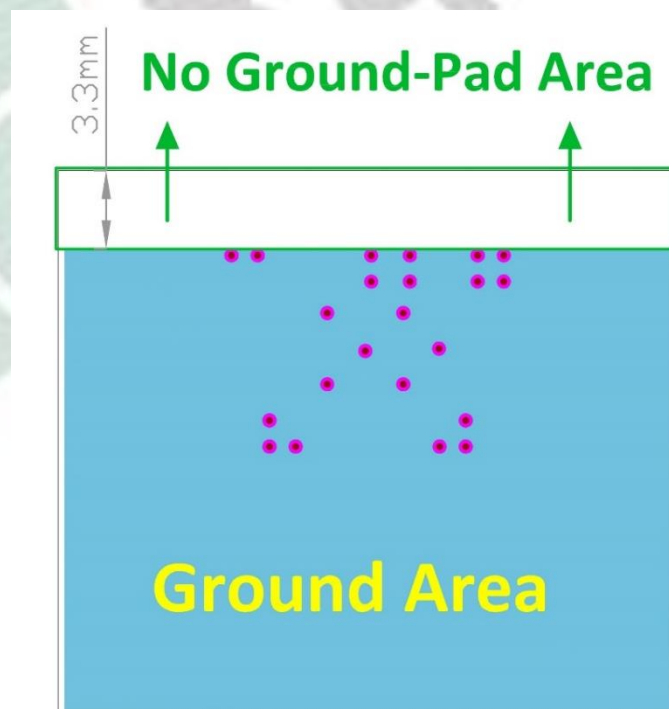


**Top layer**

Please add via holes in GROUND area as many as possible, especially around the four corners.

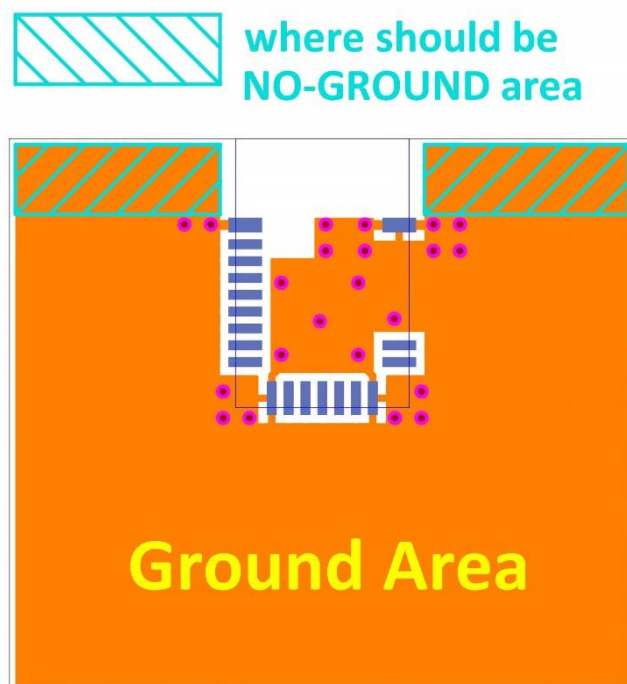
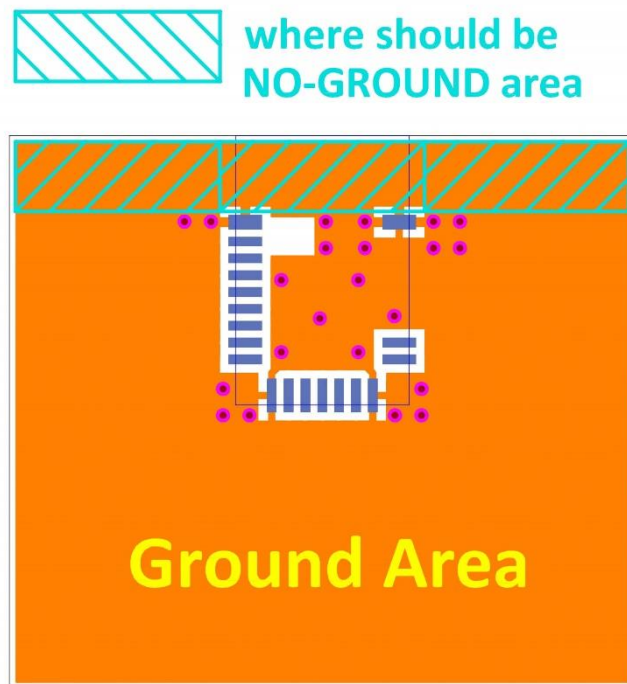


Top layer



Bottom layer

Examples of “**NOT RECOMMENDED**” layout



## 2.4. Footprint & Design Guide

Please visit “[Support](#)” page of our website to download. The package includes footprint, 2D/3D drawing, reflow graph and recommended spec for external 32.768khz.

