



## Shenzhen Huaxia Testing Technology Co., Ltd.

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# TEST REPORT

**Application No.:** CQASZ20200400255E-01  
**Applicant:** Dongguan Hele Electronics Co., Ltd  
**Address of Applicant:** Dalingya Industrial Zone, Daojiao Town, Dongguan City, Guangdong, China  
**Manufacturer:** Dongguan Hele Electronics Co., Ltd  
**Address of Manufacturer:** Dalingya Industrial Zone, Daojiao Town, Dongguan City, Guangdong, China  
**Factory:** Dongguan Hele Electronics Co., Ltd  
**Address of Factory:** Dalingya Industrial Zone, Daojiao Town, Dongguan City, Guangdong, China  
**Equipment Under Test (EUT):**  
**Product:** TWS Bluetooth earphones  
**Model No.:** In2017  
**Wear position:** Right ear  
**Brand Name:** QCY  
**Standards:** Item 19 of Article 2 Paragraph 1  
**Date of Test:** 2020-04-15 to 2020-04-22  
**Date of Issue:** 2020-04-23  
**Test Result :** PASS

**Tested By:**

Tom Chen

( Tom chen )

**Reviewed By:**

Sheek Luo

( Sheek Luo )

**Approved By:**

Jack Ai

( Jack Ai )



\* In the configuration tested, the EUT complied with the standards specified above.

The test report is effective only with both signature and specialized stamp. The result(s) shown in this report refer only to the sample(s) tested. Without written approval of CQA, this report can't be reproduced except in full.

## 1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2020-04-22		Original

## 2 Test Summary

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 Error	Item 19 of Article 2-1	$\pm 50$ PPM or less	PASS
Occupied Bandwidth	Item 19 of Article 2-1	83.5 MHz or less	PASS
Spread-spectrum Bandwidth	Item 19 of Article 2-1	500 kHz or more	PASS
Antenna Power	Item 19 of Article 2-1	3 mW /MHz or less Error+20% -80%	PASS
Spurious Emission of Tx	Item 19 of Article 2-1	(1) Below 2387 MHz: 2.5 $\mu$ W/MHz (2) 2387 to 2400 MHz : 25 $\mu$ W/MHz (3) 2483.5 through 2496.5 MHz : 25 $\mu$ W/MHz (4)Over 2496.5 MHz: 2.5 $\mu$ W/MHz	PASS
Dwell Time	Item 19 of Article 2-1	less than 0.4sec	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	Article 49-20, paragraph 1 (a)	PASS
Spurious Emission of Rx	Item 19 of Article 2-1	(1) Below 1 GHz : 4 nW (2) 1 GHz to 13 GHz : 20 nW	PASS
Transmission Antenna Gain	Item 19 of Article 2-1	/	N/A
Transmission Radiation Angle Width	Item 19 of Article 2-1	/	N/A

### 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.

N/A: This test item was not required for the output power less than 6.91dBm/MHz(E.I.R.P), So Not Applicable.

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## 4 General Information

### 4.1 General Description of E.U.T.

Product Name: TWS Bluetooth earphones  
Model No: In2017  
Trade Mark: QCY

### 4.2 Details of E.U.T.

Operating Frequency: 2402 MHz to 2480 MHz  
Type of Modulation: GFSK, ( $\pi/4$ )DQPSK  
Number of Channels: 79 Channels  
Channel Separation: 1 MHz  
Dwell Time: Per channel is less than 0.4s.  
Bluetooth Version: V5.0  
Hardware Version: V5.0  
Software Version: V5.0  
Antenna Type: Ceramic Chip Antenna  
Antenna Gain: 2.5dBi  
Rated power: GFSK: 0.008mW/MHz, ( $\pi/4$ )DQPSK: 0.008mW/MHz  
Sample Type: Portable product  
Power Supply: lithium battery: DC3.6V Charging DC5V



### 4.3 Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.	Remark
PC	Lenovo	Lenovo ideapad 100-14IBY	Provide by lab
Mouse	Lenovo	KM040	Provide by lab
AC/DC Adapter	Lenovo	PA-1450-55LN	Provide by lab

### 4.4 Deviation from Standards

None.

### 4.5 Abnormalities from Standard Conditions

None.

### 4.6 Other Information Requested by the Customer

None.

### 4.7 Test Location

All tests were performed at:

Shenzhen Huaxia Testing Technology Co., Ltd.

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua District, Shenzhen, China

No tests were sub-contracted.

## 4.8 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L5785)**

CNAS has accredited Shenzhen Huaxia Testing Technology Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **ISED Registration No.: 22984-1**

The 3m Semi-anechoic chamber of Shenzhen Huaxia Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

- **A2LA (Certificate No. 4742.01)**

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4742.01.

## 5 Equipment List

Test Equipment List						
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date	Cal. Due Date	Remark
Humi/ Temp Indicator	VICTOR	VC330	CQA-S070	2019/9/25	2020/9/24	-
Spectrum Analyzer	Rohde & Schwarz	FSU26	CQA-038	2019/10/25	2020/10/24	-
Spectrum Analyzer	Rohde & Schwarz	FSV40	CQA-075	2019/6/11	2020/6/10	-
DC Power Supply	KEYSIGHT	E3631A	CQA-028	2019/9/26	2020/9/25	-
Multi Meter	Fluke	15B	CQA-S011	2019/9/25	2020/9/24	-
iPhone 6s	Apple	A1688	FK1QJUUS GRYD	-	-	Certificate number: [T] ADF15009 9003 [R]003-150 132
Signal generator	ANRITSU	MG3692B	CQA-019	2019/9/25	2020/9/24	-

Remark:

- (a) Calibration conducted by the National Institute of Information and Communications Technology (NICT) in Japan (hereinafter referred to as "NICT") 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 NICT or a designated calibration 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.**



## 6 Test Results

### 6.1 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 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 (used in the range of 2427 - 2470.75 MHz) (2) OFDM, DS other than (1) 10mW/MHz (3) Other than (1) & (2) 10mW (4) OFDM OBW 26 - 38MHz: 5mW/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	(1) Below 2387 MHz: 2.5 $\mu$ W (2) 2387 to 2400 MHz: 25 $\mu$ W (3) 2483.5 through 2496.5 MHz: 25 $\mu$ W (4) Over 2496.5 MHz: 2.5 $\mu$ W
Spreading bandwidth	DS, FH, FH+DS, FH+OFDM: 500kHz or more
Spreading rate of spectrum	For DS system: (Spreading bandwidth) / (Frequency corresponding to transmission rate) $\geq 5$
Limit of secondary radiated	(1) Below 1 GHz: 4nW

emissions	(2) 1 GHz or higher: 20nW
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

## 6.2 E.U.T. Test Conditions

**Power Supply:** Lithium ion batteries: DC3.6V, Charging by DC5V

別表第四十三 証明規則第2条1項第19号に掲げる無線設備の試験方法

No. 43 - Proof rule article 2, paragraph 1, section 19  
Test method of Radio Equipment

### 1. General (Common)

#### 1) Environment of test site

Keep the temperature and humidity of test room in the normal temperature and humidity range as regulated in JIS Z 8703:

#### 2) Power supply voltage

##### (1) Characteristic test in Certificate of technical conformity

Supply the rated voltage to power supply.

##### (2) Other

Supply the rated voltage and the rated voltage  $\pm 10\%$  to power supply. However,

If the fluctuation of input voltage to the circuit of RF unit (except power supply) of test equipment is under  $\pm 1\%$ , when input voltage from external power supply to the test equipment is fluctuated by  $\pm 10\%$ : Conduct the test with the rated voltage only.

If the test equipment is designed to operate only by the particular fluctuation range (the range of fluctuation of power supply voltage is within  $\pm 10\%$ ), and the upper/lower limit of the particular fluctuation range is specified in the construction design specification: Conduct the test with the rated voltage and with the upper/lower limit of the particular fluctuation range.

The measurement result of the voltage fluctuation at RF circuit when DC3.6V  $\pm 10\%$ .

DC Input	DC3.6
3.96V	3.96V
3.6V	3.6V
3.24V	3.24V

**Temperature:** 5 -35.0 °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.

**EUT Channels and Frequencies List:**

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	27	2429	54	2456
1	2403	28	2430	55	2457
2	2404	29	2431	56	2458
3	2405	30	2432	57	2459
4	2406	31	2433	58	2460
5	2407	32	2434	59	2461
6	2408	33	2435	60	2462
7	2409	34	2436	61	2463
8	2410	35	2437	62	2464
9	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454		
26	2428	53	2455		

Test frequencies are the lowest channel: 0 channel (2402 MHz), middle channel: 39 channel (2441 MHz) and highest channel: 78 channel (2480 MHz).

### 6.3 Test Environment

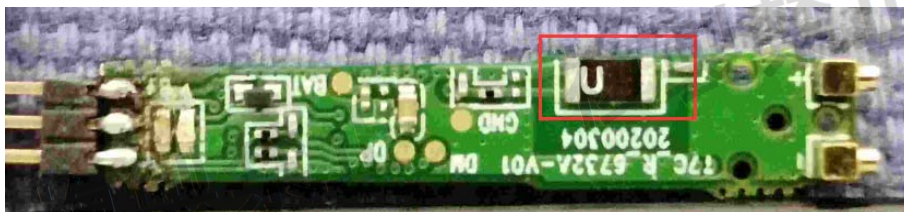
Operating Environment:	
Temperature:	28.0 °C
Humidity:	69 % RH
Atmospheric Pressure:	1009 mbar

### 6.4 Antenna Requirement

#### Standard requirement

Applicable for equipment with an antenna terminal, including testing terminals) If an antenna connector is available, all relevant tests will be carried out conducted. If not, tests will be carried out in an anechoic room or with a suitable test-fixture.

#### EUT Antenna



The EUT with Ceramic Chip Antenna, the best case gain of the antenna is 2.5dBi.



## 6.5 Interference prevention function

The device consists of the the integral antenna and 2.4 GHz BT module; Component BT module also can use the protocol function to protect interference come from outside.

### 6.5.1 Test Equipment

iPhone 6s

### 6.5.2 Test Software

S2 Terminal for Bluetooth

### 6.5.3 Test Procedure

1:Open the software

2:Search the Bluetooth device

We can use software to detect Bluetooth ID information is as follows:

BB:82:DA:E3:70:26

Test result: The unit does meet the requirements.

PASS

## 6.6 Frequency Error

Test Requirement: Item 19 of Article 2-1  
Tolerance of frequency:  $\pm 50 \times 10^{-6}$

Text Method: MIC Notice No.88 Appendix No.43

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:

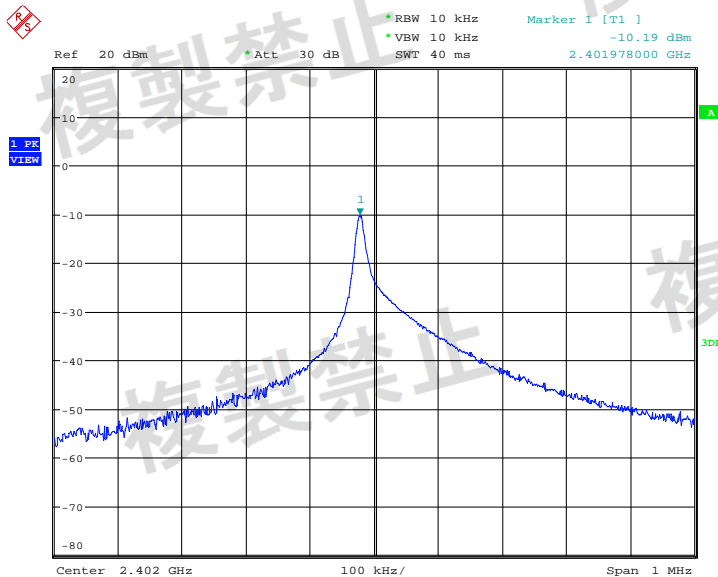
Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.6V DC	3.96V DC	3.24V DC		
Lowest	2402.0	2401.978	2401.977	2401.977	MHz	±50 PPM or less
		-9.159	-9.575	-9.575	PPM	
Middle	2441.0	2440.977	2440.977	2440.978	MHz	
		-9.422	-9.422	-9.013	PPM	
Highest	2480.0	2479.977	2479.978	2479.977	MHz	
		-9.274	-8.871	-9.274	PPM	

Note: The nominal frequency shall be confirmed by the applicant and test lab.

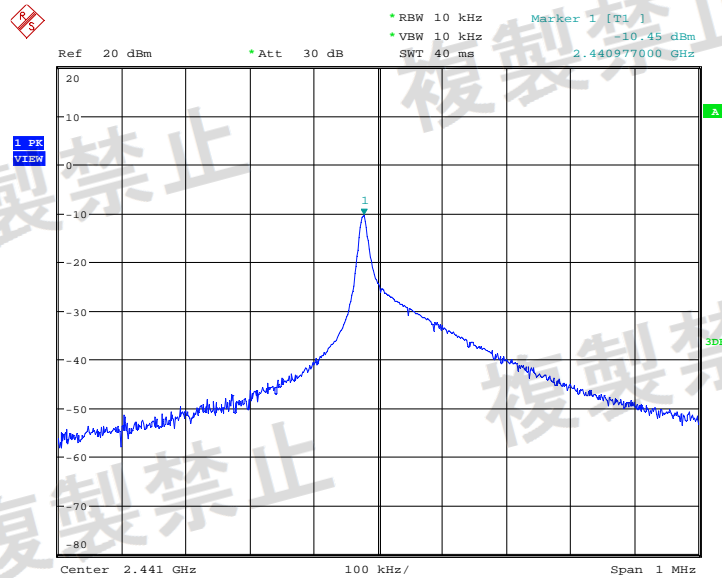
Result plot as follows:

Normal Voltage:DC3.6V

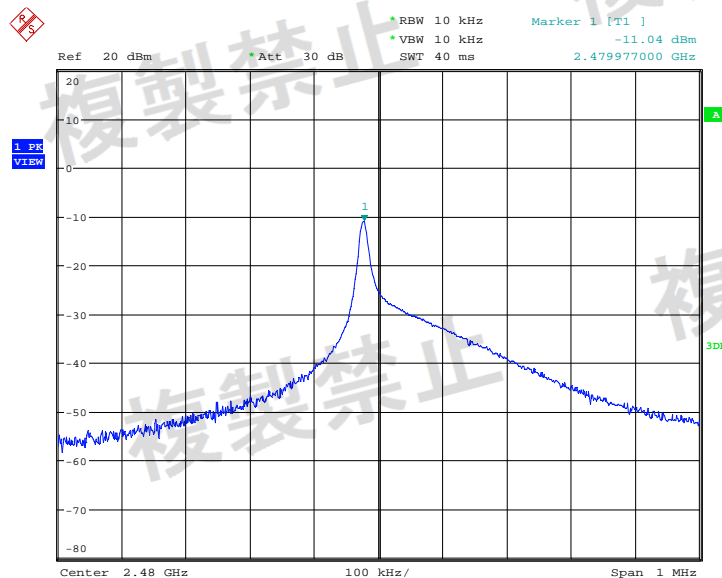
Channel 0: 2.402 GHz



Channel 39: 2.441 GHz:



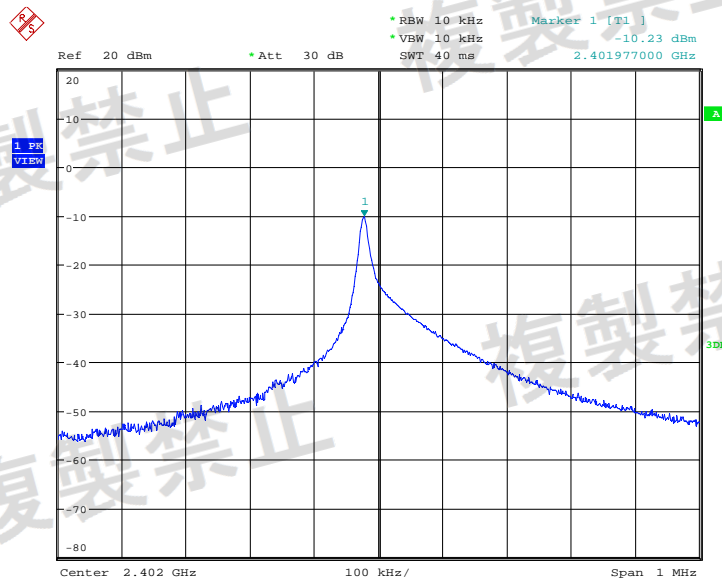
Channel 78: 2.480 GHz:



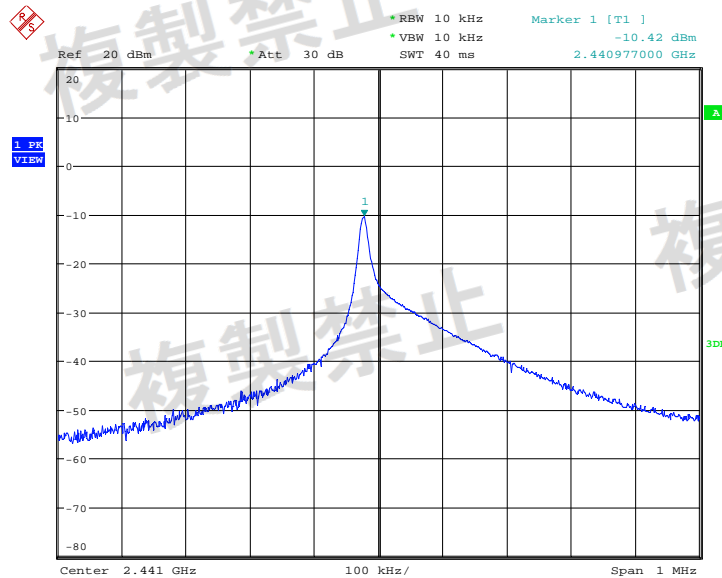
Test Result: The unit does meet the requirements.

High Voltage:DC3.96V

Channel 0: 2.402 GHz:

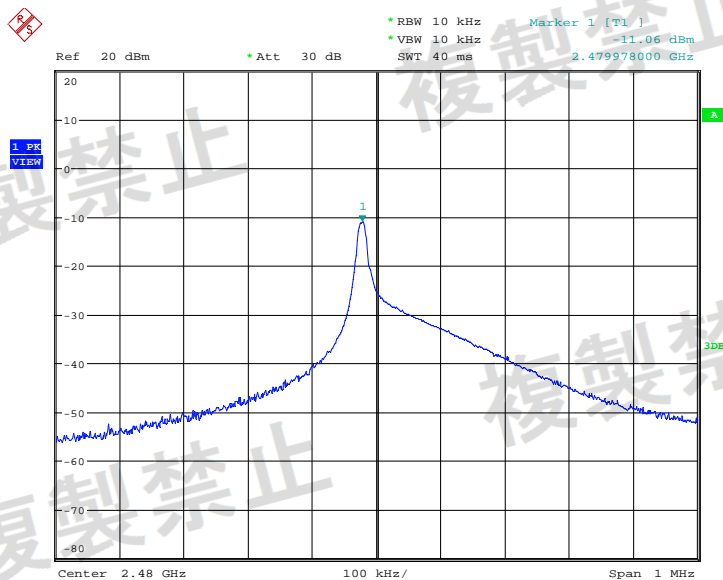


Channel 39: 2.441 GHz:





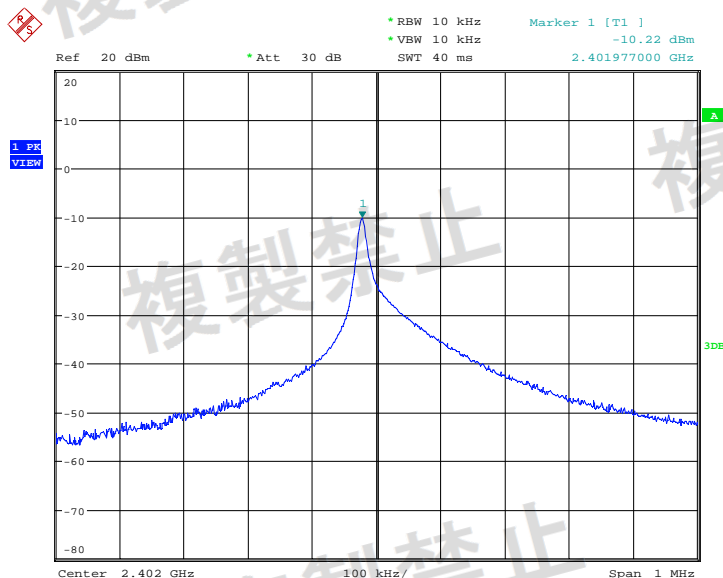
Channel 78: 2.480 GHz



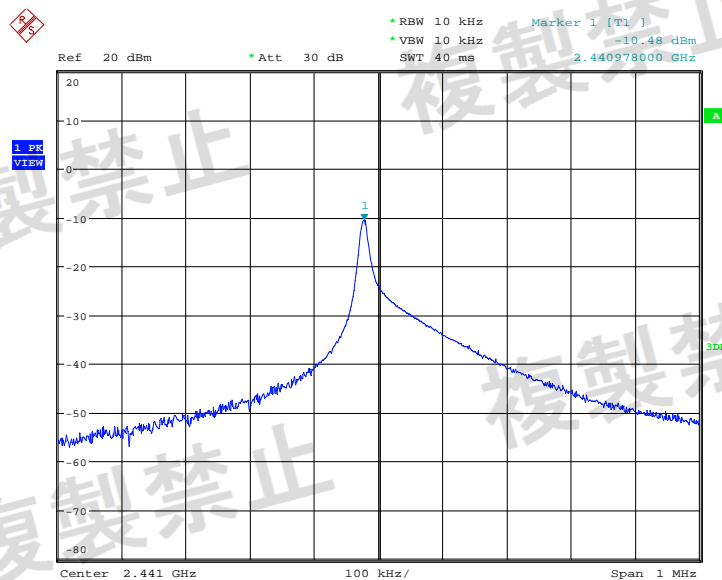
**Test Result:** The unit does meet the requirements.

