

ABEEWAY

TEST REPORT

SCOPE OF WORK

Japan Radio Testing – A003

REPORT NUMBER

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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

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

Date

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 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 10dBm for BT 4.1 BLE 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) (2) 2387 to 2400 MHz: 25μW/MHz or less(≤-16dBm/MHz) (3) 2483.5 through 2496.5 MHz: 25μW/MHz or less (≤-16dBm/MHz) (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) (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	BOONTON	4232A	11002	05-Jan-2021	CEPREI CALIBRATION & TESTING CENTER	(C)
Pulse Power Sensor	Anritsu	MA2411B	1207429	28-May-2019 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 ($\times 10^{-6}$)	± 50
Tolerance of occupied bandwidth	FH: 83.5MHz or less FH + DS: 83.5MHz or less FH + OFDM: 83.5MHz or less OFDM: 38MHz or less Others: 26MHz or less
Antenna power	Designated value (1) FH, FH+DS, FH+OFDM: 3mW/MHz(4.77dBm/MHz) (used in the range of 2427-2470.75 MHz) (2) OFDM, DS other than (1) 10mW/MHz(10dBm/MHz) (3) Other than (1) & (2) 10mW(10dBm) (4) OFDM OBW 26- 38MHz: 5mW/MHz(6.99dBm/MHz) Tolerance:+20%, -80%
Antenna gain	(1) 12.14 dBi or less in principle (2) In case of directional antenna 1) FH, FH+DS or FH+OFDM using 2427-2470.75 MHz EIRP \leq 16.91 dBm/MHz 2) OFDM or DS other than (1) EIRP \leq 22.14 dBm/MHz 3) Other than (1) and (2): 22.14 dBm or less 4) OFDM OBW 26- 38MHz: 19.14dBm/MHz 5) Half-power angle of directional antenna (e) in case of the item 2): e \leq 360/A (The A is 10 in maximum)
Tolerance of spurious emission intensity	(5) Below 2387 MHz: 2.5 μ W/MHz or less(\leq -26dBm/MHz) (6) 2387 to 2400 MHz: 25 μ W/MHz or less(\leq -16dBm/MHz) (7) 2483.5 through 2496.5 MHz: 25 μ W/MHz or less(\leq -16dBm/MHz) (8) Over 2496.5 MHz: 2.5 μ 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) (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 FH: Frequency hopping OFDM: Orthogonal frequency division multiplexing

7.2 E.U.T. test conditions

Power supply:

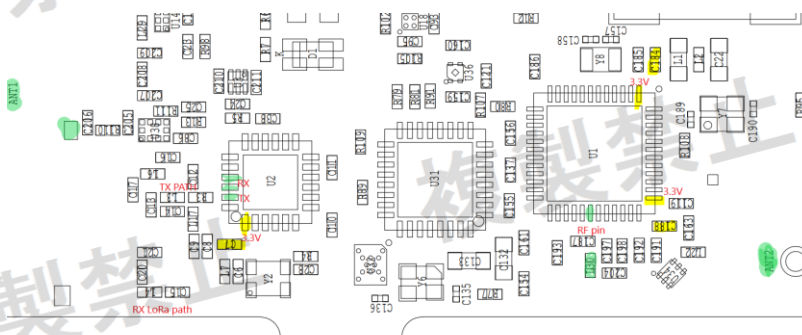
Battery: DC 3.7V

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

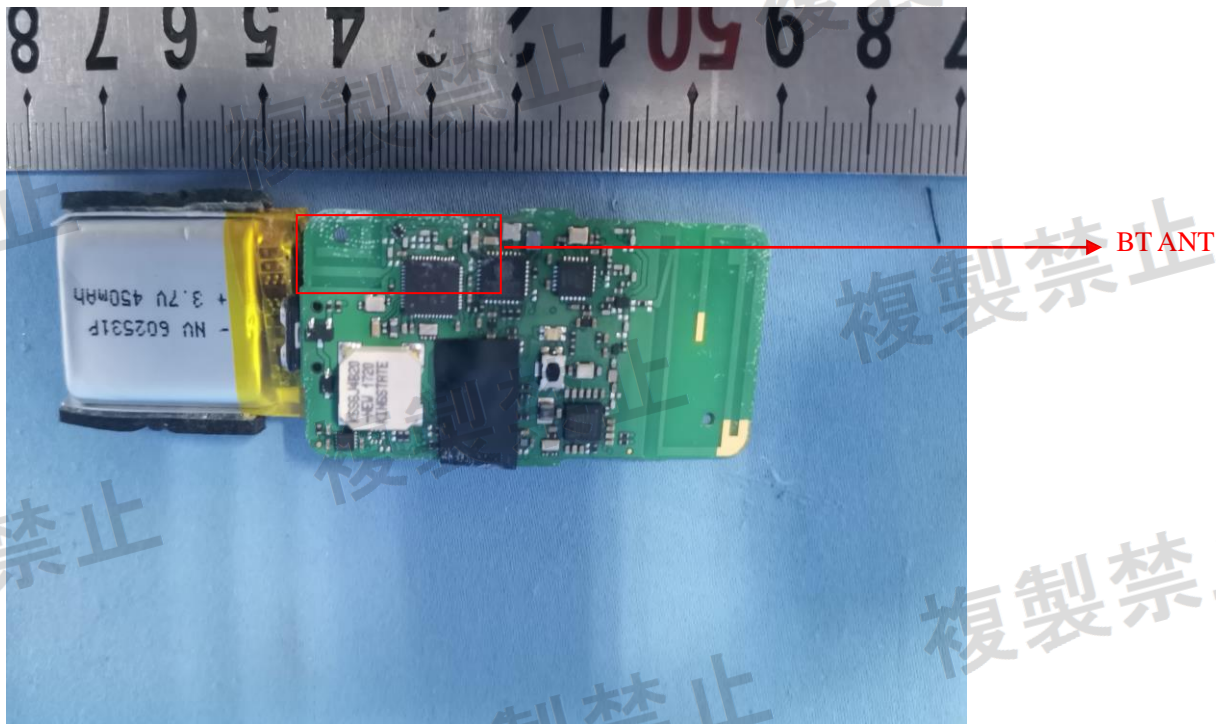
7.3 Test Environment

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

7.4 Antenna Requirement

EUT Antenna

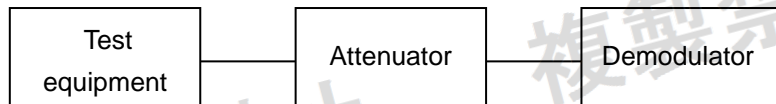
The antenna is PCB antenna on the main PCB and no consideration of replacement. The best case gain of the antenna is 1.0 dBi max.



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:

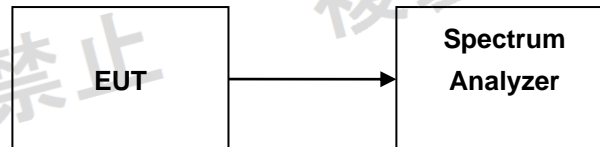
Item 19 of Article 2-1

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

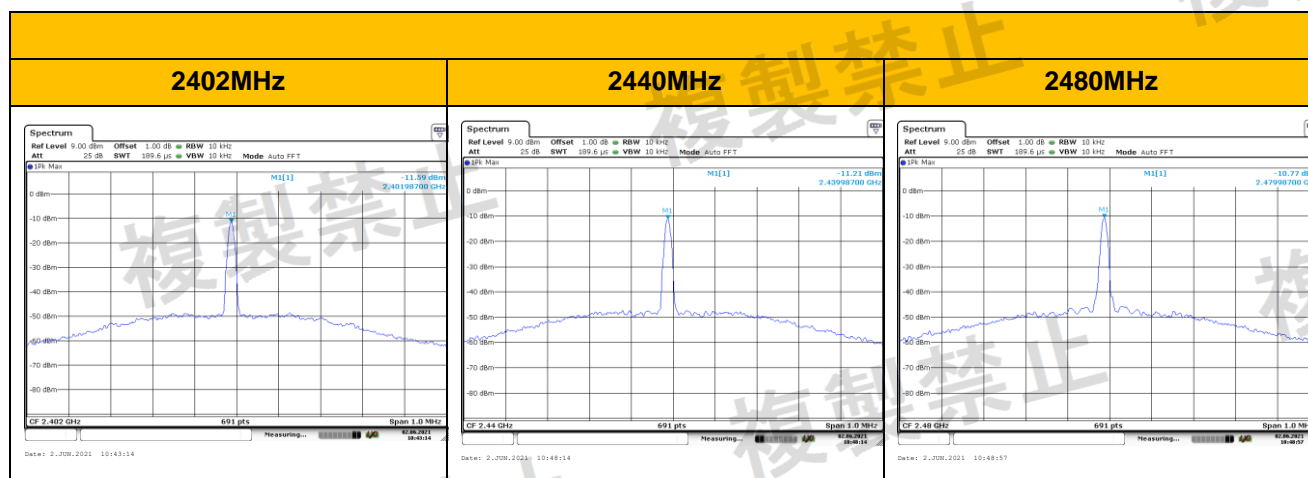
Detector mode Positive peak

Indication mode Max hold

Test result: PASS

Frequency Tolerance

BT BLE



Measurement	MHz	2402	2440	2480	Limit	Result
Frequency	MHz	2401.9870	2439.9870	2479.9870	-----	-----
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:



