



REPORT No.: SZ23050387W01

TEST REPORT

APPLICANT : Green House Co., Ltd.

PRODUCT NAME : aptX TWS

MODEL NAME : GH-TWSX;
GH-TWSX-BK;
GH-TWSX-WH;
GH-TWSX-BL.

BRAND NAME : GREEN HOUSE

STANDARD(S) : Article 2 Paragraph 1 of Item 19

RECEIPT DATE : 2023-07-13

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MORLAB

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Change History		
Version	Date	Reason for change
1.0	2023-09-15	First edition

1. Summary of Test Results

No.	Description of Test	Test Engineer	Result	Method determination /Remark
1	Frequency Error	He Yuyang	PASS	No deviation
2	Dwell Time	He Yuyang	PASS	No deviation
3	Occupied Bandwidth and Spread Bandwidth / Factor	He Yuyang	PASS	No deviation
4	Unwanted Emission Intensity	He Yuyang	PASS	No deviation
5	Antenna Power Error	He Yuyang	PASS	No deviation
6	Limitation of Collateral Emission of Receiver	He Yuyang	PASS	No deviation
7	E.I.R.P.	N/A	N/A _{Note1}	N/A
8	Radiation Angle of Antenna	N/A	N/A _{Note1}	N/A
9	Radio Interference Prevention Capability	He Yuyang	PASS	No deviation
10	Construction Protection Confirmation	N/A	PASS	No deviation

Note 1: The test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less.

Note 2: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.

Note 3: When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% confidence intervals.

1.1. Testing Applied Methods

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- MIC Notice No.88 Annex43



1.2. Test Equipment List

Description	Manufacturer	Model	Serial No.	Cal. Date	Due Date	Cal. Body	Cal. Method
EXA Signal Analyzer	Agilent	N9010A	MY53470836	2023.02.27	2024.02.26	SMQ	c
DC Power Supply	IVYTECH	IV3610	1709D361010	2022.10.10	2023.10.09	CCIC	c
Power Sensor	Agilent	U2021XA	MY54180008	2022.10.11	2023.10.10	SMQ	c
Radio Communication Tester	R&S	CMW500	108950	2023.02.09	2024.02.08	SMQ	c

Note 1: The equipment were calibrated by CCIC (Shenzhen) Metrology&Testing Service Co.,Ltd and Shenzhen Academy of Metrology and Quality Inspection.

Note 2: Calibration Method:

- Calibration conducted by the National Institute of Information and Communications Technology (NICT) (hereinafter referred to as "NICT") or a designated calibration agency under Article 102-18 paragraph (1);
- Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992);
- Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph (1);
- Calibration conducted by using measuring instruments and other equipment listed in the right column of Table No. 3 attached hereto, which shall have been given any of calibration, etc. listed above from a) to c).



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1.3. Measurement Uncertainty

No.	Test Items	Uncertainty	Remark
1	Frequency Error / 99% & 90% Bandwidth	$\pm 1.75 \times 10^{-6}$	Confidence levels of 95%
2	Antenna Power	$\pm 1.14\text{dB}$	Confidence levels of 95%
3	Spurious Emissions(<1GHz)	$\pm 2.23\text{dB}$	Confidence levels of 95%
4	Spurious Emissions(>1GHz)	$\pm 1.72\text{dB}$	Confidence levels of 95%
5	Transmission Antenna Gain	$\pm 2.49\text{dB}$	Confidence levels of 95%

1.4. Testing Laboratory

Laboratory Name	Shenzhen Morlab Communications Technology Co., Ltd.
Laboratory Address	FL.1-3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Telephone	+86 755 36698555
Facsimile	+86 755 36698525

2. General Description

2.1. Information of Applicant and Manufacturer

Applicant	Green House Co., Ltd.
Applicant Address	5F Unosawa Tokyu Bld. 1-19-15 Ebisu, Shibuya-ku, Tokyo 150-0013, JAPAN
Manufacturer	Zhejiang trefan technology Co., Ltd.
Manufacturer Address	193#, Industrial RD., Hengdian Town, Dongyang, Zhejiang, P.R.China

2.2. Information of EUT

Product Name	aptX TWS		
Sample No.	1#		
Hardware Version	XTW92_V1.0		
Software Version	V0.1.5		
Equipment Type	Bluetooth classic		
Bluetooth Version	5.2		
Modulation Technology	FHSS		
Modulation Type	GFSK(BR 1Mbps), $\pi/4$ -DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps)		
Operating Frequency Range	2402MHz – 2480MHz (at interval of 1MHz)		
Channel List	Please refer as chapter 2.4 in this report.		
Power Supply	Type		Battery
	Voltage (V)	Low	2.75
		Rated	3.7
		High	4.2

Note 1: According to the certificate holder, they declare that the product have models as below: GH-TWSX, GH-TWSX-BK, GH-TWSX-WH, GH-TWSX-BL are accordant in both hardware and software, these models only different in model name and color. Applicant information, product name and brand name are the same. Their electrical circuit design, layout, components used, and internal wiring are identical. The main measuring model is GH-TWSX-BK, only the results for GH-TWST-BK were recorded in this report.

