FCC Report (Bluetooth)

Applicant:	Dongguan IMLONG Electronic Co., Ltd.
Address of Applicant:	Huixiang Road5, Jinglian Community Qiaotou Town, Dongguan, China
Manufacturer/Factory:	Dongguan IMLONG Electronic Co., Ltd.
Address of Manufacturer/Factory:	Huixiang Road5, Jinglian Community Qiaotou Town, Dongguan, China

Equipment Under Test (EUT)

Product Name:	Bluetooth Speaker
Model No.:	SP1702, NV-05858
FCC ID:	2AH9Y-SP1702
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247
Date of sample receipt:	March 22, 2018
Date of Test:	March 23-26, 2018
Date of report issued:	April 03, 2018
Test Result :	PASS *

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

Authorized Signature:

Robinson Lo
Laboratory Manager

2 Version

Version No.	Date	Description
00	*March 27, 2018*	*Original*
01	*April 03, 2018*	*Add model number*

Prepared By: Bill. Yuan ***Date:*** *April 03, 2018*

Project Engineer

Check By: Andy. wu ***Date:*** *April 03, 2018*

Reviewer

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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna Requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(1)	Pass
20dB Occupied Bandwidth	15.247 (a)(1)	Pass
Carrier Frequencies Separation	15.247 (a)(1)	Pass
Hopping Channel Number	15.247 (a)(1)	Pass
Dwell Time	15.247 (a)(1)	Pass
Pseudorandom Frequency Hopping Sequence	15.247(b)(4)	Pass
Radiated Emission	15.205/15.209	Pass
Band Edge	15.247(d)	Pass

Pass: The EUT complies with the essential requirements in the standard.

Remark: Test according to ANSI C63.4:2014 and ANSI C63.10:2013

Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	± 4.34dB	(1)
Radiated Emission	30MHz ~ 1000MHz	± 4.24dB	(1)
Radiated Emission	1GHz ~ 26.5GHz	± 4.68dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	± 3.45dB	(1)
Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.			

5 General Information

5.1 General Description of EUT

Product Name:	Bluetooth Speaker
Model No.:	SP1702, NV-05858
Test Model No.:	SP1702
Remark:	*All above models are identical in the same PCB layout, interior structure and electrical circuits. The differences are model name for commercial purpose.*
Serial No.:	NV080403
Test sample(s) ID:	GTS201803000216-1
Sample(s) Status	Engineer sample
Hardware:	SP-1702 V1.1
Software:	SPBT1702V4.2
Operation Frequency:	2402MHz~2480MHz
Channel numbers:	79
Channel separation:	1MHz
Modulation type:	GFSK, Pi/4 QPSK, 8DPSK
Antenna Type:	PCB antenna
Antenna gain:	0 dBi(Declared by Applicant)
Power supply:	DC 3.7V, 1200mAh by Rechargeable Li-polymer Battery DC 5.0V,0.5A by USB charger

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402MHz	21	2422MHz	41	2442MHz	61	2462MHz
2	2403MHz	22	2423MHz	42	2443MHz	62	2463MHz
3	2404MHz	23	2424MHz	43	2444MHz	63	2464MHz
4	2405MHz	24	2425MHz	44	2445MHz	64	2465MHz
5	2406MHz	25	2426MHz	45	2446MHz	65	2466MHz
6	2407MHz	26	2427MHz	46	2447MHz	66	2467MHz
7	2408MHz	27	2428MHz	47	2448MHz	67	2468MHz
8	2409MHz	28	2429MHz	48	2449MHz	68	2469MHz
9	2410MHz	29	2430MHz	49	2450MHz	69	2470MHz
10	2411MHz	30	2431MHz	50	2451MHz	70	2471MHz
11	2412MHz	31	2432MHz	51	2452MHz	71	2472MHz
12	2413MHz	32	2433MHz	52	2453MHz	72	2473MHz
13	2414MHz	33	2434MHz	53	2454MHz	73	2474MHz
14	2415MHz	34	2435MHz	54	2455MHz	74	2475MHz
15	2416MHz	35	2436MHz	55	2456MHz	75	2476MHz
16	2417MHz	36	2437MHz	56	2457MHz	76	2477MHz
17	2418MHz	37	2438MHz	57	2458MHz	77	2478MHz
18	2419MHz	38	2439MHz	58	2459MHz	78	2479MHz
19	2420MHz	39	2440MHz	59	2460MHz	79	2480MHz
20	2421MHz	40	2441MHz	60	2461MHz		

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	2402MHz
The middle channel	2441MHz
The Highest channel	2480MHz

5.2 Test mode

Transmitting mode	Keep the EUT in Bluetooth continuously transmitting mode.

Remark: During the test,the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.

5.3 Test Facility

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

● **FCC —Registration No.: 381383**

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fuly described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 381383, January 08, 2018.

● **Industry Canada (IC) —Registration No.: 9079A-2**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, August 15, 2016.

5.4 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.
Address: No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102
Tel: 0755-27798480
Fax: 0755-27798960

5.5 Other Information Requested by the Customer

None.

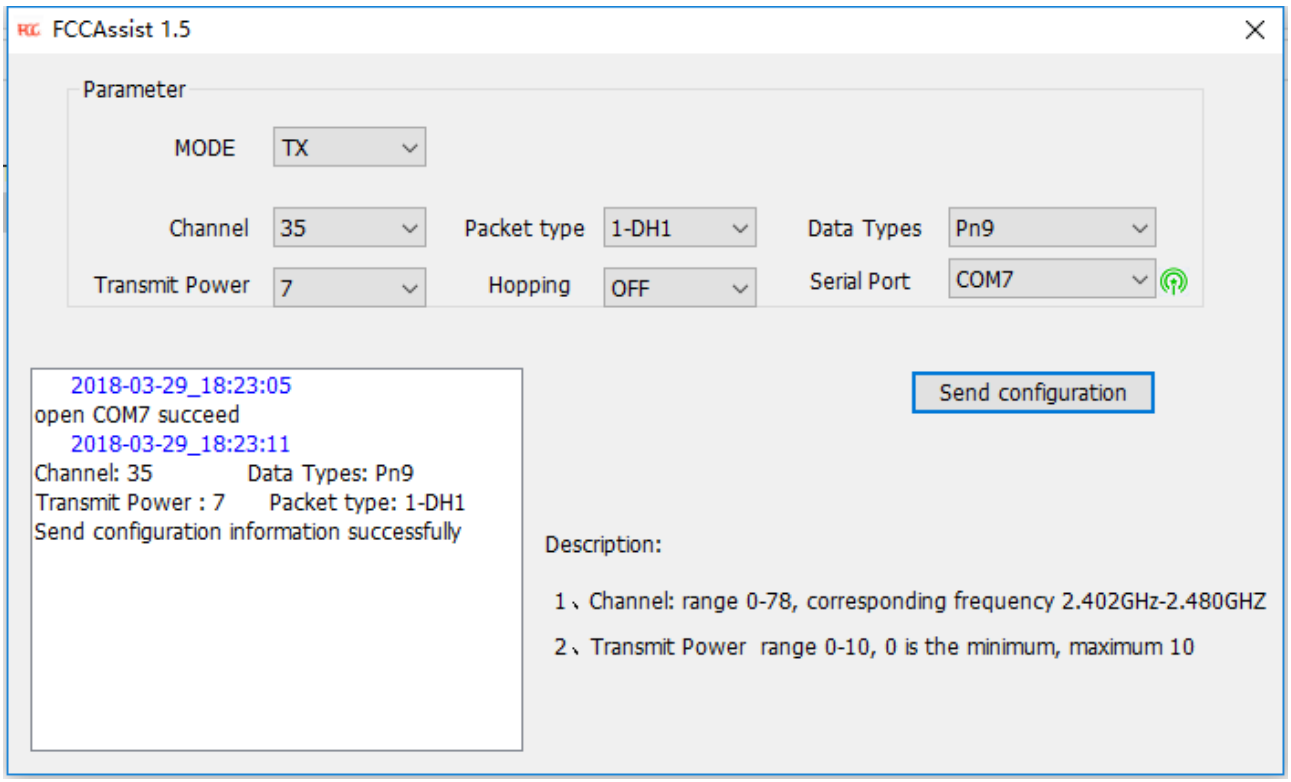
5.6 Description of Support Units

Manufacturer	Description	Model	Serial Number	FCC Approval
APPLE	USB charger	A1399	N/A	N/A

5.7 Additional Instructions

Power level setup in software			
Test Software Name	FCCAssist 1.5		
Support Units (Software installation media)	Description	Manufacturer	Model
	Laptop	Apple	A1278
Mode	Channel	Frequency (MHz)	Soft Set
GFSK, Pi/4 QPSK, 8DPSK	CH1	2402	TX level : default
	CH40	2441	
	CH79	2480	

Run Software



6 Test Instruments list

Radiated Emission:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.0(L)*6.0(W)* 6.0(H)	GTS250	July. 03 2015	July. 02 2020
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	Spectrum Analyzer	Agilent	E4440A	GTS533	June 28 2017	June 27 2018
4	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June 28 2017	June 27 2018
5	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June 28 2017	June 27 2018
6	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	June 28 2017	June 27 2018
7	Horn Antenna	ETS-LINDGREN	3160	GTS217	June 28 2017	June 27 2018
8	Loop Antenna	ZHINAN	ZN30900A	GTS534	June 28 2017	June 27 2018
9	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
10	Coaxial Cable	GTS	N/A	GTS213	June 28 2017	June 27 2018
11	Coaxial Cable	GTS	N/A	GTS211	June 28 2017	June 27 2018
12	Coaxial cable	GTS	N/A	GTS210	June 28 2017	June 27 2018
13	Coaxial Cable	GTS	N/A	GTS212	June 28 2017	June 27 2018
14	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June 28 2017	June 27 2018
15	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	June 28 2017	June 27 2018
16	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June 28 2017	June 27 2018
17	Band filter	Amindeon	82346	GTS219	June 28 2017	June 27 2018

Conducted Emission:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	GTS252	May.16 2014	May.15 2019
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June 28 2017	June 27 2018
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June 28 2017	June 27 2018
4	Artificial Mains Network	SCHWARZBECK MESS	NSLK8127	GTS226	June 28 2017	June 27 2018
5	Coaxial Cable	GTS	N/A	GTS227	N/A	N/A
6	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
7	Thermo meter	KTJ	TA328	GTS233	June 28 2017	June 27 2018

General used equipment:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Barometer	ChangChun	DYM3	GTS257	June 28 2017	June 27 2018

7 Test results and Measurement Data

7.1 Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)

15.203 requirement:

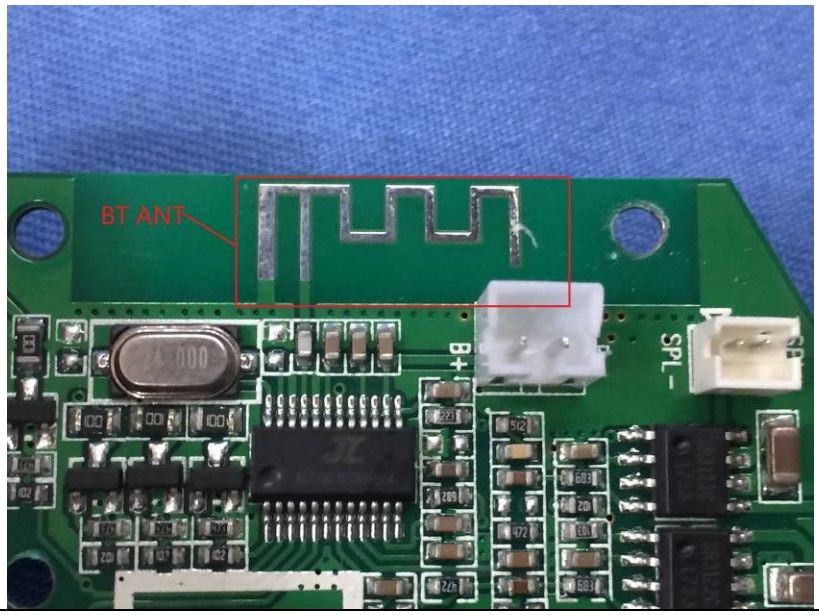
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(c) (1)(i) requirement:

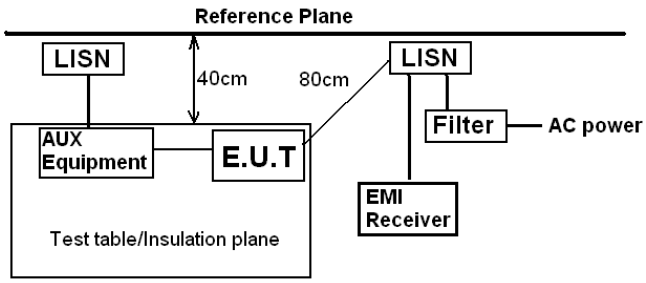
(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

E.U.T Antenna:

The antenna is PCB antenna, the best case gain of the antenna is 0dBi

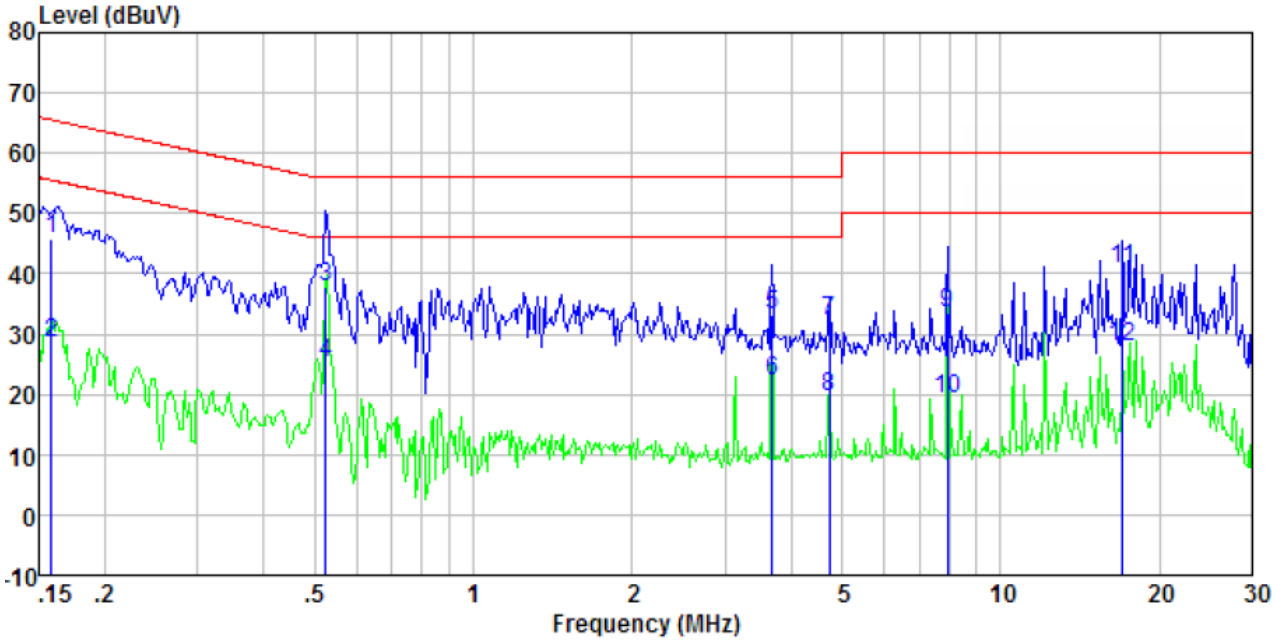


7.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207
Test Method:	ANSI C63.10:2013
Test Frequency Range:	150KHz to 30MHz
Class / Severity:	Class B
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto
Limit:	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 * Decreases with the logarithm of the frequency.
Test setup:	 *Remark:* *E.U.T: Equipment Under Test* *LISN: Line Impedence Stabilization Network* *Test table height=0.8m*
Test procedure:	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

