

FCC TEST REPORT
for
UTONG (HK) COMMERCIAL LIMITED

Bluetooth Speaker
Model No.: 74415

Prepared for : UTONG (HK) COMMERCIAL LIMITED
Address : Room 913, 9F, Hollywood Plaza, 610 Nathan Road, Mong Kok,
Kowloon, HongKong

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Date of Test : Nov. 17~24, 2016
Date of Report : Nov. 24, 2016

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TEST REPORT

Applicant : UTONG (HK) COMMERCIAL LIMITED
Manufacturer : UTONG (HK) COMMERCIAL LIMITED
EUT : Bluetooth Speaker
Model No. : 74415
Serial No. : N.A.
Trade Mark : N.A.
Rating : Input DC 5V, 600mA (Battery DC 3.7V, 1200mAh)

Measurement Procedure Used:

FCC Part15 Subpart C 2016, Paragraph 15.207, 15.247 & 15.209

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Test : Nov. 17~24, 2016

Prepared by :

(Tested Engineer / Baron Wen)

Reviewer :

(Project Manager / Dolly Mo)

Approved & Authorized Signer :

(Manager / Tom Chen)

1. GENERAL INFORMATION

1.1 Description of Device (EUT)

EUT : Bluetooth Speaker

Model Number : 74415

Test Power Supply : AC 120V, 60Hz for adapter/
DC 3.7V Battery inside

Frequency : 2402~2480MHz

Antenna Specification : PCB Antenna: 1.2dBi

Modulation : GFSK, $\pi/4$ DQPSK, 8DPSK

Applicant : UTONG (HK) COMMERCIAL LIMITED
Address : Room 913, 9F, Hollywood Plaza, 610 Nathan Road, Mong Kok,
Kowloon, HongKong

Manufacturer : UTONG (HK) COMMERCIAL LIMITED
Address : Room 913, 9F, Hollywood Plaza, 610 Nathan Road, Mong Kok,
Kowloon, HongKong

Factory : UTONG (HK) COMMERCIAL LIMITED
Address : Room 913, 9F, Hollywood Plaza, 610 Nathan Road, Mong Kok,
Kowloon, HongKong

Date of receipt : Nov. 17, 2016

Date of Test : Nov. 17~24, 2016

1.2 Auxiliary Equipment Used during Test

Adapter : Manufacturer: ZTE
M/N: STC-A2050I1000USBA-C
S/N: 201202102100876
Input: 100-240V~50/60Hz 0.3A
Output: DC 5V, 1000mA

1.3 Description of Test Facility

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

FCC-Registration No.: 752021

Shenzhen Anbotek Compliance Laboratory Limited, 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. Registration 752021, July 06, 2016.

IC-Registration No.: 8058A-1

Shenzhen Anbotek Compliance Laboratory Limited., EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration 8058A, June 13, 2016.

Test Location

All Emissions tests were performed at
Shenzhen Anbotek Compliance Laboratory Limited. at 1/F., Building 1, SEC
Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong,
China

1.4 Measurement Uncertainty

Radiation Uncertainty : Ur = 4.1 dB (Horizontal)
Ur = 4.3 dB (Vertical)
Conduction Uncertainty : Uc = 3.4dB

2. Test Procedure

GENERAL: This report shall NOT be reproduced except in full without the written approval of Shenzhen Anbotek Compliance Laboratory Limited. The EUT was transmitting a test signal during the testing.

RADIATION INTERFERENCE: The test procedure used was ANSI STANDARD C63.10-2013 using a spectrum analyzer with a pre-selector. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100KHz and the video bandwidth was 300KHz up to 1.0GHz and 1.0MHz with a video BW of 3.0MHz above 1.0GHz. The ambient temperature of the EUT was 74.3oF with a humidity of 69%.

FORMULA OF CONVERSION FACTORS: The Field Strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB. The gain of the Preselector was accounted for in the Spectrum Analyzer Meter Reading.

Example:

Freq (MHz) METER READING + ACF = FS
20 dBuV + 10.36 dB = 30.36 dBuV/m @ 3m

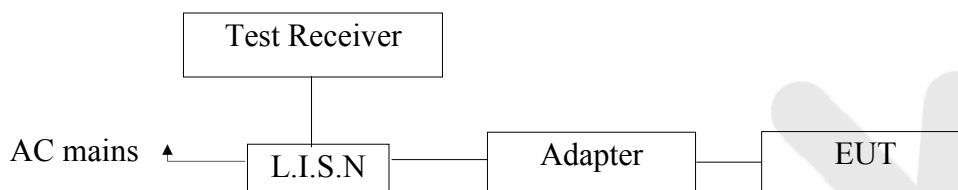
ANSI STANDARD C63.10-2013 10.1.7 MEASUREMENT PROCEDURES: The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.

3. Conducted Emission

3.1 Block Diagram of Test Setup

3.1.1. Block diagram of connection between the EUT and simulators



3.2 Power Line Conducted Emission Measurement Limits (15.207)

Frequency MHz	Limits dB(μV)	
	Quasi-peak Level	Average Level
0.15 ~ 0.50	66 ~ 56*	56 ~ 46*
0.50 ~ 5.00	56	46
5.00 ~ 30.00	60	50

Notes: 1. *Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

3.3 Configuration of EUT on Measurement

The following equipments are installed on Power Line Conducted Emission Measurement to meet the commission requirement and operating regulations in a manner which tends to maximize its emission characteristics in a normal application.

3.4 Operating Condition of EUT

- 3.4.1. Setup the EUT and simulator as shown as Section 3.1.
- 3.4.2. Turn on the power of all equipment.
- 3.4.3. Let the EUT work in test mode (Charge+TX Mode) and measure it.

3.5 Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10-2013 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9KHz.

The frequency range from 150KHz to 30MHz is checked.

The test results are reported on Section 3.6.

Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Two-Line V-network	Rohde & Schwarz	ENV216	100055	Apr. 16, 2016	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Apr. 16, 2016	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Apr. 16, 2016	1 Year

3.6 Power Line Conducted Emission Measurement Results

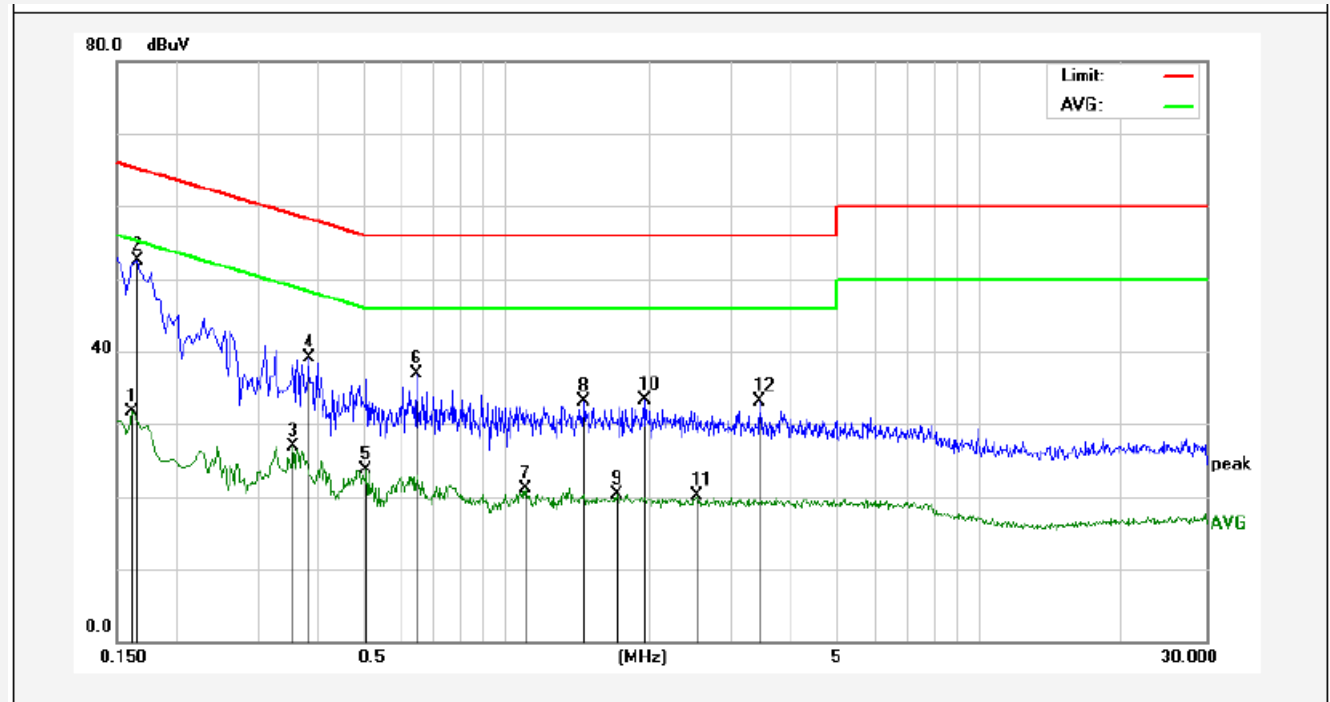
PASS.

The frequency range from 150KHz to 30 MHz is investigated.

Please refer the following pages.

CONDUCTED EMISSION TEST DATA

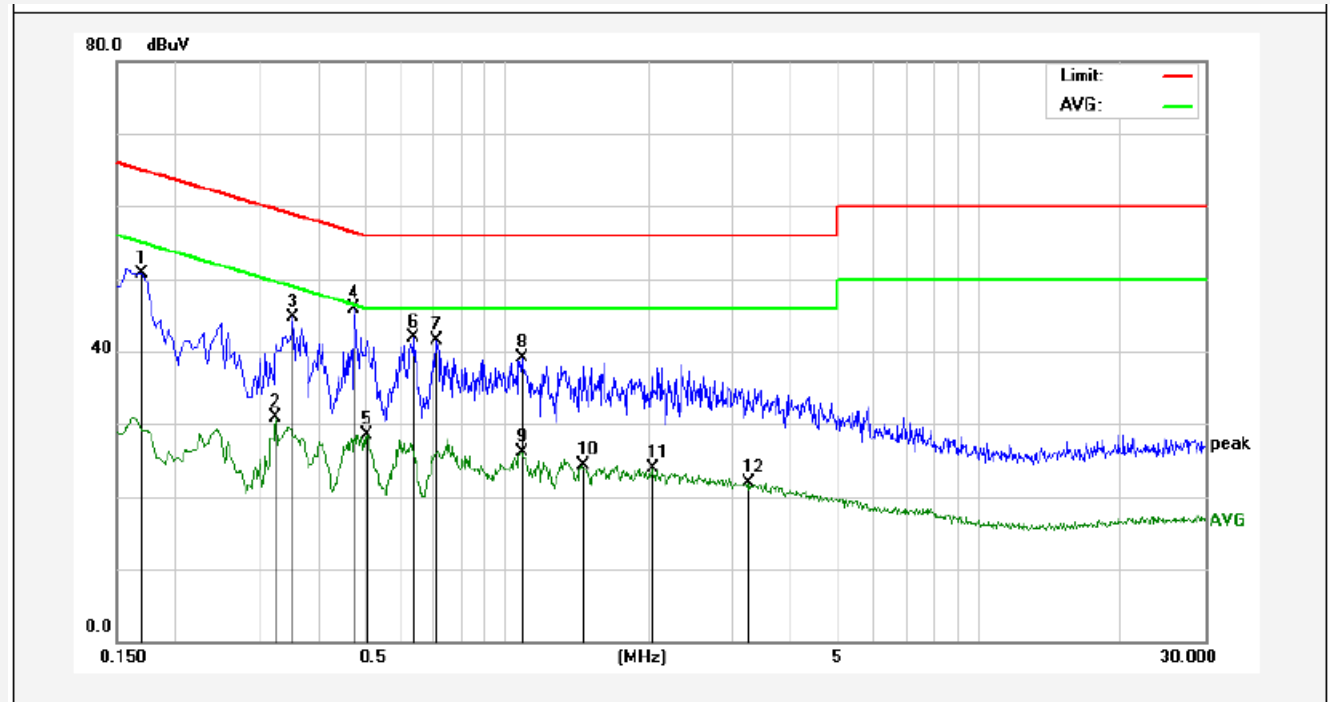
Test Site: 1# Shielded Room
Operating Condition: Charge+TX Mode
Test Specification: AC 120V, 60Hz for adapter
Comment: Live Line
Tem.:25°C Hum.:50%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1620	11.73	19.90	31.63	55.36	-23.73	AVG	
2	0.1660	32.60	19.90	52.50	65.15	-12.65	QP	
3	0.3540	7.04	19.91	26.95	48.87	-21.92	AVG	
4	0.3820	19.20	19.93	39.13	58.23	-19.10	QP	
5	0.5060	3.77	19.98	23.75	46.00	-22.25	AVG	
6	0.6460	16.97	20.02	36.99	56.00	-19.01	QP	
7	1.0980	1.02	20.12	21.14	46.00	-24.86	AVG	
8	1.4620	12.89	20.13	33.02	56.00	-22.98	QP	
9	1.7140	0.26	20.13	20.39	46.00	-25.61	AVG	
10	1.9620	13.21	20.14	33.35	56.00	-22.65	QP	
11	2.5340	-0.07	20.15	20.08	46.00	-25.92	AVG	
12	3.4340	13.02	20.17	33.19	56.00	-22.81	QP	

CONDUCTED EMISSION TEST DATA

Test Site: 1# Shielded Room
Operating Condition: Charge+TX Mode
Test Specification: AC 120V, 60Hz for adapter
Comment: Neutral Line
Tem.:25°C Hum.:50%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1700	30.88	19.90	50.78	64.96	-14.18	QP	
2	0.3260	11.06	19.90	30.96	49.55	-18.59	AVG	
3	0.3540	24.88	19.91	44.79	58.87	-14.08	QP	
4	0.4780	25.93	19.97	45.90	56.37	-10.47	QP	
5	0.5100	8.50	19.98	28.48	46.00	-17.52	AVG	
6	0.6380	21.86	20.02	41.88	56.00	-14.12	QP	
7	0.7140	21.37	20.04	41.41	56.00	-14.59	QP	
8	1.0780	19.04	20.12	39.16	56.00	-16.84	QP	
9	1.0780	5.90	20.12	26.02	46.00	-19.98	AVG	
10	1.4420	4.24	20.13	24.37	46.00	-21.63	AVG	
11	2.0380	3.78	20.14	23.92	46.00	-22.08	AVG	
12	3.2740	1.82	20.17	21.99	46.00	-24.01	AVG	

4. Radiation Interference

4.1 Requirements (15.247, 15.209):

4.1.1. Test Limits (< 30 MHz)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30

4.1.2. Test Limits (≥ 30 MHz)

FIELD STRENGTH of Fundamental: @3M	FIELD STRENGTH of Harmonics	S15.209 30 - 88 MHz	40 dBuV/m
902-928 MHz		88 - 216 MHz	43.5
2.4-2.4835 GHz		216 - 960 MHz	46
94 dBuV/m @3m	54 dBuV/m @3m	ABOVE 960 MHz	54dBuV/m

For range 9KHz~30MHz, The measured value is really too low to be recorded.