Note 2: The black bold voltage values were selected for test, about the voltage fluctuation evaluation, please refer as chapter 2.6.2 in this report.

Note 3: For a more detailed description, please refer to Specification or User's Manual supplied by



the applicant and/or manufacturer.

2.3. Information of Antenna

Antenna Manufacturer	RAIN International Technology Co., Ltd.
Brand Name	RAIN
Part No.	RANT2012F245C07
Antenna Type	Ceramic Antenna
Antenna Gain	1.95dBi

2.4. Channel List of EUT

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

Note 1: The black bold channels were selected for test.



2.5. Test Configuration of EUT

2.5.1. Evaluation of The Worst Case

Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Channel
Frequency Error	Unmodulated Single Carrier	0/39/78
Occupied Bandwidth	GFSK, $\pi/4$ -DQPSK, 8-DPSK	Hopping
Dwell Time		Hopping
Unwanted Emission Intensity		0/39/78
Antenna Power and Antenna Power Error		0/39/78
Limitation of Collateral Emission of Receiver		0/39/78
Transmission Radiation Angle Width		0/39/78
Radio Interference Prevention Capability		Normal Use

2.5.2. Operation and Transmitter Power Setting

The EUT was tested while in a continues transmitter/receiver mode under the control of tool which is provided by manufacturer, all the items of transmitter were tested under the power setting as below:

Mode	Data Rate	Channel	Power Setting
Unmodulated Single Carrier	-	0/39/78	Default
GFSK	1Mbps	0/39/78	Default
$\pi/4$ -DQPSK	2Mbps	0/39/78	Default
8-DPSK	3Mbps	0/39/78	Default



2.6. Test Conditions

2.6.1. Environment Condition

Temperature (°C)	23.5
Relative Humidity (%)	49

2.6.2. Power Supply Voltage Fluctuation

During the input supply voltage to the EUT from the external power source is varied by +/- 10%, the output voltage had been confirmed that the fluctuation of power supply to the RF unit of EUT is equal to or less +/- 1%.

Power Supply		External Voltage $V_E(V)$			Internal Voltage V_I		
		V_{EN}	V_{EL}/V_{EH}		$V_{IN}(V)$	$V_{IE}(V)$	Variation of V_I
Type1	Battery	3.70	V_{EL}	3.33	1.8	1.79	0.56%
			V_{EH}	4.07		1.81	0.56%

V_{EN} : Normal Voltage

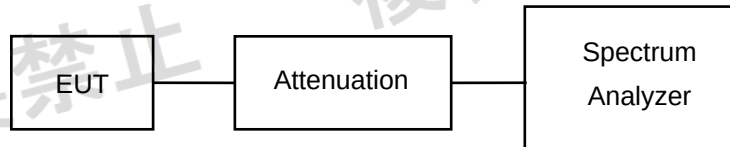
V_{EL} : V_{EL} is the declared low voltage provided that $V_{EN} \times 90\%$ is less than the declared low voltage, otherwise it is $V_{EN} \times 90\%$

V_{EH} : V_{EH} is the declared high voltage provided that $V_{EN} \times 110\%$ is larger than the declared high voltage, otherwise it is $V_{EN} \times 110\%$

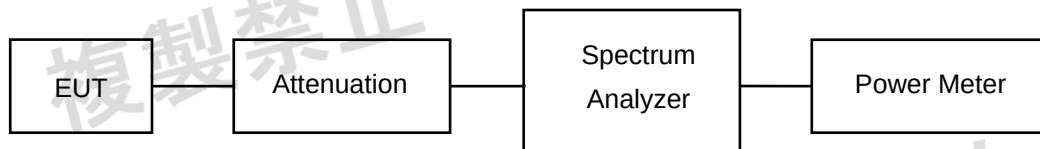
V_{IN} : The voltage supply to the radio unit.

