RADIO TEST REPORT

FCC ID: 2AOQZ-ES11

Product: Wireless charging speaker

Trade Name: ESONSTYNE

Model Name: ES11

Serial Model: X8, X9N, ES11, ES12, ES21, ES26, ES28, ES29, ES30, ES35

Report No.: UNIA2018122602FR-01

Prepared for

Shenzhen Eson Technology Co., Ltd.

3/F,No.1,Guanghui Science&Technology Park, MinQing Rd, LongHua New District, Shenzhen, China

Prepared by

Shenzhen United Testing Technology Co., Ltd.

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TEST RESULTCERTIFICATION

Applicant's name	:	Shenzhen Eson Technology Co., Ltd.
Address	:	3/F,No.1,Guanghui Science&Technology Park, MinQing Rd, LongHua New District, Shenzhen, China
Manufacture's Name	:	Shenzhen Eson Technology Co., Ltd.
Address	:	3/F,No.1,Guanghui Science&Technology Park, MinQing Rd, LongHua New District, Shenzhen, China

Product description

Product name	:	Wireless charging speaker
Trade Mark	:	ESON STYNE
Model and/or type reference	:	ES11, X8, X9N, ES11, ES12, ES21, ES26, ES28, ES29, ES30, ES35
Standards	:	FCC Rules and Regulations Part 15 Subpart C Section 15.247 ANSI C63.10: 2013 KDB558074 D01 V05: Guidance for Performing Compliance

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	:	Dec.25, 2018
Date (s) of performance of tests	:	Dec. 25, 2018--Jan. 03, 2019
Date of Issue	:	Jan. 03, 2019
Test Result	:	Pass

Prepared by: Kahn yang/Editor

Reviewer: Sherwin Qian/Supervisor

Approved & Authorized Signer: Liuze/Manager

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1 TEST SUMMARY

1.1 Environment conditions

During the measurement the environment condition were within the listed ranges：

Normal temperature	25℃
Relative humidity	55%
Air pressure	101KPa

1.2 SUMMARY of TEST RESULTS

FCC PART 15.247		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.247(a)(1)(i)	20dB Bandwidth	PASS
FCC Part 15.247(d)	Spurious RF Conducted Emission	PASS
FCC Part 15.247(b)	Maximum Peak Output Power	PASS
FCC Part 15.247(b)	Pseudorandom Frequency Hopping Sequence	PASS
FCC Part 15.247(a)(1)(iii)	Number of hopping frequency& Time of Occupancy	PASS
FCC Part 15.247(a)(1)	Frequency Separation	PASS
FCC Part 15.205/15.209	Radiated Emissions	PASS
FCC Part 15.247(d)	Band Edge Compliance of RF Emission	PASS
FCC Part15.247(g)(h)	Pseudorandom Frequency Hopping Sequence	PASS
FCC Part 15.203/15.247 (b)	Antenna Requirement	PASS

1.3 TEST FACILITY

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

Address :2F, Annex Bldg, JiahuangyuanTechPark, #365 Baotian 1 Rd,TiegangCommunity, XixiangStr, 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, which is approved by CNAS. This approval result is accepted by MRA of APLAC.

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

CNAS-LAB Code: L6494

The EMC Laboratory has been assessed and in compliance with CNAS-CL01 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of testing Laboratories.

Designation Number: CN1227

Test Firm Registration Number: 674885

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files.

1.4 MEASUREMENT UNCERTAINTY

Measurement Uncertainty

Conducted Emission Expanded Uncertainty	=	2.23dB, k=2
Radiated emission expanded uncertainty(9kHz-30MHz)	=	3.08dB, k=2
Radiated emission expanded uncertainty(30MHz-1000MHz)	=	4.42dB, k=2
Radiated emission expanded uncertainty(Above 1GHz)	=	4.06dB, k=2

2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	Wireless charging speaker
Trade Mark	ESONSTYNE
Model Name	ES11
Serial No.	X8, X9N, ES11, ES12, ES21, ES26, ES28, ES29, ES30, ES35
Model Difference	All models have the same functionality, software and electronics, only the color, front frame shape and model names may differ. Test sample model:ES11
FCC ID	2AOQZ-ES11
Antenna Type	PCB Antenna
Antenna Gain	0.0 dBi
Frequency Range	2402MHz - 2480MHz
Number of Channels	79
Modulation Type	GFSK, pi/4DQPSK
Power Source	DC7.4V from battery
Adapter Model	N/A

2.2 CARRIER FREQUENCY OF CHANNELS

Channel	Frequency (MHz)
00	2402
01	2403
:	:
:	:
77	2479
78	2480

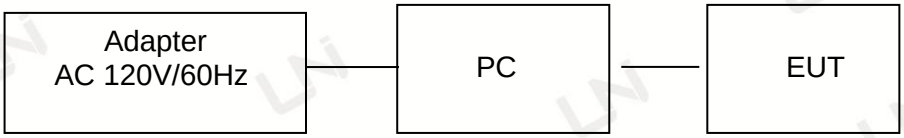
2.3 OPARATION OF EUT DURING TESTING

Operating Mode
The mode is used: Transmitting mode

Low Channel	2402MHz
Middle Channel	2441MHz
High Channel	2480MHz

2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during Conducted testing:



Operation of EUT duringRadiation and Above1GHz Radiation testing:

2.5 Special Accessories

Manufacturer	Description	Model	Serial Number	Certificate
HP	notebook	HP-CQ45	CNU1254XFC	FCC ID
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2.6 MEASUREMENT INSTRUMENTS LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	AMN	Schwarzbeck	NNLK8121	8121370	2019.09.09
2	AMN	ETS	3810/2	00020199	2019.09.09
3	EMI TEST RECEIVER	Rohde&Schwarz	ESCI	101210	2019.09.09
4	AAN	TESEQ	T8-Cat6	38888	2019.09.09
5	Horn Antenna	Sunol	DRH-118	A101415	2019.09.29
6	BicoNILog Antenna	Sunol	JB1 Antenna	A090215	2019.09.29
7	PREAMP	HP	8449B	3008A00160	2019.09.09
8	PREAMP	HP	8447D	2944A07999	2019.09.09
9	EMI TEST RECEIVER	Rohde&Schwarz	ESR3	101891	2019.09.09
10	VECTOR Signal Generator	Rohde&Schwarz	SMU200A	101521	2019.09.28
11	Signal Generator	Agilent	E4421B	MY4335105	2019.09.28
12	Spectrum Analyzer	Agilent	E4407B	MY41440676	2019.09.28
13	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2019.09.28
14	MXA Signal Analyzer	Agilent	N9020A	MY51110104	2019.09.09
15	ANT Tower&Turn table Controller	Champro	EM 1000	60764	2019.09.28
16	Anechoic Chamber	Taihe Maorui	9m*6m*6m	966A0001	2019.09.09
17	Shielding Room	Taihe Maorui	6.4m*4m*3m	643A0001	2019.09.09
18	RF Power sensor	DARE	RPR3006W	15I00041SNO88	2019.03.14
19	RF Power sensor	DARE	RPR3006W	15I00041SNO89	2019.03.14
20	RF power divider	Anritsu	K241B	992289	2019.09.28
21	Wideband radio communication tester	Rohde&Schwarz	CMW500	154987	2019.09.28
22	Biconical antenna	Schwarzbeck	VHA 9103	91032360	2019.09.08
23	Biconical antenna	Schwarzbeck	VHA 9103	91032361	2019.09.08

24	Broadband Hybrid Antennas	Schwarzbeck	VULB9163	VULB9163#958	2019.09.08
25	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1680	2019.01.12
26	Active Receive Loop Antenna	Schwarzbeck	FMZB 1919B	00023	2019.11.02
27	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170651	2019.03.14
28	Microwave Broadband Preamplifier	Schwarzbeck	BBV 9721	100472	2019.10.24
29	Active Loop Antenna	Com-Power	AL-130R	10160009	2019.05.10
30	Power Meter	KEYSIGHT	N1911A	MY50520168	2019.05.10
31	EMI Test Software	FALA	EZ-EMC	FA-03A	2019.05.10

Note: The calibration interval was one year

3 TEST CONDITIONS AND RESULTS

3.1 CONDUCTED EMISSIONS TEST

Limit

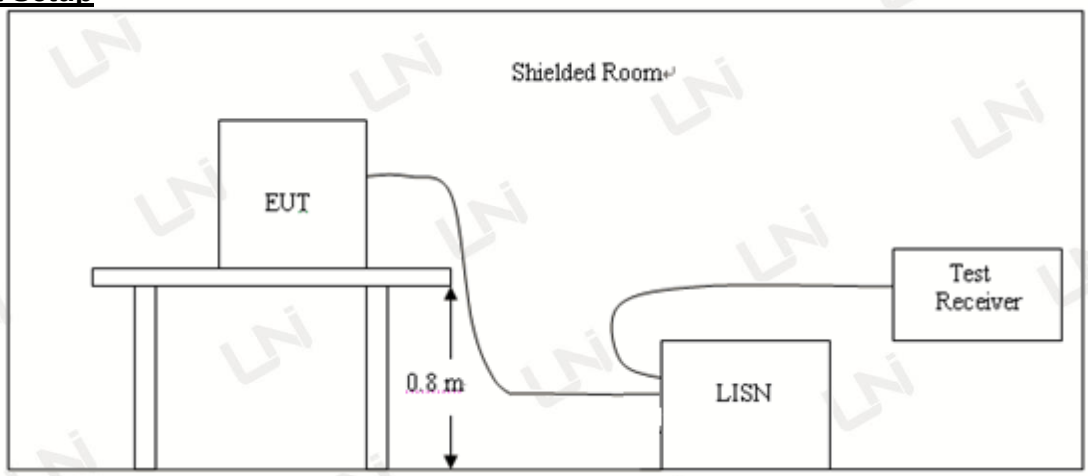
For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	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.

Test Setup



Test Procedure

1,The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. 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 AC 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.

Test Result

---PASS---

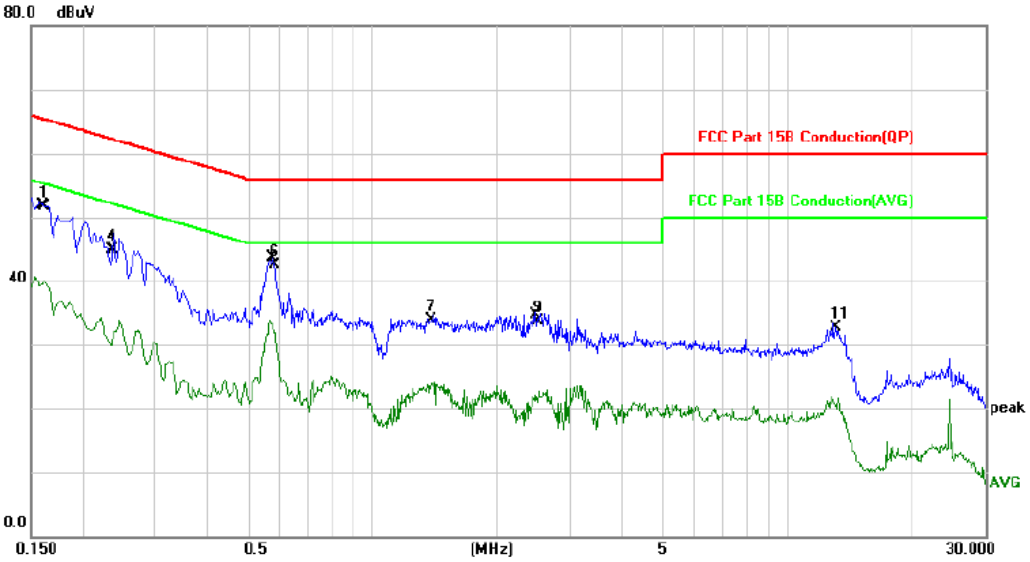
Remark:

1. All modes of GFSK, Pi/4 DQPSK, and 8DPSK were test at Low, Middle, and Highchannel; only the worst result of GFSK Middle Channel was reported as below:
2. Both 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz power supply have been tested, only the worst result of 120 VAC, 60 Hz was reported as below:.