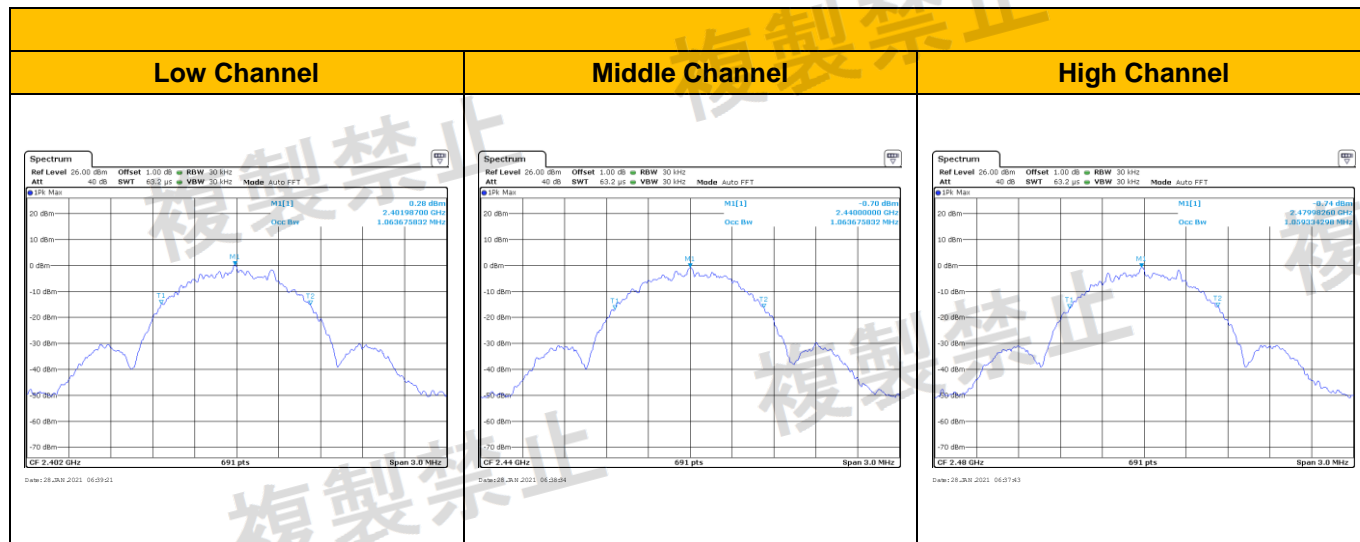
Test Procedure:

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

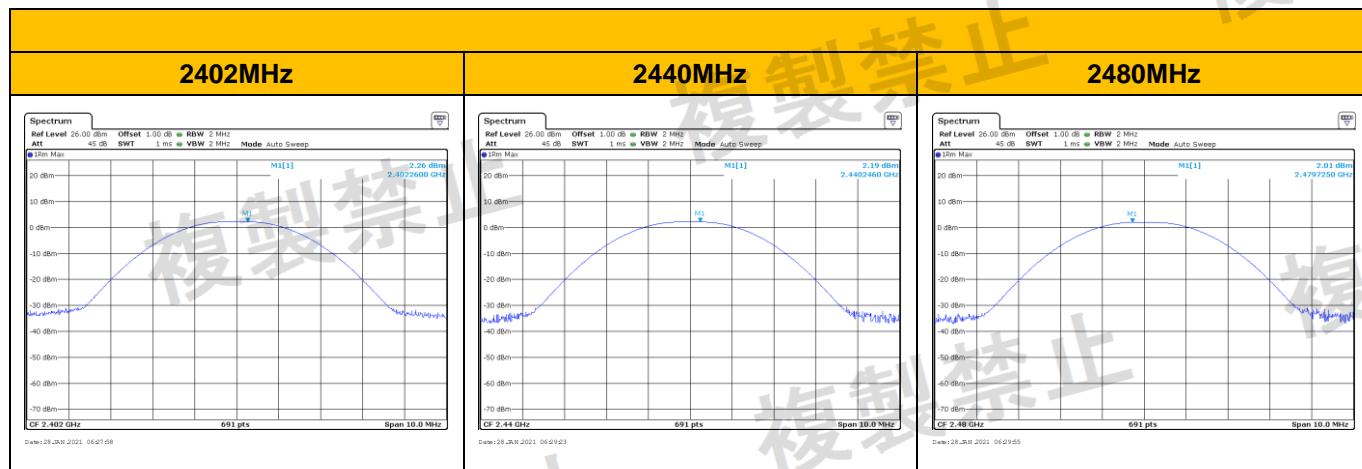
detector mode Positive peak

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%, 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 μ W/MHz (\leq -26dBm/MHz)
- (2) 2387 to 2400 MHz: 25 μ W/MHz (\leq -16dBm/MHz)
- (3) 2483.5 through 2496.5 MHz: 25 μ W/MHz (\leq -16dBm/MHz)
- (4) Over 2496.5 MHz: 2.5 μ 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

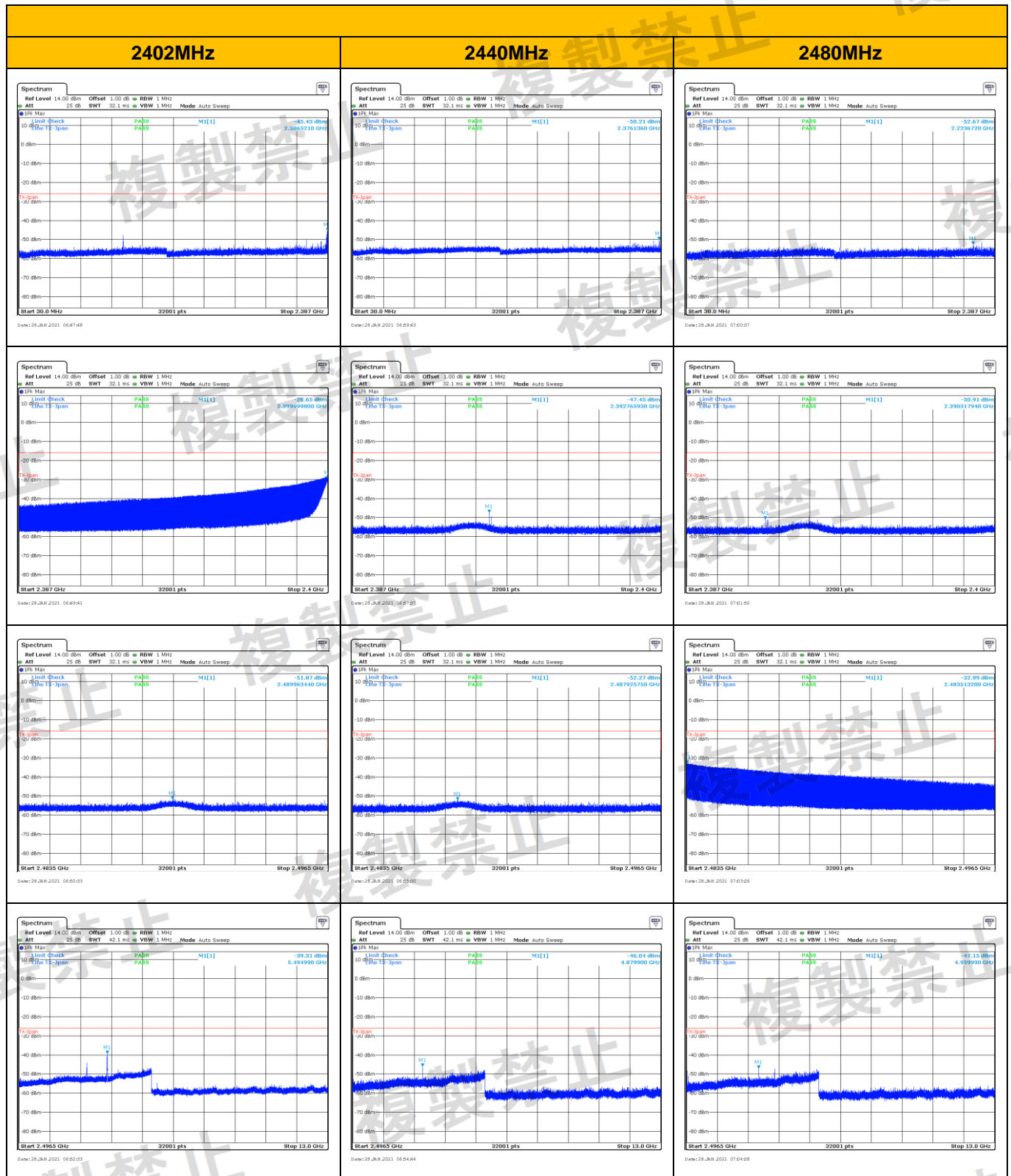
Detector mode Sample

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 (≤ -54 dBm)
- (2) 1 GHz and over: 20 nW (≤ -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:



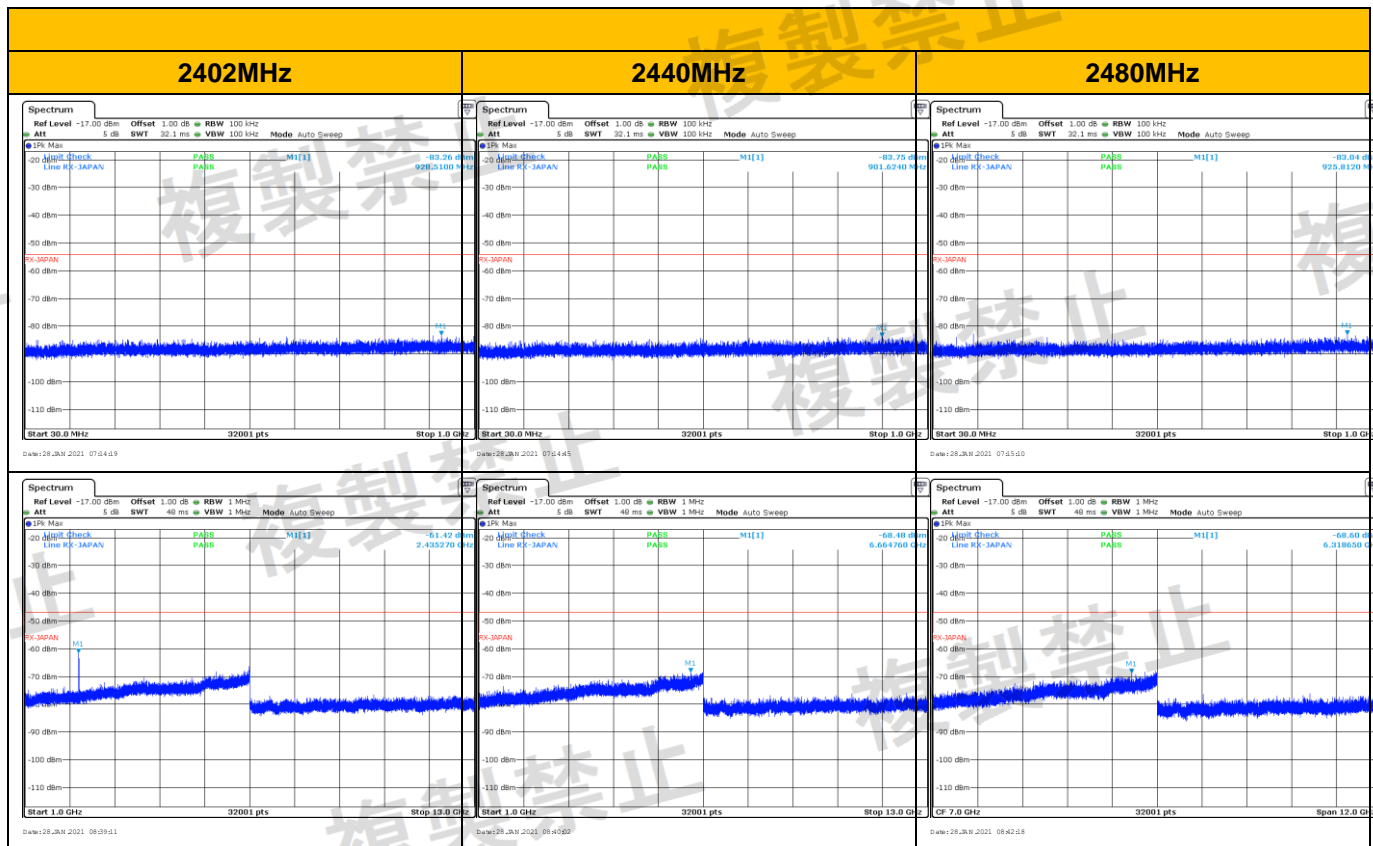
Test Procedure:

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.