2.7. Test Setup Layout Diagram

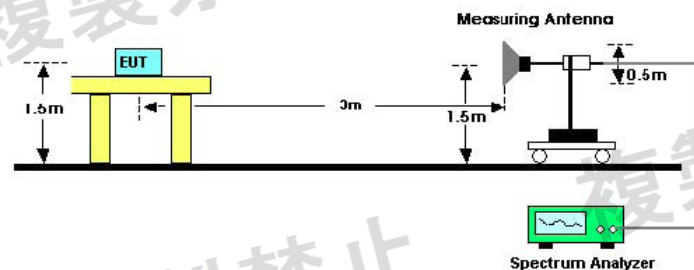
2.7.1. General Measurement



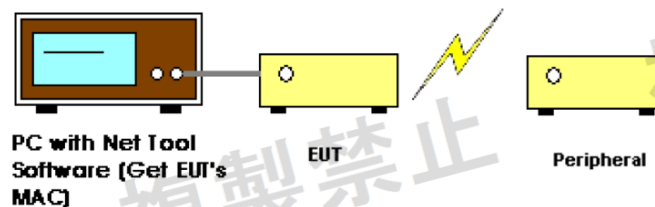
2.7.2. Antenna Power Measurement



2.7.3. Radiation Angle of Antenna



2.7.4. Radio Interference Prevention Capability Measurement





3. Description of Test Items

3.1. Frequency Error

3.1.1. Limits

Within ± 50 ppm.

3.1.2. Test Procedures

According to MIC Notice No.88 Annex43.

3.1.3. Test Setup Layout

Refer to chapter 2.7.1 in this report.

3.1.4. Test Deviation

There is no deviation with the original standard.

3.1.5. Test Results

Refer to Annex A.1 in this report.



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3.2. Dwell Time

3.2.1. Limits

The dwell time is the time spent at a particular frequency during any single hop.
The maximum dwell time shall be 0.4 s.

3.2.2. Test Procedures

According to MIC Notice No.88 Annex43.

3.2.3. Test Setup Layout

Refer to chapter 2.7.1 in this report.

3.2.4. Test Deviation

There is no deviation with the original standard.

3.2.5. Test Results

Refer to Annex A.2 in this report.



3.3. Occupied Bandwidth and Spread Bandwidth / Factor

3.3.1. Limits

Item	Type	Limits
Occupied Bandwidth	FHSS	≤83.5MHz
	DSSS	≤26MHz
	OFDM	
	Other	
Spread Bandwidth	FHSS	≥500kHz
	DSSS	
Spread Factor	FHSS	≥5
	DSSS	

3.3.2. Test Procedures

According to MIC Notice No.88 Annex43.

3.3.3. Test Setup Layout

Refer to chapter 2.7.1 in this report.

3.3.4. Test Deviation

There is no deviation with the original standard.

3.3.5. Test Results

Refer to Annex A.3 in this report.



3.4. Unwanted Emission Intensity

3.4.1. Limits

Frequency Range	Limits
30MHz-1000MHz	$\leq 0.25 \mu\text{W}/100\text{kHz}$
1000MHz-2387MHz	$\leq 2.5 \mu\text{W}/\text{MHz}$
2387MHz-2400MHz	$\leq 25 \mu\text{W}/\text{MHz}$
2483.5MHz-2496.5MHz	$\leq 25 \mu\text{W}/\text{MHz}$
2496.5MHz-12500MHz	$\leq 2.5 \mu\text{W}/\text{MHz}$

3.4.2. Test Procedures

According to MIC Notice No.88 Annex43.

3.4.3. Test Setup Layout

Refer to chapter 2.7.1 in this report.

3.4.4. Test Deviation

There is no deviation with the original standard.

3.4.5. Test Results

Refer to Annex A.4 in this report.

Note1: The spurious emissions mask that displayed on the plots is composed of several frequency ranges below:

Range	Start Freq. (MHz)	Stop Freq. (MHz)	RBW	VBW	Detector Type	Trace Mode	Limit (μW)
1	30	1000	100kHz	100kHz	Peak	Max Hold	0.25
2	1000	2387	1MHz	1MHz	Peak	Max Hold	2.5
3	2387	2400	1MHz	1MHz	Peak	Max Hold	25
4	2400	2483.5	1MHz	1MHz	Peak	Max Hold	20000
5	2483.5	2496.5	1MHz	1MHz	Peak	Max Hold	25
6	2496.5	12500	1MHz	1MHz	Peak	Max Hold	2.5

Note 2: Only the spurious with the minimum margin from the limit line will be displayed in the mark table (The lower window on the test plots).



3.5. Antenna Power Error

3.5.1. Limits

Type	Limits	
	Antenna Power Density	Antenna Power Error
FHSS	≤ 10 mW/MHz	-80-+20%
DSSS	≤ 10 mW/MHz	
OFDM	≤ 10 mW/MHz (20MHz System) ≤ 5 mW/MHz (40MHz System)	
Other	≤ 10 mW	

3.5.1. Test Procedures

According to MIC Notice No.88 Annex43.

3.5.2. Test Setup Layout

Refer to chapter 2.7.2 in this report.

3.5.3. Test Deviation

There is no deviation with the original standard.

3.5.4. Test Results

Refer to Annex A.5 in this report.