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

4.2 Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.
For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.
The turn table can rotate 360 degrees to determine the position of the maximum emission level.
The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower.
The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

For 30-1000MHz:

Set the spectrum analyzer as:
RBW = 120kHz, VBW =300kHz,
Detector= Quasi-Peak
Trace mode= Max hold.
Sweep- auto couple.

For Above 1GHz:

Set the spectrum analyzer as:
RBW = 1MHz, VBW =3MHz,
Detector= Peak
Trace mode= Max hold.
Sweep- auto couple.

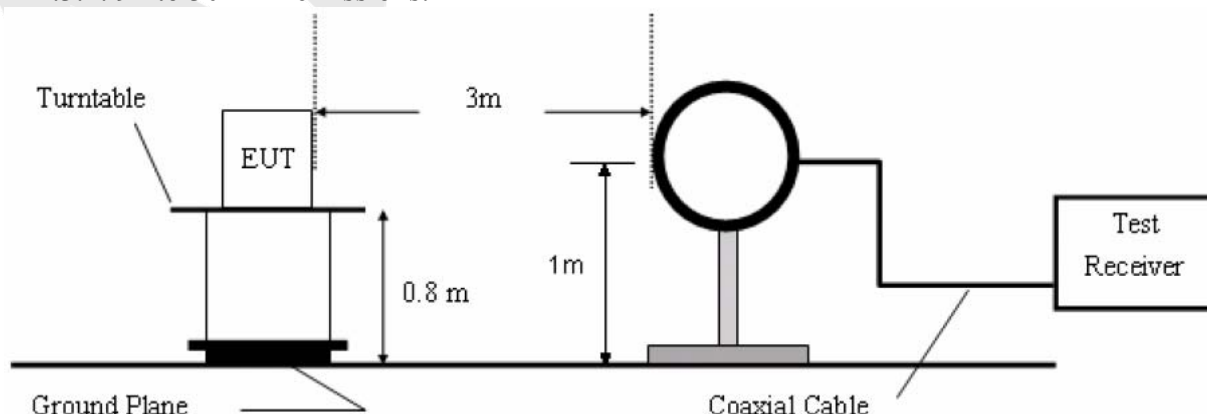
Set the spectrum analyzer as:
RBW =1MHz, VBW =10Hz
Detector= Peak for AV value
Trace mode= Max hold.
Sweep- auto couple.

Test Equipment

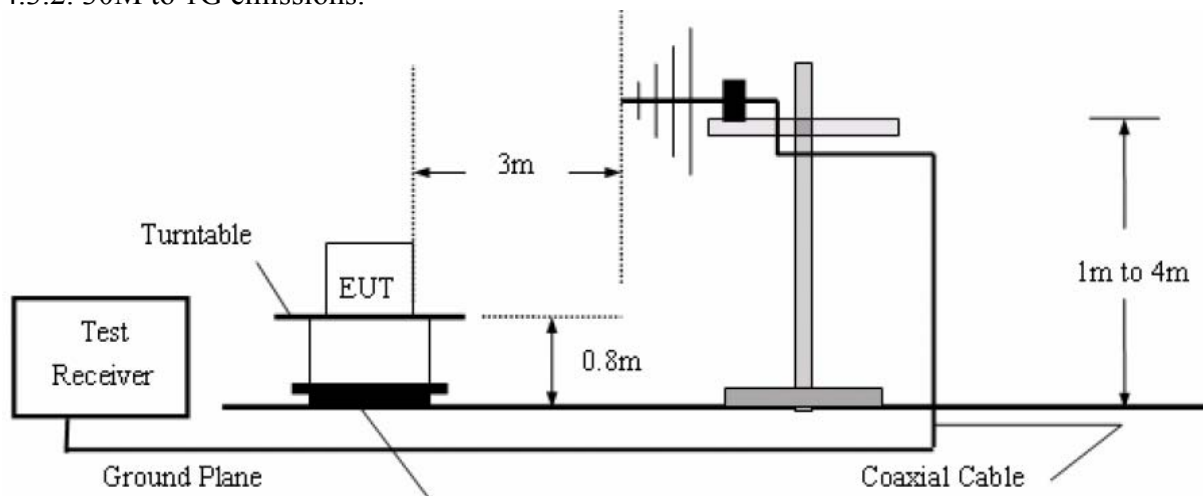
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Apr. 16, 2016	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 16, 2016	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 16, 2016	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 19, 2016	1 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 19, 2016	1 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 16, 2016	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
8	Power Sensor	DAER	RPR3006W	15I00041SN046	Jun 30, 2016	1 Year
9	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Jun 30, 2016	1 Year
10	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Jun 30, 2016	1 Year
11	Signal Generator	Agilent	E4421B	MY41000743	Jun 30, 2016	1 Year
12	DC Power supply	IV	IV-8080	YQSB0096	Jun 30, 2016	1 Year
13	TEMP&HUMI PROGRAMMABLE CHAMBER	Bell Group	BE-THK-150M8	SE-0137	Mar. 16, 2016	1 Year

4.3 Test Configuration

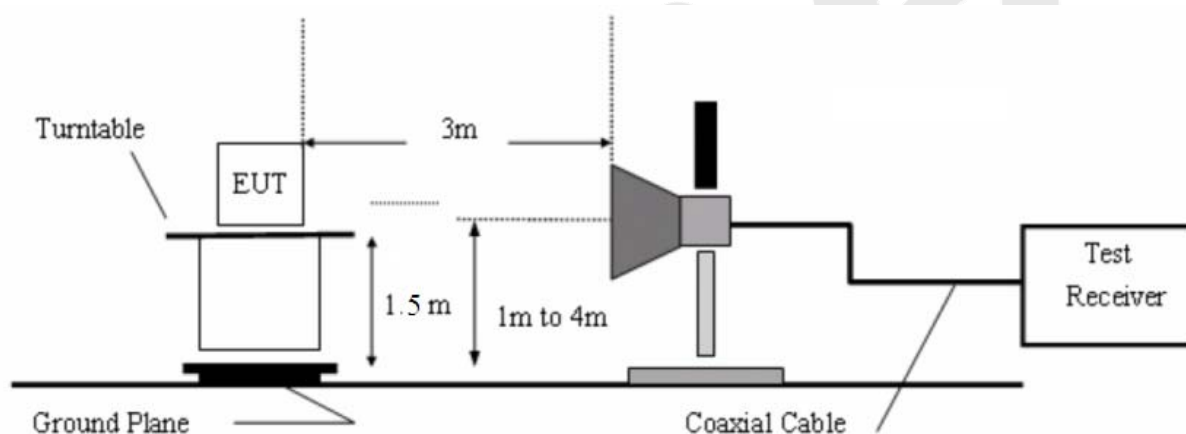
4.3.1. 9k to 30MHz emissions:



4.3.2. 30M to 1G emissions:



4.3.3. 1G to 40G emissions:



4.4 Test Results

PASS.

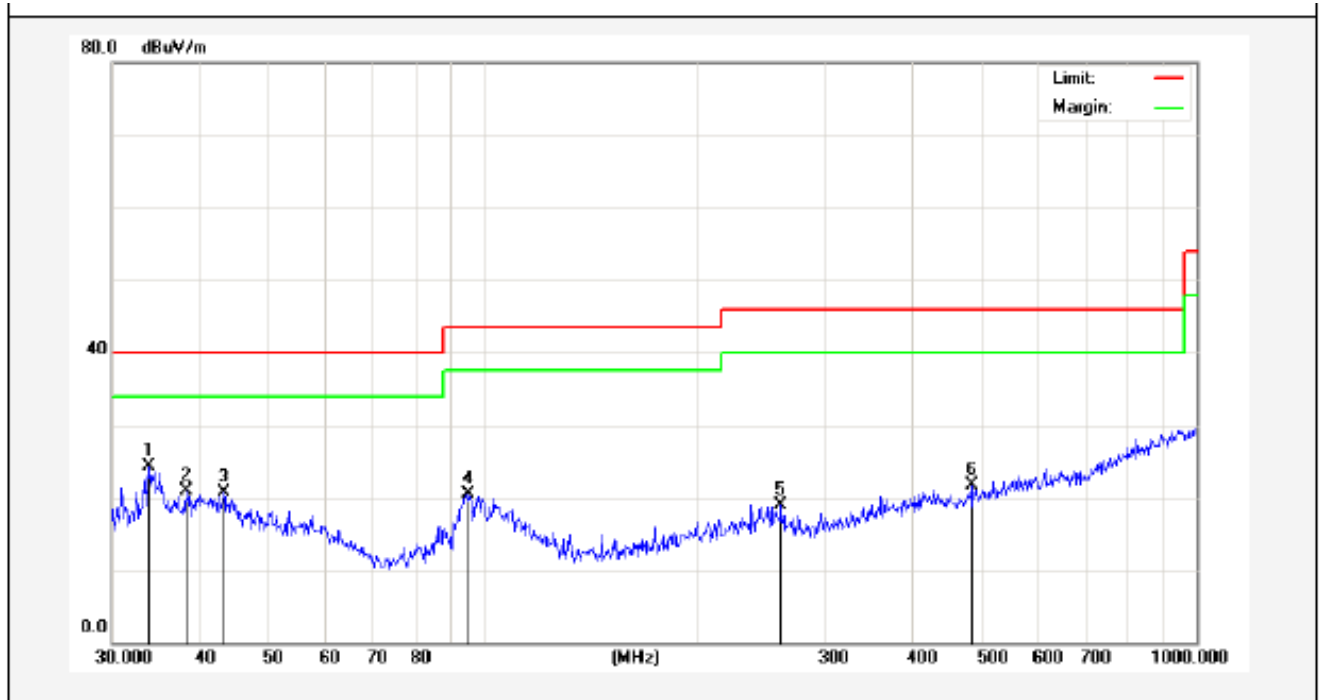
The EUT was tested on (Keeping TX Mode, BT Mode, AUX Mode) modes, only the worst data of (Keeping TX Mode) is attached in the following pages.

Only the worst case (x orientation).

GFSK, $\pi/4$ DQPSK, 8DPSK modes was tested, only the worst data of ($\pi/4$ DQPSK) is attached in the following pages.

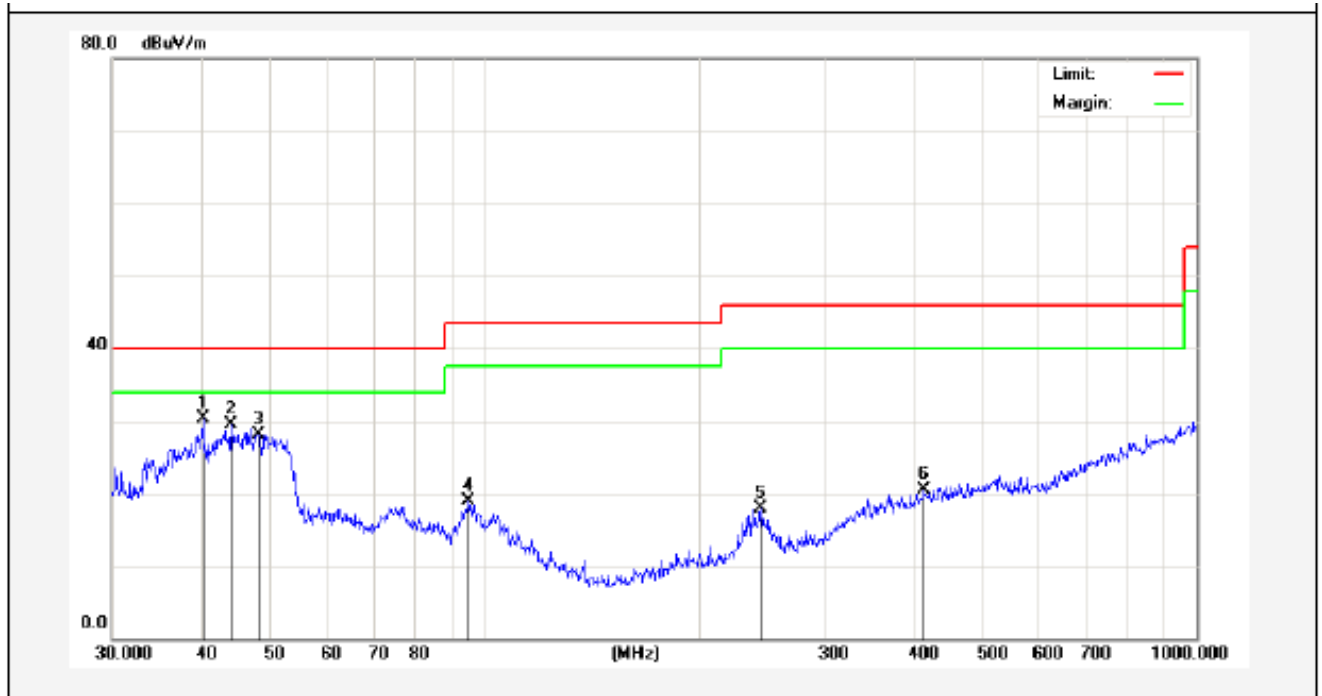
The test results of above 18000MHz are attenuated more than 20dB below the permissible limits, so the results don't record in the report.