Please refer to test data as follows:

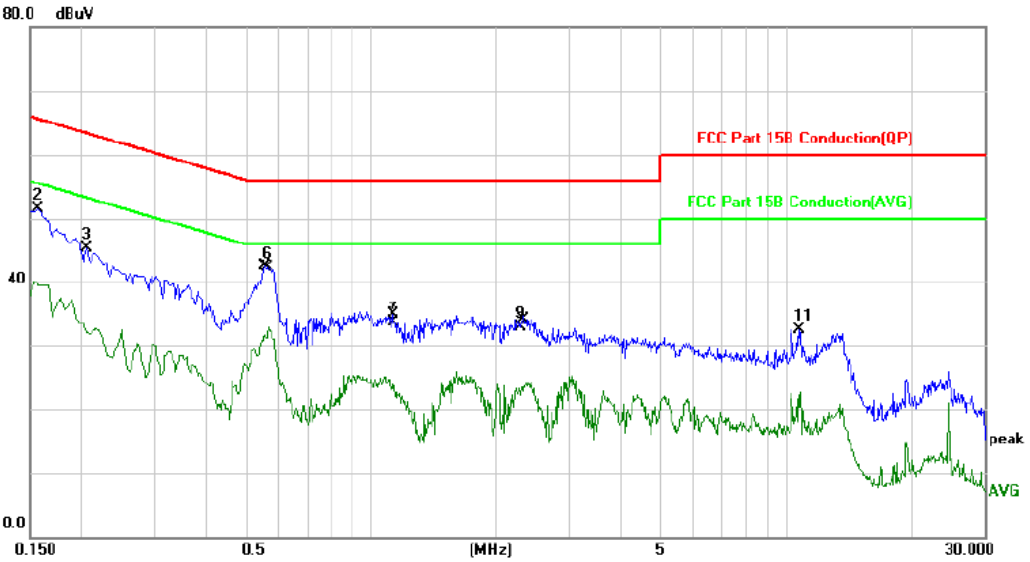
Temperature:	25℃	Relative Humidity:	48%
Test Date:	Dec. 28, 2018	Pressure:	1030hPa
Test Voltage:	AC 120V 60Hz	Polarization:	

Line	L



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1620	51.89	-0.13	51.76	65.36	-13.60	peak	
2		0.1624	39.87	-0.13	39.74	55.34	-15.60	AVG	
3		0.2340	29.98	-0.12	29.86	52.30	-22.44	AVG	
4		0.2353	45.10	-0.12	44.98	62.26	-17.28	peak	
5	*	0.5780	33.02	-0.04	32.98	46.00	-13.02	AVG	
6		0.5820	42.51	-0.04	42.47	56.00	-13.53	peak	
7		1.3860	34.14	-0.17	33.97	56.00	-22.03	peak	
8		1.3860	24.07	-0.17	23.90	46.00	-22.10	AVG	
9		2.5100	33.89	-0.16	33.73	56.00	-22.27	peak	
10		2.5100	21.05	-0.16	20.89	46.00	-25.11	AVG	
11		13.0659	32.76	-0.14	32.62	60.00	-27.38	peak	
12		13.0659	20.37	-0.14	20.23	50.00	-29.77	AVG	

Line	N



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1556	39.98	-0.13	39.85	55.69	-15.84	AVG	
2		0.1580	51.72	-0.13	51.59	65.56	-13.97	peak	
3		0.2060	45.47	-0.13	45.34	63.36	-18.02	peak	
4		0.2060	32.19	-0.13	32.06	53.36	-21.30	AVG	
5		0.5580	31.38	-0.04	31.34	46.00	-14.66	AVG	
6	*	0.5620	42.37	-0.04	42.33	56.00	-13.67	peak	
7		1.1300	33.75	-0.14	33.61	56.00	-22.39	peak	
8		1.1380	23.84	-0.14	23.70	46.00	-22.30	AVG	
9		2.2860	33.07	-0.25	32.82	56.00	-23.18	peak	
10		2.2860	22.52	-0.25	22.27	46.00	-23.73	AVG	
11		10.7900	32.55	-0.11	32.44	60.00	-27.56	peak	
12		10.7940	22.83	-0.11	22.72	50.00	-27.28	AVG	

3.2 RADIATED EMISSION TEST

Limit

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.

In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Except when the requirements applicable to a given device state otherwise, emissions from licence‑exempt transmitters shall comply with the field strength limits shown in table below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission

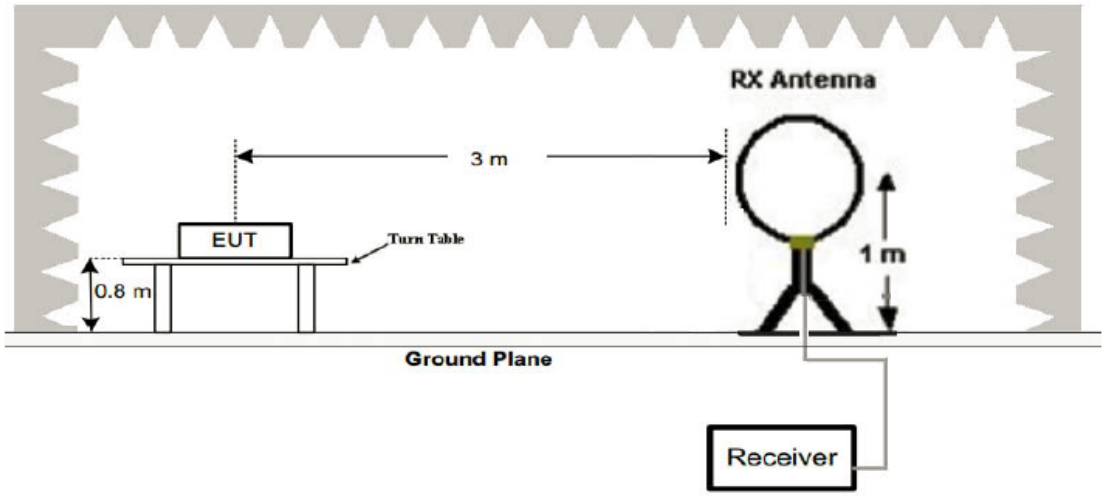
Unwanted emissions that fall into restricted bands shall comply with the limits specified in RSS-Gen; and Unwanted emissions that do not fall within the restricted frequency bands shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

Radiated emission limits

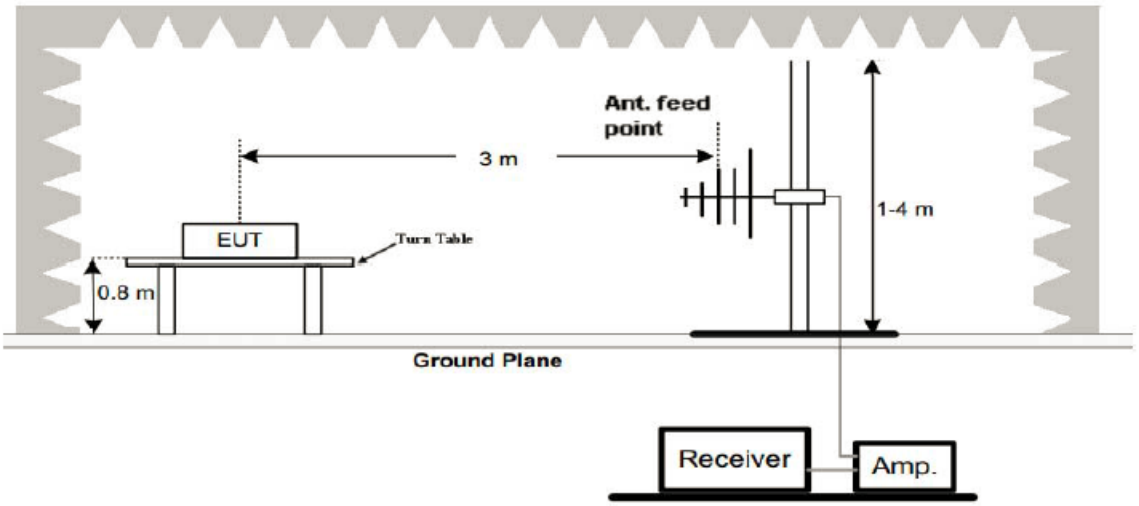
Frequency(MHz)	Distance(Meters)	Radiated(dBμV/m)	Radiated(μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

Test Setup

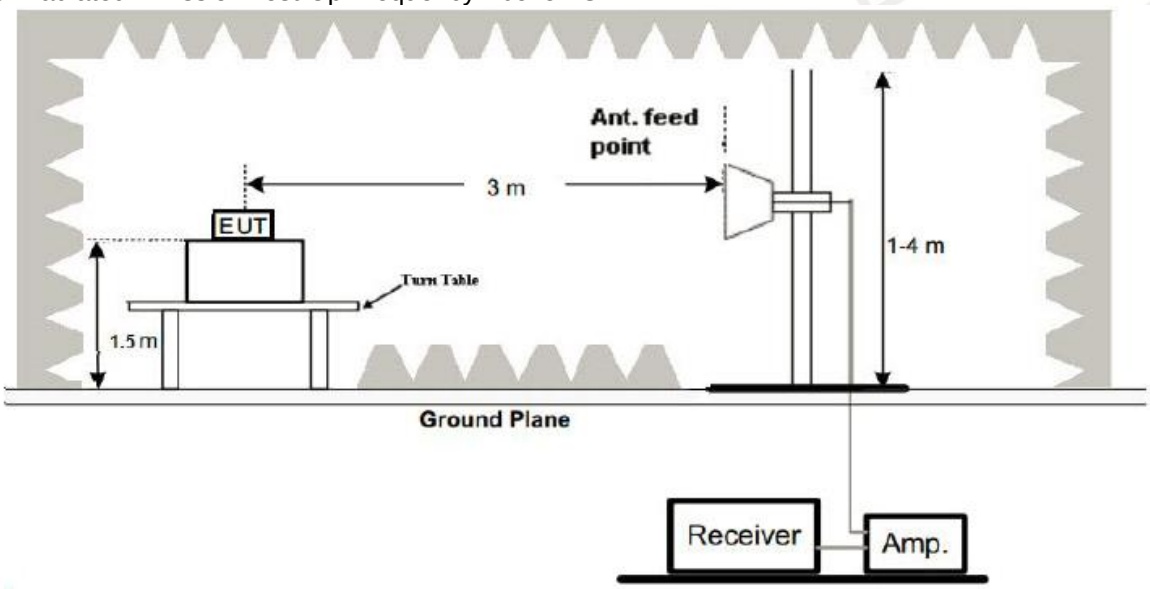
1. Radiated Emission Test-Up Frequency Below 30MHz



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



3. Radiated Emission Test-Up Frequency Above 1GHz



Test Procedure

1. Below 1GHz measurement the EUT is placed on a turntablewhich is 0.8m above ground plane, and above 1GHz measurementEUT was placed on alow permittivity and low loss tangent turn table which is 1.5m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. Radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Bilog Antenna	3
1GHz-18GHz	Horn Antenna	3
18GHz-25GHz	HornAnternna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

TEST RESULTS

---PASS---

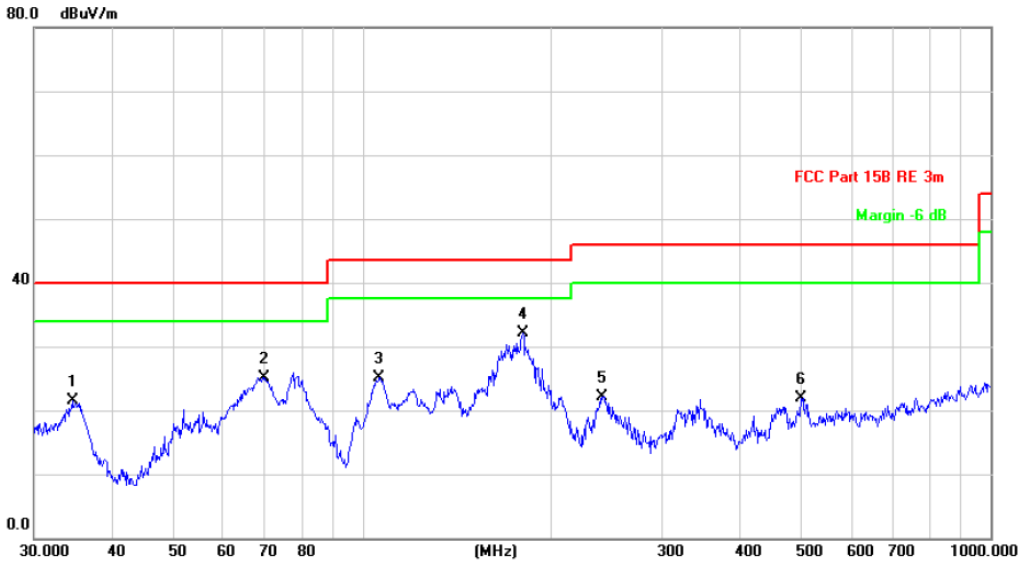
Remark:
1. All the test modes completed for test. Only the worst mode was reported.
2. By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “Z axis” position was the worst, and test data recorded in this report.
3. Radiated emission test from 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:

Note: For test below 1GHz all modes of GFSK, Pi/4 DQPSK, were test at Low, Middle, and High channel; only the worst result of GFSK Middle Channel was reported as below:

Temperature:	25℃	Relative Humidity:	48%
Test Date:	Dec. 28, 2018	Pressure:	1030hPa
Test Voltage:	DC 3.7V from battery	Polarization:	Horizontal/Vertical

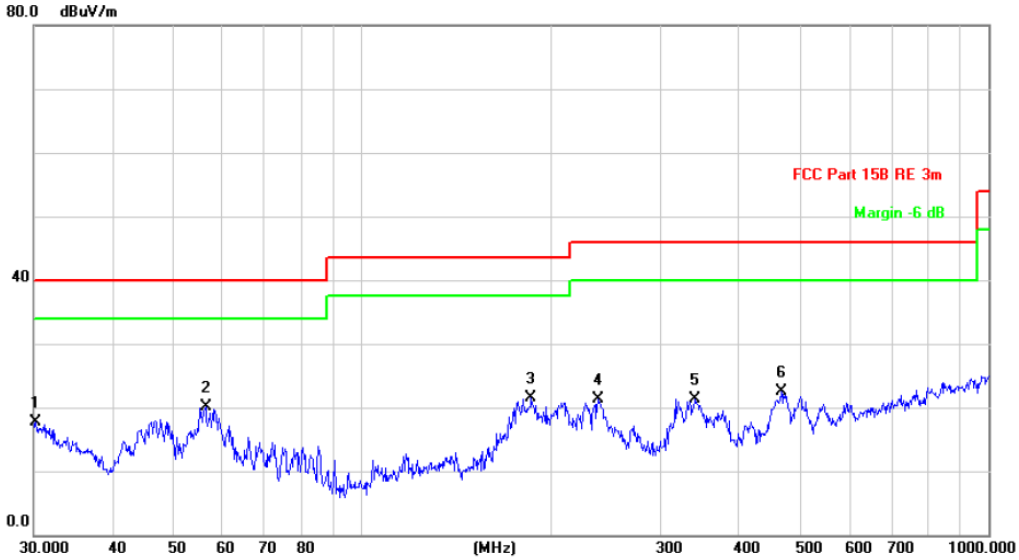
Polarization:	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		34.5173	30.19	-8.67	21.52	40.00	-18.48	QP			
2		69.6005	43.97	-18.81	25.16	40.00	-14.84	QP			
3		106.3850	38.98	-13.87	25.11	43.50	-18.39	QP			
4	*	180.0165	46.42	-14.31	32.11	43.50	-11.39	QP			
5		240.8304	35.46	-13.30	22.16	46.00	-23.84	QP			
6		499.4247	28.33	-6.43	21.90	46.00	-24.10	QP			

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

Polarization:	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		30.2111	21.46	-3.68	17.78	40.00	-22.22	QP			
2	*	56.3948	39.04	-18.88	20.16	40.00	-19.84	QP			
3		186.4409	35.98	-14.43	21.55	43.50	-21.95	QP			
4		238.3102	34.66	-13.38	21.28	46.00	-24.72	QP			
5		340.7817	31.48	-10.14	21.34	46.00	-24.66	QP			
6		467.2349	29.38	-6.83	22.55	46.00	-23.45	QP			

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 30MHz was 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:

Note: Both GFSK, Pi/4 DQPSK have been tested; only worse case GFSK is reported.