3.6. Limitation of Collateral Emission of Receiver

3.6.1. Limits

Frequency Range	Limits
30MHz-1000MHz	$\leq 4\text{nW}/100\text{kHz}$
1000MHz-12500MHz	$\leq 20\text{nW}/\text{MHz}$

3.6.2. Test Procedures

According to MIC Notice No.88 Annex43.

3.6.3. Test Setup Layout

Refer to chapter 2.7.1 in this report.

3.6.4. Test Deviation

There is no deviation with the original standard.

3.6.5. Test Results

Refer to Annex A.6 in this report.

Note 1: The spurious emissions mask that displayed on the plots is composed of several frequency ranges below:

Range	Start Freq. (MHz)	Stop Freq. (MHz)	RBW	VBW	Detector Type	Trace Mode	Limit (nW)
1	30	1000	100kHz	100kHz	Peak	Max Hold	4
2	1000	12500	1MHz	1MHz	Peak	Max Hold	20

Note 2: Only the spurious with the minimum margin from the limit line will be displayed in the mark table (The lower window on the test plots).



3.7.E.I.R.P.

3.7.1.Limits

Type	Limits
FHSS	6.91-16.91dBm/MHz
DSSS	12.14-22.14dBm/MHz
OFDM	12.14-22.14dBm/MHz (20MHz System) 9.13-19.13dBm/MHz (40MHz System)
Other	12.14-22.14dBm

Note: This item not be applied to the transmission antenna which has a gain of 2.14dBi or less

3.7.2.Test Procedures

According to MIC Notice No.88 Annex43.

3.7.3.Test Setup Layout

Refer to chapter 2.7.2 in this report.

3.7.4.Test Deviation

There is no deviation with the original standard.

3.7.5.Test Results

Refer to Annex A.7 in this report.



3.8. Radiation Angle of Antenna

3.8.1. Limits

Type	Limits
FHSS	360° /A; (A= E.I.R.P./ 6.91, if A<1; then A=1)
DSSS	360° /A; (A= E.I.R.P./ 12.14, if A<1; then A=1)
OFDM	
Other	

Note: This item not be applied to the transmission antenna which has a gain of 2.14dBi or less

3.8.2. Test Procedures

According to MIC Notice No.88 Annex43.

3.8.3. Test Setup Layout

Refer to chapter 2.7.3 in this report.

3.8.4. Test Deviation

There is no deviation with the original standard.

3.8.5. Test Results

Refer to Annex A.8 in this report.



3.9. Radio Interference Prevention Capability

3.9.1. Limits

The one automatically to transmit and to receive identification code with the wireless equipment of the wireless station used in the same premises.

3.9.2. Test Procedures

According to MIC Notice No.88 Annex43.

3.9.3. Test Setup Layout

Refer to chapter 2.7.4 in this report.

3.9.4. Test Deviation

There is no deviation with the original standard.

3.9.5. Test Results

Refer to Annex A.9 in this report.

3.10. Construction Protection Confirmation Method

3.10.1.Limits

The high-frequency section and modulation section of the radio equipment except for the antenna system shall not be capable of being opened easily.

3.10.2.Confirmation Method

The RF and modulation portions are protected against illegal modification as following method:

Protected Method	Description
Surface Mount Technology	RF and Modulation part are mounted on PCB with surface mount technology and there is no any adjustable parts on PCB or adjustable parts are not exposed.