Job No.:	011611732I	Polarization:	Horizontal
Standard:	(RE)FCC PART 15C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test (30~1000MHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	Keeping TX Mode	Distance:	3m



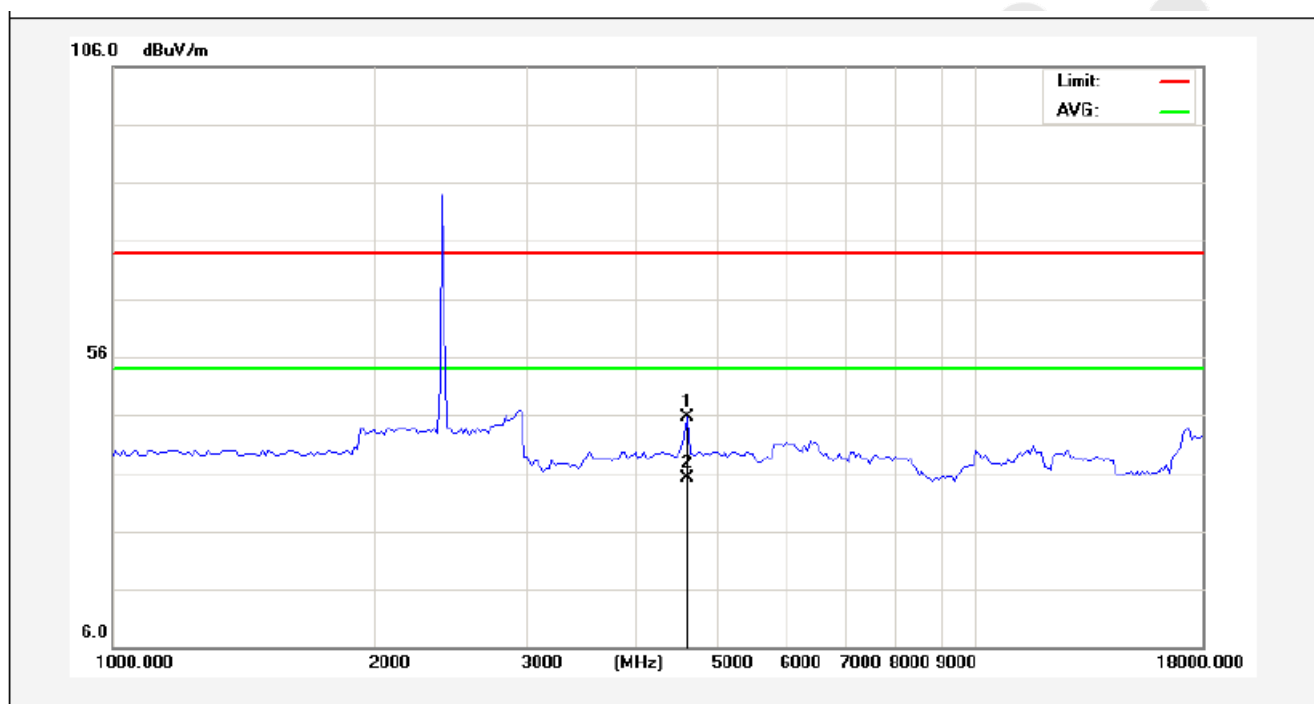
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	33.7986	39.24	-14.92	24.32	40.00	-15.68	peak			
2	38.0783	32.74	-11.88	20.86	40.00	-19.14	peak			
3	43.0505	32.19	-11.57	20.62	40.00	-19.38	peak			
4	95.0930	41.49	-21.00	20.49	43.50	-23.01	peak			
5	261.0583	37.81	-18.96	18.85	46.00	-27.15	peak			
6	482.2156	33.18	-11.47	21.71	46.00	-24.29	peak			

Job No.:	011611732I	Polarization:	Vertical
Standard:	(RE)FCC PART 15C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test (30~1000MHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	Keeping TX Mode	Distance:	3m



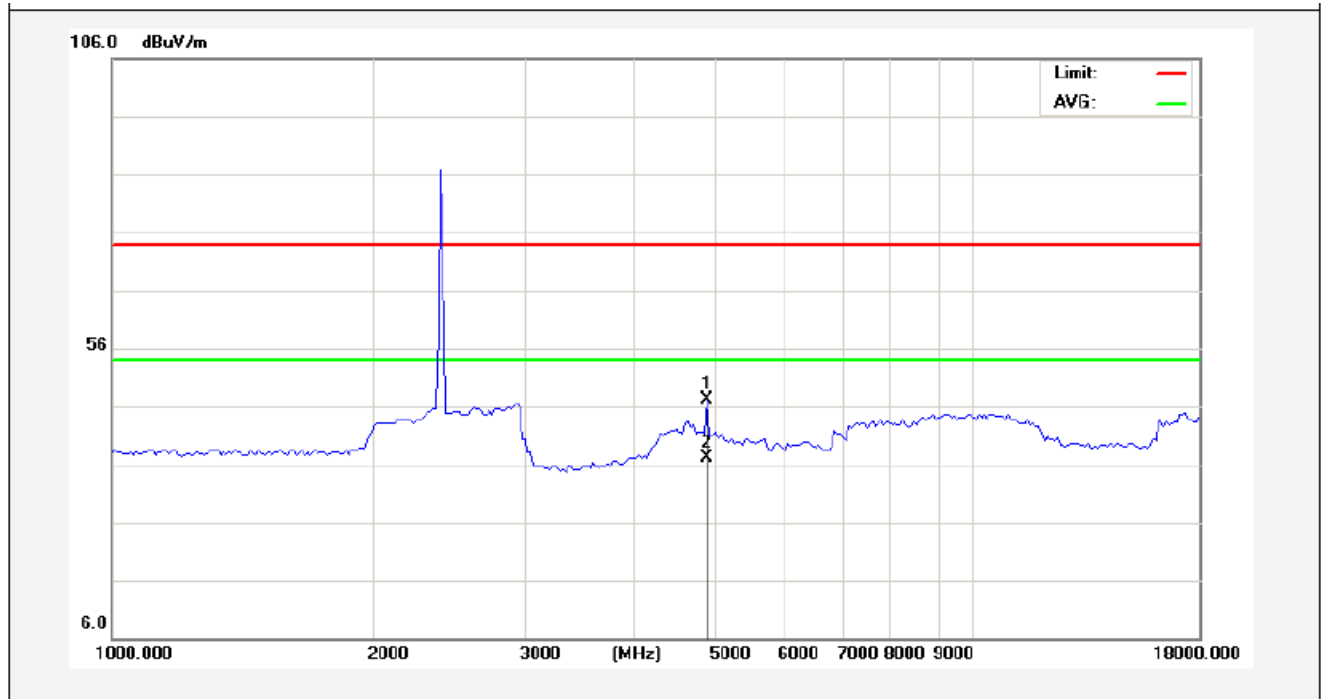
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	40.2757	40.85	-10.48	30.37	40.00	-9.63	peak			
2	44.1202	41.55	-11.98	29.57	40.00	-10.43	peak			
3	48.1626	41.88	-13.75	28.13	40.00	-11.87	peak			
4	95.0930	34.89	-16.00	18.89	43.50	-24.61	peak			
5	244.2321	32.02	-14.07	17.95	46.00	-28.05	peak			
6	414.7223	32.02	-11.44	20.58	46.00	-25.42	peak			

Job No.:	011611732I	Polarization:	Horizontal
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V Battery inside
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2402 MHz)	Distance:	3m



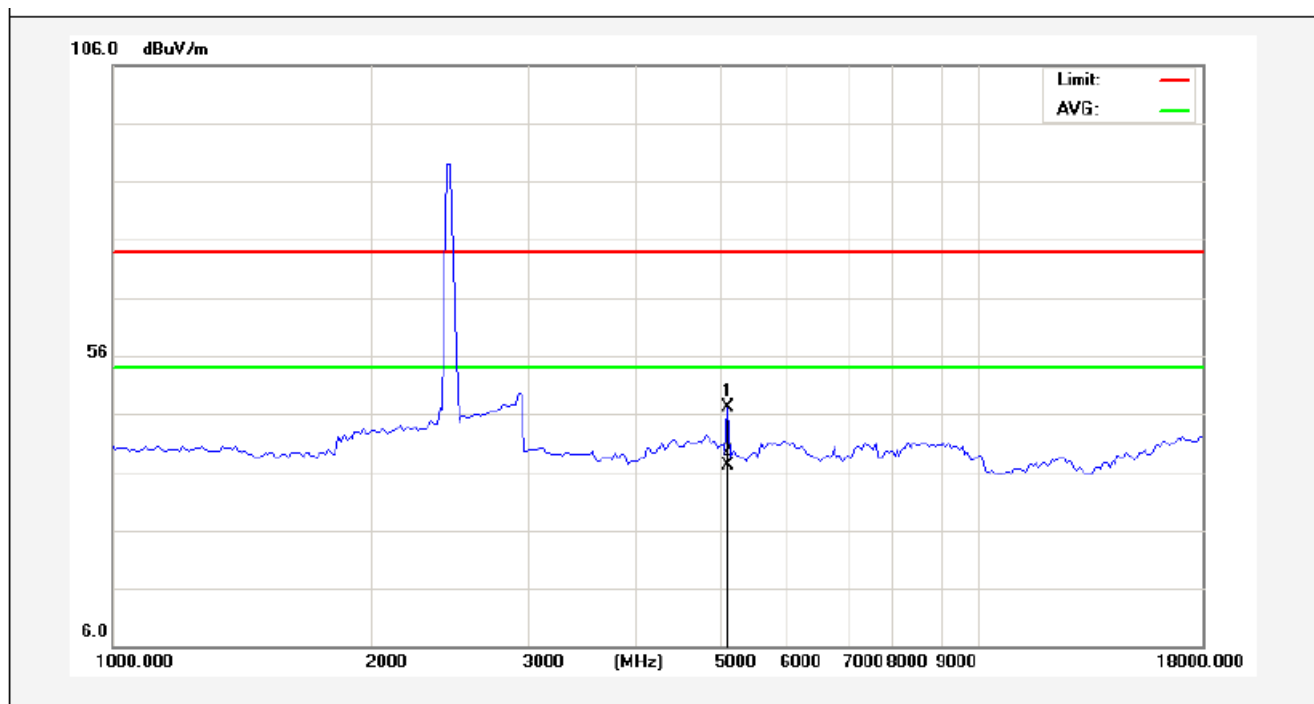
Frequency	CableLoss	AntFactor	Preamplifier	ReadLevel	Level	Limit	Over Limit	Remark
MHz	dB	dB/m	dB	dBμV	dBμV/m	dBμV/m	dB	
4612.500	2.24	30.60	32.50	45.34	45.68	74.00	-28.32	Peak
4612.500	2.24	30.60	32.50	34.89	35.23	54.00	-18.77	AV

Job No.:	011611732I	Polarization:	Vertical
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V Battery inside
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2402 MHz)	Distance:	3m



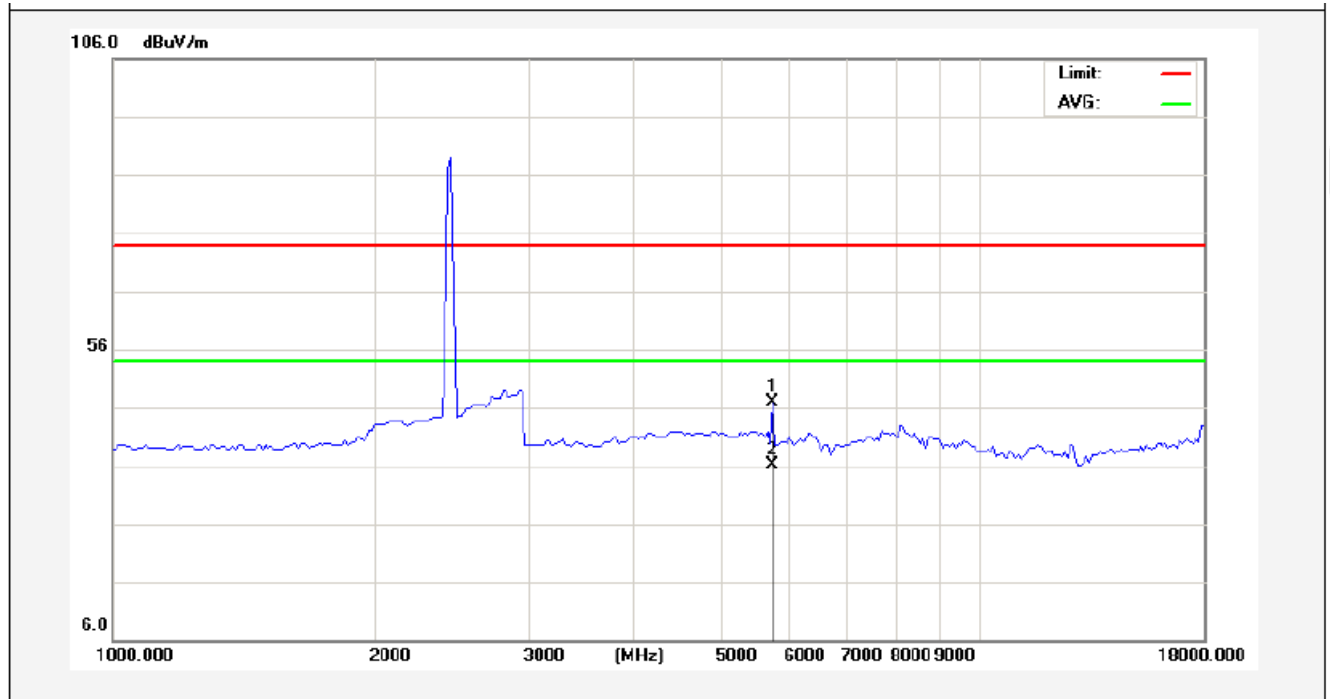
Frequency	CableLoss	AntFactor	PreampFactor	ReadLevel	Level	Limit	Over Limit	Remark
MHz	dB	dB/m	dB	dBμV	dBμV/m	dBμV/m	dB	
4867.500	2.25	30.40	32.50	46.96	47.11	74.00	-26.89	Peak
4867.500	2.25	30.40	32.50	37.06	37.21	54.00	-16.79	AV

Job No.:	011611732I	Polarization:	Horizontal
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V Battery inside
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2441 MHz)	Distance:	3m



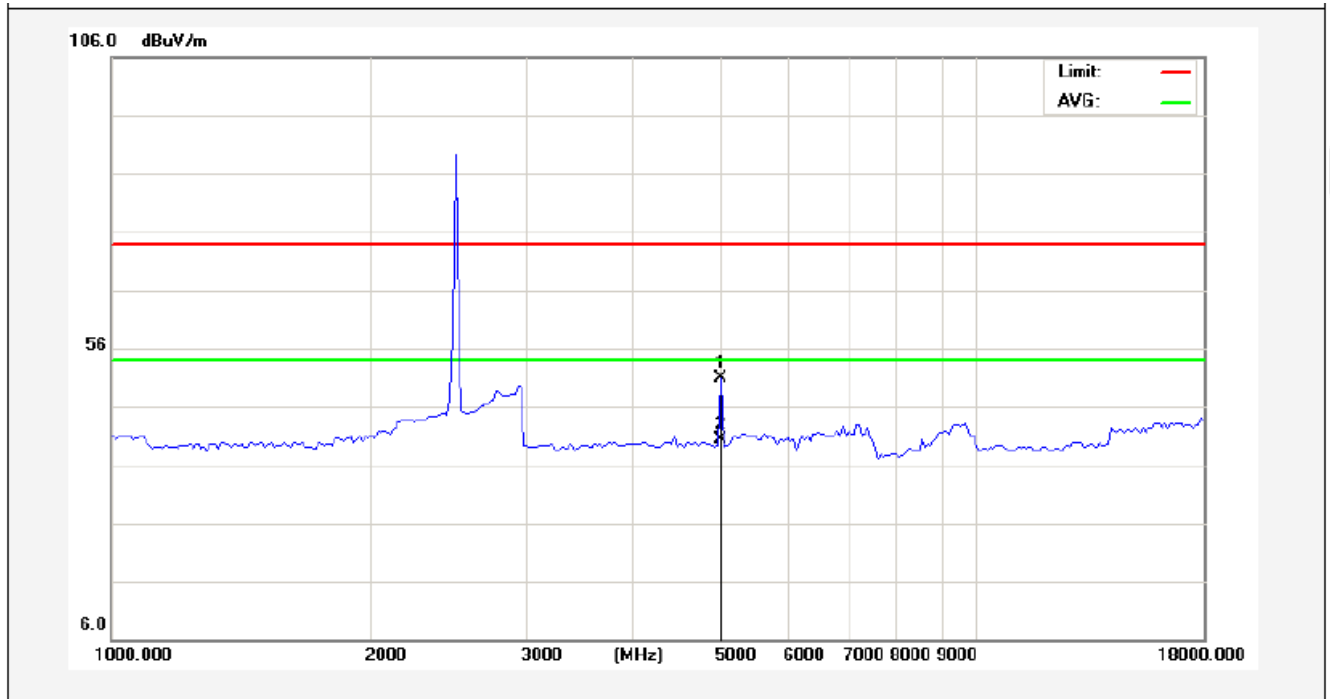
Frequency	CableLoss	AntFactor	Preamplifier	ReadLevel	Level	Limit	Over Limit	Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
5122.500	2.26	30.50	32.50	46.99	47.25	74.00	-26.75	Peak
5122.500	2.26	30.50	32.50	36.95	37.21	54.00	-16.79	AV