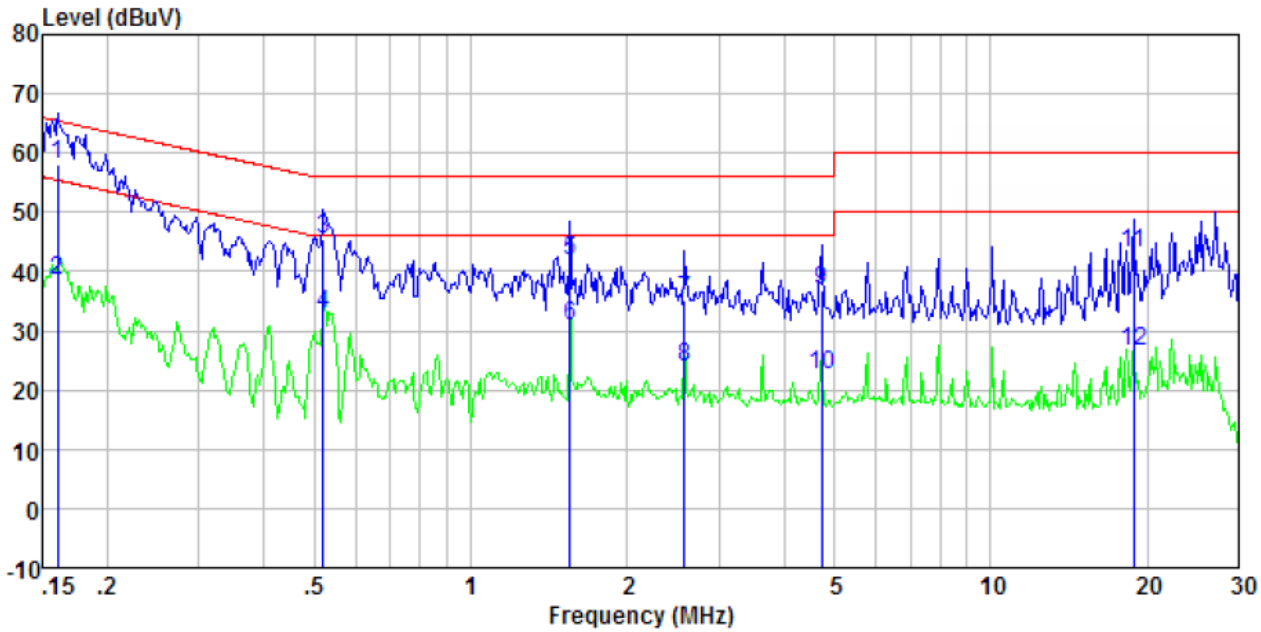
Measurement data:

Line:



Freq MHz	Reading level dBuV	lISN/ISN factor dB	Cable loss dB	level dBuV	Limit level dBuV	Over limit dB	Remark
0.158	45.26	0.40	0.08	45.74	65.56	-19.82	QP
0.158	28.10	0.40	0.08	28.58	55.56	-26.98	Average
0.524	37.50	0.31	0.11	37.92	56.00	-18.08	QP
0.524	24.89	0.31	0.11	25.31	46.00	-20.69	Average
3.681	32.63	0.20	0.18	33.01	56.00	-22.99	QP
3.681	21.83	0.20	0.18	22.21	46.00	-23.79	Average
4.721	31.72	0.20	0.17	32.09	56.00	-23.91	QP
4.721	19.17	0.20	0.17	19.54	46.00	-26.46	Average
7.935	33.10	0.20	0.19	33.49	60.00	-26.51	QP
7.935	18.92	0.20	0.19	19.31	50.00	-30.69	Average
17.018	40.26	0.24	0.22	40.72	60.00	-19.28	QP
17.018	27.52	0.24	0.22	27.98	50.00	-22.02	Average

Neutral:

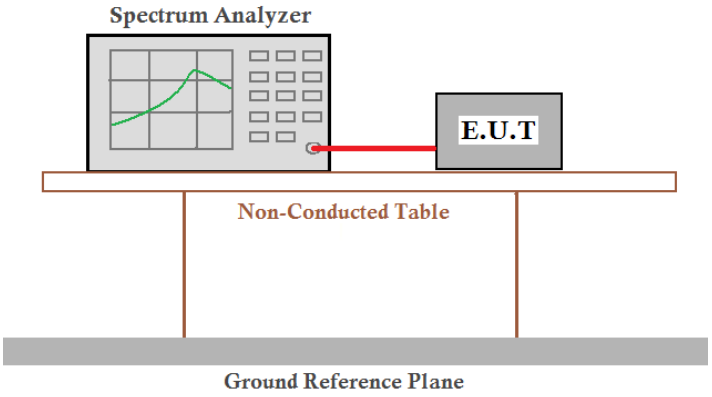


Freq MHz	Reading level dBuV	lISN/ISN factor dB	Cable loss dB	level dBuV	Limit level dBuV	Over limit dB	Remark
0.161	57.59	0.40	0.08	58.07	65.43	-7.36	QP
0.161	37.94	0.40	0.08	38.42	55.43	-17.01	Average
0.521	44.91	0.31	0.11	45.33	56.00	-10.67	QP
0.521	32.27	0.31	0.11	32.69	46.00	-13.31	Average
1.552	41.52	0.20	0.17	41.89	56.00	-14.11	QP
1.552	30.48	0.20	0.17	30.85	46.00	-15.15	Average
2.581	34.88	0.20	0.18	35.26	56.00	-20.74	QP
2.581	23.42	0.20	0.18	23.80	46.00	-22.20	Average
4.721	36.55	0.20	0.17	36.92	56.00	-19.08	QP
4.721	22.05	0.20	0.17	22.42	46.00	-23.58	Average
18.820	42.49	0.28	0.23	43.00	60.00	-17.00	QP
18.820	26.16	0.28	0.23	26.67	50.00	-23.33	Average

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level =Receiver Read level + LISN Factor + Cable Loss

7.3 Conducted Peak Output Power

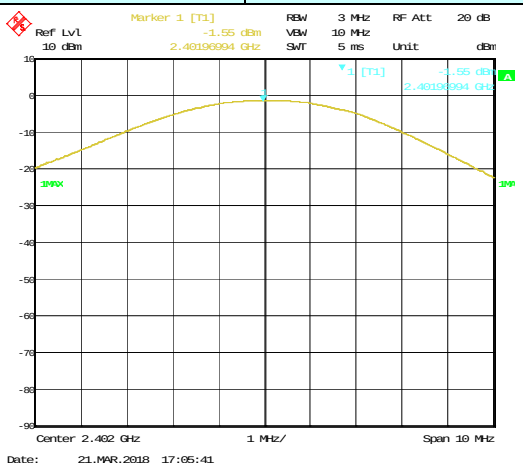
Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.10:2013
Limit:	30dBm(for GFSK),20.97dBm(for EDR)
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

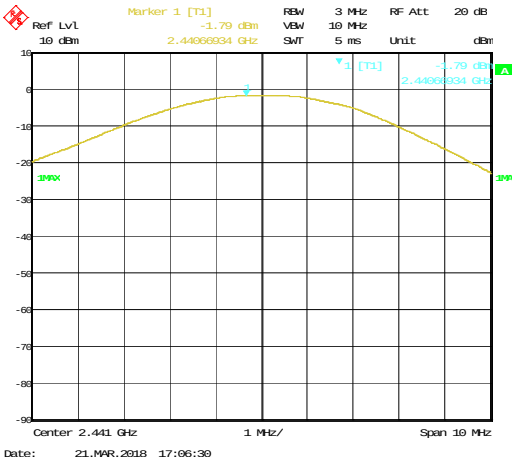
Mode	Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
GFSK	Lowest	-1.55	30.00	Pass
	Middle	-1.79		
	Highest	-2.40		
Pi/4QPSK	Lowest	-0.19	20.97	Pass
	Middle	-0.53		
	Highest	-1.16		
8DPSK	Lowest	-0.26	20.97	Pass
	Middle	-0.53		
	Highest	-1.16		

Test plot as follows:

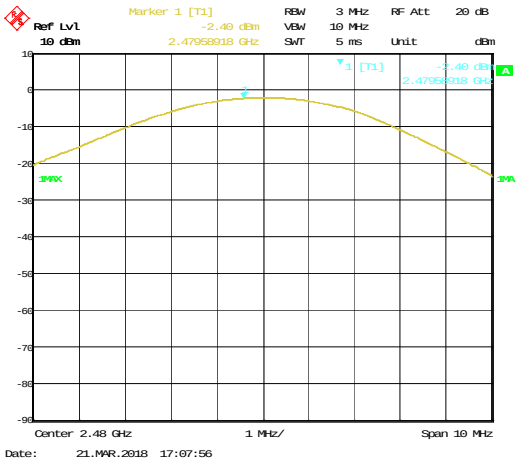
Test mode:	GFSK mode



Lowest channel

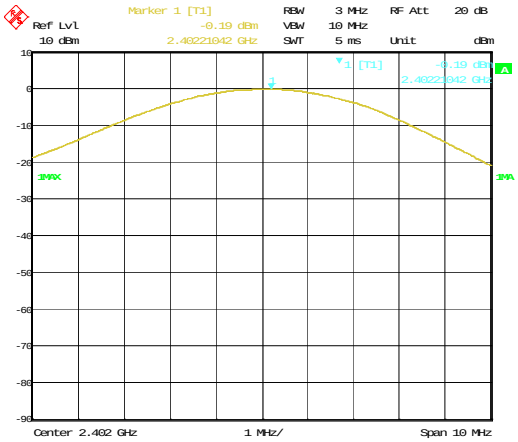


Middle channel

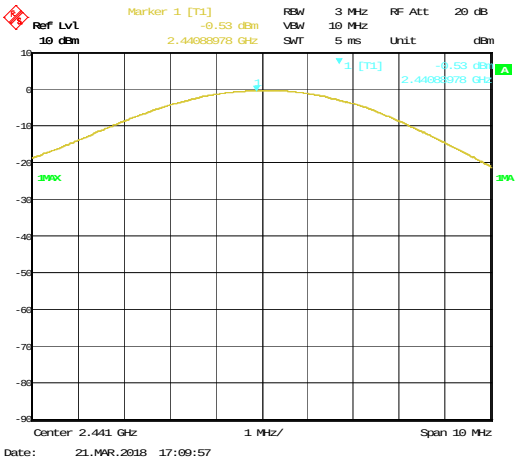


Highest channel

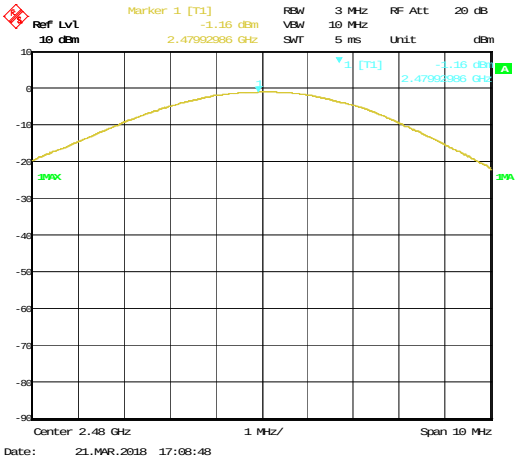
Test mode:	Pi/4QPSK mode



Lowest channel



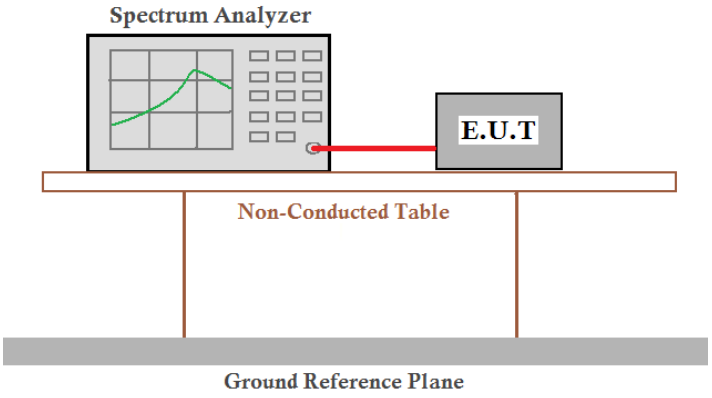
Middle channel



Highest channel

Remark:
GFSK, Pi/4QPSK, 8DPSK modulation all have been tested, and found the GFSK , Pi/4QPSK modulation which it is worse case and reported their plots only.

7.4 20dB Emission Bandwidth

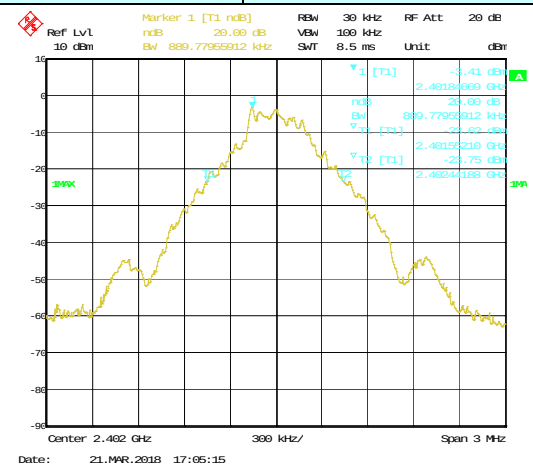
Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.10:2013
Limit:	N/A
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

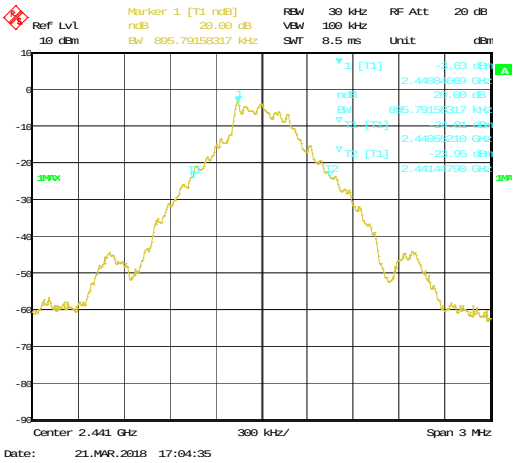
Mode	Test channel	20dB Emission Bandwidth (MHz)	Result
GFSK	Lowest	0.890	Pass
	Middle	0.896	
	Highest	0.896	
Pi/4QPSK	Lowest	1.238	Pass
	Middle	1.269	
	Highest	1.269	
8DPSK	Lowest	1.238	Pass
	Middle	1.269	
	Highest	1.269	

Test plot as follows:

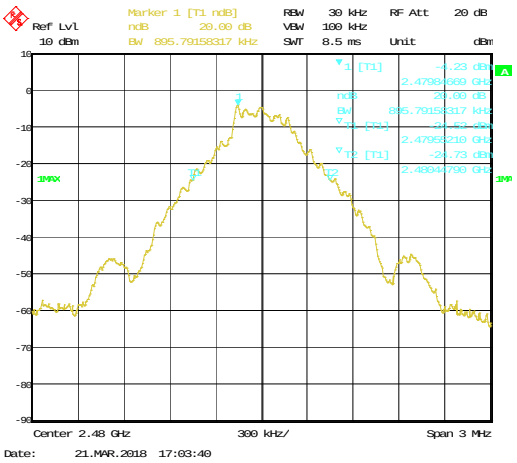
Test mode:	GFSK mode



Lowest channel

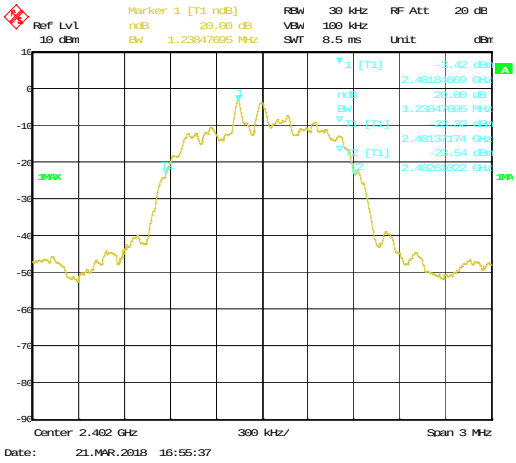


Middle channel

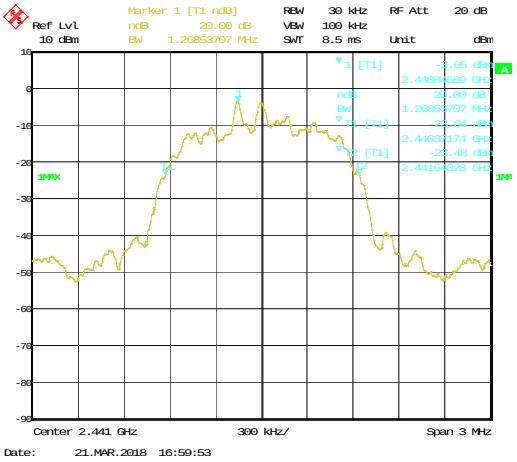


Highest channel

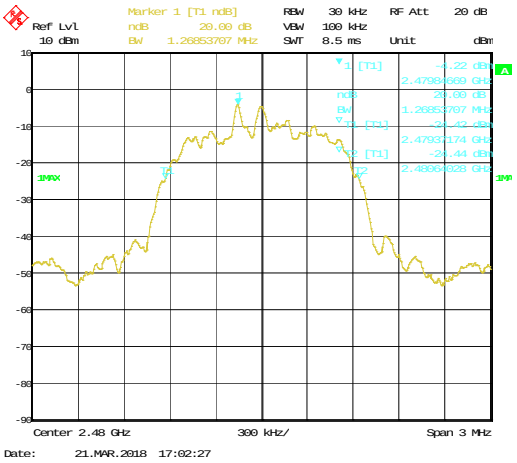
Test mode:	Pi/4QPSK mode



Lowest channel

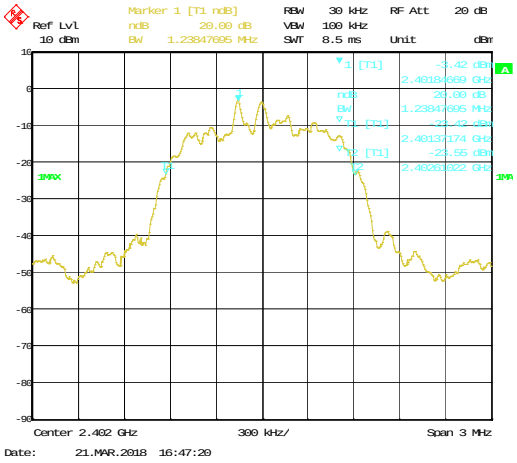


Middle channel

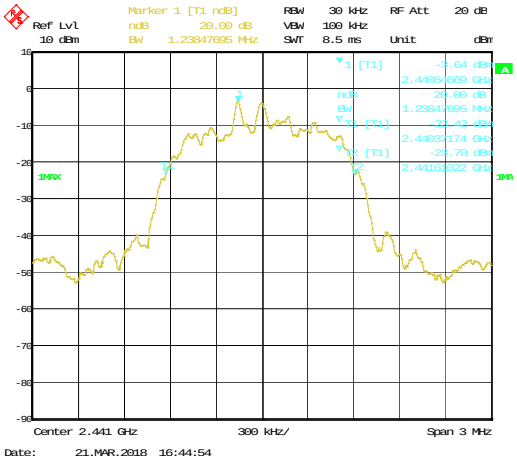


Highest channel

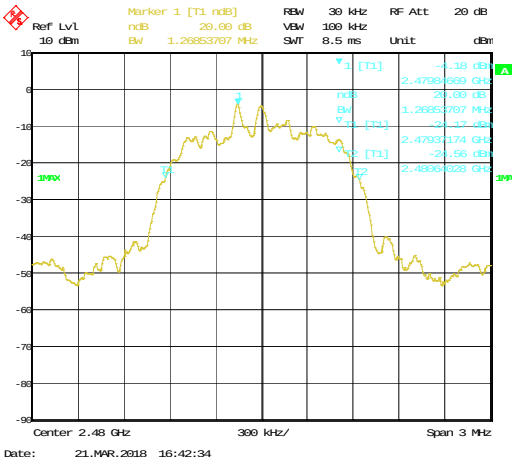
Test mode:	8DPSK mode



Lowest channel

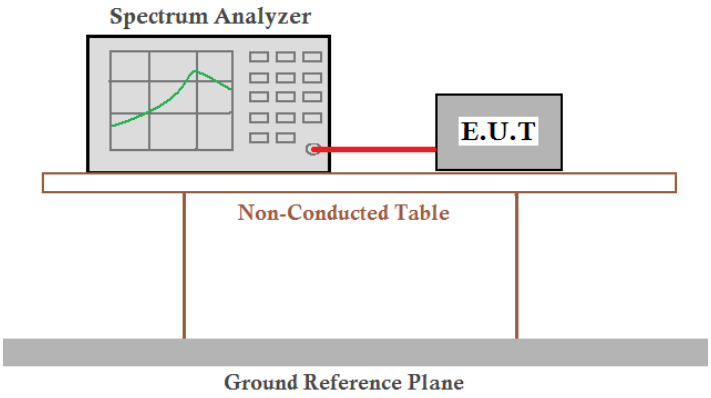


Middle channel



Highest channel

7.5 Carrier Frequencies Separation

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100KHz, VBW=300KHz, detector=Peak
Limit:	0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

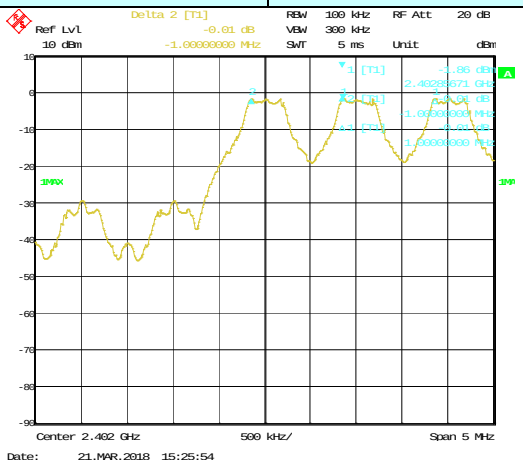
Mode	Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
GFSK	Lowest	1000	597	Pass
	Middle	1000	597	Pass
	Highest	1000	597	Pass
Pi/4QPSK	Lowest	1000	846	Pass
	Middle	1000	846	Pass
	Highest	1000	846	Pass
8DSK	Lowest	1000	846	Pass
	Middle	1000	846	Pass
	Highest	1000	846	Pass

Note: According to section 7.4

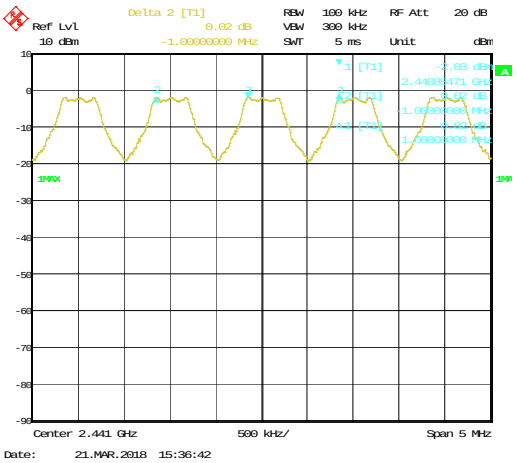
Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	896	597
Pi/4QPSK	1269	846
8DPSK	1269	846

Test plot as follows:

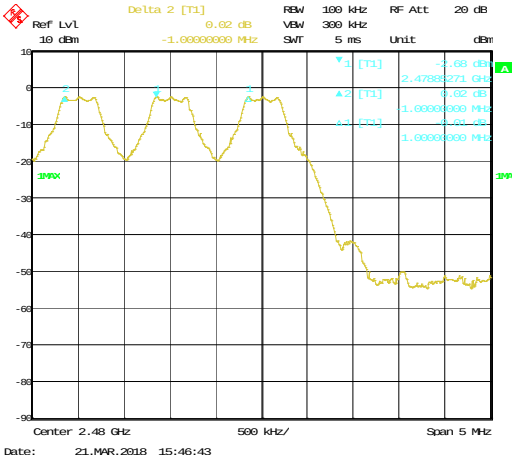
Modulation mode:	GFSK



Lowest channel

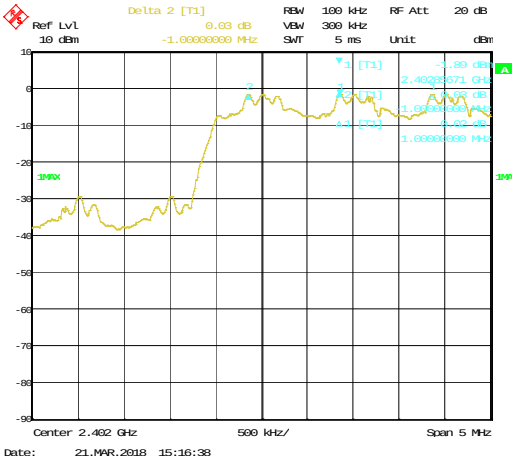


Middle channel

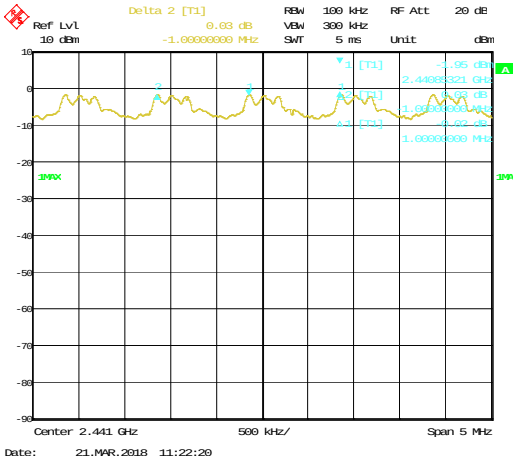


Highest channel

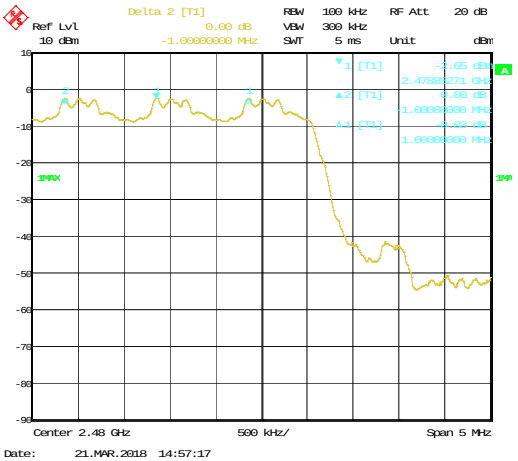
Test mode:	Pi/4QPSK mode



Lowest channel

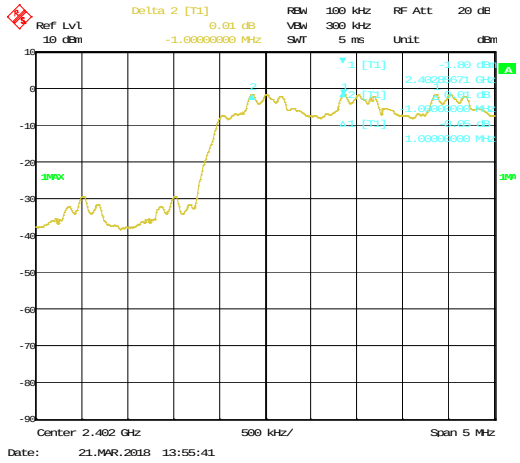


Middle channel

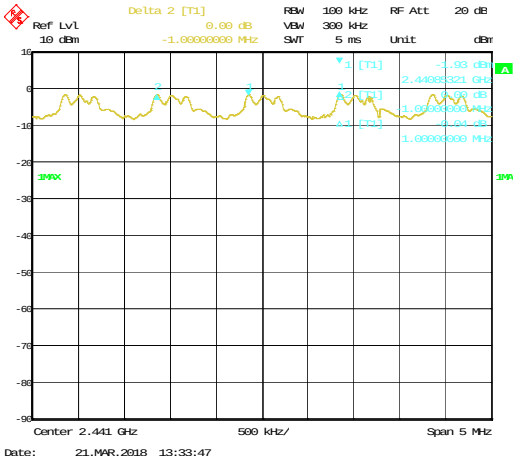


Highest channel

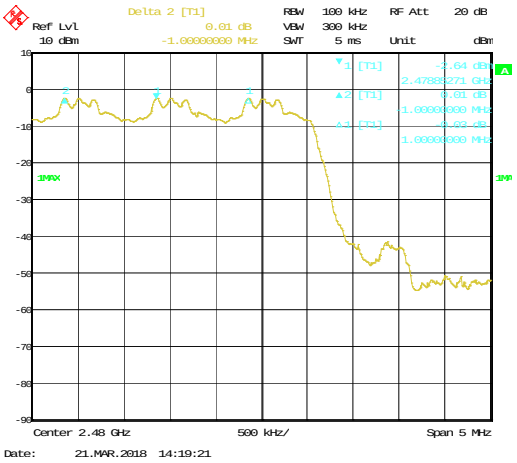
Test mode:	8DPSK mode



Lowest channel

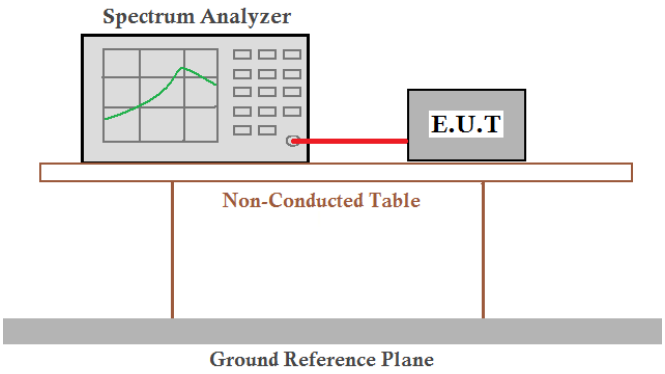


Middle channel



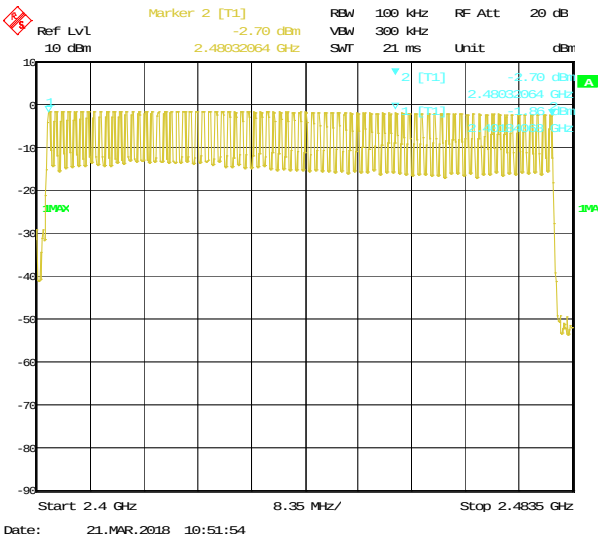
Highest channel

7.6 Hopping Channel Number

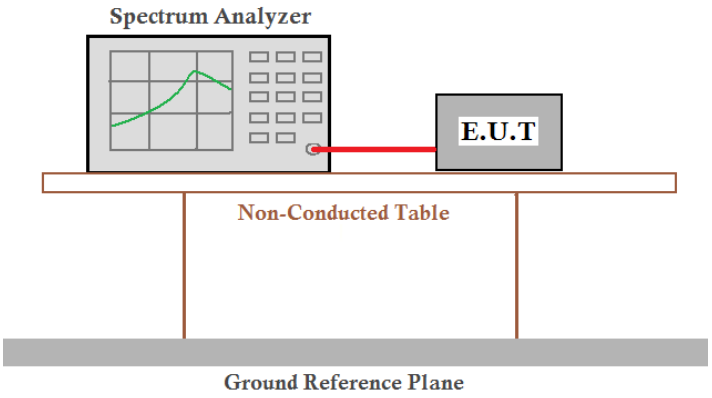
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak
Limit:	15 channels
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data:

Mode	Hopping channel numbers	Limit	Result
GFSK	79	15	Pass
Pi/4QPSK	79	15	Pass
8DPSK	79	15	Pass



7.7 Dwell Time

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=1MHz, VBW=1MHz, Span=0Hz, Detector=Peak
Limit:	0.4 Second
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	DH1	134.72	400	Pass
2441MHz	DH3	272.48	400	Pass
2441MHz	DH5	312.11	400	Pass

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

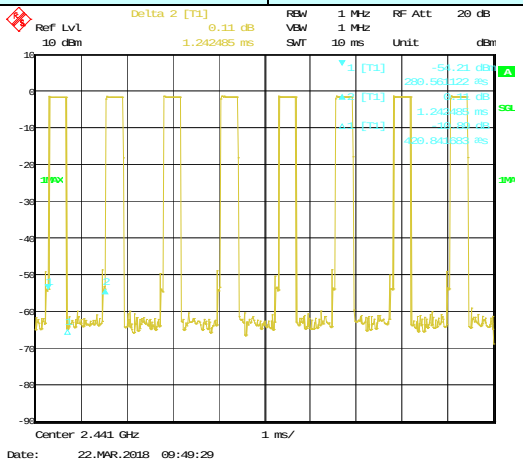
DH1 time slot=0.421(ms)*(1600/ (2*79))*31.6=134.72ms

DH3 time slot=1.703(ms)*(1600/ (4*79))*31.6=272.48ms

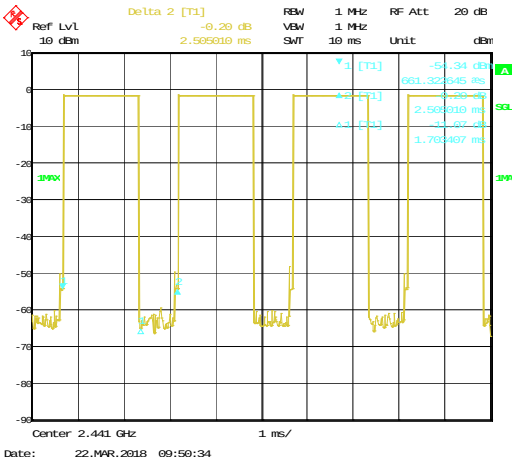
DH5 time slot=2.926(ms)*(1600/ (6*79))*31.6=312.11ms

Test plot as follows:

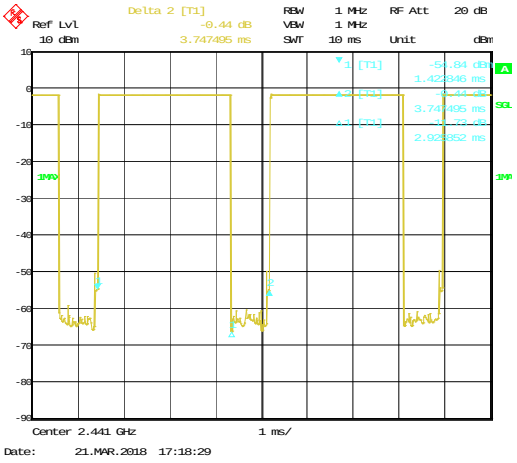
Test channel:	2441MHz



DH1



DH3



DH5

7.8 Pseudorandom Frequency Hopping Sequence

Test Requirement:	FCC Part15 C Section 15.247 (a)(1) requirement:

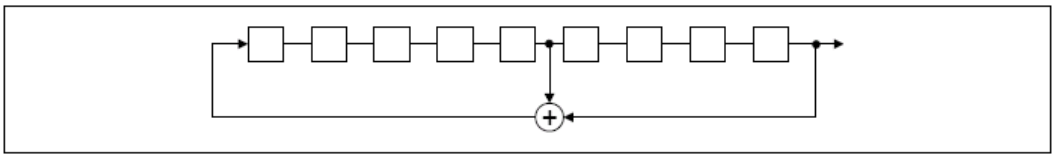
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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 Pseudorandom 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 hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence

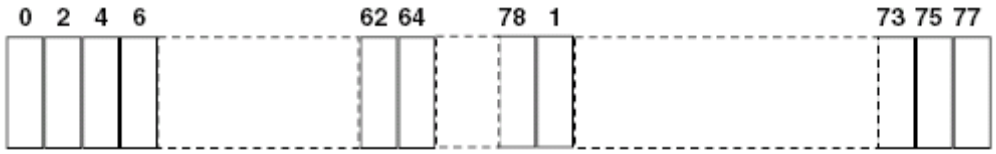
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized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

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



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:

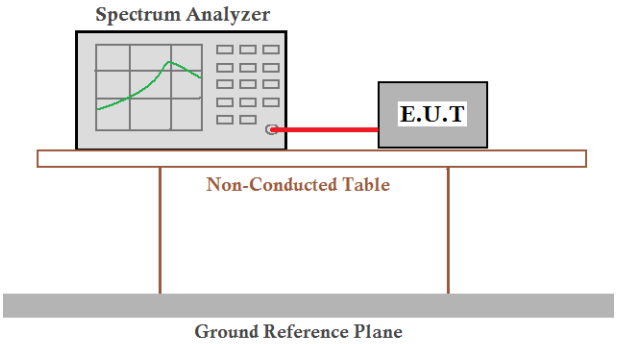


Each frequency used equally on the average by each transmitter.

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

7.9 Band Edge

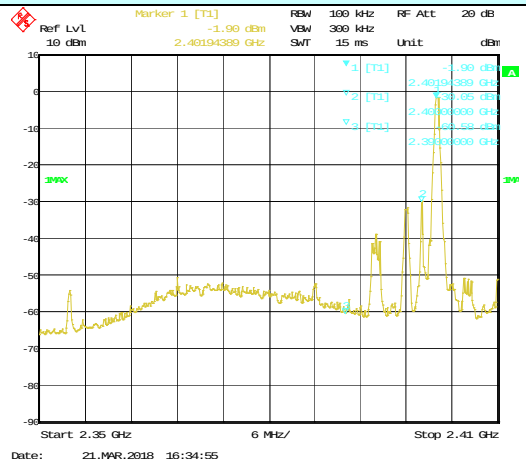
7.9.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Detector=Peak
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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 desired power, based on either an RF conducted or a radiated measurement.
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

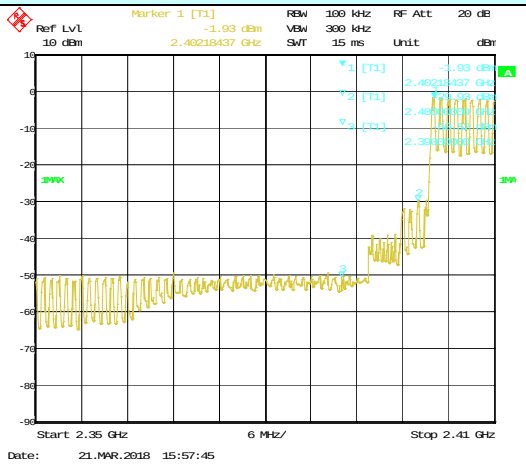
Test plot as follows:

GFSK Mode:

Test channel:	Lowest channel

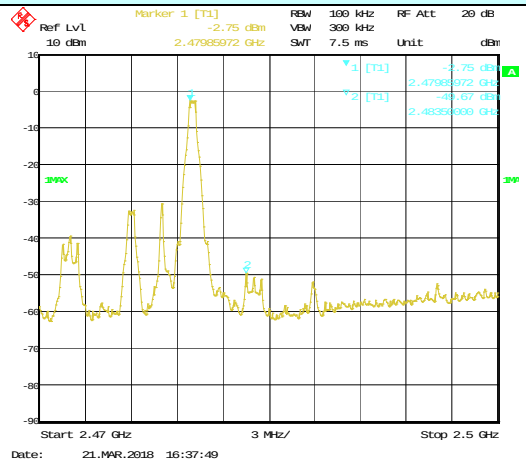


No-hopping mode

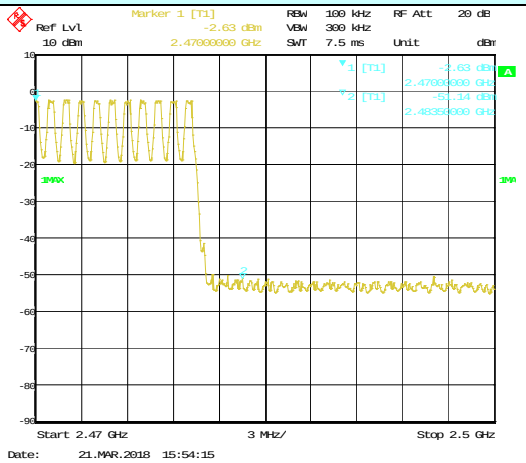


Hopping mode

Test channel:	Highest channel



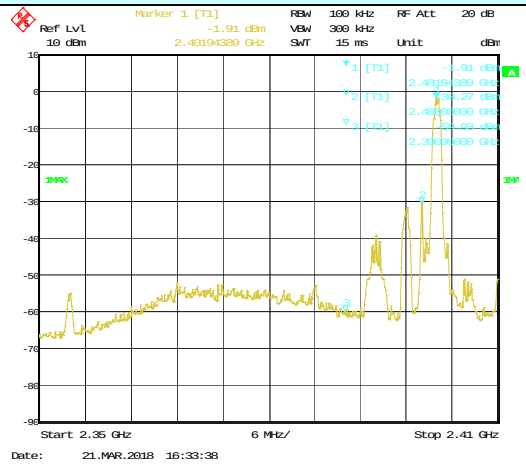
No-hopping mode



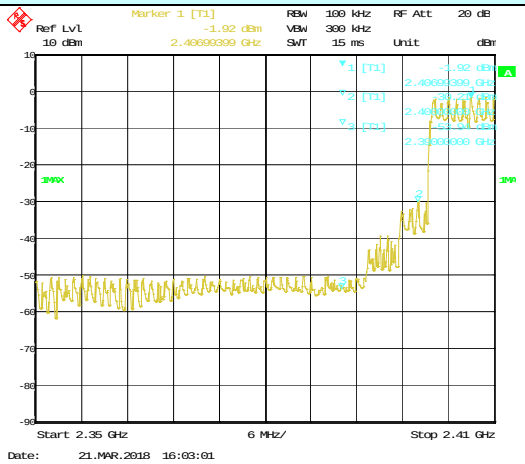
Hopping mode

Pi/4QPSK Mode:

Test channel:	Lowest channel

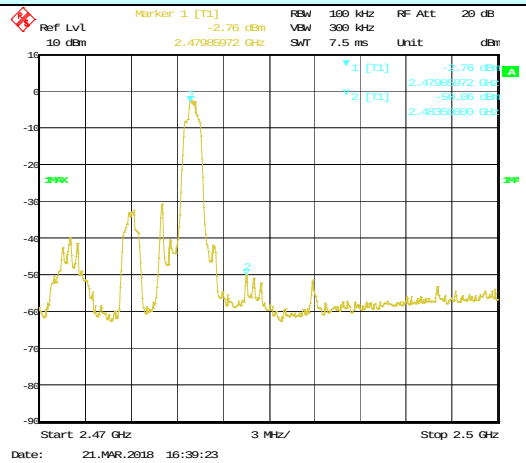


No-hopping mode

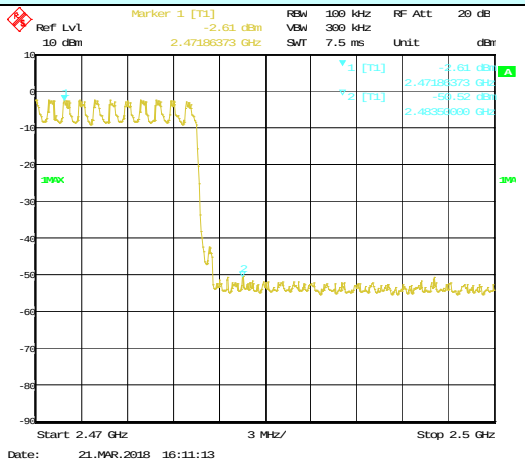


Hopping mode

Test channel:	Highest channel



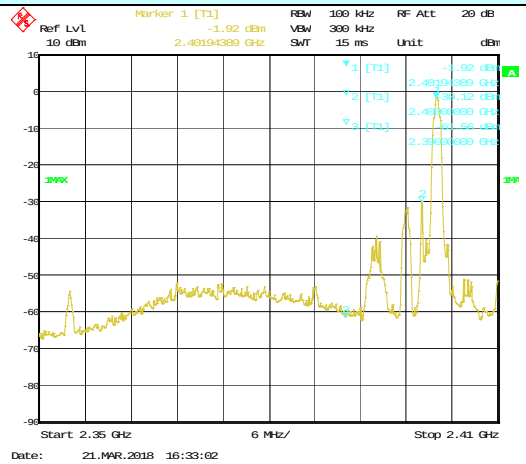
No-hopping mode



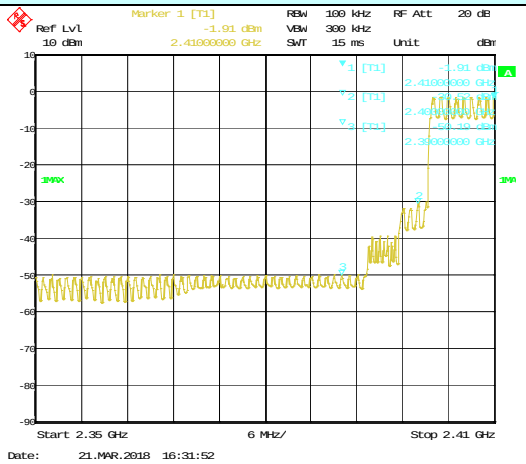
Hopping mode

8DPSK Mode:

Test channel:	Lowest channel

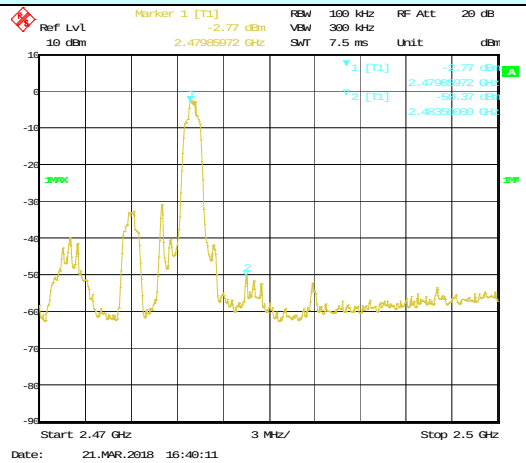


No-hopping mode

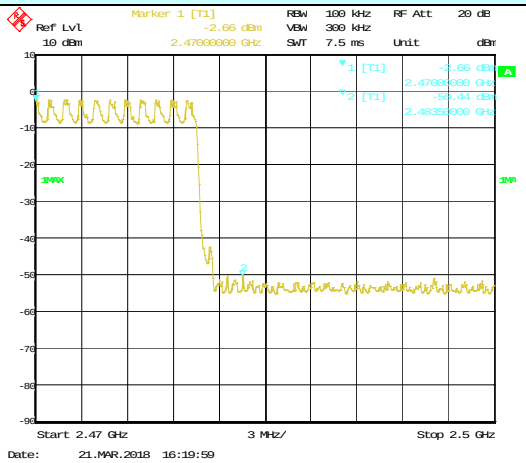


Hopping mode

Test channel:	Highest channel

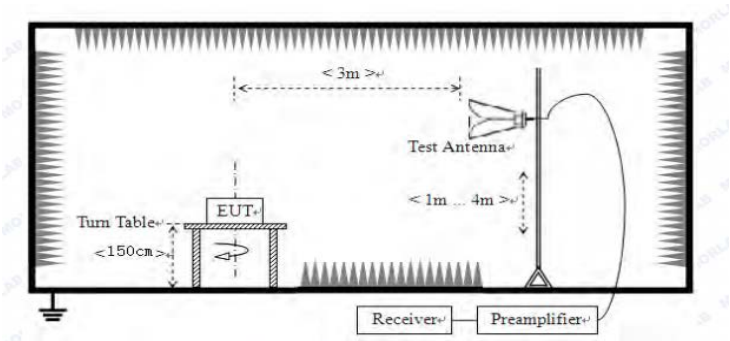


No-hopping mode



Hopping mode

7.9.2 Radiated Emission Method

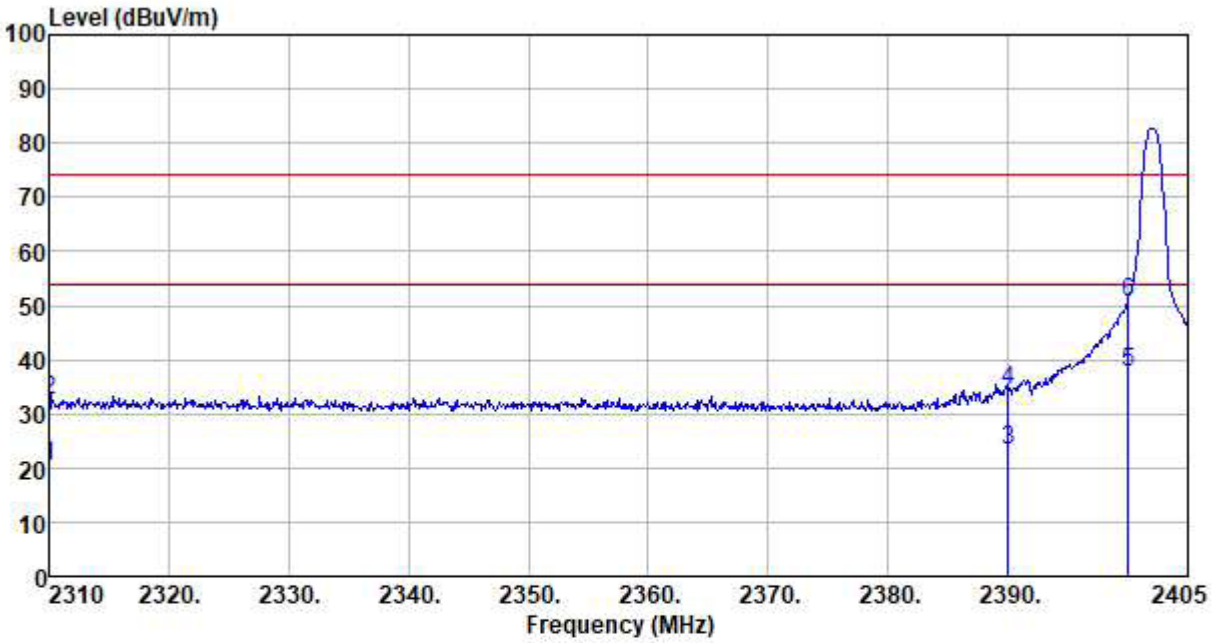
<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209 and 15.205</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Test Frequency Range:</td><td>All restriction band have been tested, and 2.3GHz to 2.5GHz band is the worse case</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average Value</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><td>Frequency</td><td>Limit (dBuV/m @3m)</td><td>Remark</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>54.00</td><td>Average Value</td></tr>
<tr><td>74.00</td><td>Peak Value</td></tr>
</table>
</td></tr>
<tr><td>Test setup:</td><td> 
</td></tr>
<tr><td>Test Procedure:</td><td>1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</td></tr>
<tr><td>Test Instruments:</td><td>Refer to section 6.0 for details</td></tr>
<tr><td>Test mode:</td><td>Refer to section 5.2 for details</td></tr>
<tr><td>Test results:</td><td>Pass</td></tr>
</table>