## 2.5. Pin Assignment

| Pin No. | Name          | Pin function  | Description                                                                      |
|---------|---------------|---------------|----------------------------------------------------------------------------------|
| (1)     | <b>GND</b>    | Ground        | The pad must be connected to a solid ground plane                                |
| (2)     | <b>SWDIO</b>  | Digital I/O   | Serial Wire debug I/O for debug and programming                                  |
| (3)     | <b>SWDCLK</b> | Digital input | Serial Wire debug clock input for debug and programming                          |
| (4)     | <b>P0.21</b>  | Digital I/O   | General-purpose digital I/O                                                      |
|         | <b>RESET</b>  |               | Configurable as system RESET pin                                                 |
| (5)     | <b>P0.20</b>  | Digital I/O   | General-purpose digital I/O                                                      |
| (6)     | <b>P0.14</b>  | Digital I/O   | General-purpose digital I/O                                                      |
| (7)     | <b>P0.18</b>  | Digital I/O   | General-purpose digital I/O                                                      |
| (8)     | <b>P0.16</b>  | Digital I/O   | General-purpose digital I/O                                                      |
| (9)     | <b>P0.12</b>  | Digital I/O   | General-purpose digital I/O                                                      |
| (10)    | <b>GND</b>    | Ground        | The pad must be connected to a solid ground plane                                |
| (11)    | <b>P0.05</b>  | Digital I/O   | General-purpose digital I/O                                                      |
|         | <b>AIN3</b>   | Analog input  | SAADC input                                                                      |
| (12)    | <b>P0.04</b>  | Digital I/O   | General-purpose digital I/O                                                      |
|         | <b>AIN2</b>   | Analog input  | SAADC input                                                                      |
| (13)    | <b>P0.01</b>  | Digital I/O   | General-purpose digital I/O                                                      |
|         | <b>XL2</b>    | Analog input  | Connection to 32.768khz crystal (LFXO)                                           |
| (14)    | <b>P0.00</b>  | Digital I/O   | General-purpose digital I/O                                                      |
|         | <b>XL1</b>    | Analog input  | Connection to 32.768khz crystal (LFXO)                                           |
| (15)    | <b>VDD</b>    | Power         | Power-supply pin                                                                 |
| (16)    | <b>GND</b>    | Ground        | The pad must be connected to a solid ground plane                                |
| (17)    | <b>DCC</b>    | Power         | DC/DC converter output pin                                                       |
| (18)    | <b>DEC4</b>   | Power         | 1V3 regulator supply decoupling. Input from DC/DC converter. Output from 1V3 LDO |
| (19)    | <b>GND</b>    | Ground        | The pad must be connected to a solid ground plane                                |

### 3. Main Chip Solution

| RF IC           | Crystal Frequency |
|-----------------|-------------------|
| Nordic NRF52805 | 32MHZ             |

*32MHz crystal is already inside the module.*



## 4. Specification

*Any technical spec shall refer to Nordic's official documents as final reference.*

### 4.1. Absolute Maximum Ratings

|                                    | Note                       | Min.   | Max.      | Unit               |
|------------------------------------|----------------------------|--------|-----------|--------------------|
| <b>Supply voltages</b>             |                            |        |           |                    |
| VDD                                |                            | -0.3   | +3.9      | V                  |
| VSS                                |                            |        | 0         | V                  |
| <b>I/O pin voltage</b>             |                            |        |           |                    |
| V <sub>I/O</sub> , VDD ≤ 3.6 V     |                            | -0.3   | VDD + 0.3 | V                  |
| V <sub>I/O</sub> , VDD > 3.6 V     |                            | -0.3   | 3.9       | V                  |
| <b>Environmental WLCSP package</b> |                            |        |           |                    |
| Storage temperature                |                            | -40    | +125      | °C                 |
| MSL                                | Moisture Sensitivity Level |        | 1         |                    |
| ESD HBM                            | Human Body Model           |        | 3         | kV                 |
| ESD HBM Class                      | Human Body Model Class     |        | 2         |                    |
| ESD CDM                            | Charged Device Model       |        | 1         | kV                 |
| <b>Flash memory</b>                |                            |        |           |                    |
| Endurance                          |                            | 10 000 |           | write/erase cycles |
| Retention at 85 °C                 |                            | 10     |           | years              |