Job No.:	011611732I	Polarization:	Vertical
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V Battery inside
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2441 MHz)	Distance:	3m



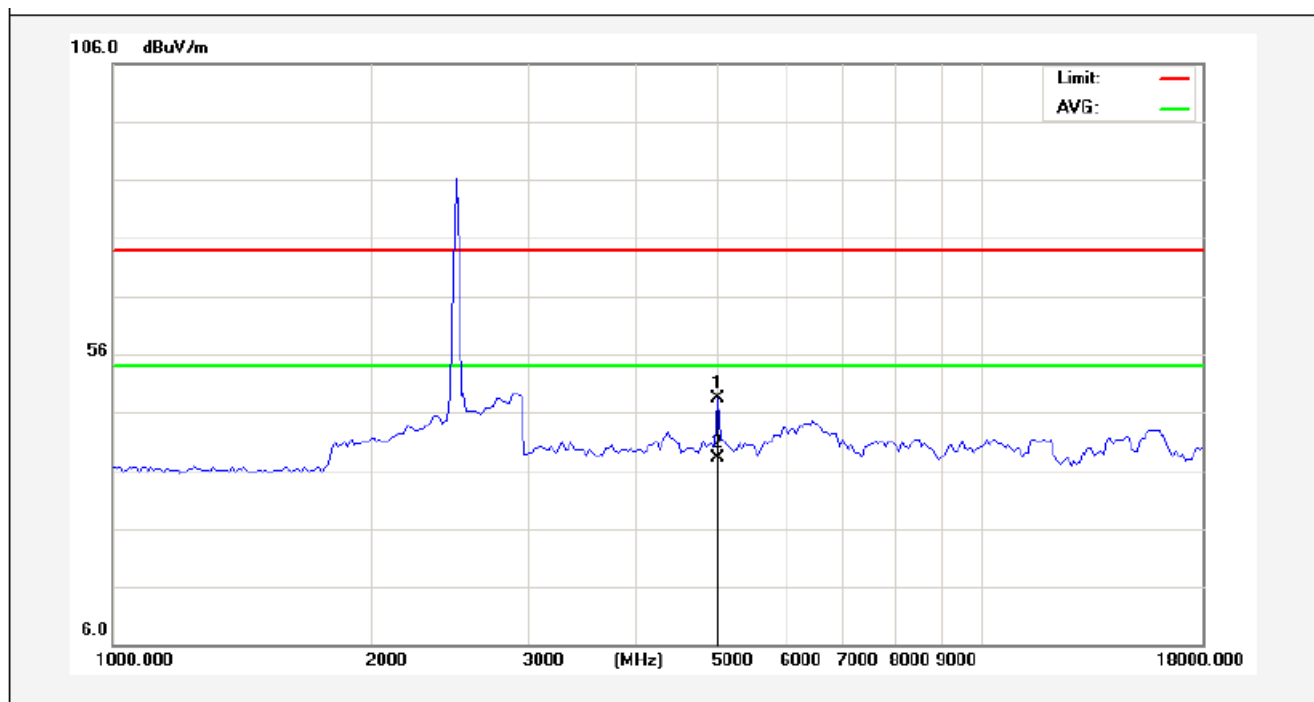
Frequency	CableLoss	AntFactor	PreamplFactor	ReadLevel	Level	Limit	Over Limit	Remark
MHz	dB	dB/m	dB	dBμV	dBμV/m	dBμV/m	dB	
5760.000	2.18	30.44	32.50	46.72	46.84	74.00	-27.16	Peak
5760.000	2.18	30.44	32.50	36.09	36.21	54.00	-17.79	AV

Job No.:	011611732I	Polarization:	Horizontal
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V Battery inside
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2480 MHz)	Distance:	3m



Frequency	CableLoss	AntFactor	Preamplifier	ReadLevel	Level	Limit	Over Limit	Remark
MHz	dB	dB/m	dB	dBμV	dBμV/m	dBμV/m	dB	
5037.500	2.21	30.45	32.50	50.71	50.87	74.00	-23.13	Peak
5037.500	2.21	30.45	32.50	40.18	40.34	54.00	-13.66	AV

Job No.:	011611732I	Polarization:	Vertical
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V Battery inside
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2480 MHz)	Distance:	3m



Frequency	CableLoss	AntFactor	Preamplifier	ReadLevel	Level	Limit	Over Limit	Remark
MHz	dB	dB/m	dB	dBμV	dBμV/m	dBμV/m	dB	
4995.000	2.23	30.45	32.50	48.28	48.46	74.00	-25.54	Peak
4995.000	2.23	30.45	32.50	38.03	38.21	54.00	-15.79	AV

Radiated Band Edge:

Test Mode: GFSK					Test channel: Lowest			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
2390.00	45.40	29.15	3.41	34.01	43.95	74.00	-30.05	H
2400.00	62.55	29.16	3.43	34.01	61.13	74.00	-12.87	H
2390.00	46.19	29.15	3.41	34.01	44.74	74.00	-29.26	V
2400.00	64.86	29.16	3.43	34.01	63.44	74.00	-10.56	V
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
2390.00	35.38	29.15	3.41	34.01	33.93	54.00	-20.07	H
2400.00	46.77	29.16	3.43	34.01	45.35	54.00	-8.65	H
2390.00	35.51	29.15	3.41	34.01	34.06	54.00	-19.94	V
2400.00	48.66	29.16	3.43	34.01	47.24	54.00	-6.76	V

Test Mode: GFSK					Test channel: Highest			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
2483.50	47.81	29.28	3.53	34.03	46.59	74.00	-27.41	H
2500.00	46.50	29.30	3.56	34.03	45.33	74.00	-28.67	H
2483.50	49.07	29.28	3.53	34.03	47.85	74.00	-26.15	V
2500.00	47.74	29.30	3.56	34.03	46.57	74.00	-27.43	V
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
2483.50	38.24	29.28	3.53	34.03	37.02	54.00	-16.98	H
2500.00	35.88	29.30	3.56	34.03	34.71	54.00	-19.29	H
2483.50	39.66	29.28	3.53	34.03	38.44	54.00	-15.56	V
2500.00	36.01	29.30	3.56	34.03	34.84	54.00	-19.16	V

Remark:

- During the test, pre-scan the GFSK, $\pi/4$ QPSK, 8DPSK modulation, and found the GFSK modulation is worse case, the report only record this mode.
- Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

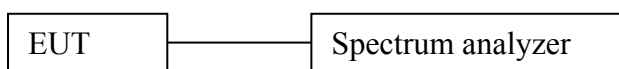
5. CHANNEL SEPARATION TEST

5.1 Measurement Procedure

The EUT must have its hopping function enabled. Using the following spectrum analyzer settings:

1. Span= Wide enough to capture the peaks of two adjacent channels
2. Set the RBW = 100 kHz.
3. Set the VBW = 1.0 MHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

5.2 Test SET-UP



5.3 Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Apr. 16, 2016	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 16, 2016	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 16, 2016	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 19, 2016	1 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 19, 2016	1 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 16, 2016	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
8	Power Sensor	DAER	RPR3006W	15I00041SN046	Jun 30, 2016	1 Year
9	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Jun 30, 2016	1 Year
10	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Jun 30, 2016	1 Year
11	Signal Generator	Agilent	E4421B	MY41000743	Jun 30, 2016	1 Year
12	DC Power supply	IV	IV-8080	YQSB0096	Jun 30, 2016	1 Year
13	TEMP&HUMI PROGRAMMABLE CHAMBER	Bell Group	BE-THK-150M8	SE-0137	Mar. 16, 2016	1 Year

5.4 Test Results

Test Item : Frequency Separation Test Mode : CH Low ~ CH High
Test Voltage : DC 3.7V Battery inside Temperature : 24°C
Test Result : PASS Humidity : 55%RH

Channel	Frequency (MHz)	Separation Read Value (kHz)	Limit (kHz)	Modulation Mode
Mid	2441	1157.75	1031.0	GFSK
Mid	2441	999.25	1252.0	$\pi/4$ DQPSK
Mid	2441	1001.75	1253.0	8DPSK

Remark:

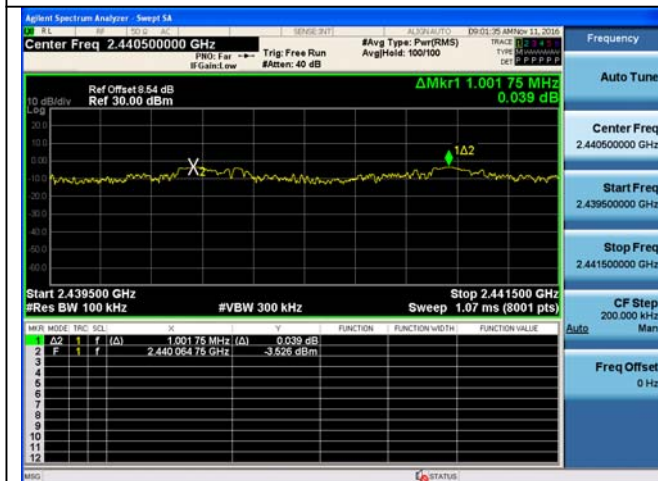
1. The limit of mode (EDR) is 2/3 of 20dB BW;



Test Mode: GFSK---Mid



Test Mode: $\pi/4$ DQPSK---Mid



Test Mode: 8DPSK---Mid

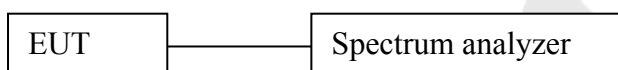
6. 20DB BANDWIDTH TEST

6.1 Measurement Procedure

Using the following spectrum analyzer settings:

1. Span= approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel.
2. Set the RBW = 30 kHz.
3. Set the VBW = 100 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

6.2 Test SET-UP



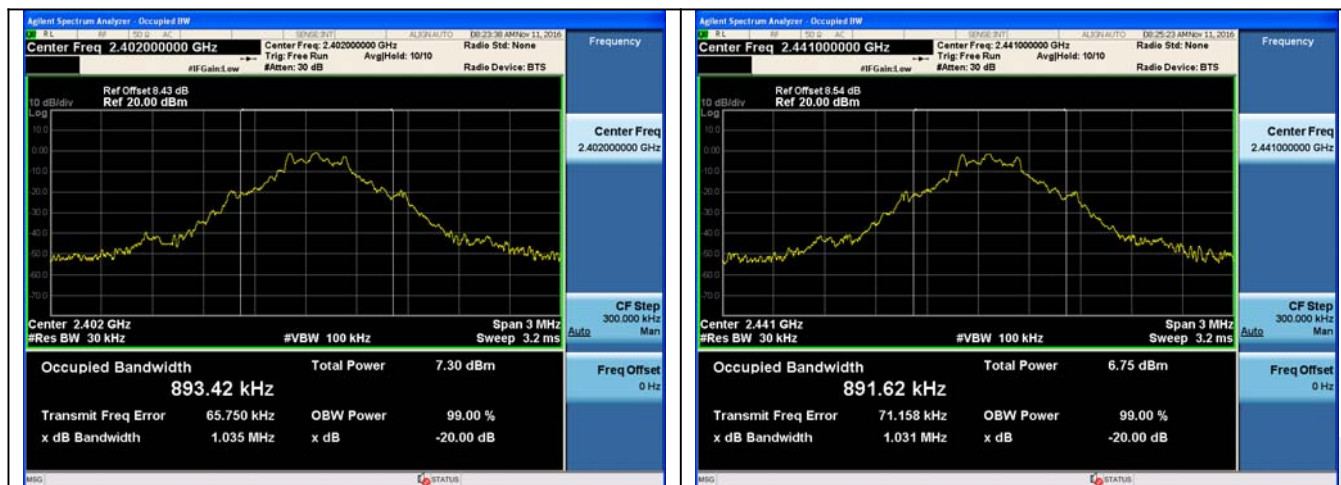
6.3 Test Equipment

Same as the equipment listed in 5.3.

6.4 Test Results

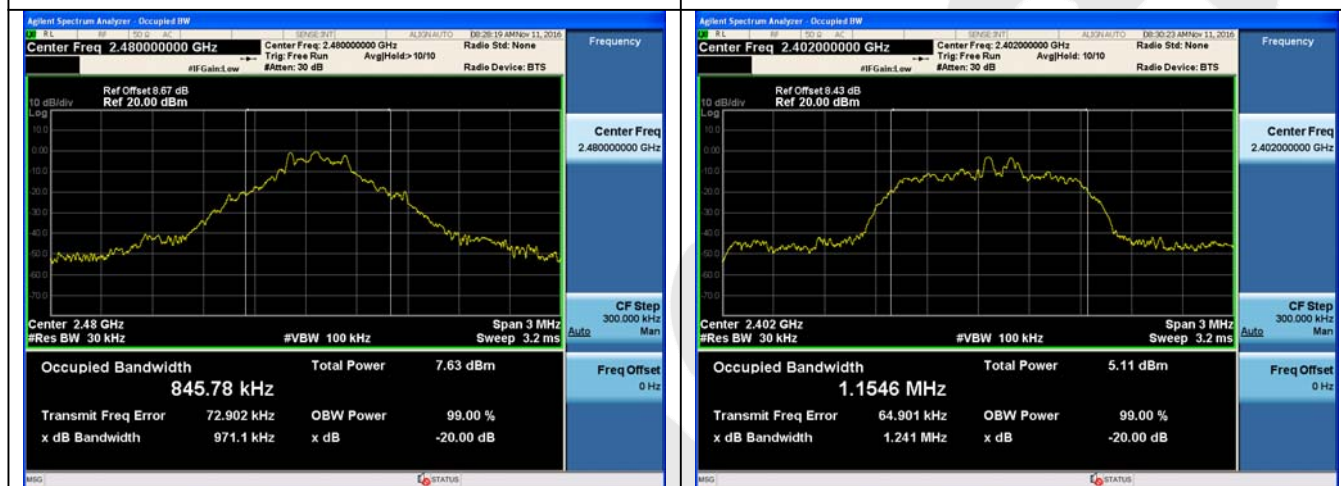
Test Item	: 20dB BW	Test Mode	: CH Low ~ CH High
Test Voltage	: DC 3.7V Battery inside	Temperature	: 24°C
Test Result	: PASS	Humidity	: 55%RH

Channel	Frequency (MHz)	20dB Down BW(kHz)	Modulation Mode
Low	2402	1035.0	GFSK
Mid	2441	1031.0	GFSK
High	2480	971.1	GFSK
Low	2402	1241.0	$\pi/4$ DQPSK
Mid	2441	1252.0	$\pi/4$ DQPSK
High	2480	1245.0	$\pi/4$ DQPSK
Low	2402	1249.0	8DPSK
Mid	2441	1253.0	8DPSK
High	2480	1247.0	8DPSK