GFSK: CH Low (2402MHz)Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4804.00	57.59	-3.64	53.95	74	20.05	PK
4804.00	44.73	-3.64	41.09	54	12.91	AV
7206.00	54.55	-0.95	53.60	74	20.40	PK
7206.00	41.38	-0.95	40.43	54	13.57	AV
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GFSK: CH Low (2402MHz) Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4804.00	58.65	-3.64	55.01	74	18.99	PK
4804.00	44.18	-3.64	40.54	54	13.46	AV
7206.00	54.81	-0.95	53.86	74	20.14	PK
7206.00	42.05	-0.95	41.10	54	12.90	AV
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GFSK: CH Middle (2441MHz) Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4882.00	58.41	-3.51	54.90	74	19.10	PK
4882.00	43.48	-3.51	39.97	54	14.03	AV
7323.00	54.71	-0.82	53.89	74	20.11	PK
7323.00	40.51	-0.82	39.69	54	14.31	AV
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GFSK: CH Middle (2441MHz) Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4882.00	57.26	-3.51	53.75	74	20.25	PK
4882.00	45.73	-3.51	42.22	54	11.78	AV
7323.00	54.93	-0.82	54.11	74	19.89	PK
7323.00	40.83	-0.82	40.01	54	13.99	AV
--	--	--	--	--	--	--

GFSK: CH High (2480MHz) Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4960.00	58.11	-3.43	54.68	74	19.32	PK
4960.00	45.39	-3.43	41.96	54	12.04	AV
7440.00	55.17	-0.75	54.42	74	19.58	PK
7440.00	42.26	-0.75	41.51	54	12.49	AV
--	--	--	--	--	--	--

GFSK: CH High (2480MHz) Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4960.00	56.81	-3.43	53.38	74	20.62	PK
4960.00	44.88	-3.43	41.45	54	12.55	AV
7440.00	55.02	-0.75	54.27	74	19.73	PK
7440.00	42.78	-0.75	42.03	54	11.97	AV
--	--	--	--	--	--	--

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz.
(2) Factor = Antenna Factor + Cable Loss – Pre-amplifier.
(3) Margin= Limits –Emission Level
(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) 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.
(6) All modes of operation were investigated and the worst-case emissions are reported.

Radiated Band Edge Test:

Note: Both GFSK, Pi/4 DQPSK have been tested; only worse case GFSK is reported.

Operation Mode: GFSK TX CH Low (2402MHz)

Horizontal (Worst case):

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2335.00	52.99	-5.78	47.21	74	26.79	PK
2335.00	--	--	--	54	--	AV
2390.00	56.10	-5.84	50.26	74	23.74	PK
2390.00	--	--	--	54	--	AV
2400.00	57.08	-5.84	51.24	74	22.76	PK
2400.00	--	--	--	54	--	AV

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2335.00	54.03	-5.78	48.25	74	25.75	PK
2335.00	--	--	--	54	--	AV
2390.00	56.43	-5.84	50.59	74	23.41	PK
2390.00	--	--	--	54	--	AV
2400.00	57.52	-5.84	51.68	74	22.32	PK
2400.00	--	--	--	54	--	AV

Operation Mode: GFSK TX CH High (2480MHz)

Horizontal (Worst case):

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	55.88	-5.65	50.23	74	23.77	PK
2483.50	--	--	--	54	--	AV
2489.00	54.21	-5.65	48.56	74	25.44	PK
2489.00	--	--	--	54	--	AV
2500.00	51.92	-5.72	46.20	74	27.80	PK
2500.00	--	--	--	54	--	AV

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	57.21	-5.65	51.56	74	22.44	PK
2483.50	--	--	--	54	--	AV
2489.00	55.17	-5.65	49.52	74	24.48	PK
2489.00	--	--	--	54	--	AV
2500.00	52.83	-5.72	47.11	74	26.89	PK
2500.00	--	--	--	54	--	AV

Remark：

(1) Factor = Antenna Factor + Cable Loss – Pre-amplifier.

(2) Margin= Limits –Emission Level

(3) -- Mean the PK detector measured value is below average limit.

3.3 CONDUCTED OUTPUT POWER

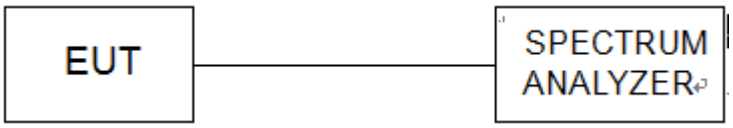
Limit

The Maximum Peak Output Power Measurement is 30dBm.

Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power sensor.

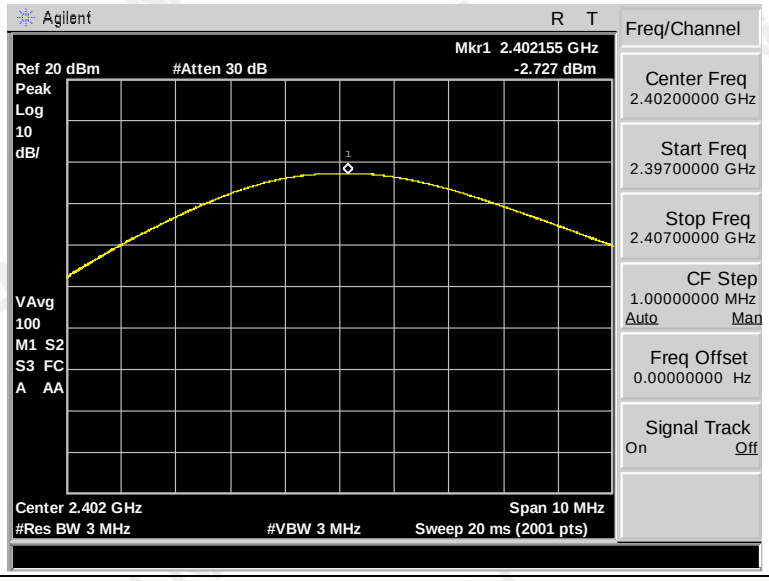
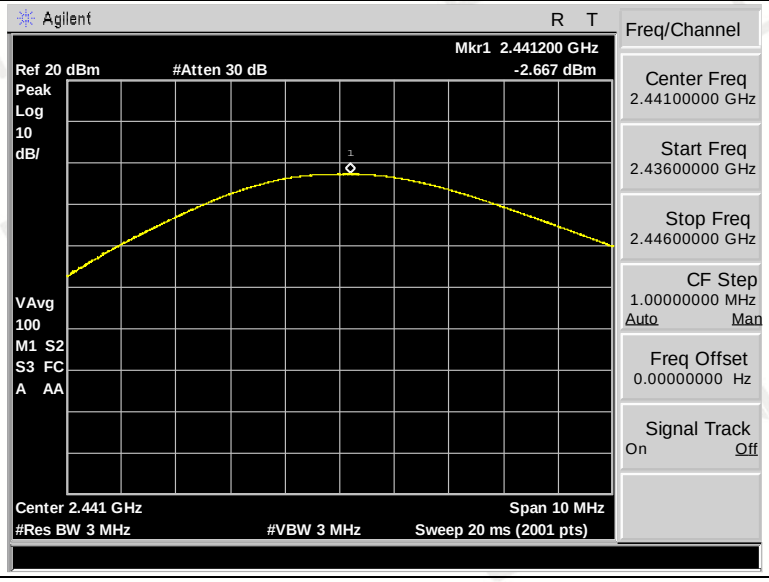
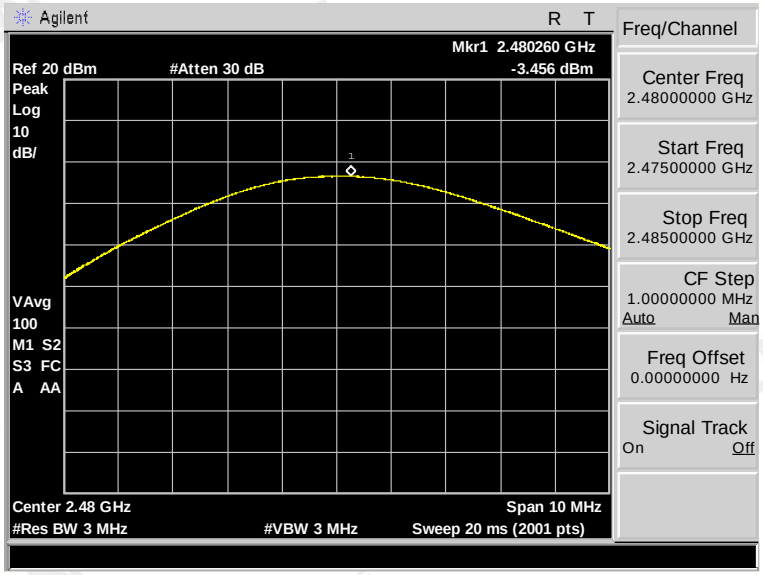
Test Configuration

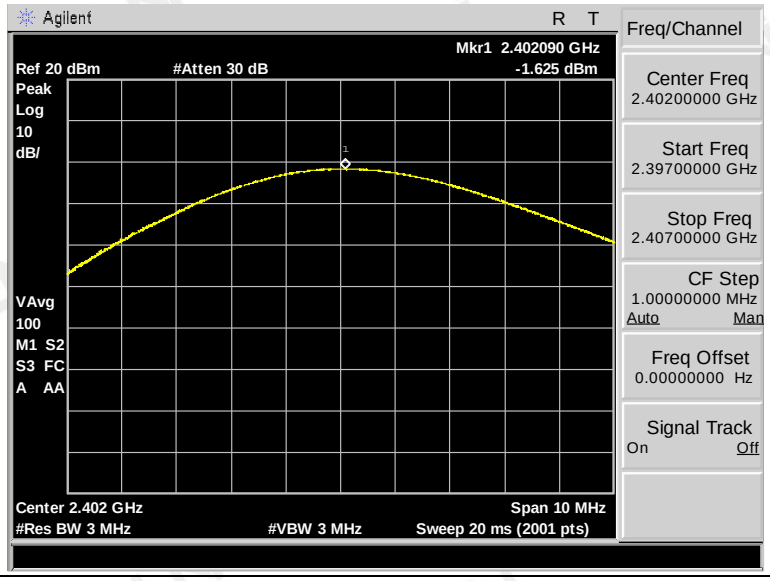
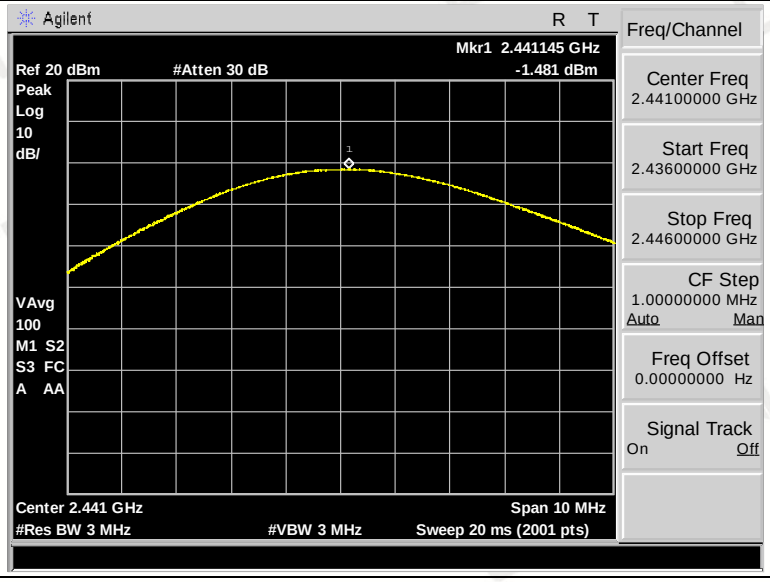
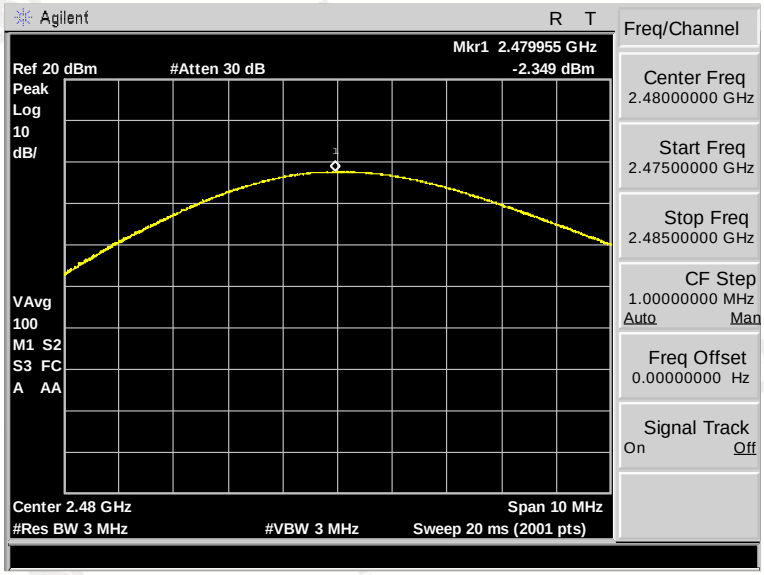


Test Result

Type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK	00	-2.727	30	Pass
	39	-2.667		
	78	-3.456		
pi/4DQPSK	00	-1.625	30	Pass
	39	-1.481		
	78	-2.349		

Note: 1.The test results including the cable lose.