### 4.2. Operation Conditions

| Symbol             | Parameter                                  | Min. | Nom. | Max. | Units |
|--------------------|--------------------------------------------|------|------|------|-------|
| VDD                | Supply voltage, independent of DCDC enable | 1.7  | 3.0  | 3.6  | V     |
| t <sub>R_VDD</sub> | Supply rise time (0 V to 1.7 V)            |      |      | 60   | ms    |
| TA                 | Operating temperature                      | -40  | 25   | 85   | °C    |

Important: The on-chip power-on reset circuitry may not function properly for rise times longer than the specified maximum.

## 4.3. Electrical Specifications

### 4.3.1. General Radio Characteristics

| Symbol             | Description                      | Min. | Typ.      | Max. | Units |
|--------------------|----------------------------------|------|-----------|------|-------|
| $f_{OP}$           | Operating frequencies            | 2360 |           | 2500 | MHz   |
| $f_{PLL,CH,SP}$    | PLL channel spacing              |      | 1         |      | MHz   |
| $f_{DELTA,1M}$     | Frequency deviation @ 1 Mbps     |      | $\pm 170$ |      | kHz   |
| $f_{DELTA,BLE,1M}$ | Frequency deviation @ BLE 1 Mbps |      | $\pm 250$ |      | kHz   |
| $f_{DELTA,2M}$     | Frequency deviation @ 2 Mbps     |      | $\pm 320$ |      | kHz   |
| $f_{DELTA,BLE,2M}$ | Frequency deviation @ BLE 2 Mbps |      | $\pm 500$ |      | kHz   |
| $fsk_{BPS}$        | On-the-air data rate             | 1000 |           | 2000 | kbps  |

### 4.3.2. Radio Current Consumption (Transmitter)

| Symbol                   | Description                                      | Min. | Typ. | Max. | Units |
|--------------------------|--------------------------------------------------|------|------|------|-------|
| $I_{TX,PLUS4dBm,DCDC}$   | TX only run current (DCDC, 3V) $P_{RF} = +4$ dBm |      | 7.0  |      | mA    |
| $I_{TX,PLUS4dBm}$        | TX only run current $P_{RF} = +4$ dBm            |      | 15.4 |      | mA    |
| $I_{TX,0dBm,DCDC}$       | TX only run current (DCDC, 3V) $P_{RF} = 0$ dBm  |      | 4.6  |      | mA    |
| $I_{TX,0dBm}$            | TX only run current $P_{RF} = 0$ dBm             |      | 10.1 |      | mA    |
| $I_{TX,MINUS4dBm,DCDC}$  | TX only run current DCDC, 3V $P_{RF} = -4$ dBm   |      | 3.6  |      | mA    |
| $I_{TX,MINUS4dBm}$       | TX only run current $P_{RF} = -4$ dBm            |      | 7.8  |      | mA    |
| $I_{TX,MINUS8dBm,DCDC}$  | TX only run current DCDC, 3V $P_{RF} = -8$ dBm   |      | 3.2  |      | mA    |
| $I_{TX,MINUS8dBm}$       | TX only run current $P_{RF} = -8$ dBm            |      | 6.8  |      | mA    |
| $I_{TX,MINUS12dBm,DCDC}$ | TX only run current DCDC, 3V $P_{RF} = -12$ dBm  |      | 2.9  |      | mA    |
| $I_{TX,MINUS12dBm}$      | TX only run current $P_{RF} = -12$ dBm           |      | 6.2  |      | mA    |
| $I_{TX,MINUS16dBm,DCDC}$ | TX only run current DCDC, 3V $P_{RF} = -16$ dBm  |      | 2.7  |      | mA    |
| $I_{TX,MINUS16dBm}$      | TX only run current $P_{RF} = -16$ dBm           |      | 5.7  |      | mA    |
| $I_{TX,MINUS20dBm,DCDC}$ | TX only run current DCDC, 3V $P_{RF} = -20$ dBm  |      | 2.5  |      | mA    |
| $I_{TX,MINUS20dBm}$      | TX only run current $P_{RF} = -20$ dBm           |      | 5.4  |      | mA    |
| $I_{TX,MINUS40dBm,DCDC}$ | TX only run current DCDC, 3V $P_{RF} = -40$ dBm  |      | 2.1  |      | mA    |
| $I_{TX,MINUS40dBm}$      | TX only run current $P_{RF} = -40$ dBm           |      | 4.3  |      | mA    |
| $I_{START,TX,DCDC}$      | TX start-up current DC/DC, 3 V, $P_{RF} = 4$ dBm | ..   | ..   | ..   | mA    |
| $I_{START,TX}$           | TX start-up current, $P_{RF} = 4$ dBm            | ..   | ..   | ..   | mA    |