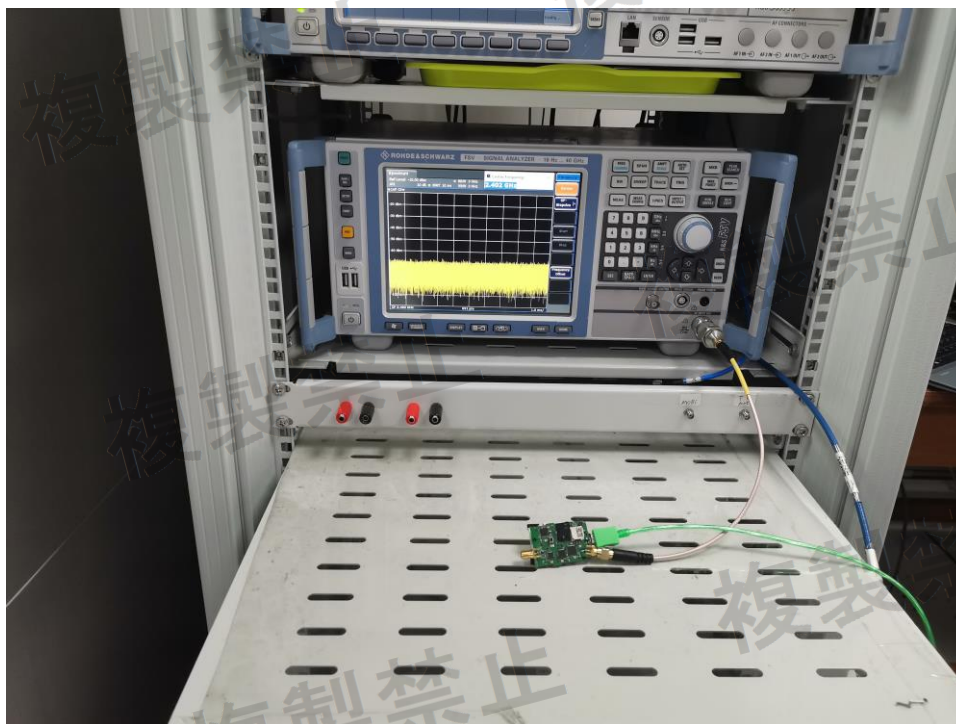
Bluetooth IC were welding on the PCB board and cannot be open or revise easily.



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.

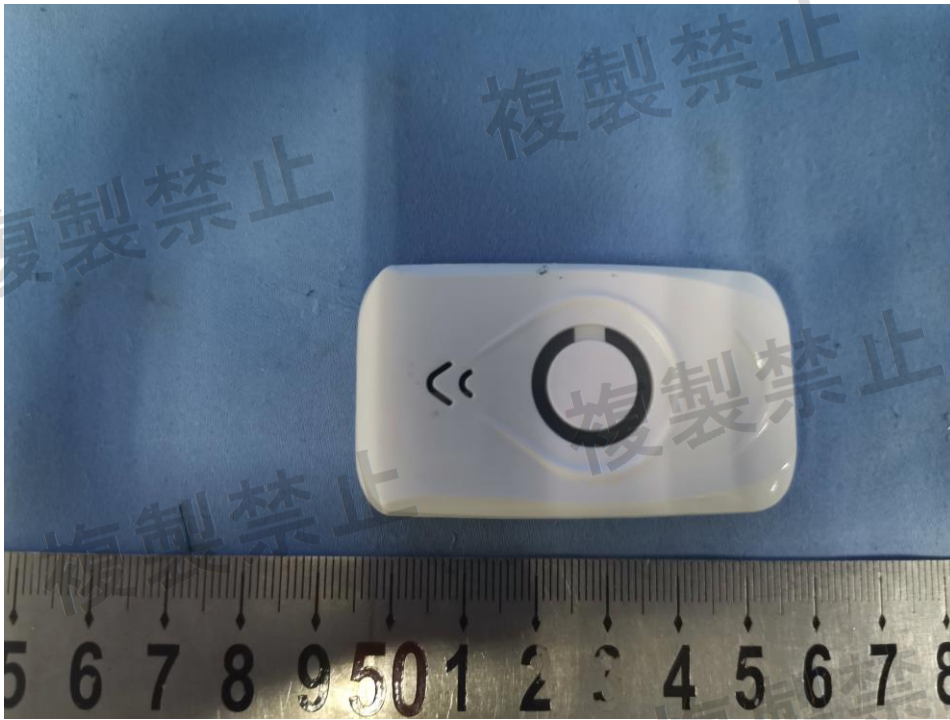
Appendix A. EUT Test Setup and Constructional Details