**Low Voltage:** DC3.24V

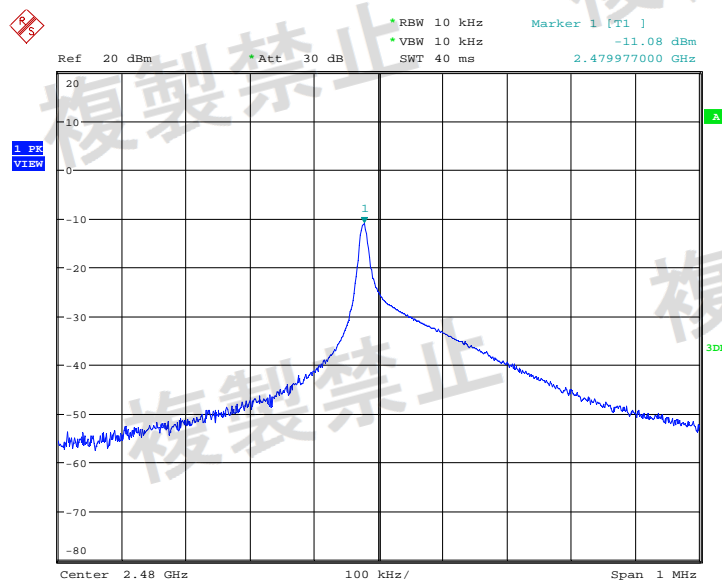
Channel 0: 2.402 GHz:



Channel 39: 2.441 GHz:



Channel 78: 2.480 GHz:



Test Result: The unit does meet the requirements.

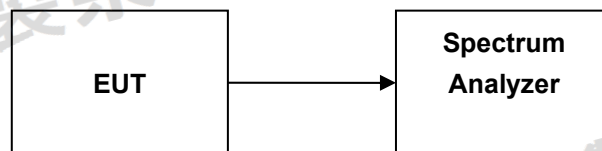
## 6.7 Occupied Bandwidth (99%)

Test Requirement: Item 19 of Article 2-1  
FH: 83.5MHz or less

Text Method: MIC Notice No.88 Appendix No.43

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, Modulation Tx  
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 83.5 MHz (FHSS),  
RBW 1 MHz  
VBW 1 MHz  
Sweep Time Auto  
detector mode Positive peak  
Indication mode Max hold  
OBW 99%

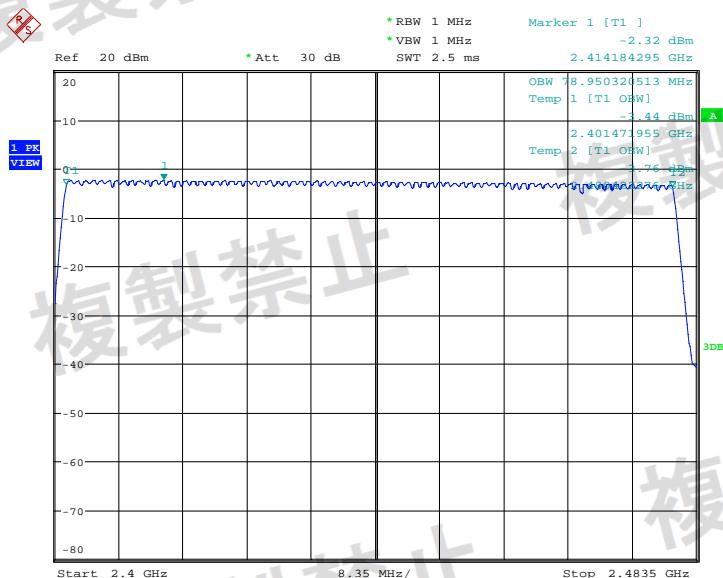
**Test Result:**

Modulation	Test channels	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.6V DC	3.96V DC	3.24V DC		
GFSK	79 channels (2402~2480)	78.95	78.74	78.74	MHz	83.50 MHz or less
( $\pi/4$ )DQPSK	79 channels (2402~2480)	79.08	78.91	78.91	MHz	83.50 MHz or less

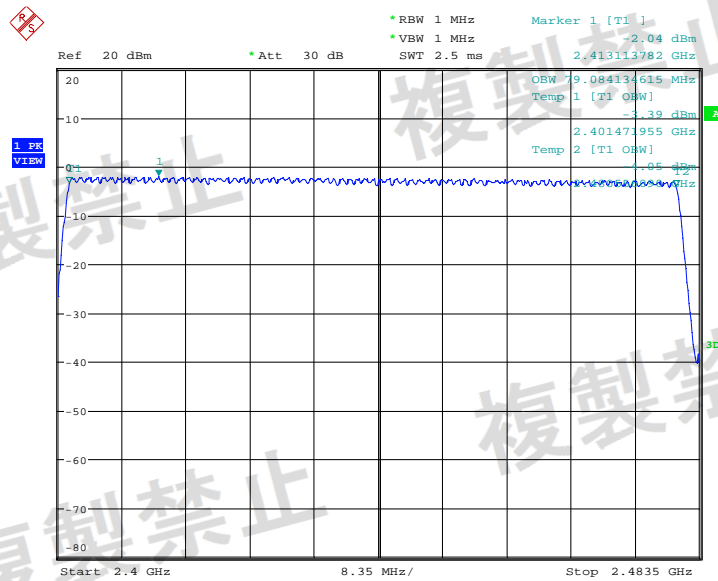
Result plot as follows:

**Normal Voltage:DC3.6V**

GFSK



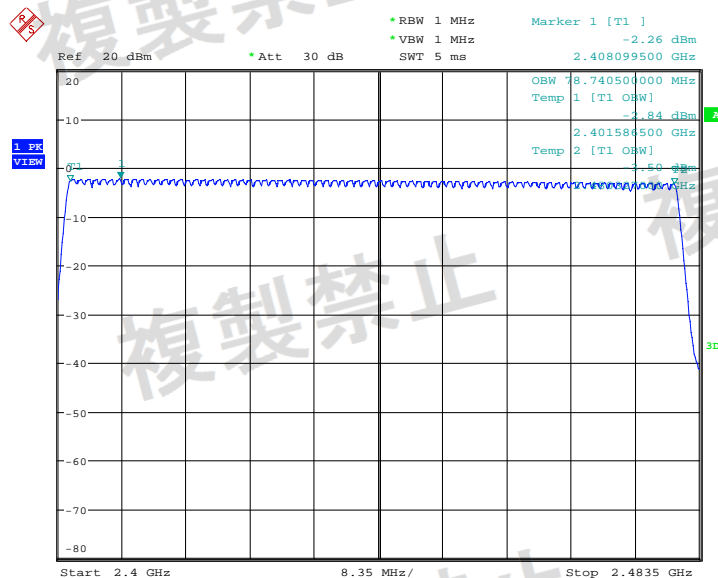
( $\pi/4$ )DQPSK



Test Result: The unit does meet the requirements.

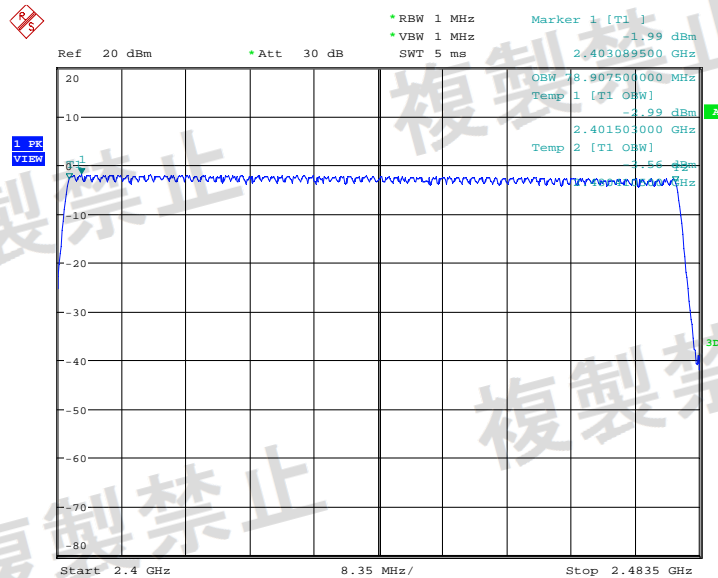
High Voltage:DC3.96V

GFSK





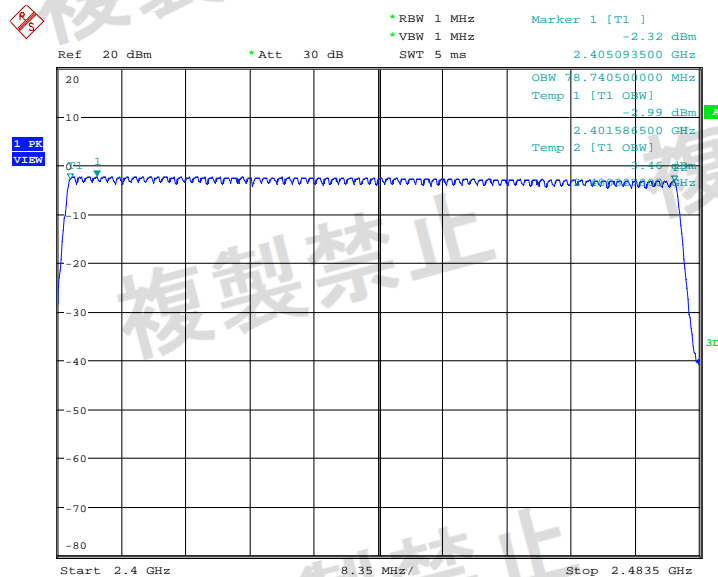
( $\pi/4$ )DQPSK



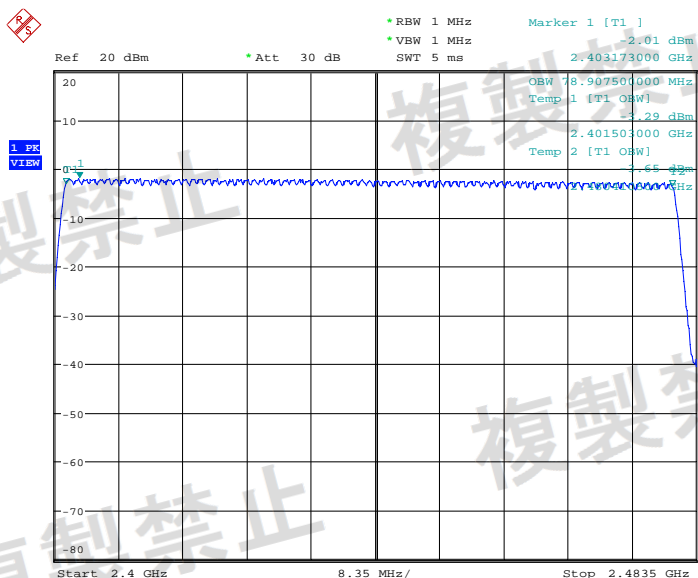
Test Result: The unit does meet the requirements.

Low Voltage:DC3.24V

GFSK



( $\pi/4$ )DQPSK



Test Result: The unit does meet the requirements.

## 6.8 Spread spectrum Bandwidth (90%)

Test Requirement: Item 19 of Article 2-1  
500 kHz or more

Text Method: MIC Notice No.88 Appendix No.43

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, Modulation Tx  
  
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 83.5MHz (FHSS),  
RBW 1 MHz  
VBW 1 MHz  
Sweep Time Auto  
detector mode Positive peak  
Indication mode Max hold  
  
OBW 90%

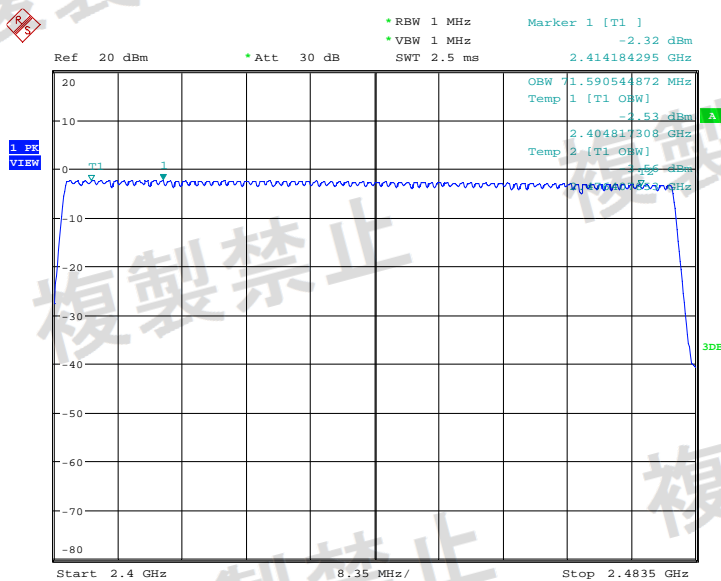
Test Result:

Modulation	Test channels	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.6V DC	3.96V DC	3.24V DC		
GFSK	79 channels (2402~2480)	71.59	71.39	71.39	MHz	500 kHz or more
( $\pi/4$ )DQPSK	79 channels (2402~2480)	71.59	71.48	71.48	MHz	500 kHz or more

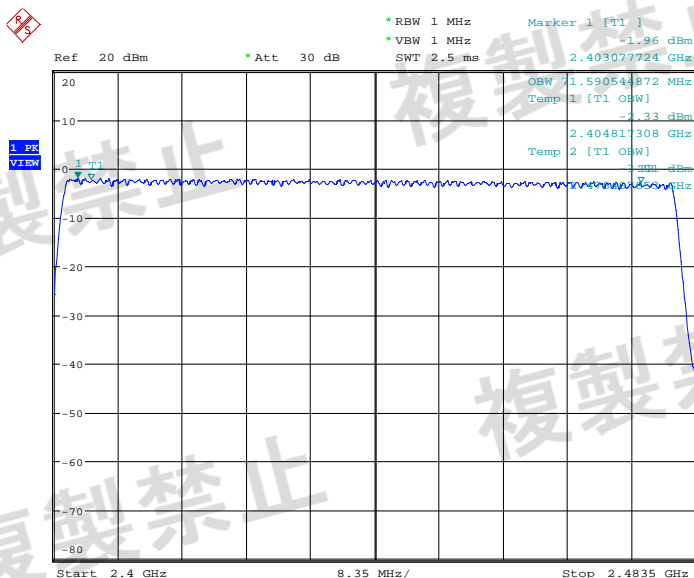
Result plot as follows:

Normal Voltage:DC3.6V

GFSK



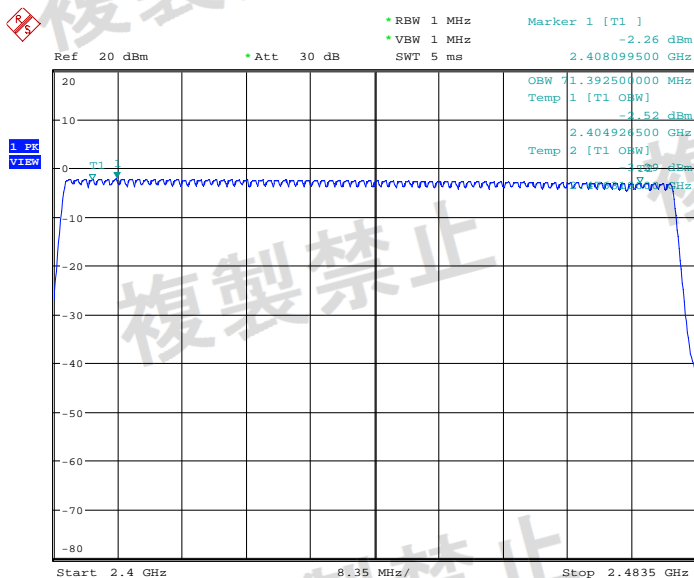
( $\pi/4$ )DQPSK



Test Result: The unit does meet the requirements.

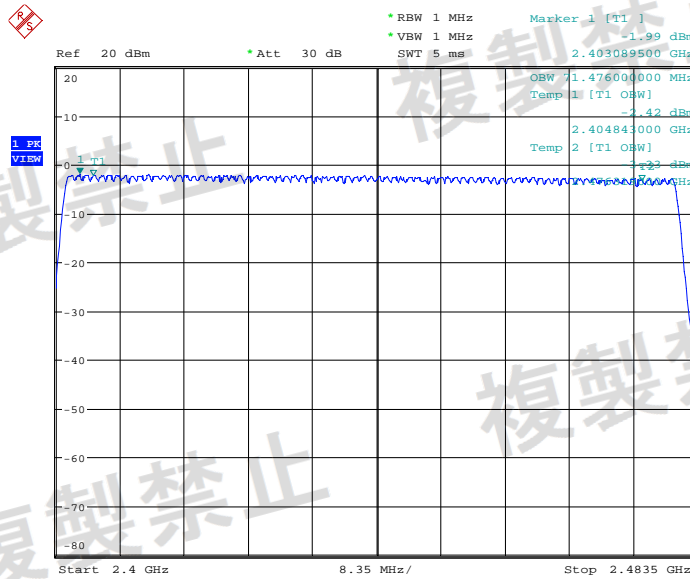
High Voltage:DC3.96V

GFSK





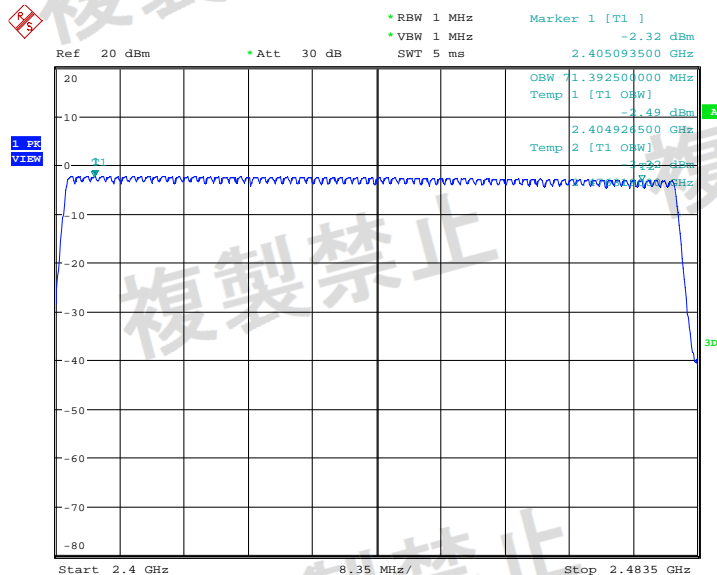
( $\pi/4$ )DQPSK



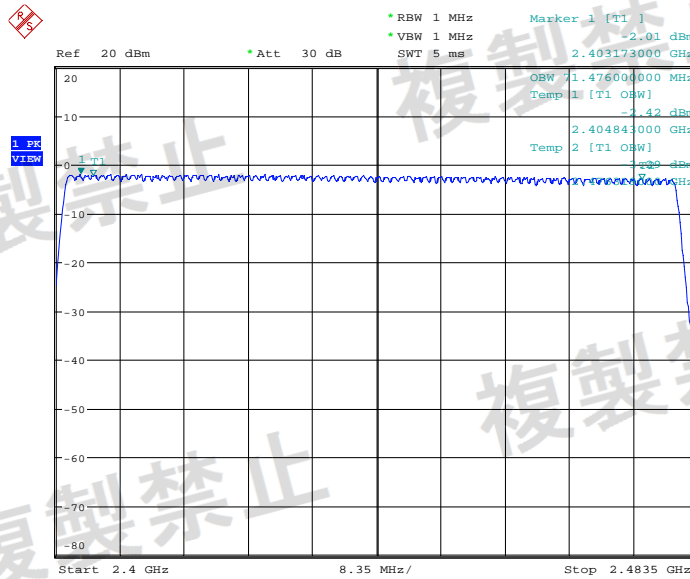
Test Result: The unit does meet the requirements.

Low Voltage:DC3.24V

GFSK



( $\pi/4$ )DQPSK



Test Result: The unit does meet the requirements.