3.10.3.Reference Documents

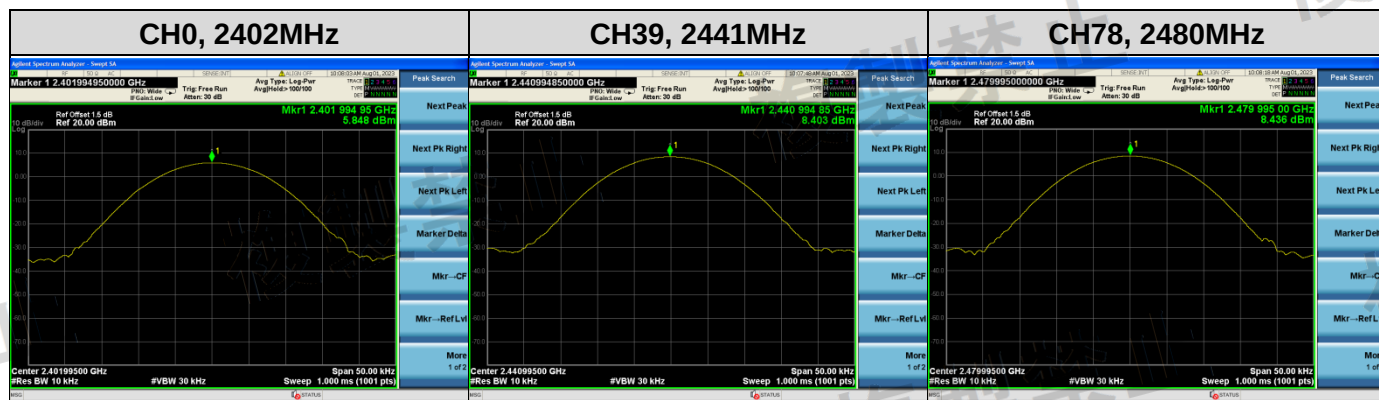
Reference Documents	Item
Photo	



Annex A Test Data and Results

A.1. Frequency Error

Channel	Frequency f_c (MHz)	Test Frequency f (MHz)	Frequency Error (ppm)	Verdict
0	2402	2401.9950	-2.08	PASS
39	2441	2440.9949	-2.09	PASS
78	2480	2479.9950	-2.02	PASS



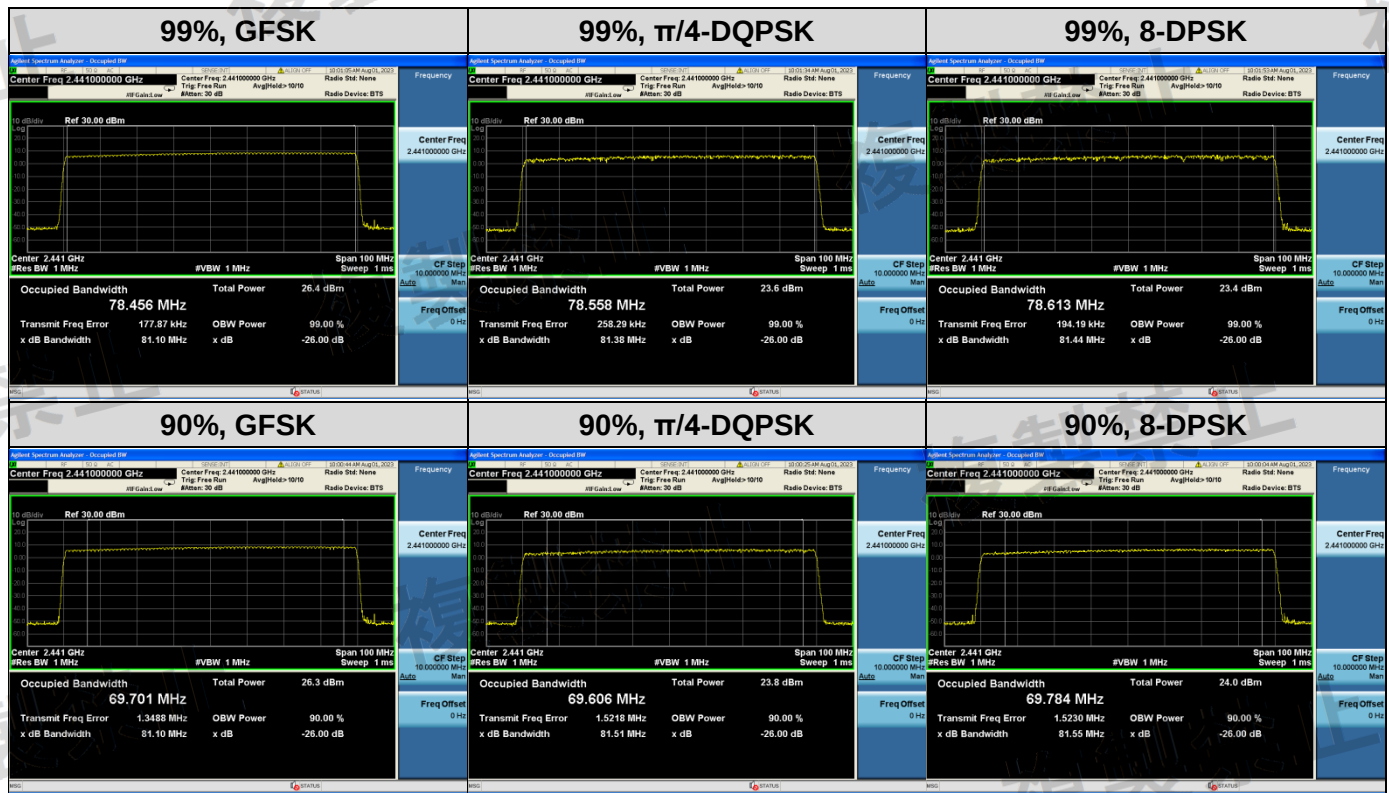


A.2. Dwell Time

Test Mode	Frequency (MHz)	Package Mode	Pulse Time (ms)	Total of Dwell (ms)	Limit (ms)	Verdict
GFSK	2402	DH5	2.88	307.20	400	PASS
$\pi/4$ -DQPSK	2402	2-DH5	2.88	307.20		PASS
8-DPSK	2402	3-DH5	2.88	307.20		PASS

