

**ABEEWAY**

# TEST REPORT

**SCOPE OF WORK**

Japan Radio Testing – A003

**REPORT NUMBER**

210118040SZN-001

**ISSUE DATE**

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Japan Radio Test Report-Bluetooth 2.4G Band  
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# JAPAN Radio Test Report

Data transmission equipment operating in the 2.4GHz

|                         |  |
|-------------------------|--|
| <b>Applicant:</b>       | ABEEWAY  |
| <b>Address:</b>         | Les Algorithmes-Aristote A, 2000 Route des Lucioles                                    |
| <b>Manufacturer:</b>    | Nationgate Solution Sdn Bhd  |
| <b>Address:</b>         | 1413, Solok Perusahaan Satu, Kawasan Perindustrian Prai, 13600 Perai, Penang, Malaysia |
| <b>Product Name:</b>    | Micro Tracker  |
| <b>Model No.:</b>       | A003   |
| <b>Trade Mark:</b>      | NA   |
| <b>Standard:</b>        | Article 49-20 and the relevant articles of the Ordinance Regulating Radio Equipment    |
| <b>Test Procedure:</b>  | MIC Notice No.88 Appendix No.43  |
| <b>Date of Receipt:</b> | 18 January 2021  |
| <b>Date of Test:</b>    | 18 January 2021 to 08 July 2021  |
| <b>Date of Issue:</b>   | 08 July 2021   |
| <b>Test Result:</b>     | Pass*  |
| <b>Note:</b>            | N/A  |

\* In the configuration tested, the EUT detailed in this report complied with the standards specified above. Please refer to section 3 of this report for further detail.

**Prepared and Checked By:****Approved By:****Signature****Rode Liu**  
**Project Engineer****Signature****Peter Kang**  
**Senior Technical Supervisor****Date****08 July 2021**

This summary is part of the full report and should be read in conjunction with it.

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## 2 Revision History

| Report No.       | Version | Description                  | Issued Date  |
|------------------|---------|------------------------------|--------------|
| 210118040SZN-001 | Rev.01  | Initial issue of report      | 09 June 2021 |
|                  | Rev.02  | The second report was issued | 03 July 2021 |
|                  | Rev.03  | The third report was issued  | 07 July 2021 |
|                  | Rev.04  | The fourth report was issued | 08 July 2021 |
|                  |         |                              |              |

### 3 Summary of Test Result

| Test                               | Test Requirement       | Limit/Severity  | Result |
|------------------------------------|------------------------|---|--------|
| Antenna Requirement                | Item 19 of Article 2-1 | Notice 88 Appendix 43, B-1 (1)&(2)  | PASS   |
| Test frequency                     | Item 19 of Article 2-1 | Notice 88 Appendix 43, A-3  | PASS   |
| Frequency Tolerance                | Item 19 of Article 2-1 | ±50 ppm or less   | PASS   |
| Occupied Bandwidth                 | Item 19 of Article 2-1 | 83.5MHz or less for BT 4.1<br>26MHz or less for BT 4.1 BLE  | PASS   |
| Antenna Power                      | Item 19 of Article 2-1 | 4.77dBm/MHz or less for BT4.1<br>10dBm for BT 4.1 BLE<br>Tolerance: +20%, -80%  | PASS   |
| Spurious Emission of Tx            | Item 19 of Article 2-1 | (1) Below 2387 MHz: 2.5µW/MHz or less(≤-26dBm/MHz)<br>(2) 2387 to 2400 MHz: 25µW/MHz or less(≤-16dBm/MHz)<br>(3) 2483.5 through 2496.5 MHz: 25µW/MHz or less (≤-16dBm/MHz)<br>(4) Over 2496.5 MHz: 2.5µW/MHz or less(≤-26dBm/MHz) | PASS   |
| Interference prevention capability | Item 19 of Article 2-1 | Notice 88 Appendix 43, 44, 45   | PASS   |
| RF accessibility                   | Item 19 of Article 2-1 | Notice 88 Appendix 43, 44, 45   | PASS   |
| Spurious Emission of Rx            | Item 19 of Article 2-1 | (1) Below 1 GHz: 4nW or less(≤-54dBm/MHz)<br>(2) 1 GHz and over: 20nW or less(≤-47dBm/MHz)  | PASS   |

**Remark:**

EUT: In this whole report EUT means Equipment Under Test.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radio Frequency.

Item 19 of Article 2 Paragraph 1.

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## 5 General Information

### 5.1 Client Information

Applicant: ABEEWAY  
 Address of Applicant: Les Algorithmes-Aristote A, 2000 Route des Lucioles  
 Manufacturer: Natingate Solution Sdn Bhd  
 Address of Manufacturer: 1413, Solok Perusahaan Satu, Kawasan Perindustrian Prai, 13600 Perai, Penang, Malaysia  
 Factory: NA  
 Address of Factory: NA

### 5.2 General Description of EUT

Product Name: Micro Tracker  
 Model No.: A003  
 Trade Mark: NA  
 Remark: N/A

### 5.3 Details of EUT

Operating Frequency: 2402MHz-2480MHz  
 Bluetooth Version: BT V4.0  
 Type of Modulation: GFSK  
 Transmit Data Rate: GFSK:1Mbps  
 Number of Channels: 40 for BT BLE  
 Channel Separation: 2MHz for BT BLE  
 Antenna Type: Integral Antenna  
 Antenna gain: 1.0 dBi max  
 Normal antenna power: F1D: 2.0 mW(BT BLE)  
 Power Supply: Power by USB port and DC 3.7V for battery

### 5.4 Description of Support Units

The EUT has been tested with associated equipment below.

| Description | Manufacturer | Model No.    |
|-------------|--------------|--------------|
| Laptop      | HP           | Compaq 2510p |

**5.5 Deviation from Standards**

None.

**5.6 Abnormalities from Standard Conditions**

None.

**5.7 Other Information Requested by the Customer**

None.