GFSK Modulation
CH00

CH39

CH78


pi/4DQPSK Modulation
CH00

CH39

CH78


3.4 OCCUPIED BANDWIDTH MEASUREMENT

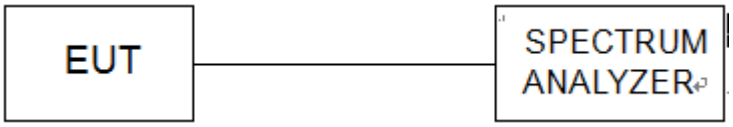
Limit

For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwidth.

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30 KHz RBW and 100 KHz VBW.
The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

Test Configuration



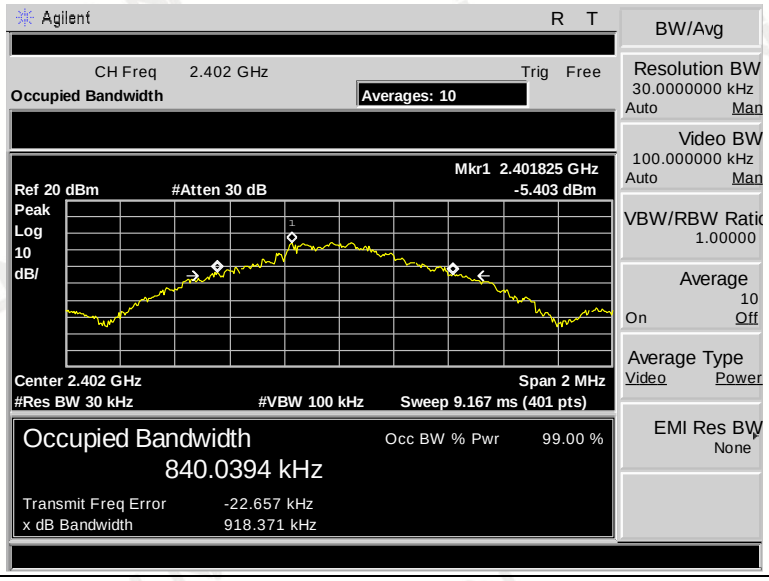
Test Result

---PASS---

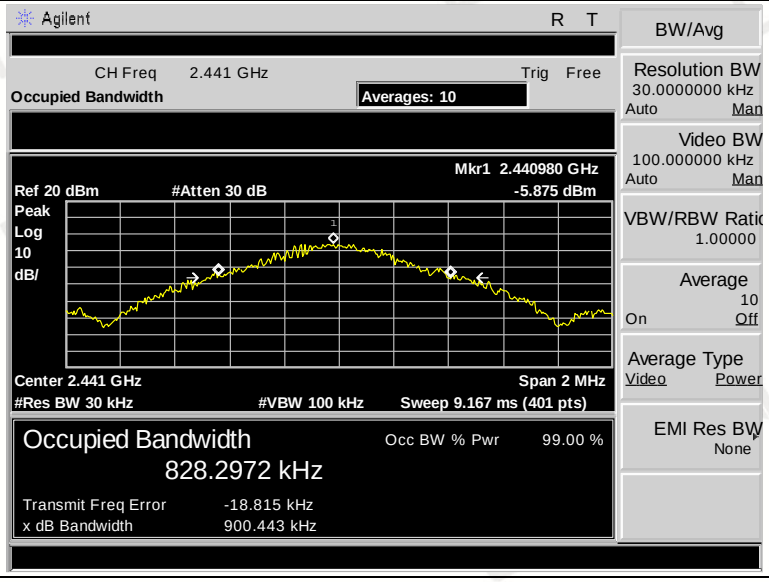
Modulation	Channel	OBW (MHz)	20dB bandwidth (MHz) 99%	Result
GFSK	CH00	0.8400	0.918	Pass
	CH39	0.8283	0.900	
	CH78	0.8327	0.842	
pi/4DQPSK	CH00	1.1845	1.246	
	CH39	1.1845	1.247	
	CH78	1.2006	1.273	

GFSK Modulation

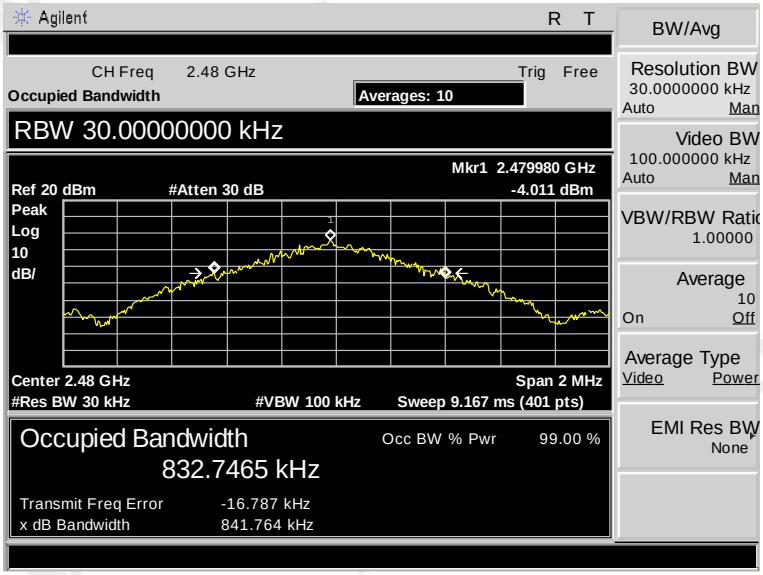
CH00

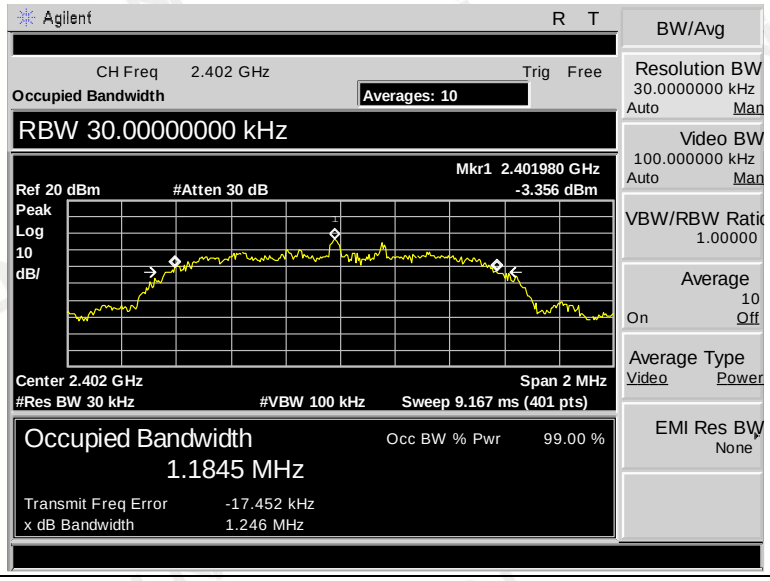
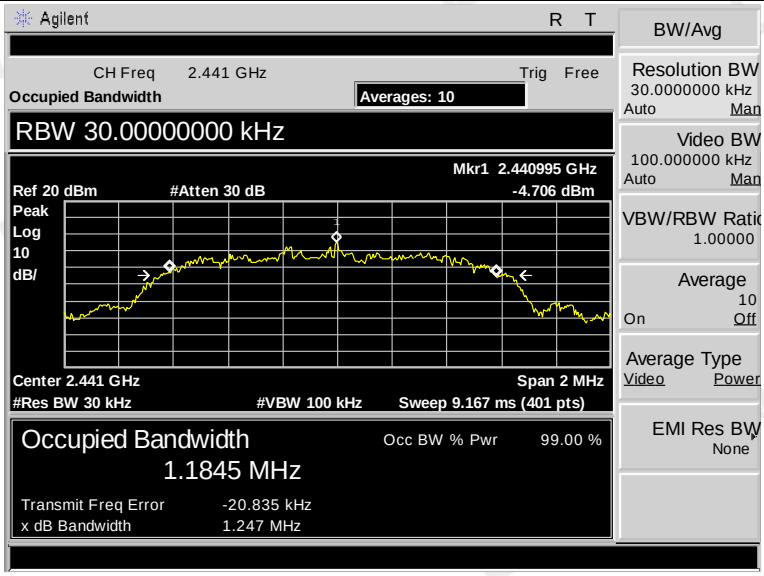
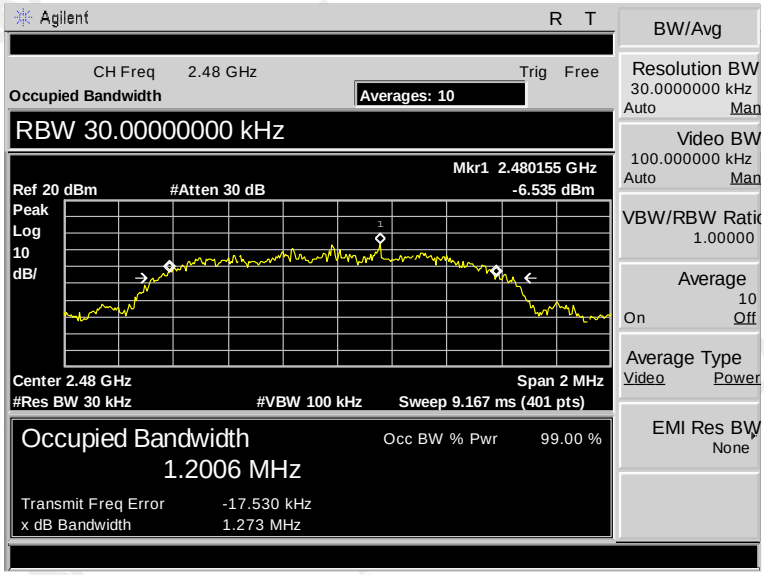


CH39



CH78



pi/4DQPSK Modulation
CH00

CH39

CH78


3.5 Frequency Separation

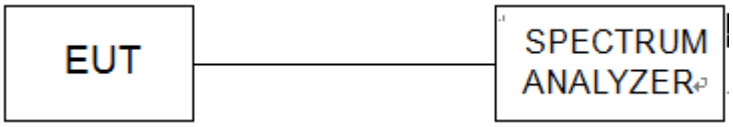
LIMIT

According to 15.247(a)(1),frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with100KHz RBW and 300 KHz VBW.

Test Configuration



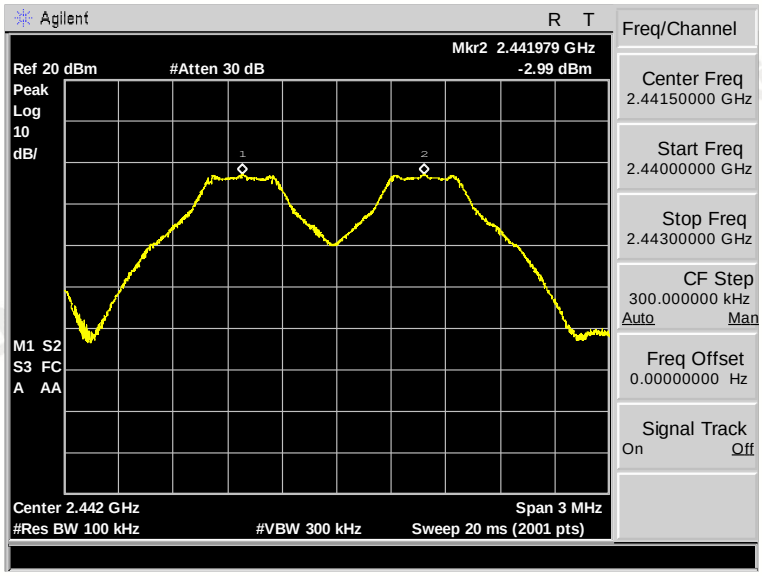
TEST RESULTS

Modulation	Channel	Channel Separation (MHz)	Limit(MHz)	Result
GFSK	CH38	1.000	25KHz or 2/3*20dB bandwidth	Pass
	CH39			
pi/4DQPSK	CH38	1.007	25KHz or 2/3*20dB bandwidth	Pass
	CH39			

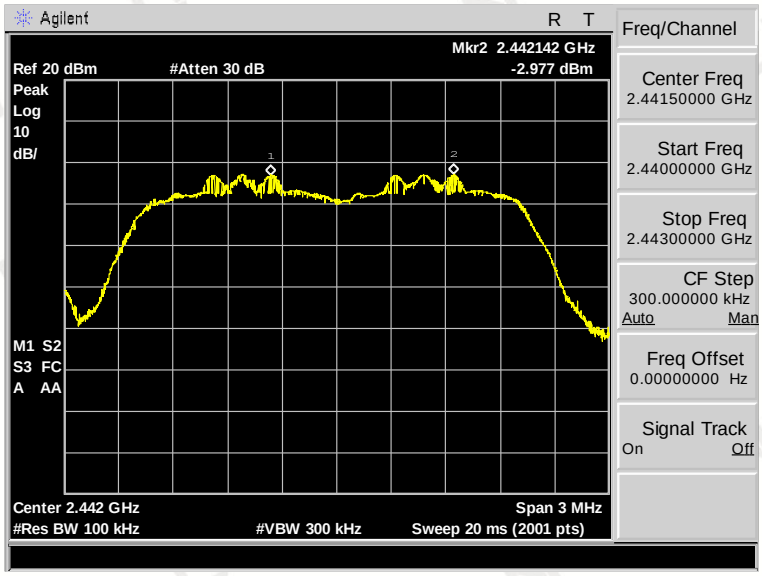
Note:

We have tested all mode at high, middle and low channel, and recorded worst case at middle

GFSK Modulation



pi/4DQPSKModulation



3.6 Number of hopping frequency

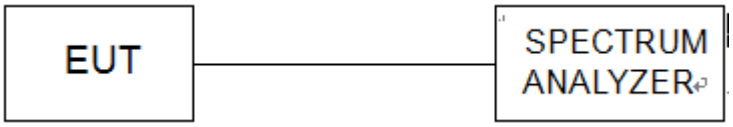
Limit

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set spectrum analyzer start 2400MHz to 2483.5MHz with 100 KHz RBW and 300 KHz VBW.