Remark:

1. *During the test, pre-scan the GFSK, Pi/4QPSK, 8DPSK modulation, and found the GFSK modulation which it is worse case.*
2. *Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.*

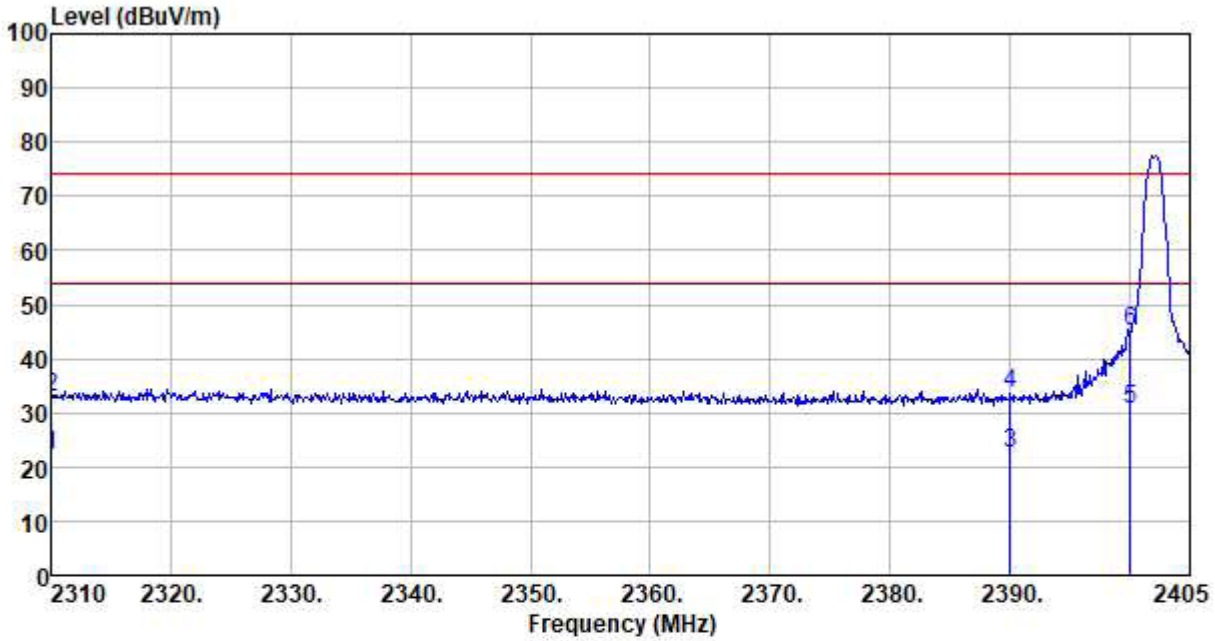
Test mode:	GFSK	Test channel:	Lowest

Horizontal:



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
2310.000	23.57	27.91	5.30	36.64	20.14	54.00	-33.86	Average
2310.000	35.89	27.91	5.30	36.64	32.46	74.00	-41.54	Peak
2390.000	26.88	27.59	5.38	36.71	23.14	54.00	-30.86	Average
2390.000	38.07	27.59	5.38	36.71	34.33	74.00	-39.67	Peak
2400.000	41.39	27.58	5.39	36.71	37.65	54.00	-16.35	Average
2400.000	54.17	27.58	5.39	36.71	50.43	74.00	-23.57	Peak

Vertical:



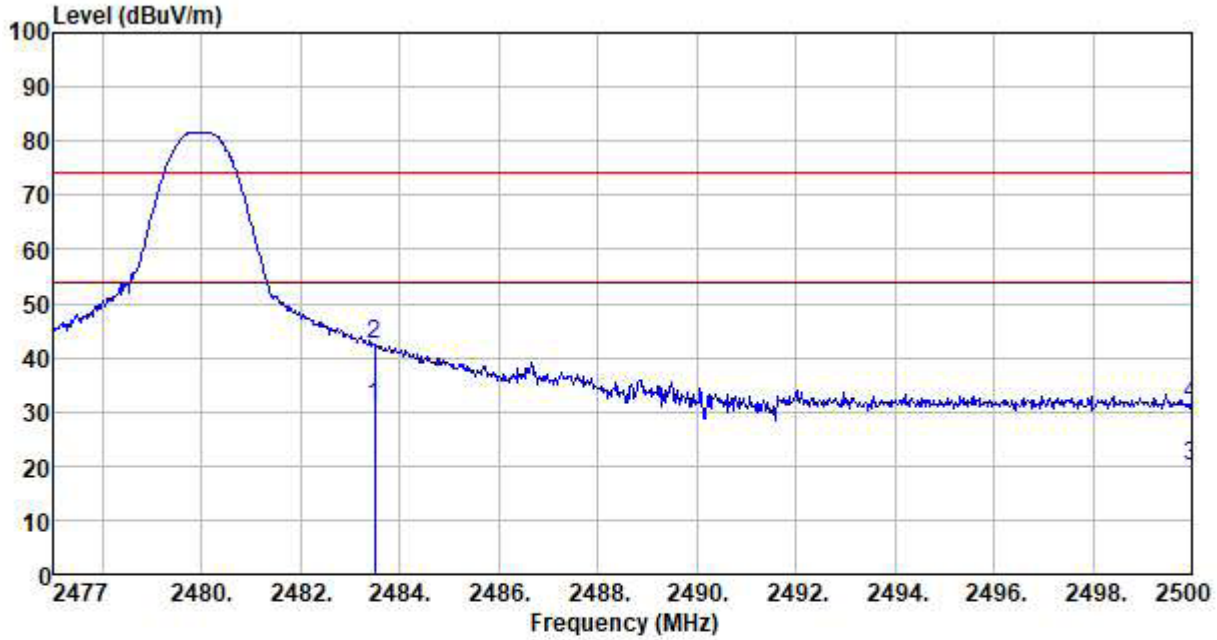
Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
2310.000	25.66	27.91	5.30	36.64	22.23	54.00	-31.77	Average
2310.000	36.26	27.91	5.30	36.64	32.83	74.00	-41.17	Peak
2390.000	26.08	27.59	5.38	36.71	22.34	54.00	-31.66	Average
2390.000	37.21	27.59	5.38	36.71	33.47	74.00	-40.53	Peak
2400.000	34.43	27.58	5.39	36.71	30.69	54.00	-23.31	Average
2400.000	48.89	27.58	5.39	36.71	45.15	74.00	-28.85	Peak

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

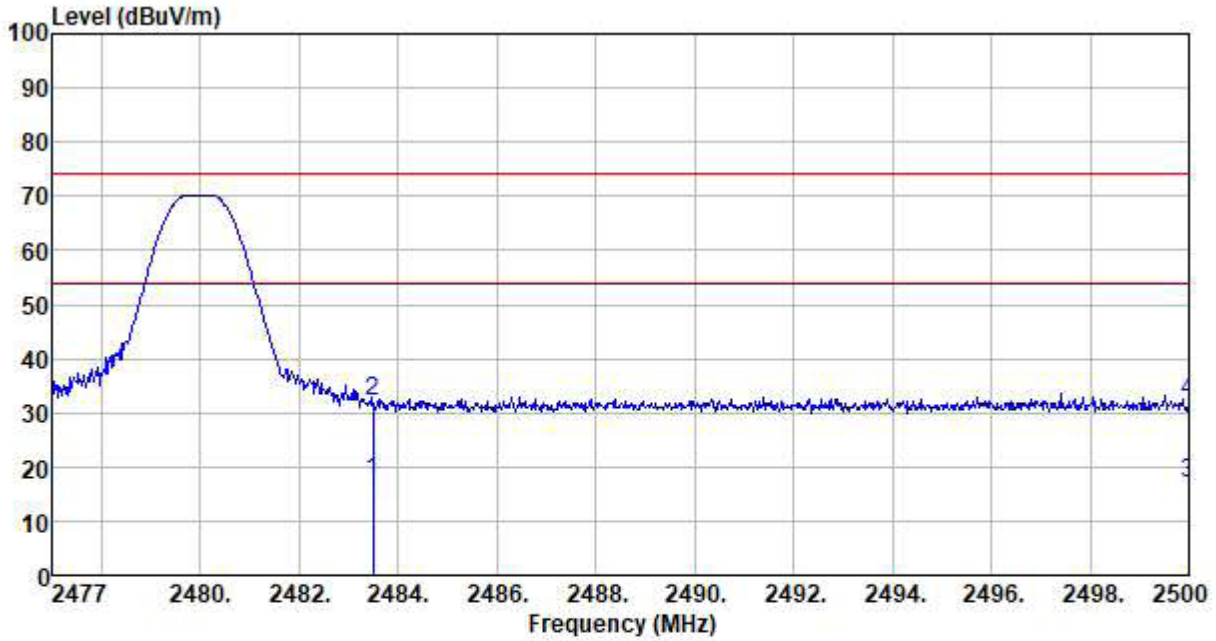
Test mode:	GFSK	Test channel:	Highest

Horizontal:



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2483.500	34.74	27.53	5.47	36.78	30.96	54.00	-23.04	Average
2483.500	46.16	27.53	5.47	36.78	42.38	74.00	-31.62	Peak
2500.000	23.80	27.55	5.49	36.79	20.05	54.00	-33.95	Average
2500.000	35.29	27.55	5.49	36.79	31.54	74.00	-42.46	Peak

Vertical:



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
2483.500	21.24	27.53	5.47	36.78	17.46	54.00	-36.54	Average
2483.500	35.79	27.53	5.47	36.78	32.01	74.00	-41.99	Peak
2500.000	20.79	27.55	5.49	36.79	17.04	54.00	-36.96	Average
2500.000	35.90	27.55	5.49	36.79	32.15	74.00	-41.85	Peak

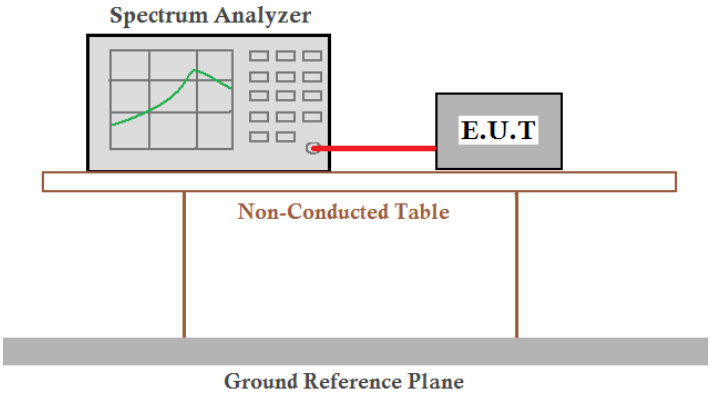
Remark:

3. Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

4. The emission levels of other frequencies are very lower than the limit and not show in test report.

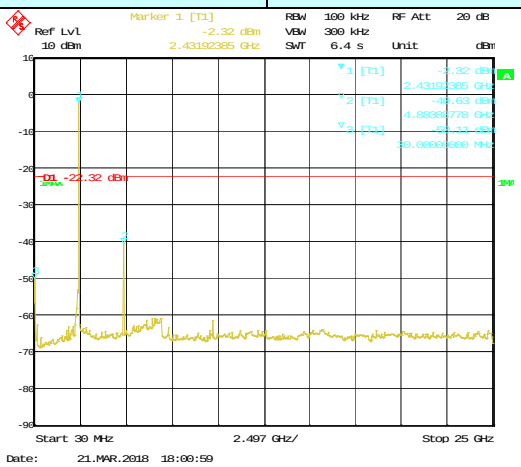
7.10 Spurious Emission

7.10.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 Meas Guidance V04
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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 desired power, based on either an RF conducted or a radiated measurement.
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

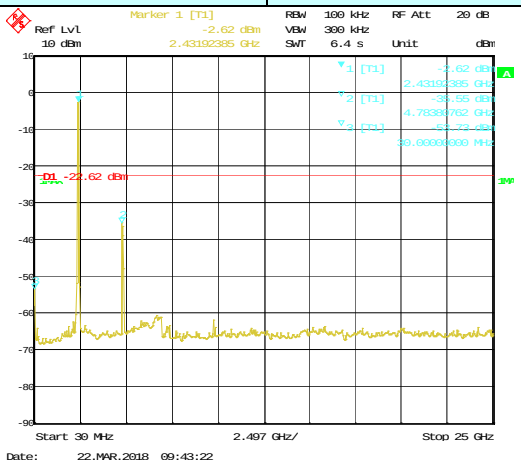
Remark:
During the test, pre-scan the GFSK, Pi/4QPSK, 8DPSK modulation, and found the GFSK modulation which it is worse case.

Test channel:	Lowest channel



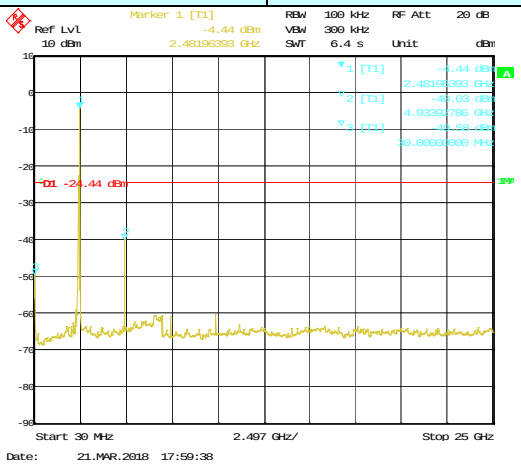
30MHz~25GHz

Test channel:	Middle channel



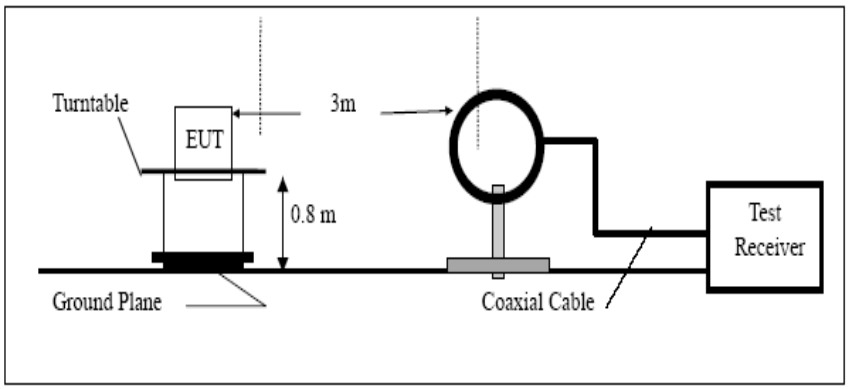
30MHz~25GHz

Test channel:	Highest channel

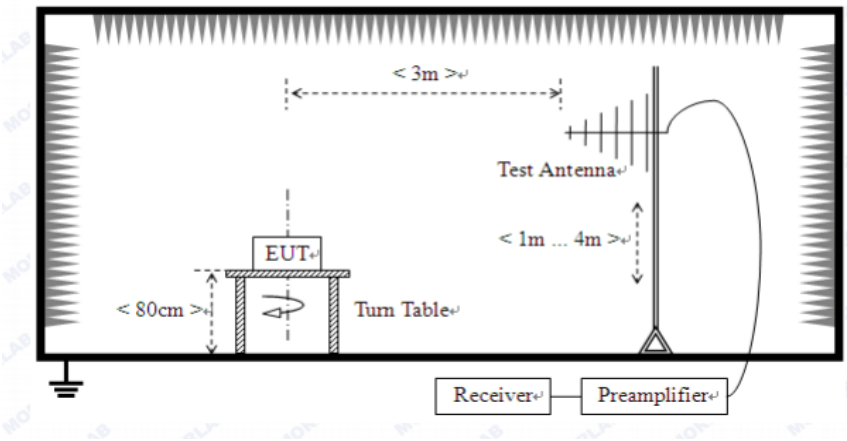


30MHz~25GHz

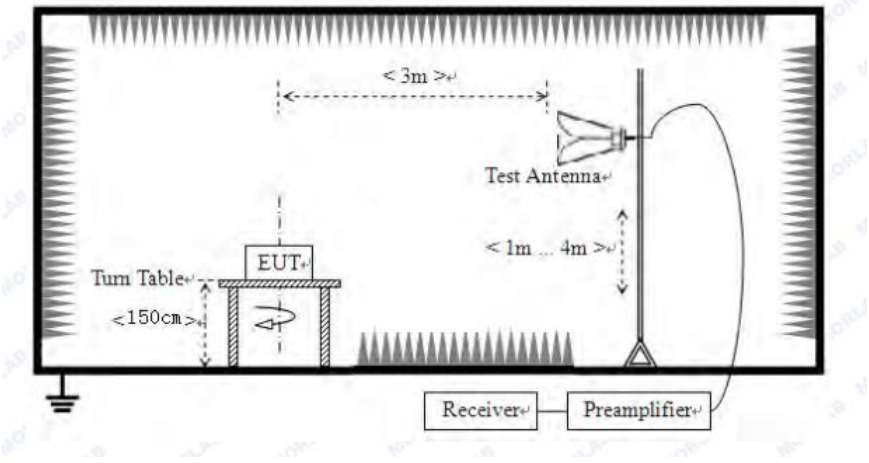
7.10.2 Radiated Emission Method

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Test Frequency Range:</td><td>9kHz to 25GHz</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><th>Frequency</th><th>Detector</th><th>RBW</th><th>VBW</th><th>Value</th></tr>
<tr><td>9KHz-150KHz</td><td>PK/AV/QP</td><td>200Hz</td><td>600Hz</td><td>PK/AV/QP</td></tr>
<tr><td>150KHz-30MHz</td><td>PK/AV/QP</td><td>9KHz</td><td>30KHz</td><td>PK/AV/QP</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120KHz</td><td>300KHz</td><td>Quasi-peak</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><th>Frequency</th><th>Limit (uV/m)</th><th>Value</th><th>Measurement Distance</th></tr>
<tr><td>0.009MHz-0.490MHz</td><td>2400/F(KHz)</td><td>QP</td><td>300m</td></tr>
<tr><td>0.490MHz-1.705MHz</td><td>24000/F(KHz)</td><td>QP</td><td>300m</td></tr>
<tr><td>1.705MHz-30MHz</td><td>30</td><td>QP</td><td>30m</td></tr>
<tr><td>30MHz-88MHz</td><td>100</td><td>QP</td><td rowspan="6">3m</td></tr>
<tr><td>88MHz-216MHz</td><td>150</td><td>QP</td></tr>
<tr><td>216MHz-960MHz</td><td>200</td><td>QP</td></tr>
<tr><td>960MHz-1GHz</td><td>500</td><td>QP</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>500</td><td>Average</td></tr>
<tr><td>5000</td><td>Peak</td></tr>
</table>
</td></tr>
<tr><td>Test setup:</td><td>Below 30MHz
 

