FCC RADIO TEST REPORT

FCC ID: 2AXJ6TS-PTLS-2001

Sample： PTL Base Station

Trade Name： thingsocket turn things alive.

Main Model： TS-PTLS-2001

Additional Model： N/A

Report No.： UNIA21092225ER-61

Prepared for

UNINET INFOSYSTEM LIMITED/ THINGSOCKET SOLUTIONS

Unit 813, Data Technology Hub, TKO Industrial Est., 5 Chun Cheong St., HONG KONG, China

Prepared by

Shenzhen United Testing Technology Co., Ltd.

2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

TEST RESULT CERTIFICATION

Applicant ..... : UNINET INFOSYSTEM LIMITED/ THINGSOCKET SOLUTIONS

Address ..... : Unit 813, Data Technology Hub, TKO Industrial Est., 5 Chun Cheong St., HONG KONG, China

Manufacturer ..... : Hangzhou Century Link Technology Co., LTD

Address ..... : NO.528, Xingqi Road,Yuhang Economic And Technological Development Zone, Linping District, Hangzhou

Product description

Product..... : PTL Base Station

Trade Name..... : thingsocket turn things alive.

Model Name ..... : TS-PTLS-2001

Test Methods..... : FCC Rules and Regulations Part 15 Subpart C Section 15.249, ANSI C63.10: 2013

This device described above has been tested by Shenzhen United Testing Technology Co., Ltd., and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test ..... :

Date (s) of performance of tests..... : Sep. 22, 2021 ~ Oct. 22, 2021

Date of Issue..... : Oct. 26, 2021

Test Result..... : Pass

Prepared by: kahn.yang

Kahn yang/Editor

Reviewer: Sky dong

Sky dong/Supervisor

Approved & Authorized Signer: liuze

Liuze/Manager

Table of Contents Page

1 TEST SUMMARY 4

2 GENERAL INFORMATION 6

2.1 GENERAL DESCRIPTION OF EUT 6

2.2 CARRIER FREQUENCY OF CHANNELS 7

2.3 TEST MODE 7

2.4 TEST SETUP 8

2.5 DESCRIPTION TEST PERIPHERAL AND EUT PERIPHERAL 8

2.6 MEASUREMENT INSTRUMENTS LIST 9

3 CONDUCTED EMISSION 10

3.1 TEST LIMIT 10

3.2 TEST SETUP 10

3.3 TEST PROCEDURE 11

3.4 TEST RESULT 11

4 RADIATED EMISSION 14

4.1 TEST LIMIT 14

4.2 TEST SETUP 15

4.3 TEST PROCEDURE 16

4.4 TEST RESULT 16

5 BAND EDGE 23

5.1 TEST LIMIT 23

5.2 TEST PROCEDURE 23

5.3 TEST RESULT 23

6 OCCUPIED BANDWIDTH 26

6.1 TEST SETUP 26

6.2 TEST PROCEDURE 26

6.4 TEST RESULT 26

7 ANTENNA REQUIREMENT 28

8 PHOTO OF TEST 29

8.1 RADIATED EMISSION 29

8.2 CONDUCTED EMISSION 30

1 TEST SUMMARY

1.1 TEST PROCEDURES AND RESULTS

ITEM	STANGARD	RESULT
CONDUCTED EMISSION	FCC Part 15.207	COMPLIANT
RADIATED EMISSION	FCC Part 15.209/15.249	COMPLIANT
BAND EDGE	FCC Part 15.249/15.205	COMPLIANT
OCCUPIED BANDWIDTH	FCC Part 15.215	COMPLIANT
ANTENNA REQUIREMENT	FCC Part 15.203	COMPLIANT

1.2 TEST FACILITY

Test Firm : Shenzhen United Testing Technology Co., Ltd.

Address : 2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.The testing quality system of our laboratory meets with ISO/IEC-17025 requirements. This approval result is accepted by MRA of APLAC.

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

A2LA Certificate Number: 4747.01
The EMC Laboratory has been accredited by A2LA, and in compliance with ISO/IEC 17025:2017 General Requirements for testing Laboratories.

FCC Registration Number: 674885
The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission.

IC Registration Number: 21947
The EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada.

1.3 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

A. Conducted Measurement:

Test Site	Method	Measurement Frequency Range	U, (dB)	NOTE
UNI	ANSI	9kHz ~ 150kHz	2.96	
		150kHz ~ 30MHz	2.44	

B. Radiated Measurement:

Test Site	Method	Measurement Frequency Range	U, (dB)	NOTE
UNI	ANSI	9kHz ~ 30MHz	2.50	
		30MHz ~ 1000MHz	4.80	
		Above 1000MHz	4.13	

2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Product:	PTL Base Station
Trade Name:	thingsocket turn things alive.
Main Model:	TS-PTLS-2001
Additional Model:	N/A
Model Difference:	N/A
FCC ID:	2AXJ6TS-PTLS-2001
Frequency Range:	2402MHz~2482MHz
Number of Channels:	81CH
Modulation Type:	GFSK
Antenna Type:	SMA Antenna
Antenna Gain:	2dBi
Battery:	N/A
Adapter:	Model: GME18A-060230FDS Input: AC 100-240V, 50/60Hz, 0.8A Output: DC 6.0V, 2.3A
Power Source:	DC 6.0V from adapter with AC 120(240)V/60Hz