A.3. Occupied Bandwidth and Spread Bandwidth / Factor

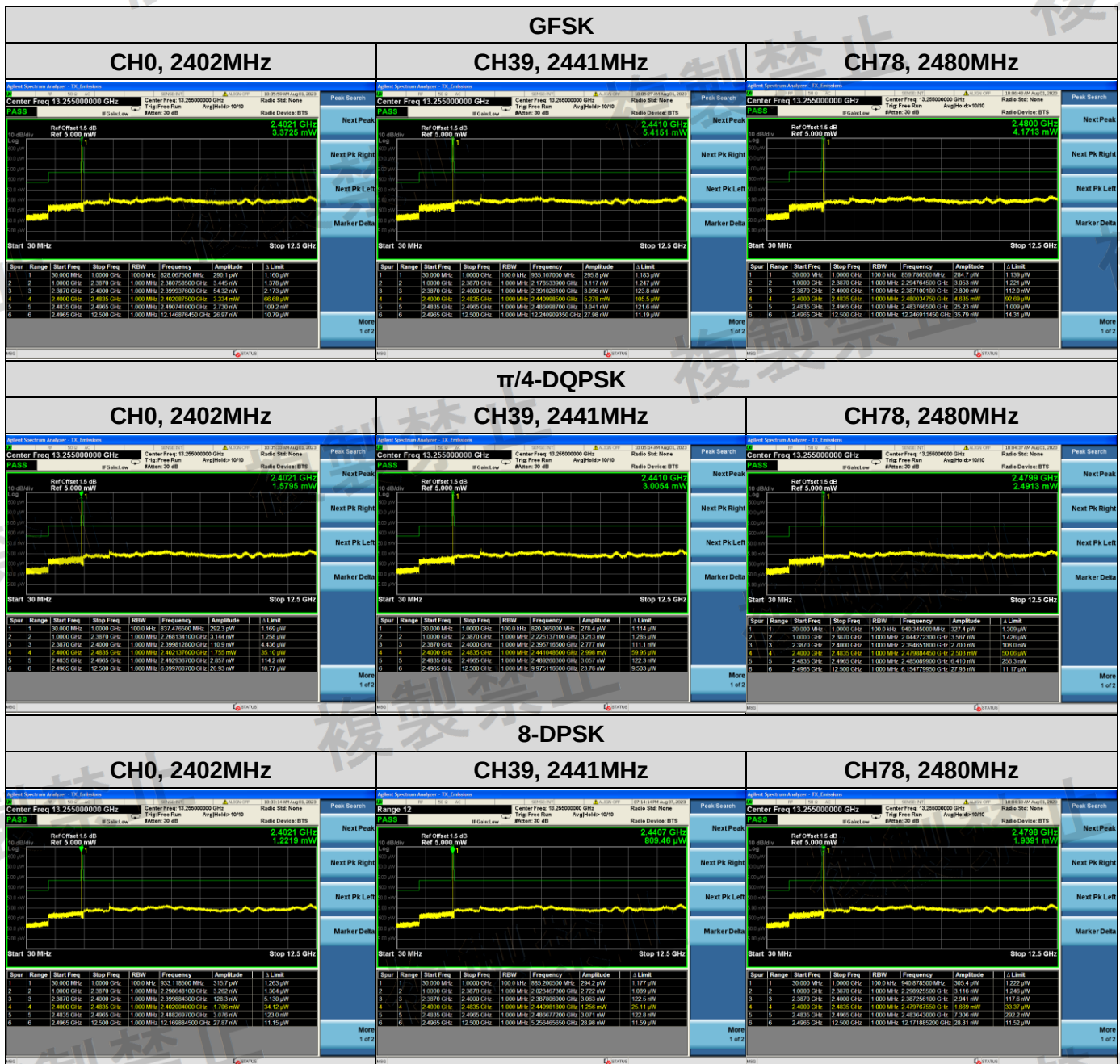
Test Mode	99% Occupied Bandwidth (MHz)	90% Spread-spectrum Bandwidth (MHz)	Spread Spectrum Factor	Verdict
GFSK	78.456	69.701	69.701	PASS
$\pi/4$ -DQPSK	78.558	69.606	34.803	PASS
8-DPSK	78.613	69.784	23.261	PASS