30MHz~1GHz</td></tr>
</table>



Above 1GHz



Test Procedure:	1. The EUT was placed on the top of a rotating table (0.8 meters below 1G and 1.5 meters above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have

	10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Remark:

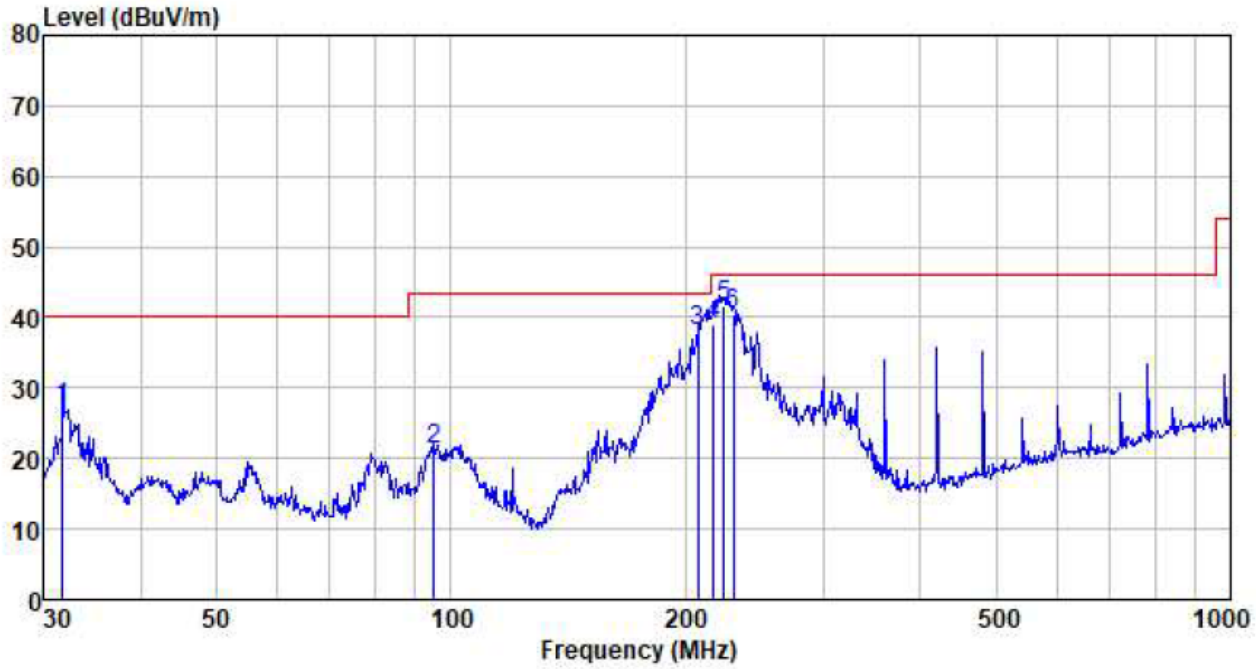
1. *During the test, pre-scan the GFSK, Pi/4QPSK, 8DPSK modulation, and found the GFSK modulation which it is worse case.*
2. *Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.*

Measurement data:

9 kHz ~ 30 MHz
The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

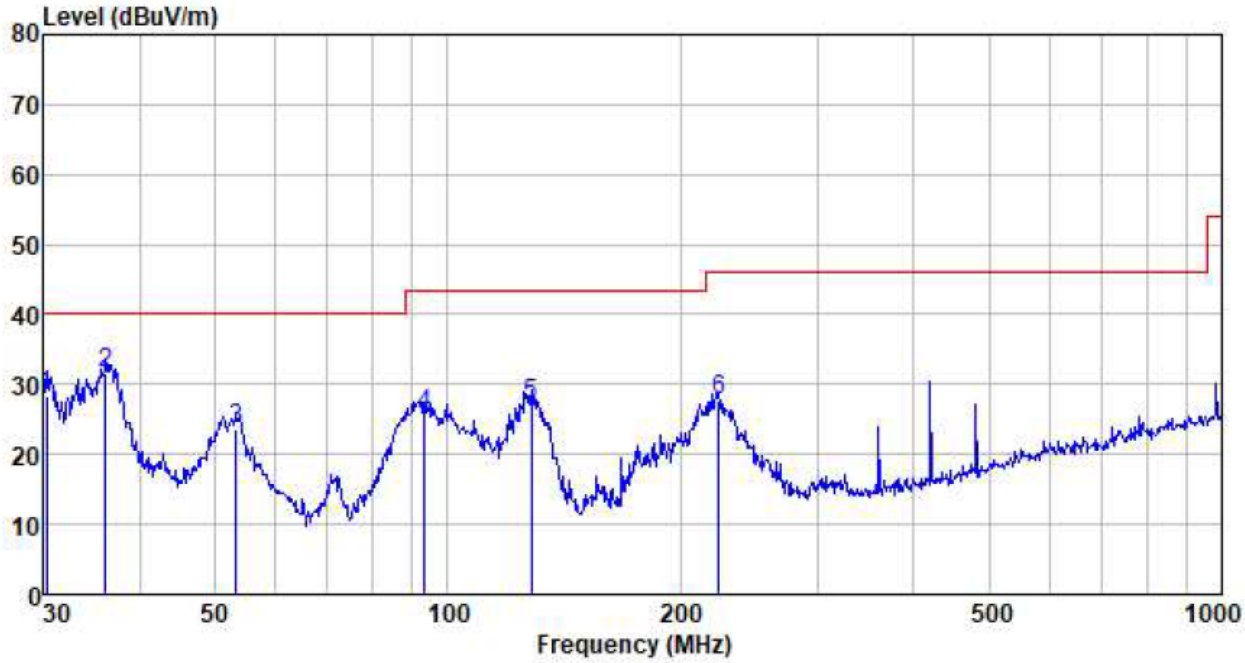
■ **Below 1GHz**

Horizontal:



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
31.731	50.41	11.24	0.57	35.13	27.09	40.00	-12.91	QP
95.093	45.26	11.52	1.15	36.68	21.25	43.50	-22.25	QP
207.123	62.92	10.69	1.88	37.34	38.15	43.50	-5.35	QP
217.544	63.45	11.05	1.95	37.35	39.10	46.00	-6.90	QP
223.733	65.67	11.27	1.98	37.35	41.57	46.00	-4.43	QP
230.099	64.32	11.49	2.02	37.36	40.47	46.00	-5.53	QP

Vertical:

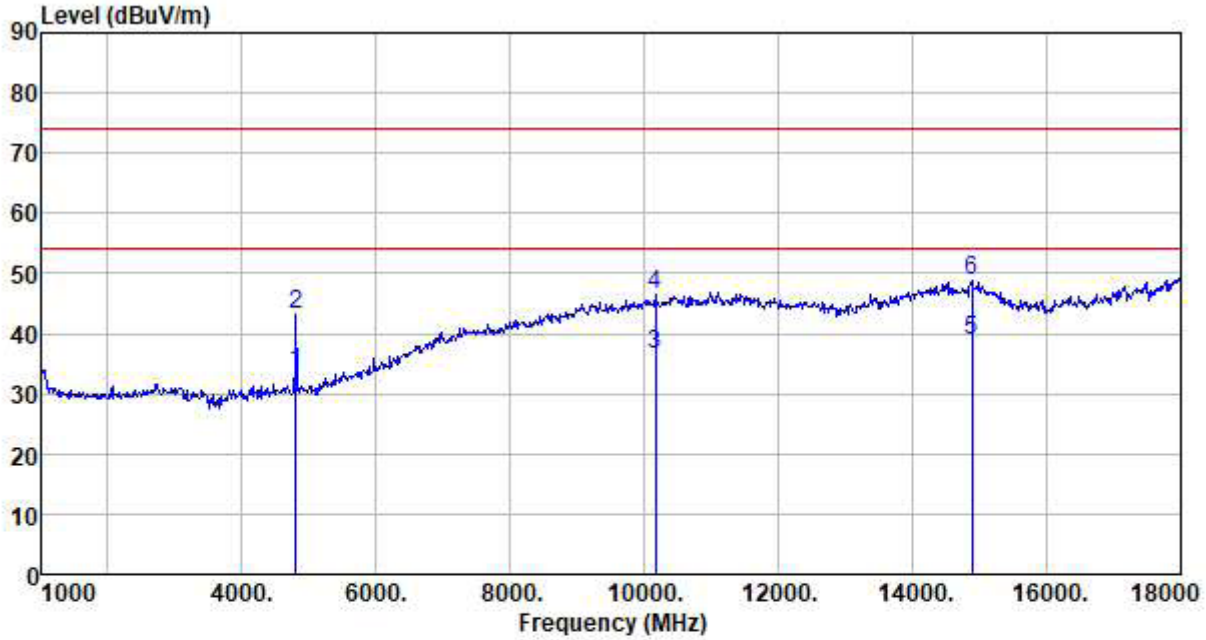


Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
30.317	51.59	11.21	0.55	35.02	28.33	40.00	-11.67	QP
36.127	54.98	11.52	0.62	35.43	31.69	40.00	-8.31	QP
53.318	47.09	11.95	0.80	36.23	23.61	40.00	-16.39	QP
93.440	49.83	11.25	1.14	36.67	25.55	43.50	-17.95	QP
128.113	54.19	8.43	1.42	36.94	27.10	43.50	-16.40	QP
223.733	51.90	11.27	1.98	37.35	27.80	46.00	-18.20	QP

■ **Above 1GHz**

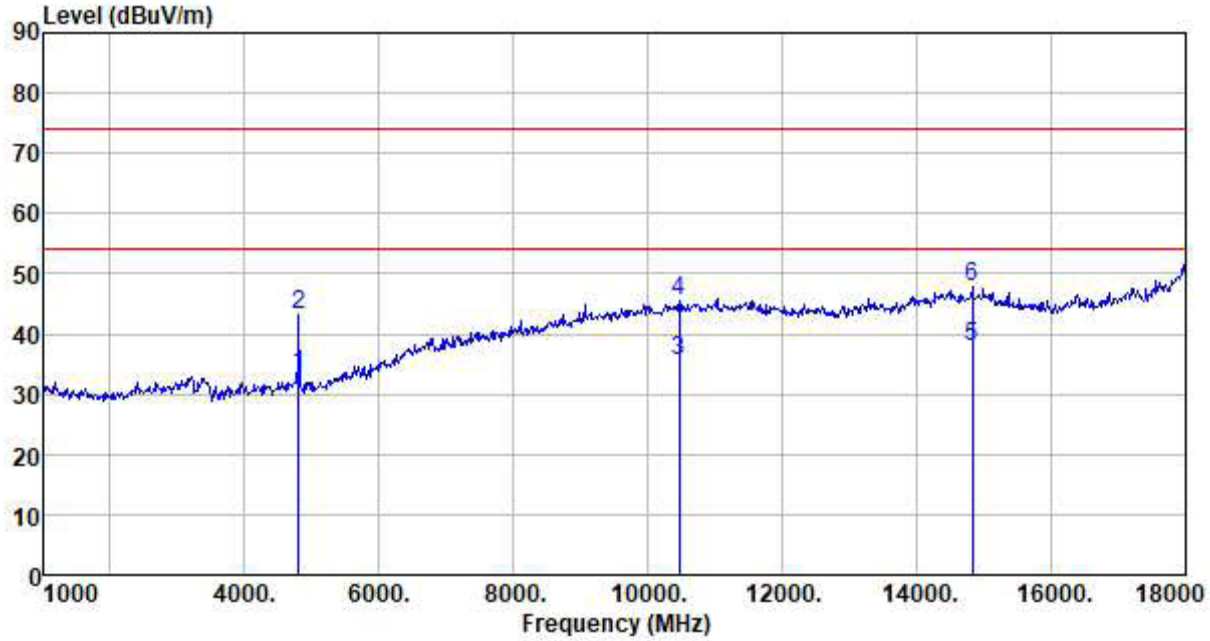
Test mode:	GFSK	Test channel:	Lowest

Horizontal:



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
4804.000	31.63	31.20	8.60	37.73	33.70	54.00	-20.30	Average
4804.000	41.24	31.20	8.60	37.73	43.31	74.00	-30.69	Peak
10163.000	18.84	38.64	14.51	35.38	36.61	54.00	-17.39	Average
10163.000	28.78	38.64	14.51	35.38	46.55	74.00	-27.45	Peak
14889.000	16.19	40.60	17.39	35.47	38.71	54.00	-15.29	Average
14889.000	26.19	40.60	17.39	35.47	48.71	74.00	-25.29	Peak

Vertical:



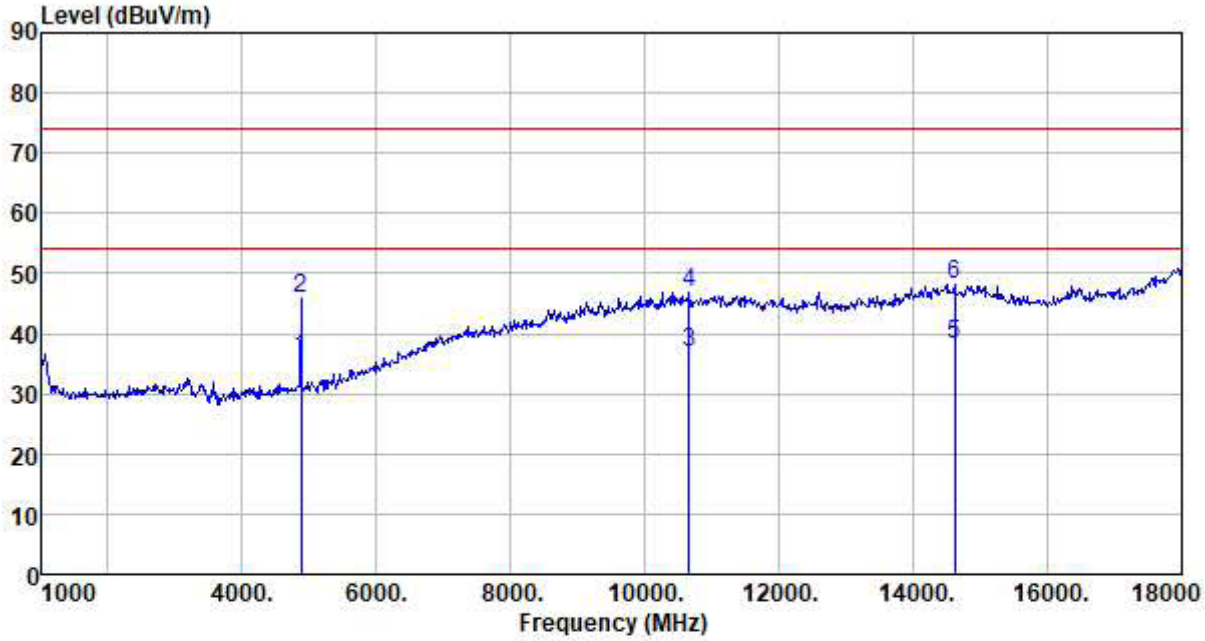
Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
4804.000	31.07	31.20	8.60	37.73	33.14	54.00	-20.86	Average
4804.000	41.10	31.20	8.60	37.73	43.17	74.00	-30.83	Peak
10469.000	17.45	39.11	14.66	35.75	35.47	54.00	-18.53	Average
10469.000	27.41	39.11	14.66	35.75	45.43	74.00	-28.57	Peak
14821.000	15.17	40.70	17.37	35.53	37.71	54.00	-16.29	Average
14821.000	25.21	40.70	17.37	35.53	47.75	74.00	-26.25	Peak

