FCC TEST REPORT
for
Shenzhen lianshunwei Technology Co., Ltd

Portable mini speaker
Model No.: T-2306A, Z-2306A, BS-306

Prepared for	:	Shenzhen lianshunwei Technology Co., Ltd
Address	:	the 2rd floor, Building B, Guotai Industry park, Xintang village, Guanlan Town, Bao'an District Shenzhen China

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Report Number	:	R011610128I
Date of Test	:	Oct. 14~ Nov. 02, 2016
Date of Report	:	Nov. 03, 2016

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TEST REPORT

Applicant	:	Shenzhen lianshunwei Technology Co., Ltd
Manufacturer	:	Shenzhen lianshunwei Technology Co., Ltd
EUT	:	Portable mini speaker
Model No.	:	T-2306A, Z-2306A, BS-306
Serial No.	:	N.A.
Trade Mark	:	N.A.
Rating	:	Input DC 5V, 500mA (via battery DC 3.7V, 500mAh inside)

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 : Oct. 14~ Nov. 02, 2016

Prepared by : Baron Wen
(Tested Engineer / Baron Wen)

Reviewer : Amy Ding
(Project Manager / Amy Ding)

Approved & Authorized Signer : Tom Chen
(Manager / Tom Chen)

1. GENERAL INFORMATION

1.1 Description of Device (EUT)

EUT	:	Portable mini speaker
Model Number	:	T-2306A, Z-2306A, BS-306 (Note: All samples are the same except the model number and colour, so we prepare "T-2306A" for test only.)
Test Power Supply	:	AC 120V, 60Hz for adapter/ AC 240V, 60Hz for adapter/ DC 3.7V Battery inside
Frequency	:	2402~2480MHz
Antenna Specification	:	PCB Antenna: 1dBi
Modulation	:	GFSK, π/4DQPSK, 8DPSK
Applicant	:	Shenzhen lianshunwei Technology Co., Ltd
Address	:	the 2rd floor, Building B, Guotai Industry park, Xintang village, Guanlan Town, Bao'an District Shenzhen China
Manufacturer	:	Shenzhen lianshunwei Technology Co., Ltd
Address	:	the 2rd floor, Building B, Guotai Industry park, Xintang village, Guanlan Town, Bao'an District Shenzhen China
Factory	:	Shenzhen lianshunwei Technology Co., Ltd
Address	:	the 2rd floor, Building B, Guotai Industry park, Xintang village, Guanlan Town, Bao'an District Shenzhen China
Date of receipt	:	Oct. 14, 2016
Date of Test	:	Oct. 14~ Nov. 02, 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
Mobile Phone	:	Manufacturer: HUAWEI M/N: C8650 S/N: L6W7NA11B1013157 CE , FCC, DOC

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 registed 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, Jun. 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.

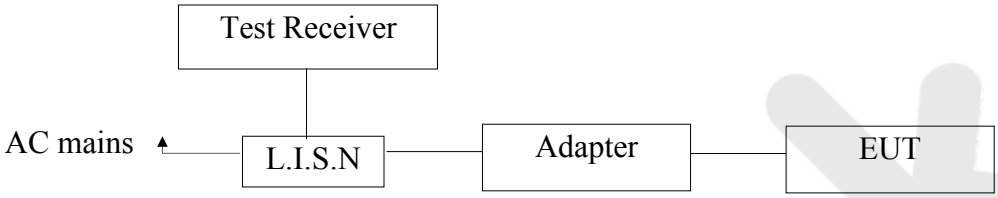
Example:
Freq (MHz) METER READING + ACF = FS
20 dBuV + 10.36 dB = 30.36 dBuV/m @ 3m

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+BT 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

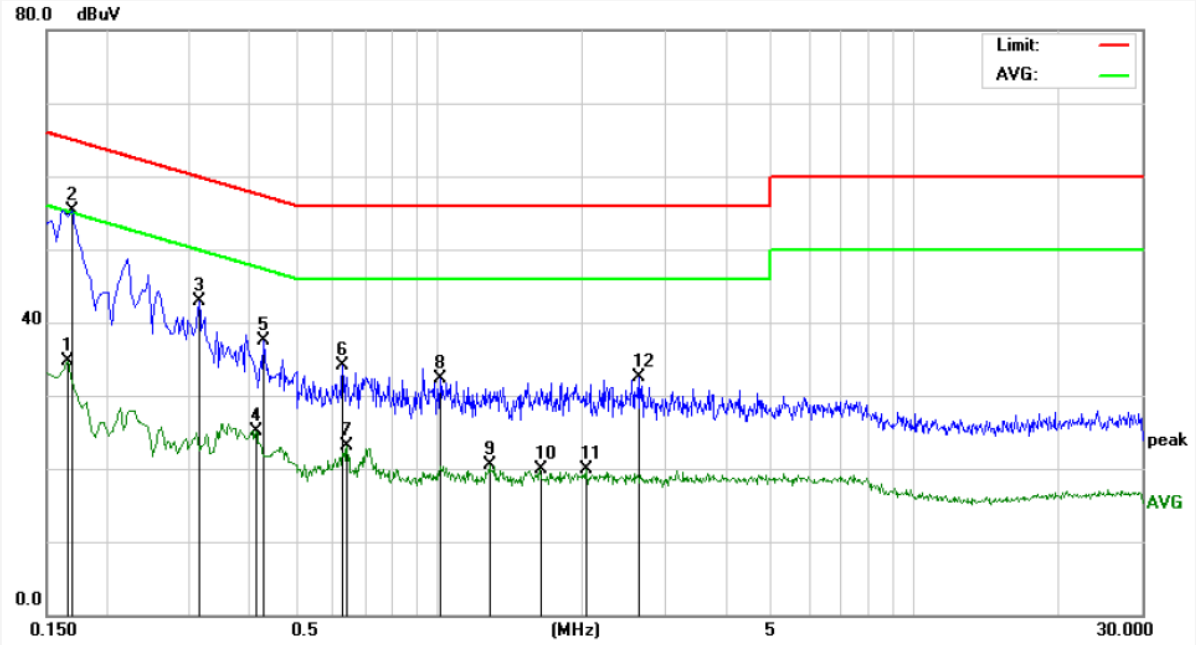
PASS.

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

Please refer the following pages.

CONDUCTED EMISSION TEST DATA

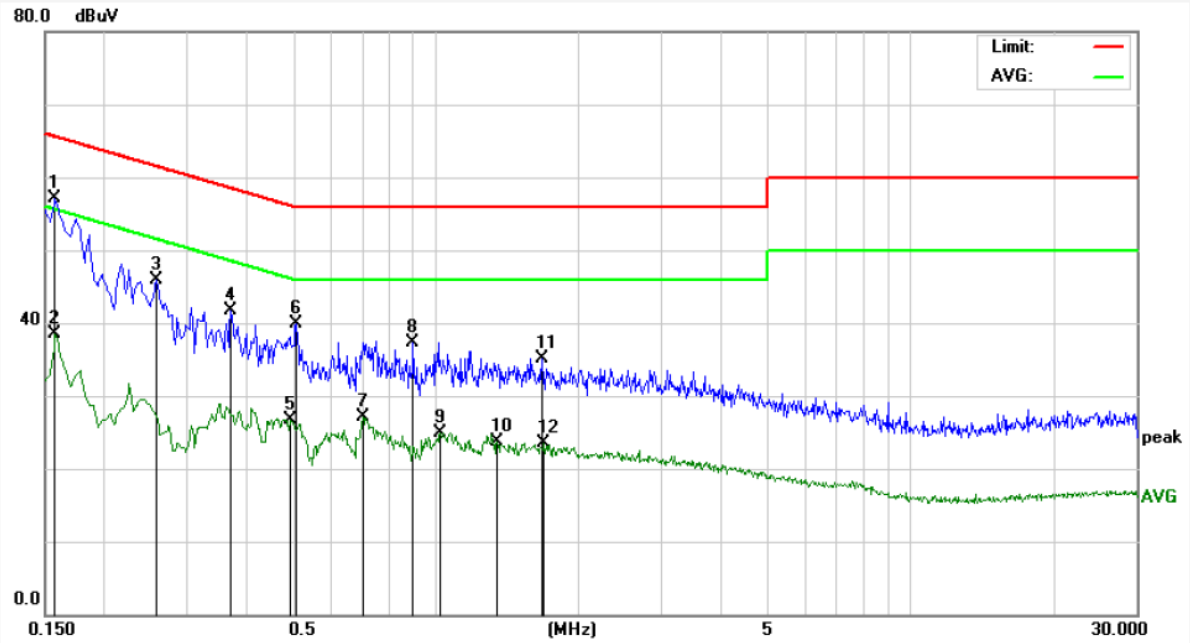
Test Site:	1# Shielded Room
Operating Condition:	Charge+BT Mode
Test Specification:	AC 120V, 60Hz for adapter
Comment:	Live Line
	Tem.:25℃ Hum.:50%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1660	14.75	20.00	34.75	55.15	-20.40	AVG	
2	0.1700	35.37	20.00	55.37	64.96	-9.59	QP	
3	0.3140	22.95	20.00	42.95	59.86	-16.91	QP	
4	0.4140	5.20	20.00	25.20	47.57	-22.37	AVG	
5	0.4300	17.58	20.00	37.58	57.25	-19.67	QP	
6	0.6300	14.11	20.00	34.11	56.00	-21.89	QP	
7	0.6419	3.05	20.00	23.05	46.00	-22.95	AVG	
8	1.0100	12.37	20.00	32.37	56.00	-23.63	QP	
9	1.2780	0.54	20.00	20.54	46.00	-25.46	AVG	
10	1.6340	-0.13	20.00	19.87	46.00	-26.13	AVG	
11	2.0420	-0.19	20.00	19.81	46.00	-26.19	AVG	
12	2.6300	12.47	20.00	32.47	56.00	-23.53	QP	

CONDUCTED EMISSION TEST DATA

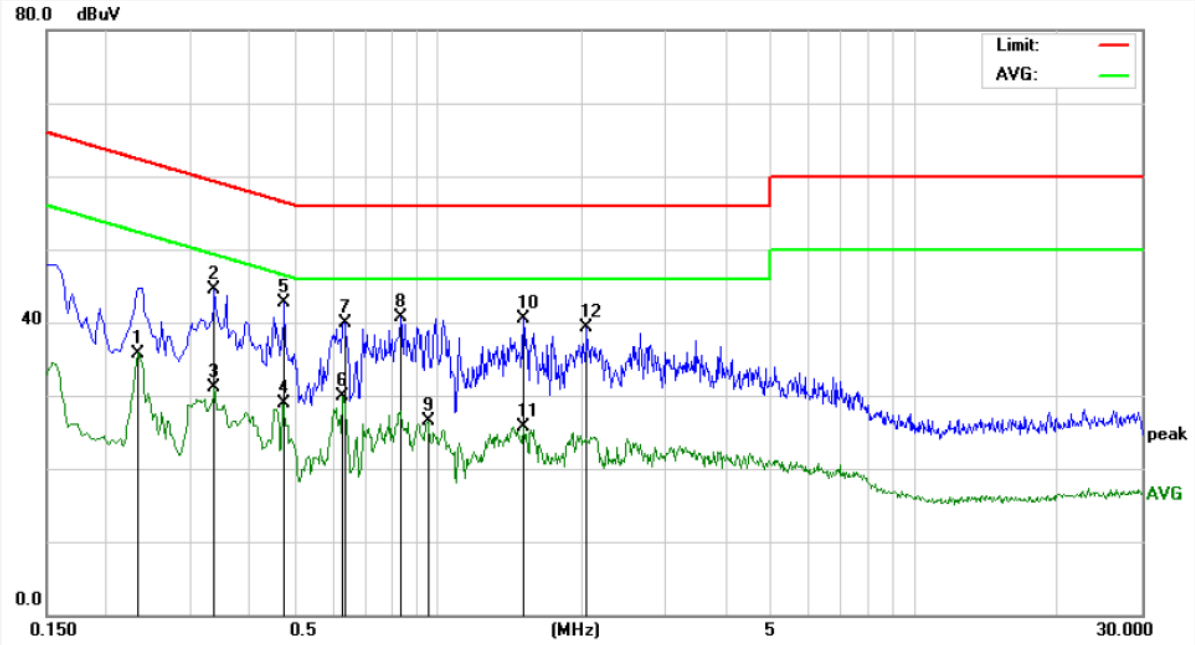
Test Site:	1# Shielded Room
Operating Condition:	Charge+BT Mode
Test Specification:	AC 120V, 60Hz for adapter
Comment:	Neutral Line
	Tem.:25℃ Hum.:50%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1580	37.13	20.00	57.13	65.56	-8.43	QP	
2	0.1580	18.48	20.00	38.48	55.56	-17.08	AVG	
3	0.2580	25.88	20.00	45.88	61.49	-15.61	QP	
4	0.3700	21.74	20.00	41.74	58.50	-16.76	QP	
5	0.4940	6.78	20.00	26.78	46.10	-19.32	AVG	
6	0.5100	19.91	20.00	39.91	56.00	-16.09	QP	
7	0.7019	7.01	20.00	27.01	46.00	-18.99	AVG	
8	0.8980	17.29	20.00	37.29	56.00	-18.71	QP	
9	1.0220	4.96	20.00	24.96	46.00	-21.04	AVG	
10	1.3460	3.68	20.00	23.68	46.00	-22.32	AVG	
11	1.6780	15.19	20.00	35.19	56.00	-20.81	QP	
12	1.6980	3.59	20.00	23.59	46.00	-22.41	AVG	