## 6.9 Antenna Power

Test Requirement:

Item 19 of Article 2-1

2400-2427MHz, 2470.75-2483.5MHz: 10mW/MHz or less

2427-2470.75MHz: 3mW/MHz or less

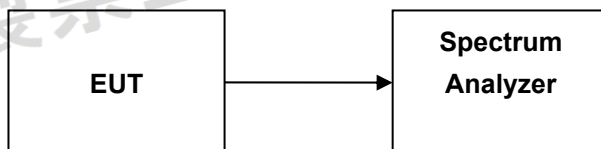
Text Method:

MIC Notice No.88 Appendix No.43

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, Modulation Tx

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

3. Spectrum Analyzer conditions:

Center Frequency: Test Frequency

Span: 2 times of occupied bandwidth

RBW: 1 MHz

VBW: 3 MHz

Sweep Time: Auto

detector mode: Positive peak

Indication mode: Max hold

4. Spectrum Analyzer conditions( Measure of Antenna Power):

Center Frequency: Frequency of Peak Power (Search Frequency by 3)

Span: 0Hz

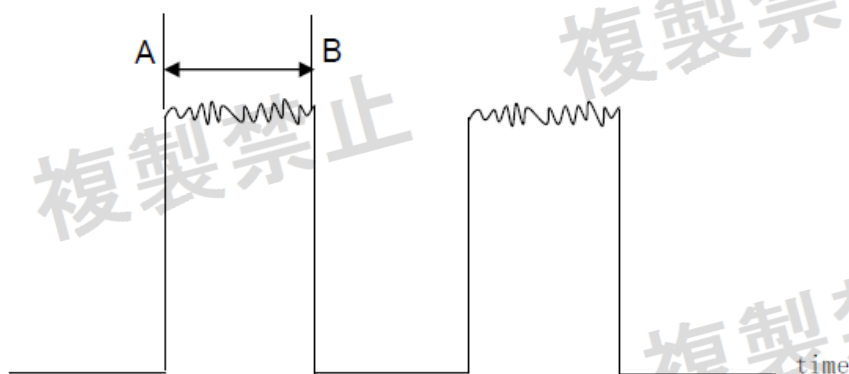
RBW: 1 MHz

VBW: 1 MHz

Sweep Time: Auto

detector mode: Positive peak

Indication mode: Sample Average



Measures the Average Burst power (A to B)

**Test Result:**

**GFSK:**

Modulation	Test channels	Test Result			Item	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.6V DC	3.96V DC	3.24V DC		
GFSK	79 channels (2402~2480)	-3.58	-2.82	-2.48	Average Burst Power(dBm)	/
		0.006	0.007	0.008	Antenna power(mW/MHz)	≤3 mW /MHz
		-25.000	-12.50	0.000	Antenna power Tolerance (%)	+20% -80%
		-22.13	-21.36	-21.02	Antenna power(dBm/MHz)	/
		-19.63	-18.86	-18.52	EIRP(dBm/MHz)	≤6.91dBm/MHz

**(π/4)DQPSK:**

Modulation	Test channels	Test Result			Item	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.6V DC	3.96V DC	3.24V DC		
(π/4)DQPSK	79 channels (2402~2480)	-2.72	-2.68	-2.94	Average Burst Power(dBm)	/
		0.007	0.008	0.007	Antenna power(mW/MHz)	≤3 mW /MHz
		-12.500	0	-12.50	Antenna power Tolerance (%)	+20% -80%
		-21.27	-21.22	-21.48	Antenna power(dBm/MHz)	/
		-18.77	-18.72	-18.98	EIRP(dBm/MHz)	≤6.91dBm/MHz

**Remark:**

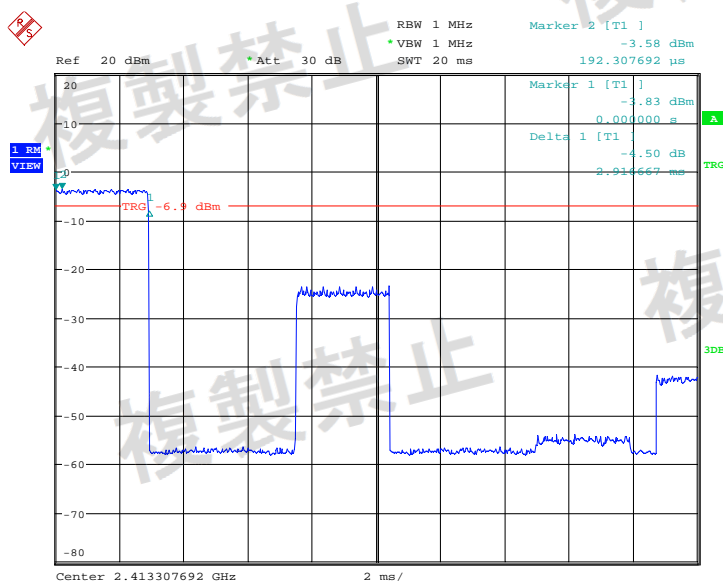
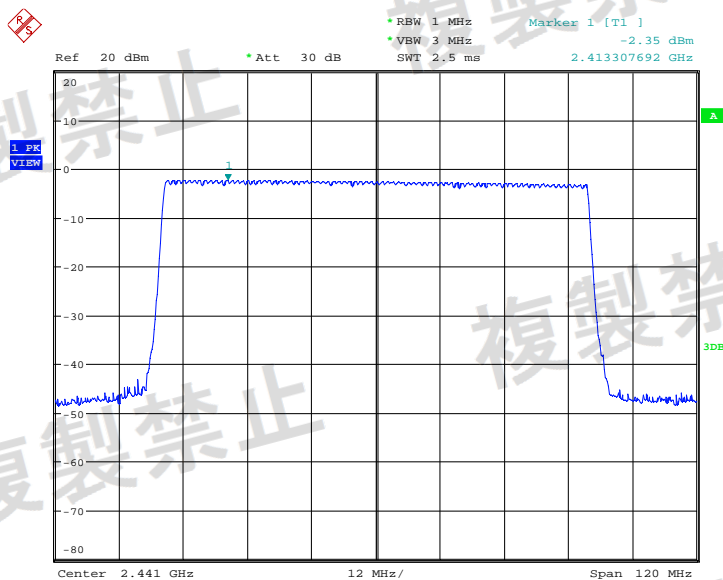
1. Antenna power(mW/MHz)=Average Burst Power / Spread Band width
2. The "Spread Band width" please refer to section 7.6.
3. Tolerance (%) :[( test value- rate power)/rater power]\*100
4. EIRP= Antenna power + Antenna Gain
5. Antenna Gain is 2.5 dBi
6. Rated power: GFSK: 0.008mW/MHz, (π/4)DQPSK: 0.008mW/MHz



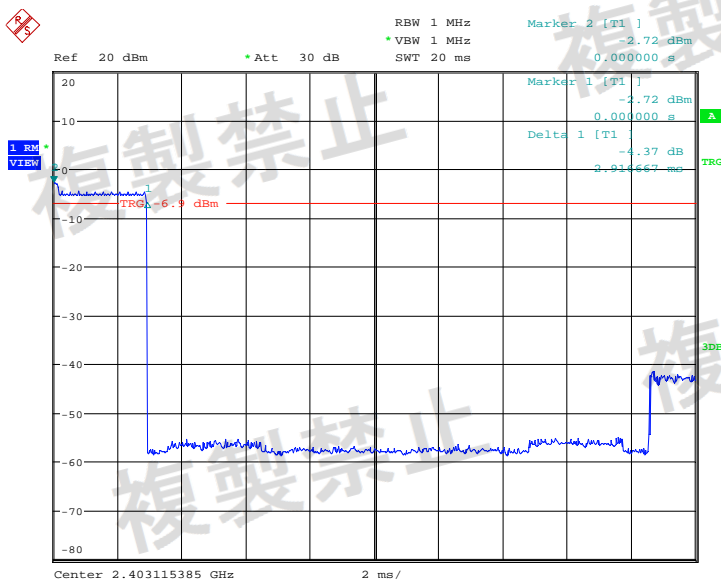
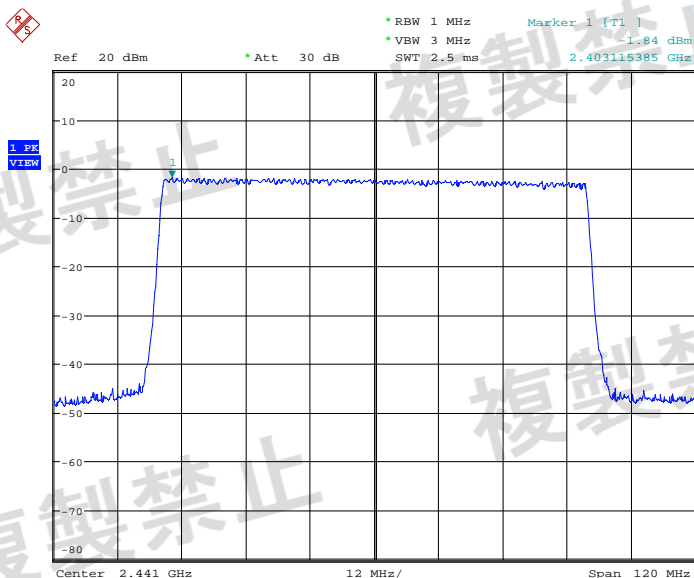
Result plot as follows:

Normal Voltage:DC3.6V

GFSK



( $\pi/4$ )DQPSK

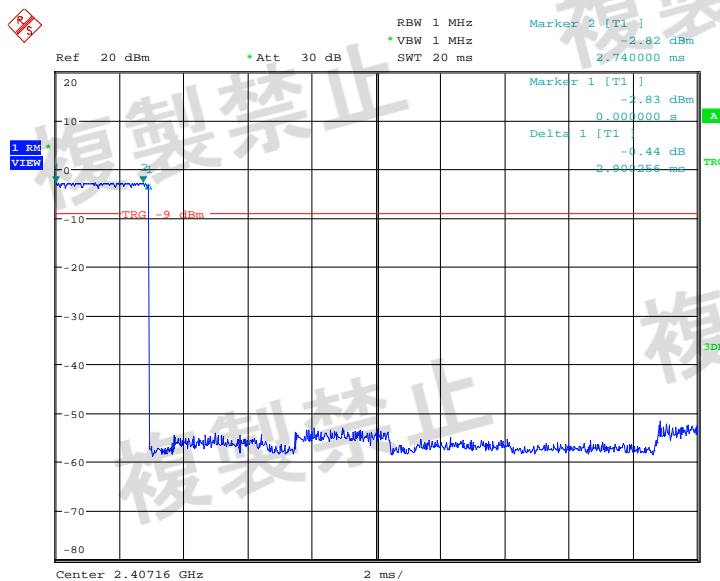
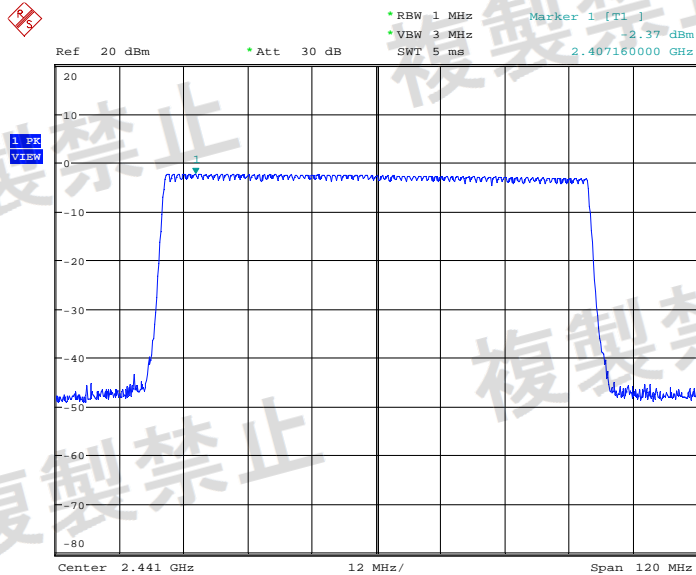


Remark: The "Spread Band width" please refer to section 7.6.

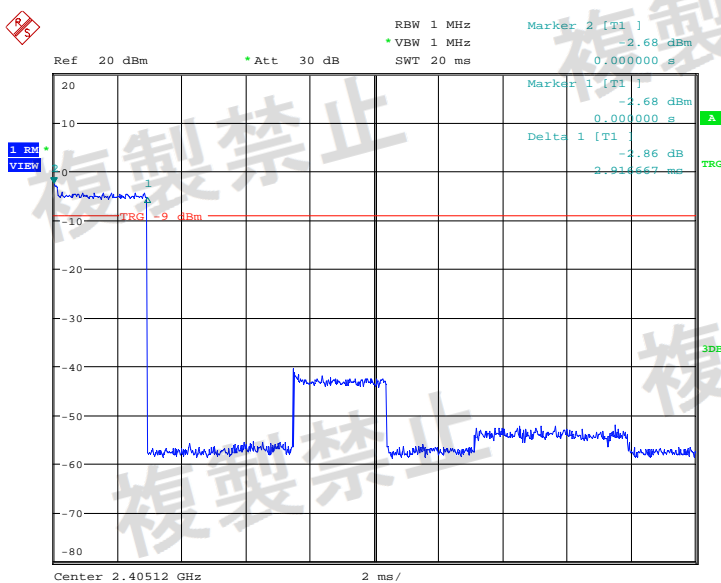
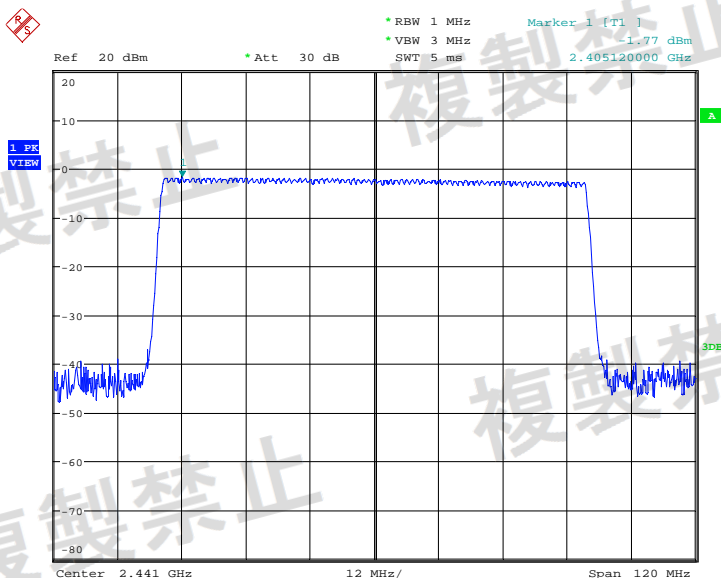
Test result: The unit does meet the requirements.

High Voltage:DC3.96V

GFSK



( $\pi/4$ )DQPSK

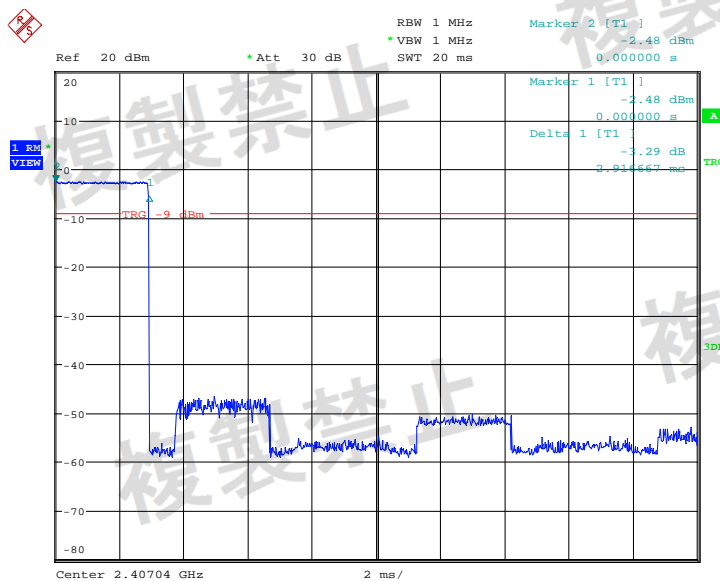
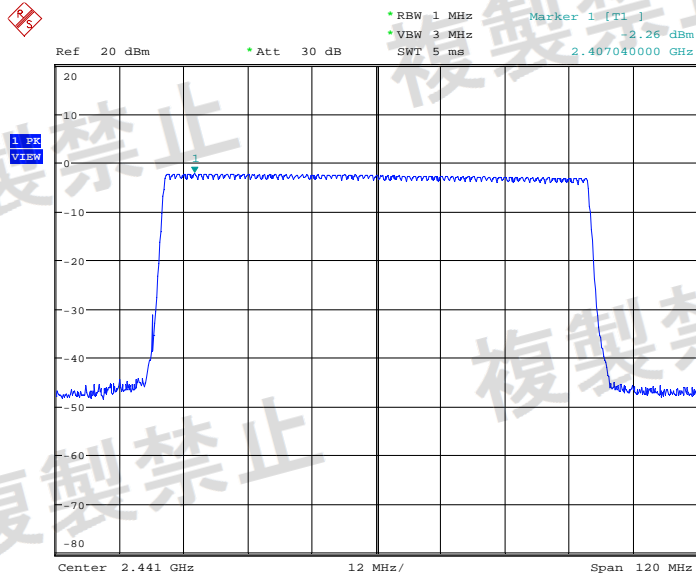


Remark: The "Spread Band width" please refer to section 7.6.

Test result: The unit does meet the requirements.

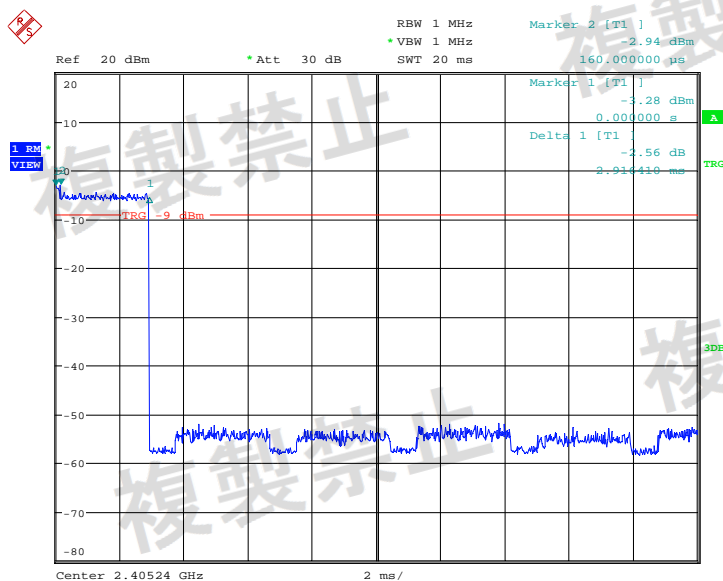
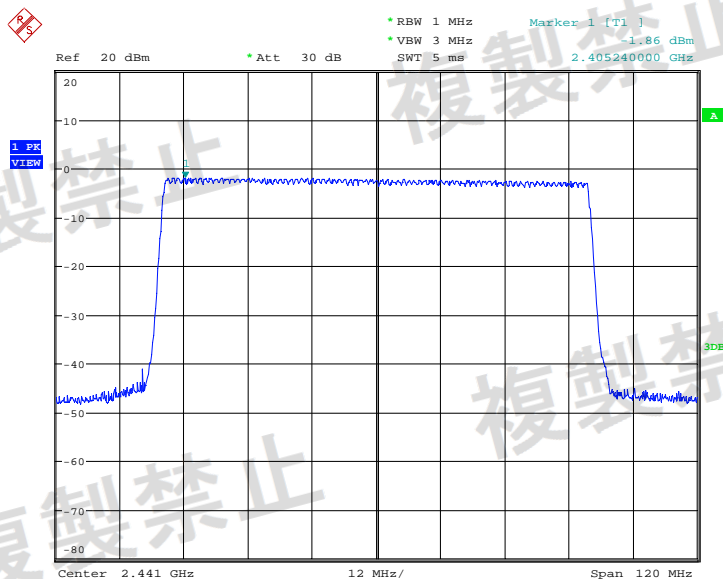
Low Voltage:DC3.24V

GFSK





( $\pi/4$ )DQPSK



Remark: The "Spread Band width" please refer to section 7.6.

Test result: The unit does meet the requirements.