### 4.3.3. Radio Current Consumption (Receiver)

| Symbol                 | Description                                        | Min. | Typ. | Max. | Units |
|------------------------|----------------------------------------------------|------|------|------|-------|
| $I_{RX,1M,DCDC}$       | RX only run current (DC/DC, 3 V) 1 Mbps/1 Mbps BLE |      | 4.6  |      | mA    |
| $I_{RX,1M}$            | RX only run current (LDO, 3 V) 1 Mbps/1 Mbps BLE   |      | 10.0 |      | mA    |
| $I_{RX,2M,DCDC}$       | RX only run current (DC/DC, 3 V) 2 Mbps/2 Mbps BLE |      | 5.2  |      | mA    |
| $I_{RX,2M}$            | RX only run current (LDO, 3 V) 2 Mbps/2 Mbps BLE   |      | 11.2 |      | mA    |
| $I_{START,RX,1M,DCDC}$ | RX start-up current (DC/DC, 3 V) 1 Mbps/1 Mbps BLE |      | 3.5  |      | mA    |
| $I_{START,RX,1M}$      | RX start-up current 1 Mbps/1 Mbps BLE              |      | 6.7  |      | mA    |

### 4.3.4. Transmitter Specification

| Symbol      | Description                                        | Min. | Typ. | Max.    | Units |
|-------------|----------------------------------------------------|------|------|---------|-------|
| $P_{RF}$    | Maximum output power                               |      | 4    |         | dBm   |
| $P_{RFC}$   | RF power control range                             |      | 24   |         | dB    |
| $P_{RFCR}$  | RF power accuracy                                  |      |      | $\pm 4$ | dB    |
| $P_{RF1,1}$ | 1st Adjacent Channel Transmit Power 1 MHz (1 Mbps) |      | -25  |         | dBc   |
| $P_{RF2,1}$ | 2nd Adjacent Channel Transmit Power 2 MHz (1 Mbps) |      | -50  |         | dBc   |
| $P_{RF1,2}$ | 1st Adjacent Channel Transmit Power 2 MHz (2 Mbps) |      | -25  |         | dBc   |
| $P_{RF2,2}$ | 2nd Adjacent Channel Transmit Power 4 MHz (2 Mbps) |      | -50  |         | dBc   |

### 4.3.5. Receiver Operation

| Symbol                  | Description                                                                                        | Min. | Typ. | Max. | Units |
|-------------------------|----------------------------------------------------------------------------------------------------|------|------|------|-------|
| $P_{RX,MAX}$            | Maximum received signal strength at < 0.1% PER                                                     |      | 0    |      | dBm   |
| $P_{SENS,IT,1M}$        | Sensitivity, 1 Mbps nRF mode ideal transmitter <sup>1</sup>                                        |      | -94  |      | dBm   |
| $P_{SENS,IT,2M}$        | Sensitivity, 2 Mbps nRF mode ideal transmitter <sup>1</sup>                                        |      | -91  |      | dBm   |
| $P_{SENS,IT,SP,1M,BLE}$ | Sensitivity, 1 Mbps BLE ideal transmitter, packet length $\leq 37$ bytes BER= $1E-3$ <sup>2</sup>  |      | -97  |      | dBm   |
| $P_{SENS,IT,LP,1M,BLE}$ | Sensitivity, 1 Mbps BLE ideal transmitter, packet length $\geq 128$ bytes BER= $1E-4$ <sup>3</sup> |      | -96  |      | dBm   |
| $P_{SENS,IT,SP,2M,BLE}$ | Sensitivity, 2 Mbps BLE ideal transmitter, packet length $\leq 37$ bytes                           |      | -94  |      | dBm   |

1. Typical sensitivity applies when ADDR0 is used for receiver address correlation. When ADDR [1...7] are used for receiver address correlation, the typical sensitivity for this mode is degraded by 3dB.