Appendix A.1 EUT Test Setup

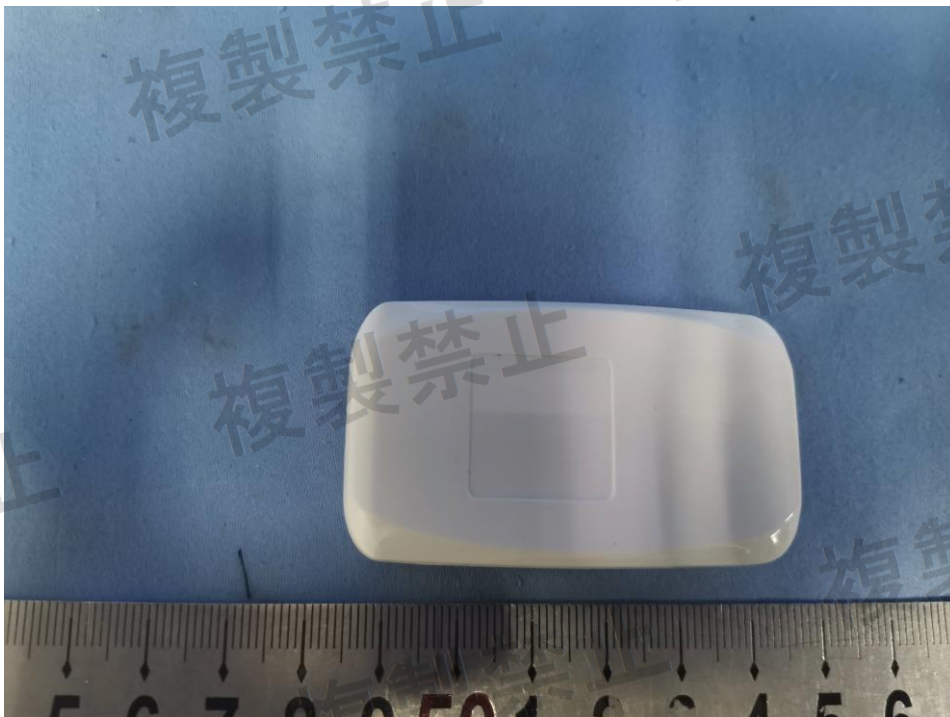


Appendix A.2 EUT Constructional Details

External Photo



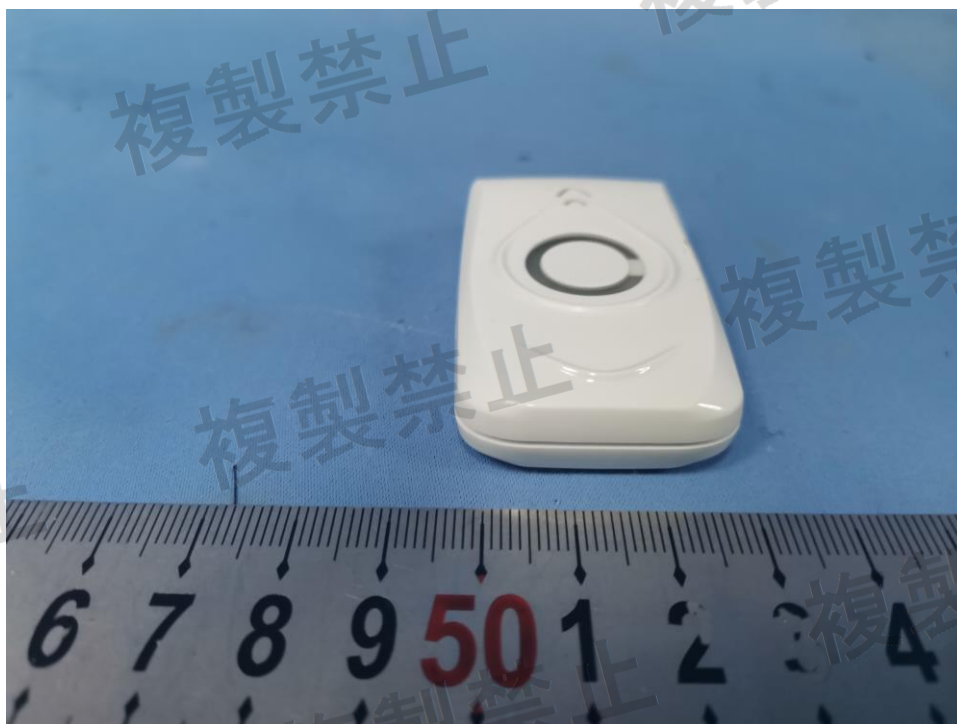
External Photo



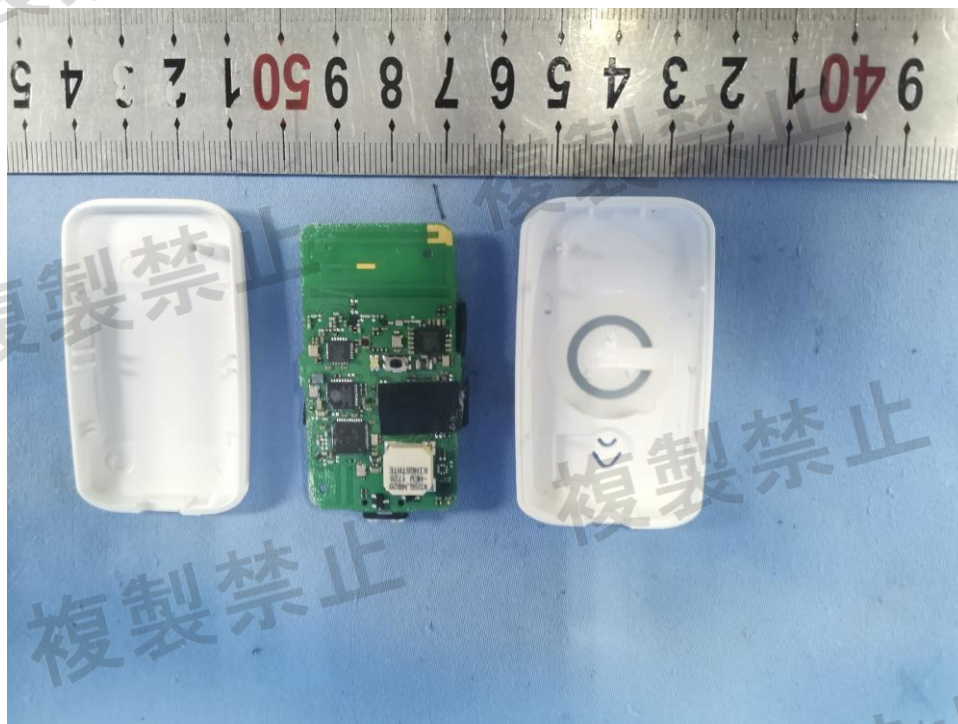