CONDUCTED EMISSION TEST DATA

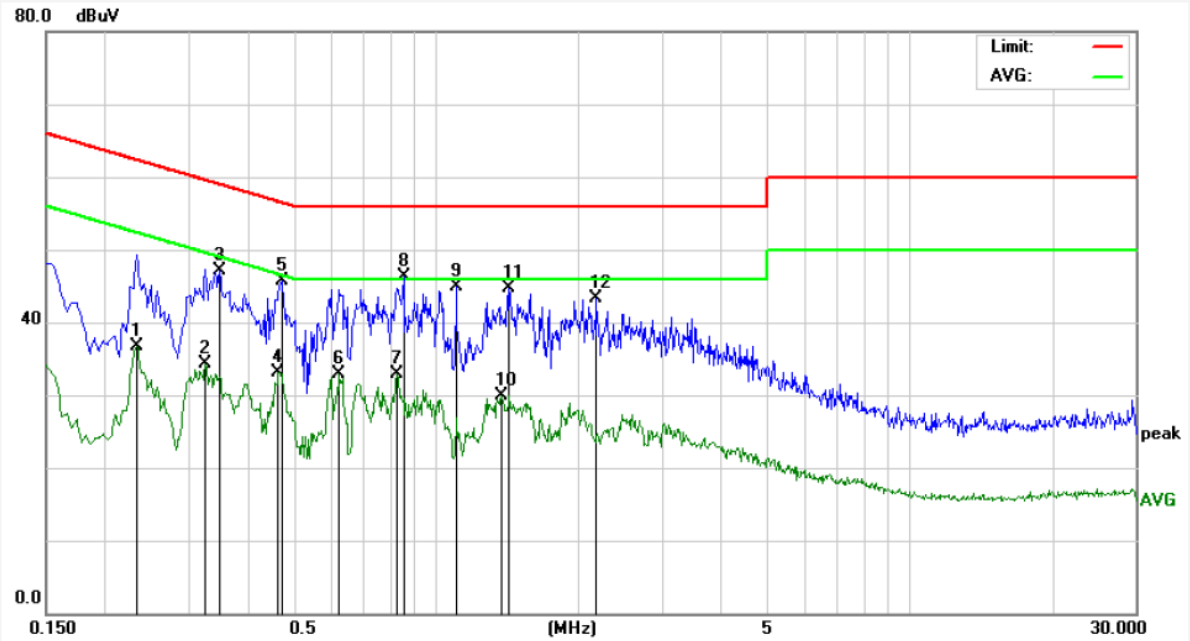
Test Site:	1# Shielded Room
Operating Condition:	Charge+BT Mode
Test Specification:	AC 240V, 60Hz for adapter
Comment:	Live Line
	Tem.:25℃ Hum.:50%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.2340	15.80	20.00	35.80	52.30	-16.50	AVG	
2	0.3379	24.41	20.00	44.41	59.25	-14.84	QP	
3	0.3379	11.12	20.00	31.12	49.25	-18.13	AVG	
4	0.4700	8.89	20.00	28.89	46.51	-17.62	AVG	
5	0.4740	22.80	20.00	42.80	56.44	-13.64	QP	
6	0.6300	9.83	20.00	29.83	46.00	-16.17	AVG	
7	0.6340	19.95	20.00	39.95	56.00	-16.05	QP	
8	0.8340	20.70	20.00	40.70	56.00	-15.30	QP	
9	0.9500	6.43	20.00	26.43	46.00	-19.57	AVG	
10	1.5060	20.43	20.00	40.43	56.00	-15.57	QP	
11	1.5060	5.65	20.00	25.65	46.00	-20.35	AVG	
12	2.0500	19.27	20.00	39.27	56.00	-16.73	QP	

CONDUCTED EMISSION TEST DATA

Test Site:	1# Shielded Room
Operating Condition:	Charge+BT Mode
Test Specification:	AC 240V, 60Hz for adapter
Comment:	Neutral Line
	Tem.:25℃ Hum.:50%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.2340	16.64	20.00	36.64	52.30	-15.66	AVG	
2	0.3260	14.34	20.00	34.34	49.55	-15.21	AVG	
3	0.3500	27.09	20.00	47.09	58.96	-11.87	QP	
4	0.4660	13.03	20.00	33.03	46.58	-13.55	AVG	
5	0.4740	25.73	20.00	45.73	56.44	-10.71	QP	
6	0.6260	12.90	20.00	32.90	46.00	-13.10	AVG	
7	0.8300	12.90	20.00	32.90	46.00	-13.10	AVG	
8	0.8540	26.37	20.00	46.37	56.00	-9.63	QP	
9	1.1019	24.87	20.00	44.87	56.00	-11.13	QP	
10	1.3779	9.98	20.00	29.98	46.00	-16.02	AVG	
11	1.4299	24.71	20.00	44.71	56.00	-11.29	QP	
12	2.1860	23.29	20.00	43.29	56.00	-12.71	QP	

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 dBμV/m @3m	54 dBμV/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 30MHz to 1000MHz:
Set the spectrum analyzer as:
RBW = 100kHz, 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.

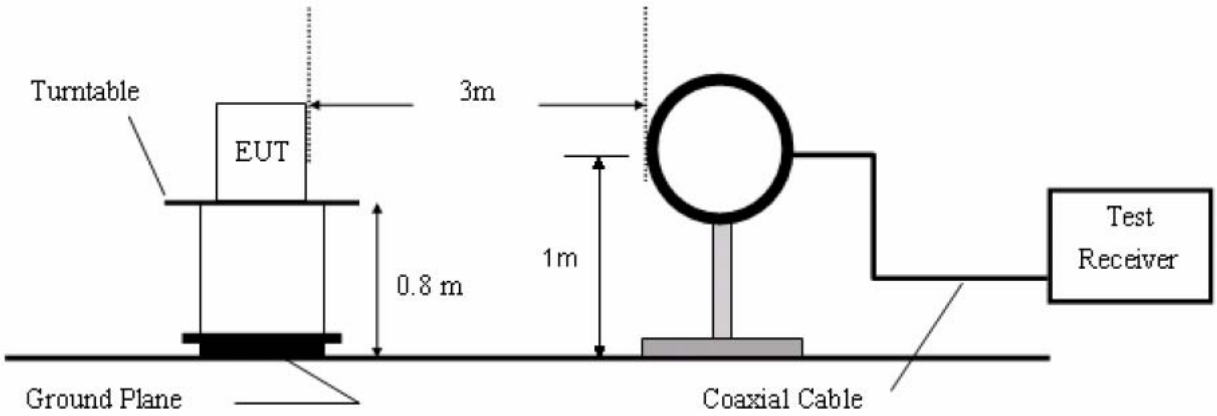
Set the spectrum analyzer as:
RBW =1MHz, VBW =10Hz
Detector= Average
Trace mode= Max hold.
Sweep- auto couple.

Test Equipment

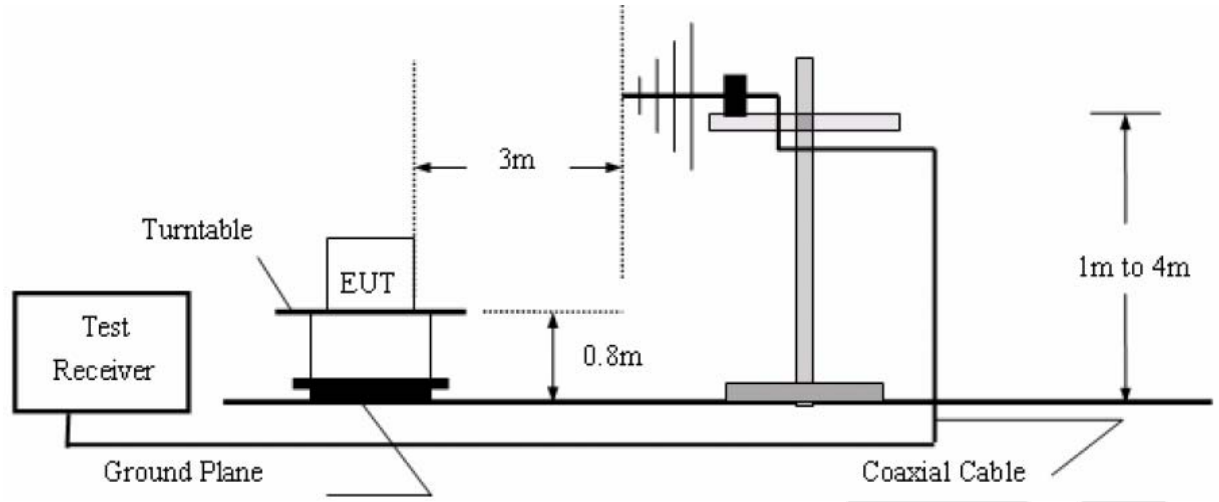
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Apr. 16, 2016	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 16, 2016	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 16, 2016	1 Year
4.	Double Ridged 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

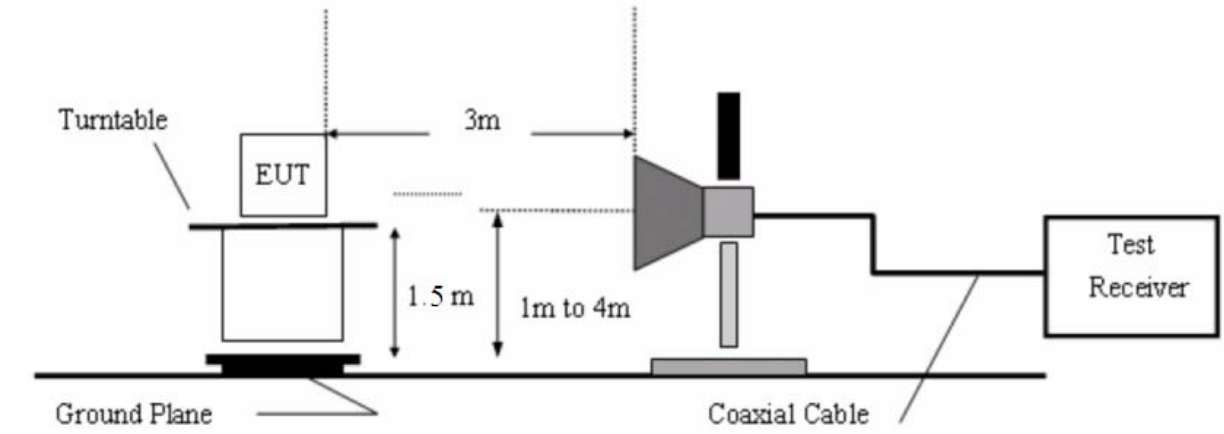
4.3.1. 9k to 30MHz emissions:



4.3.2. 30M to 1G emissions:



4.3.3. 1G to 40G emissions:



4.4 Test Results

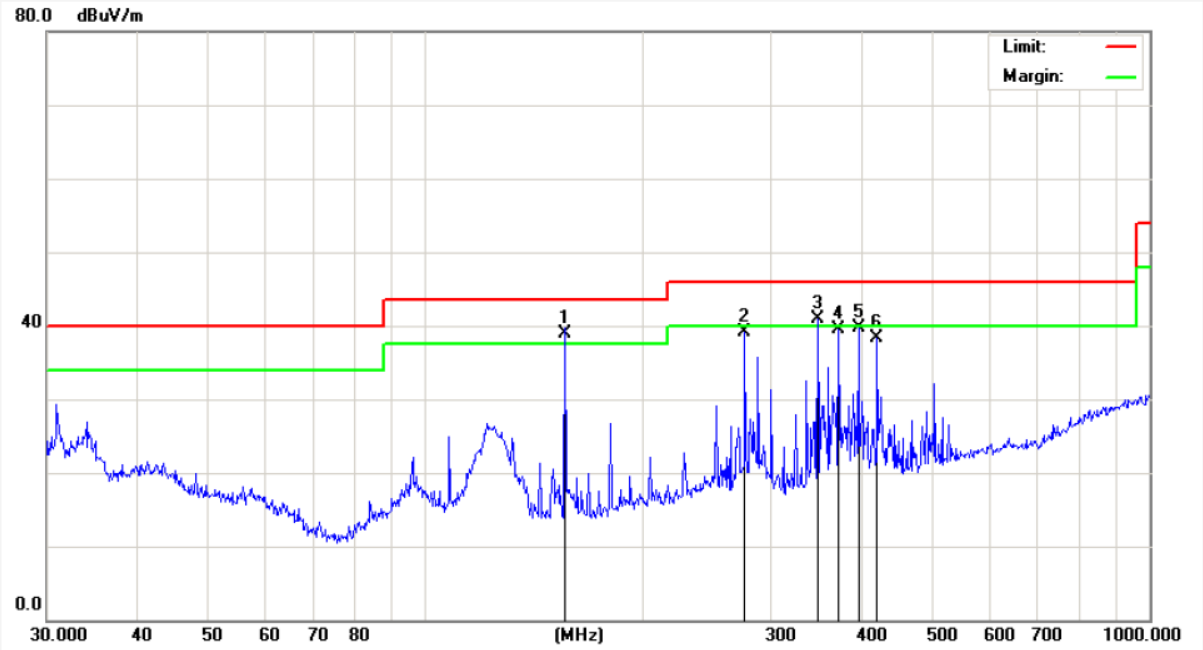
PASS.

The EUT was tested on (Charge+BT Mode, Charge+AUX Mode, Charge+TF Mode, Charge+USD Mode) modes, only the worst data of (Charge+TF Mode) is attached in the following pages.
Only the worst case (x orientation).

The EDR was tested on (π/4DQPSK, 8DPSK) modes, only the worst data of (π/4DQPSK) is attached in the following pages.