2. As defined in the Bluetooth Core Specification v4.0 Volume 6: Core System Package (Low Energy Controller Volume).

3. Equivalent BER limit <  $10E-04$ .

### 4.3.6. RX Selectivity

| Symbol                   | Description                                              | Min. | Typ. | Max. | Units |
|--------------------------|----------------------------------------------------------|------|------|------|-------|
| $C/I_{1M,co-channel}$    | 1Mbps mode, co-channel interference                      |      | 9    |      | dB    |
| $C/I_{1M,-1MHz}$         | 1 Mbps mode, Adjacent (-1 MHz) interference              |      | -2   |      | dB    |
| $C/I_{1M,+1MHz}$         | 1 Mbps mode, Adjacent (+1 MHz) interference              |      | -10  |      | dB    |
| $C/I_{1M,-2MHz}$         | 1 Mbps mode, Adjacent (-2 MHz) interference              |      | -19  |      | dB    |
| $C/I_{1M,+2MHz}$         | 1 Mbps mode, Adjacent (+2 MHz) interference              |      | -42  |      | dB    |
| $C/I_{1M,-3MHz}$         | 1 Mbps mode, Adjacent (-3 MHz) interference              |      | -38  |      | dB    |
| $C/I_{1M,+3MHz}$         | 1 Mbps mode, Adjacent (+3 MHz) interference              |      | -48  |      | dB    |
| $C/I_{1M,\pm 6MHz}$      | 1 Mbps mode, Adjacent ( $\geq 6$ MHz) interference       |      | -50  |      | dB    |
| $C/I_{1MBLE,co-channel}$ | 1 Mbps BLE mode, co-channel interference                 |      | 6    |      | dB    |
| $C/I_{1MBLE,-1MHz}$      | 1 Mbps BLE mode, Adjacent (-1 MHz) interference          |      | -2   |      | dB    |
| $C/I_{1MBLE,+1MHz}$      | 1 Mbps BLE mode, Adjacent (+1 MHz) interference          |      | -9   |      | dB    |
| $C/I_{1MBLE,-2MHz}$      | 1 Mbps BLE mode, Adjacent (-2 MHz) interference          |      | -22  |      | dB    |
| $C/I_{1MBLE,+2MHz}$      | 1 Mbps BLE mode, Adjacent (+2 MHz) interference          |      | -46  |      | dB    |
| $C/I_{1MBLE,>3MHz}$      | 1 Mbps BLE mode, Adjacent ( $\geq 3$ MHz) interference   |      | -50  |      | dB    |
| $C/I_{1MBLE,image}$      | Image frequency interference                             |      | -22  |      | dB    |
| $C/I_{1MBLE,image,1MHz}$ | Adjacent (1 MHz) interference to in-band image frequency |      | -35  |      | dB    |
| $C/I_{2M,co-channel}$    | 2 Mbps mode, co-channel interference                     |      | 10   |      | dB    |
| $C/I_{2M,-2MHz}$         | 2 Mbps mode, Adjacent (-2 MHz) interference              |      | 6    |      | dB    |
| $C/I_{2M,+2MHz}$         | 2 Mbps mode, Adjacent (+2 MHz) interference              |      | -14  |      | dB    |
| $C/I_{2M,-4MHz}$         | 2 Mbps mode, Adjacent (-4 MHz) interference              |      | -20  |      | dB    |
| $C/I_{2M,+4MHz}$         | 2 Mbps mode, Adjacent (+4 MHz) interference              |      | -44  |      | dB    |
| $C/I_{2M,-6MHz}$         | 2 Mbps mode, Adjacent (-6 MHz) interference              |      | -42  |      | dB    |
| $C/I_{2M,+6MHz}$         | 2 Mbps mode, Adjacent (+6 MHz) interference              |      | -47  |      | dB    |
| $C/I_{2M,\geq 12MHz}$    | 2 Mbps mode, Adjacent ( $\geq 12$ MHz) interference      |      | -52  |      | dB    |
| $C/I_{2MBLE,co-channel}$ | 2 Mbps BLE mode, co-channel interference                 |      | 6    |      | dB    |
| $C/I_{2MBLE,-2MHz}$      | 2 Mbps BLE mode, Adjacent (-2 MHz) interference          |      | -2   |      | dB    |
| $C/I_{2MBLE,+2MHz}$      | 2 Mbps BLE mode, Adjacent (+2 MHz) interference          |      | -12  |      | dB    |
| $C/I_{2MBLE,-4MHz}$      | 2 Mbps BLE mode, Adjacent (-4 MHz) interference          |      | -22  |      | dB    |
| $C/I_{2MBLE,+4MHz}$      | 2 Mbps BLE mode, Adjacent (+4 MHz) interference          |      | -46  |      | dB    |
| $C/I_{2MBLE,\geq 6MHz}$  | 2 Mbps BLE mode, Adjacent ( $\geq 6$ MHz) interference   |      | -50  |      | dB    |
| $C/I_{2MBLE,image}$      | Image frequency interference                             |      | -29  |      | dB    |
| $C/I_{2MBLE,image,2MHz}$ | Adjacent (2 MHz) interference to in-band image frequency |      | -44  |      | dB    |