## 6.10 Spurious Emissions of Tx

Test Requirement:	Item 19 of Article 2-1
Text Method:	MIC Notice No.88 Appendix No.43
	(1) Below 2387 MHz: 2.5 $\mu$ W/MHz(-26dBm/MHz) (2) 2387 to 2400 MHz: 25 $\mu$ W/MHz(-16dBm/MHz) (3) 2483.5 through 2496.5 MHz: 25 $\mu$ W/MHz(-16dBm/MHz) (4) Over 2496.5 MHz: 2.5 $\mu$ W/MHz(-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, , Modulation Tx  
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 13 GHz by peak mode.  
Step 2  
IF the value measured by Step1 is 2 dB or less, measure in average mode.  
Test setup for Step 1:  
Frequency: 30 MHz – 1000 MHz  
RBW 100 KHz  
VBW 100 KHz  
Sweep Time Auto  
detector mode Positive peak  
Indication mode Max hold  
  
Frequency: 1000 MHz – 2400 MHz , 2483.5 MHz –13 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

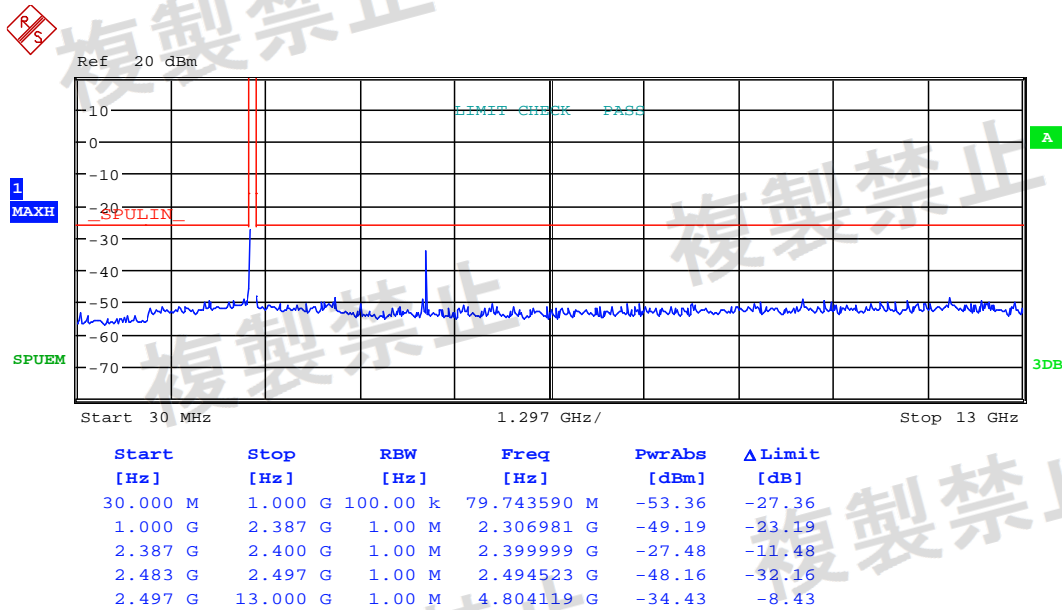
## Test Result:

Result plot as follows:

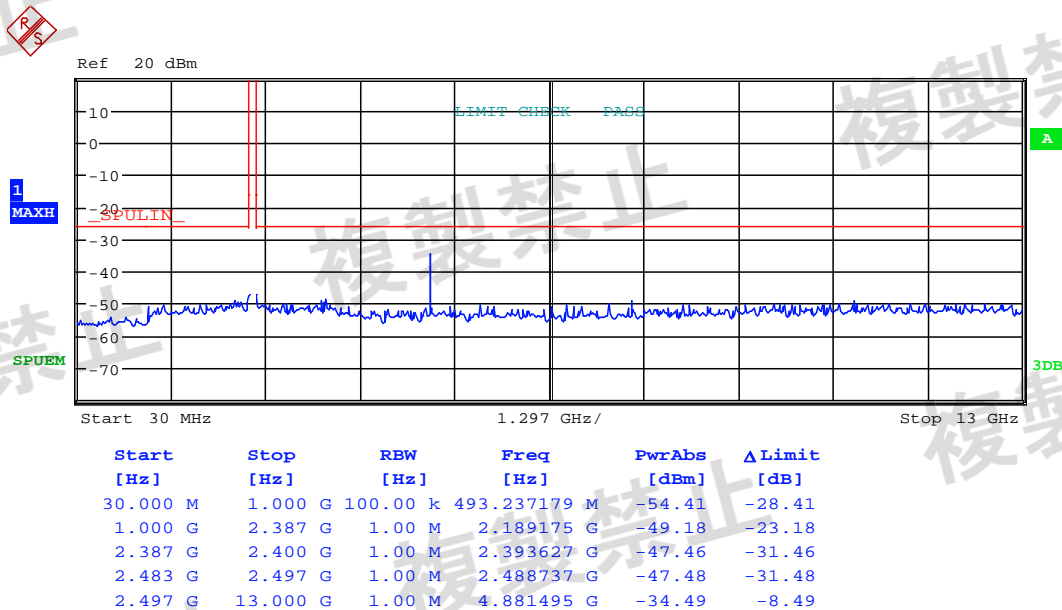
Normal Voltage DC3.6V

GFSK

Channel 0 (2.402 GHz)



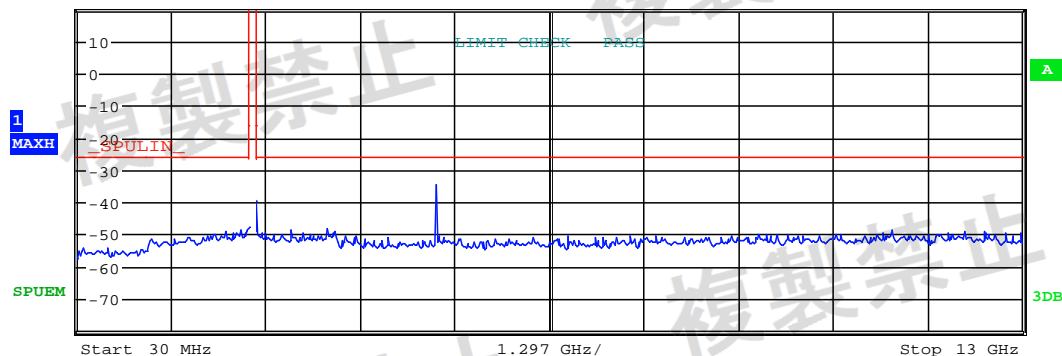
Channel 39 (2.441 GHz)



Channel 78 (2.480 GHz)



Ref 20 dBm



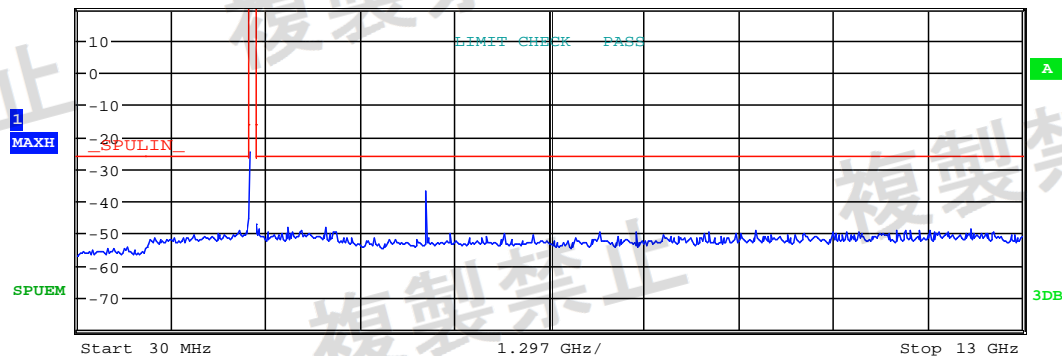
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	445.048077 M	-54.55	-28.55
1.000 G	2.387 G	1.00 M	2.373663 G	-48.62	-22.62
2.387 G	2.400 G	1.00 M	2.396170 G	-47.64	-31.64
2.483 G	2.497 G	1.00 M	2.483695 G	-39.83	-23.83
2.497 G	13.000 G	1.00 M	4.959921 G	-34.61	-8.61

( $\pi/4$ ) DQPSK

Channel 0 (2.402 GHz)



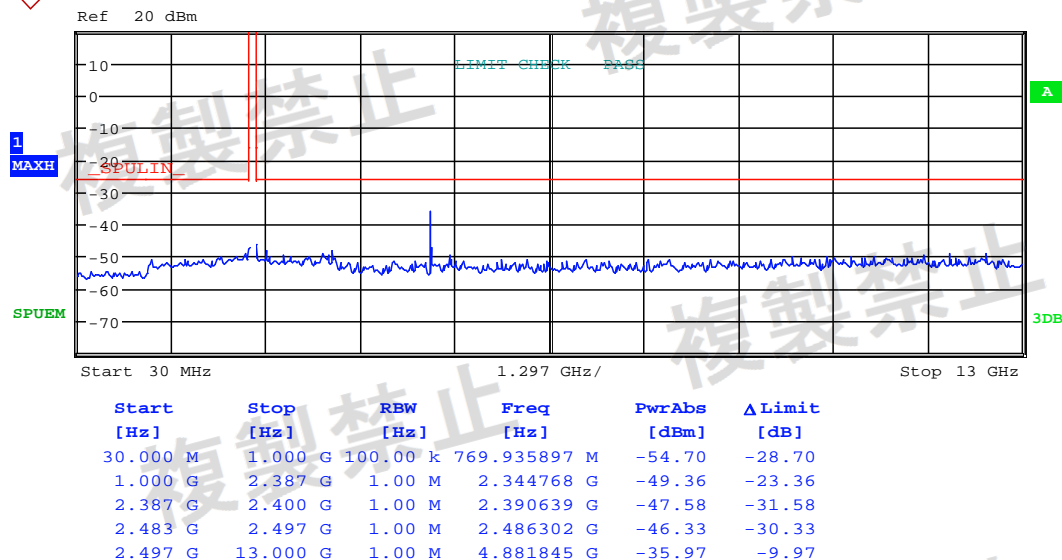
Ref 20 dBm



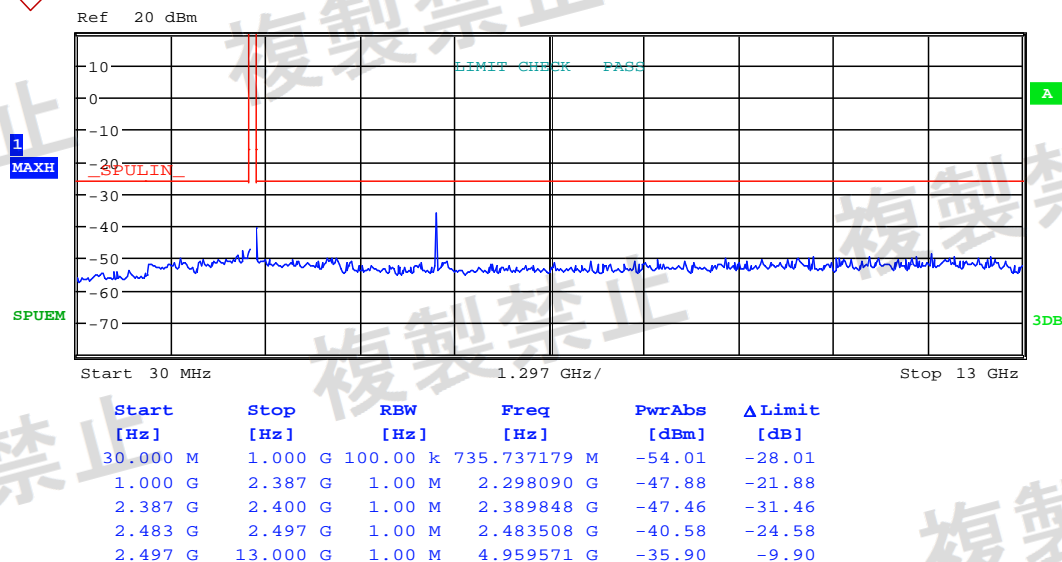
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	709.310897 M	-54.19	-28.19
1.000 G	2.387 G	1.00 M	2.378109 G	-49.33	-23.33
2.387 G	2.400 G	1.00 M	2.399997 G	-24.82	-8.82
2.483 G	2.497 G	1.00 M	2.487710 G	-47.56	-31.56
2.497 G	13.000 G	1.00 M	4.804469 G	-37.20	-11.20



Channel 39 (2.441 GHz)



Channel 78 (2.480 GHz)



Test Result: The unit does meet the requirements.

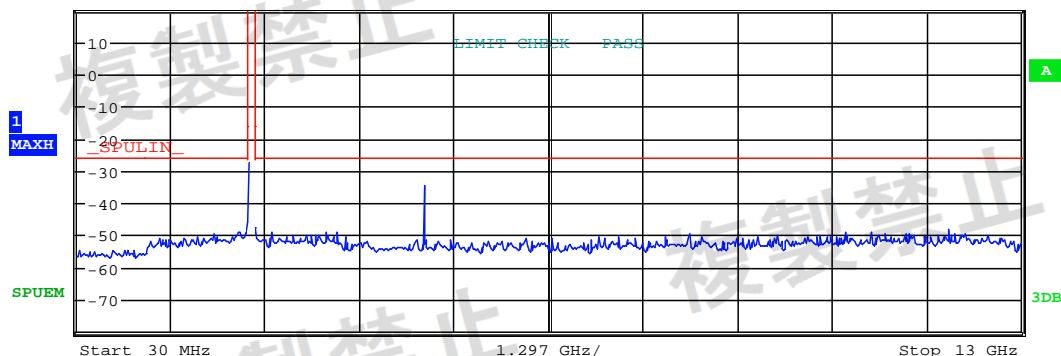
## High Voltage DC3.96V

GFSK

Channel 0 (2.402 GHz)



Ref 20 dBm

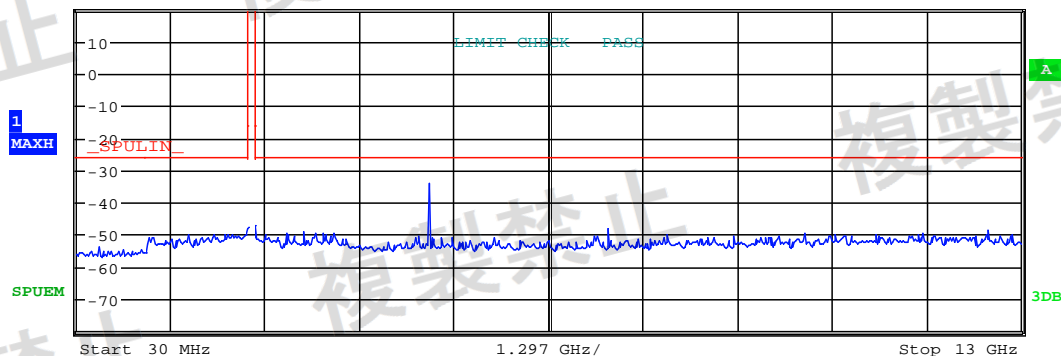


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	724.855769 M	-54.71	-28.71
1.000 G	2.387 G	1.00 M	2.275862 G	-49.14	-23.14
2.387 G	2.400 G	1.00 M	2.399990 G	-27.55	-11.55
2.483 G	2.497 G	1.00 M	2.494913 G	-47.95	-31.95
2.497 G	13.000 G	1.00 M	4.804119 G	-34.76	-8.76

## Channel 39 (2.441 GHz)



Ref 20 dBm

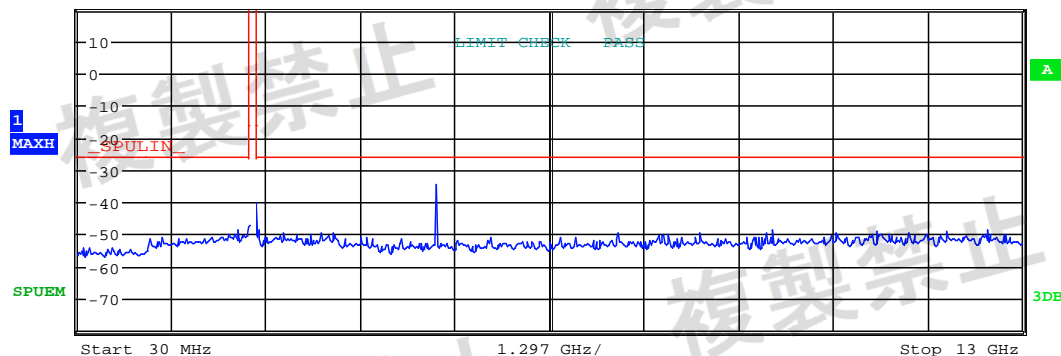


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	350.224359 M	-54.11	-28.11
1.000 G	2.387 G	1.00 M	2.371441 G	-50.02	-24.02
2.387 G	2.400 G	1.00 M	2.396155 G	-47.78	-31.78
2.483 G	2.497 G	1.00 M	2.488741 G	-47.60	-31.60
2.497 G	13.000 G	1.00 M	4.881495 G	-34.13	-8.13

Channel 78 (2.480 GHz)



Ref 20 dBm



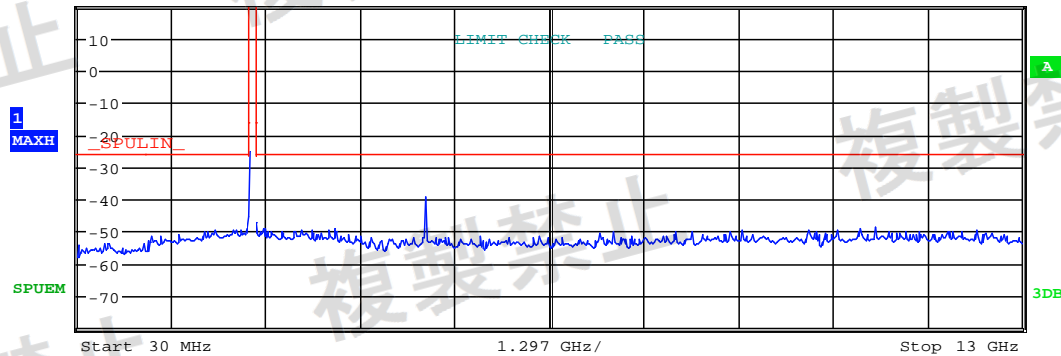
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	106.169872 M	-54.45	-28.45
1.000 G	2.387 G	1.00 M	2.233630 G	-48.89	-22.89
2.387 G	2.400 G	1.00 M	2.397696 G	-47.31	-31.31
2.483 G	2.497 G	1.00 M	2.483743 G	-40.25	-24.25
2.497 G	13.000 G	1.00 M	4.960271 G	-34.79	-8.79

( $\pi/4$ ) DQPSK

Channel 0 (2.402 GHz)

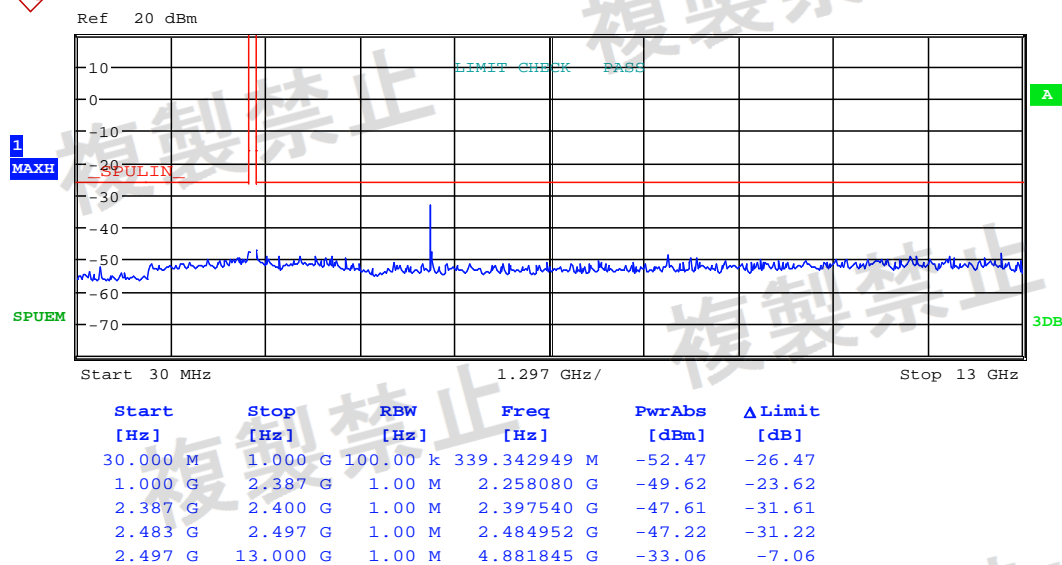


Ref 20 dBm

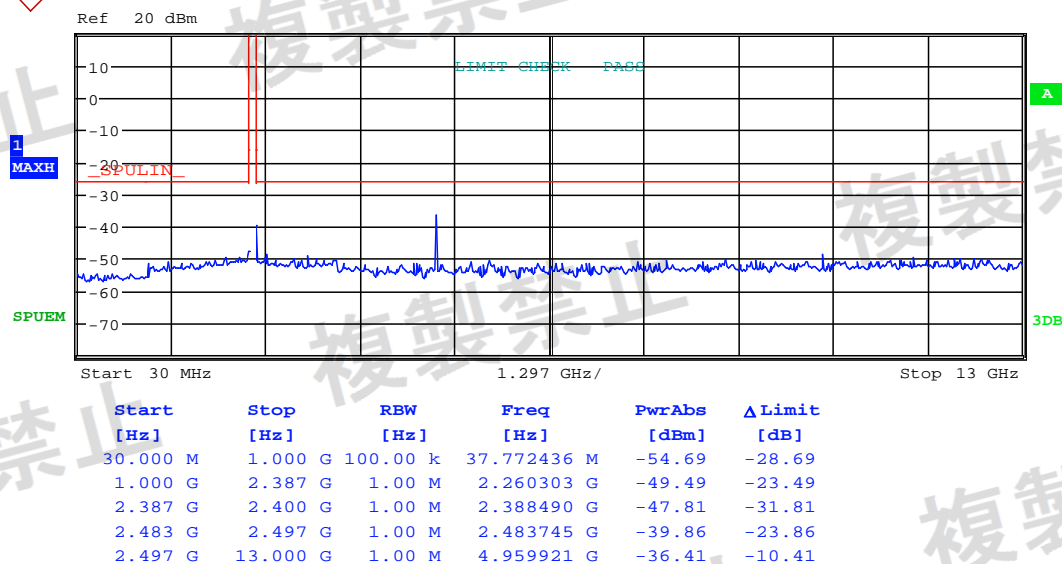


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	454.375000 M	-53.87	-27.87
1.000 G	2.387 G	1.00 M	2.378109 G	-49.10	-23.10
2.387 G	2.400 G	1.00 M	2.399964 G	-25.19	-9.19
2.483 G	2.497 G	1.00 M	2.484733 G	-47.22	-31.22
2.497 G	13.000 G	1.00 M	4.803769 G	-39.25	-13.25