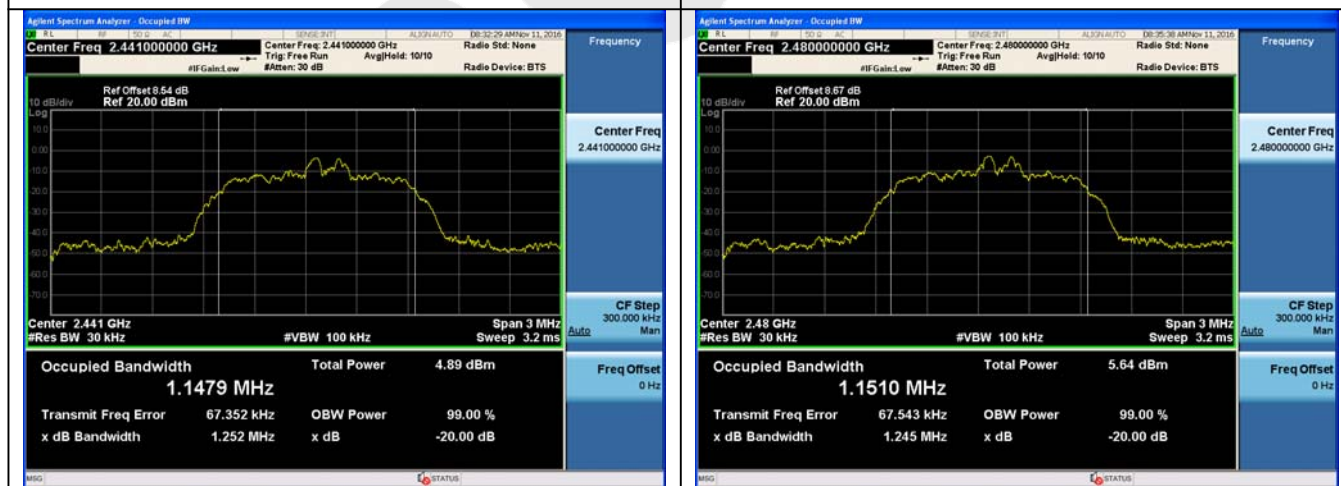
Test Mode: GFSK---Low

Test Mode: GFSK---Mid



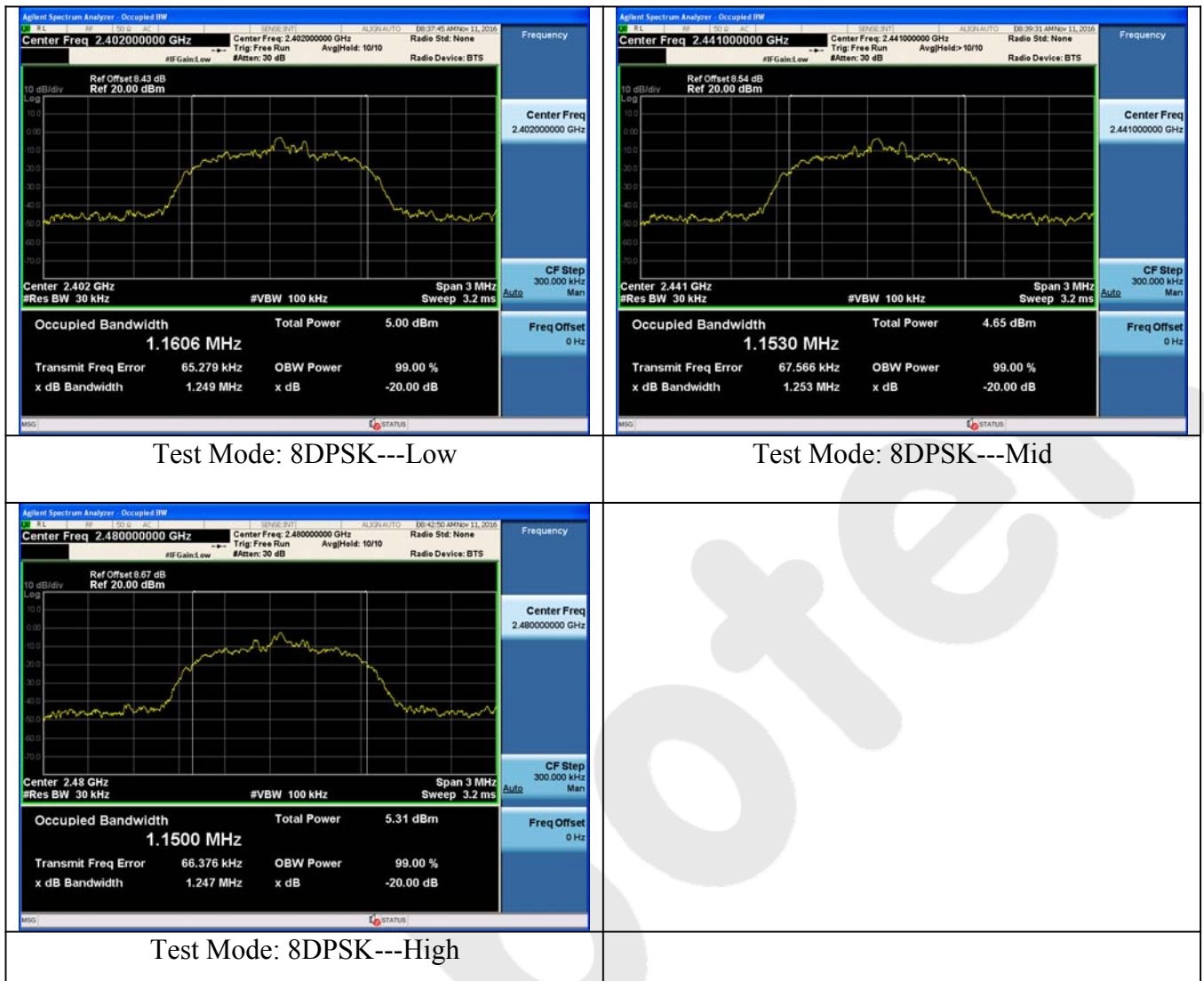
Test Mode: GFSK---High

Test Mode: $\pi/4$ DQPSK---Low



Test Mode: $\pi/4$ DQPSK---Mid

Test Mode: $\pi/4$ DQPSK---High



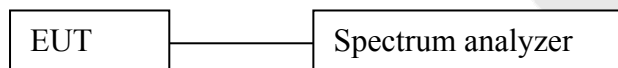
7. QUANTITY OF HOPPING CHANNEL TEST

7.1 Measurement Procedure

The EUT must have its hopping function enabled. Using the following spectrum analyzer setting:

1. Span= the frequency band of operation
2. Set the RBW = 1 MHz.
3. Set the VBW = 1 MHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

7.2 Test SET-UP



7.3 Test Equipment

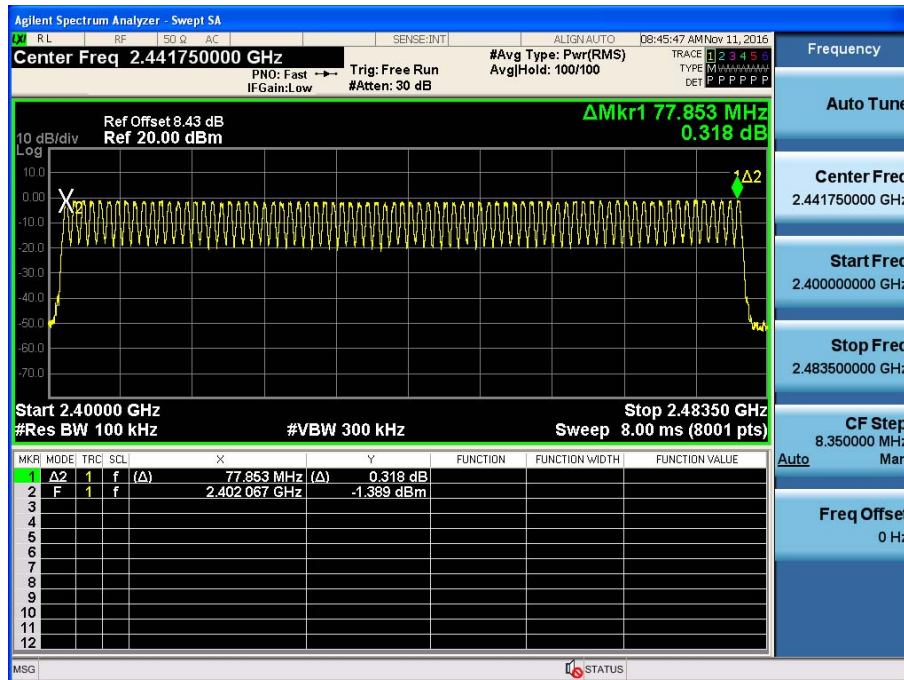
Same as the equipment listed in 5.3.

7.4 Test Results

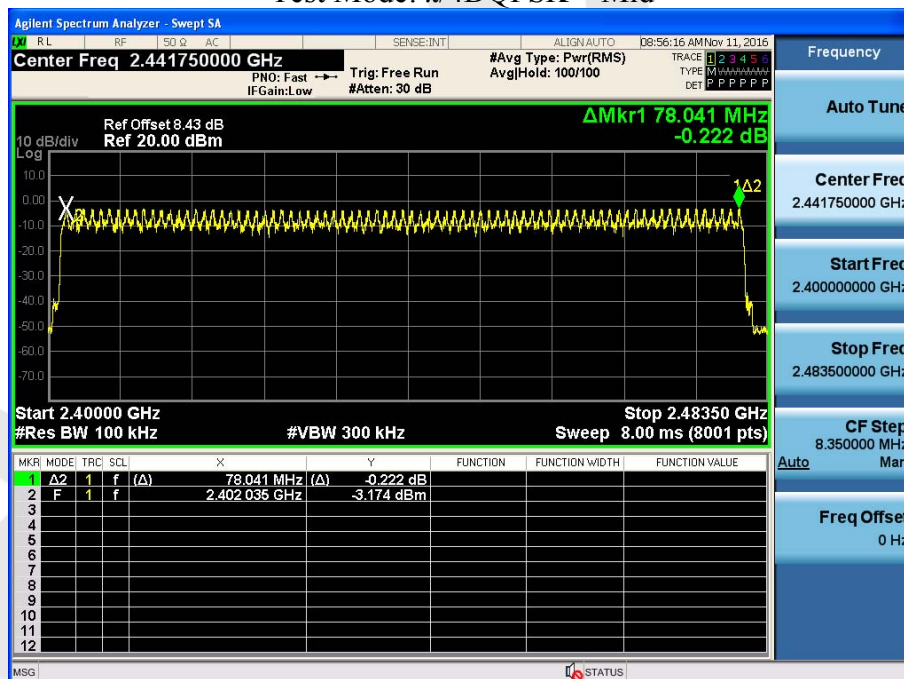
Test Item	: Number of Hopping Frequency	Test Mode	: CH Low ~ CH High
Test Voltage	: DC 3.7V Battery inside	Temperature	: 24℃
Test Result	: PASS	Humidity	: 55%RH

Hopping Channel Frequency Range	Quantity of Hopping Channel	Quantity of Hopping Channel
2402-2480	79	>15

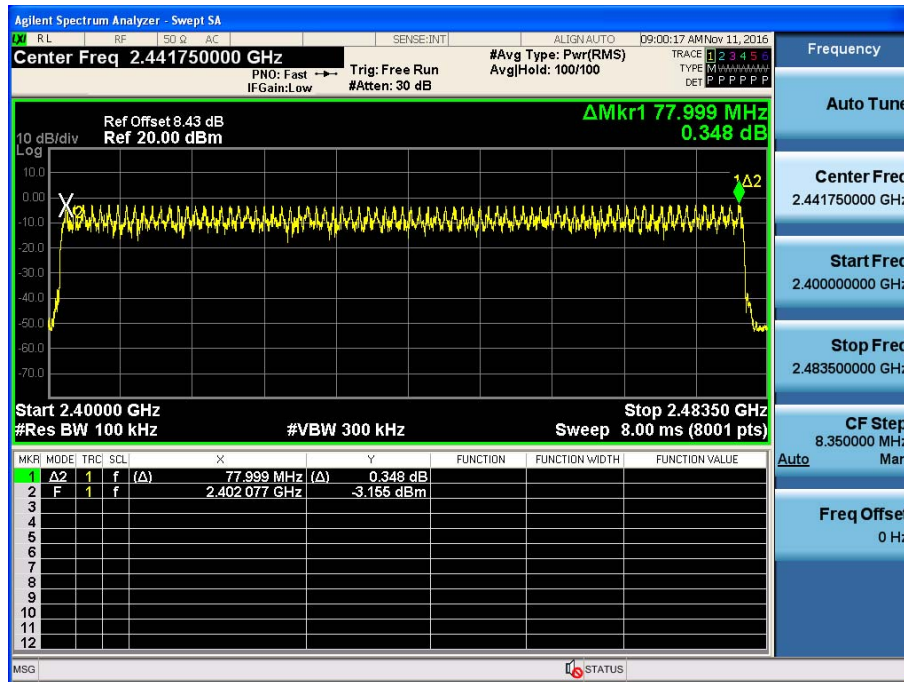
Test Mode: GFSK---Mid



Test Mode: $\pi/4$ DQPSK---Mid



Test Mode: 8DPSK---Mid



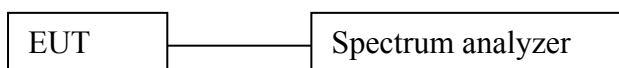
8. DWELL TIME TEST

8.1 Measurement Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span= zero span, centered on a hopping channel
2. Set the RBW = 1 MHz.
3. Set the VBW = 1 MHz.
4. Sweep time = as necessary to capture the entire dwell time per hopping channel.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

8.2 Test SET-UP



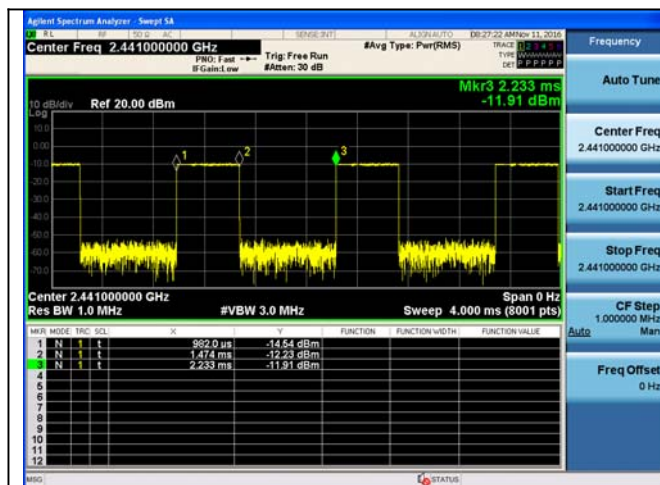
8.3 Test Equipment

Same as the equipment listed in 5.3.