Remark: Wanted signal level at PIN = -67 dBm. One interferer is used, having equal modulation as the wanted signal. The input power of the interferer where the sensitivity equals BER = 0.1% is presented.

### 4.3.7. RX Intermodulation

| Symbol                      | Description                                                                | Min. | Typ. | Max. | Units |
|-----------------------------|----------------------------------------------------------------------------|------|------|------|-------|
| P <sub>IMD,5TH,1M</sub>     | IMD performance, 1 Msps, 5th offset channel, Packet length <= 37 bytes     |      | -33  |      | dBm   |
| P <sub>IMD,5TH,1M,BLE</sub> | IMD performance, BLE 1 Msps, 5th offset channel, Packet length <= 37 bytes |      | -30  |      | dBm   |
| P <sub>IMD,5TH,2M</sub>     | IMD performance, 2 Msps, 5th offset channel, Packet length <= 37 bytes     |      | -33  |      | dBm   |
| P <sub>IMD,5TH,2M,BLE</sub> | IMD performance, BLE 2 Msps, 5th offset channel, Packet length <= 37 bytes |      | -31  |      | dBm   |

Remark: Wanted signal level at PIN = -64dBm. Two interferers with equal input power are used. The interferer closest in frequency is not modulated, the other interferer is modulated equal with the wanted signal. The input power of the interferers where the sensitivity equals BER = 0.1% is presented.

### 4.3.8. Radio Timing Parameters

| Symbol                        | Description                                                                                                              | Min. | Typ. | Max. | Units |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------|------|------|------|-------|
| t <sub>TXEN,BLE,1M</sub>      | Time between TXEN task and READY event after channel FREQUENCY configured (1 Mbps BLE and 150 µs TIFS)                   |      | 140  |      | µs    |
| t <sub>TXEN,FAST,BLE,1M</sub> | Time between TXEN task and READY event after channel FREQUENCY configured (1 Mbps BLE with fast ramp-up and 150 µs TIFS) |      | 40   |      | µs    |
| t <sub>TXDIS,BLE,1M</sub>     | When in TX, delay between DISABLE task and DISABLED event for MODE = Nrf_1Mbit and MODE = Ble_1Mbit                      |      | 6    |      | µs    |
| t <sub>RXEN,BLE,1M</sub>      | Time between the RXEN task and READY event after channel FREQUENCY configured (1 Mbps BLE)                               |      | 140  |      | µs    |
| t <sub>RXEN,FAST,BLE,1M</sub> | Time between the RXEN task and READY event after channel FREQUENCY configured (1 Mbps BLE with fast ramp-up)             |      | 40   |      | µs    |
| t <sub>RXDIS,BLE,1M</sub>     | When in RX, delay between DISABLE task and DISABLED event for MODE = Nrf_1Mbit and MODE = Ble_1Mbit                      |      | 0    |      | µs    |
| t <sub>TXDIS,BLE,2M</sub>     | When in TX, delay between DISABLE task and DISABLED event for MODE = Nrf_2Mbit and MODE = Ble_2Mbit                      |      | 4    |      | µs    |
| t <sub>RXDIS,BLE,2M</sub>     | When in RX, delay between DISABLE task and DISABLED event for MODE = Nrf_2Mbit and MODE = Ble_2Mbit                      |      | 0    |      | µs    |