Channel 39 (2.441 GHz)



Channel 78 (2.480 GHz)

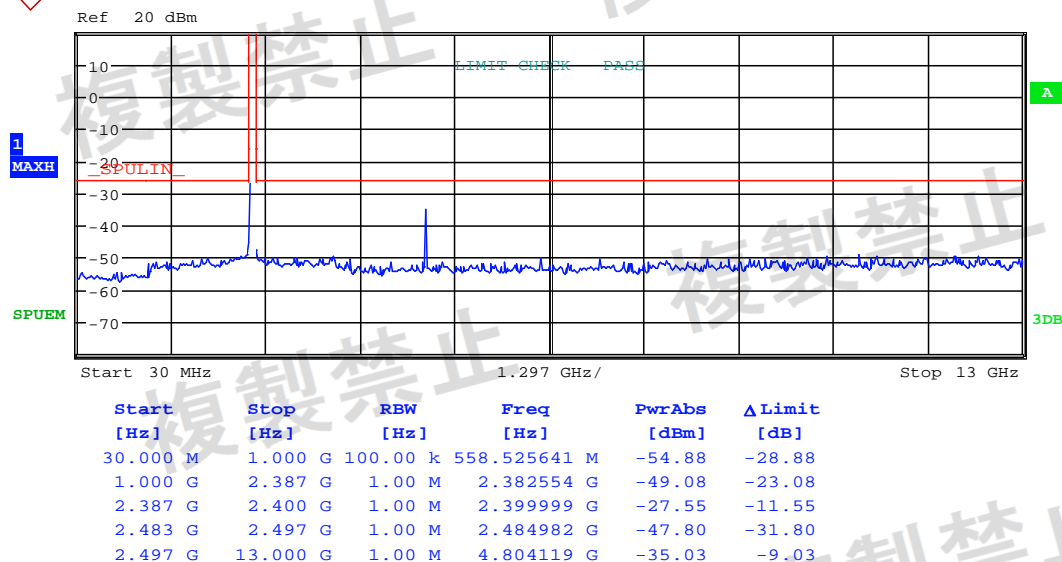


Test Result: The unit does meet the requirements.

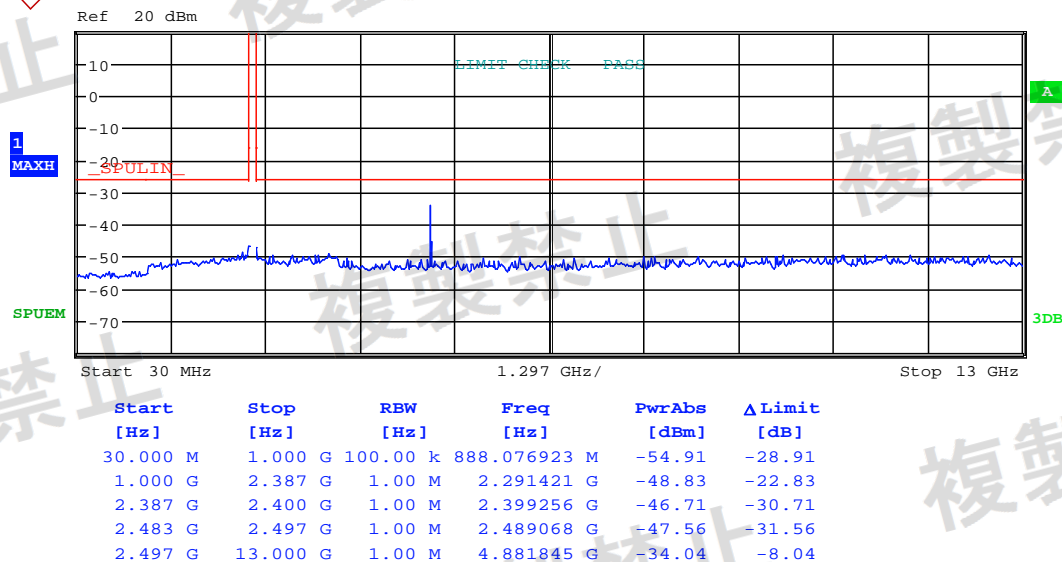
# Low Voltage DC3.24V

GFSK

Channel 0 (2.402 GHz)



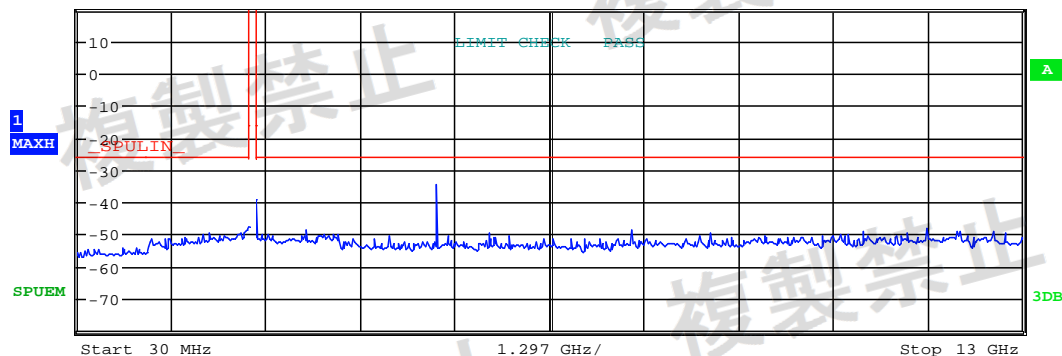
Channel 39 (2.441 GHz)



Channel 78 (2.480 GHz)



Ref 20 dBm



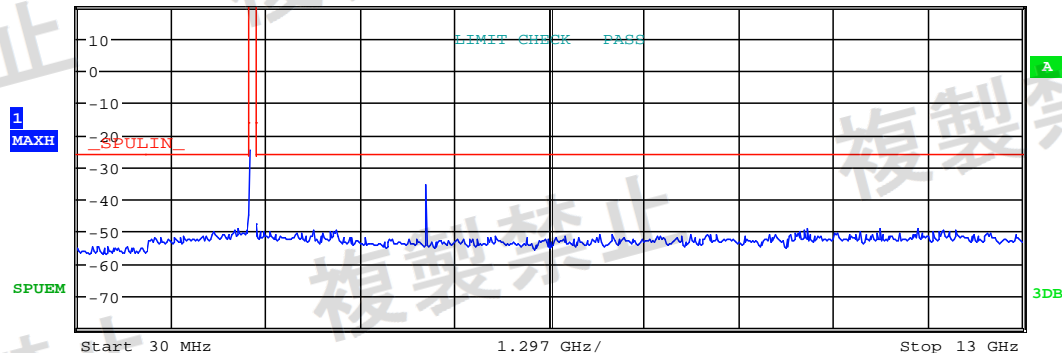
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	659.567308 M	-54.39	-28.39
1.000 G	2.387 G	1.00 M	2.360327 G	-49.00	-23.00
2.387 G	2.400 G	1.00 M	2.387854 G	-47.88	-31.88
2.483 G	2.497 G	1.00 M	2.483511 G	-39.53	-23.53
2.497 G	13.000 G	1.00 M	4.959921 G	-34.64	-8.64

( $\pi/4$ ) DQPSK

Channel 0 (2.402 GHz)



Ref 20 dBm



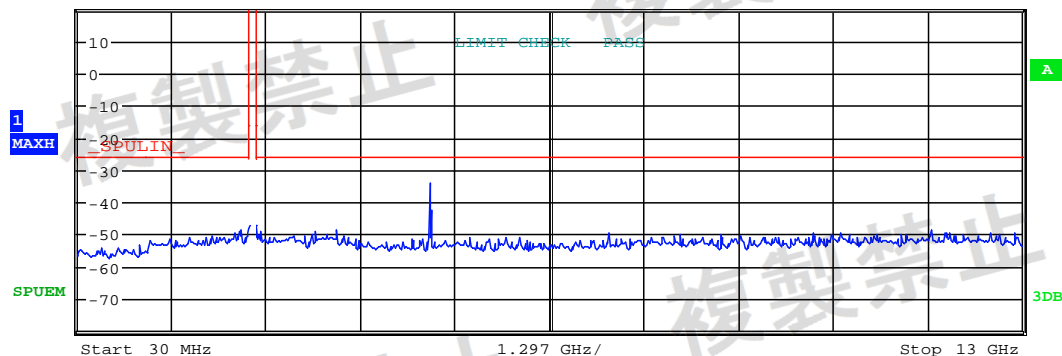
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	325.352564 M	-54.85	-28.85
1.000 G	2.387 G	1.00 M	2.231407 G	-49.26	-23.26
2.387 G	2.400 G	1.00 M	2.399986 G	-24.87	-8.87
2.483 G	2.497 G	1.00 M	2.490925 G	-47.86	-31.86
2.497 G	13.000 G	1.00 M	4.804119 G	-35.64	-9.64



Channel 39 (2.441 GHz)



Ref 20 dBm

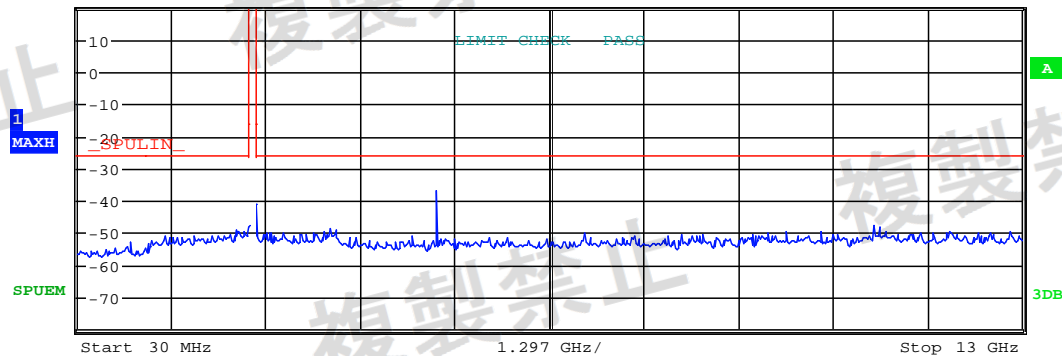


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	878.750000 M	-53.64	-27.64
1.000 G	2.387 G	1.00 M	2.282530 G	-48.61	-22.61
2.387 G	2.400 G	1.00 M	2.399176 G	-47.24	-31.24
2.483 G	2.497 G	1.00 M	2.492589 G	-47.42	-31.42
2.497 G	13.000 G	1.00 M	4.881145 G	-34.39	-8.39

Channel 78 (2.480 GHz)



Ref 20 dBm



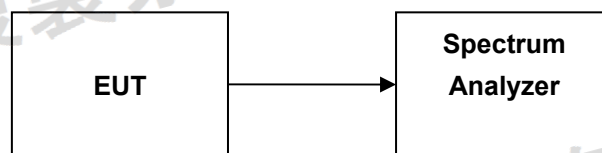
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
30.000 M	1.000 G	100.00 k	763.717949 M	-53.01	-27.01
1.000 G	2.387 G	1.00 M	2.215848 G	-49.48	-23.48
2.387 G	2.400 G	1.00 M	2.395789 G	-47.88	-31.88
2.483 G	2.497 G	1.00 M	2.483886 G	-41.41	-25.41
2.497 G	13.000 G	1.00 M	4.959571 G	-36.87	-10.87

Test Result: The unit does meet the requirements.

## 6.11 Dwell Time

Test Requirement:	Item 19 of Article 2-1 less than 0.4sec
Text Method:	MIC Notice No.88 Appendix No.43
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. Modulation/Spread/Hopping ON, Hopping frequency is fixed, Bluetooth equipment is setting DH5 mode

Test Configuration:



Test Procedure:

1. Test Conditions:  
Spectrum Analyzer is used for measurement.
2. EUT conditions:  
Modulation/Spread/Hopping ON, Hopping frequency is fixed, Bluetooth equipment is setting DH5 mode  
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 (fixed hopping frequency)  
Span 0 Hz  
RBW 1 MHz  
VBW 1 MHz  
Sweep Time EUT condition  
Trigger Video Trigger  
Measures the Transmission time of 1 burst (sec)  
Measures the Burst cycle (sec)
4. Calculation procedure :  
$$\text{Dwell time} = (0.4(\text{s}) \times [\text{spreading rate}] \times [\text{Transmission time of 1 burst}(\text{s})]) / ([\text{burst cycle}(\text{s})] \times [\text{No. of hopping channel}])$$
  
Note:  
\* Spreading rate =  $[\text{Spread bandwidth (actual measurement value)}] / [\text{Transmission rate}]$

**Test Result:**

**GFSK mode:**

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.6V DC	3.96V DC	3.24V DC		
Lowest	2402	0.282	0.281	0.283	Sec	less than 0.4 sec
Middle	2441	0.281	0.283	0.281	Sec	
Highest	2480	0.281	0.284	0.283	Sec	

**( $\pi/4$ )DQPSK mode:**

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.6V DC	3.96V DC	3.24V DC		
Lowest	2402	0.282	0.282	0.282	Sec	less than 0.4 sec
Middle	2441	0.283	0.284	0.283	Sec	
Highest	2480	0.282	0.281	0.283	Sec	

Remark: Calculated method: Dwell time = (0.4(s) x [spreading rate] x [Transmission time of 1 burst(s)]) / ([burst cycle(s)] x [No. of hopping channel])

Note: Spreading rate = [Spread bandwidth (actual measurement value)]/[Transmission rate]

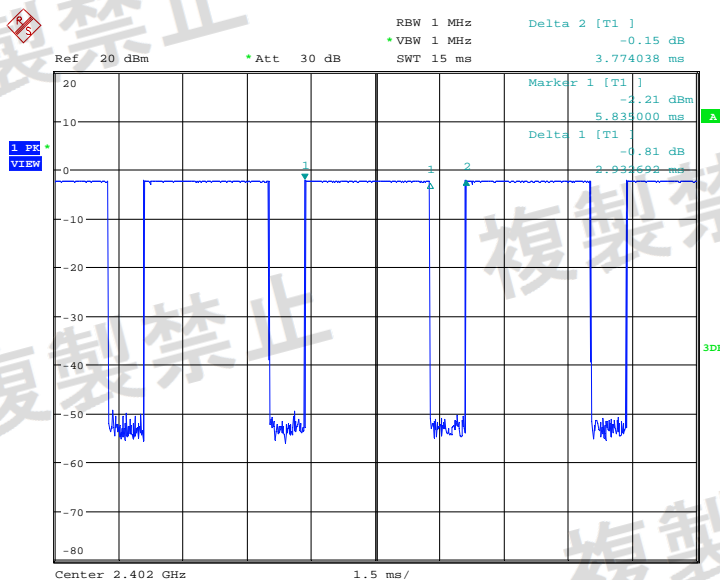
Transmission rate is 1.0 Mbps.

Result plot as follows:

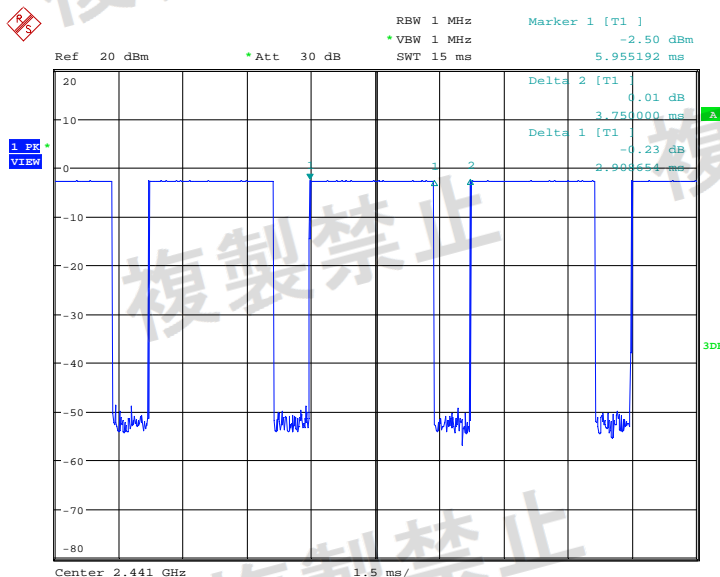
**Normal Voltage:DC3.6V**

GFSK

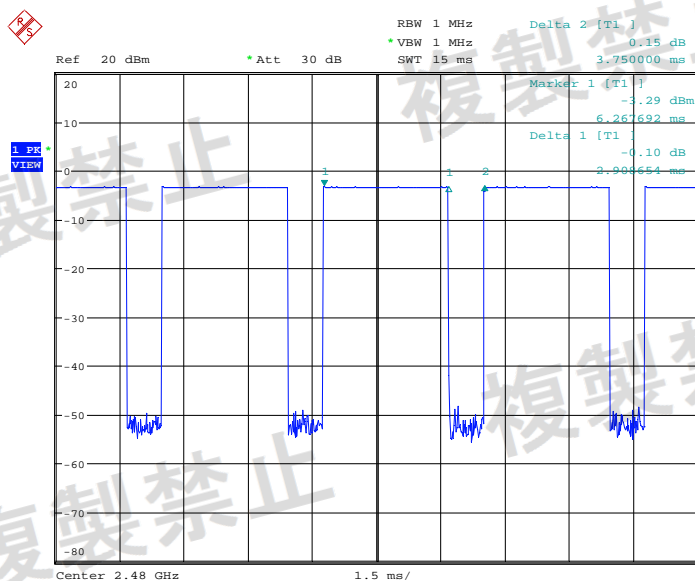
Channel 0 (2.402 GHz)



Channel 39 (2.441 GHz)

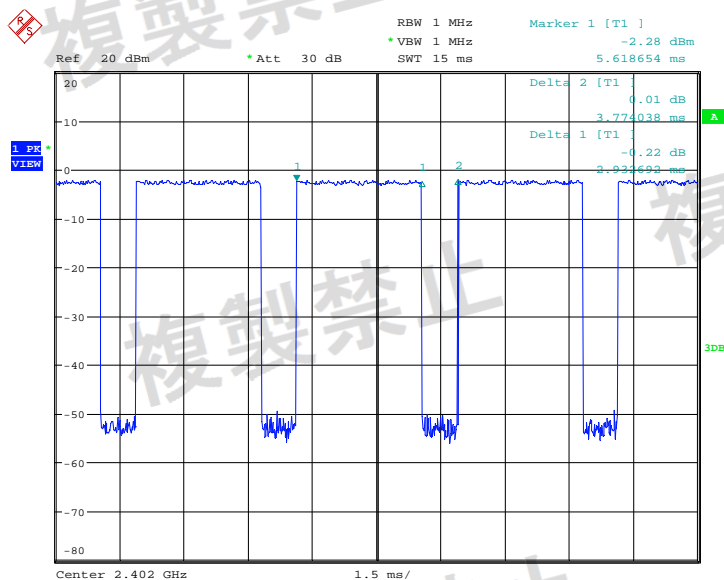


Channel 78 (2.480 GHz)