2.2 CARRIER FREQUENCY OF CHANNELS

Channel List							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2402	22	2423	43	2444	64	2465
02	2403	23	2424	44	2445	65	2466
03	2404	24	2425	45	2446	66	2467
04	2405	25	2426	46	2447	67	2468
05	2406	26	2427	47	2448	68	2469
06	2407	27	2428	48	2449	69	2470
07	2408	28	2429	49	2450	70	2471
08	2409	29	2430	50	2451	71	2472
09	2410	30	2431	51	2452	72	2473
10	2411	31	2432	52	2453	73	2474
11	2412	32	2433	53	2454	74	2475
12	2413	33	2434	54	2455	75	2476
13	2414	34	2435	55	2456	76	2477
14	2415	35	2436	56	2457	77	2478
15	2416	36	2437	57	2458	78	2479
16	2417	37	2438	58	2459	79	2480
17	2418	38	2439	59	2460	80	2481
18	2419	39	2440	60	2461	81	2482
19	2420	40	2441	61	2462		
20	2421	41	2442	62	2463		
21	2422	42	2443	63	2464		

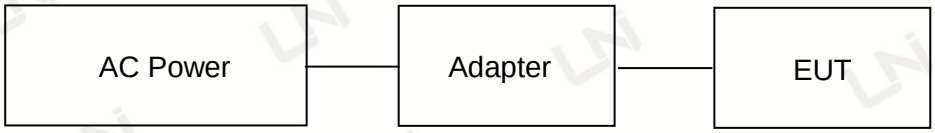
2.3 TEST MODE

The EUT was programmed to be in continuously transmitting mode.

Channel List		
Test Channel	EUT Channel	Test Frequency (MHz)
Low	CH01	2402
Middle	CH41	2442
High	CH81	2482

2.4 TEST SETUP

Operation of EUT during Conducted and Radiation testing:



2.5 DESCRIPTION TEST PERIPHERAL AND EUT PERIPHERAL

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Note
E-1	PTL Base Station	thingsocket	TS-PTLS-2001	EUT

Item	Shielded Type	Ferrite Core	Length	Note

Note:

1. The support equipment was authorized by Declaration of Confirmation.
2. For detachable type I/O cable should be specified the length in cm in『Length』column.
3. “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.

2.6 MEASUREMENT INSTRUMENTS LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
Conduction Emissions Measurement					
1	Conducted Emission Test Software	EZ-EMC	Ver.CCS-3A1-CE	N/A	N/A
2	AMN	Schwarzbeck	NNLK8121	8121370	2022.09.22
3	AAN	TESEQ	T8-Cat6	38888	2022.09.22
4	Pulse Limiter	CYBRTEK	EM5010	E115010056	2022.05.17
5	EMI Test Receiver	Rohde&Schwarz	ESCI	101210	2022.09.22
Radiated Emissions Measurement					
1	Radiated Emission Test Software	EZ-EMC	Ver.CCS-03A1	N/A	N/A
2	Horn Antenna	Sunol	DRH-118	A101415	2022.09.27
3	Broadband Hybrid Antenna	Sunol	JB1	A090215	2022.03.01
4	PREAMP	HP	8449B	3008A00160	2022.09.22
5	PREAMP	HP	8447D	2944A07999	2022.05.17
6	EMI TEST RECEIVER	Rohde&Schwarz	ESR3	101891	2022.09.22
7	VECTOR Signal Generator	Rohde&Schwarz	SMU200A	101521	2022.09.22
8	Signal Generator	Agilent	E4421B	MY4335105	2022.09.22
9	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2022.09.22
10	MXA Signal Analyzer	Keysight	N9020A	MY51110104	2022.09.22
11	RF Power sensor	DARE	RPR3006W	15I00041SNO88	2022.05.17
12	RF Power sensor	DARE	RPR3006W	15I00041SNO89	2022.05.17
13	RF power divider	Anritsu	K241B	992289	2022.09.22
14	Wideband radio communication tester	Rohde&Schwarz	CMW500	154987	2022.09.22
15	Active Loop Antenna	Com-Power	AL-130R	10160009	2022.07.25
16	Broadband Hybrid Antennas	Schwarzbeck	VULB9163	VULB9163#958	2022.09.22
17	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1680	2022.05.23
18	Horn Antenna	A-INFOMW	LB-180400-KF	J211060660	2022.09.27
19	Microwave Broadband Preamplifier	Schwarzbeck	BBV 9721	100472	2022.09.22
20	Signal Generator	Agilent	N5183A	MY47420153	2022.09.22
21	Spctrum Analyzer	Rohde&Schwarz	FSP 40	100501	2022.09.22
22	Power Meter	KEYSIGHT	N1911A	MY50520168	2022.09.22
23	Frequency Meter	VICTOR	VC2000	997406086	2022.09.22
24	DC Power Source	HYELEC	HY5020E	055161818	2022.09.22

3 CONDUCTED EMISSION

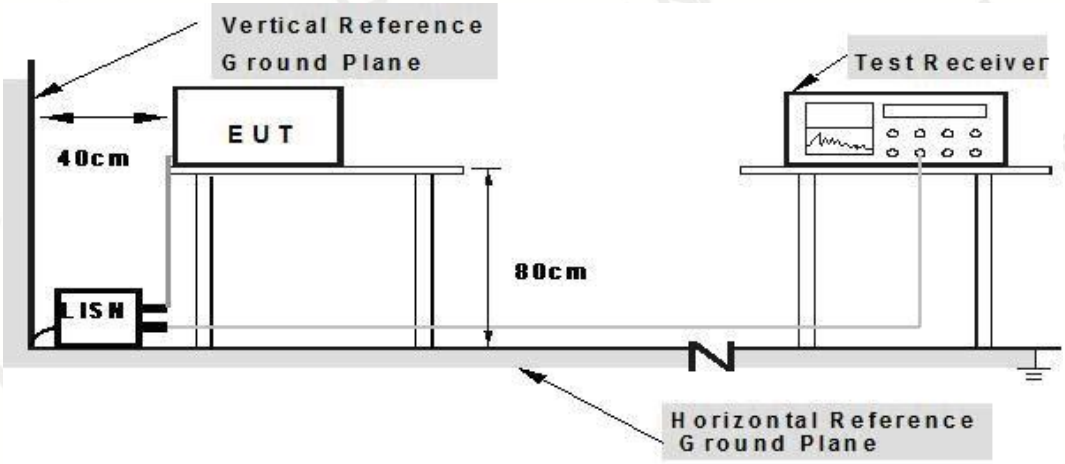
3.1 TEST LIMIT

For unintentional device, according to § 15.207(a) Line Conducted Emission Limits is as following

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15~0.50	79	66	66~56*	56~46*
0.50~5.00	73	60	56	46
5.00~30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency.
For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

3.2 TEST SETUP



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.3 TEST PROCEDURE

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is placed on a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.