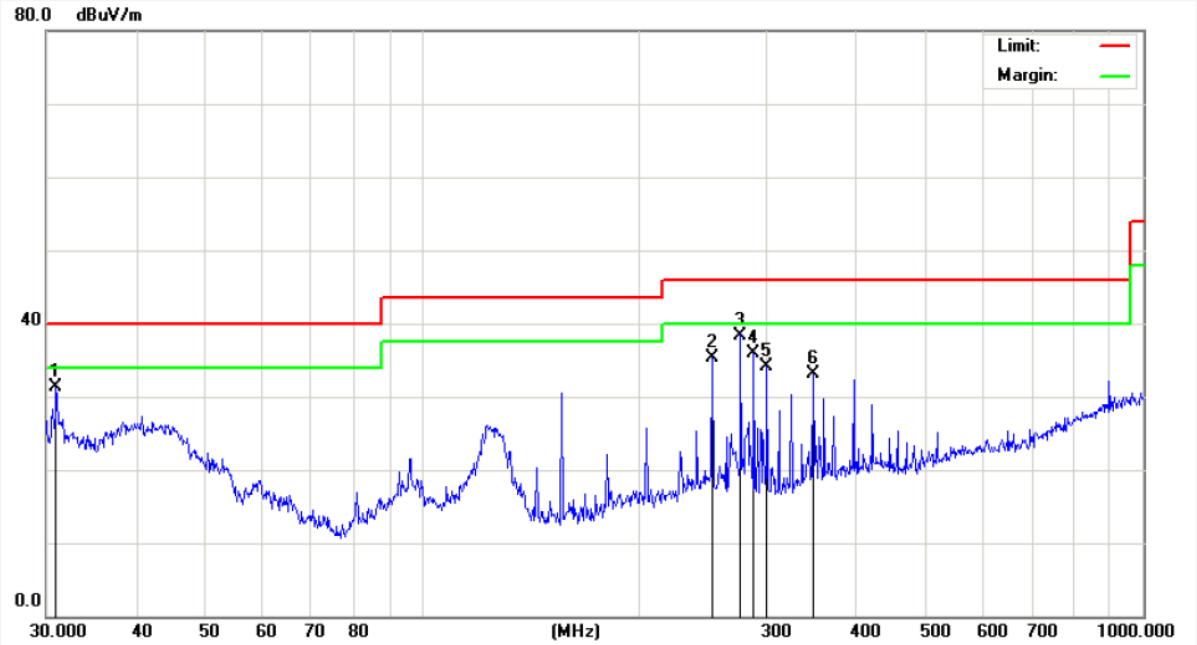
The test results of above 18000MHz are attenuated more than 20dB below the permissible limits, so the results don't record in the report.

Job No.:	**011610128I**	**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:	**Charge+TF Mode**	**Distance:**	**3m**



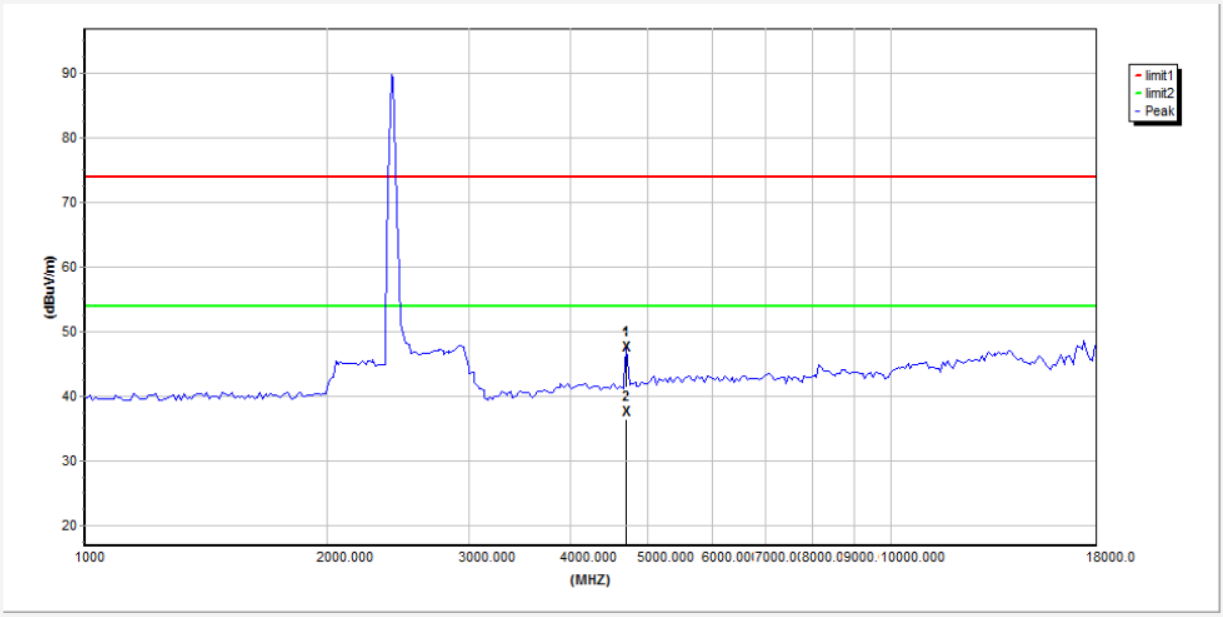
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	155.9101	62.06	-23.06	39.00	43.50	-4.50	QP			
2	276.1235	57.46	-18.38	39.08	46.00	-6.92	QP			
3	348.0274	54.93	-14.05	40.88	46.00	-5.12	QP			
4	372.0045	52.96	-13.43	39.53	46.00	-6.47	QP			
5	396.2415	52.71	-12.94	39.77	46.00	-6.23	QP			
6	420.5803	50.69	-12.38	38.31	46.00	-7.69	QP			

Job No.:	**011610128I**	**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:	**Charge+TF Mode**	**Distance:**	**3m**



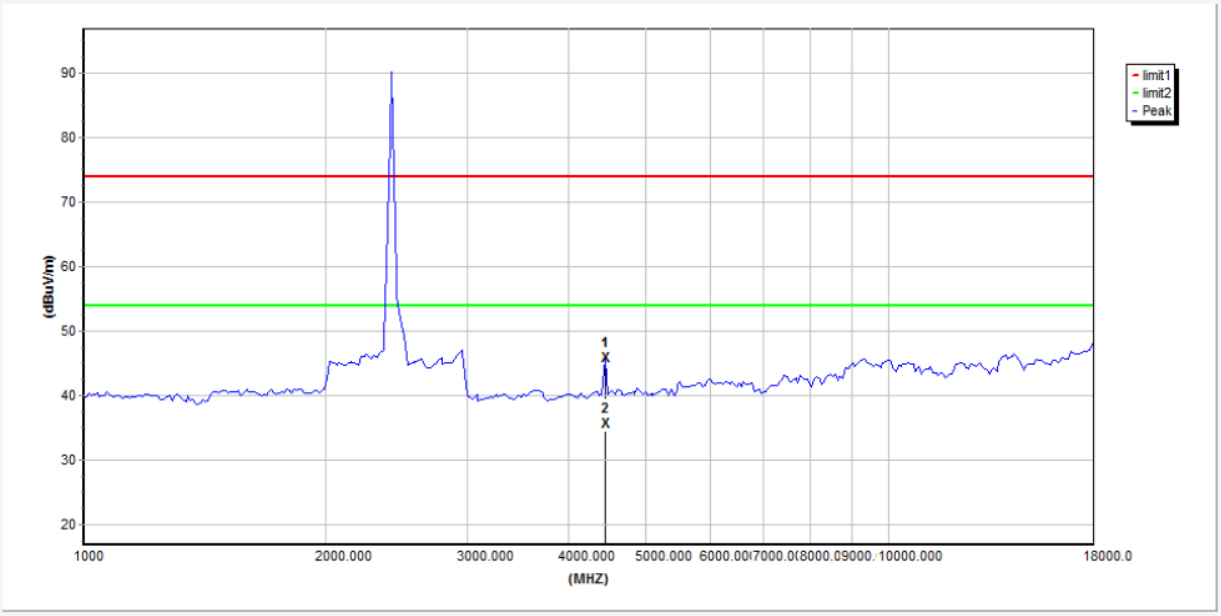
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	30.9619	47.83	-16.44	31.39	40.00	-8.61	QP			
2	252.0627	49.39	-14.03	35.36	46.00	-10.64	QP			
3	276.1235	53.39	-14.99	38.40	46.00	-7.60	QP			
4	287.9904	50.88	-15.01	35.87	46.00	-10.13	QP			
5	300.3672	48.77	-14.69	34.08	46.00	-11.92	QP			
6	348.0274	46.11	-13.05	33.06	46.00	-12.94	QP			

Job No.:	**011610128I**	**Polarization:**	**Horizontal**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**DC 3.7V**
Test item:	**Radiation Test (Above 1GHz)**	**Temp.(C)/Hum.(%RH):**	**24.3(C)/55%RH**
Test Mode:	**TX(2402 MHz)**	**Distance:**	**3m**



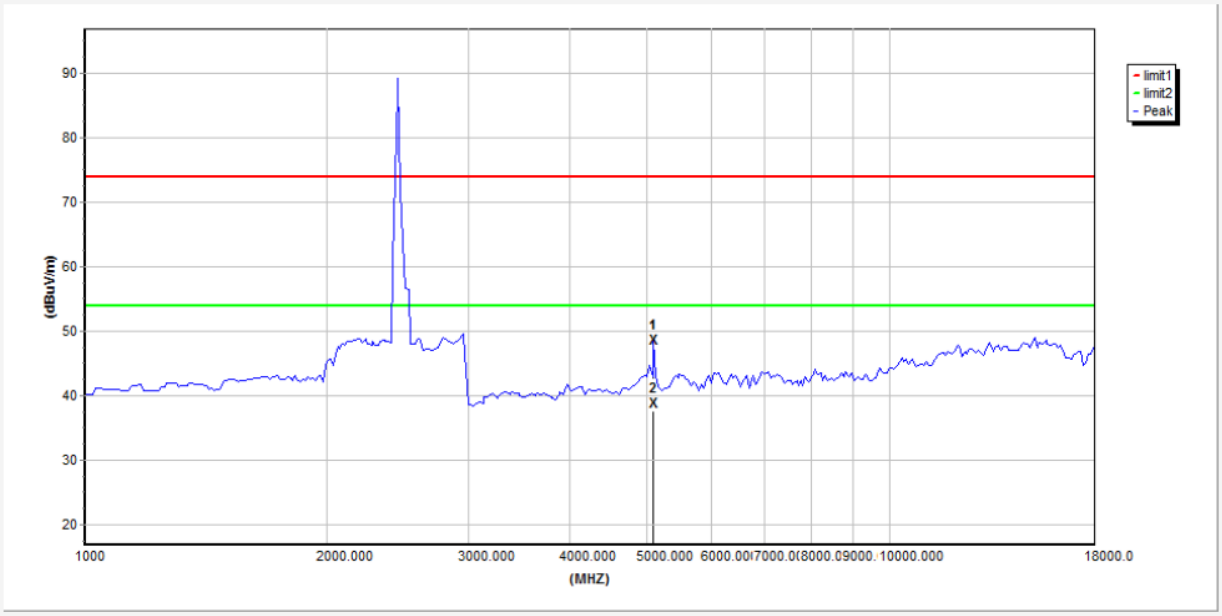
No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	4697.5000	47.46	3.11	16.26	16.26	44.35	74.00	-26.54	peak	---	---
2	4697.5000	37.46	3.11	16.26	16.26	34.35	54.00	-16.54	AVG	---	---

Job No.:	**011610128I**	**Polarization:**	**Vertical**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**DC 3.7V**
Test item:	**Radiation Test (Above 1GHz)**	**Temp.(C)/Hum.(%RH):**	**24.3(C)/55%RH**
Test Mode:	**TX(2402 MHz)**	**Distance:**	**3m**



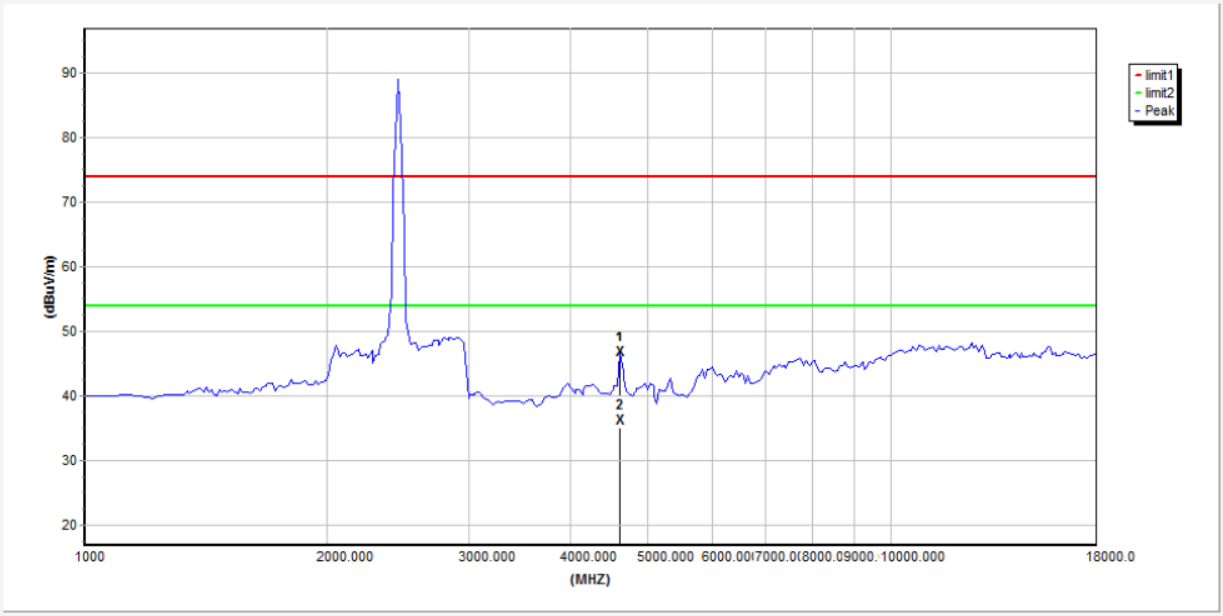
No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	4442.5000	45.65	2.68	15.07	15.07	42.97	74.00	-28.35	peak	---	---
2	4442.5000	35.44	2.68	15.07	15.07	32.76	54.00	-18.56	AVG	---	---