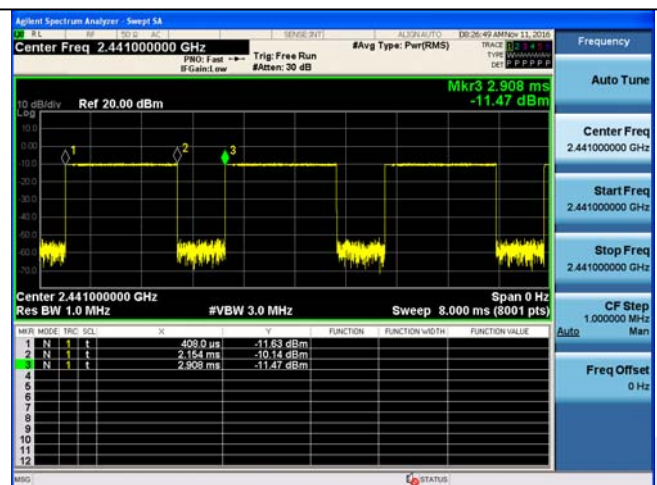
8.4 Test Results

Test Item	:	Time of Occupancy	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3.7V Battery inside	Temperature	:	24°C
Test Result	:	PASS	Humidity	:	55%RH

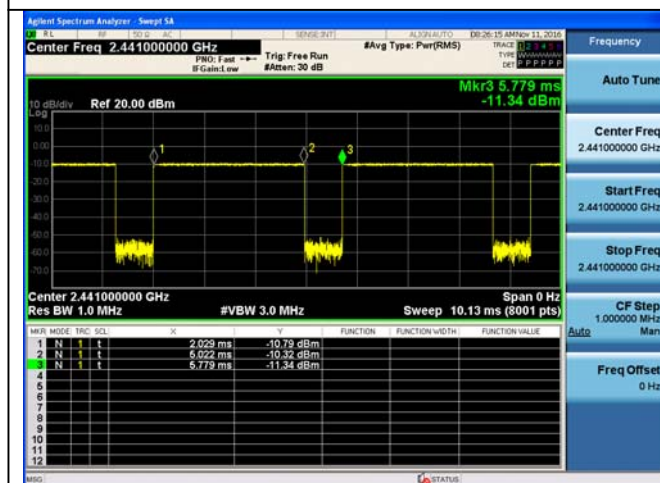
Package Type	Pulse width (ms)	Time slot length(ms)	Dwell time (ms)	Limit (s)	Modulation
DH1	0.492	time slot length *1600/2 /79 * 31.6	157.44	0.4	GFSK
DH3	1.746	time slot length *1600/4 /79 * 31.6	279.36	0.4	GFSK
DH5	2.993	time slot length *1600/6 /79 * 31.6	319.25	0.4	GFSK
DH1	0.504	time slot length *1600/2 /79 * 31.6	161.28	0.4	$\pi/4$ DQPSK
DH3	1.754	time slot length *1600/4 /79 * 31.6	280.64	0.4	$\pi/4$ DQPSK
DH5	3.002	time slot length *1600/6 /79 * 31.6	320.21	0.4	$\pi/4$ DQPSK
DH1	0.503	time slot length *1600/2 /79 * 31.6	160.96	0.4	8DPSK
DH3	1.752	time slot length *1600/4 /79 * 31.6	280.32	0.4	8DPSK
DH5	3.002	time slot length *1600/6 /79 * 31.6	320.21	0.4	8DPSK



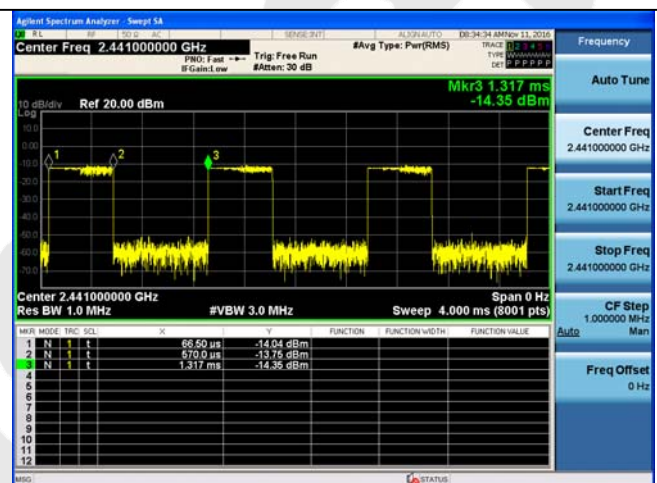
Test Mode: GFSK---DH1



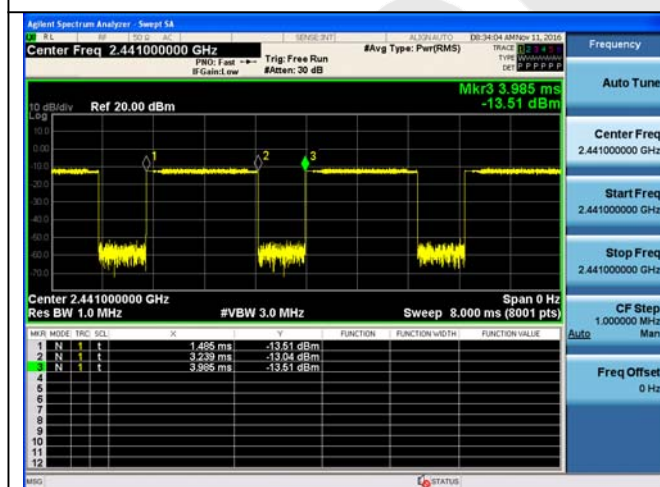
Test Mode: GFSK---DH3



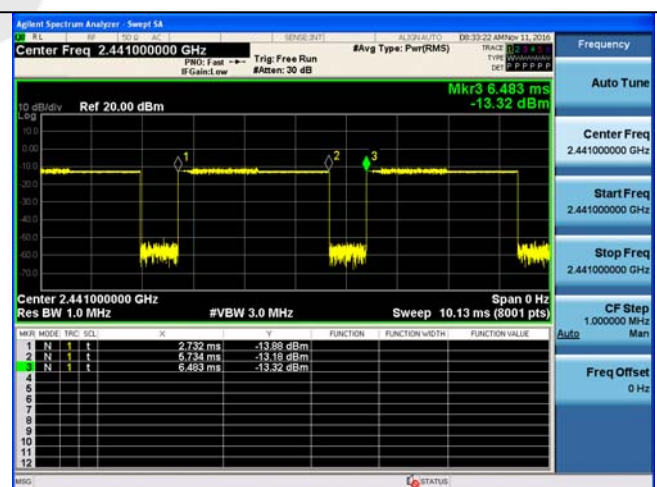
Test Mode: GFSK---DH5



Test Mode: $\pi/4$ DQPSK---DH1



Test Mode: $\pi/4$ DQPSK---DH3



Test Mode: $\pi/4$ DQPSK---DH5



9. MAXIMUM PEAK OUTPUT POWER TEST

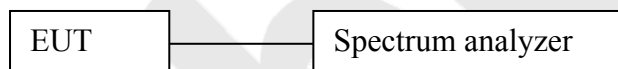
9.1 Measurement Procedure

- a. Check the calibration of the measuring instrument(SA) using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using proper RBW and VBW setting.
- d. Measure the captured power within the band and recording the plot.
- e. Repeat above procedures until all frequencies required were complete.

Using the following spectrum analyzer settings:

1. Span= approximately 5 times the 20dB bandwidth, centered on a hopping channel
2. Set the RBW = 3 MHz.
3. Set the VBW = 3 MHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

9.2 Test SET-UP



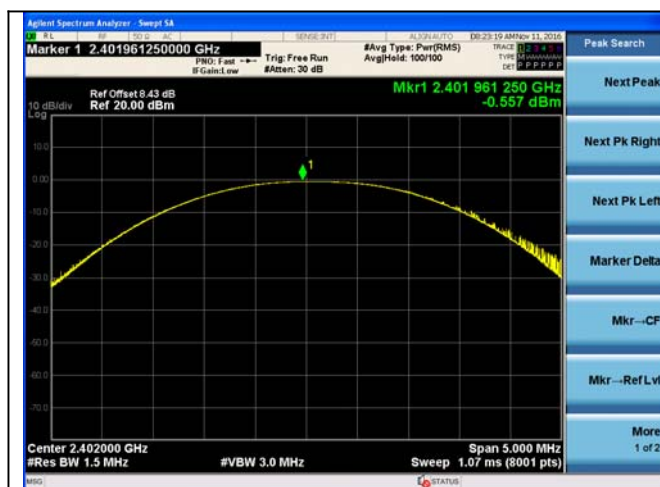
9.3 Test Equipment

Same as the equipment listed in 5.3.

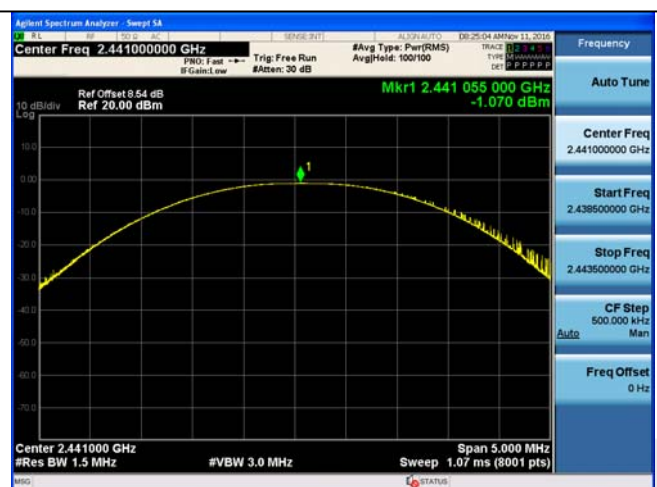
9.4 Test Results

Test Item : Max. peak output power Test Mode : CH Low ~ CH High
Test Voltage : DC 3.7V Battery inside Temperature : 24°C
Test Result : PASS Humidity : 55%RH

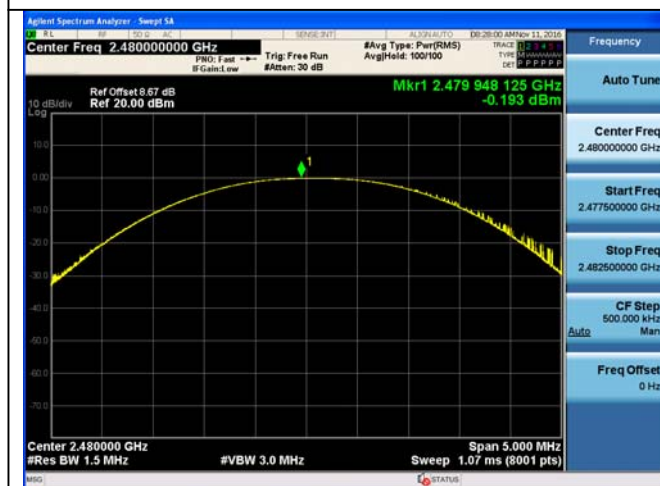
Channel Frequency (MHz)	Peak Power output(mW)	Peak Power output(dBm)	Peak Power Limit(mW)	Results	Modulation
2402	0.880	-0.557	125	PASS	GFSK
2441	0.782	-1.070	125	PASS	GFSK
2480	0.957	-0.193	125	PASS	GFSK
2402	0.717	-1.446	125	PASS	$\pi/4$ DQPSK
2441	0.646	-1.898	125	PASS	$\pi/4$ DQPSK
2480	0.793	-1.010	125	PASS	$\pi/4$ DQPSK
2402	0.780	-1.078	125	PASS	8DPSK
2441	0.693	-1.592	125	PASS	8DPSK
2480	0.857	-0.670	125	PASS	8DPSK