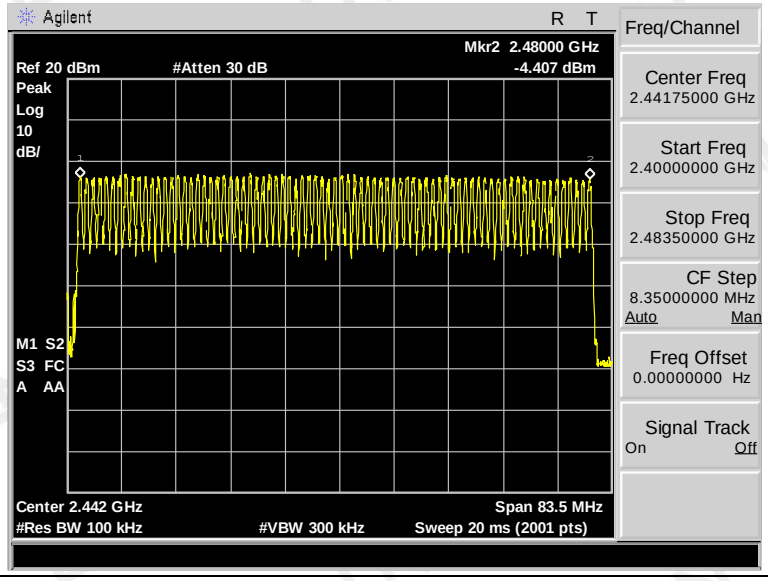
Test Configuration

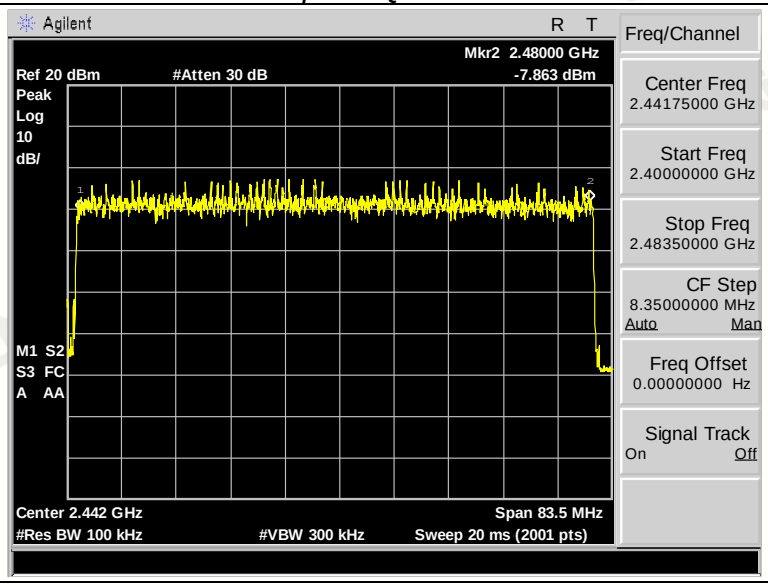


Test Results

Modulation	Number of Hopping Channel	Limit	Result
GFSK	79	≥15	Pass
π/4DQPSK	79		

GFSK



pi/4DQPSK


Agilent
R T
Mkr2 2.48000 GHz
Ref 20 dBm
#Atten 30 dB
-7.863 dBm
Peak
Log
10
dB/
M1 S2
S3 FC
A AA
Center 2.442 GHz
Span 83.5 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 20 ms (2001 pts)
Freq/Channel
Center Freq
2.44175000 GHz
Start Freq
2.40000000 GHz
Stop Freq
2.48350000 GHz
CF Step
8.35000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off

3.7 Time of Occupancy (Dwell Time)

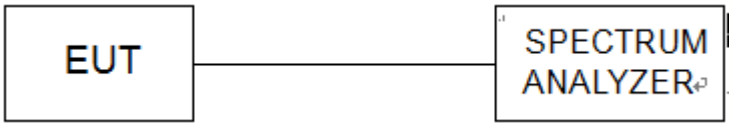
Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with 1MHz RBW and 1MHz VBW, Span 0Hz.

Test Configuration



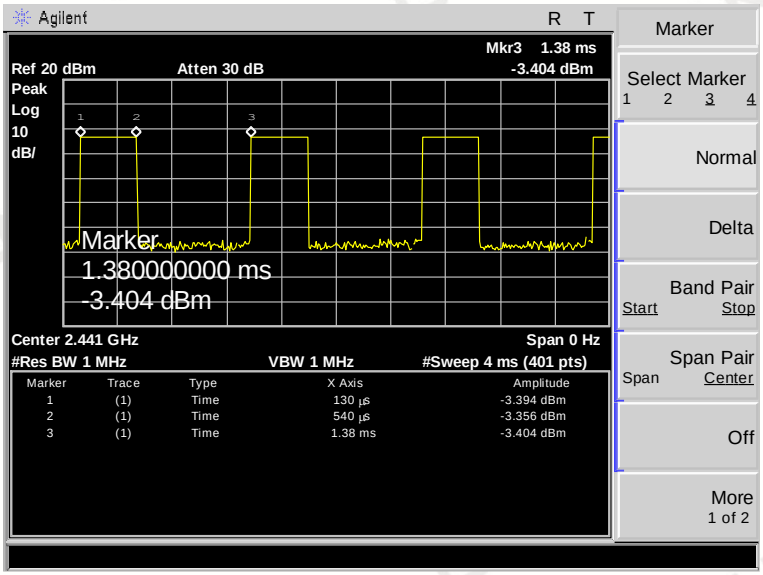
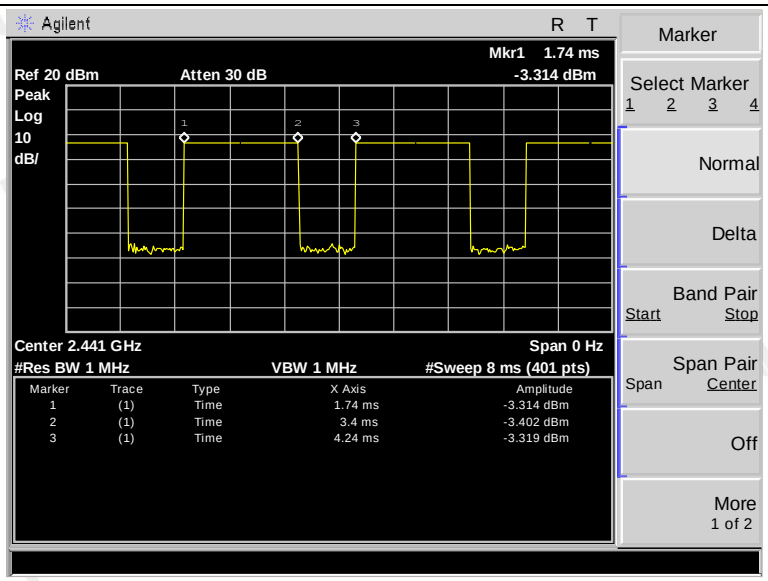
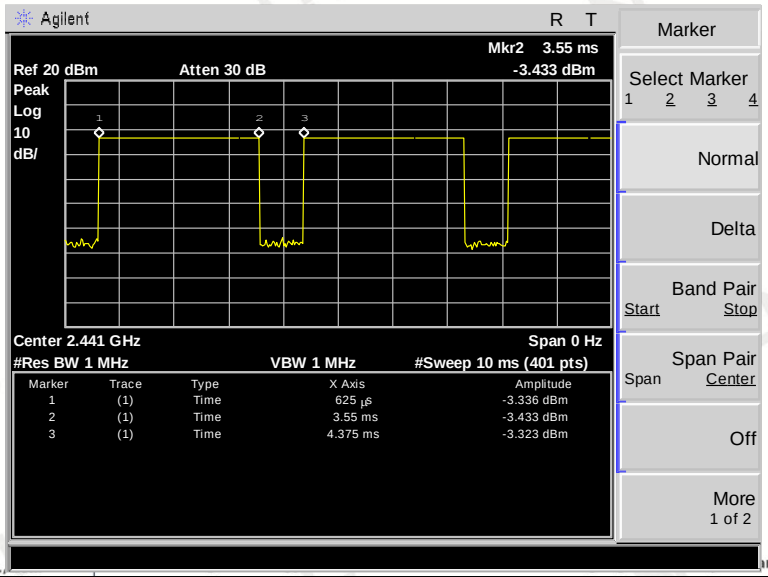
Test Results

Modulation	Packet	Pulse time (ms)	Dwell time (ms)	Limit (s)	Result
GFSK	DH1	0.410	0.131	0.40	Pass
	DH3	1.660	0.266		
	DH5	2.925	0.312		
π/4DQPSK	2-DH1	0.400	0.128	0.40	Pass
	2-DH3	1.660	0.266		
	2-DH5	2.925	0.312		

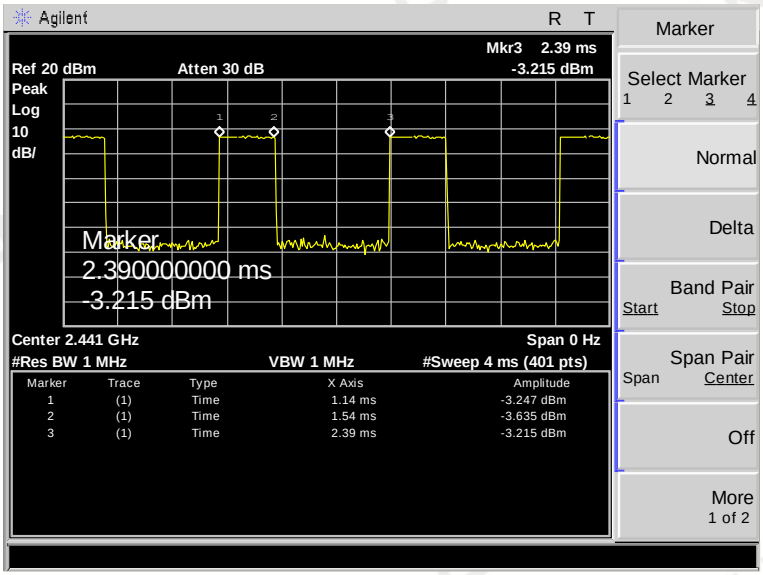
Note:

1. We have tested all mode at high,middle and low channel,andrecoreded worst case at middle channel.
2. Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second for DH1, 2-DH1, 3-DH1

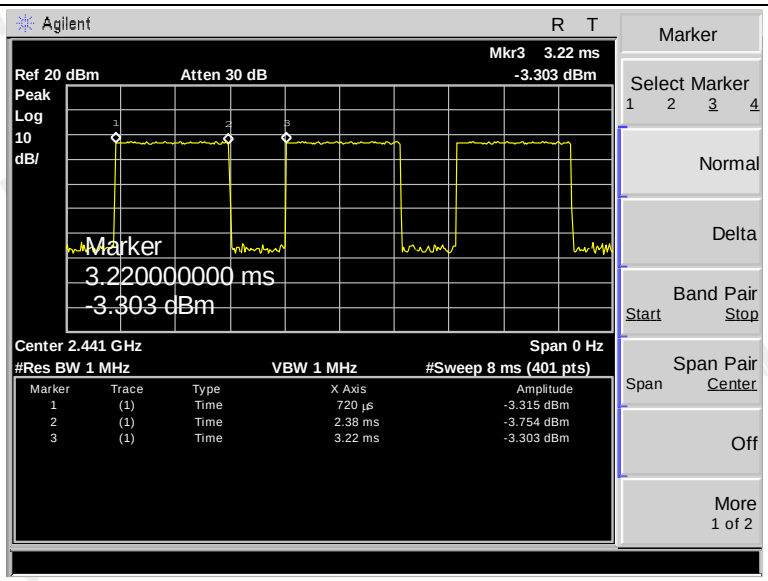
   Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second for DH3, 2-DH3, 3-DH3

GFSK
DH1

DH3

DH5


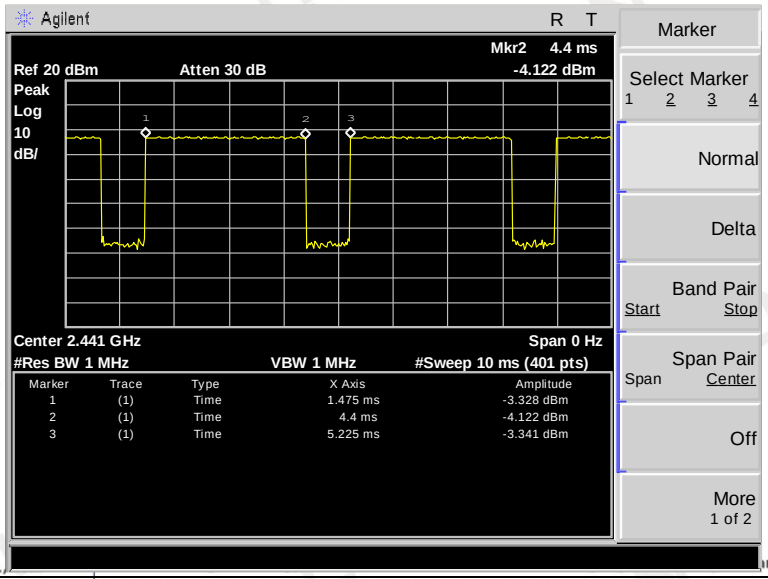
π/4DQPSK
2-DH1



2-DH3



2-DH5



3.8 OUT-OF BAND EMISSIONS

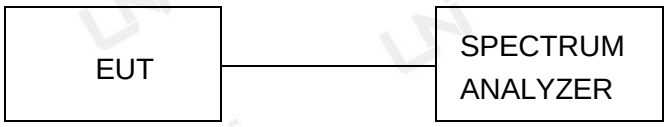
Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desiredpower, based on either an RF con-ducted or a radiated measurement, pro-vided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter com-plies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

Test Procedure

Connect the transmitter output to spectrumanalyzer using a low loss RF cable, and set the spectrumanalyzer to RBW=100 kHz, VBW= 300 kHz, peak detector , and max hold. Measurements utilizing these setting are made of the in-band reference level, bandedge and out-of-band emissions.