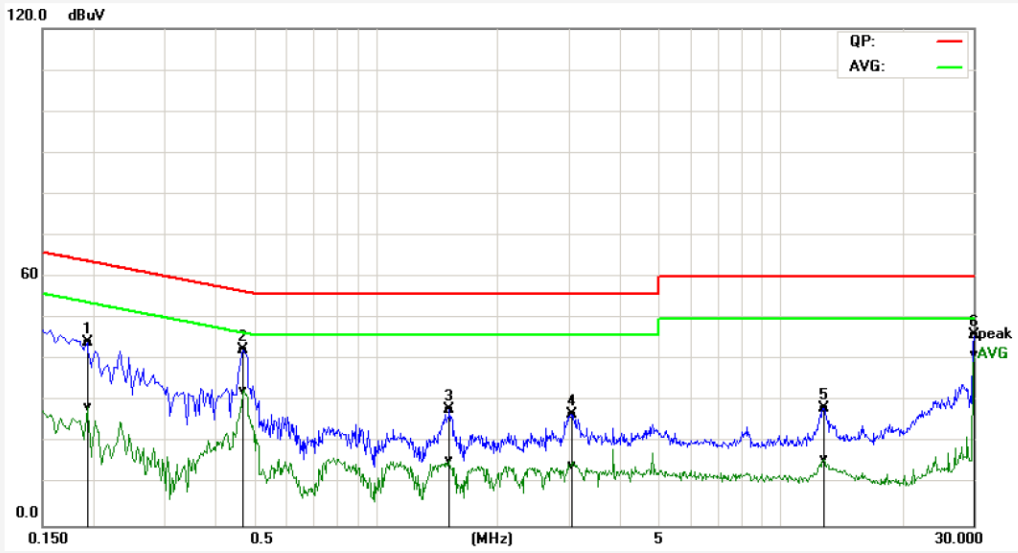
3.4 TEST RESULT

PASS

Remark:

1. All modes were tested at AC 120V and 240V, only the worst result of AC 120V was reported.
2. All modes were test at Low, Middle, and High channel, only the worst result of GFSK Middle Channel was reported.

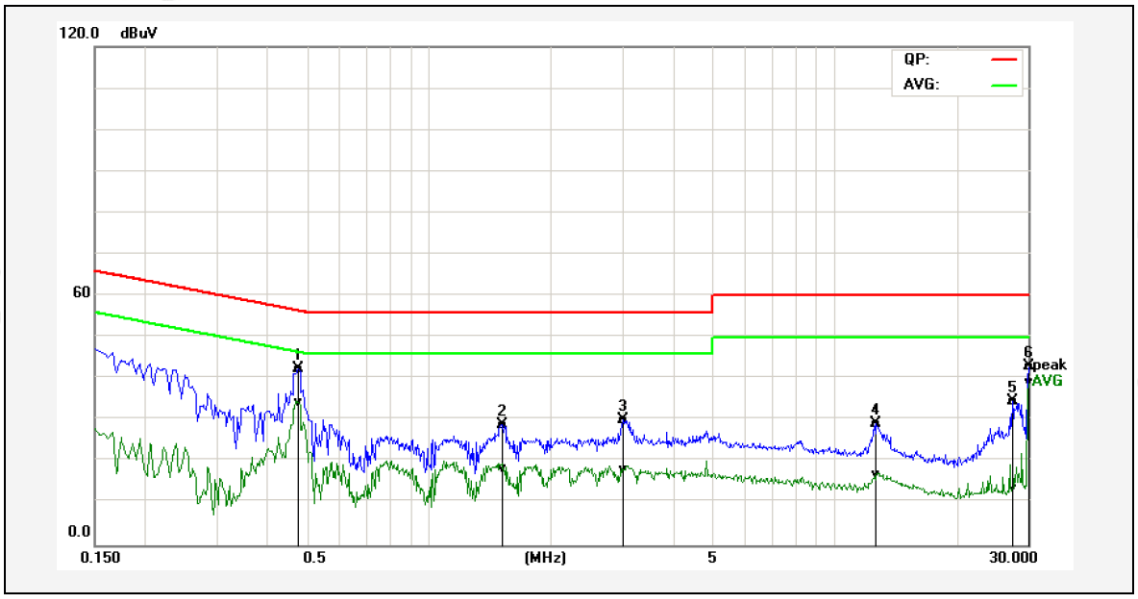
Temperature:	24℃	Relative Humidity:	48%
Test Date:	Sep. 26, 2021	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Line
Test Mode:	Transmitting mode of GFSK 2442MHz		



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1P	0.1940	34.42	19.08	9.72	44.14	28.80	63.86	53.86	-19.72	-25.06	Pass
2P	0.4700	32.74	22.80	9.80	42.54	32.60	56.51	46.51	-13.97	-13.91	Pass
3P	1.5260	18.12	6.02	9.87	27.99	15.89	56.00	46.00	-28.01	-30.11	Pass
4P	3.0420	16.94	4.66	9.95	26.89	14.61	56.00	46.00	-29.11	-31.39	Pass
5P	12.8300	28.17	15.89	0.24	28.41	16.13	60.00	50.00	-31.59	-33.87	Pass
6*	30.0000	45.22	40.38	0.78	46.00	41.16	60.00	50.00	-14.00	-8.84	Pass

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.