**6 Equipment Used during Test**

| Test Equipment                      | Manufacturer | Model No. | Serial number | Cal. Date (dd-mm-yyyy)     | Calibration body                    | Classification |
|-------------------------------------|--------------|-----------|---------------|----------------------------|-------------------------------------|----------------|
| Spectrum Analyzer                   | R&S          | E4007B    | 101506        | 22-Dec-2020                | CEPREI CALIBRATION & TESTING CENTER | (C)            |
| Wideband Radio Communication Tester | R&S          | CMW500    | 159876        | 01-Dec-2020                | CEPREI CALIBRATION & TESTING CENTER | (C)            |
| RF Power Meter                      | BOONTO N     | 4232A     | 11002         | 05-Jan-2021                | CEPREI CALIBRATION & TESTING CENTER | (C)            |
| Pulse Power Sensor                  | Anritsu      | MA2411B   | 1207429       | 28-May-2019<br>10-May-2020 | CEPREI CALIBRATION & TESTING CENTER | (C)            |
| True RMS Multimeter                 | Fluke        | 175       | 10470115      | 01-Dec-2020                | CEPREI CALIBRATION & TESTING CENTER | (C)            |

Remark:

- (a) Calibration conducted by the National Institute of Information and Communications Technology (NITC) in Japan (hereinafter referred to as "NITC") or a designated calibration agency under Article 102-18 paragraph (1) in JRL
- (b) Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Act (Act No.51 of 1992)
- (c) Calibration conducted in countries except Japan, which shall be equivalent to the calibration Conducted by the NITC or a designation agency under Article 102-18 paragraph (1)
- (d) Calibration, etc. conducted by using measuring instruments and other equipment listed in the right column of appended table No.3, which shall have been given any type of calibration, etc. listed above from (a) to (c). From JRL Article 24-2, paragraph 4, item 2

**Notice: Calibration duration for above equipments is 1 year.**

## 7 Test Results

### 7.1 Radio Technical Requirements Specification

**Table 1: Radio Technical Requirements Specification for 2.4 GHz band wide-band low-power data communication system (Item 19 of Article 2-1)**

| Items                                       | Technical standard   |
|---|--|
| Assigned frequency or designated frequency  | 2400-2483.5MHz   |
| Communication method                        | One-way communication, simplex, semi-duplex, or duplex operation of digital signal transmission including spread spectrum  |
| Tolerance of frequency ( $\times 10^{-6}$ ) | $\pm 50$   |
| Tolerance of occupied bandwidth             | FH: 83.5MHz or less<br>FH + DS: 83.5MHz or less<br>FH + OFDM: 83.5MHz or less<br>OFDM: 38MHz or less<br>Others: 26MHz or less  |
| Antenna power                               | Designated value<br>(1) FH, FH+DS, FH+OFDM: 3mW/MHz(4.77dBm/MHz)<br>(used in the range of 2427-2470.75 MHz)<br>(2) OFDM, DS other than (1) 10mW/MHz(10dBm/MHz)<br>(3) Other than (1) & (2) 10mW(10dBm)<br>(4) OFDM OBW 26- 38MHz: 5mW/MHz(6.99dBm/MHz)<br>Tolerance:+20%, -80%   |
| Antenna gain                                | (1) 12.14 dBi or less in principle<br>(2) In case of directional antenna<br>1) FH, FH+DS or FH+OFDM using 2427-2470.75 MHz<br>EIRP $\leq$ 16.91 dBm/MHz<br>2) OFDM or DS other than (1)<br>EIRP $\leq$ 22.14 dBm/MHz<br>3) Other than (1) and (2):<br>22.14 dBm or less<br>4) OFDM OBW 26- 38MHz:<br>19.14dBm/MHz<br>5) Half-power angle of directional antenna (e) in case of the item 2):<br>e $\leq$ 360/A (The A is 10 in maximum) |
| Tolerance of spurious emission intensity    | (5) Below 2387 MHz: 2.5 $\mu$ W/MHz or less( $\leq$ -26dBm/MHz)<br>(6) 2387 to 2400 MHz: 25 $\mu$ W/MHz or less( $\leq$ -16dBm/MHz)<br>(7) 2483.5 through 2496.5 MHz: 25 $\mu$ W/MHz or less( $\leq$ -16dBm/MHz)<br>(8) Over 2496.5 MHz: 2.5 $\mu$ W/MHz or less( $\leq$ -26dBm/MHz)   |
| Spreading bandwidth                         | DS, FH, FH+DS: 500kHz or more  |
| Spreading rate of spectrum                  | (Spreading bandwidth) / (Frequency corresponding to transmission rate) $\geq$ 5  |
| Limit of secondary radiated emissions       | (1) Below 1 GHz: 4 nW( $\leq$ -54dBm)<br>(2) 1 GHz or higher: 20 nW( $\leq$ -47dBm)  |
| Interference prevention function            | Shall have the function of automatic transmission and reception of identification sign.  |
| Structure                                   | Shall be of the structure that the RF and modulator sections excluding antenna cannot easily be opened.  |
| Note  | DS: Direct spread<br>FH: Frequency hopping<br>OFDM: Orthogonal frequency division multiplexing   |

## 7.2 E.U.T. test conditions

Power supply:

Battery:

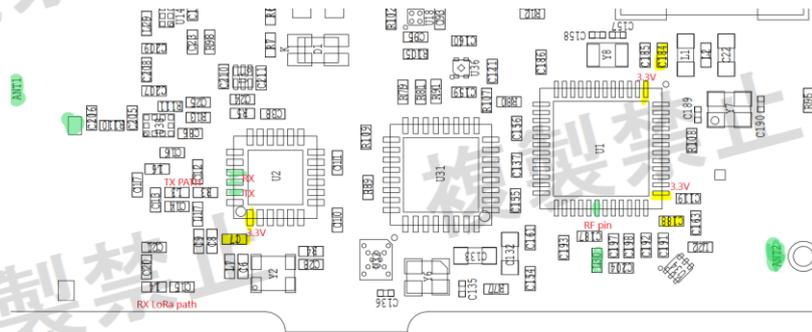
DC 3.7V

The RF unit is supplied by DC 3.3V. The fluctuation of input voltage to the circuit of RF unit of test equipment is under  $\pm 1\%$ , when input voltage from DC 3.3V to the test equipment is fluctuated by  $\pm 10\%$ . So, all measurement has been conducted by only rated voltage.

The measurement result of the voltage fluctuation at RF circuit when DC 3.7V  $\pm 10\%$

| Power supply voltage | measured value |
|----------------------|----------------|
| DC 3.7V              | DC 3.32V       |
| DC 3.54V             | DC 3.31V       |
| DC 3.86V             | DC 3.34V       |

U1: acts as BT module, U2: acts as Lora module; the power supply of chip pins are as follows:



Temperature:

-10°C - +55°C

Humidity:

45-85 % RH

Atmospheric Pressure:

1000 -1010 mbar

Test frequencies:

If the EUT can be set to 3 or more different (carrier) frequencies in 1 allocated band, testing shall be performed using the Lowest, Middle and the Highest frequency (L, M and H). If there are 2 or fewer frequencies, testing shall be performed with the available frequencies.