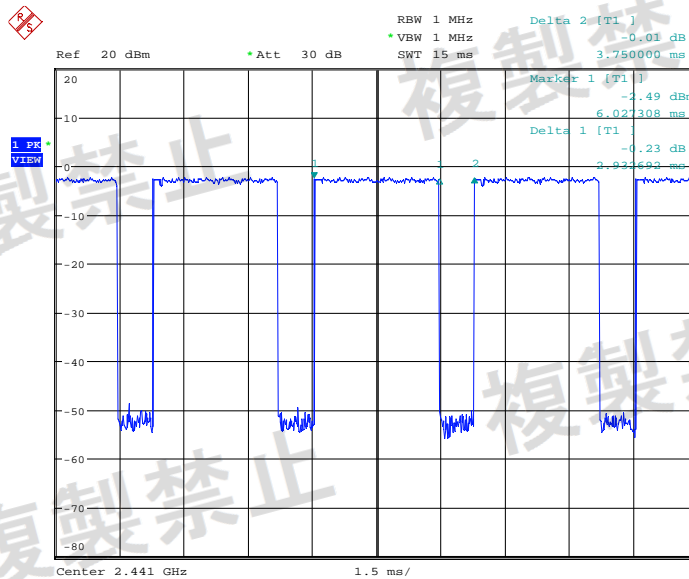


( $\pi/4$ )DQPSK

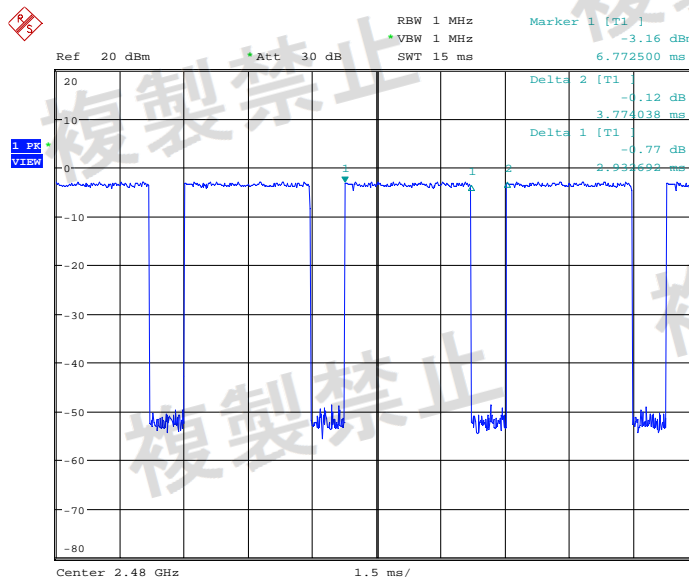
Channel 0 (2.402 GHz)



Channel 39 (2.441 GHz)



Channel 78 (2.480 GHz)



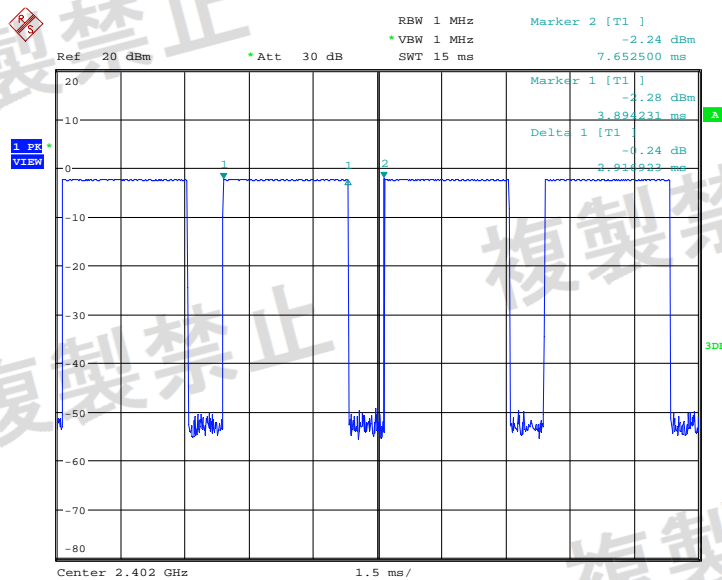
Test Result: The unit does meet the requirements.



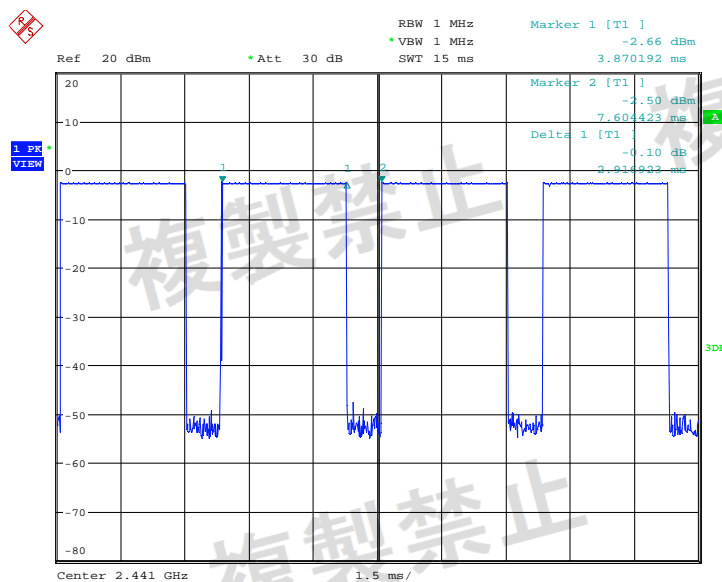
High Voltage:DC3.96V

GFSK

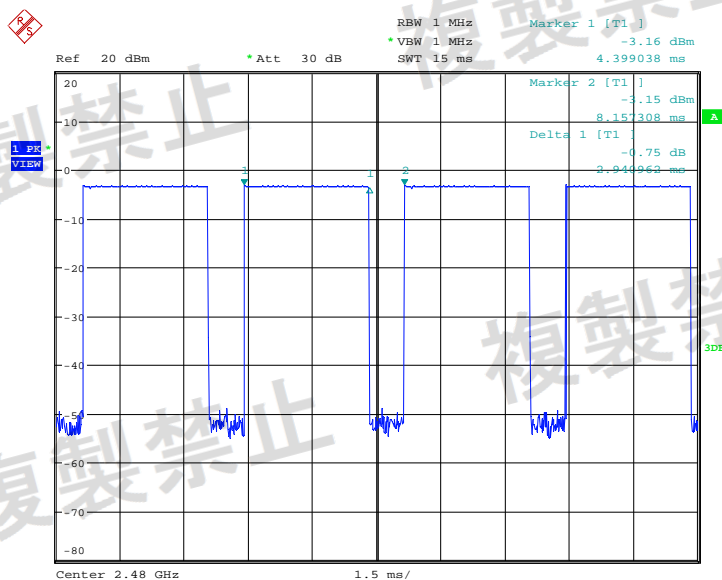
Channel 0 (2.402 GHz)



Channel 39 (2.441 GHz)

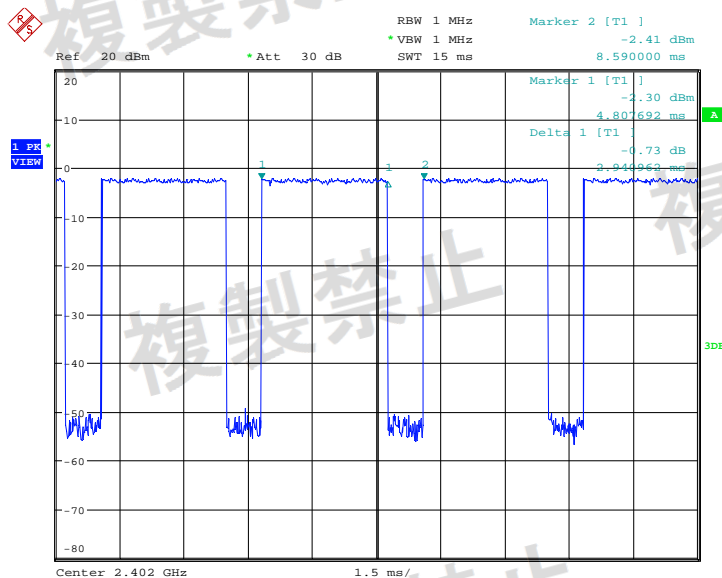


Channel 78 (2.480 GHz)

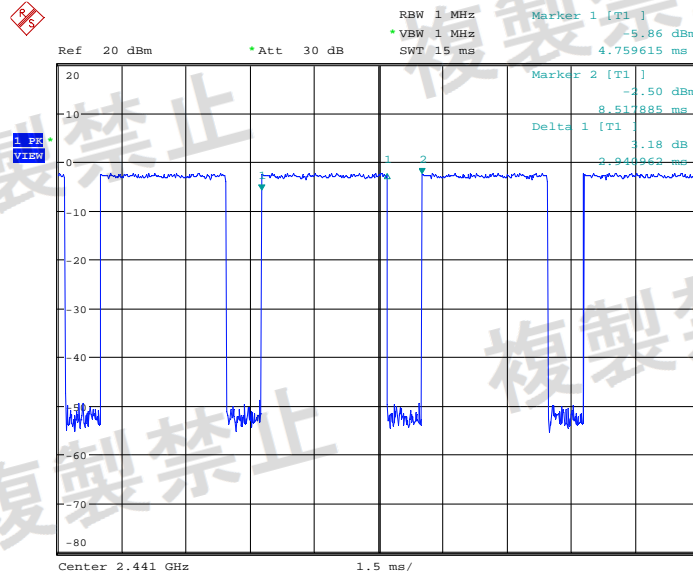


( $\pi/4$ )DQPSK

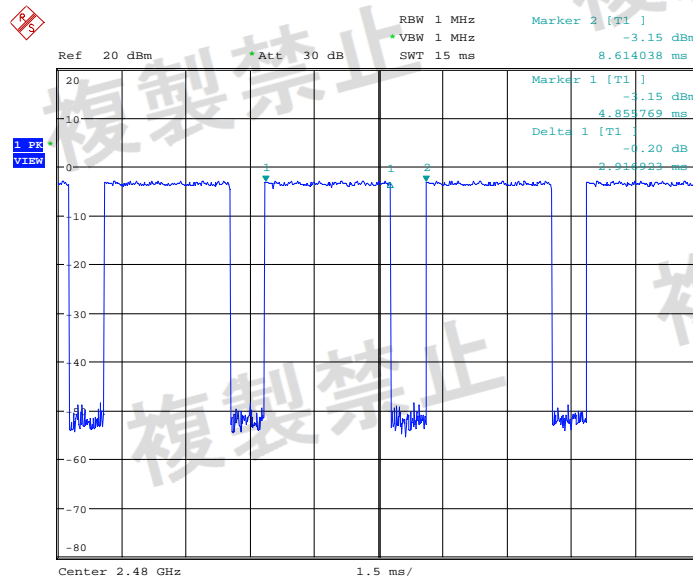
Channel 0 (2.402 GHz)



Channel 39 (2.441 GHz)



Channel 78 (2.480 GHz)

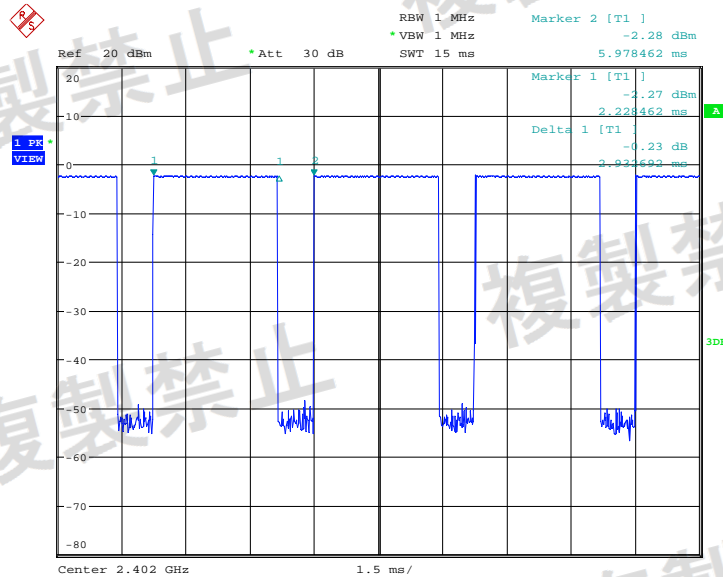


Test Result: The unit does meet the requirements.

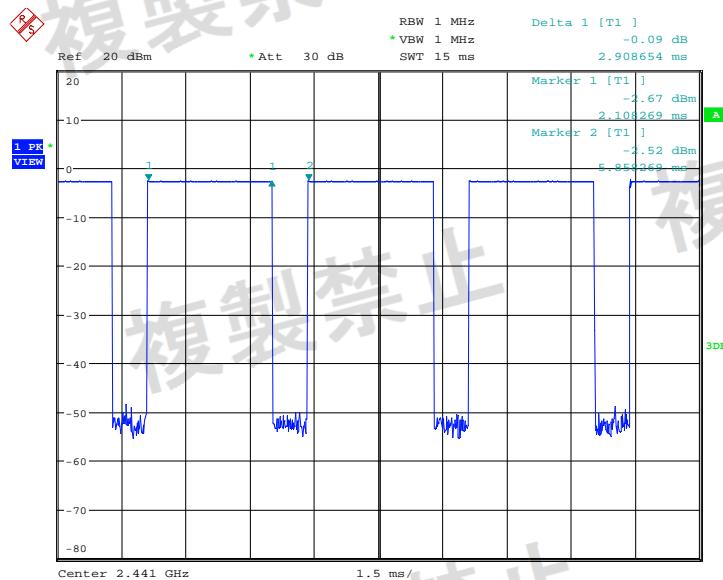
Low Voltage:DC3.24V

GFSK

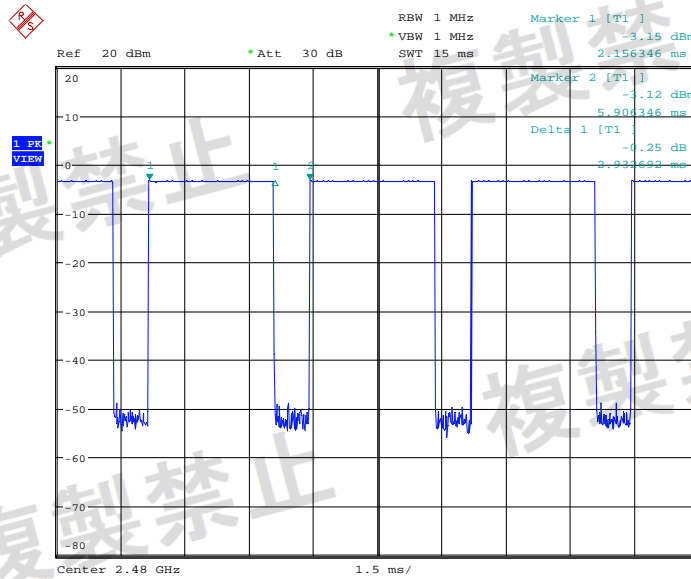
Channel 0 (2.402 GHz)



Channel 39 (2.441 GHz)

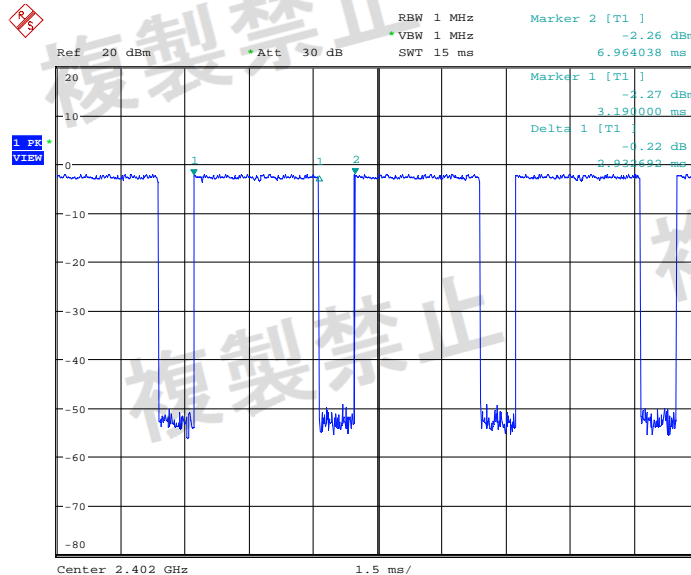


Channel 78 (2.480 GHz)

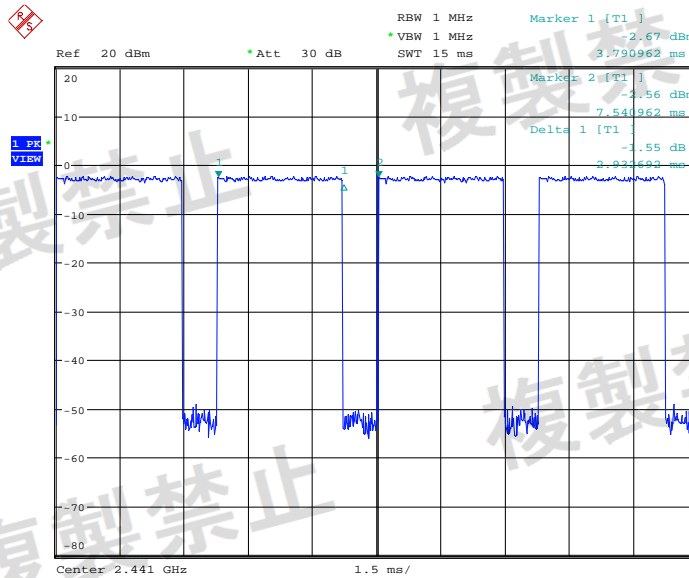


( $\pi/4$ )DQPSK

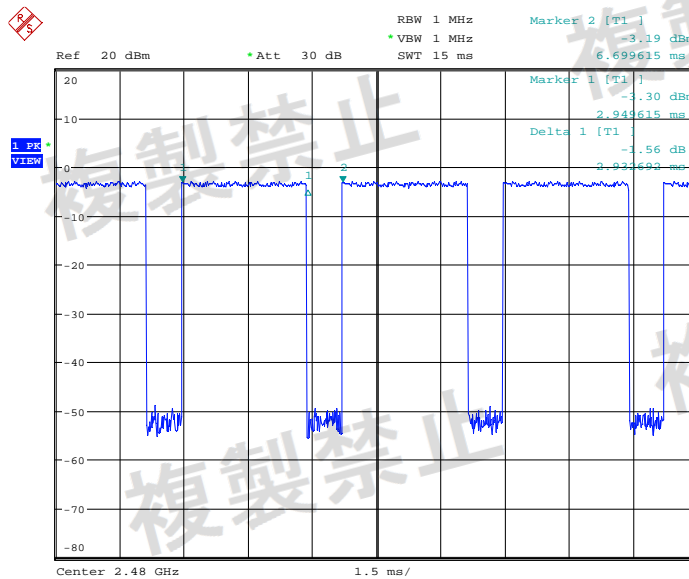
Channel 0 (2.402 GHz)



Channel 39 (2.441 GHz)



Channel 78 (2.480 GHz)



Test Result: The unit does meet the requirements.



## 6.12 Pseudorandom Frequency Hopping Sequence

Standard requirement

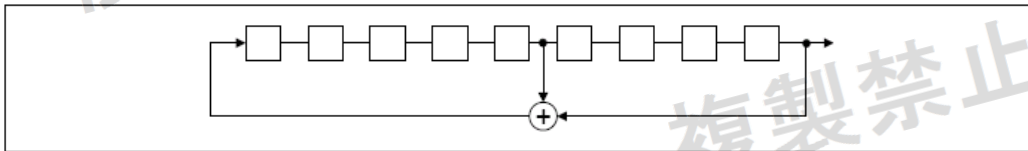
Article 2, Item (19) Notice 88 Appendix 43, 44, 45 requirement:

The EUT shall have the capability to transmit or to receive the MAC identification automatically, so that sender and receiver shall exclude other equipment.

EUT Pseudorandom Frequency Hopping Sequence

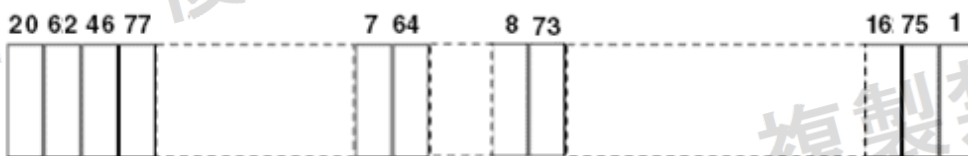
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. and the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence:  $2^9 - 1 = 511$  bits
- Longest sequence of zeros: 8 (non-inverted signal)



*Linear Feedback Shift Register for Generation of the PRBS sequence*

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

## 6.13 RF accessibility

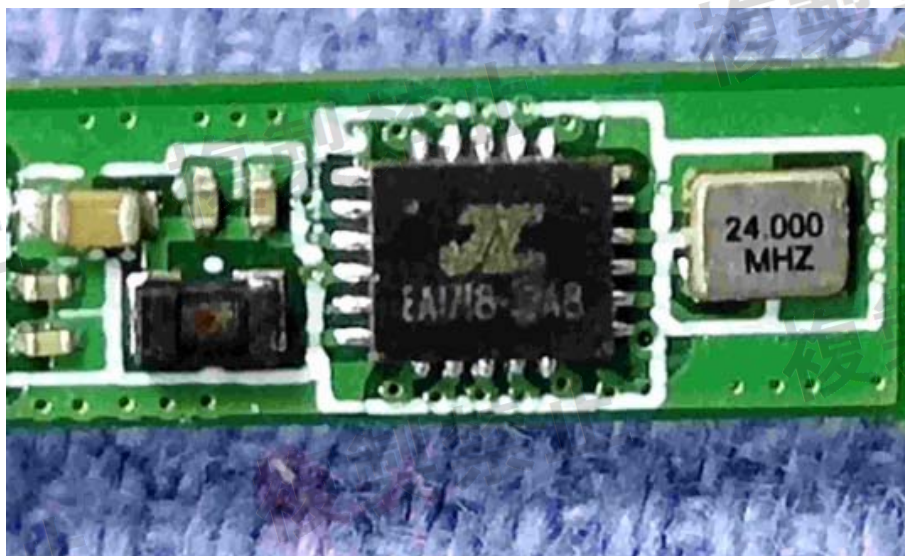
### Standard requirement

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.

