

FCC TEST REPORT  
for  
RILLPAC (CHINA) CO., LIMITED

Bluetooth Earphones  
Model No.: BT30, BT10

Prepared for : RILLPAC (CHINA) CO., LIMITED  
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Date of Test : Sept. 27~Oct. 17, 2016  
Date of Report : Oct. 17, 2016

## TABLE OF CONTENTS

Description

Page

Test Report

<b>1. GENERAL INFORMATION.....</b>	<b>5</b>
1.1 Description of Device (EUT).....	5
1.2 Auxiliary Equipment Used during Test.....	6
1.3 Description of Test Facility.....	6
1.4 Measurement Uncertainty.....	6
<b>2. TEST PROCEDURE.....</b>	<b>7</b>
2.1. Summary of Test Results.....	7
2.2. Description of Test Modes.....	7
2.3. List of channels:.....	8
<b>3. CONDUCTED EMISSION.....</b>	<b>10</b>
3.1 Block Diagram of Test Setup.....	10
3.2 Power Line Conducted Emission Measurement Limits (15.207).....	10
3.3 Configuration of EUT on Measurement.....	10
3.4 Operating Condition of EUT.....	10
3.5 Test Procedure.....	11
3.6 Power Line Conducted Emission Measurement Results.....	11
<b>4. RADIATION INTERFERENCE.....</b>	<b>16</b>
4.1 Requirements (15.247, 15.209):.....	16
4.2 Test Procedure.....	16
4.3 Test Configuration.....	17
4.4 Test Results.....	18
<b>5. CHANNEL SEPARATION TEST.....</b>	<b>27</b>
5.1 Measurement Procedure.....	27
5.2 Test SET-UP.....	27
5.3 Test Equipment.....	27
5.4 Test Results.....	28
<b>6. 20DB BANDWIDTH TEST.....</b>	<b>30</b>
6.1 Measurement Procedure.....	30
6.2 Test SET-UP.....	30
6.3 Test Equipment.....	30
6.4 Test Results.....	30
<b>7. QUANTITY OF HOPPING CHANNEL TEST.....</b>	<b>32</b>
7.1 Measurement Procedure.....	32
7.2 Test SET-UP.....	32
7.3 Test Equipment.....	32
7.4 Test Results.....	32

<b>8. DWELL TIME TEST.....</b>	<b>34</b>
8.1 Measurement Procedure.....	34
8.2 Test SET-UP.....	34
8.3 Test Equipment.....	34
8.4 Test Results.....	34
<b>9. MAXIMUM PEAK OUTPUT POWER TEST.....</b>	<b>36</b>
9.1 Measurement Procedure.....	36
9.2 Test SET-UP.....	36
9.3 Test Equipment.....	36
9.4 Test Results.....	37
<b>10. BAND EDGE TEST.....</b>	<b>39</b>
10.1 Measurement Procedure.....	39
10.2 Test SET-UP.....	39
10.3 Test Equipment.....	40
10.4 Test Results.....	40
<b>11. ANTENNA APPLICATION.....</b>	<b>44</b>
11.1 Antenna requirement.....	44
11.2 Result.....	44
<b>12. PHOTOGRAPH.....</b>	<b>45</b>
12.1 Photo of Power Line Conducted Emission Measurement.....	45
12.2 Photo of Radiation Emission Test.....	45
<b>APPENDIX I (EXTERNAL PHOTOS).....</b>	<b>47</b>
<b>APPENDIX II (INTERNAL PHOTOS).....</b>	<b>50</b>

## TEST REPORT

Applicant : RILLPAC (CHINA) CO., LIMITED  
Manufacturer : Rillpac (Shanghai) Electronics Technology Co., LTD.  
EUT : Bluetooth Earphones  
Model No. : BT30, BT10  
Serial No. : N.A.  
Trade Mark : Rillpac  
Rating : DC 5V, 60mA

Measurement Procedure Used:

FCC Part15 Subpart C 2015, 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.