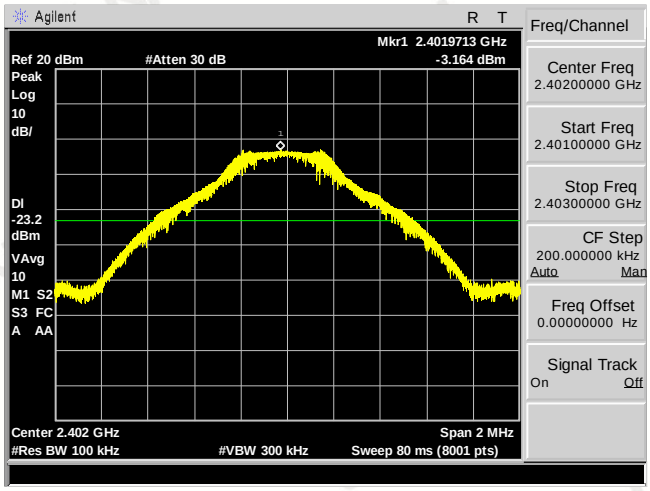
Test Configuration

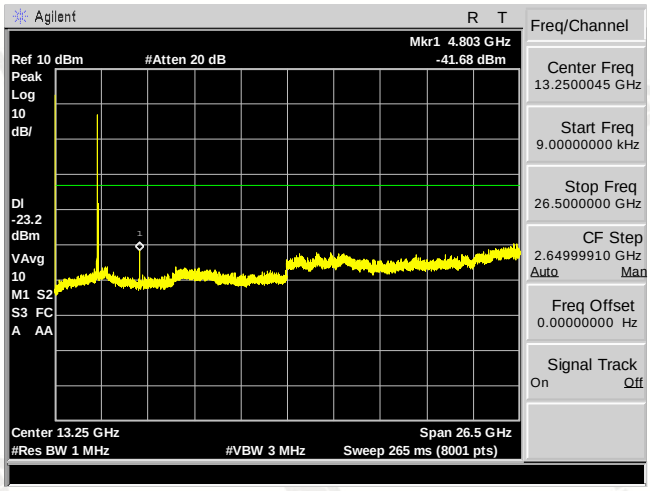


Test Results

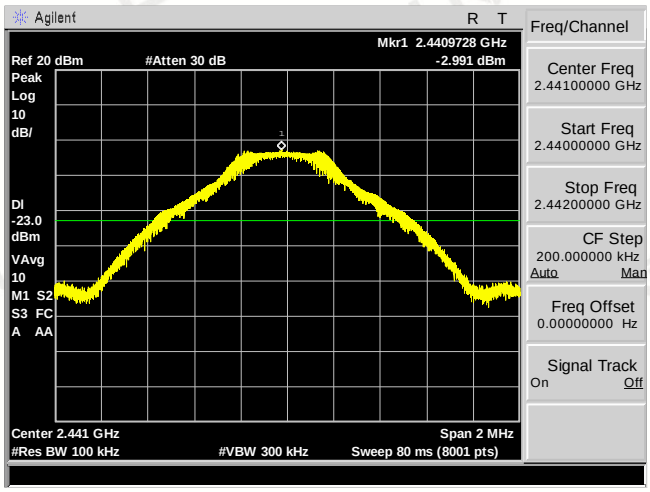
Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandage measurement data.