Temperature:	24℃	Relative Humidity:	48%
Test Date:	Sep. 26, 2021	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Neutral
Test Mode:	Transmitting mode of GFSK 2442MHz		



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1P	0.4780	32.66	24.43	9.80	42.46	34.23	56.37	46.37	-13.91	-12.14	Pass
2P	1.5260	19.15	8.71	9.87	29.02	18.58	56.00	46.00	-26.98	-27.42	Pass
3P	3.0140	20.26	8.17	9.93	30.19	18.10	56.00	46.00	-25.81	-27.90	Pass
4P	12.6860	19.16	6.89	9.96	29.12	16.85	60.00	50.00	-30.88	-33.15	Pass
5P	27.4900	24.18	3.03	10.58	34.76	13.61	60.00	50.00	-25.24	-36.39	Pass
6*	30.0000	32.26	28.63	10.65	42.91	39.28	60.00	50.00	-17.09	-10.72	Pass

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.

4 RADIATED EMISSION

4.1 TEST LIMIT

For unintentional device, according to § 15.209(a), except for Class B digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F (kHz)	-	Quasi-peak	300
0.490MHz-1.705MHz	24000/F (kHz)	-	Quasi-peak	30
1.705MHz-30MHz	30	-	Quasi-peak	30
30MHz-88MHz	100	40.0	Quasi-peak	3
88MHz-216MHz	150	43.5	Quasi-peak	3
216MHz-960MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1GHz	500	54.0	Average	3
		74.0	Peak	3

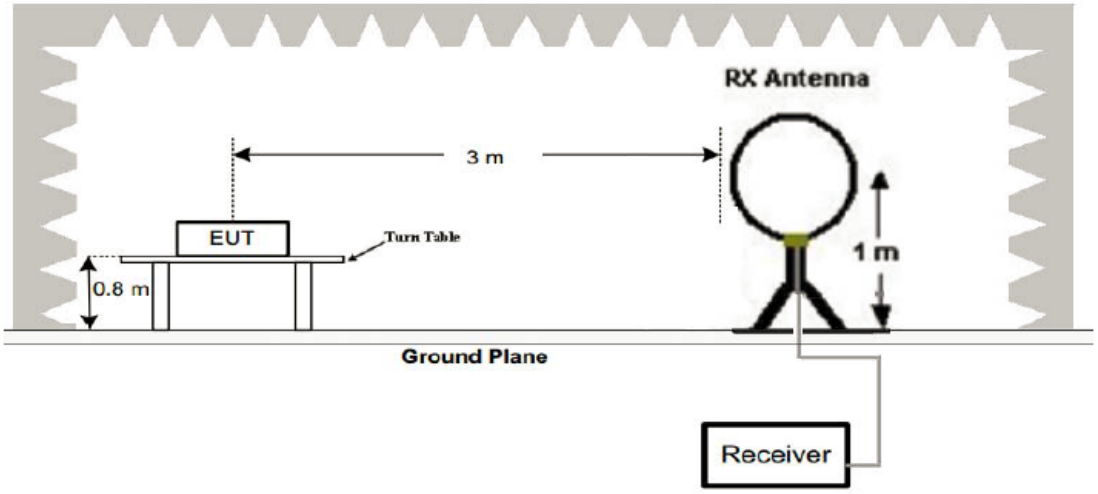
For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

Limit: (Field strength of the fundamental signal)

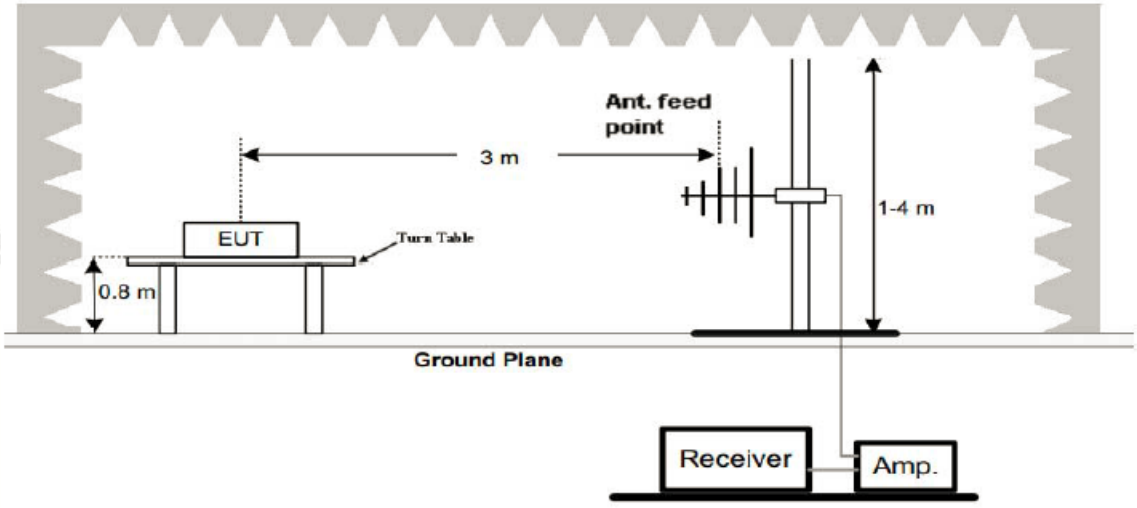
Frequency	Limit (dBuV/m @3m)	Remark
2400MHz-2483.5MHz	94.0	Average Value
	114.0	Peak Value