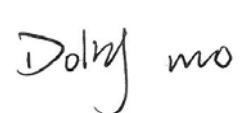
This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Test : Sept. 27~Oct. 17, 2016

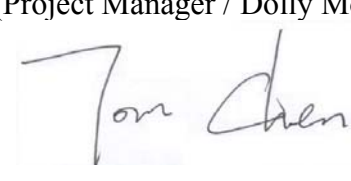
Prepared by :

  
(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 Earphones
Model Number	: BT30, BT10 (Note: All samples are the same except the model number and appearance, so we prepare "BT30" 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	: Ceramic Antenna: 2dBi
Modulation	: GFSK, $\pi/4$ DQPSK, 8DPSK
Applicant Address	: RILLPAC (CHINA) CO., LIMITED Room 803, Chevalier House, 45-51 Chatham Road South, Tsim Sha Tsui, Kowloon, Hongkong
Manufacturer Address	: Rillpac (Shanghai) Electronics Technology Co., LTD. Room 29014, 1st Area, Building 1, No. 888, Huanhu West 2nd Road, Nanhui new Town, Pudong, Shanghai China
Factory Address	: Rillpac (Shanghai) Electronics Technology Co., LTD. Room 29014, 1st Area, Building 1, No. 888, Huanhu West 2nd Road, Nanhui new Town, Pudong, Shanghai China
Date of receipt	: Sept. 27, 2016
Date of Test	: Sept. 27~Oct. 17, 2016
Note	: This report is for BT3.0 module

## 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

### 2.1. Summary of Test Results

The EUT has been tested according to the following specifications:

Standard Section	Test Item	Judgment
15.203/15.247(c)	Antenna Requirement	PASS
15.207	Conducted Emission	PASS
15.247(b)(1)	Conducted Peak Output Power	PASS
15.247(a)(1)	20dB Occupied Bandwidth	PASS
15.247(a)(1)	Carrier Frequencies Separation	PASS
15.247(a)(1)	Hopping Channel Number	PASS
15.247(a)(1)	Dwell Time	PASS
15.205/15.209	Spurious Emission	PASS
15.247(d)	Band Edge	PASS
<b>Remark:</b> "N/A" is an abbreviation for Not Applicable.		

### 2.2. Description of Test Modes

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned follow was evaluated respectively.

Test Mode	Description
Transmitting mode	Keep the EUT in Transmitting mode with worst case data rate

**Remark:** The sample was placed 0.8m above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

### 2.3. List of channels:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460
05	2407	32	2434	59	2461
06	2408	33	2435	60	2462
07	2409	34	2436	61	2463
08	2410	35	2437	62	2464
09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454		
26	2428	53	2455		
Remark: Channel 0, 39 & 78 selected for GFSK, $\pi/4$ -DQPSK and 8DPSK.					



**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

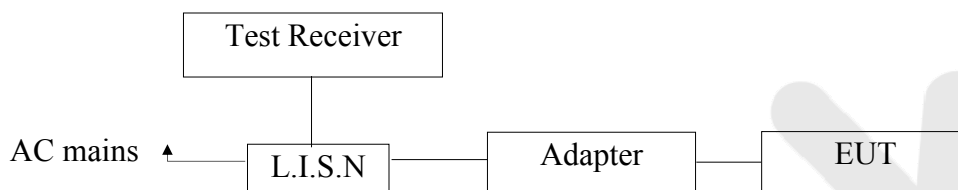
**ANSI STANDARD C63.10-2013 10.1.7 MEASUREMENT PROCEDURES:** The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation.

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 (Charging) 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