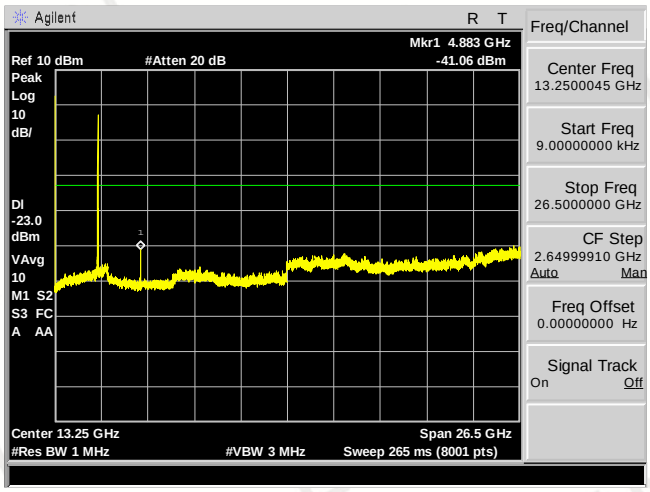
GFSK CH00



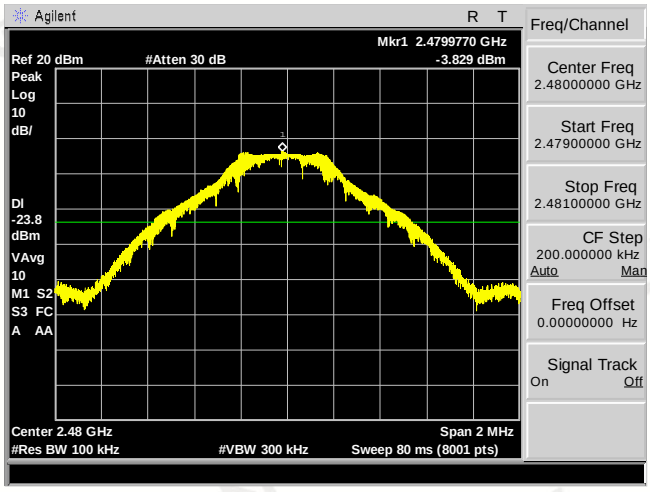


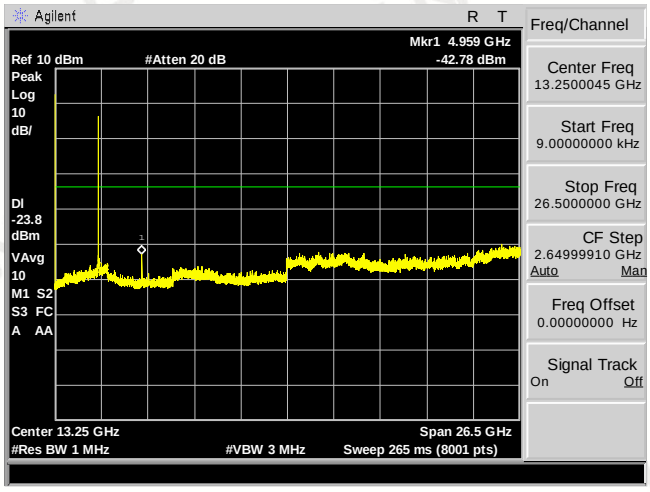
GFSK CH39



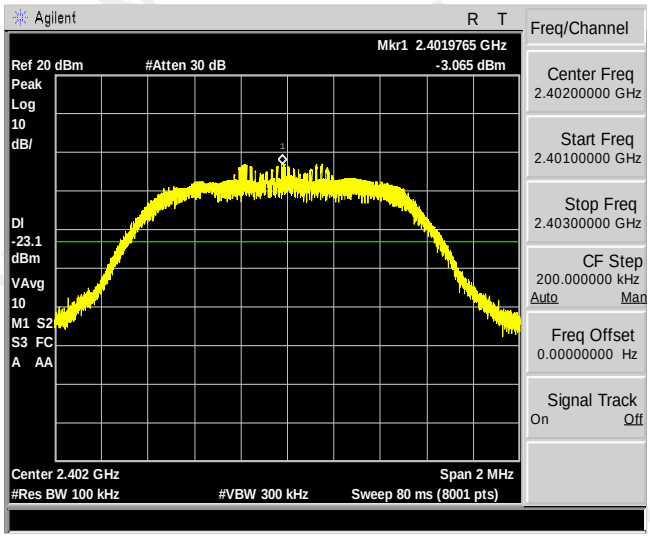


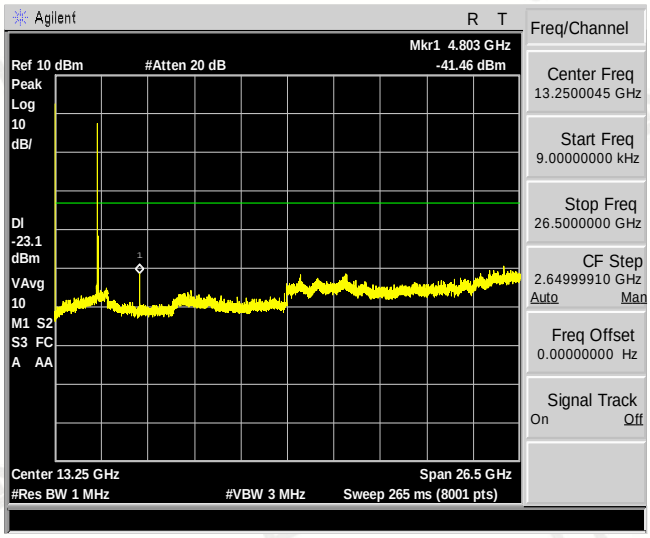
GFSK CH78



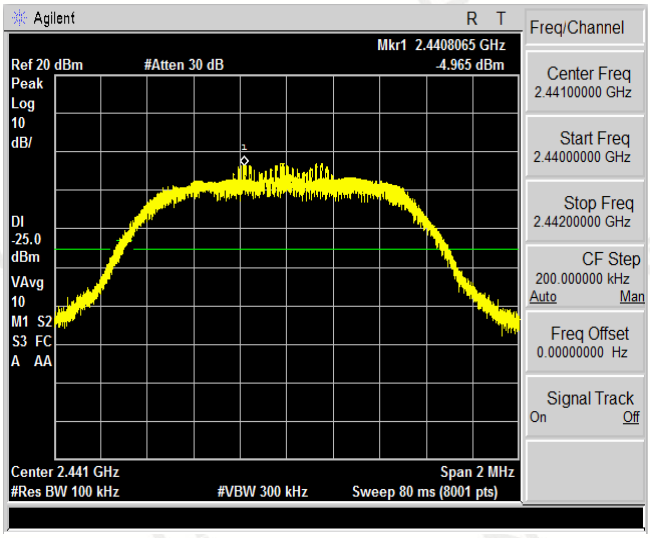


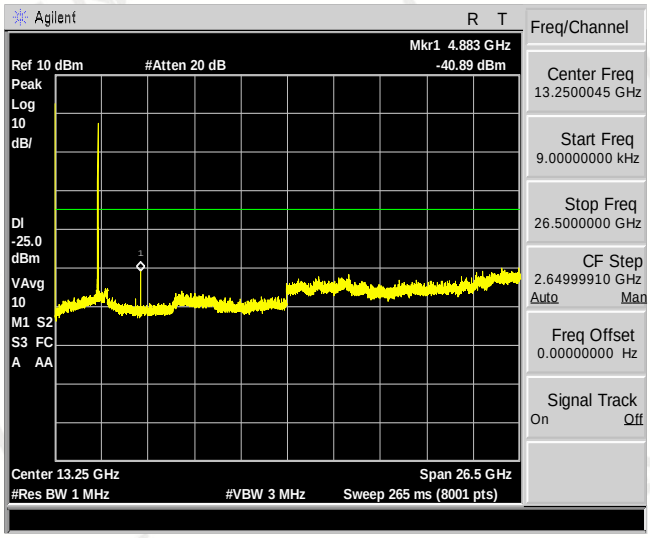
π/4DQPSK CH00



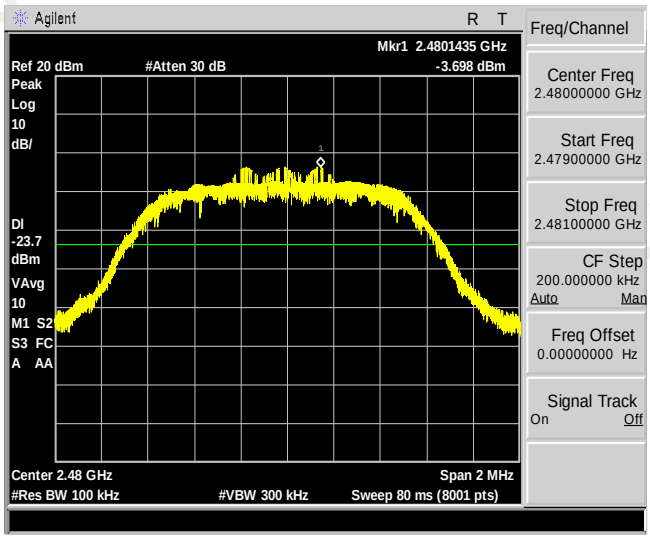


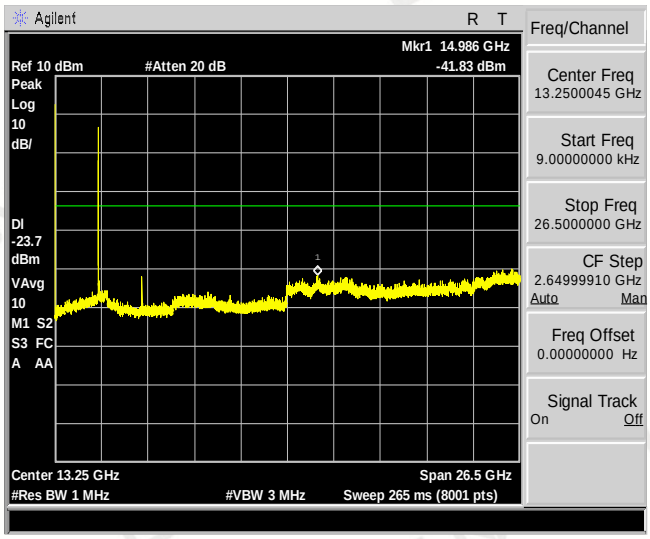
π/4DQPSK CH39





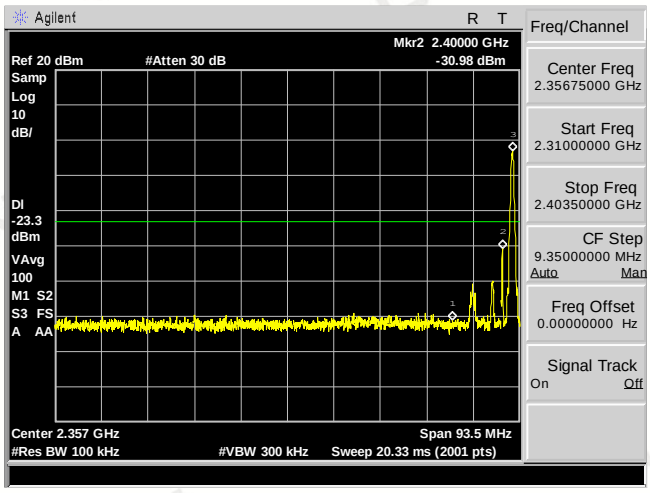
π/4DQPSK CH78



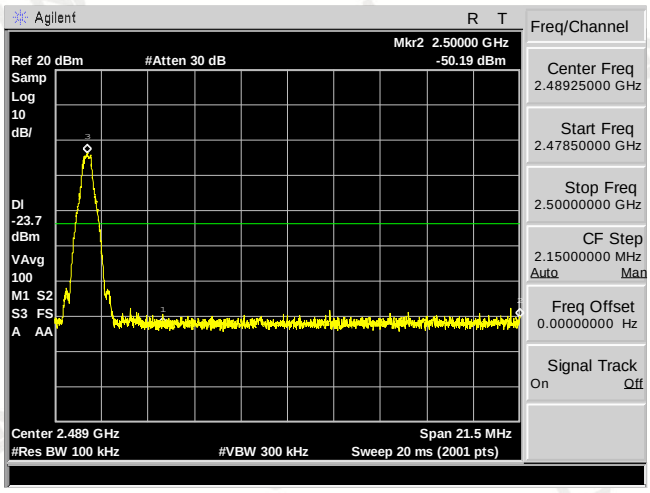


Conducted Band EdgeTest:

GFSK



Left Band edge hoping off



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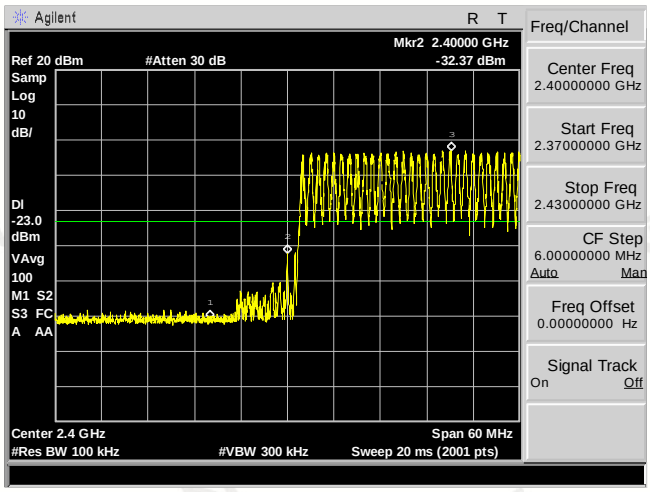

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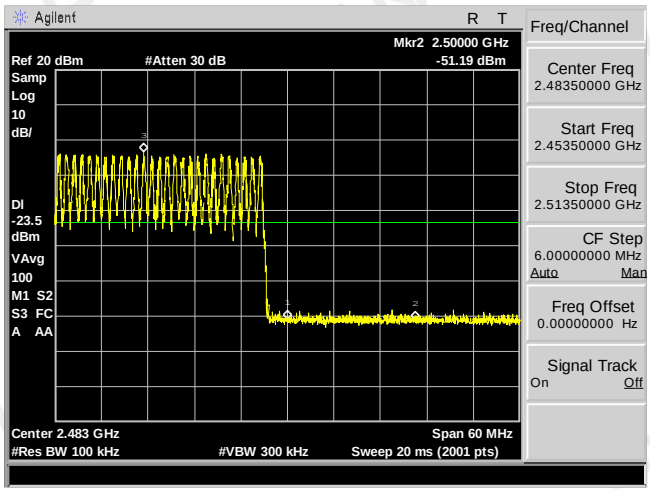
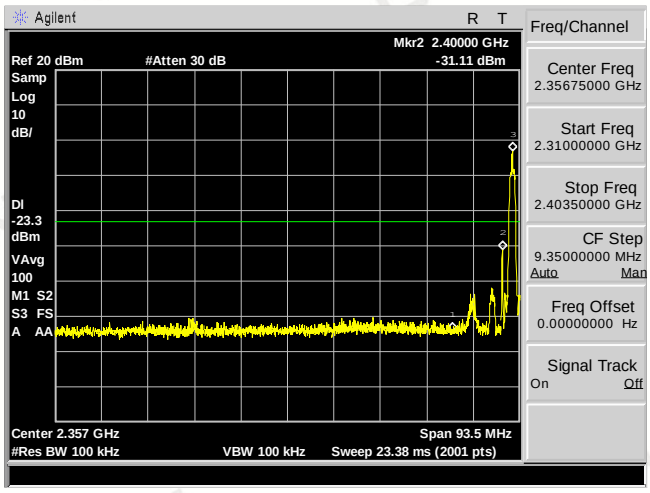
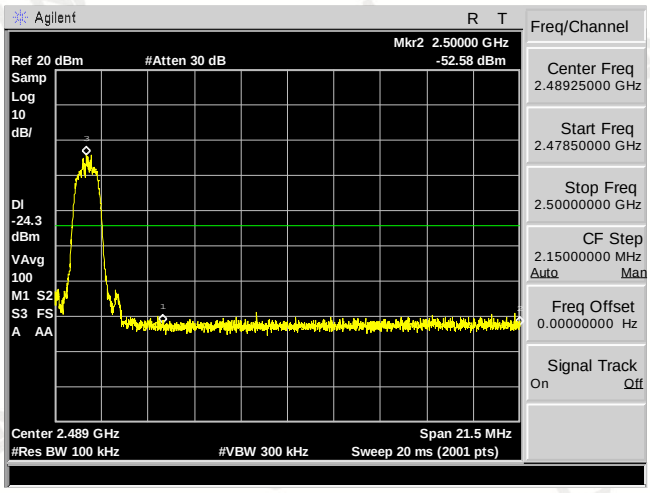
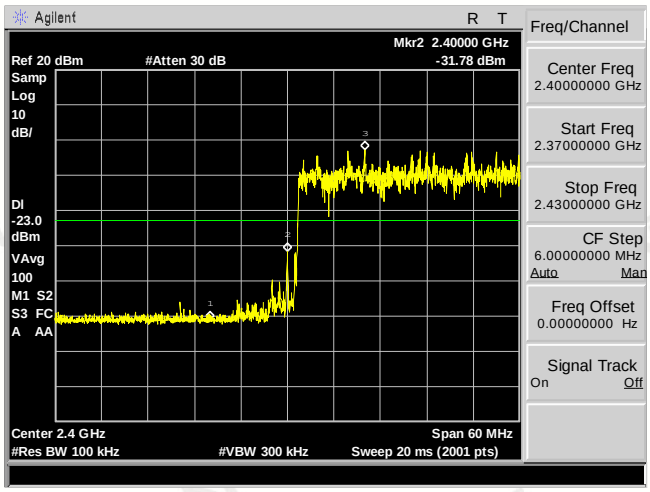
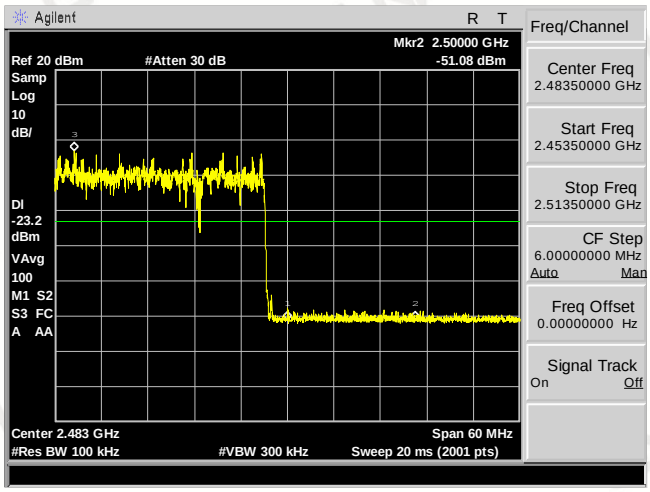


RightBand edge hoping on

π/4DQPSK	
	
Left Band edge hoping off	RightBand edge hoping off
	
Left Band edge hoping on	RightBand edge hoping on

3.9 Pseudorandom Frequency Hopping Sequence

TEST APPLICABLE

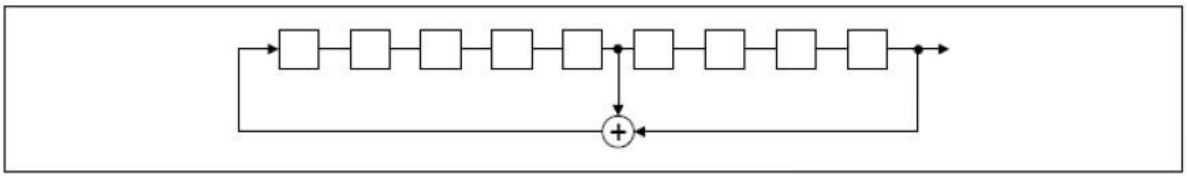
For 47 CFR Part 15C section 15.247 (g) (h) requirement:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence Requirement

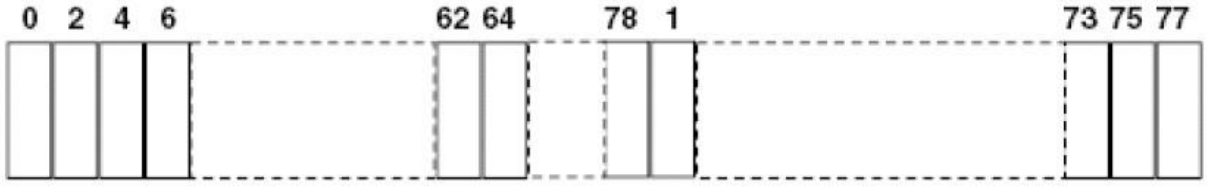
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the firststage. The sequence begins with the first one of 9 consecutive ones, forexample: the shift register is initialized with nine ones.

- Number of shift register stages:9
- Length of pseudo-random sequence:29-1=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 follows:



Each frequency used equally on the average by each transmitter.

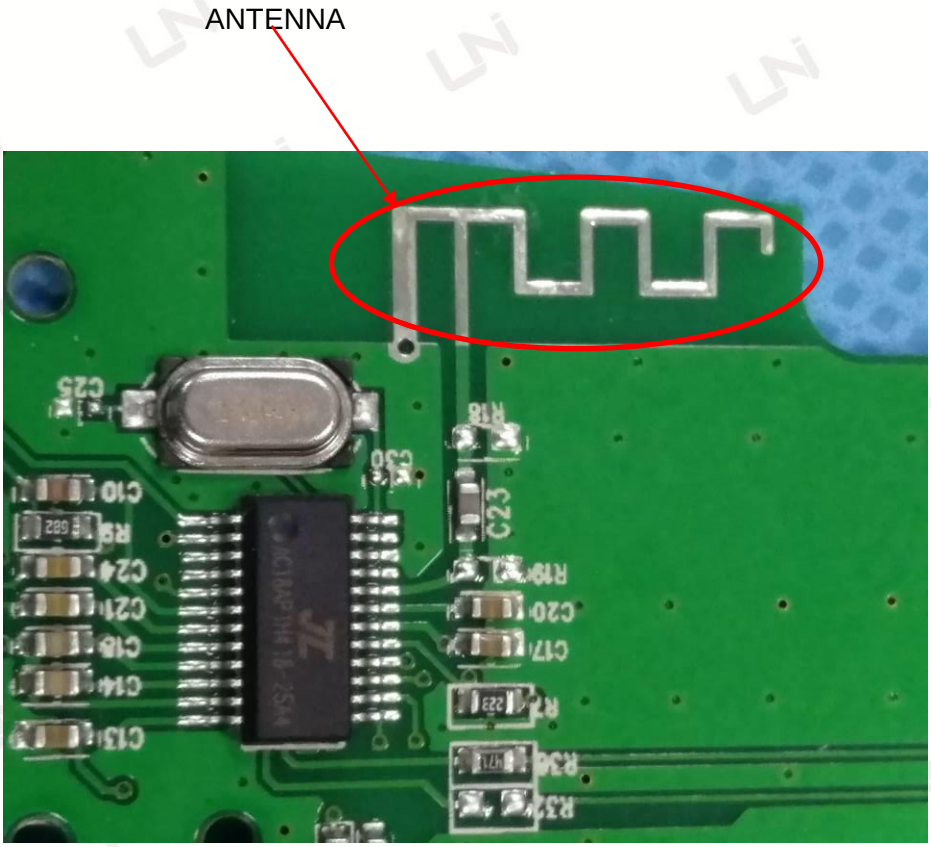
According to Bluetooth Core Specification, Bluetooth receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any Bluetooth transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g)
According to Bluetooth Core Specification, the Bluetooth system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.
Compliance for section 15.247(h)
According to Bluetooth Core specification, the Bluetooth system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels. According to the Bluetooth Core specification, the Bluetooth system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

3.10 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.