Channel List for BT BLE

|      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|
| 2402 | 2404 | 2406 | 2408 | 2410 | 2412 | 2414 | 2416 | 2418 | 2420 |
| 2422 | 2424 | 2426 | 2428 | 2430 | 2432 | 2434 | 2436 | 2438 | 2440 |
| 2442 | 2444 | 2446 | 2448 | 2450 | 2452 | 2454 | 2456 | 2458 | 2460 |
| 2462 | 2464 | 2466 | 2468 | 2470 | 2472 | 2474 | 2476 | 2478 | 2480 |

Test Channel for BT BLE

|                  |    |         |
|------------------|----|---------|
| Lowest Channel:  | 0  | 2402MHz |
| Middle Channel:  | 20 | 2440MHz |
| Highest Channel: | 39 | 2480MHz |

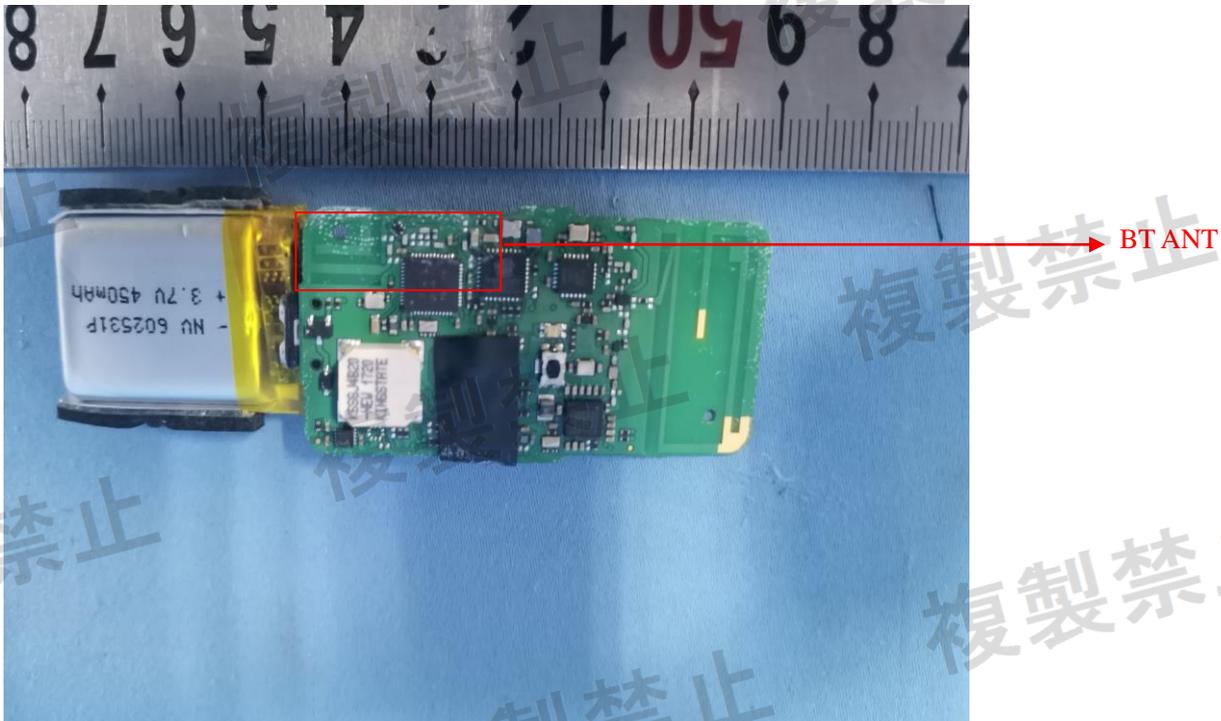
### 7.3 Test Environment

| Operating Environment: |           |
|------------------------|-----------|
| Temperature:           | 25.0 °C   |
| Humidity:              | 53.0 % RH |
| Atmospheric Pressure:  | 1001 mbar |

### 7.4 Antenna Requirement

#### EUT Antenna

The antenna is PCB antenna on the main PCB and no consideration of replacement. The best case gain of the antenna is 1.0 dBi max.



## 7.5 Interference prevention function

### 1) Measurement system diagram

When transmitting identification code



### 2) Condition of measuring instrument

Demodulator must be able to demodulate the transmitting signal emitted by test equipment and to indicate the identification code.

### 3) Condition of test equipment the mode of normal use.

### 4) Measuring operation procedure

When test equipment has the function to transmit identification code automatically:

A) Transmit the predetermined identification code from test equipment.

B) Confirm the transmitted identification code by demodulator.

Identification code: F3:21:DD:05:83:AE

### 5) Test result: The unit does meet the requirements.

## 7.6 Frequency Tolerance

Test Requirement: Item 19 of Article 2-1

Tolerance of frequency:  $\pm 50 \times 10^{-6}$

Test Status: Test the EUT in transmitting mode without modulation.

Test Configuration:



Test Procedure:

1. Test Conditions:

Spectrum Analyzer is used for measurement.

2. EUT conditions:

Modulation/Spread/Hopping OFF, CW Tx

3. Spectrum Analyzer conditions:

Frequency: Test Frequency

Span 1MHz

RBW 10 kHz (Modulation OFF)

VBW 10 kHz (Modulation OFF)

Sweep Time Auto

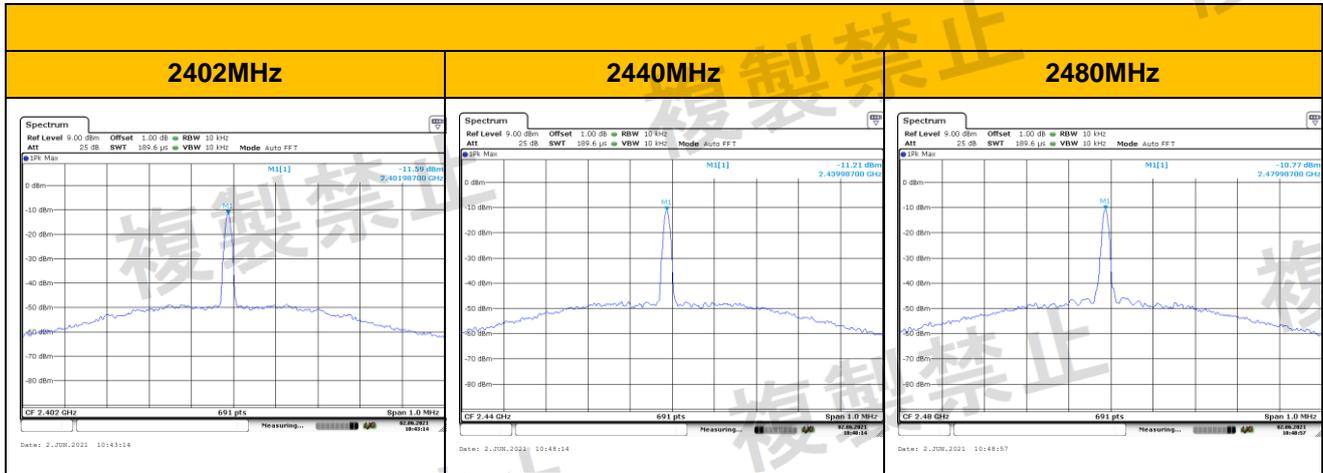
Detector mode Positive peak

Indication mode Max hold

**Test result: PASS**

## Frequency Tolerance

BT BLE



| Measurement Frequency | MHz | 2402      | 2440      | 2480      | Limit           | Result |
|-----------------------|-----|-----------|-----------|-----------|-----------------|--------|
| Measured Value        | MHz | 2401.9870 | 2439.9870 | 2479.9870 | -----           | -----  |
| Frequency Tolerance   | ppm | -5.41     | -5.33     | -5.24     | ±50 ppm or less | Pass   |