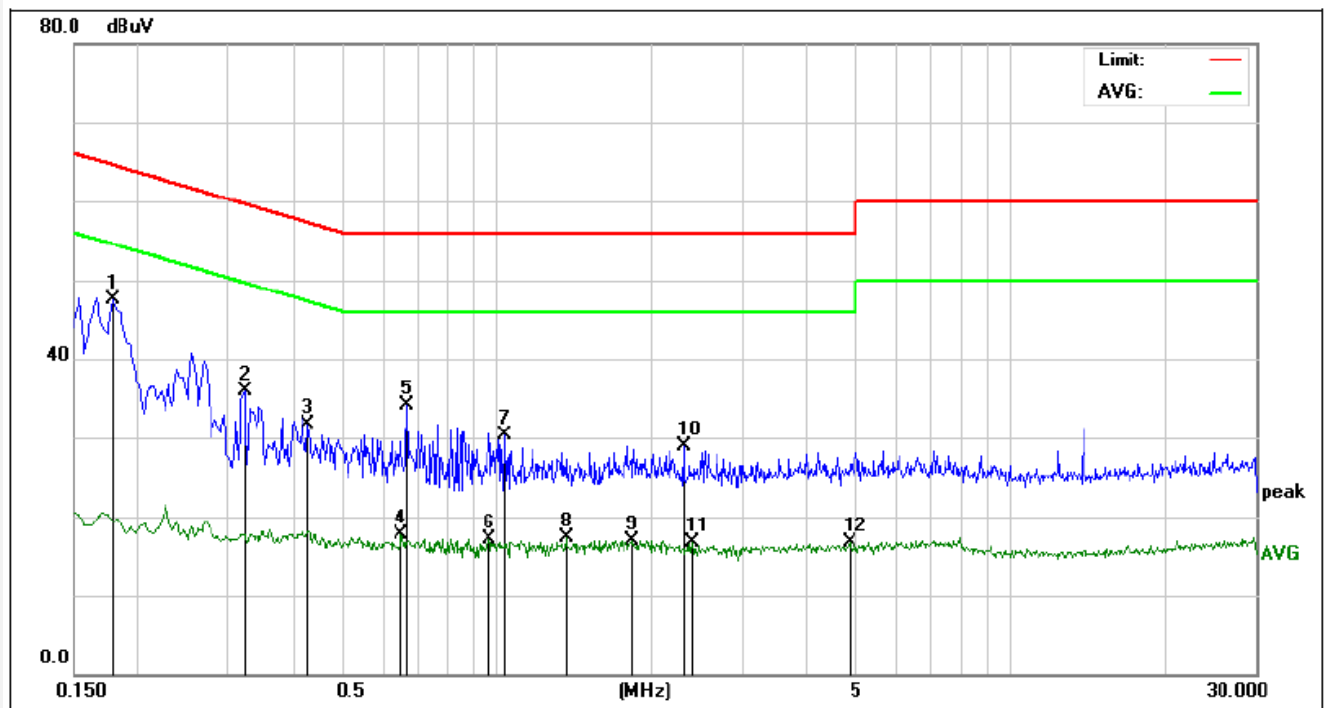
**PASS.**

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

Please refer the following pages.

## CONDUCTED EMISSION TEST DATA

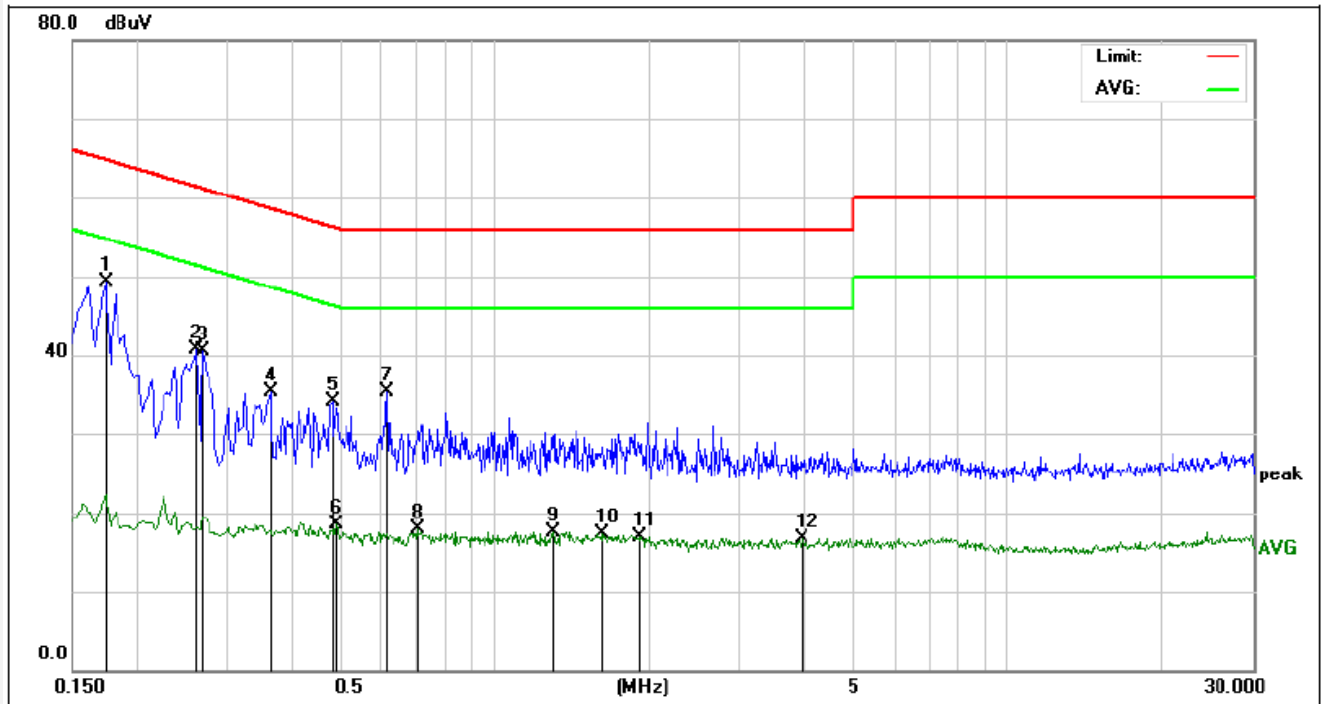
Test Site: 1# Shielded Room  
Operating Condition: Charging  
Test Specification: AC 120V, 60Hz for adapter  
Comment: Live Line  
Tem.:25℃ Hum.:50%