4.2 TEST SETUP

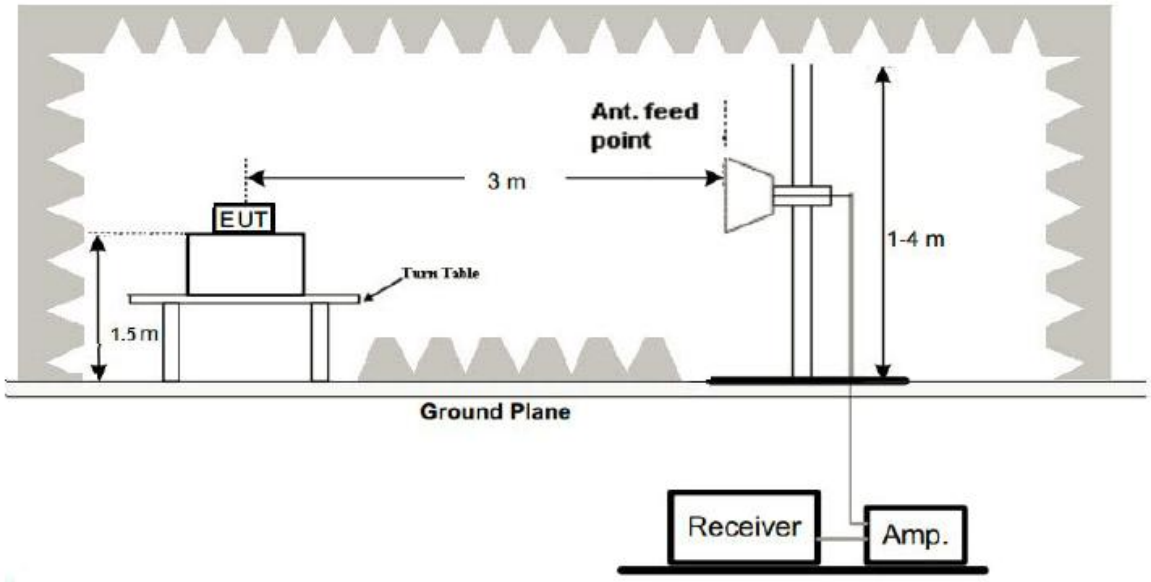
1. Radiated Emission Test-Up Frequency Below 30MHz



2. Radiated Emission Test-Up Frequency 30MHz~1GHz



3. Radiated Emission Test-Up Frequency Above 1GHz



4.3 TEST PROCEDURE

1. Below 1GHz measurement the EUT is placed on turntable which is 0.8m above ground plane. And above 1GHz measurement EUT was placed on low permittivity and low tangent turn table which is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The test frequency range from 9kHz to 25GHz per FCC PART 15.33(a).

Note:
For battery operated equipment, the equipment tests shall be performed using a new battery.

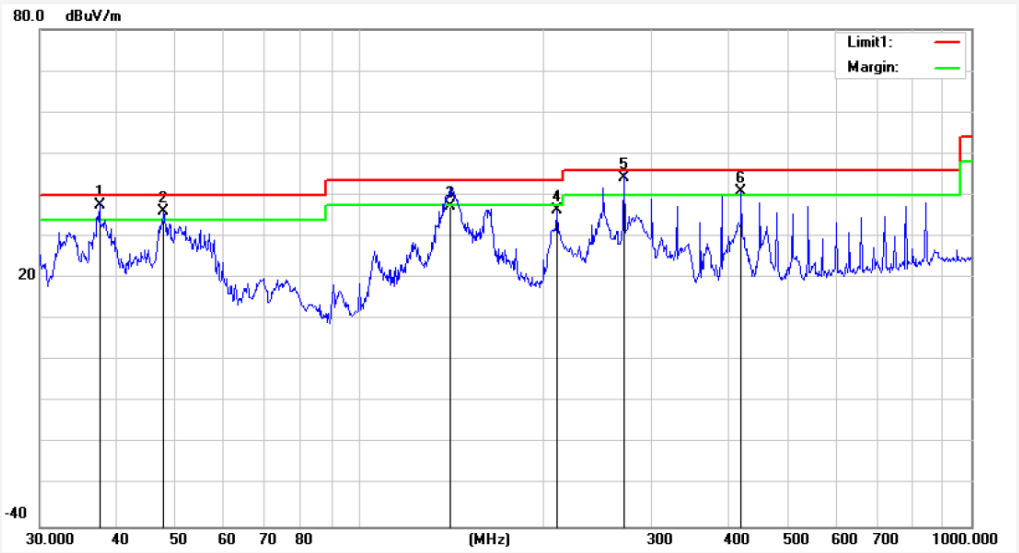
4.4 TEST RESULT

PASS

Remark:
1. All modes were test at Low, Middle, and High channel, only the worst result of GFSK Middle Channel was reported for below 1GHz test.
2. By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “X axis” position was the worst, and test data recorded in this report.
3. Radiated emission test from 9kHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9kHz to 30MHz and not recorded in this report.

Below 1GHz Test Results:

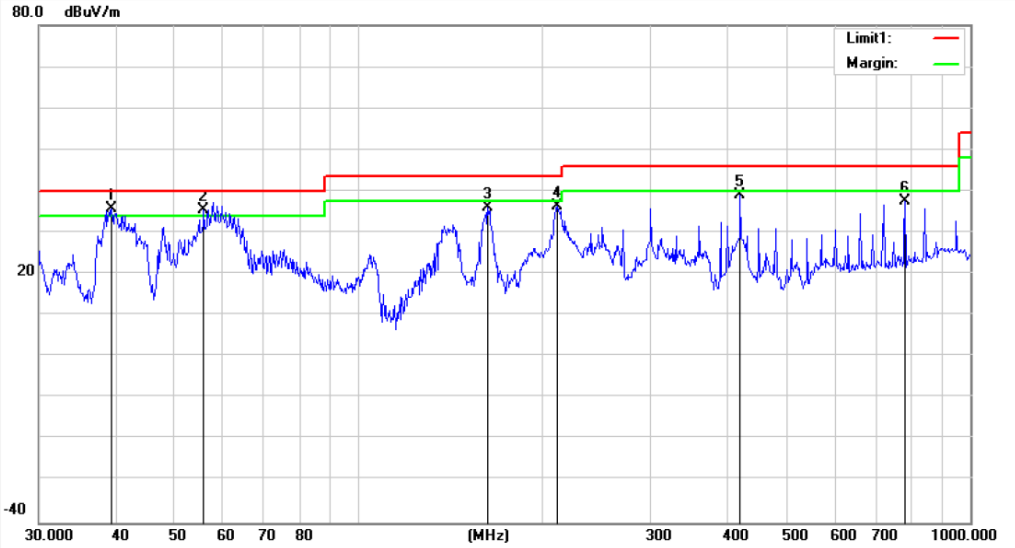
Temperature:	24℃	Relative Humidity:	48%
Test Date:	Sep. 27, 2021	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Horizontal
Test Mode:	Transmitting mode of GFSK 2442MHz		