Job No.:	**011610128I**	**Polarization:**	**Horizontal**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**DC 3.7V**
Test item:	**Radiation Test (Above 1GHz)**	**Temp.(C)/Hum.(%RH):**	**24.3(C)/55%RH**
Test Mode:	**TX(2441 MHz)**	**Distance:**	**3m**



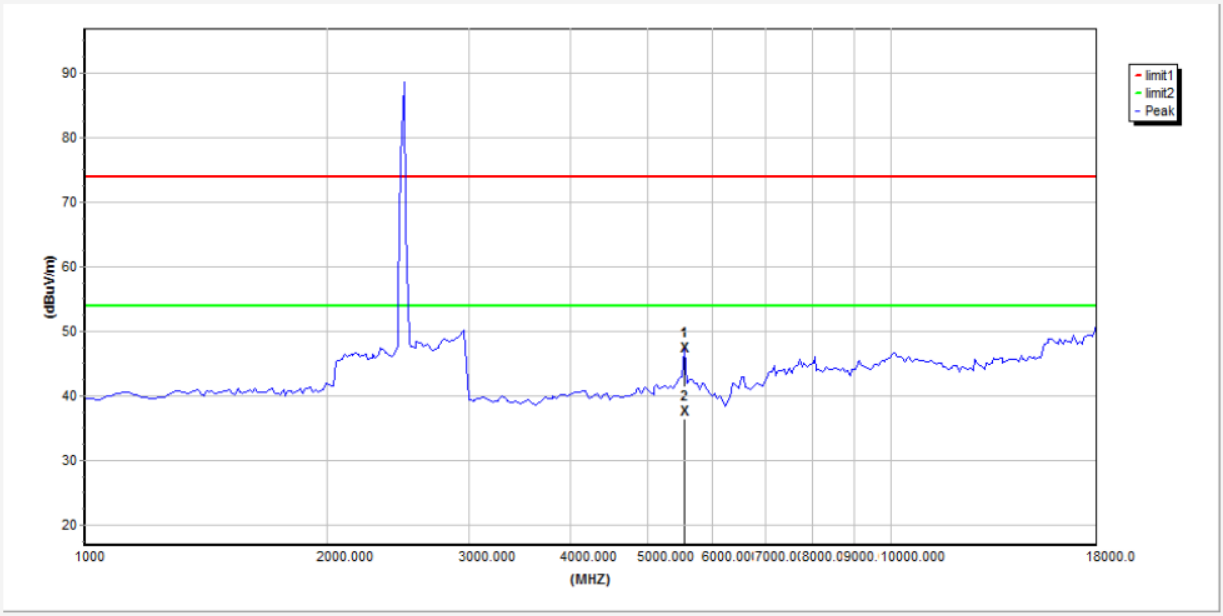
No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	5082.6566	48.52	3.7	17.83	17.84	44.81	74.00	-25.48	peak	---	---
2	5082.6566	38.63	3.7	17.83	17.84	34.92	54.00	-15.37	AVG	---	---

Job No.:	**011610128I**	**Polarization:**	**Vertical**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**DC 3.7V**
Test item:	**Radiation Test (Above 1GHz)**	**Temp.(C)/Hum.(%RH):**	**24.3(C)/55%RH**
Test Mode:	**TX(2441 MHz)**	**Distance:**	**3m**



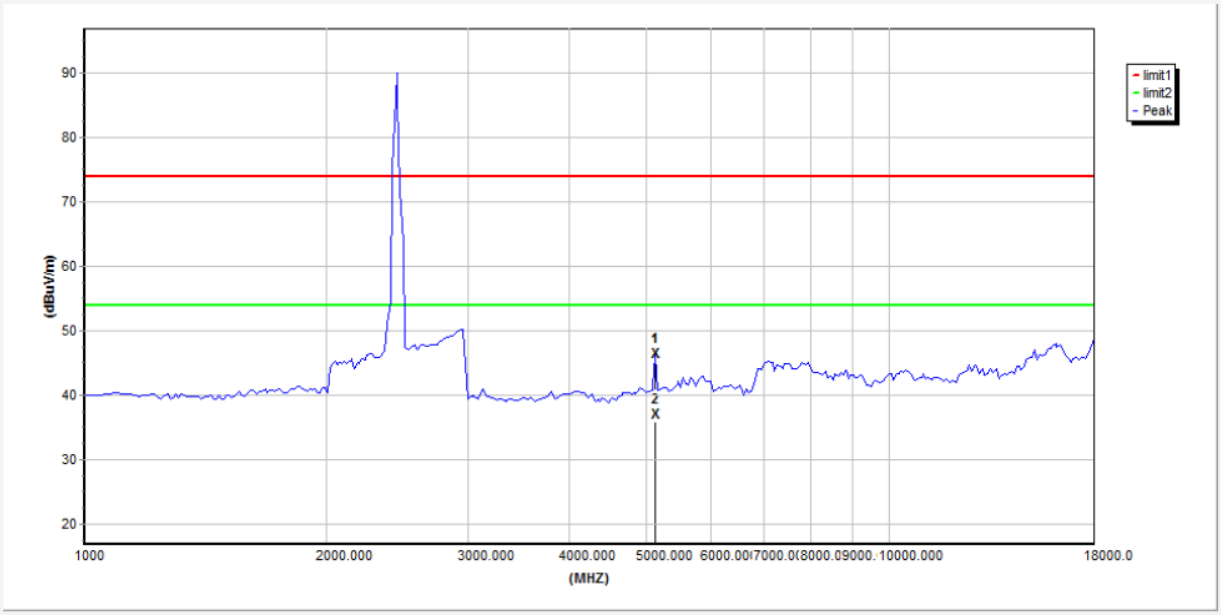
No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	4612.5000	46.67	2.96	15.77	15.77	43.71	74.00	-27.33	peak	---	---
2	4612.5000	36.03	2.96	15.77	15.77	33.07	54.00	-17.97	AVG	---	---

Job No.:	**011610128I**	**Polarization:**	**Horizontal**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**DC 3.7V**
Test item:	**Radiation Test (Above 1GHz)**	**Temp.(C)/Hum.(%RH):**	**24.3(C)/55%RH**
Test Mode:	**TX(2480 MHz)**	**Distance:**	**3m**



No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	5547.5000	47.26	4.26	17.02	17.04	42.98	74.00	-26.74	peak	---	---
2	5547.5000	37.58	4.26	17.02	17.04	33.30	54.00	-16.42	AVG	---	---

Job No.:	**011610128I**	**Polarization:**	**Vertical**
Standard:	**(RE)FCC PART 15C_Class B_3m**	**Power Source:**	**DC 3.7V**
Test item:	**Radiation Test (Above 1GHz)**	**Temp.(C)/Hum.(%RH):**	**24.3(C)/55%RH**
Test Mode:	**TX(2480 MHz)**	**Distance:**	**3m**



No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	5122.5000	46.32	3.73	17.76	17.77	42.58	74.00	-27.68	peak	---	---
2	5122.5000	36.84	3.73	17.76	17.77	33.10	54.00	-17.16	AVG	---	---

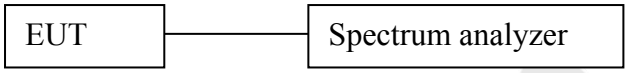
5. CHANNEL SEPARATION TEST

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

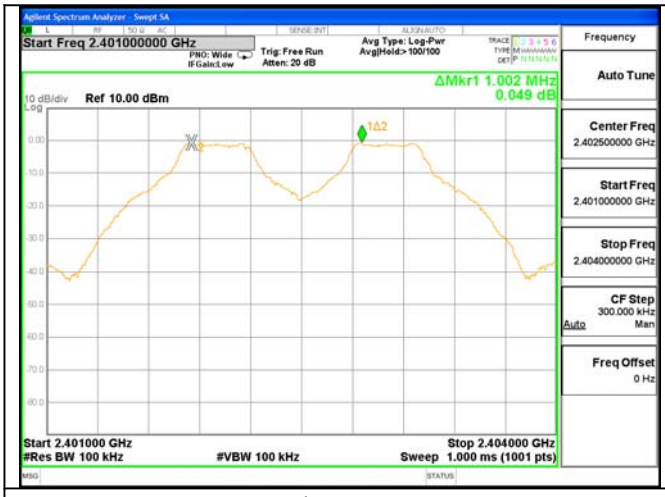
5.4 Test Results

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

Channel	Frequency (MHz)	Separation Read Value (kHz)	Limit (kHz)	Modulation Mode
Low	2402	1002	927.3	BDR
Mid	2441	1002	919.9	BDR
High	2480	1002	928.3	BDR
Low	2402	1002	844.7	EDR
Mid	2441	1002	840.7	EDR
High	2480	1002	840.7	EDR

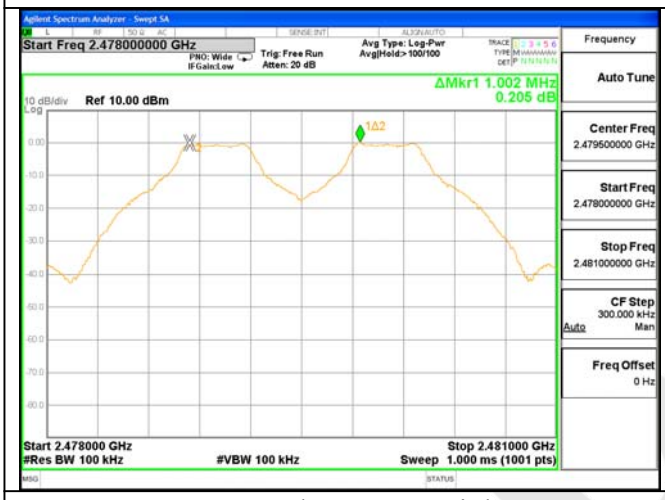
Remark:

1. The limit of mode (EDR) is 2/3 of 20dB BW;
2. The EDR was tested on (π/4DQPSK, 8DPSK) modes, only the worst data of (π/4DQPSK) is attached in the following pages.

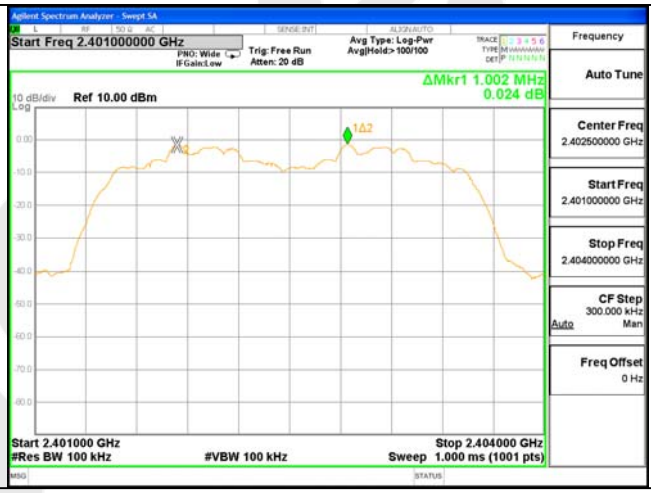


Test Mode: BDR---Low

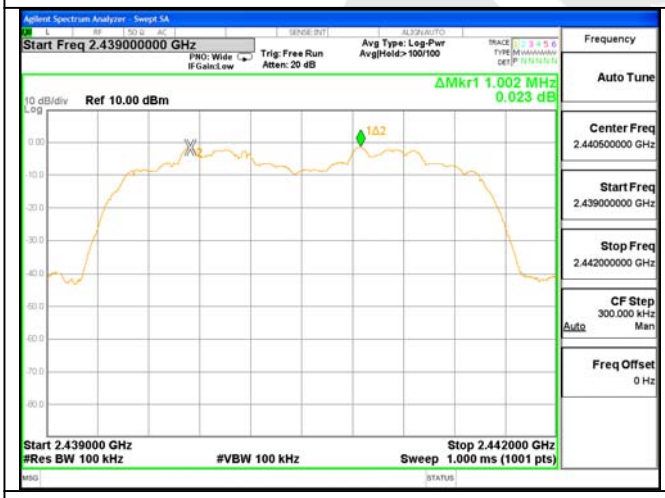
Test Mode: BDR---Mid



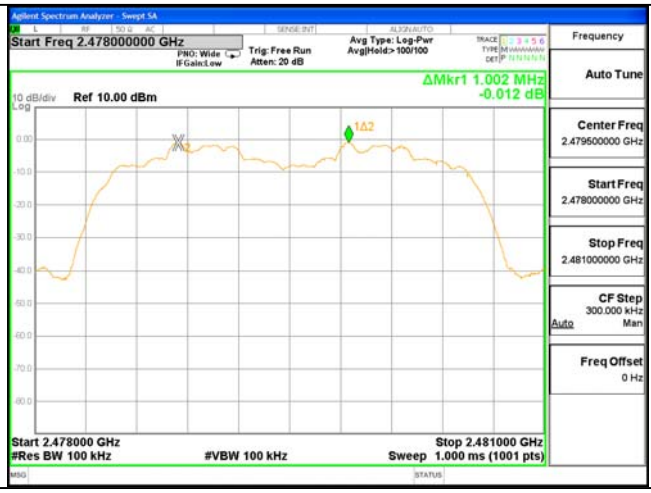
Test Mode: BDR---High



Test Mode: EDR---Low



Test Mode: EDR---Mid



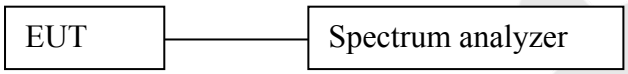
Test Mode: EDR---High

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

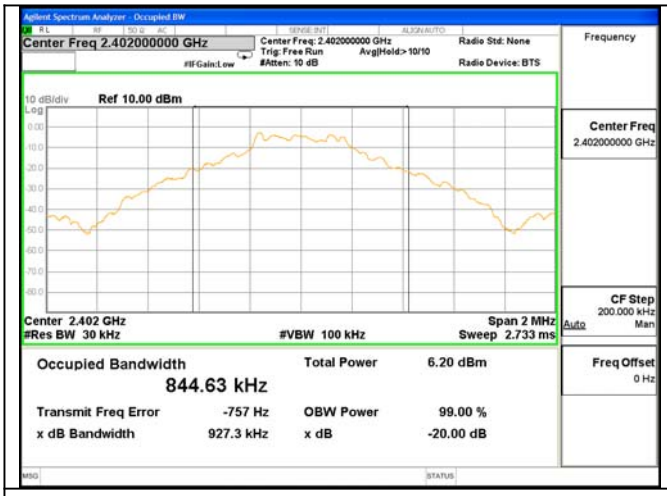
Same as the equipment listed in 5.3.