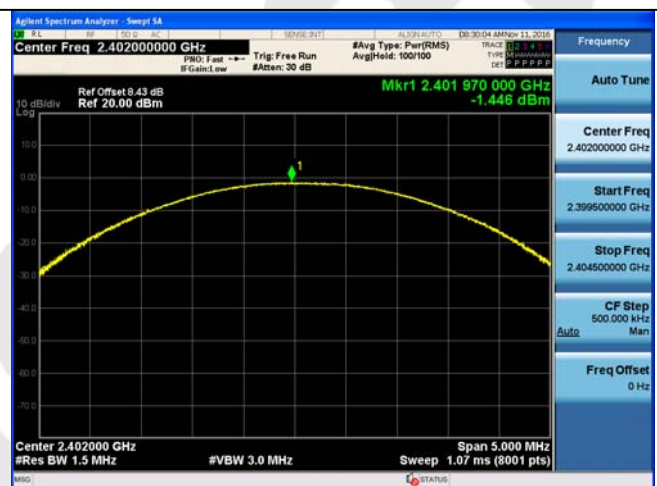
Test Mode: GFSK---Low



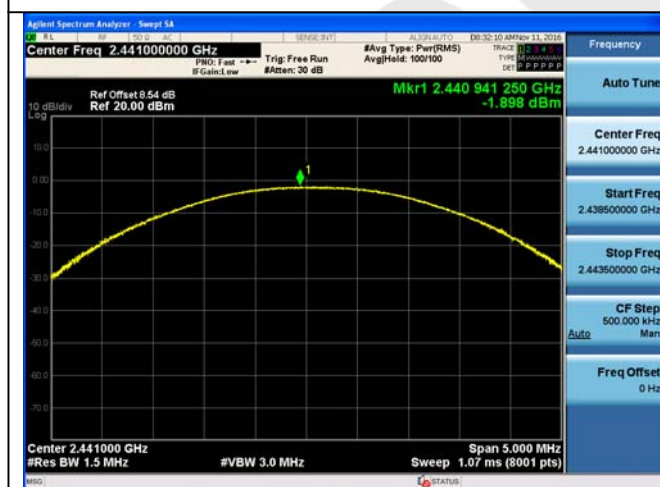
Test Mode: GFSK---Mid



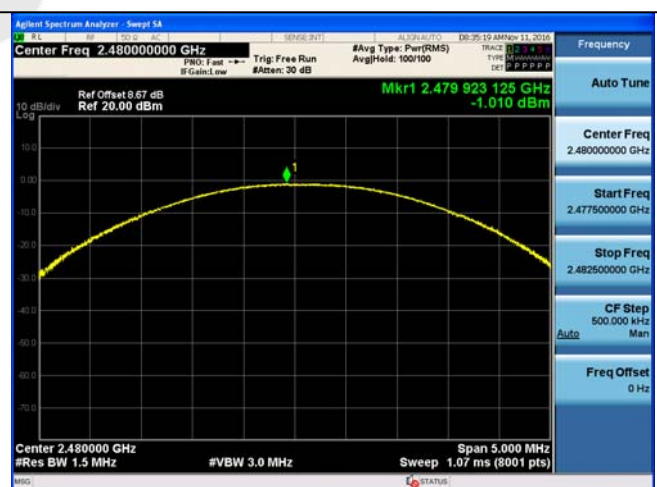
Test Mode: GFSK---High



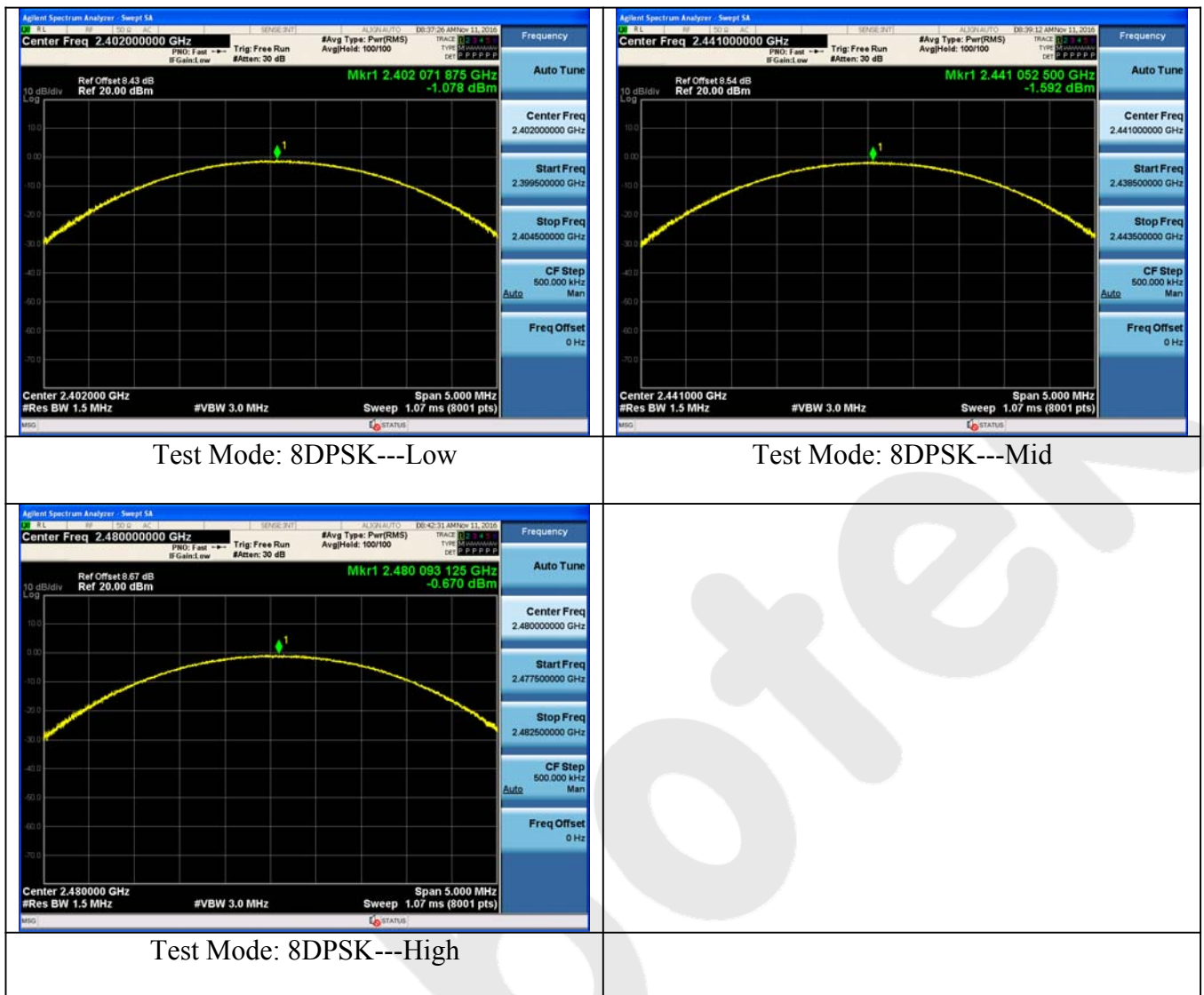
Test Mode: $\pi/4$ DQPSK---Low



Test Mode: $\pi/4$ DQPSK---Mid



Test Mode: $\pi/4$ DQPSK---High



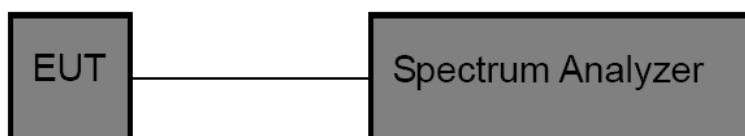
10. 100KHZ BANDWIDTH OF FREQUENCY BAND EDGE

REQUIREMENT

10.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (d)
Test Limit	in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, 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).

10.2. Test Setup



10.3. Test Procedure

The EUT must have its hopping/Non-hopping function enabled. Using the following spectrum analyzer setting:

1. Set the RBW = 100KHz.
2. Set the VBW = 300KHz.
3. Sweep time = auto couple.
4. Detector function = peak.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.

10.4 Test Results

Pass.

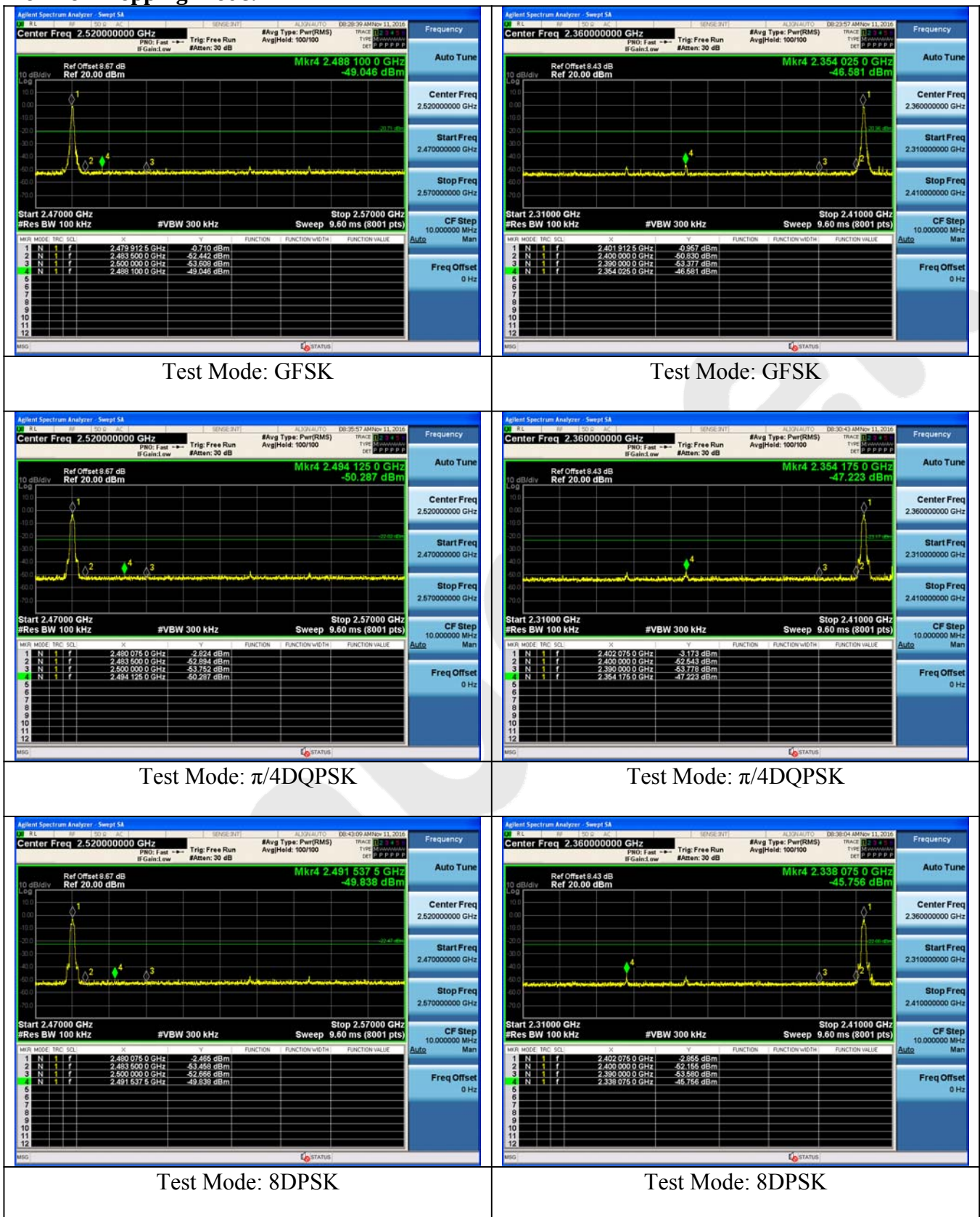
Please refer the following data.

Test Item	: Band eadge	Test Mode	: CH Low ~ CH High
Test Voltage	: DC 3.7V Battery inside	Temperature	: 24℃
Test Result	: PASS	Humidity	: 55%RH

For Hopping Mode



For Non-Hopping Mode:



11. ANTENNA APPLICATION

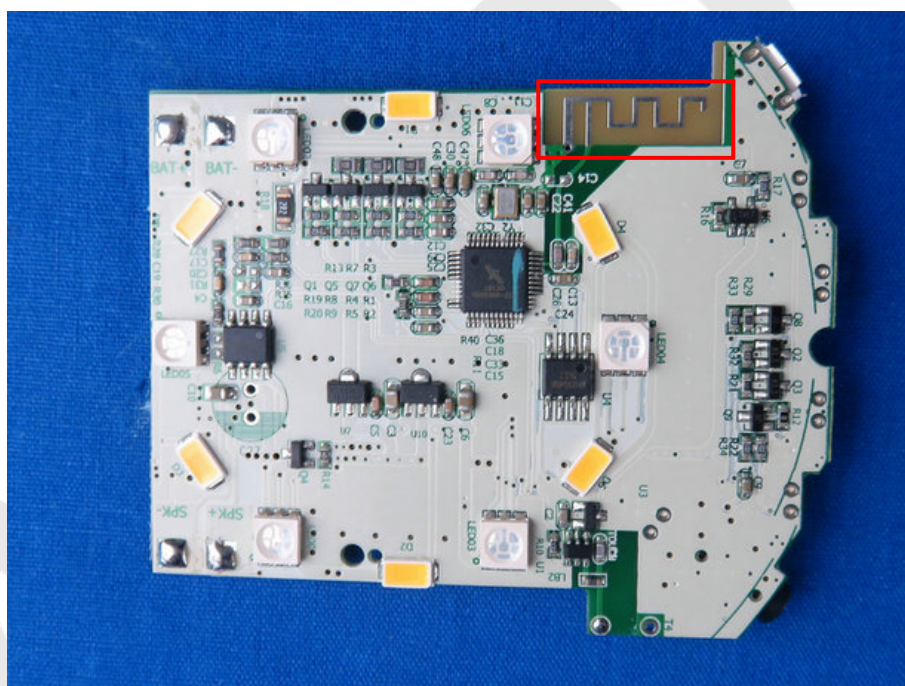
11.1 Antenna requirement

The EUT'S antenna is met the requirement of FCC part 15C 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

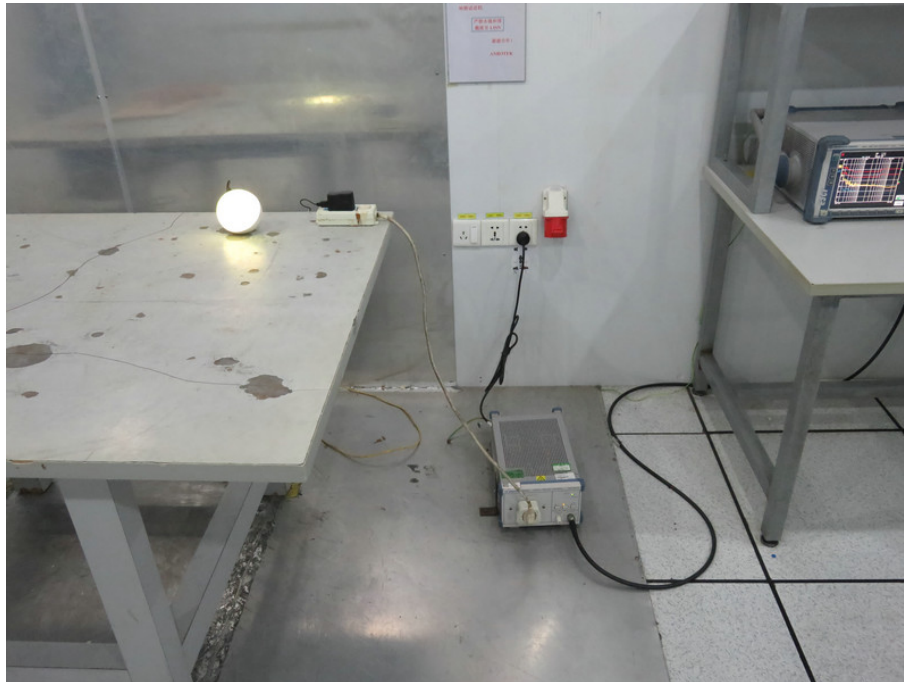
11.2 Result

The EUT's antenna used a PCB Antenna, The antenna's gain is 1.2 dBi and meets the requirement.

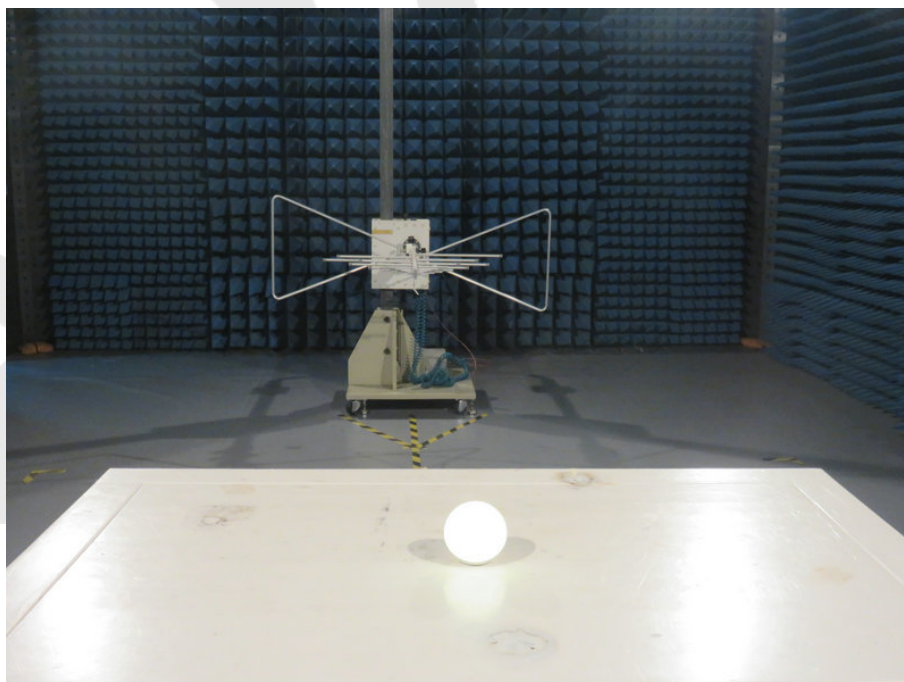


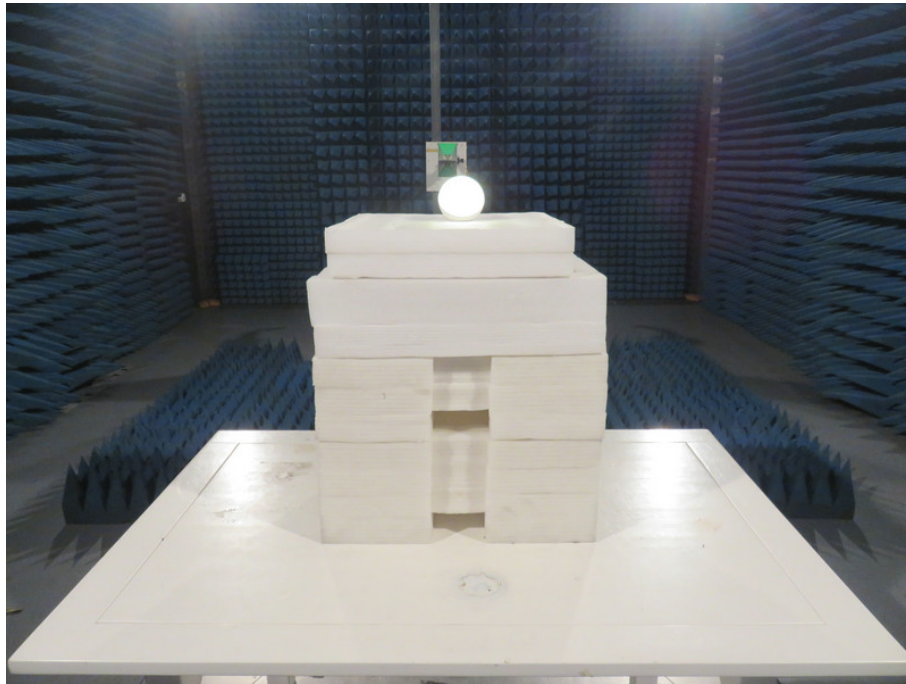
12. PHOTOGRAPH

12.1 Photo of Power Line Conducted Emission Measurement



12.2 Photo of Radiation Emission Test





APPENDIX I (EXTERNAL PHOTOS)