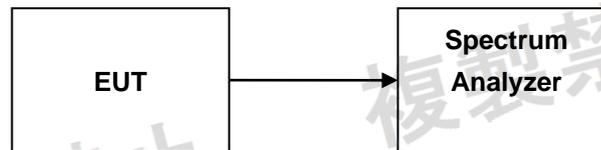
## 7.7 Occupied Bandwidth (99%)

Test Requirement: Item 19 of Article 2-1

Occupied Bandwidth:  $\leq 26\text{MHz}$  (OFDM, DS and Others)

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:



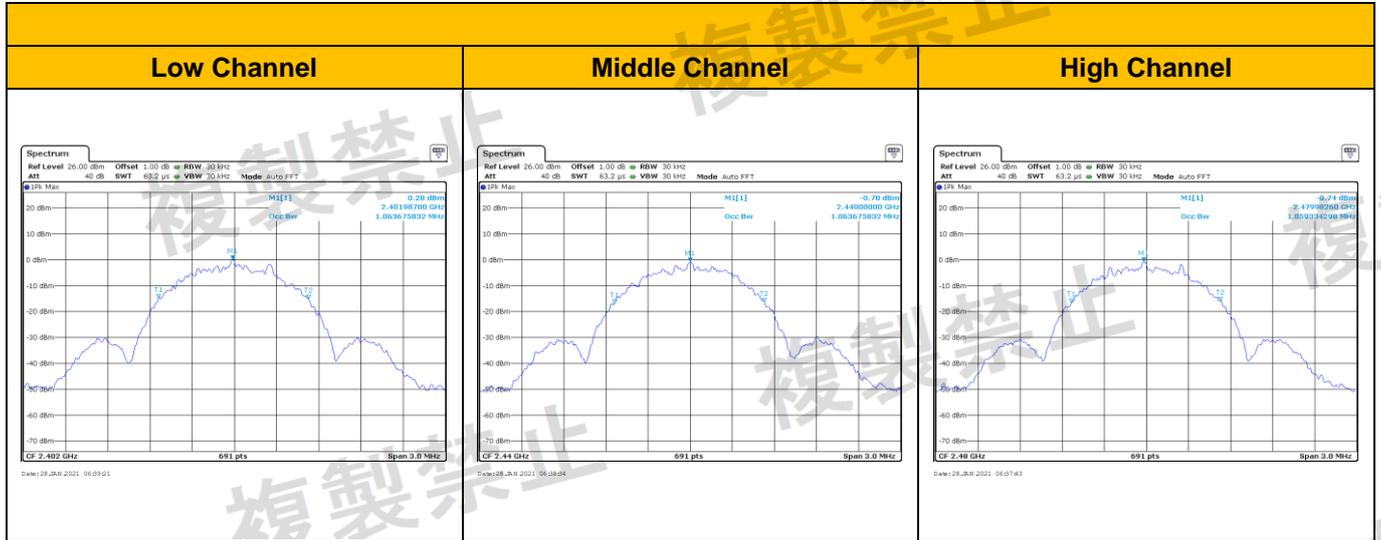
Test Procedure:

1. Test Conditions:  
Spectrum Analyzer is used for measurement.
2. EUT conditions:  
Modulation/Spread/Hopping ON  
For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal.
3. Spectrum Analyzer conditions:  
Frequency: Test Frequency  
Span 3MHz  
RBW 30KHz  
VBW 30KHz  
Sweep Time Auto  
Detector mode Positive peak  
Indication mode Max hold  
OBW 99%

**Test result: Pass**

## Occupied Bandwidth (99%)

BT BLE



| Measurement Frequency    | MHz | 2402  | 2440  | 2480  | Limit         | Result |
|--------------------------|-----|-------|-------|-------|---------------|--------|
| Occupied Band width(MHz) | MHz | 1.064 | 1.064 | 1.059 | 26MHz or Less | Pass   |

## 7.8 Antenna Power

Test Requirement: Item 19 of Article 2-1  
10mW or less

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:



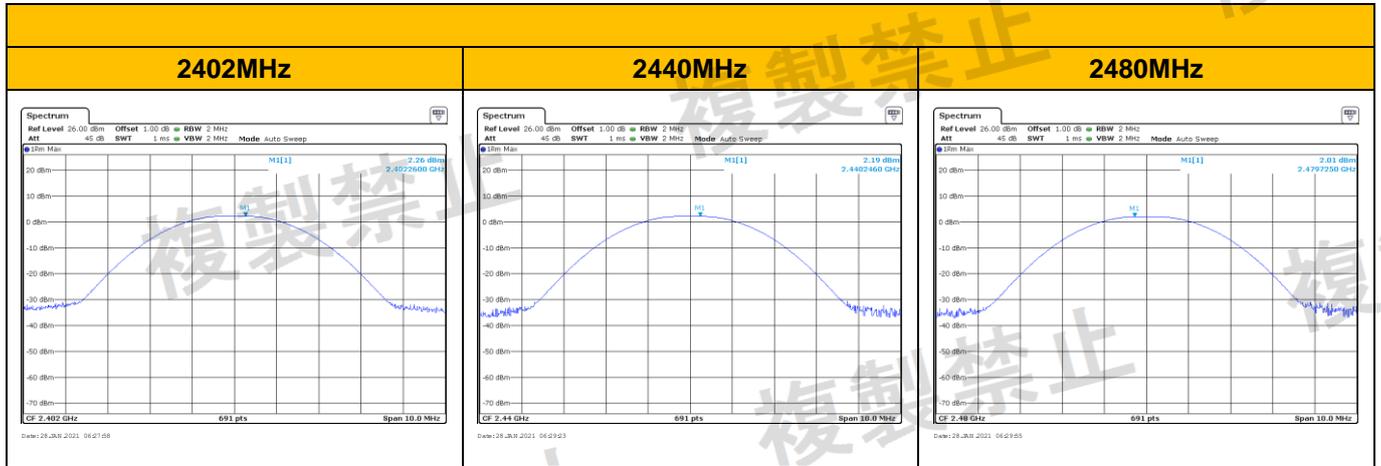
Test Procedure:

1. Test Conditions:  
Spectrum Analyzer is used for measurement.
2. EUT conditions:  
Modulation/Spread/Hopping ON  
For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal.
3. Spectrum Analyzer conditions:  
Frequency: Test Frequency  
Span 10 MHz  
RBW 2 MHz  
VBW 2 MHz  
Sweep Time Auto  
detector mode Positive peak  
Indication mode Max hold