No.	Frequency (MHz)	Reading (dBuV)	Correct dB	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Remark
1	0.1780	27.56	19.90	47.46	64.57	-17.11	QP
2	0.3220	15.92	19.90	35.82	59.65	-23.83	QP
3	0.4300	11.61	19.89	31.50	57.25	-25.75	QP
4	0.6540	-2.33	19.98	17.65	46.00	-28.35	AVG
5	0.6700	14.05	19.98	34.03	56.00	-21.97	QP
6	0.9660	-2.80	20.04	17.24	46.00	-28.76	AVG
7	1.0339	10.29	20.04	30.33	56.00	-25.67	QP
8	1.3619	-2.76	20.12	17.36	46.00	-28.64	AVG
9	1.8300	-3.00	20.12	17.12	46.00	-28.88	AVG
10	2.3100	8.94	20.12	29.06	56.00	-26.94	QP
11	2.3980	-3.37	20.18	16.81	46.00	-29.19	AVG
12	4.8540	-3.33	20.18	16.85	46.00	-29.15	AVG

### CONDUCTED EMISSION TEST DATA

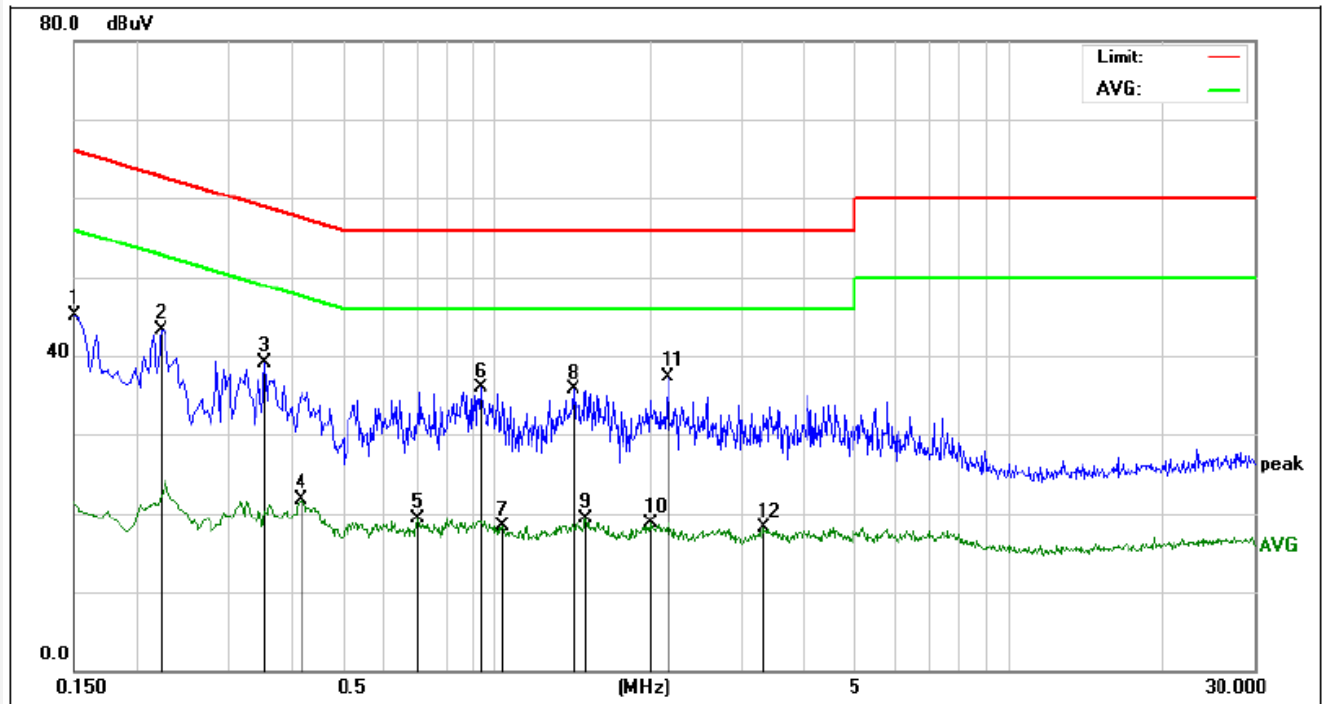
Test Site: 1# Shielded Room  
Operating Condition: Charging  
Test Specification: AC 120V, 60Hz for adapter  
Comment: Neutral Line  
Tem.:25°C Hum.:50%