External Photo



External Photo



Internal Photo



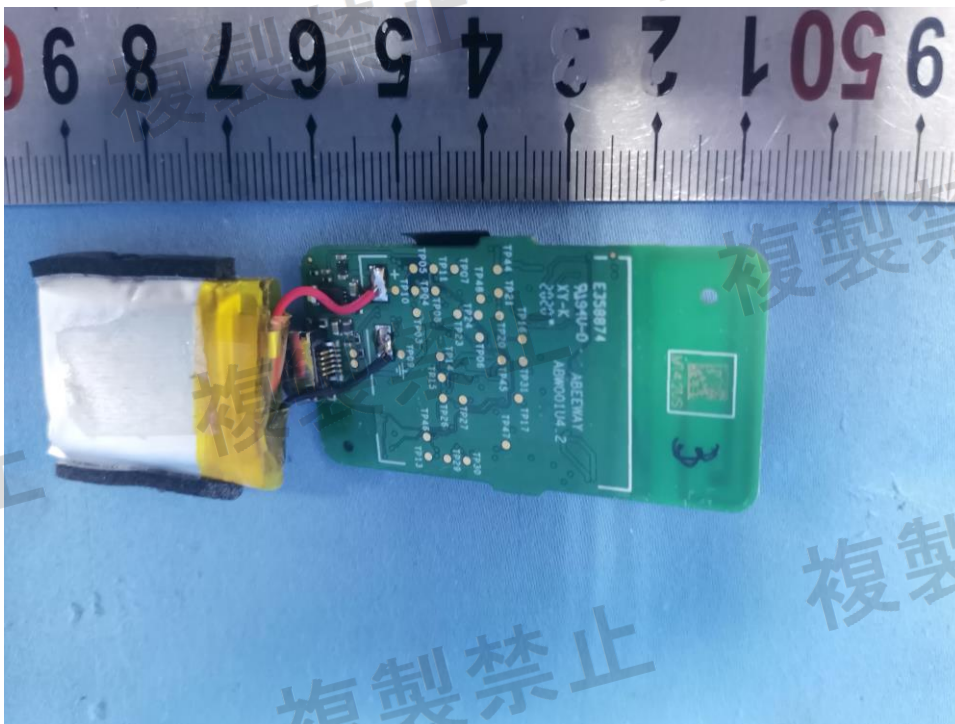
Internal Photo



Internal Photo



Internal Photo



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