6.4 Test Results

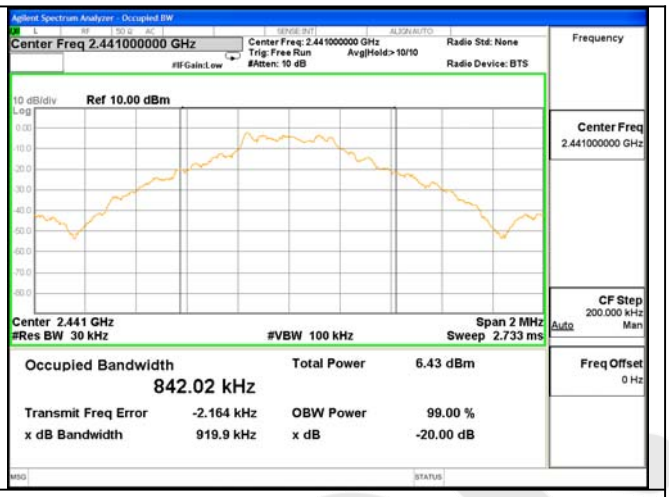
Test Item	:	20dB BW	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3.7V	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

Channel	Frequency (MHz)	20dB Down BW(kHz)	Modulation Mode
Low	2402	927.3	BDR
Mid	2441	919.9	BDR
High	2480	928.3	BDR
Low	2402	1267.0	EDR
Mid	2441	1261.0	EDR
High	2480	1261.0	EDR

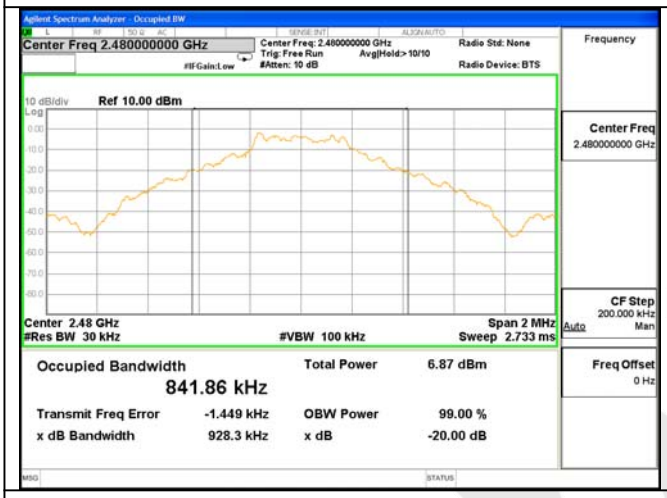
Remark: The EDR was tested on (π /4DQPSK, 8DPSK) modes, only the worst data of (π /4DQPSK) is attached in the following pages.



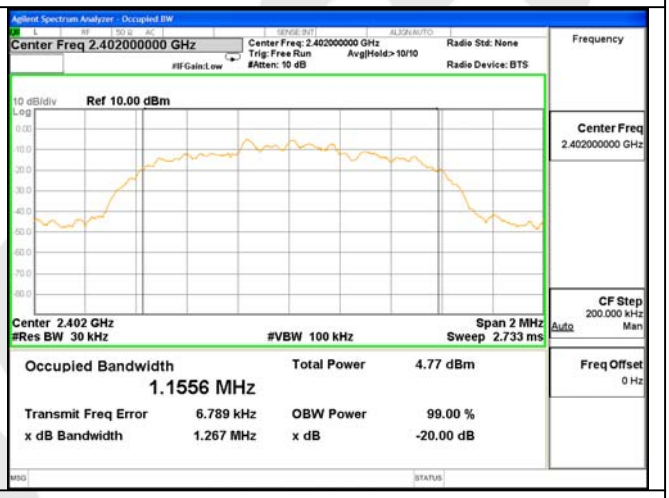
Test Mode: BDR---Low



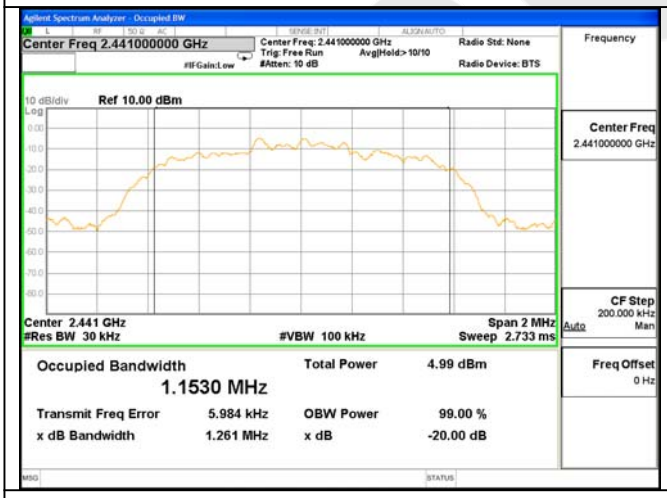
Test Mode: BDR---Mid



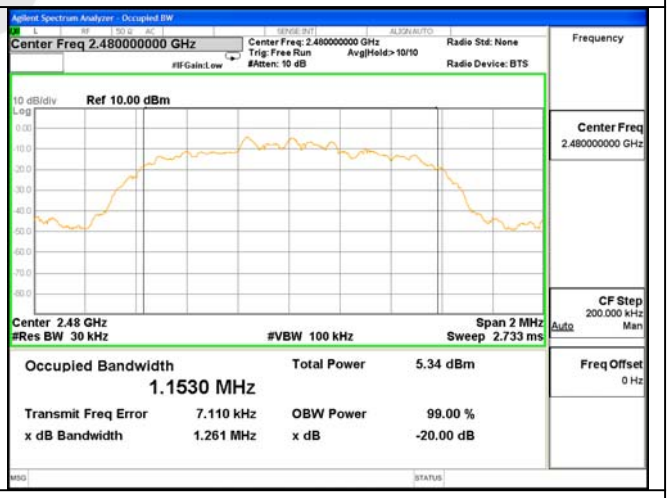
Test Mode: BDR---High



Test Mode: EDR---Low



Test Mode: EDR---Mid



Test Mode: EDR---High

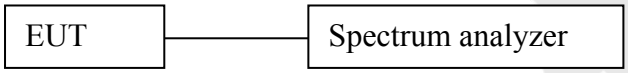
7. QUANTITY OF HOPPING CHANNEL TEST

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



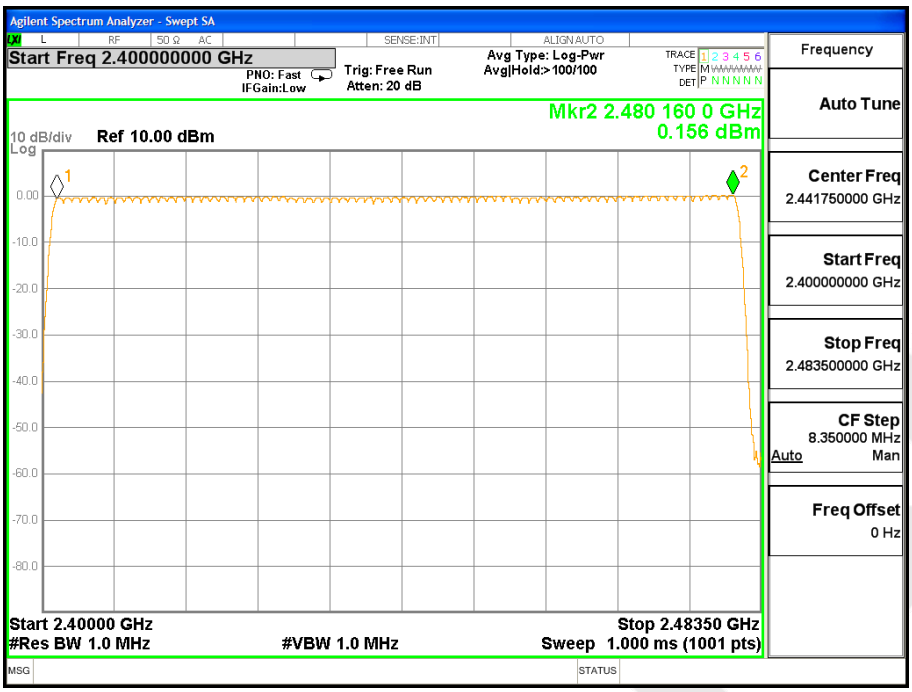
7.3 Test Equipment

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	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

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


Agilent Spectrum Analyzer - Swept SA
Start Freq 2.400000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr2 2.480 160 0 GHz
0.156 dBm
10 dB/div
Log
Ref 10.00 dBm
Start 2.40000 GHz
#Res BW 1.0 MHz
#VBW 1.0 MHz
Stop 2.48350 GHz
Sweep 1.000 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.441750000 GHz
Start Freq
2.400000000 GHz
Stop Freq
2.483500000 GHz
CF Step
8.350000 MHz
Auto
Man
Freq Offset
0 Hz

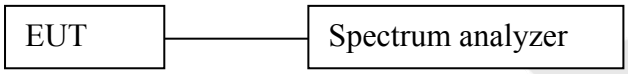
8. DWELL TIME TEST

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	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

Package Type	*Pulse width (ms)*	Time slot length(ms)	Dwell time (ms)	Limit (s)	Modulation
DH1	0.374	time slot length *1600/2 /79 * 31.6	119.68	0.4	BDR
DH3	1.610	time slot length *1600/4 /79 * 31.6	257.60	0.4	BDR
DH5	2.878	time slot length *1600/6 /79 * 31.6	306.99	0.4	BDR
DH1	0.364	time slot length *1600/2 /79 * 31.6	116.48	0.4	EDR
DH3	1.620	time slot length *1600/4 /79 * 31.6	259.20	0.4	EDR
DH5	2.855	time slot length *1600/6 /79 * 31.6	304.53	0.4	EDR

Remark: The EDR was tested on (π /4DQPSK, 8DPSK) modes, only the worst data of (π /4DQPSK) is attached in the following pages.

Test Mode: BDR---DH1

Test Mode: BDR---DH3

Test Mode: BDR---DH5

Test Mode: EDR---DH1

Test Mode: EDR---DH1

Test Mode: EDR---DH3

9. MAX IMUM 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

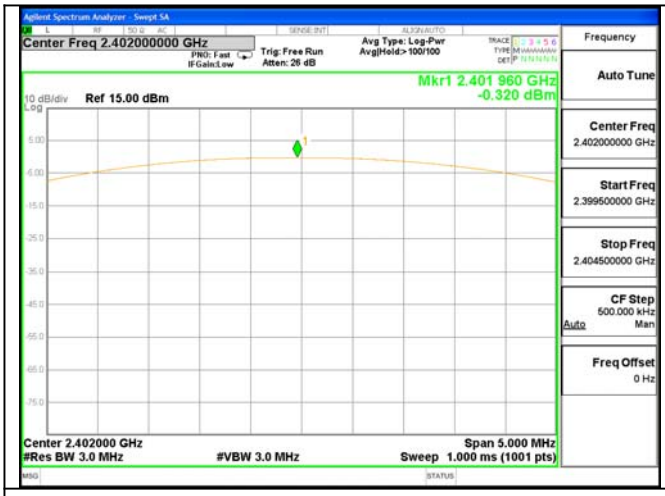
Same as the equipment listed in 5.3.