A.4. Unwanted Emission Intensity

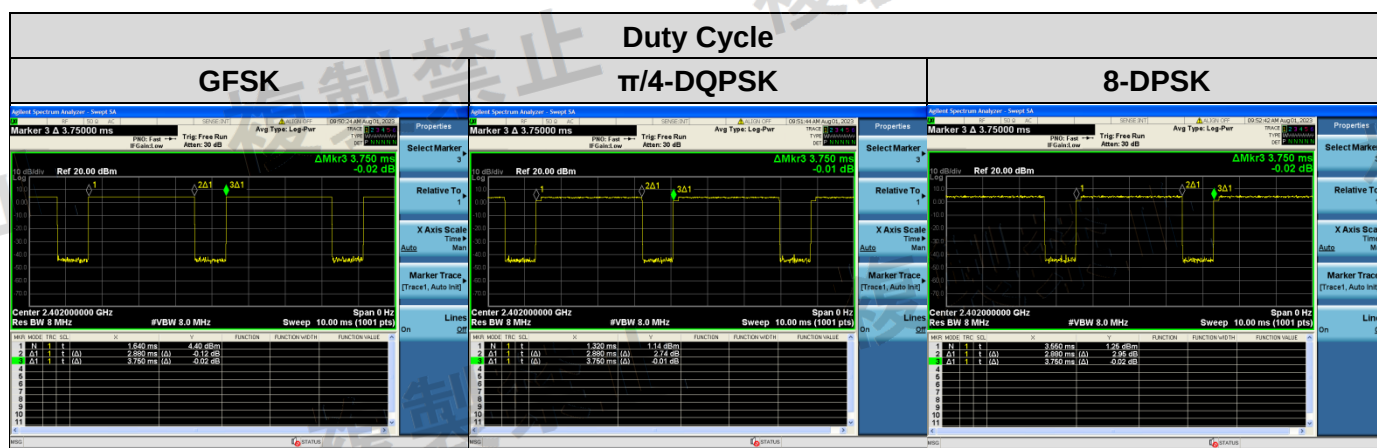
Mode	Frequency Range (MHz)	Test Result Value	Limit	Verdict
GFSK, $\pi/4$ -DQPSK, 8-DPSK	30~1000	Refer to below plot	0.25 μ W/100kHz	PASS
	1000~2387		2.5 μ W/MHz	PASS
	2387~2400		25 μ W/MHz	PASS
	2483.5~2496.5		25 μ W/MHz	PASS
	2496.5~12500		2.5 μ W/MHz	PASS





A.5. Antenna Power Error

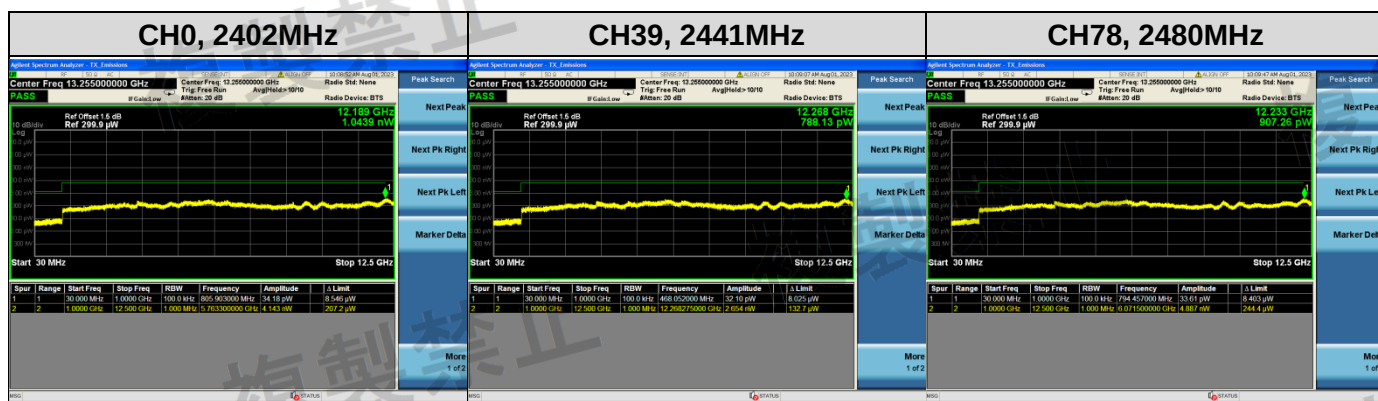
Mode	Power Test Value (dBm)	Spread spectrum BW (MHz)	Duty Factor	Antenna Power Density PD		Declare Power (mW/MHz)	Antenna Power Error	Verdict
				(dBm/M Hz)	(mW/M Hz)			
GFSK	6.85	69.70	1.15	-10.43	0.091	0.10	-9.00%	PASS
$\pi/4$ -DQPSK	3.95	69.61	1.15	-13.33	0.046	0.10	-54.00%	PASS
8-DPSK	3.82	69.78	1.15	-13.47	0.045	0.10	-55.00%	PASS





A.6. Limitation of Collateral Emission of Receiver

Mode	Frequency Range (MHz)	Test Result Value	Limit	Verdict
Receive	30~1000	Refer to below plot	4nW/100kHz	PASS
	1000~12500		20nW/MHz	PASS





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A.7. E.I.R.P.