**Test result: PASS**

## Antenna Power

BT BLE



| Test Frequency |     | 2402MHz | 2440MHz | 2480MHz | Rated output power | Limit                     | Result |
|----------------|-----|---------|---------|---------|--------------------|---------------------------|--------|
| Unit           | dBm | 2.26    | 2.19    | 2.01    | 3.0                | 10 or Less                | Pass   |
|                | mW  | 1.68    | 1.66    | 1.59    | 2.0                | 10 or Less                | Pass   |
| Tolerance Max: |     | -16.0   | -17%    | -20.5%  | /                  | Upper +20%,<br>Lower -80% | Pass   |

## 7.9 Spurious Emissions of Tx

Test Requirement:

Item 19 of Article 2-1  
for 2412-2472MHz

- (1) Below 2387 MHz: 2.5 $\mu$ W/MHz ( $\leq$ -26dBm/MHz)
- (2) 2387 to 2400 MHz: 25 $\mu$ W/MHz ( $\leq$ -16dBm/MHz)
- (3) 2483.5 through 2496.5 MHz: 25 $\mu$ W/MHz ( $\leq$ -16dBm/MHz)
- (4) Over 2496.5 MHz: 2.5 $\mu$ W/MHz ( $\leq$ -26dBm/MHz)

Test Status:

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:



Test Procedure:

1. Test Conditions:

Spectrum Analyzer is used for measurement.

2. EUT conditions:

Modulation/Spread/Hopping ON

For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal.

3. Spectrum Analyzer conditions:

Step 1

All spurious are measured from 30 MHz to 12.5 GHz by peak mode.

Step 2

IF the value measured by Step1 is 3 dB or less, measure in average mode.

Test setup for Step 1:

Frequency: 30 MHz- 2400 MHz, 2483.5 MHz-12.5 GHz

RBW 1 MHz

VBW 1 MHz

Sweep Time Auto

Detector mode Positive peak

Indication mode Max hold

Test setup for Step 2:

Frequency: Spurious Frequency

RBW 1 MHz

VBW 1 MHz

Sweep Time Auto

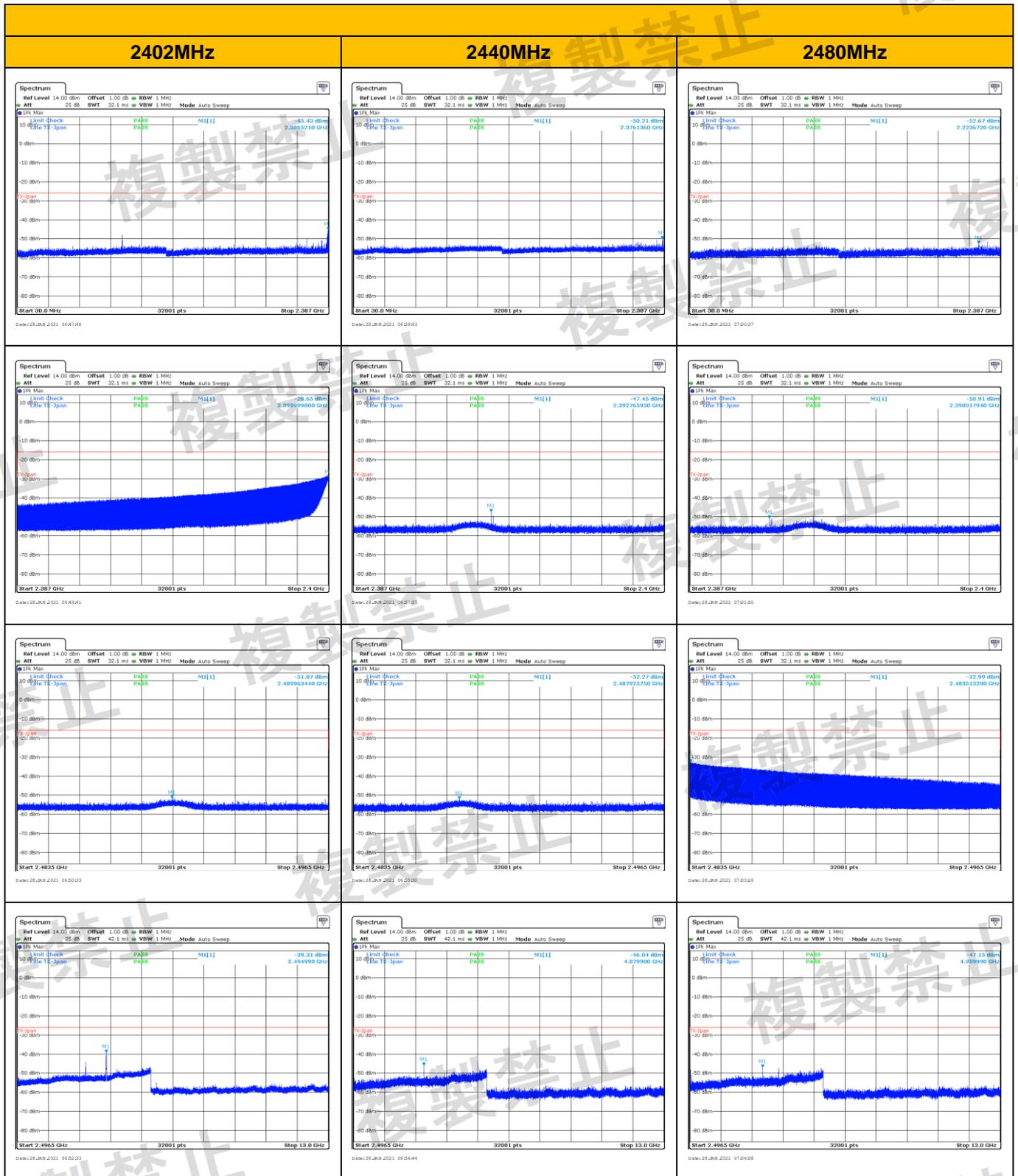
Detector mode Sample

Indication mode Max hold

**Test result: PASS**

## Spurious Emissions of Tx

BT BLE



| Test frequency band | Unit    | 2402MHz    | 2440MHz     | 2480MHz     | Limit | Result |
|---------------------|---------|------------|-------------|-------------|-------|--------|
| Under 2387MHz       | dBm/MHz | -45.43     | -50.21      | -52.67      | ≤-26  | Pass   |
|                     | MHz     | 2386.521   | 2376.136    | 2223.6720   | ----- | -----  |
| 2387-2400MHz        | dBm/MHz | -28.65     | -47.45      | -50.91      | ≤-16  | Pass   |
|                     | MHz     | 2399.99990 | 2392.765930 | 2390.317940 | ----- | -----  |
| 2483.5-2496.5MHz    | dBm/MHz | -51.87     | -52.27      | -32.99      | ≤-16  | Pass   |
|                     | MHz     | 2487.963   | 2487.925750 | 2483.51320  | ----- | -----  |
| 2496.5MHz-12.5GHz   | dBm/MHz | -39.31     | -46.04      | -47.15      | ≤-26  | Pass   |
|                     | MHz     | 5494.99    | 4879.900    | 4959.990    | ----- | -----  |