### 4.3.9. RSSI Specifications

| Symbol                     | Description                                  | Min. | Typ. | Max. | Units |
|----------------------------|----------------------------------------------|------|------|------|-------|
| RSSI <sub>ACC</sub>        | RSSI accuracy <sup>18</sup>                  |      | ±2   |      | dB    |
| RSSI <sub>RESOLUTION</sub> | RSSI resolution                              |      | 1    |      | dB    |
| RSSI <sub>PERIOD</sub>     | RSSI sampling time from RSSI_START task      |      | 0.25 |      | µs    |
| RSSI <sub>SETTLE</sub>     | RSSI settling time after signal level change |      | 15   |      | µs    |

### 4.3.10. CPU

| Symbol                  | Description                                  | Min. | Typ. | Max. | Units        |
|-------------------------|----------------------------------------------|------|------|------|--------------|
| W <sub>FLASH</sub>      | CPU wait states, running from flash          | 0    |      | 2    |              |
| W <sub>RAM</sub>        | CPU wait states, running from RAM            |      |      | 0    |              |
| CM <sub>FLASH</sub>     | CoreMark <sup>1</sup> , running from flash   |      | 144  |      | CoreMark     |
| CM <sub>FLASH/MHz</sub> | CoreMark per MHz, running from flash         |      | 2.25 |      | CoreMark/MHz |
| CM <sub>FLASH/mA</sub>  | CoreMark per mA, running from flash, DCDC 3V |      | 65   |      | CoreMark/mA  |

### 4.3.11. Power Management

| Symbol                           | Description                                                                           | Min. | Typ. | Max. | Units |
|----------------------------------|---------------------------------------------------------------------------------------|------|------|------|-------|
| I <sub>ON_RAMOFF_EVENT</sub>     | System ON, no RAM retention, wake on any event                                        |      | 0.6  |      | µA    |
| I <sub>ON_RAMON_EVENT</sub>      | System ON, full 24 kB RAM retention, wake on any event                                |      | 0.8  |      | µA    |
| I <sub>ON_RAMON_POF</sub>        | System ON, full 24 kB RAM retention, wake on any event, power-fail comparator enabled |      | 0.8  |      | µA    |
| I <sub>ON_RAMON_GPIOTE</sub>     | System ON, full 24 kB RAM retention, wake on GPIOTE input (event mode)                |      | 3.3  |      | µA    |
| I <sub>ON_RAMON_GPIOTEPORT</sub> | System ON, full 24 kB RAM retention, wake on GPIOTE PORT event                        |      | 0.8  |      | µA    |
| I <sub>ON_RAMOFF_RTC</sub>       | System ON, no RAM retention, wake on RTC (running from LFRC clock)                    |      | 1.4  |      | µA    |
| I <sub>ON_RAMON_RTC</sub>        | System ON, full 24 kB RAM retention, wake on RTC (running from LFRC clock)            |      | 1.5  |      | µA    |
| I <sub>OFF_RAMOFF_RESET</sub>    | System OFF, no RAM retention, wake on reset                                           |      | 0.3  |      | µA    |
| I <sub>OFF_RAMON_RESET</sub>     | System OFF, full 24 kB RAM retention, wake on reset                                   |      | 0.5  |      | µA    |
| I <sub>ON_RAMON_RTC_LFXO</sub>   | System ON, full 24 kB RAM retention, wake on RTC (running from LFXO clock)            |      | 1.1  |      | µA    |
| I <sub>ON_RAMOFF_RTC_LFXO</sub>  | System ON, no RAM retention, wake on RTC (running from LFXO clock)                    |      | 1.0  |      | µA    |

## 5. FCC Compliance

This equipment has been tested and found to comply with the limits for a Class 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 the radio communications. However, there are no guarantees that interference will not occur in a particular installation.

### Troubleshooting

If this equipment does cause harmful interference to radio reception, which can be determined by turning the equipment off and on, the user is encouraged to correct the interference by one or more of the following instructions.