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1!	37.5480	50.46	-12.96	37.50	40.00	-2.50	60	100	QP
2!	47.8260	55.78	-19.63	36.15	40.00	-3.85	90	100	peak
3	140.3421	53.73	-16.53	37.20	43.50	-6.30	120	100	QP
4	210.0482	53.88	-17.62	36.26	43.50	-7.24	160	100	peak
5*	270.3748	59.92	-15.69	44.23	46.00	-1.77	180	100	QP
6!	420.5803	53.66	-12.78	40.88	46.00	-5.12	200	100	peak

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss – Pre-amplifier

Temperature:	24℃	Relative Humidity:	48%
Test Date:	Sep. 27, 2021	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Vertical
Test Mode:	Transmitting mode of GFSK 2442MHz		



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1*	39.4371	50.14	-14.35	35.79	40.00	-4.21	90	100	peak
2!	55.8046	56.79	-21.28	35.51	40.00	-4.49	100	100	peak
3	162.6106	53.37	-17.20	36.17	43.50	-7.33	120	100	peak
4	210.7860	53.92	-17.66	36.26	43.50	-7.24	160	100	peak
5	420.5803	51.80	-12.78	39.02	46.00	-6.98	200	100	peak
6	782.3451	45.53	-8.03	37.50	46.00	-8.50	220	100	peak

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss – Pre-amplifier

Remark：
1. Measuring frequencies from 9 kHz to the 1 GHz, Radiated emission test from 9kHz to 30MHzwas verified, and no any emission was found except system noise floor.
2. * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
3. The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120kHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10kHz.

Above 1 GHz Test Results:

CH01 (2402MHz)

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2402	111.77	-5.84	105.93	114	-8.07	PK
2402	82.35	-5.84	76.51	94	-17.49	AV
4804	60.03	-3.64	56.39	74	-17.61	PK
4804	48.85	-3.64	45.21	54	-8.79	AV
7206	56.60	-0.95	55.65	74	-18.35	PK
7206	46.10	-0.95	45.15	54	-8.85	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2402	111.69	-5.84	105.85	114	-8.15	PK
2402	81.72	-5.84	75.88	94	-18.12	AV
4804	59.89	-3.64	56.25	74	-17.75	PK
4804	48.92	-3.64	45.28	54	-8.72	AV
7206	56.74	-0.95	55.79	74	-18.21	PK
7206	46.15	-0.95	45.20	54	-8.80	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH41 (2442MHz)

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2442	112.46	-5.71	106.75	114	-7.25	PK
2442	82.55	-5.71	76.84	94	-17.16	AV
4884	60.24	-3.51	56.73	74	-17.27	PK
4884	49.13	-3.51	45.62	54	-8.38	AV
7326	56.82	-0.82	56.00	74	-18.00	PK
7326	46.21	-0.82	45.39	54	-8.61	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2442	112.57	-5.71	106.86	114	-7.14	PK
2442	82.66	-5.71	76.95	94	-17.05	AV
4884	60.33	-3.51	56.82	74	-17.18	PK
4884	49.28	-3.51	45.77	54	-8.23	AV
7326	56.75	-0.82	55.93	74	-18.07	PK
7326	46.20	-0.82	45.38	54	-8.62	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH81 (2482MHz)

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2482	112.17	-5.65	106.52	114	-7.48	PK
2482	82.36	-5.65	76.71	94	-17.29	AV
4964	59.95	-3.43	56.52	74	-17.48	PK
4964	49.07	-3.43	45.64	54	-8.36	AV
7446	56.39	-0.75	55.64	74	-18.36	PK
7446	46.06	-0.75	45.31	54	-8.69	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2482	112.25	-5.65	106.60	114	-7.40	PK
2482	82.44	-5.65	76.79	94	-17.21	AV
4964	59.99	-3.43	56.56	74	-17.44	PK
4964	48.95	-3.43	45.52	54	-8.48	AV
7446	56.22	-0.75	55.47	74	-18.53	PK
7446	45.98	-0.75	45.23	54	-8.77	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

Remark:
1. Measuring frequencies from 1 GHz to the 25 GHz.
2. “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
3. * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
4. Data of measurement within this frequency range shown “--- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120kHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10kHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
6. When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
7. All modes of operation were investigated and the worst-case emissions of π/4 DQPSK are reported.
8. For fundamental frequency, RBW >20dB BW, VBW>=3XRBW, PK detector for PK value, AV detector for AV value.

5 BAND EDGE

5.1 TEST LIMIT

FCC PART 15.249(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

5.2 TEST PROCEDURE

The band edge compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW to 1MHz and VBM to 3MHz to measure the peak field strength and set RBW to 1MHz and VBW to 10Hz to measure the average radiated field strength. Peak detector is for both.