### Tamper proof Declaration:

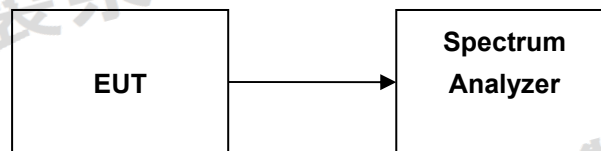
- ☐ 1. Sealed with special screws.
- ☐ 2. Plastic chassis is being welded using ultrasonic waves.
- ☐ 3. Chassis is glued using a special adhesive.
- ☐ 4. Metal covers are spot-fused.
- ☐ 5. Cover is specially interlocked.
- ☐ 6. RF and Modulation components are covered with shielding case and this shielding case is soldered.
- ☐ 7. Shield case is welded at RF and modulation parts, and ID-ROM is welded using the BGA Method.
- ☐ 8. Shield case is welded at RF and modulation parts, and ID-ROM is glued at its lead with a special adhesive.
- ☐ 9. Shield case is welded at RF and modulation parts, and ID-ROM is glued with a non-transparent laminating agent.
- ☒ 10. RF and Modulation parts are mounted on PCB with surface mount technology, and there is no any adjustable parts on PCB or adjustable parts are not exposed.



Result: Method used to meet "can not open easily requirement" is soldering, the RF IC has 22 pins and the terminal pitch is below 0.5mm. Any attempt to modify the RF chip will void the normal operation of this device.

## 6.14 Spurious Emissions of Rx

Test Requirement:	Item 19 of Article 2-1
Text Method:	MIC Notice No.88 Appendix No.43
	(1) Below 1 GHz : 4 nW(-54dBm) or less (2) 1 GHz and over : 20 nW(-47dBm) 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:

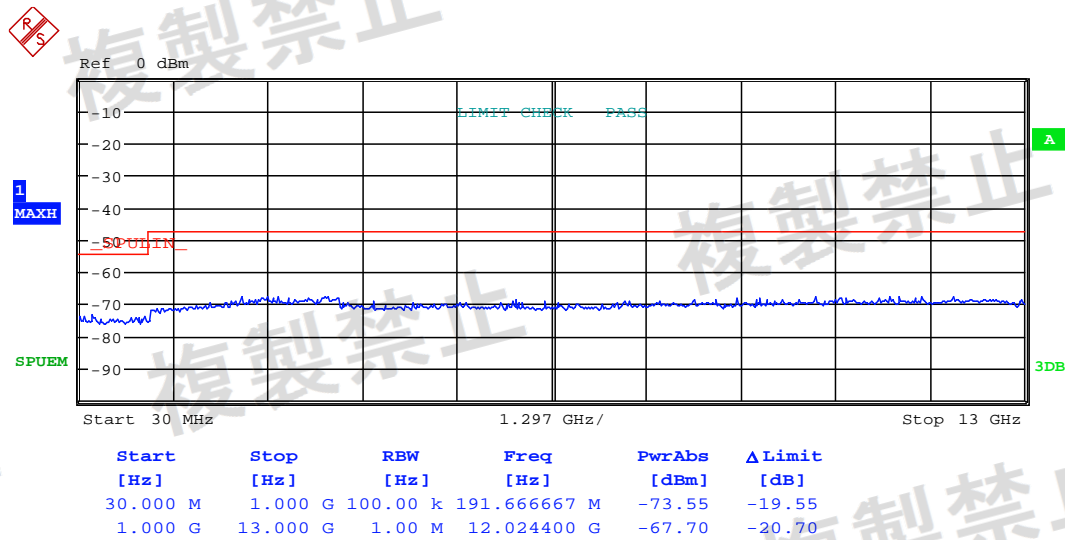
1. Test Conditions:  
Spectrum Analyzer is used for measurement.
2. EUT conditions:  
Modulation/Spread/Hopping ON  
For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal.
3. Spectrum Analyzer conditions:  
Step 1  
All spurious are measured from 30 MHz to 13 GHz by peak mode.  
Step 2  
IF the value measured by Step1 is 2 dB or less, measure in average mode.  
Test setup for Step 1:  
Frequency: 30 MHz – 2400 MHz , 2483.5 MHz –13 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:

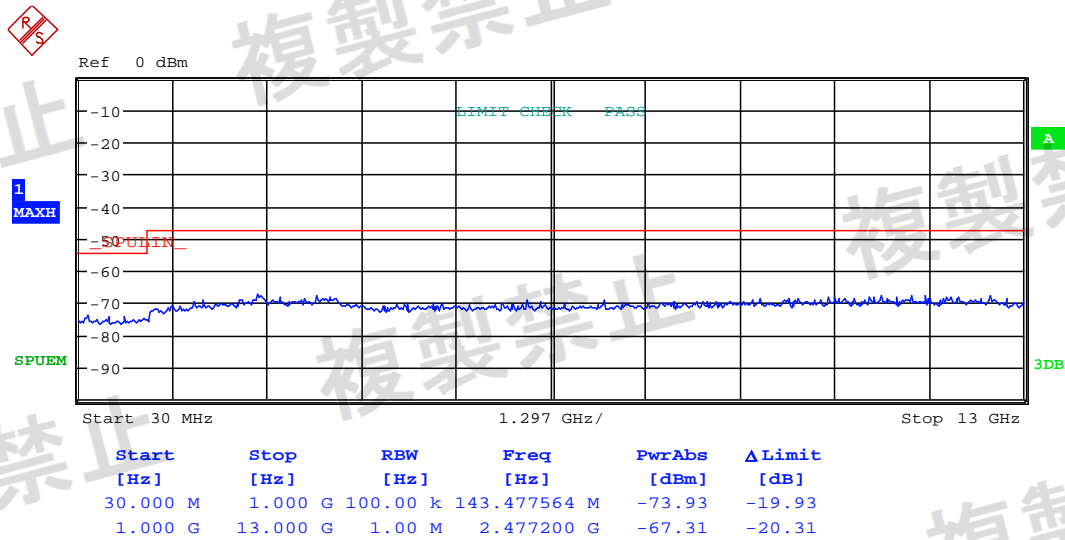
Result plot as follows:

Normal Voltage DC3.6V

GFSK



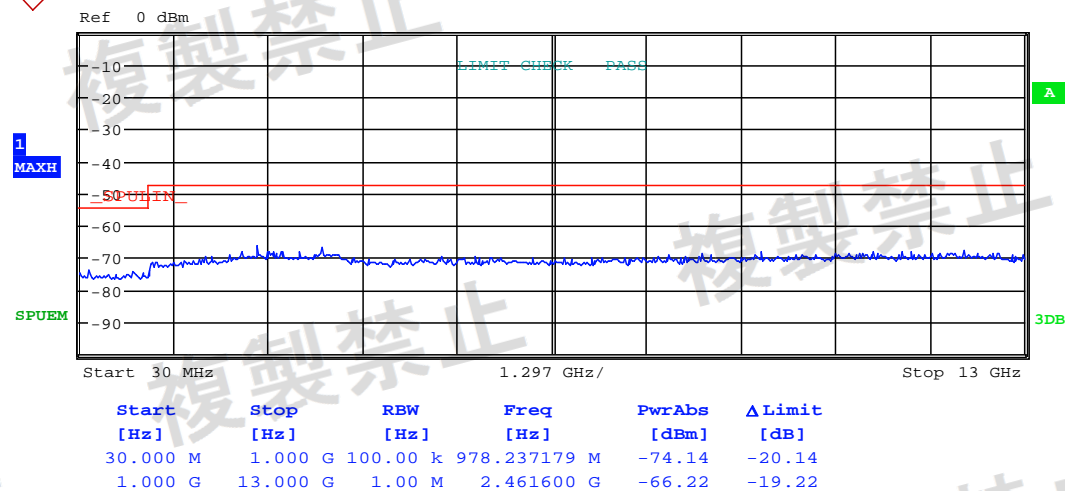
( $\pi/4$ )DQPSK



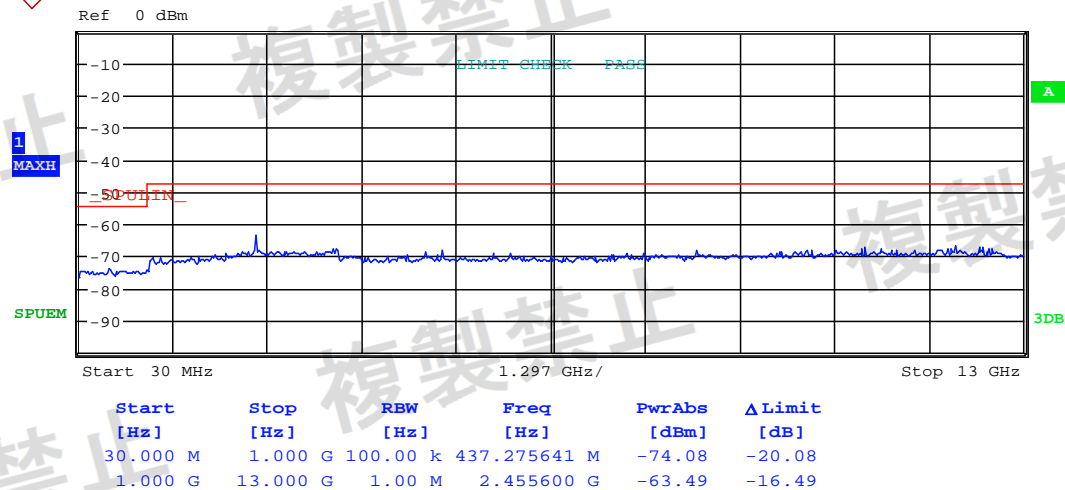


# High Voltage DC3.96V

GFSK



( $\pi/4$ )DQPSK



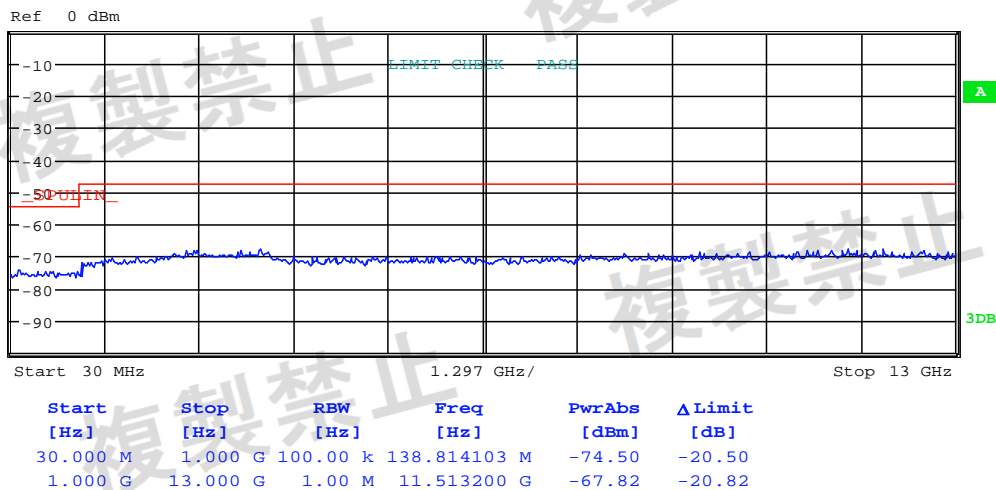
# Low Voltage DC3.24V

GFSK



1  
MAXH

SPUEM

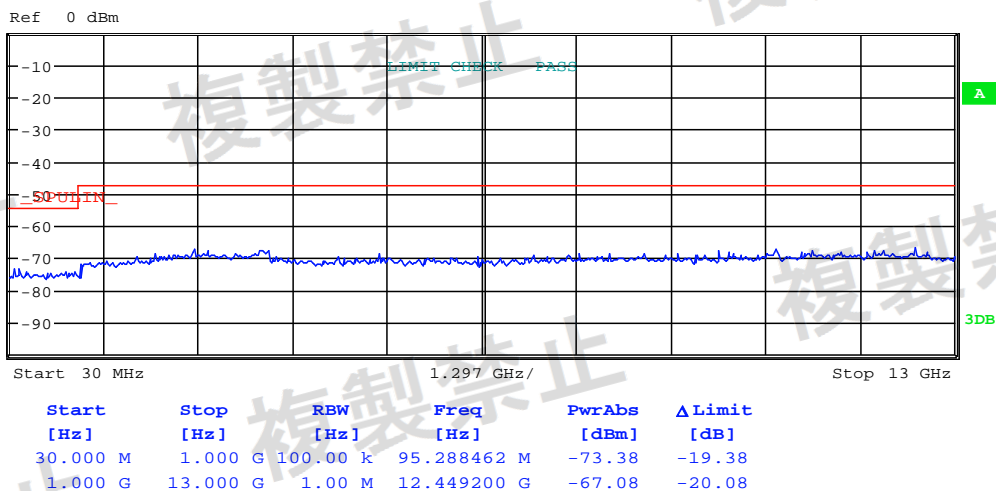


( $\pi/4$ )DQPSK



1  
MAXH

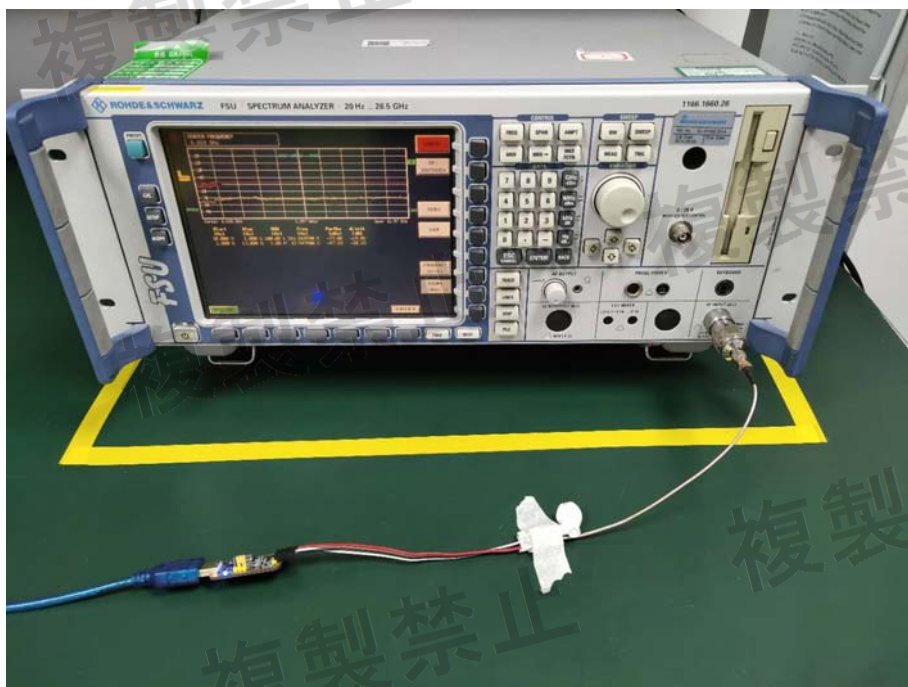
SPUEM





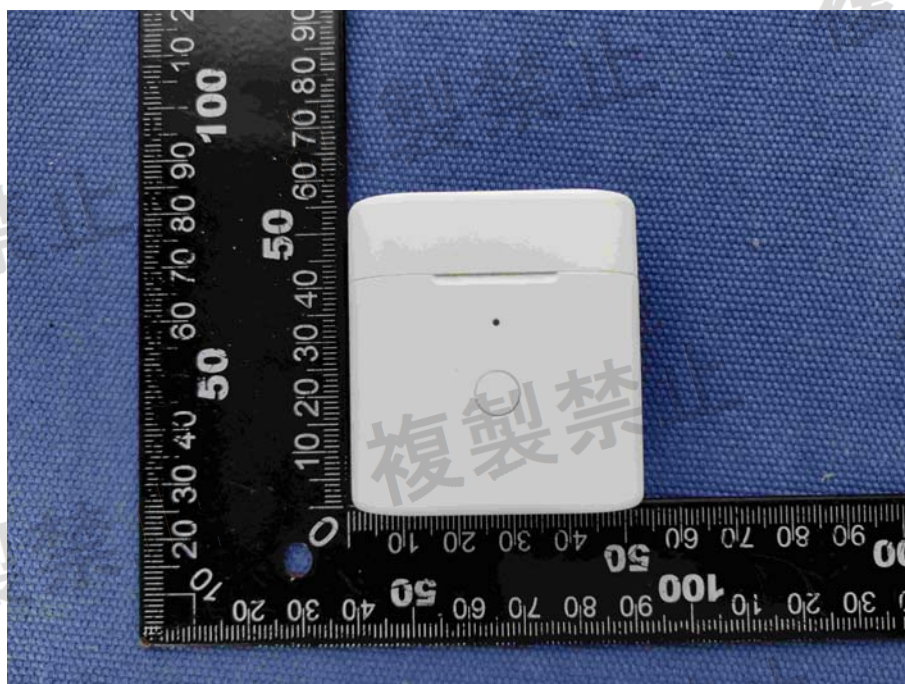
## 7 Photographs

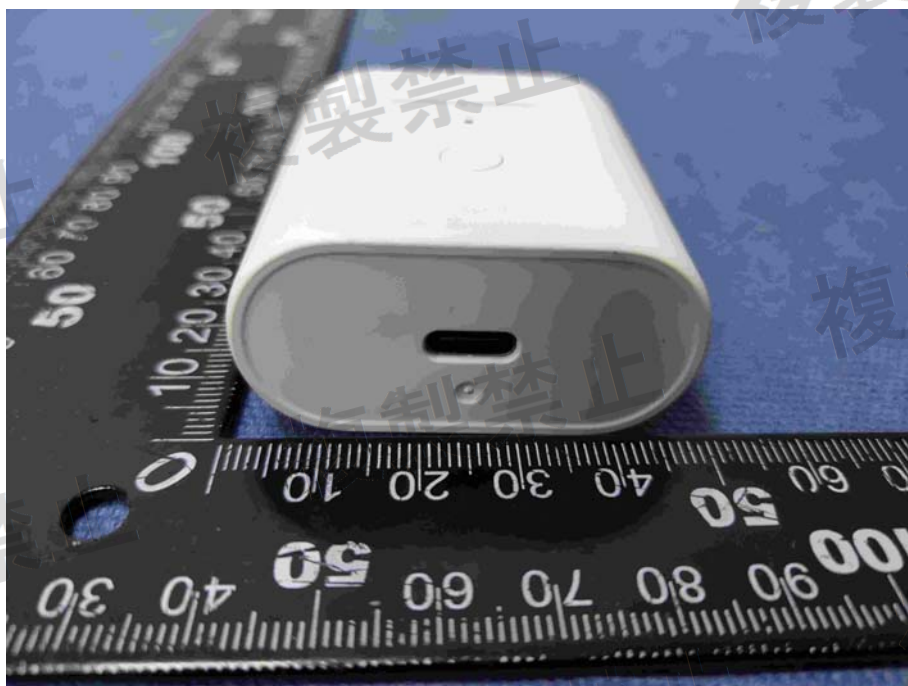
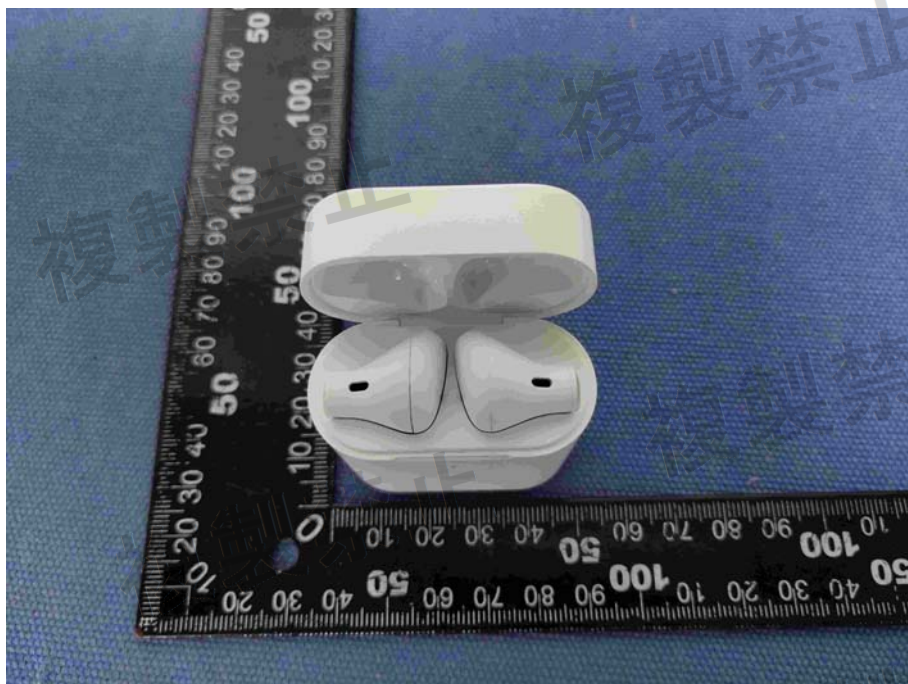
### 7.1 Test Setup