No.	Frequency (MHz)	Reading (dBuV)	Correct dB	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Remark
1	0.1740	29.31	19.89	49.20	64.76	-15.56	QP
2	0.2620	20.70	19.89	40.59	61.36	-20.77	QP
3	0.2700	20.44	19.89	40.33	61.12	-20.79	QP
4	0.3660	15.30	19.98	35.28	58.59	-23.31	QP
5	0.4820	14.17	19.98	34.15	56.30	-22.15	QP
6	0.4900	-1.59	20.04	18.45	46.17	-27.72	AVG
7	0.6140	15.24	20.04	35.28	56.00	-20.72	QP
8	0.7060	-2.08	20.04	17.96	46.00	-28.04	AVG
9	1.2980	-2.50	20.12	17.62	46.00	-28.38	AVG
10	1.6180	-2.77	20.12	17.35	46.00	-28.65	AVG
11	1.9180	-3.03	20.12	17.09	46.00	-28.91	AVG
12	3.9740	-3.21	20.18	16.97	46.00	-29.03	AVG

## CONDUCTED EMISSION TEST DATA

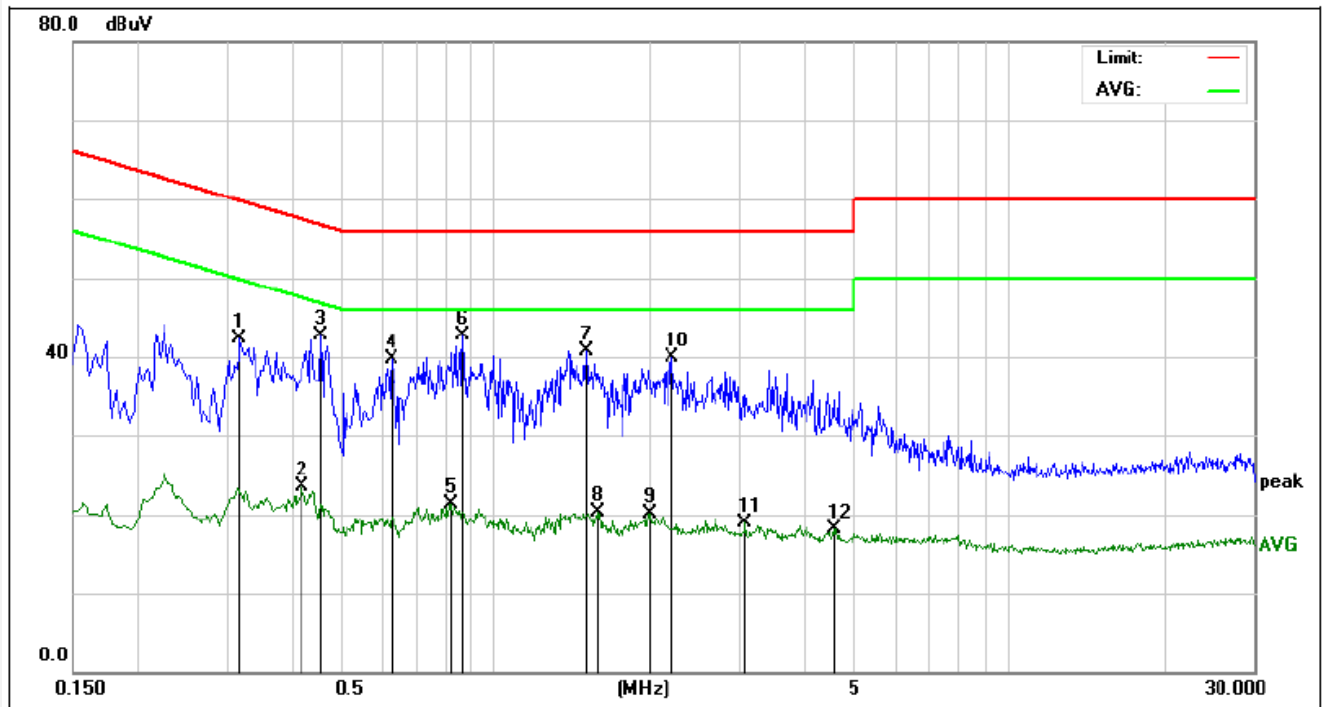
Test Site: 1# Shielded Room  
Operating Condition: Charging  
Test Specification: AC 240V, 60Hz for adapter  
Comment: Live Line  
Tem.:25℃ Hum.:50%



No.	Frequency (MHz)	Reading (dBuV)	Correct dB	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Remark
1	0.1500	25.19	19.97	45.16	65.99	-20.83	QP
2	0.2220	23.33	19.97	43.30	62.74	-19.44	QP
3	0.3540	19.08	19.97	39.05	58.87	-19.82	QP
4	0.4180	1.70	19.89	21.59	47.49	-25.90	AVG
5	0.7019	-0.66	19.89	19.23	46.00	-26.77	AVG
6	0.9300	15.90	19.89	35.79	56.00	-20.21	QP