## 7.10 Spurious Emissions of Rx

Test Requirement: Item 19 of Article 2-1

- (1) Below 1 GHz: 4 nW ( $\leq -54$ dBm)
- (2) 1 GHz and over: 20 nW ( $\leq -47$ dBm)

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:



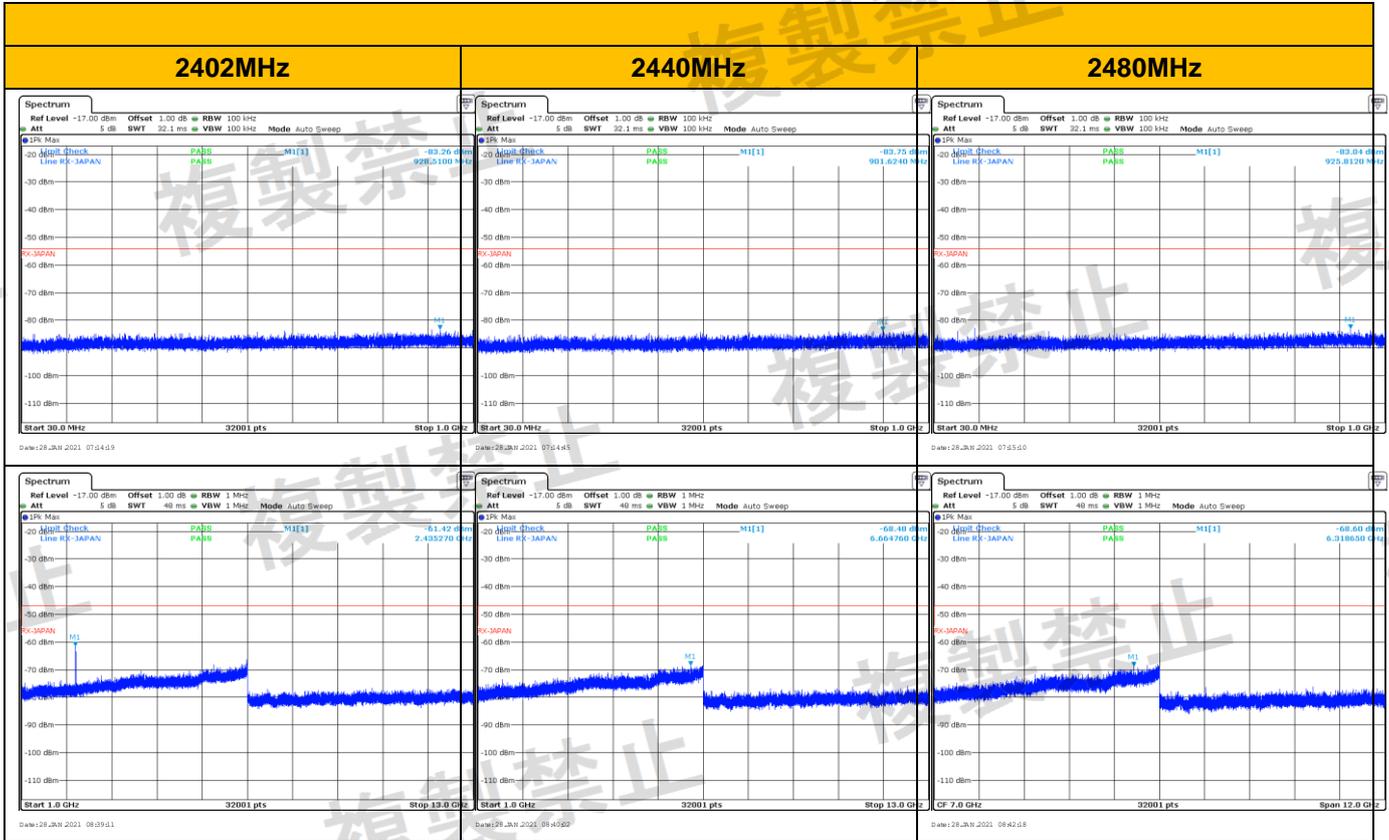
Test Procedure:

1. Test Conditions:  
Spectrum Analyzer is used for measurement.
2. EUT conditions:  
Modulation/Spread/Hopping ON  
For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal.
3. Spectrum Analyzer conditions:  
Step 1  
All spurious are measured from 30 MHz to 26 GHz by peak mode.  
Step 2  
IF the value measured by Step1 is 3 dB or less, measure in average mode.  
Test setup for Step 1:  
Frequency: 30 MHz-2400 MHz , 2483.5 MHz-26 GHz  
RBW 100 kHz (30-1GHz) , 1 MHz (over 1GHz)  
VBW 100 kHz (30-1GHz) , 1 MHz (over 1GHz)  
Sweep Time Auto  
Detector mode Positive peak  
Indication mode Max hold  
Test setup for Step 2:  
Frequency: Spurious Frequency  
Span 0 Hz  
RBW 100 kHz (30-1GHz) , 1 MHz (over 1GHz)  
VBW 100 kHz (30-1GHz) , 1 MHz (over 1GHz)  
Sweep Time Auto  
Detector mode Sample  
Indication mode Max hold

**Test result: PASS**

## Spurious Emissions of Rx

BT BLE



| Test frequency band | Unit | 2402MHz  | 2440MHz  | 2480MHz  | Limit | Result |
|---------------------|------|----------|----------|----------|-------|--------|
| Under 1GHz          | dBm  | -83.26   | -83.75   | -83.84   | ≤-54  | Pass   |
|                     | MHz  | 928.5100 | 901.624  | 925.812  | ----- | -----  |
| 1-26GHz             | dBm  | -61.42   | -68.48   | -68.60   | ≤-47  | Pass   |
|                     | MHz  | 2435.27  | 6664.760 | 6318.650 | ----- | -----  |

## 7.11 RF accessibility

### Standard requirement

Article 49-20, paragraph 1 (a)

The EUT shall be constructed in such a way that sensitive RF parts, (like modulation and oscillator parts) cannot be reached easily by the user. These parts shall be covered by soldered metal caps or glue or by other mechanical covers. If the covers are fixed with screws, these shall be not the common type(s) like a Phillips, but special versions like Torx, so that the user cannot open the device with common tools.