1. Figure



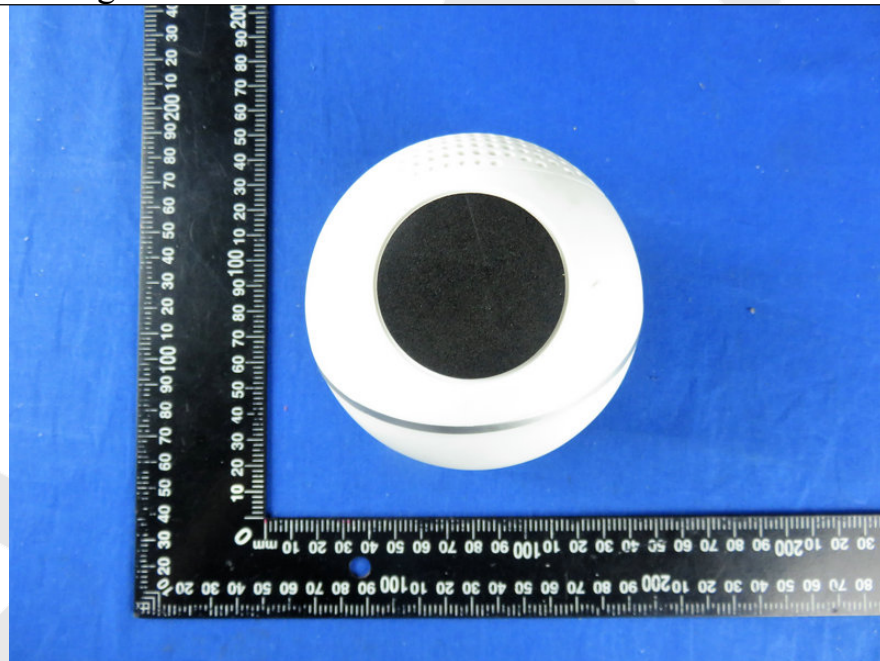
2. Figure



3. Figure



4. Figure



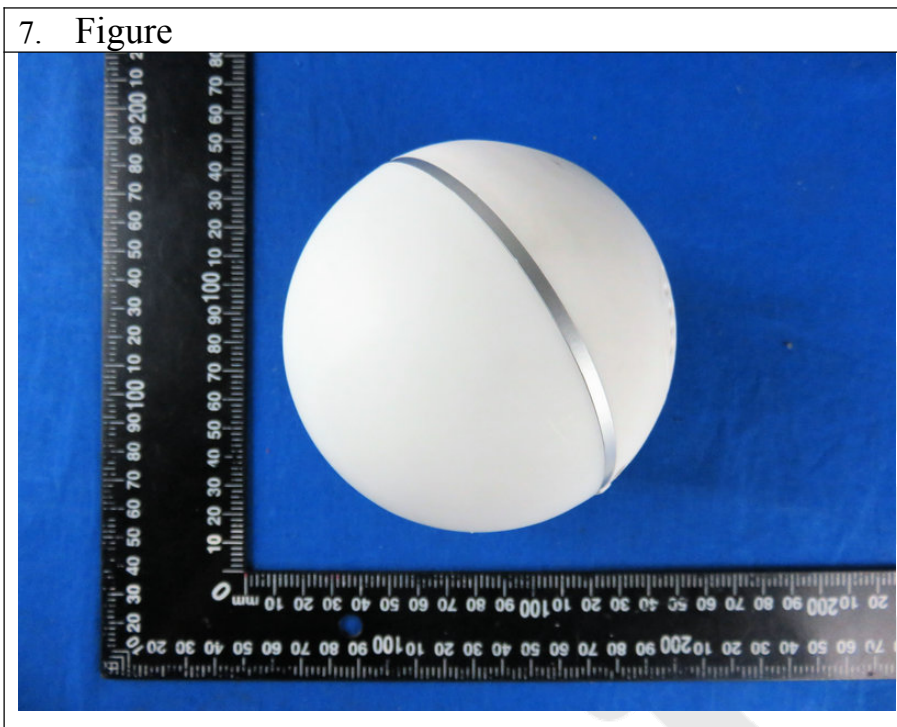
5. Figure



6. Figure

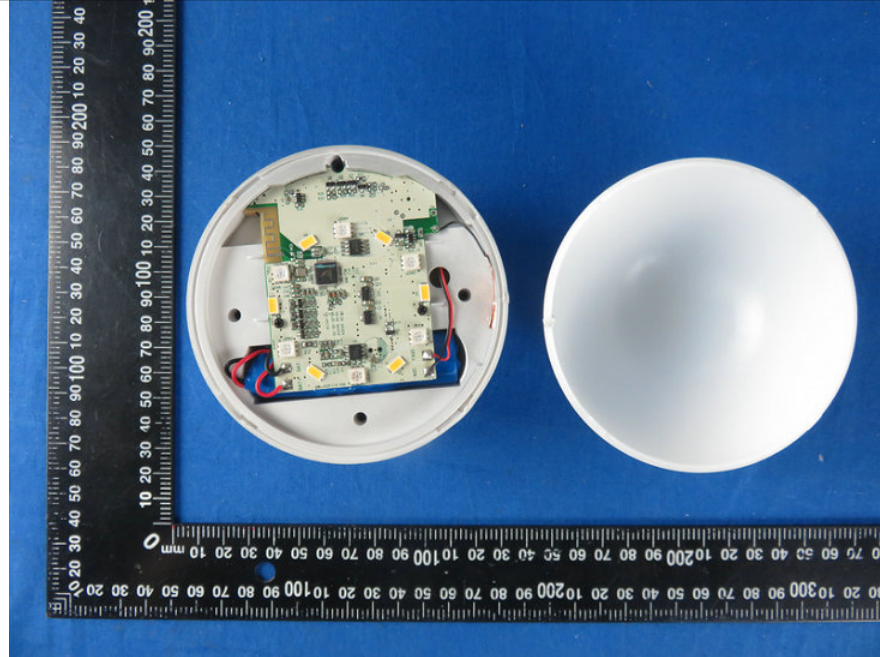


7. Figure



APPENDIX II (INTERNAL PHOTOS)

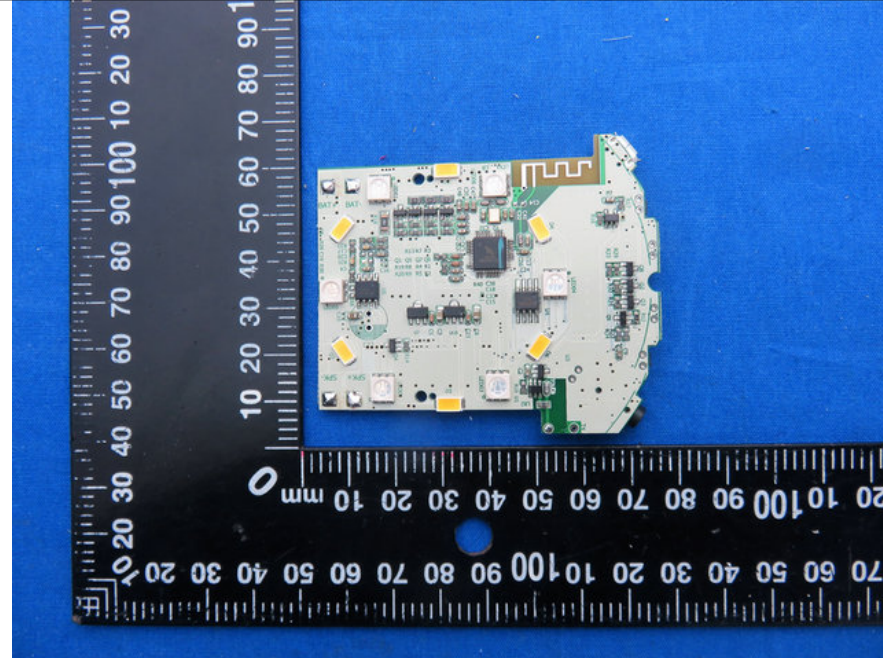
1. Figure



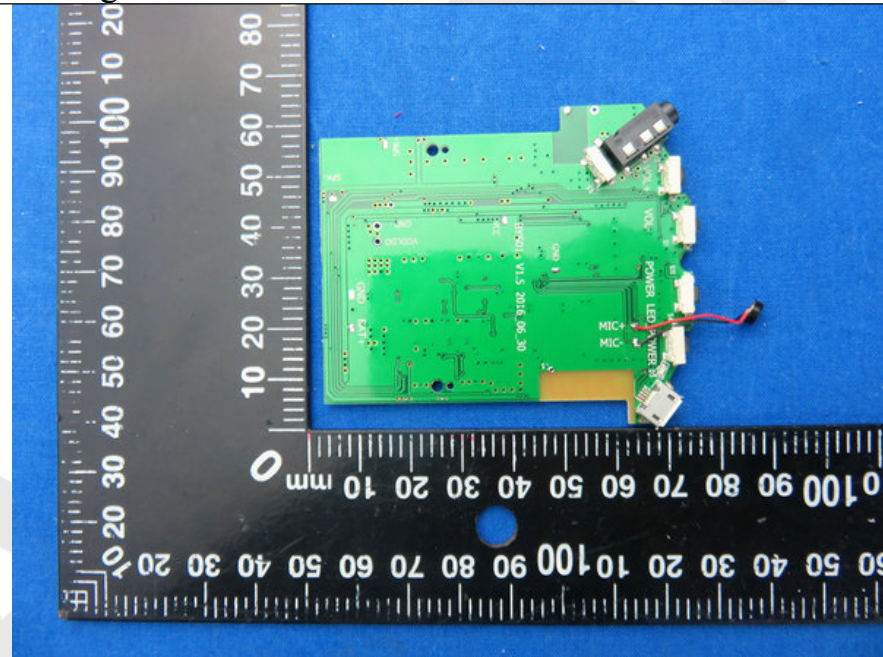
2. Figure



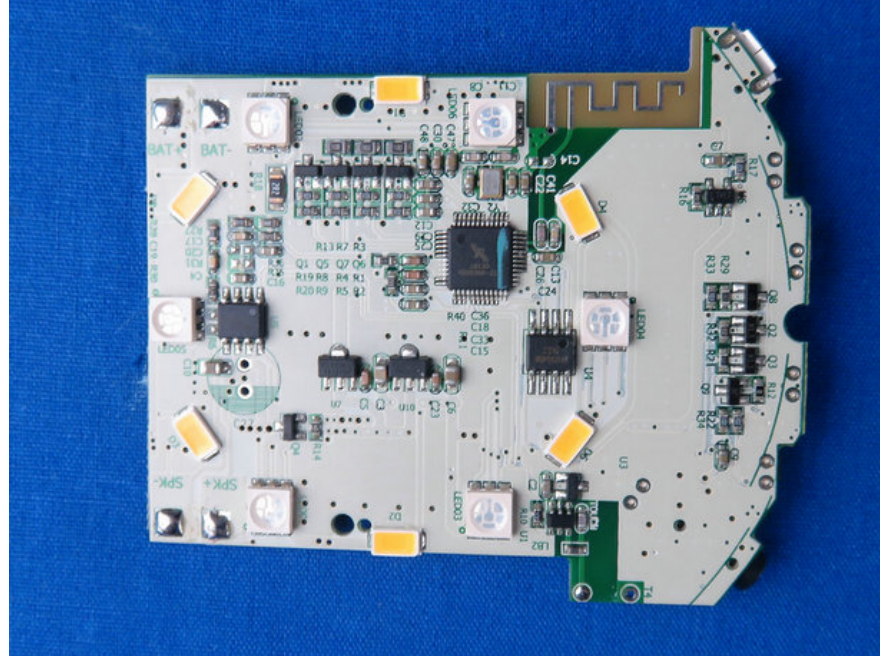
3. Figure



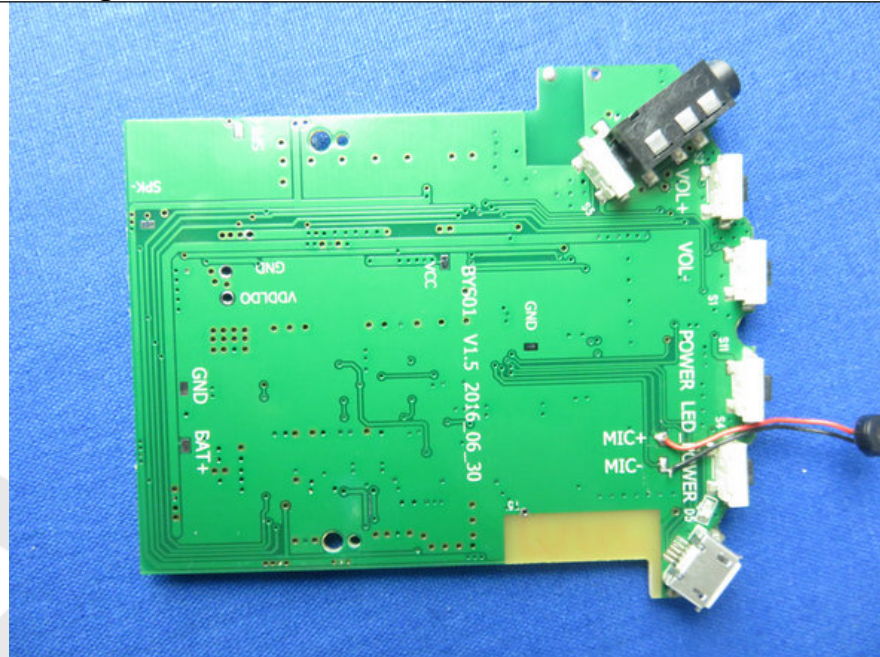
4. Figure



5. Figure



6. Figure



7. Figure