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Consult dealer or an experienced radio technician.

### Conditions

Operation is subject to the following conditions

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

### FCC Caution

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.

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

### RF Exposure

#### **FCC RF Radiation Exposure Statement:**

1. This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
2. For body worn operation, this device has been tested and meets FCC RF exposure guidelines. When used with an accessory that contains metal may not ensure compliance with FCC RF exposure guidelines.

**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.

#### **Required End Product Labeling**

Any device incorporating this module must include an external, visible, permanent marking or label which states: "Contains FCC ID: SH6MDBT42T"

#### **Applicable FCC Rules**

This module has been tested and found to comply with the following requirements for Modular Approval.

- Part 15.247 - Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

#### **Additional testing, Part 15 Subpart B disclaimer**

The modular transmitter 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 product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

#### **Test Modes**

This device uses various test mode programs for test set up which operate separate from production firmware. Host integrators should contact the grantee for assistance with test modes needed for module/host compliance test requirements.

#### **Antennas**

The following external antenna type have been approved for use with this module.

| Radio | Model     | Antenna Type | Freq. (MHz) | Max. Peak Antenna Gain (dBi) |
|-------|-----------|--------------|-------------|------------------------------|
| BLE   | MDBT42T   | Chip         | 2402-2480   | -1.52                        |
| BLE   | MDBT42T-P | PCB          | 2402-2480   | -4.67                        |

In the end product, the antenna(s) used with this transmitter must be installed and must not be co-located or operation in conjunction with any other antenna or transmitter except in

accordance with FCC multi-transmitter product procedures.

#### End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 5mm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following:

Contains FCC ID: SH6MDBT42T

#### Manual Information to the End User

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

## 6. IC Caution

*This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:*

- 1. This device may not cause interference.*
- 2. This device must accept any interference, including interference that may cause undesired operation of the device.*

### **Avis Canadien**

*L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :*

- 1. L'appareil ne doit pas produire de brouillage;*
- 2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

### **RF Radiation Exposure Statement:**

1. To comply with the Canadian RF exposure compliance requirements, this device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter.
2. For body worn operation, this phone has been tested and meets RF exposure guidelines when used with an accessory that contains no metal. Use of other accessories may not ensure compliance with RF exposure guidelines.

### **Déclaration de l'exposition aux radiations RF:**

1. Pour se conformer aux exigences de conformité RF canadienne l'exposition, cet appareil et son antenne ne doivent pas être co-localisés ou fonctionnant en conjonction avec une autre antenne ou transmetteur.
2. Pour le fonctionnement du corps, ce téléphone a été testé et répond aux directives d'exposition RF lorsqu'il est utilisé avec un accessoire qui ne contient pas de métal. Utilisation d'autres accessoires peut ne pas assurer le respect des directives d'exposition RF.

### **Required End Product Labeling**

Any device incorporating this module must include an external, visible, permanent marking or label which states: "Contains IC : 8017A-MDBT42T"

### **Obligation d'étiquetage du produit final:**

Tout dispositif intégrant ce module doit comporter un externe, visible, marquage permanent ou une étiquette qui dit: "Contient IC : 8017A-MDBT42T"

## Antennas

This radio transmitter has been approved by Industry 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.

## Antennes

Cet émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous avec le gain maximal admissible indiqué. types d'antennes non inclus dans cette liste, ayant un gain supérieur au gain maximum indiqué pour ce type, sont strictement interdits pour une utilisation avec cet appareil.

| Radio | ISED HVIN | Antenna Type | Freq. (MHz) | Max. Peak Antenna Gain (dBi) |
|-------|-----------|--------------|-------------|------------------------------|
| BLE   | MDBT42T   | Chip         | 2402-2480   | -1.52                        |
| BLE   | MDBT42T-P | PCB          | 2402-2480   | -4.67                        |

## 7. NCC 警語

根據 NCC 低功率電波輻射性電機管理辦法規定

### LP0002 低功率射頻器材技術規範\_章節 3.8.2

取得審驗證明之低功率射頻器材，非經核准，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

低功率射頻器材之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前述合法通信，指依電信管理法規定作業之無線電通信。

低功率射頻器材須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

此模組於取得認證後將依規定於模組本體標示審驗合格標籤，並要求平台廠商於平台上標示。

「本產品內含射頻模組：ID 編號 XXXXX」字樣