9.4 Test Results

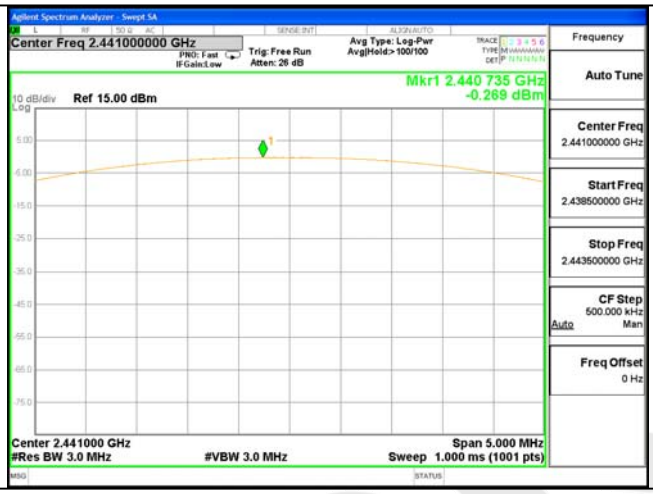
Test Item	:	Max. peak output power	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3.7V	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

Channel Frequency (MHz)	Peak Power output(mW)	Peak Power output(dBm)	Peak Power Limit(mW)	Results	Modulation
2402	0.929	-0.320	1000	PASS	BDR
2441	0.940	-0.269	1000	PASS	BDR
2480	**1.062**	**0.262**	1000	PASS	BDR
2402	0.919	-0.366	125	PASS	EDR
2441	0.941	-0.266	125	PASS	EDR
2480	1.045	0.193	125	PASS	EDR

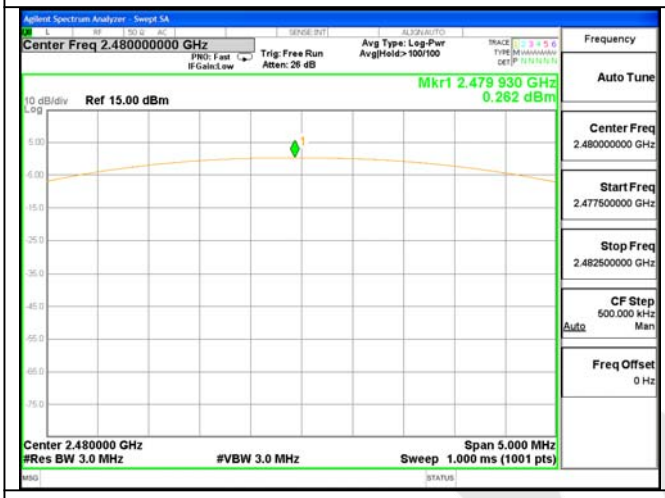
Remark: The EDR was tested on (π /4DQPSK, 8DPSK) modes, only the worst data of (π /4DQPSK) is attached in the following pages.



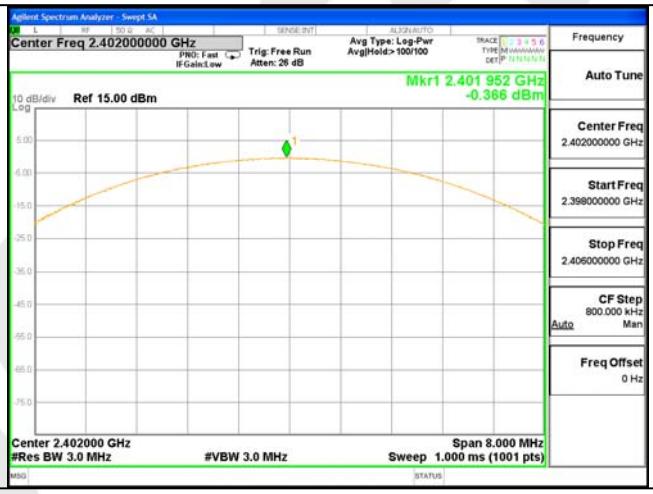
Test Mode: BDR---Low



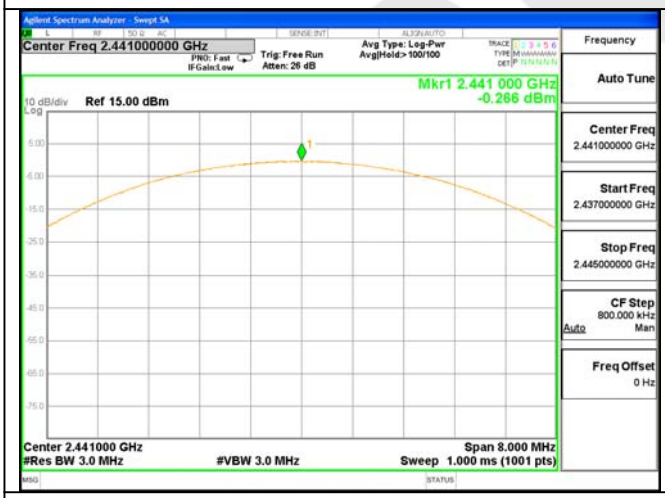
Test Mode: BDR---Mid



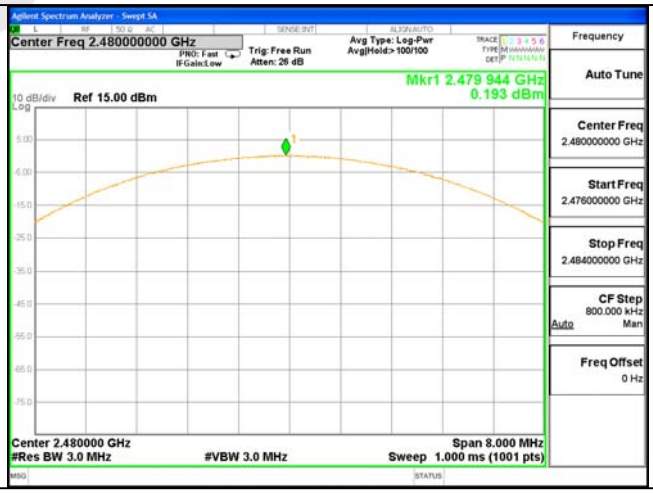
Test Mode: BDR---High



Test Mode: EDR---Low



Test Mode: EDR---Mid



Test Mode: EDR---High

10. BAND EDGE TEST

10.1 Measurement Procedure

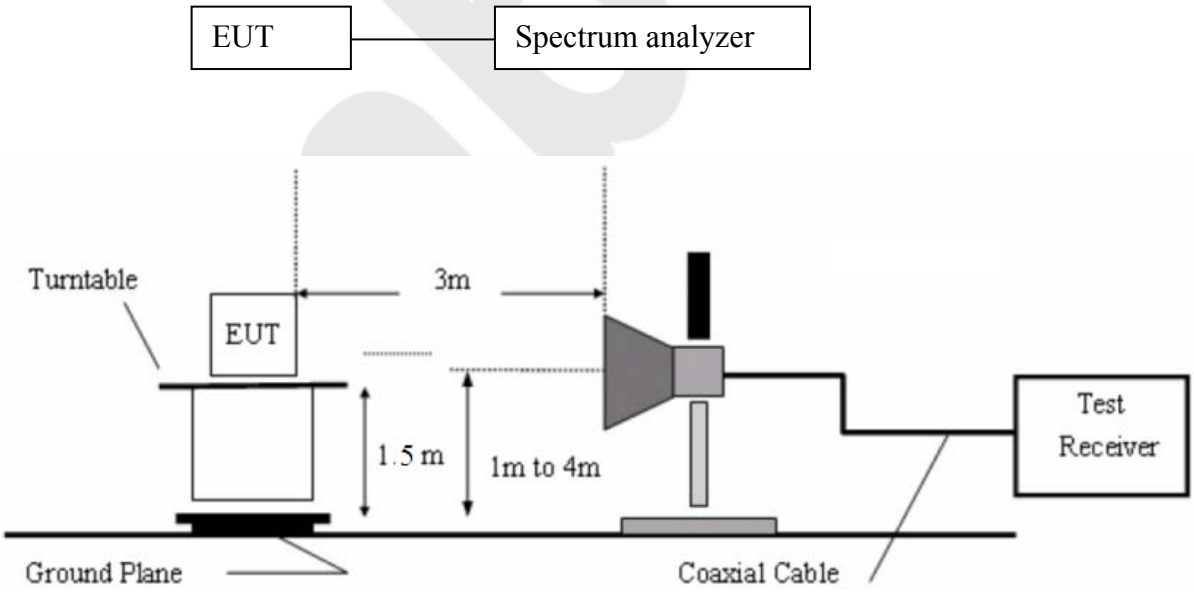
A) Conducted Emission method:

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Put it on the Rotated table and turn on the EUT and make it operate in transmitting mode. Then set it to low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100kHz with a convenient frequency span including 100kHz bandwidth from band edge,
4. Measurement the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Report above procedures until all measured frequencies were complete.

B) Radiated Emission method:

The EUT is placed on a turn table which is 1.5 meter high above the ground. 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.
for Radiated emissions restricted band RBW= 1 MHz, VBW= 3 MHz.

10.2 Test SET-UP



10.3 Test Equipment

Same as the equipment listed in 5.3.

10.4 Test Results

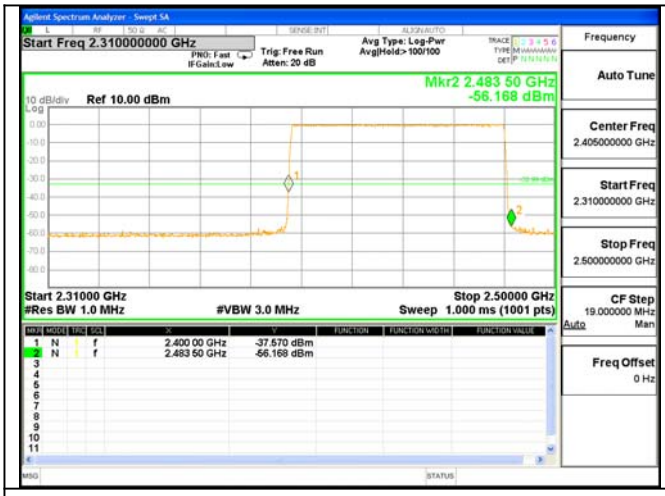
Pass.

Please refer the following data.

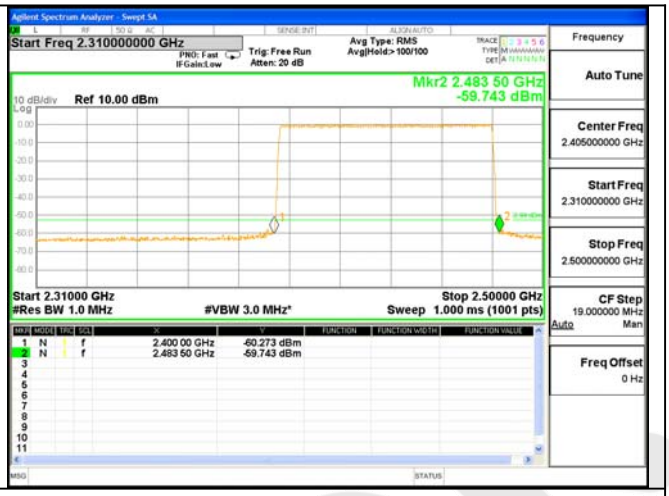
Test Item	:	Band eadge	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3.7V	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

For Hopping Mode:

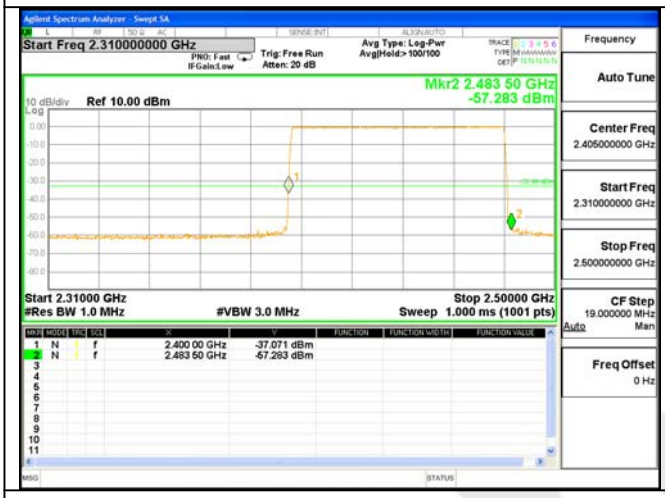
Remark: The EDR was tested on (π/4DQPSK, 8DPSK) modes, only the worst data of (π/4DQPSK) is attached in the following pages.



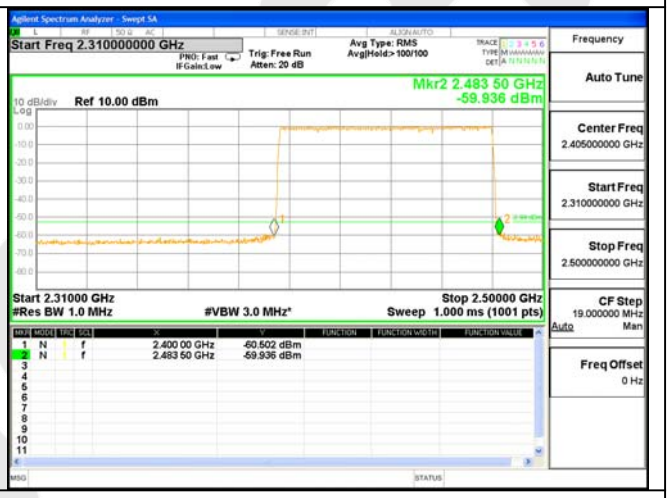
Test Mode: BDR



Test Mode: BDR



Test Mode: EDR



Test Mode: EDR

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

For Non-Hopping Mode:

1. Conducted Test

Frequency (MHz)	Peak Power Output(dBm)	Emission read Value(dBm)	Result of Band edge(dBc)	Band edge Limit(dBc)	Modulation
<2400	-0.338	-39.811	39.473	>20dBc	BDR
	-0.752	-30.876	30.124	>20dBc	EDR
>2483.5	0.258	-53.813	54.071	>20dBc	BDR
	-0.208	-52.118	51.910	>20dBc	EDR

2. Radiated emission Test

Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)		Band edge Limit (dBuV/m)		Modulation
		PK	AV	PK	AV	
<2400	V	50.23	38.09	74.00	54.00	BDR
	V	52.46	40.11	74.00	54.00	EDR
>2483.5	V	51.12	41.25	74.00	54.00	BDR
	V	49.87	37.68	74.00	54.00	EDR

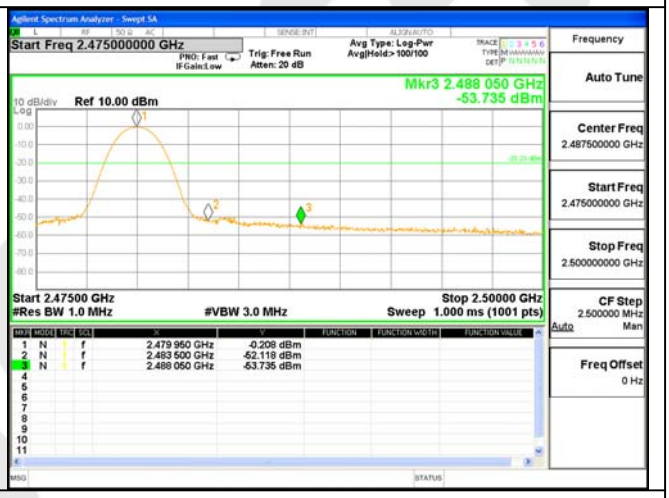
Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)		Band edge Limit (dBuV/m)		Modulation
		PK	AV	PK	AV	
<2400	H	48.90	37.89	74.00	54.00	BDR
	H	50.67	40.33	74.00	54.00	EDR
>2483.5	H	49.78	39.67	74.00	54.00	BDR
	H	48.03	38.93	74.00	54.00	EDR

Remark: The EDR was tested on (π/4DQPSK, 8DPSK) modes, only the worst data of (π/4DQPSK) is attached in the following pages.