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

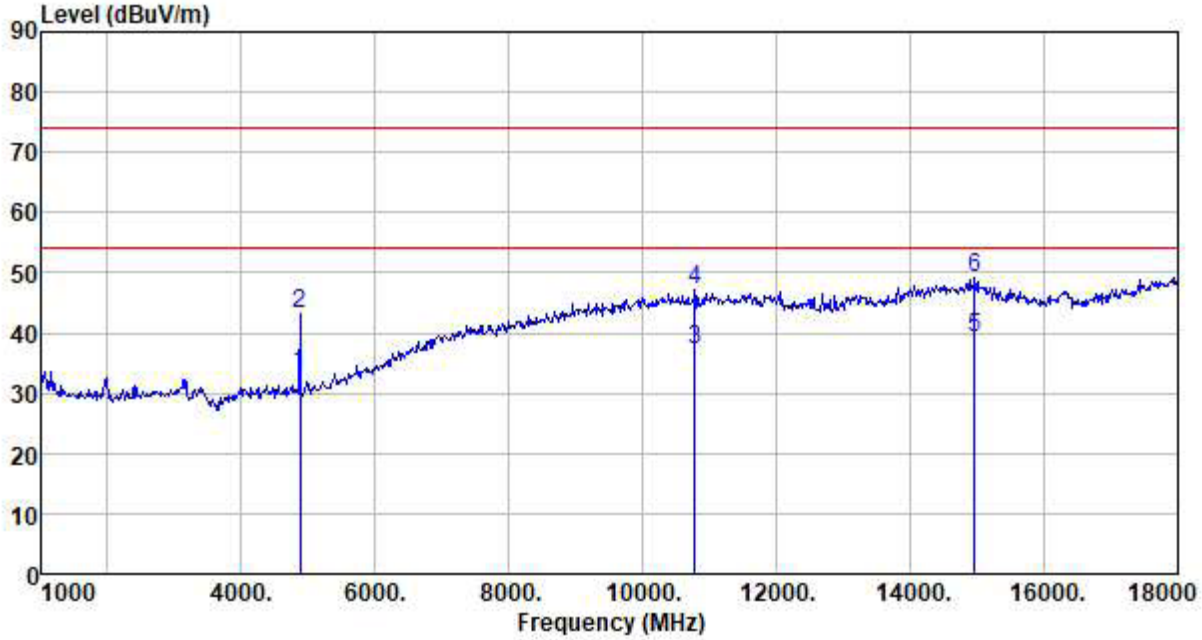
Test mode:	GFSK	Test channel:	Middle

Horizontal:



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
4882.000	33.71	31.33	8.67	37.76	35.95	54.00	-18.05	Average
4882.000	43.72	31.33	8.67	37.76	45.96	74.00	-28.04	Peak
10656.000	18.80	39.23	14.77	36.00	36.80	54.00	-17.20	Average
10656.000	28.90	39.23	14.77	36.00	46.90	74.00	-27.10	Peak
14617.000	15.54	41.20	17.26	35.83	38.17	54.00	-15.83	Average
14617.000	25.54	41.20	17.26	35.83	48.17	74.00	-25.83	Peak

Vertical:



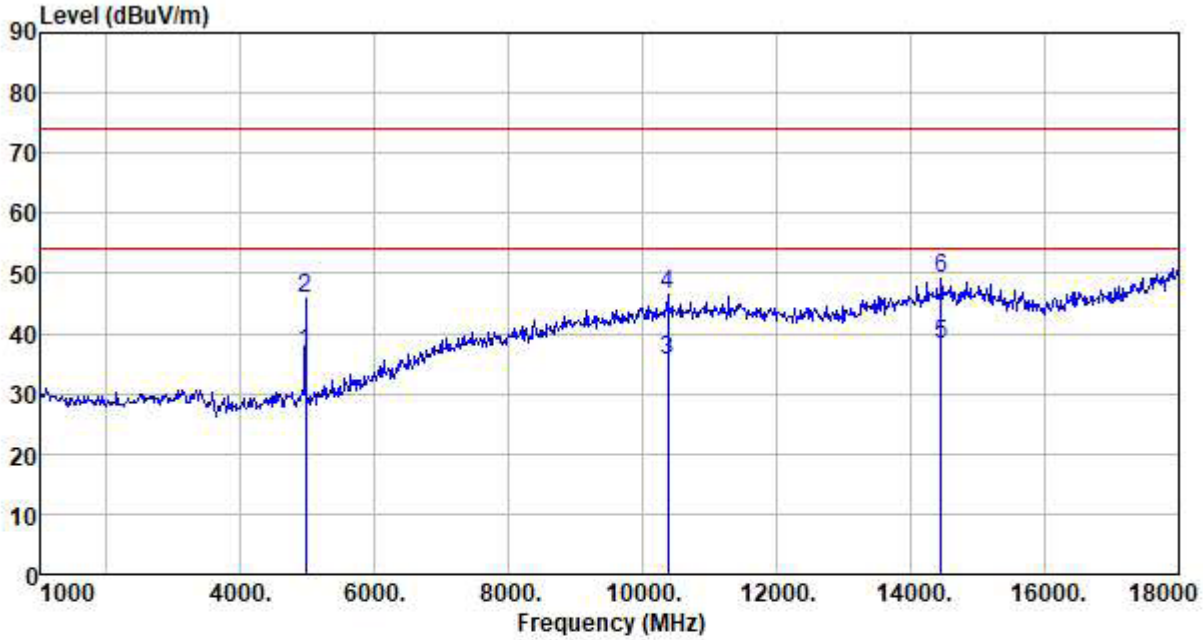
Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
4882.000	31.02	31.33	8.67	37.76	33.26	54.00	-20.74	Average
4882.000	41.02	31.33	8.67	37.76	43.26	74.00	-30.74	Peak
10775.000	19.10	39.25	14.81	36.11	37.05	54.00	-16.95	Average
10775.000	29.07	39.25	14.81	36.11	47.02	74.00	-26.98	Peak
14957.000	16.60	40.40	17.43	35.36	39.07	54.00	-14.93	Average
14957.000	26.54	40.40	17.43	35.36	49.01	74.00	-24.99	Peak

Remark:

3. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
4. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

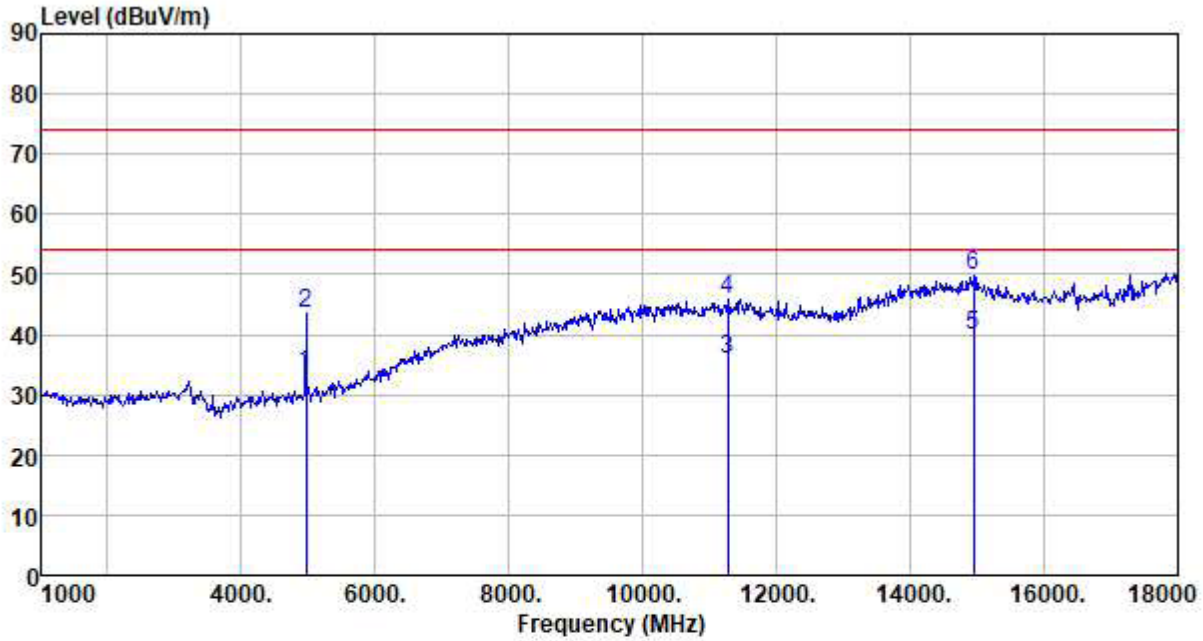
Test mode:	GFSK	Test channel:	Highest

Horizontal:



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
4960.000	34.44	31.44	8.73	37.78	36.83	54.00	-17.17	Average
4960.000	43.47	31.44	8.73	37.78	45.86	74.00	-28.14	Peak
10367.000	17.57	38.96	14.62	35.64	35.51	54.00	-18.49	Average
10367.000	28.62	38.96	14.62	35.64	46.56	74.00	-27.44	Peak
14447.000	15.55	41.49	17.17	36.06	38.15	54.00	-15.85	Average
14447.000	26.53	41.49	17.17	36.06	49.13	74.00	-24.87	Peak

Vertical:



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
4960.000	31.22	31.44	8.73	37.78	33.61	54.00	-20.39	Average
4960.000	41.26	31.44	8.73	37.78	43.65	74.00	-30.35	Peak
11268.000	17.87	39.35	14.96	36.35	35.83	54.00	-18.17	Average
11268.000	27.85	39.35	14.96	36.35	45.81	74.00	-28.19	Peak
14940.000	17.37	40.40	17.43	35.36	39.84	54.00	-14.16	Average
14940.000	27.37	40.40	17.43	35.36	49.84	74.00	-24.16	Peak

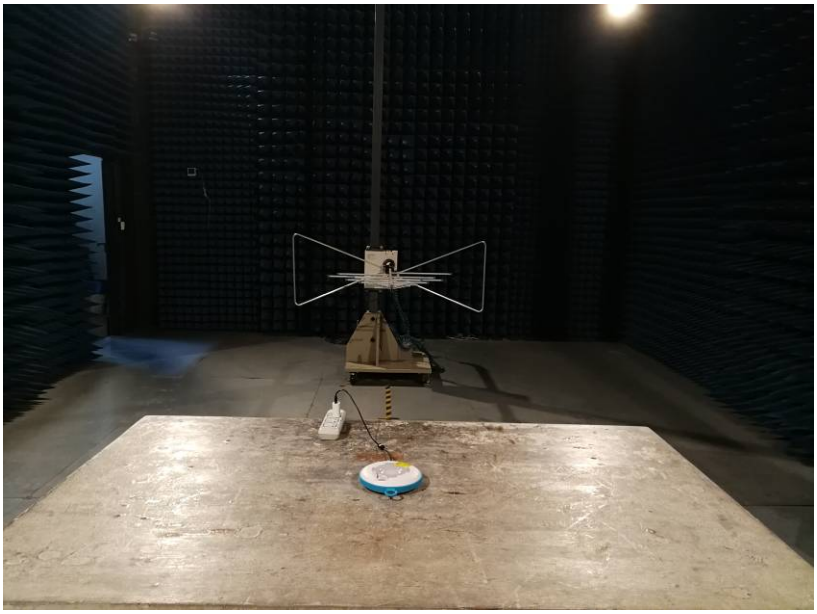
Remark:

5. Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

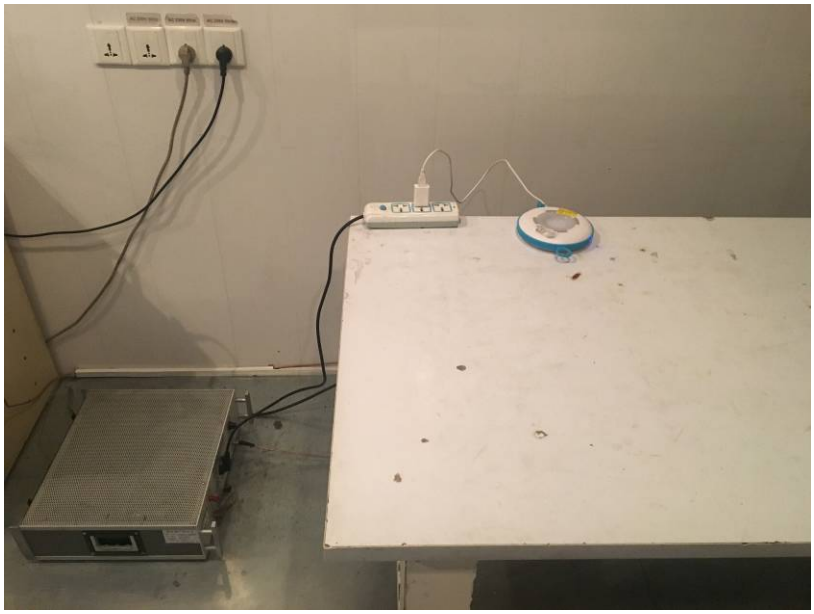
6. The emission levels of other frequencies are very lower than the limit and not show in test report.