5.3 TEST RESULT

PASS

Operation Mode: TX CH01 (2402MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	57.59	-5.81	51.78	74	-22.22	PK
2310	/	-5.81	/	54	/	AV
2390	57.72	-5.84	51.88	74	-22.12	PK
2390	/	-5.84	/	54	/	AV
2400	57.60	-5.84	51.76	74	-22.24	PK
2400	/	-5.84	/	54	/	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	57.07	-5.81	51.26	74	-22.74	PK
2310	/	-5.81	/	54	/	AV
2390	57.75	-5.84	51.91	74	-22.09	PK
2390	/	-5.84	/	54	/	AV
2400	57.44	-5.84	51.60	74	-22.40	PK
2400	/	-5.84	/	54	/	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Operation Mode: TX CH81 (2482MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.5	57.01	-5.65	51.36	74	-22.64	PK
2483.5	/	-5.65	/	54	/	AV
2500	56.80	-5.72	51.08	74	-22.92	PK
2500	/	-5.72	/	54	/	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.5	56.75	-5.65	51.10	74	-22.90	PK
2483.5	/	-5.65	/	54	/	AV
2500	57.04	-5.72	51.32	74	-22.68	PK
2500	/	-5.72	/	54	/	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

6 OCCUPIED BANDWIDTH

6.1 TEST SETUP

Same as Radiated Emission Measurement.

6.2 TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation.
3. Based on ANSI C63.10 section 6.9.2: RBW=10kHz, VBW=30kHz, Span=2MHz.
4. The useful radiated emission from the EUT was detected by the spectrum analyzer with peak detector.

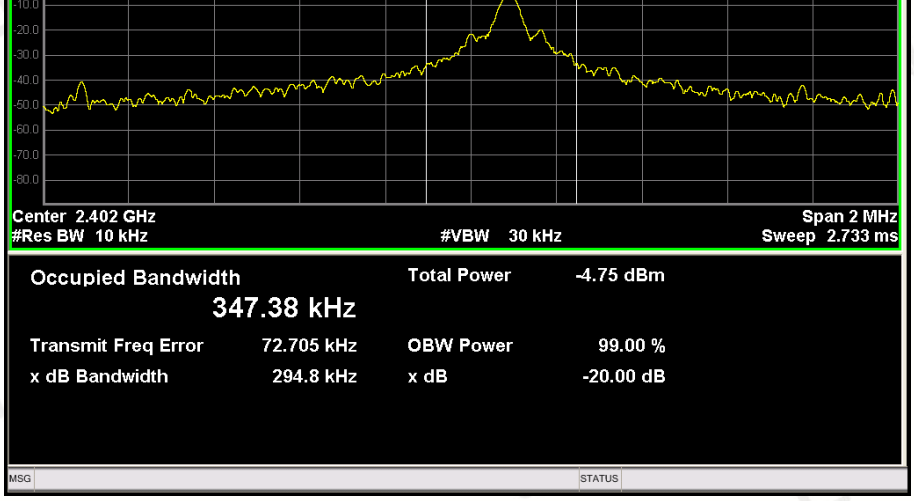
6.4 TEST RESULT

PASS

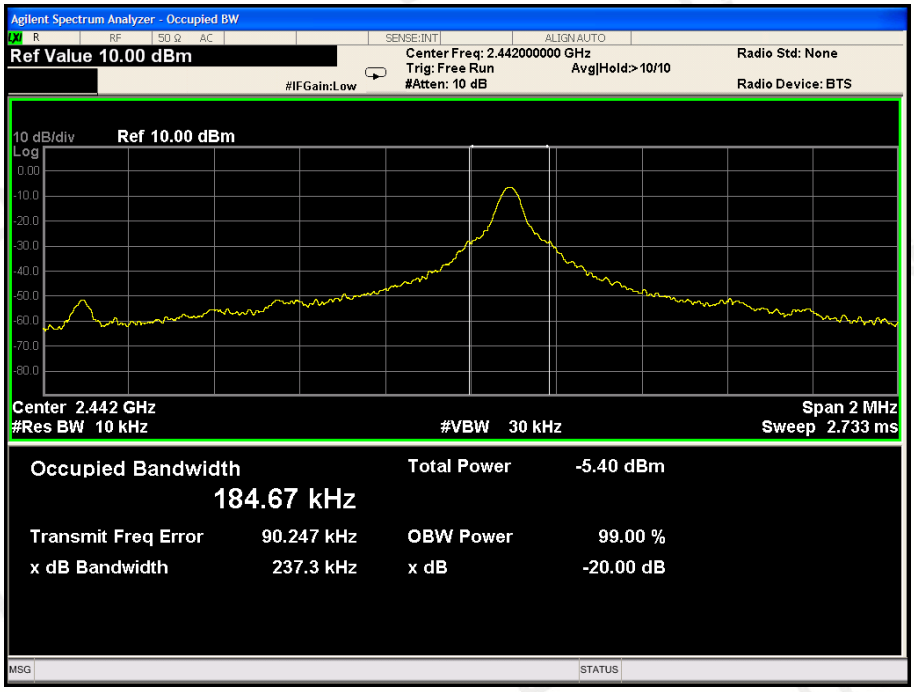
GFSK Modulation:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
CH01	2402	0.295	PASS
CH41	2442	0.237	PASS
CH81	2482	0.262	PASS