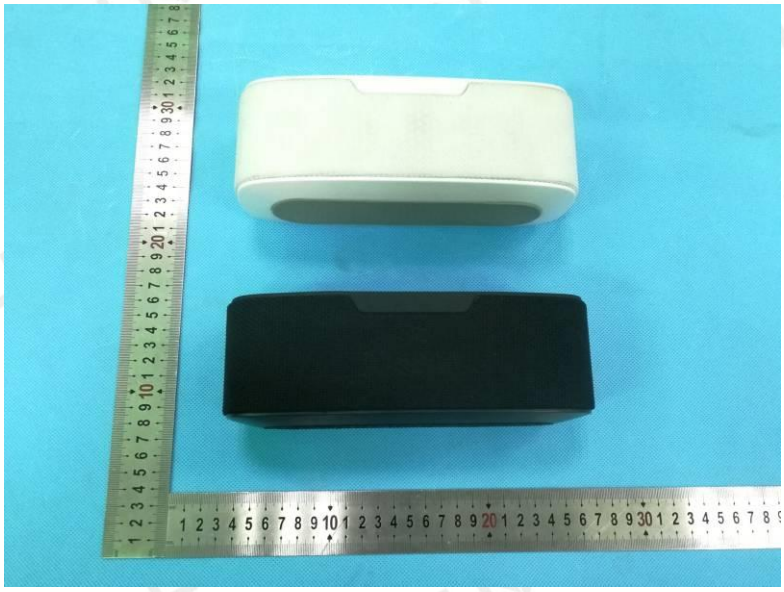
Antenna Connected Construction
The antenna used in this product is anIntegral Antenna, the directional gains of antenna used for transmitting is 0.0dBi.



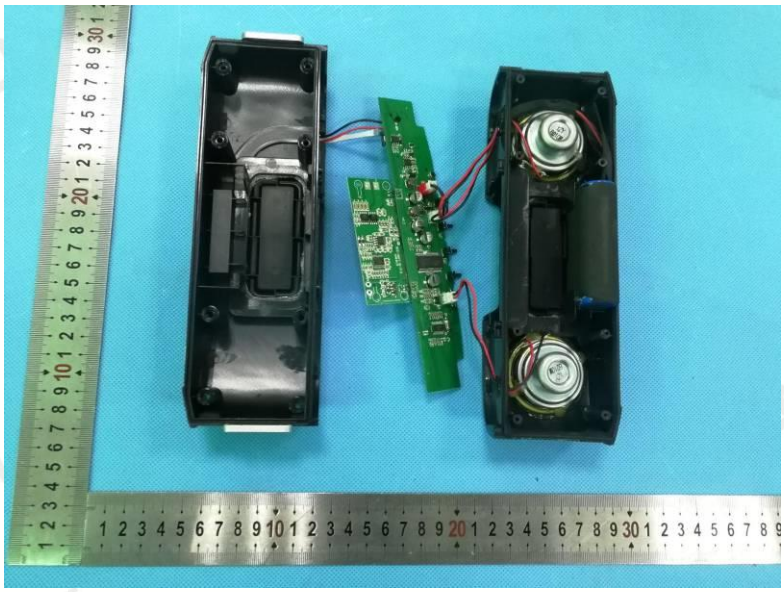
4 PHOTOGRAPH OF TEST

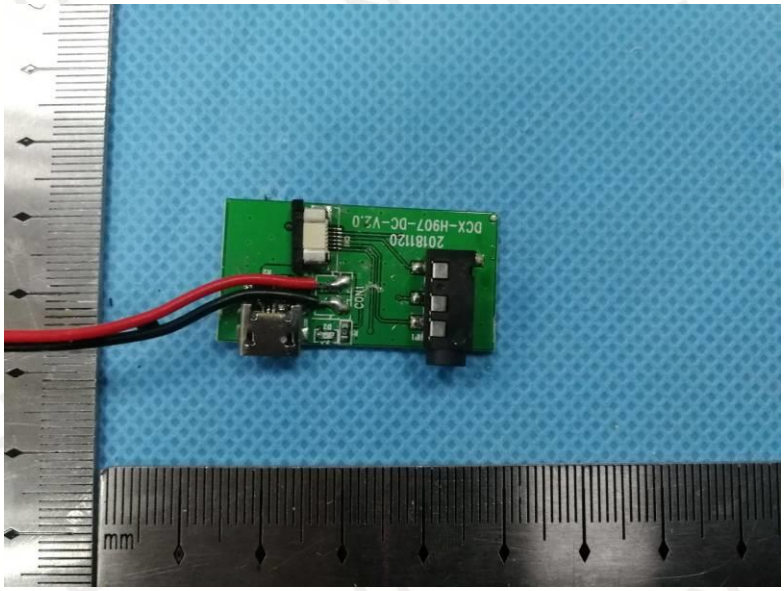
5 PHOTOGRAPH OF EUT

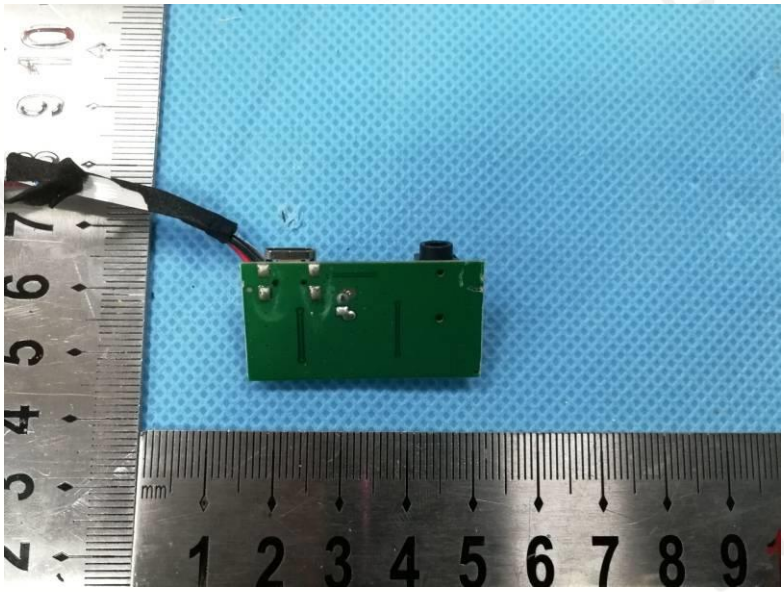
External Photos

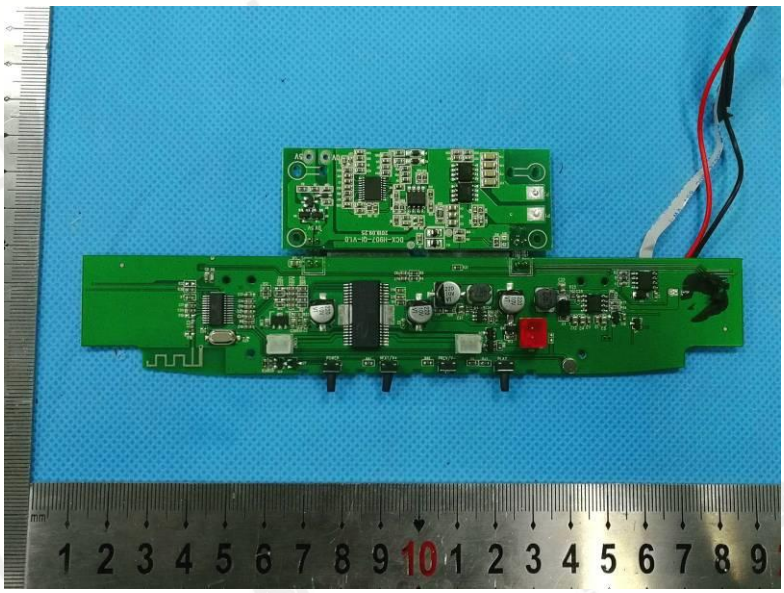


Internal Photos




DCX-H907-DC-V2.0
20181120
CON1
mm


mm
1 2 3 4 5 6 7 8 9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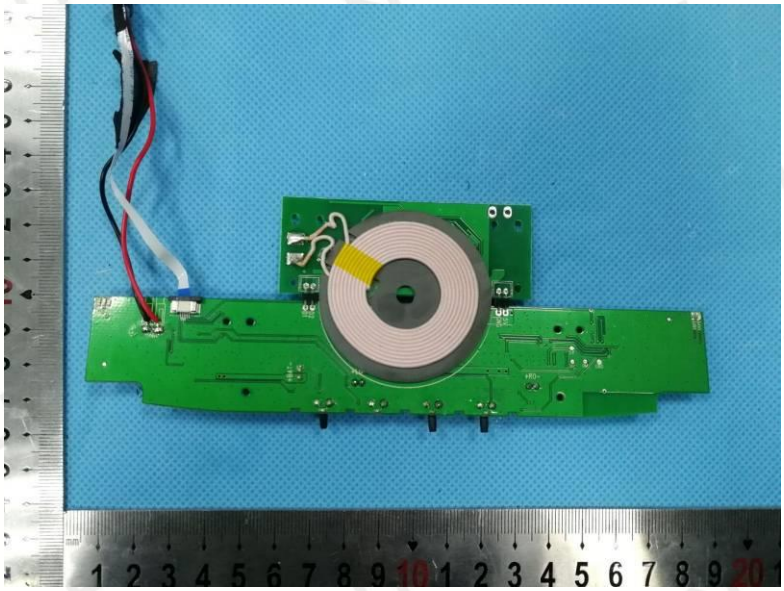

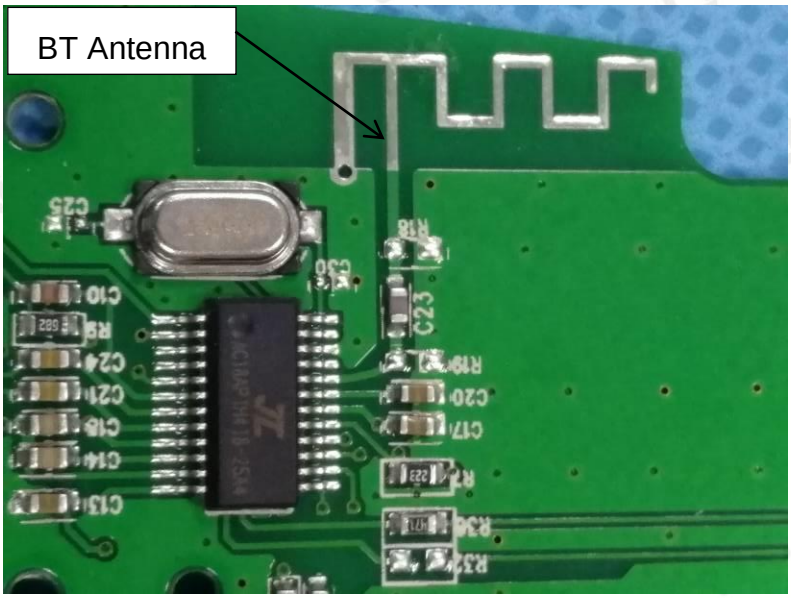

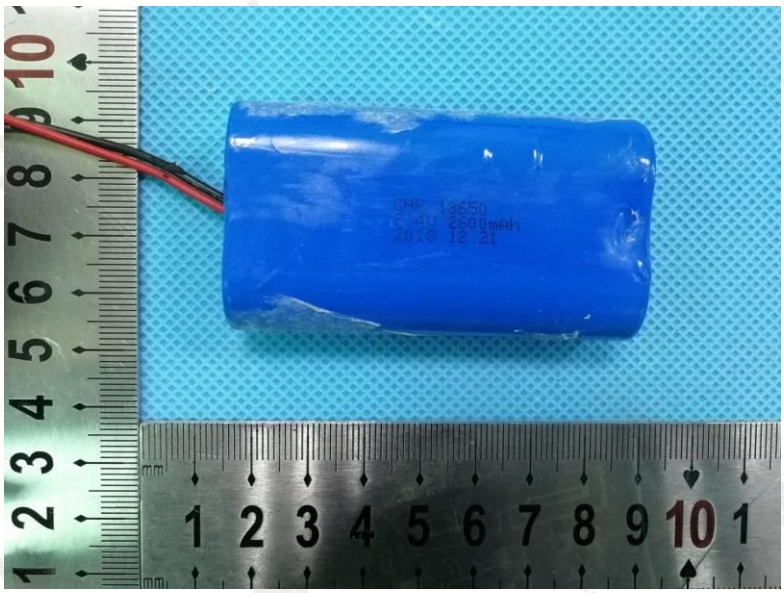

**********End of Report**********