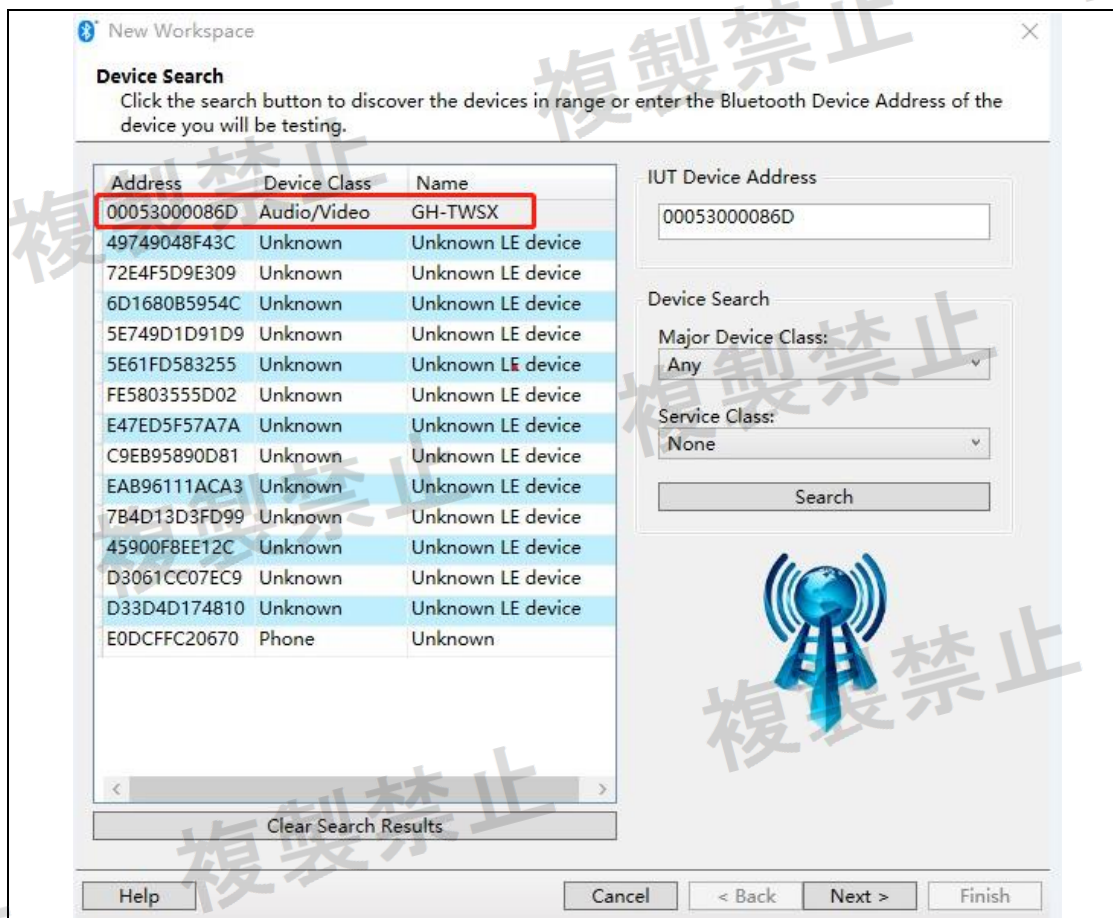
Note: This test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less.

A.8. Radiation Angle of Antenna

Note: This test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less.

A.9. Radio Interference Prevention Capability

The identification code of the EUT is: 00053000086D



New Workspace

Device Search
Click the search button to discover the devices in range or enter the Bluetooth Device Address of the device you will be testing.

Address	Device Class	Name
00053000086D	Audio/Video	GH-TWSX
49749048F43C	Unknown	Unknown LE device
72E4F5D9E309	Unknown	Unknown LE device
6D1680B5954C	Unknown	Unknown LE device
5E749D1D91D9	Unknown	Unknown LE device
5E61FD583255	Unknown	Unknown LE device
FE5803555D02	Unknown	Unknown LE device
E47ED5F57A7A	Unknown	Unknown LE device
C9EB95890D81	Unknown	Unknown LE device
EAB96111ACA3	Unknown	Unknown LE device
7B4D13D3FD99	Unknown	Unknown LE device
45900F8EE12C	Unknown	Unknown LE device
D3061CC07EC9	Unknown	Unknown LE device
D33D4D174810	Unknown	Unknown LE device
E0DCFFC20670	Phone	Unknown

IUT Device Address: 00053000086D

Device Search
Major Device Class: Any
Service Class: None
Search

Clear Search Results

Help Cancel < Back Next > Finish

END OF REPORT