8 Test Setup Photo

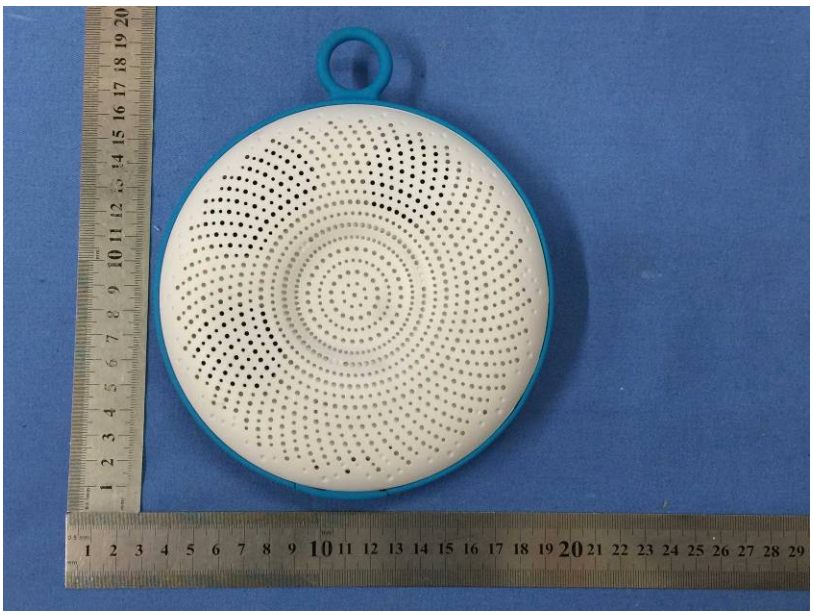
Radiated Emission

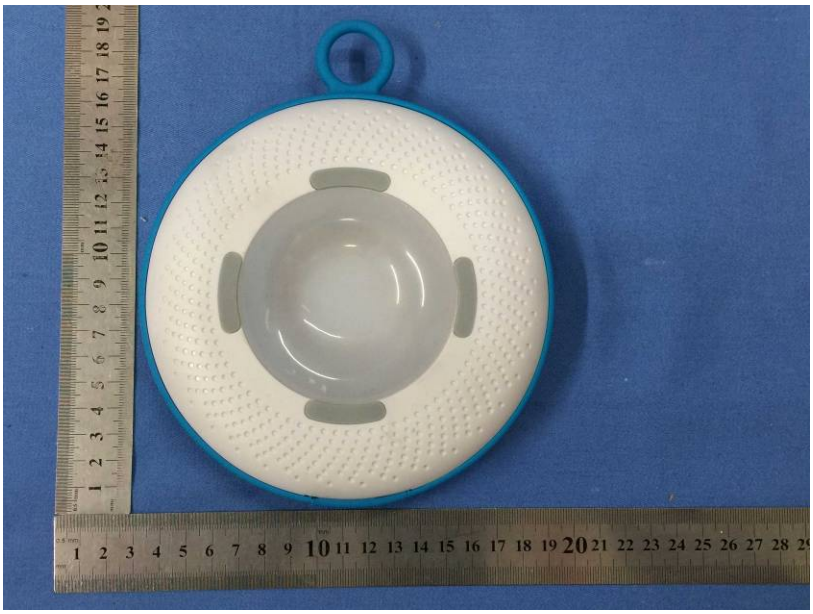


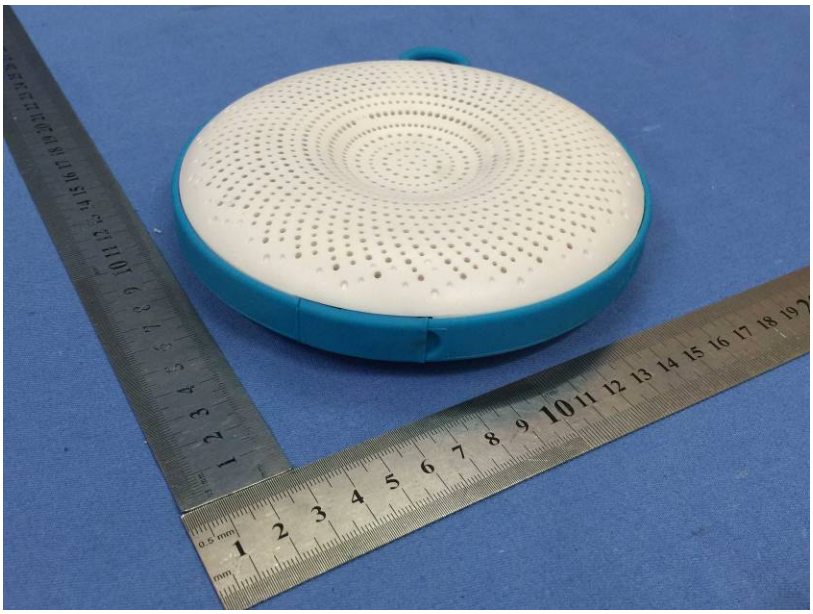
Conducted Emission

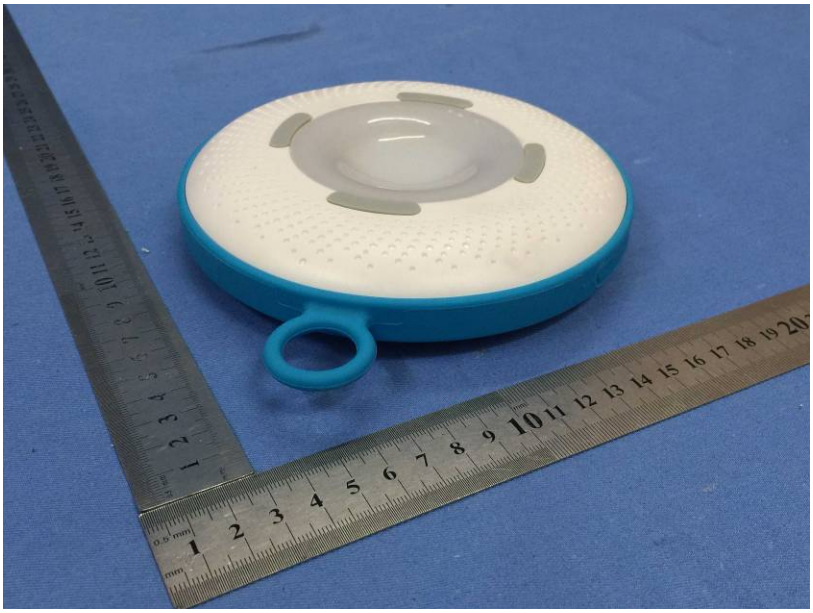


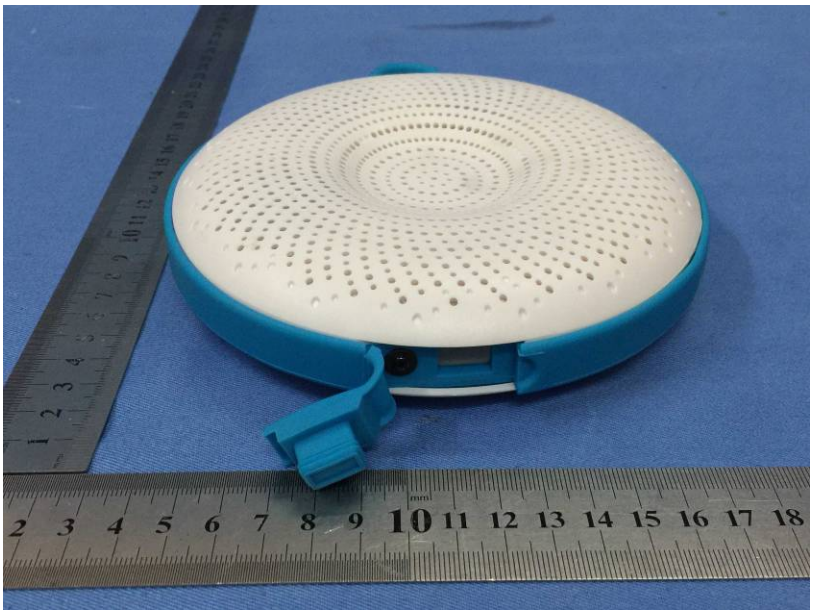
9 EUT Constructional Details

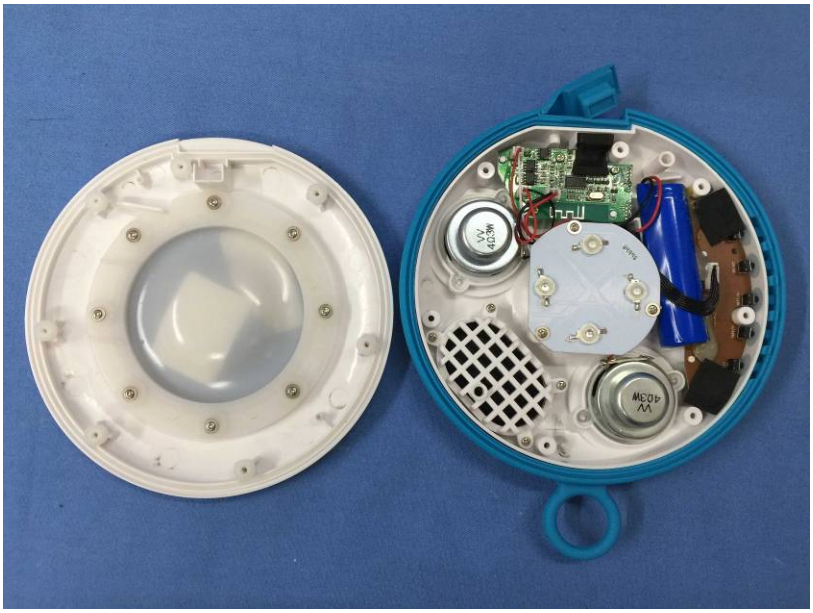


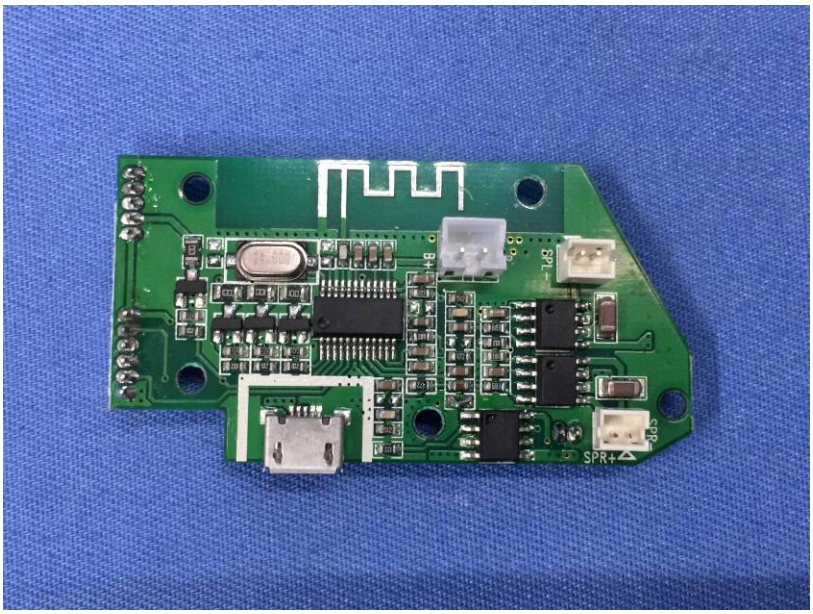


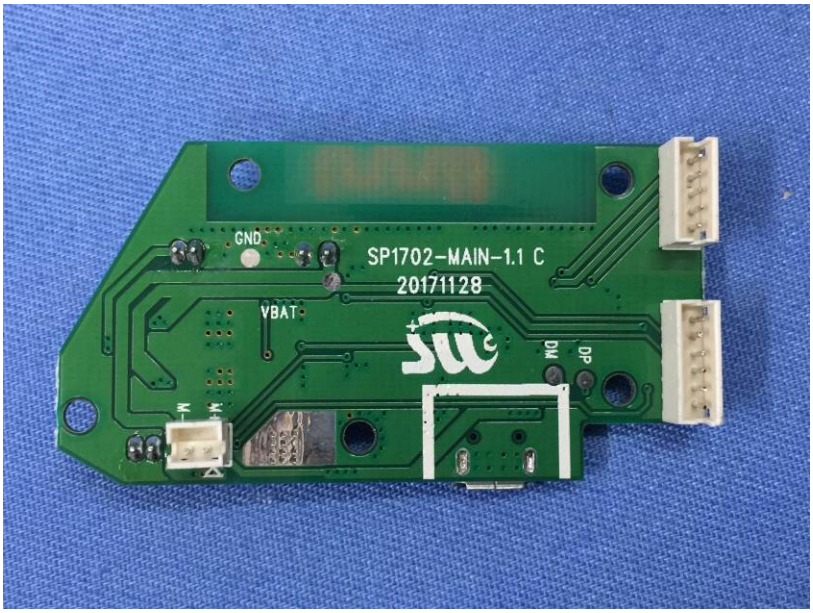


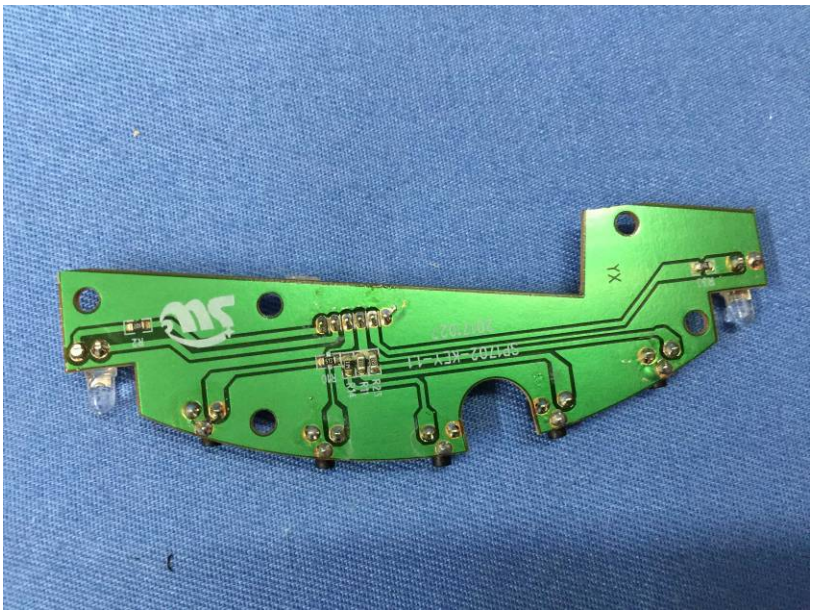


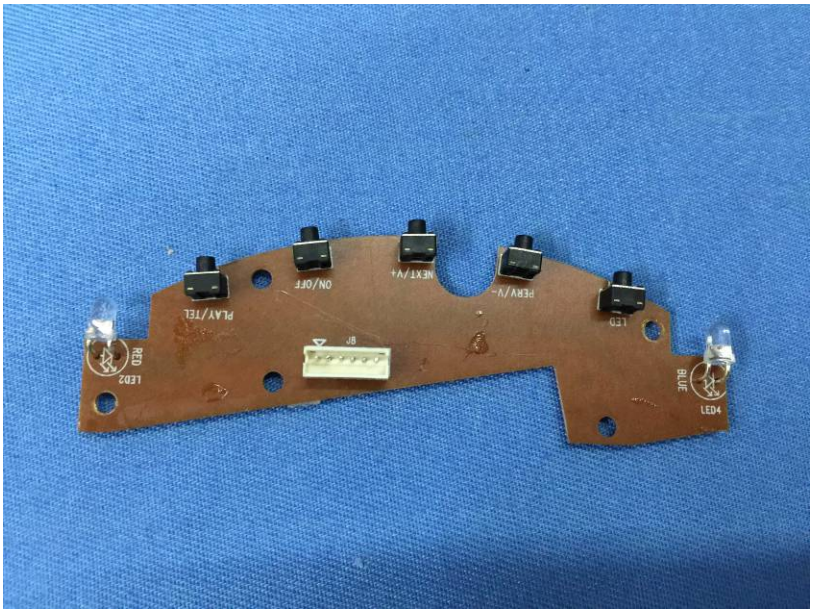


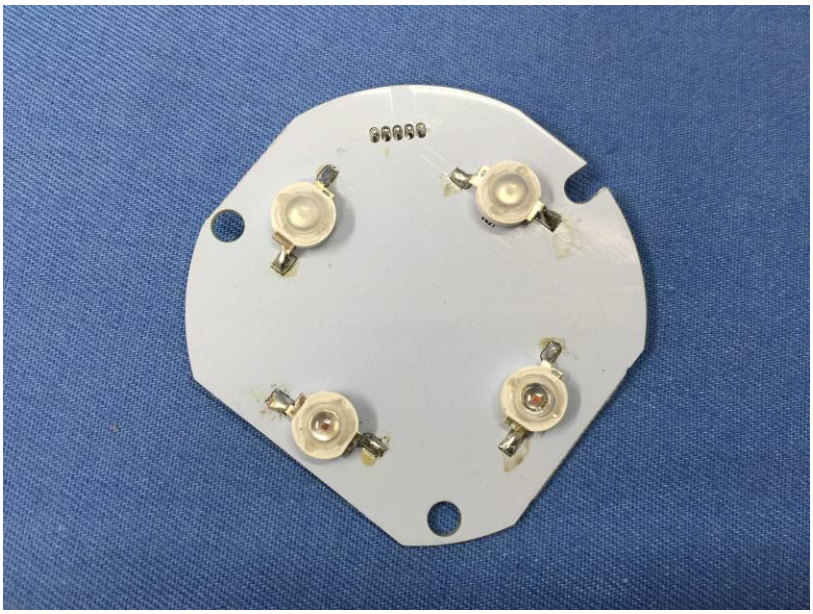


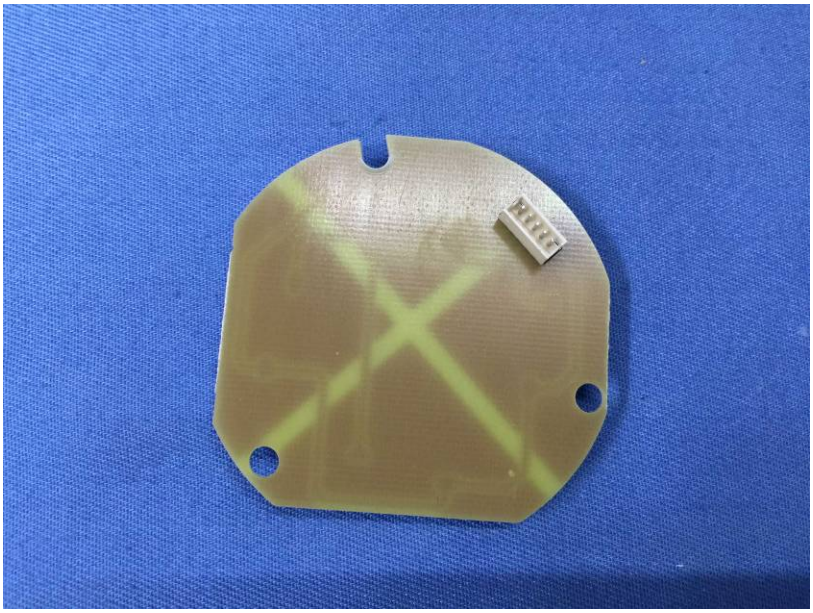

B+
SPR+


GND
SP1702-MAIN-1.1 C
20171128
VBAT
DM
DP




ON/OFF
NEXT/V+
PERV/V-
PLAY/TEL
LED
LED2
RED
BLUE
LED4





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