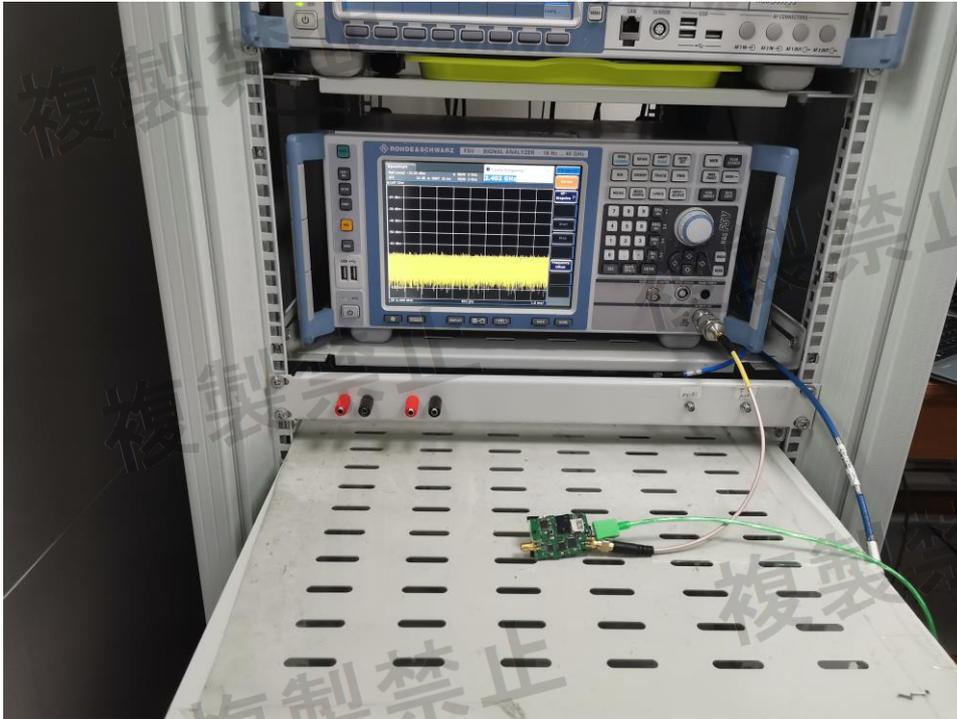
Bluetooth IC were welding on the PCB board and cannot be open or revise easily.



The semiconductor part that composes the high-frequency part and modulation parts of radio equipment have more than ten terminals, more than one integrated circuit whose interval of terminal is less than 1.5mm. This Bluetooth IC comply with the annex of guideline "Interpretation of equipment structure-That prevents its external case from opening easily in order to prevent unlawful modification", registered approval body conference document number 001(Rev.03), so that this product cannot be opened and modified easily.

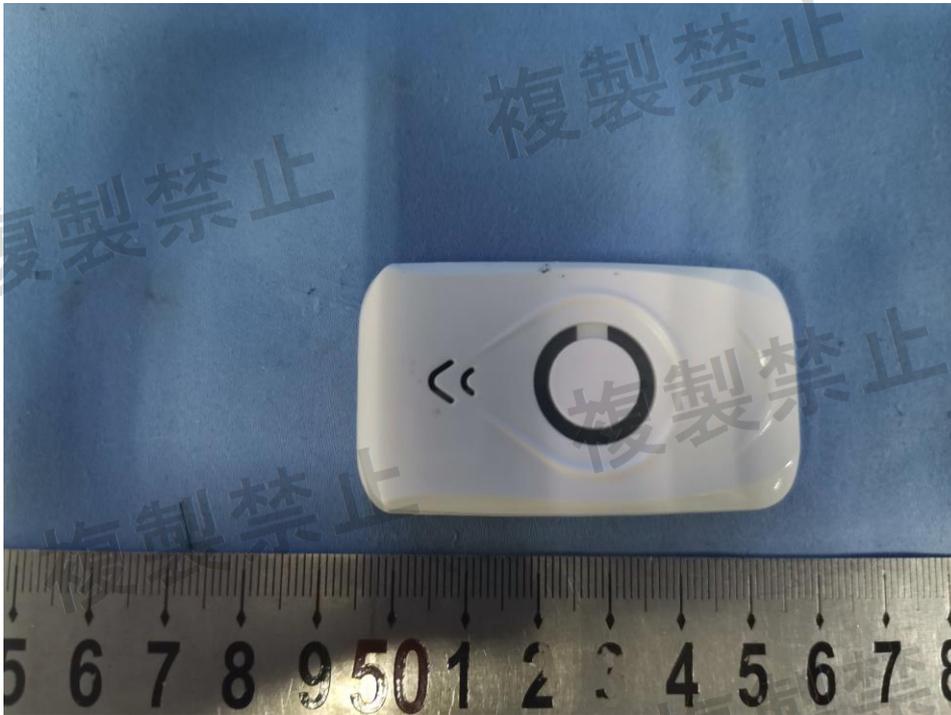
## Appendix A. EUT Test Setup and Constructional Details