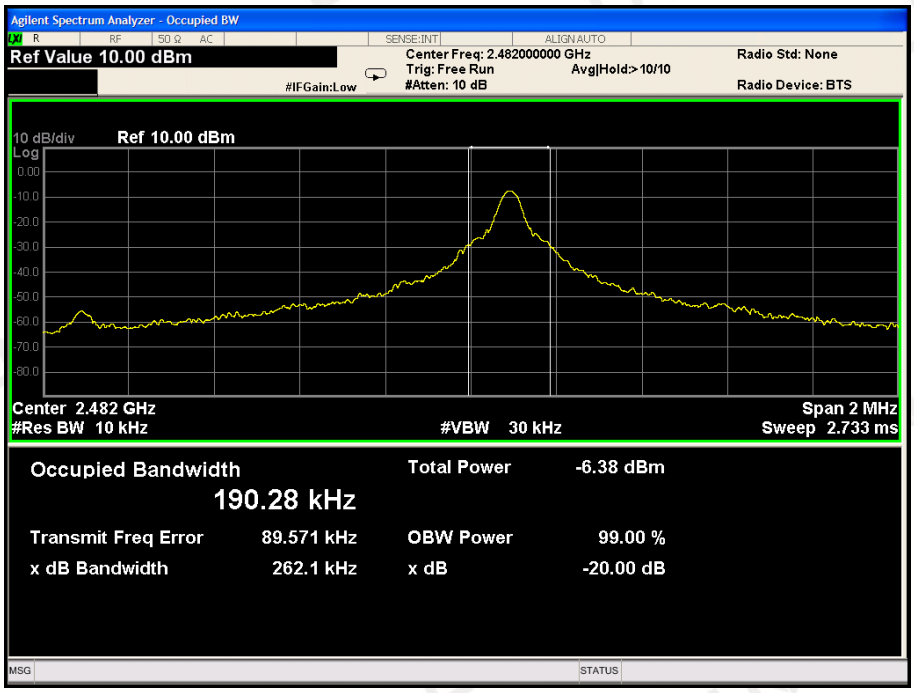
CH01: 2402MHz



CH41: 2442MHz



CH81: 2482MHz

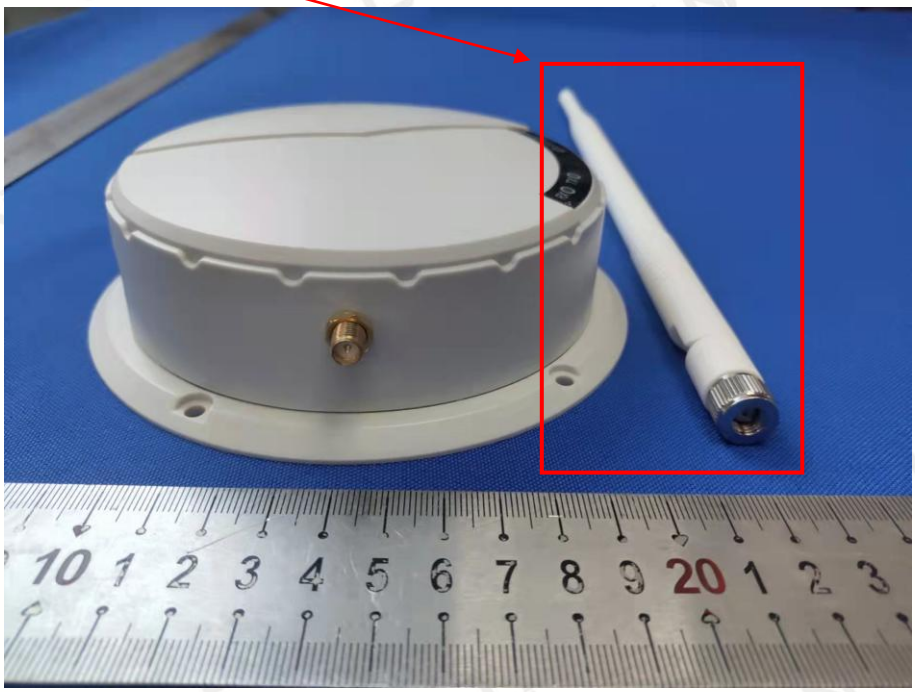


7 ANTENNA REQUIREMENT

Standard Applicable:
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

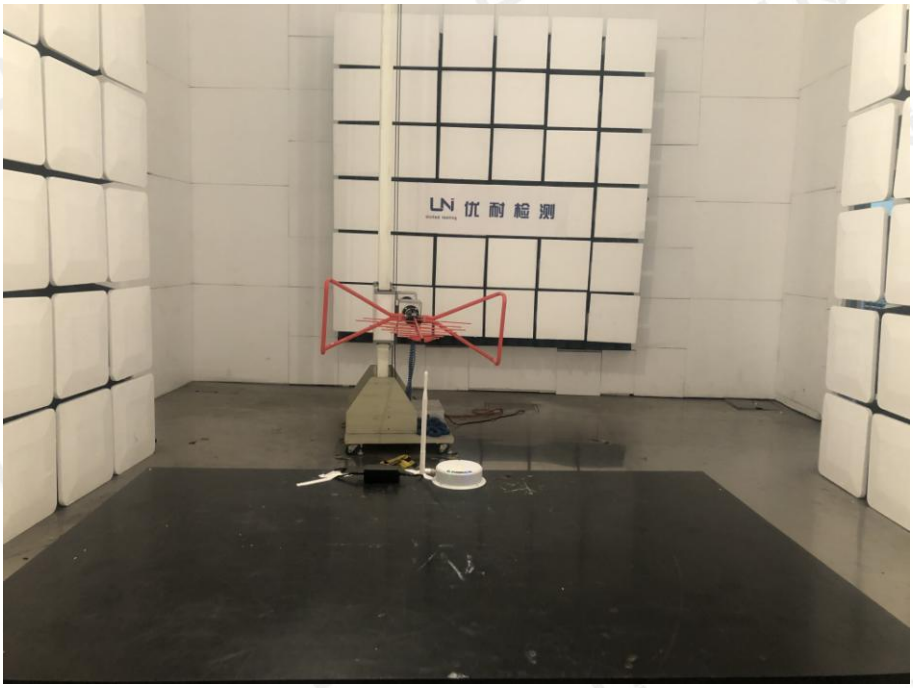
Antenna Connected Construction
The antenna used in this product is a SMA Antenna, The directional gains of antenna used for transmitting is 2dBi.

ANTENNA:



8 PHOTO OF TEST

8.1 RADIATED EMISSION



8.2 CONDUCTED EMISSION

End of Report