Test Mode: BDR

Test Mode: BDR

Test Mode: EDR



Test Mode: EDR

11. ANTENNA APPLICATION

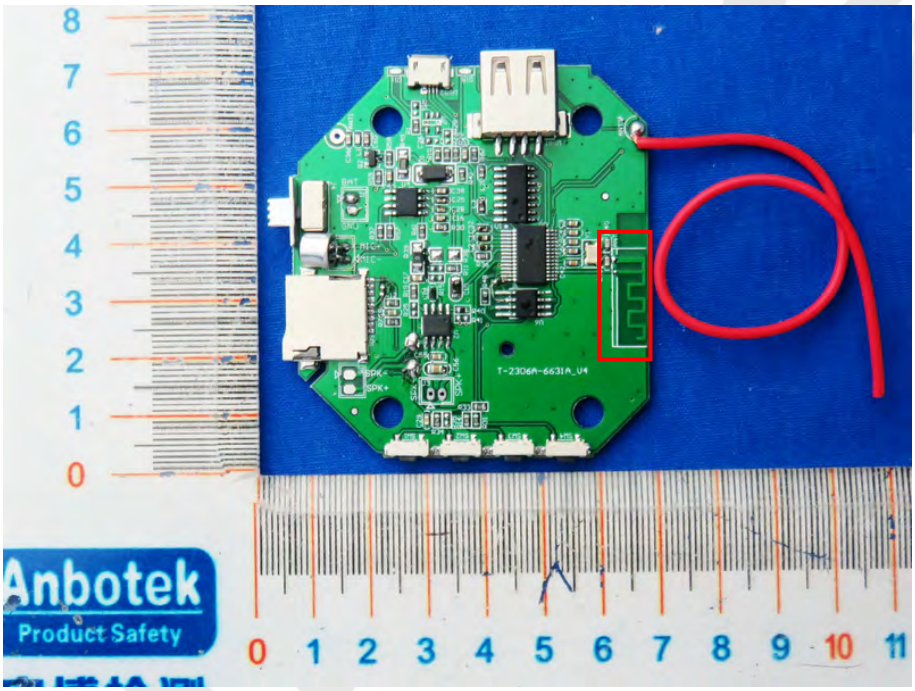
11.1 Antenna requirement

The EUT'S antenna is met the requirement of FCC part 15C section 15.203 and 15.247.

FCC part 15C section 15.247 requirements:
Systems operating in the 2402-2480MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

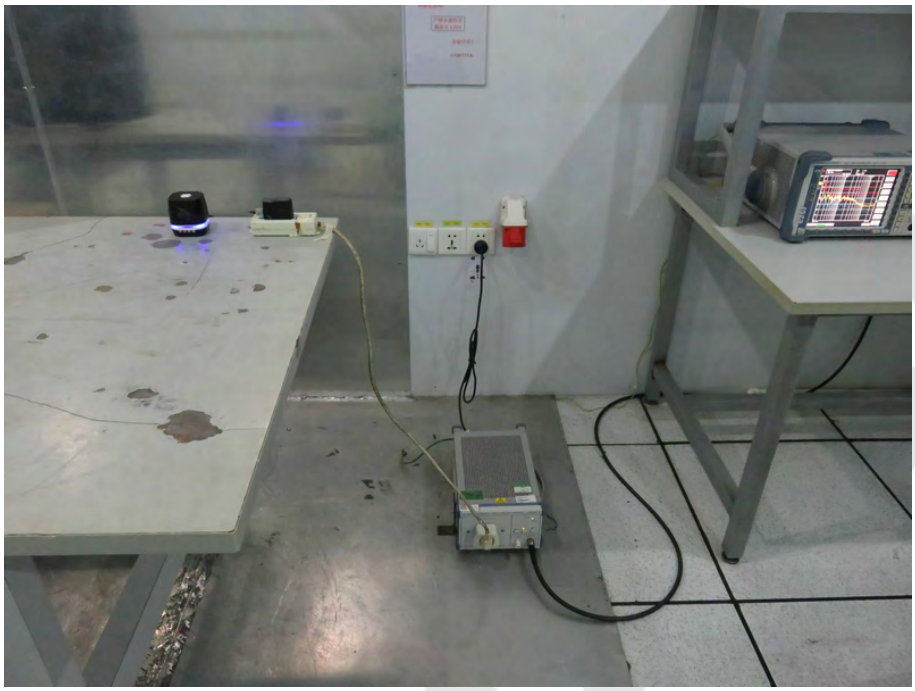
11.2 Result

The EUT's antenna used a PCB Antenna, The antenna's gain is 1dBi and meets the requirement.

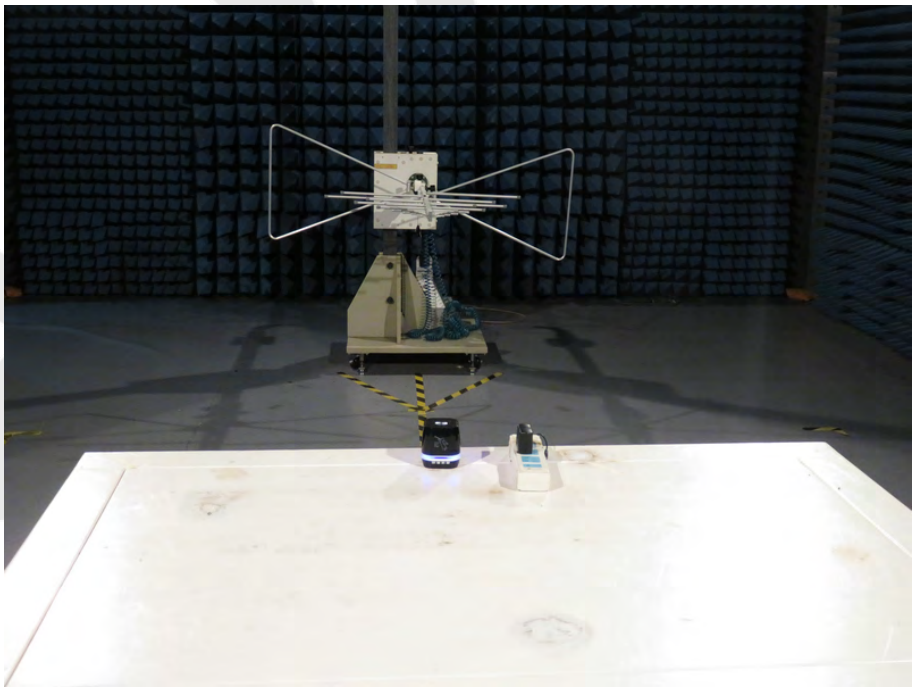


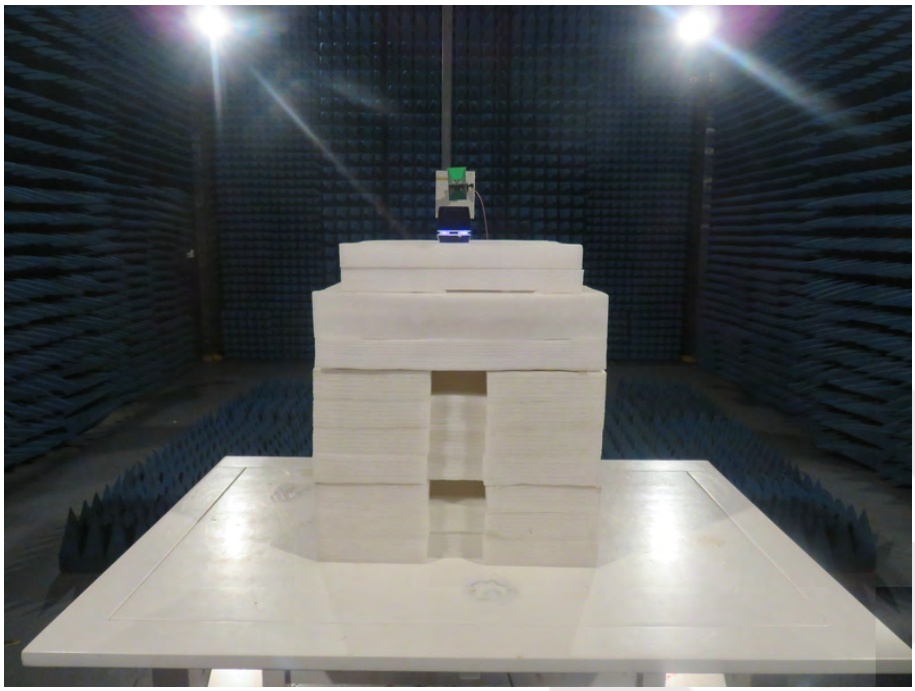
12. PHOTOGRAPH

12.1 Photo of Power Line Conducted Emission Measurement



12.2 Photo of Radiation Emission Test





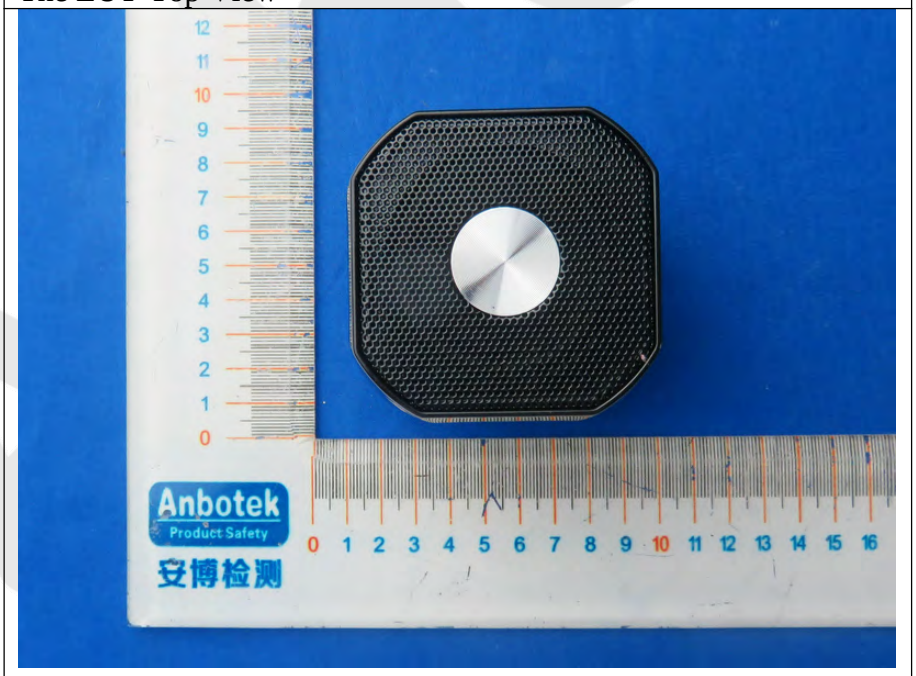
APPENDIX I (EXTERNAL PHOTOS)