### Appendix A.1 EUT Test Setup

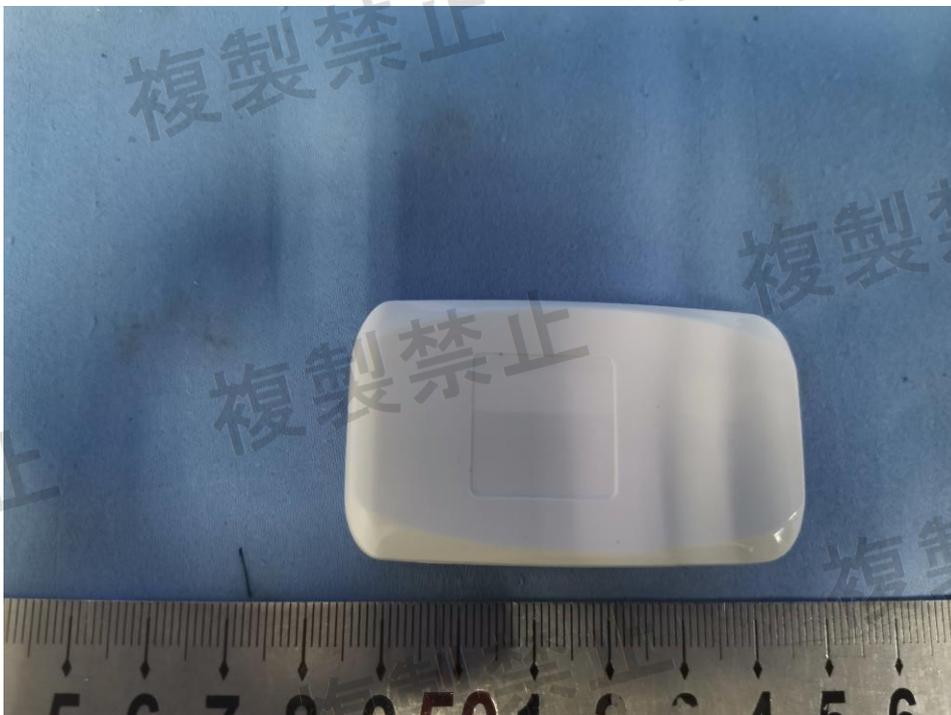


**Appendix A.2 EUT Constructional Details**

External Photo



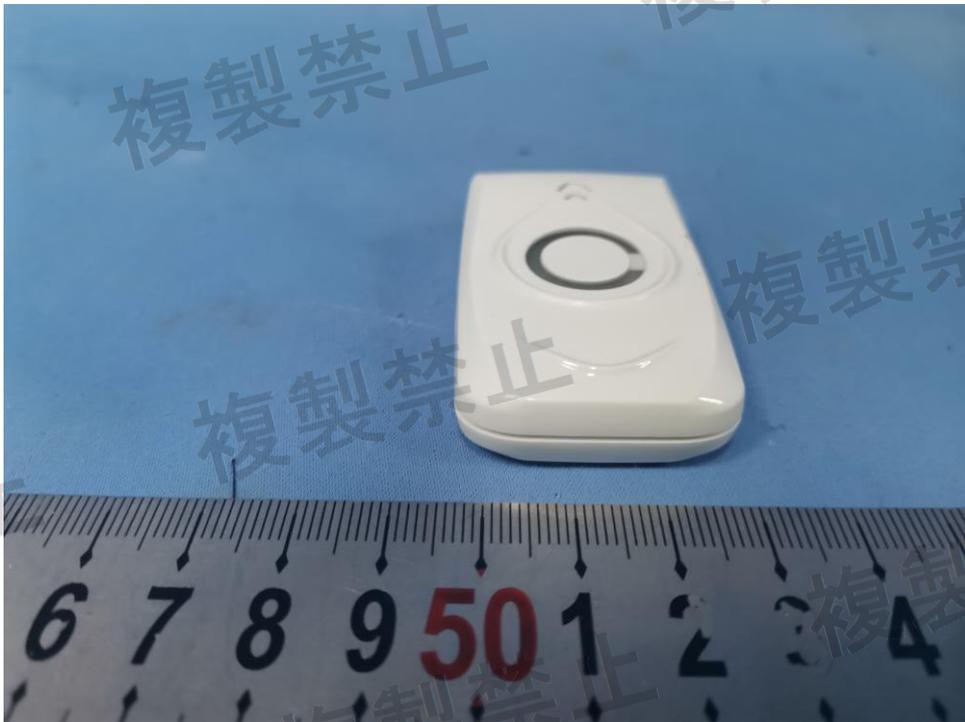
External Photo



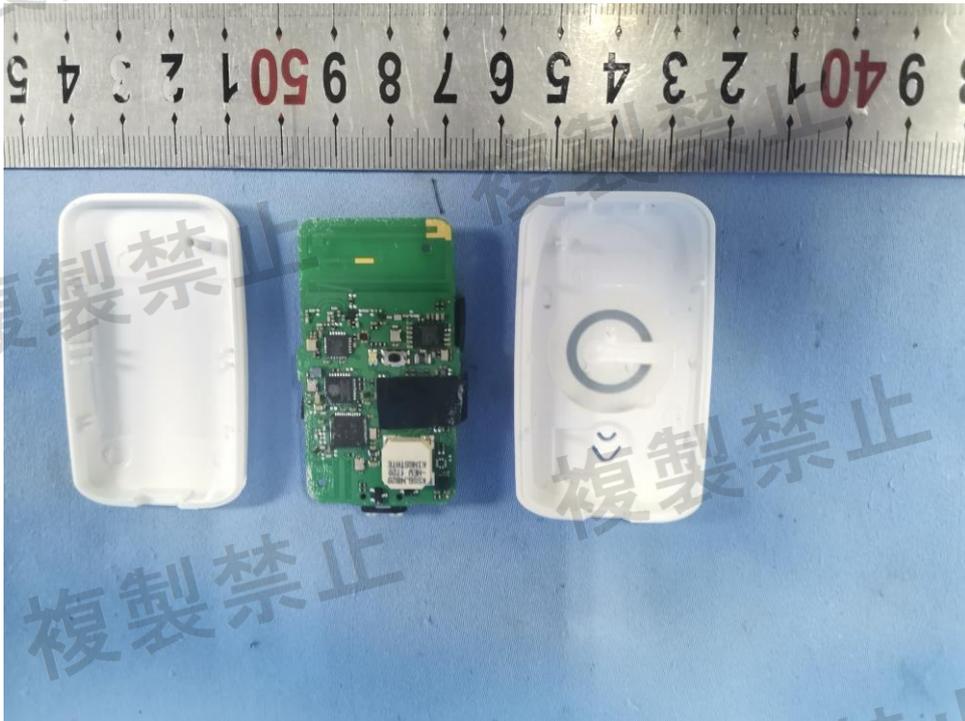
External Photo



External Photo



Internal Photo



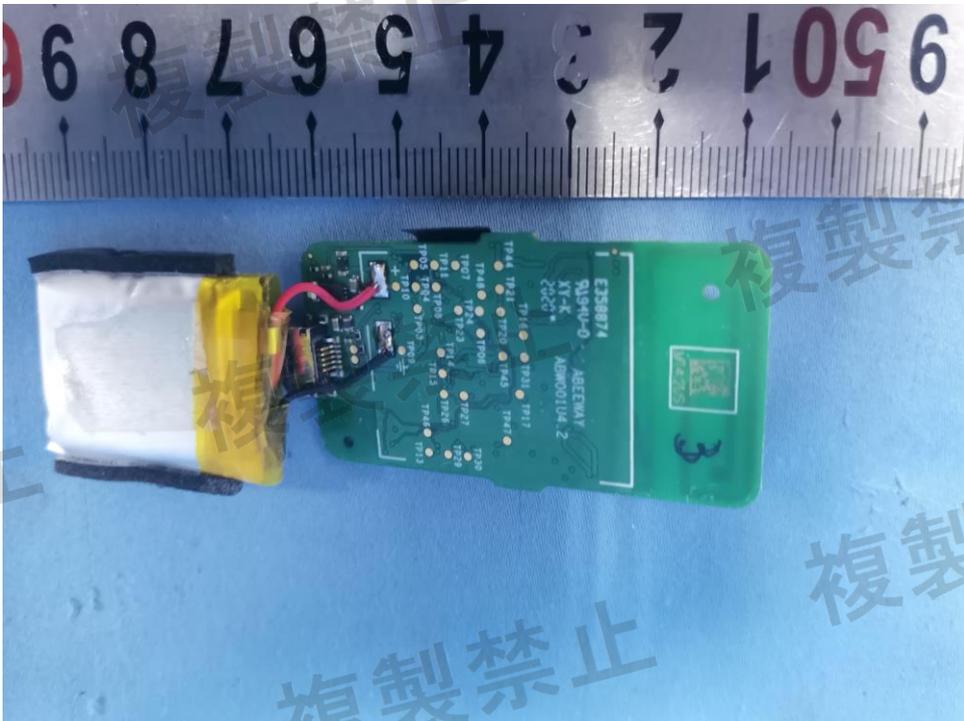
Internal Photo



Internal Photo



Internal Photo



\*\*\*\*\* End of Report \*\*\*\*\*