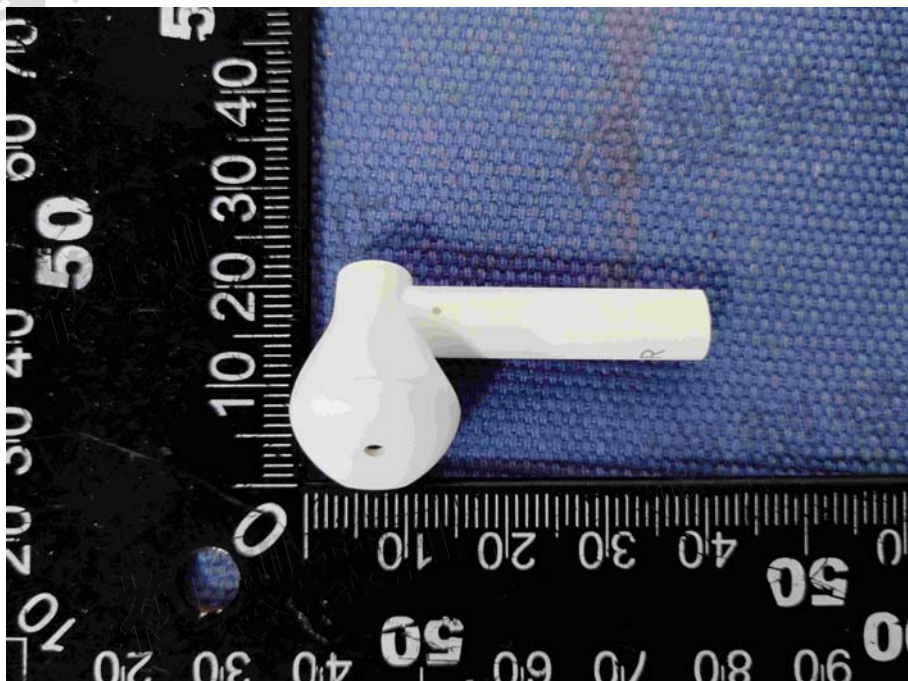
### 7.2 EUT Constructional Details

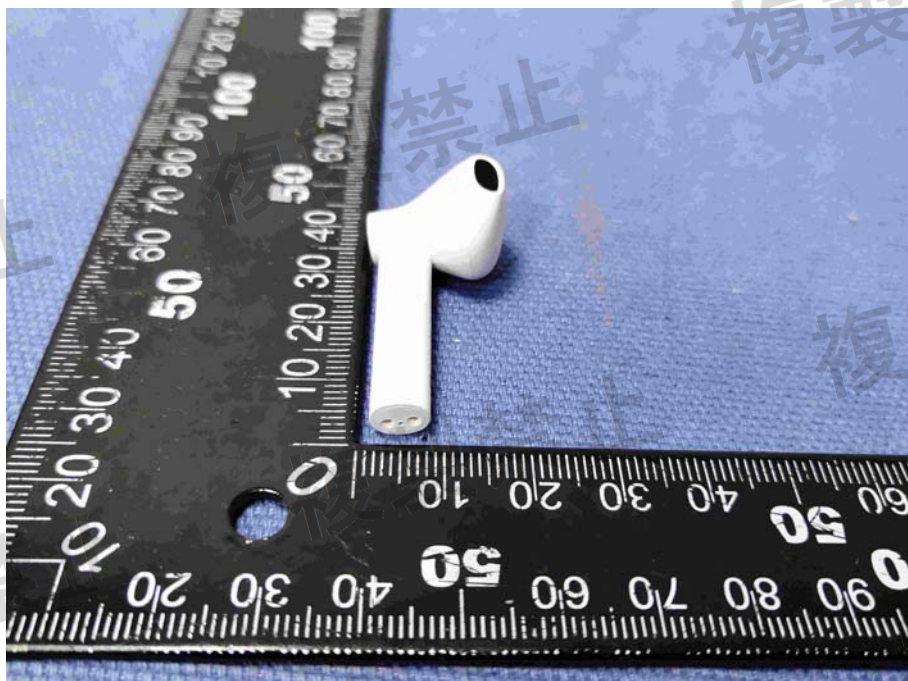
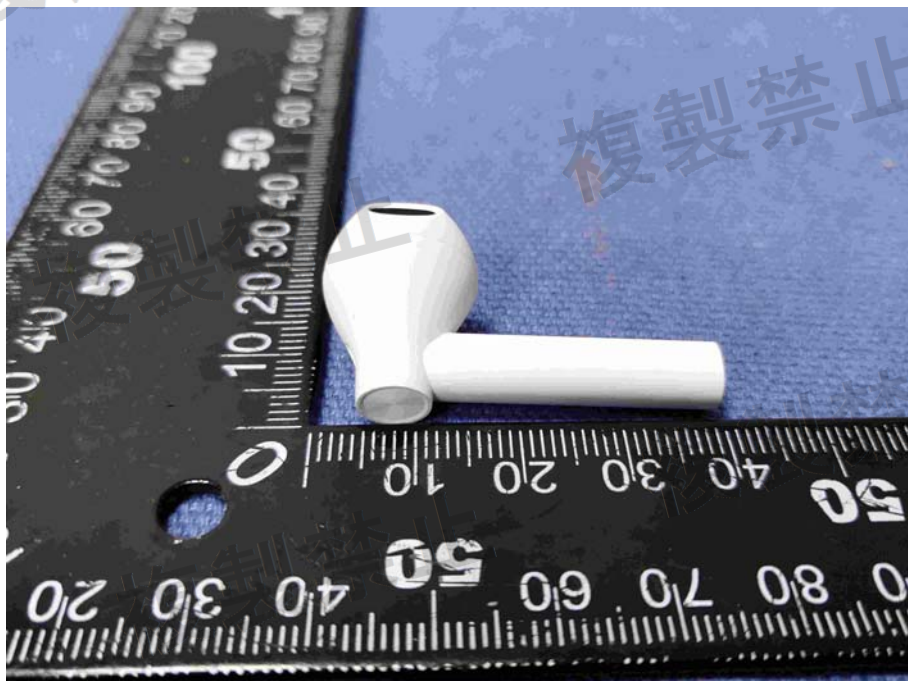
Test Model No.: In2017



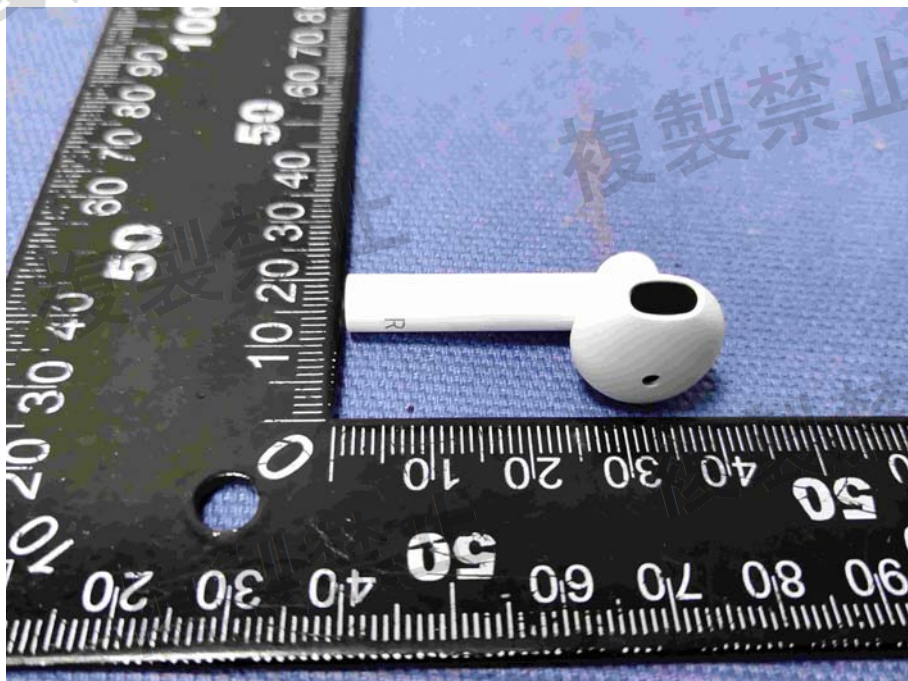


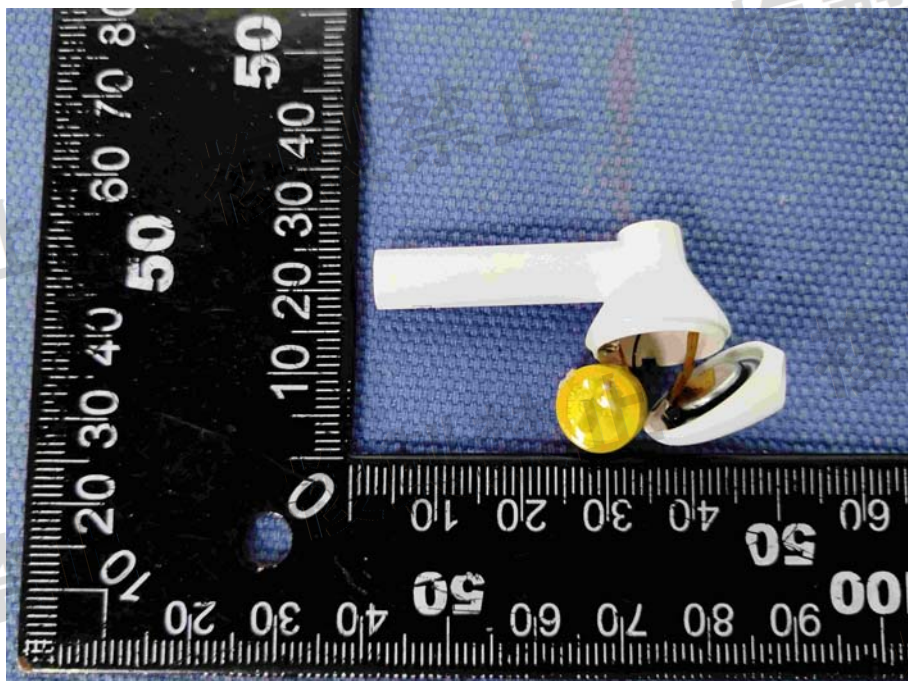
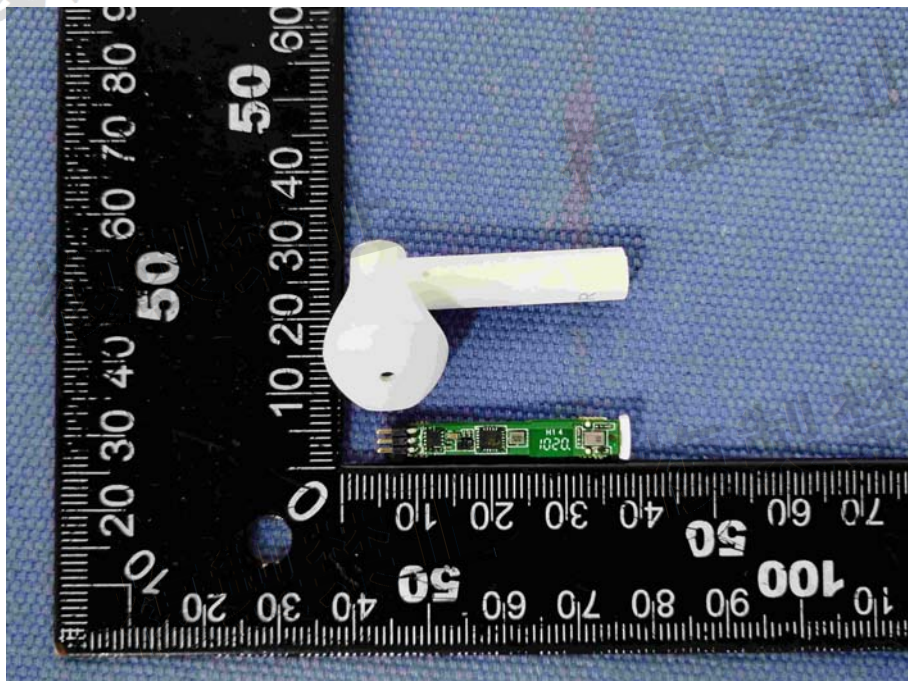




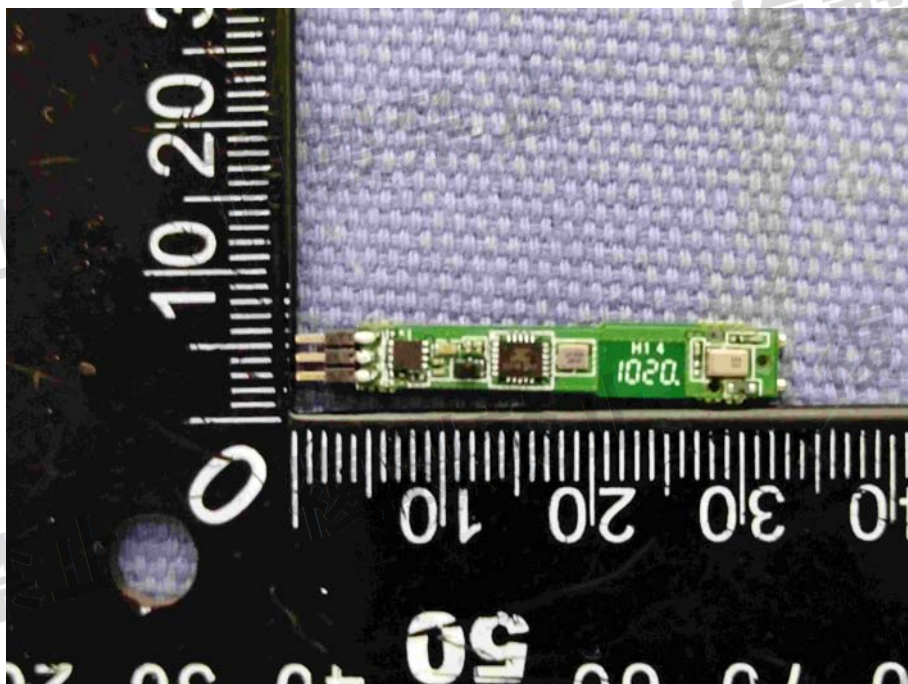
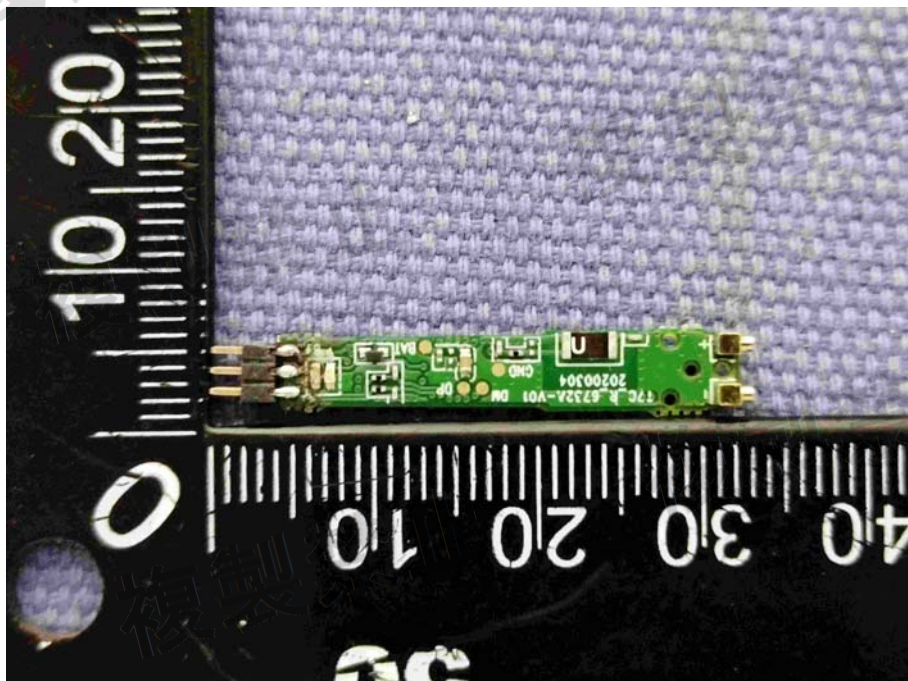


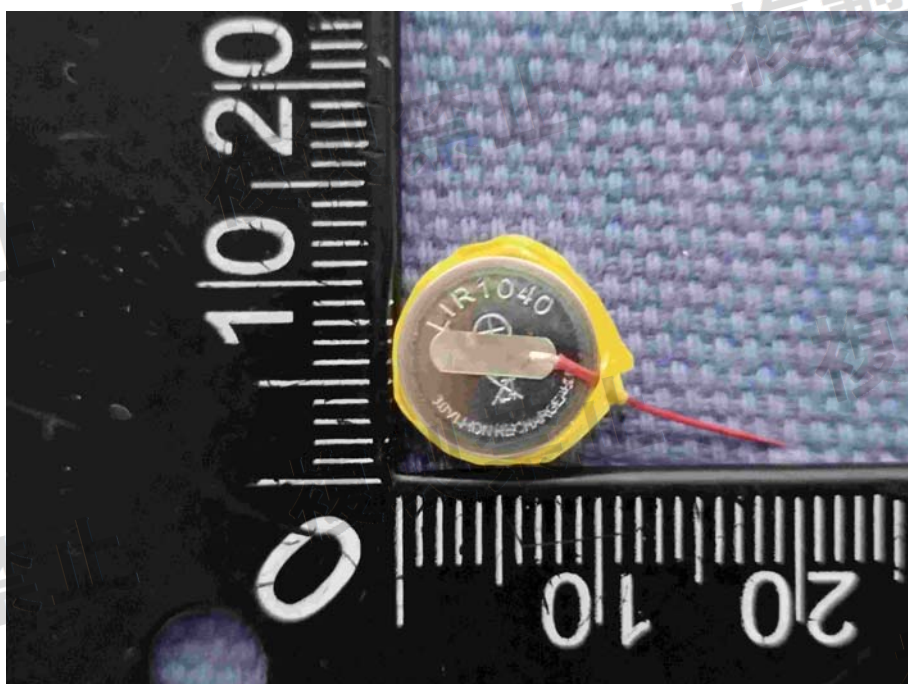
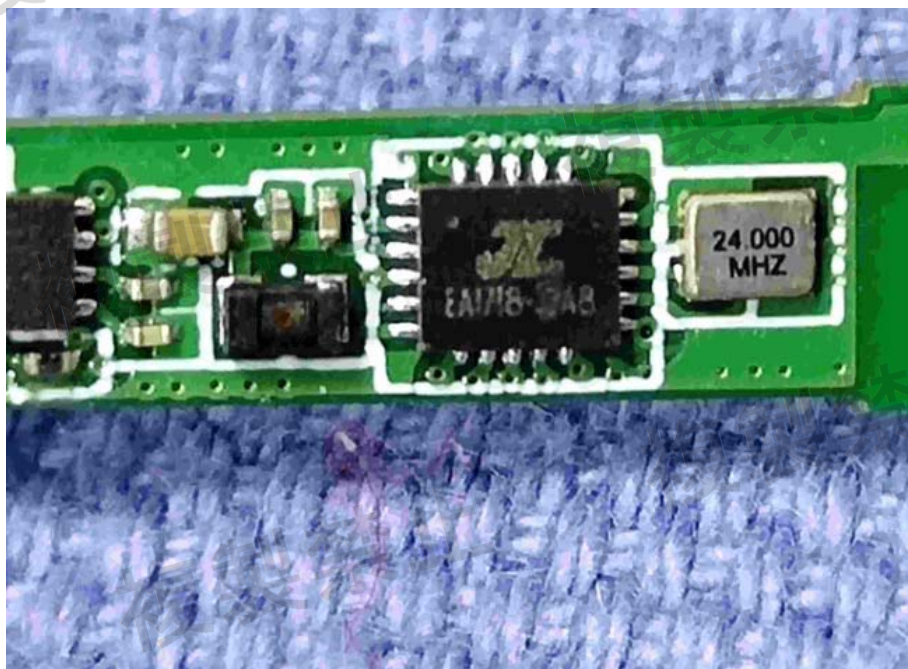












--End of Report--