1. Figure

The EUT-Overall View

2. Figure

The EUT-Top View

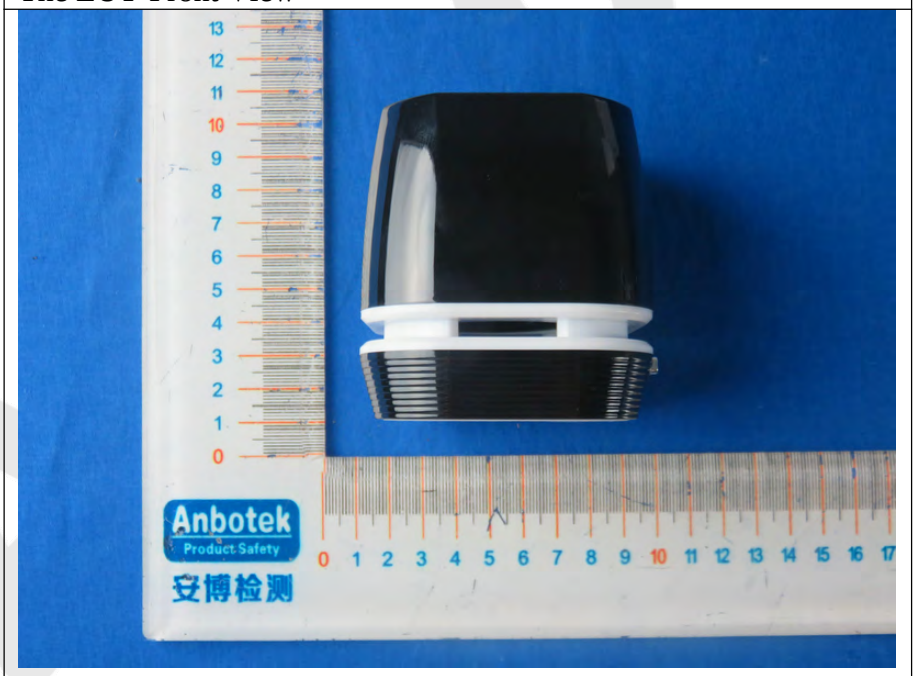


3. Figure

The EUT-Bottom View

4. Figure

The EUT-Front View



5. Figure

The EUT- Back View

6. Figure

The EUT- Right View

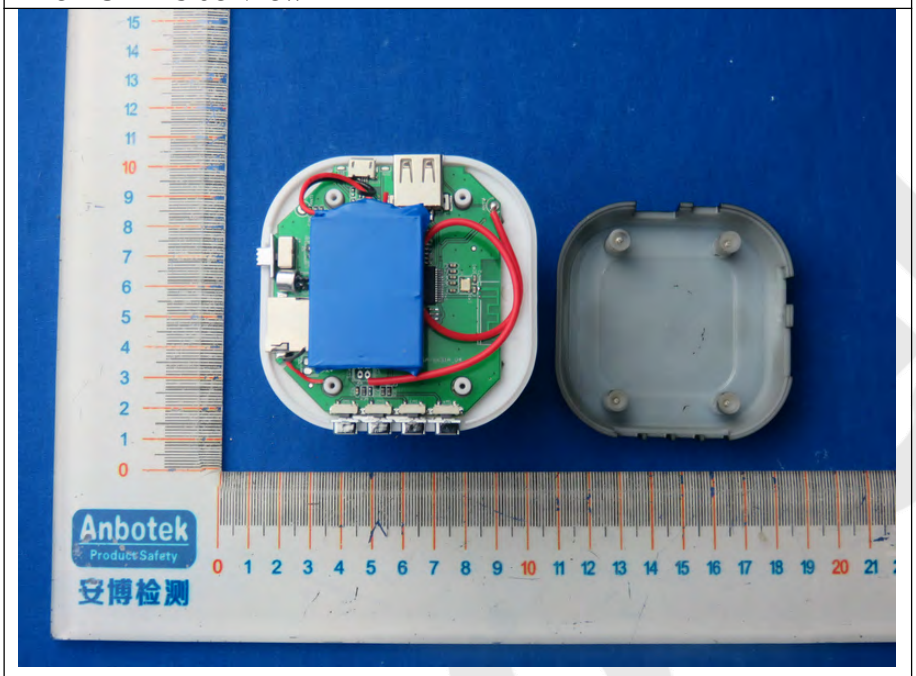
7. Figure

The EUT- Left View

APPENDIX Ⅱ(INTERNAL PHOTOS)

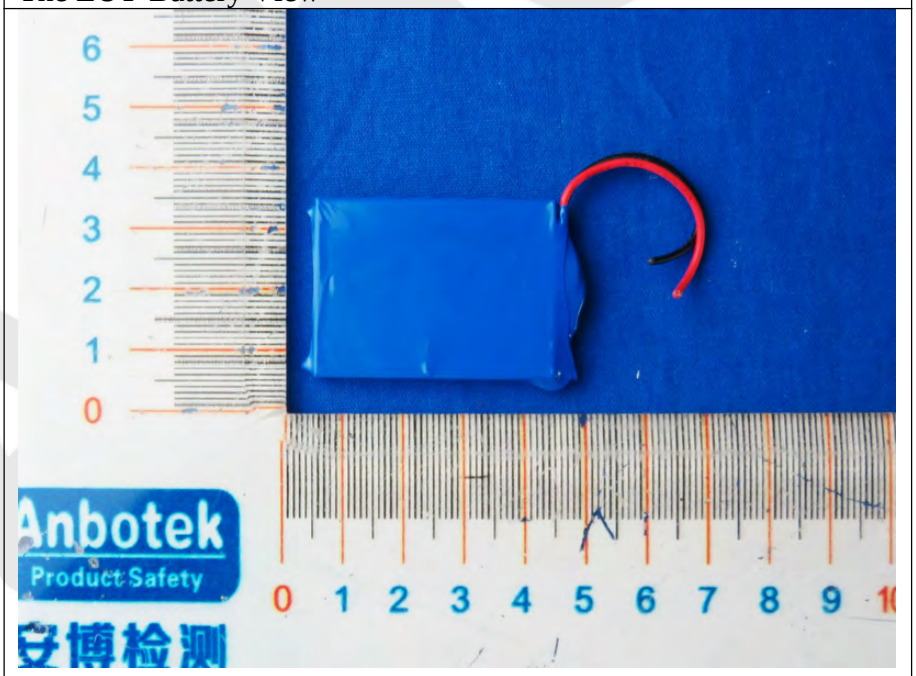
1. Figure

The EUT-Inside View



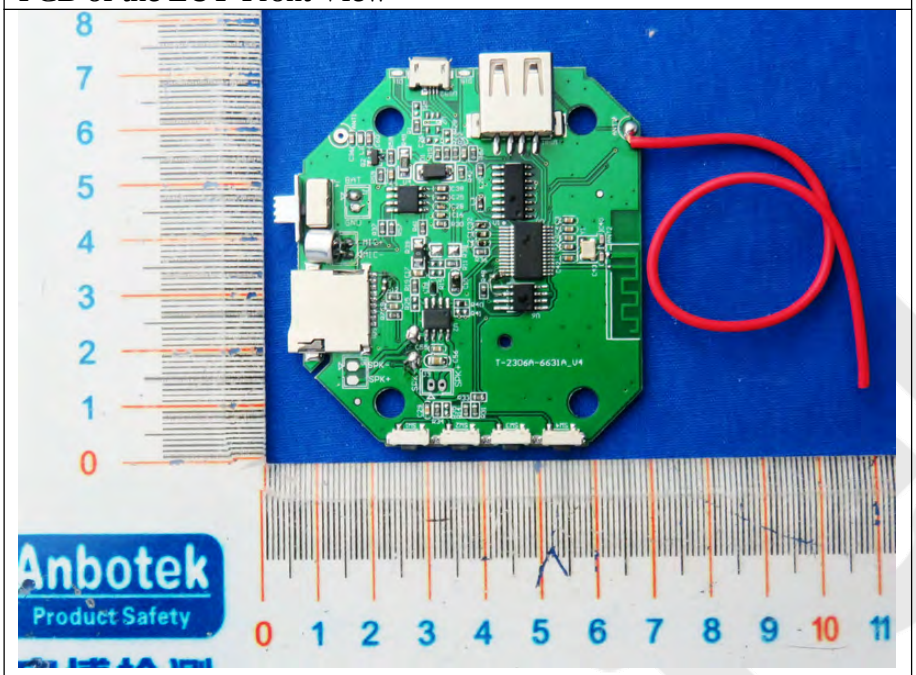
2. Figure

The EUT-Battery View



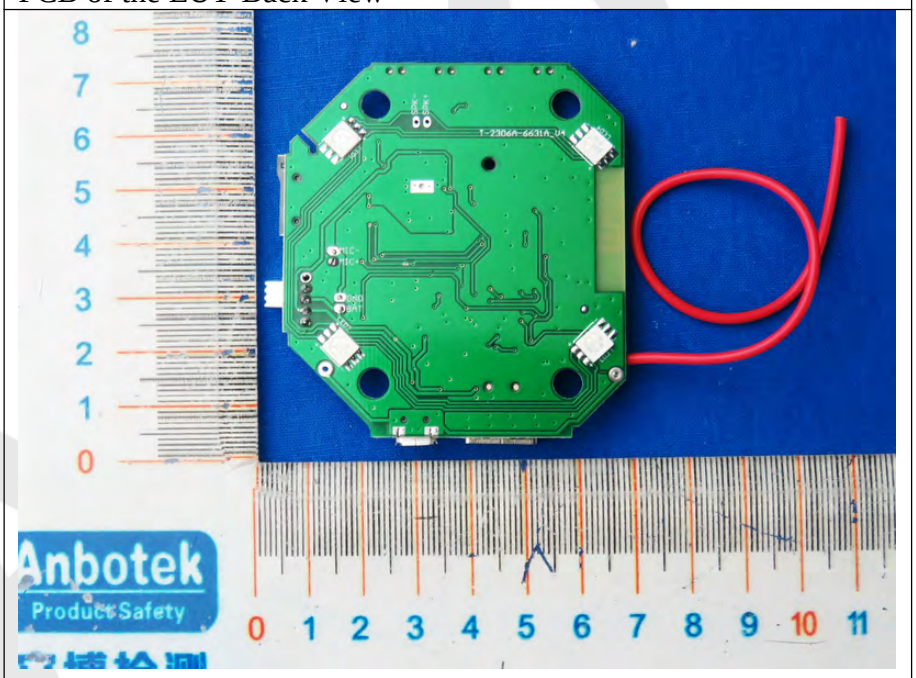
3. Figure

PCB of the EUT-Front View



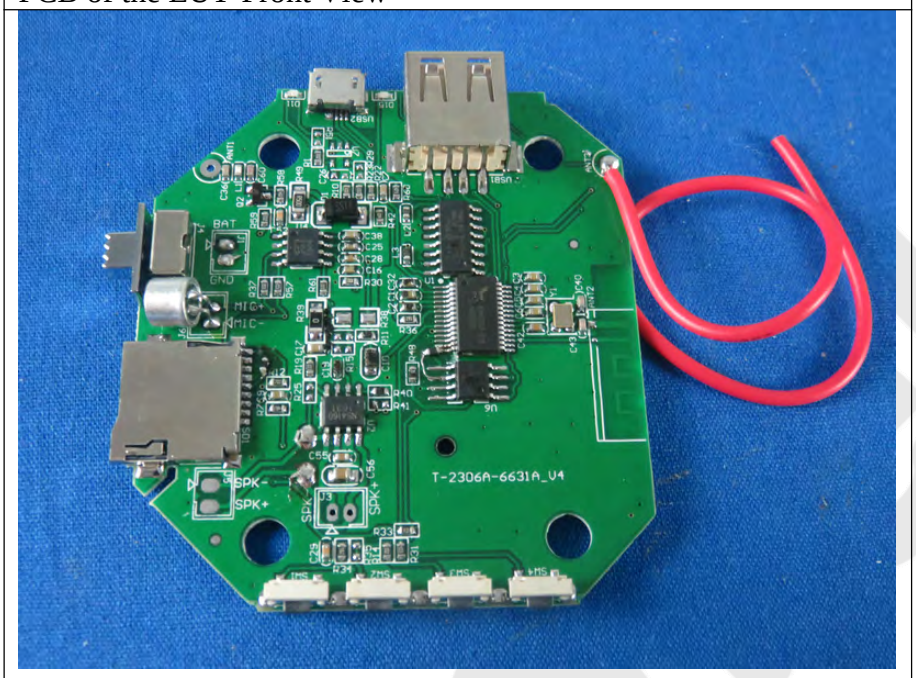
4. Figure

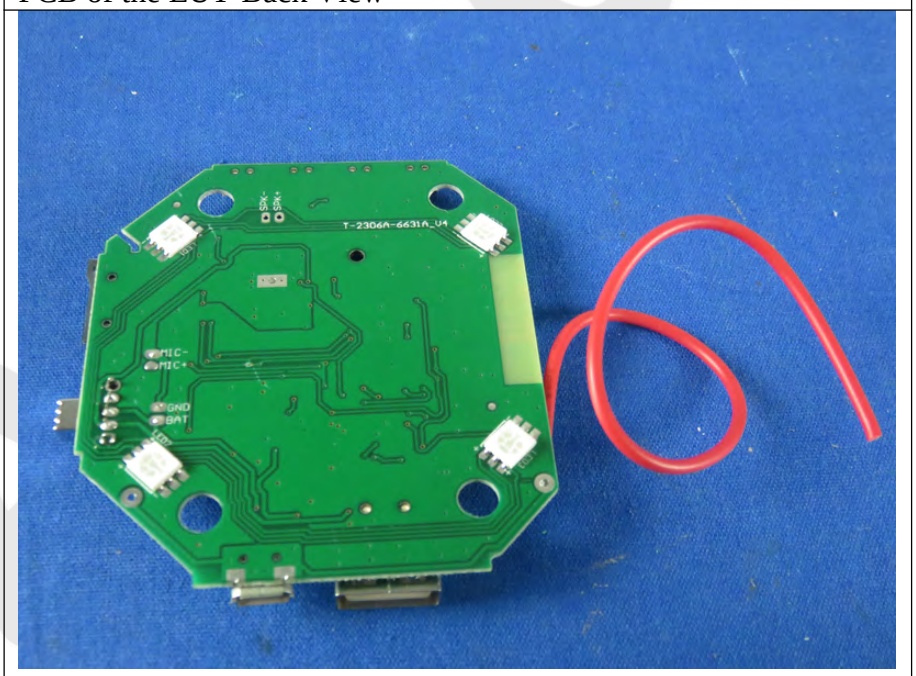
PCB of the EUT-Back View



5. Figure

PCB of the EUT-Front View



6. Figure

PCB of the EUT-Back View