7	1.0300	-1.72	20.01	18.29	46.00	-27.71	AVG
8	1.4180	15.70	20.01	35.71	56.00	-20.29	QP
9	1.5020	-0.76	20.01	19.25	46.00	-26.75	AVG
10	1.9940	-1.20	19.96	18.76	46.00	-27.24	AVG
11	2.1580	17.33	19.96	37.33	56.00	-18.67	QP
12	3.3180	-1.88	19.96	18.08	46.00	-27.92	AVG

## CONDUCTED EMISSION TEST DATA

Test Site: 1# Shielded Room  
Operating Condition: Charging  
Test Specification: AC 240V, 60Hz for adapter  
Comment: Neutral Line  
Tem.:25°C Hum.:50%



No.	Frequency (MHz)	Reading (dBuV)	Correct dB	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Remark
1	0.3180	22.22	19.97	42.19	59.76	-17.57	QP
2	0.4180	3.45	19.97	23.42	47.49	-24.07	AVG
3	0.4580	22.62	19.97	42.59	56.73	-14.14	QP
4	0.6300	19.67	19.89	39.56	56.00	-16.44	QP
5	0.8139	1.25	19.89	21.14	46.00	-24.86	AVG
6	0.8620	22.76	19.89	42.65	56.00	-13.35	QP
7	1.5060	20.77	20.01	40.78	56.00	-15.22	QP
8	1.5820	0.29	20.01	20.30	46.00	-25.70	AVG
9	2.0020	0.08	20.01	20.09	46.00	-25.91	AVG
10	2.2060	19.96	19.96	39.92	56.00	-16.08	QP
11	3.0579	-1.01	19.96	18.95	46.00	-27.05	AVG
12	4.5499	-1.95	19.96	18.01	46.00	-27.99	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 ( $\geq 30$ 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.

### 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



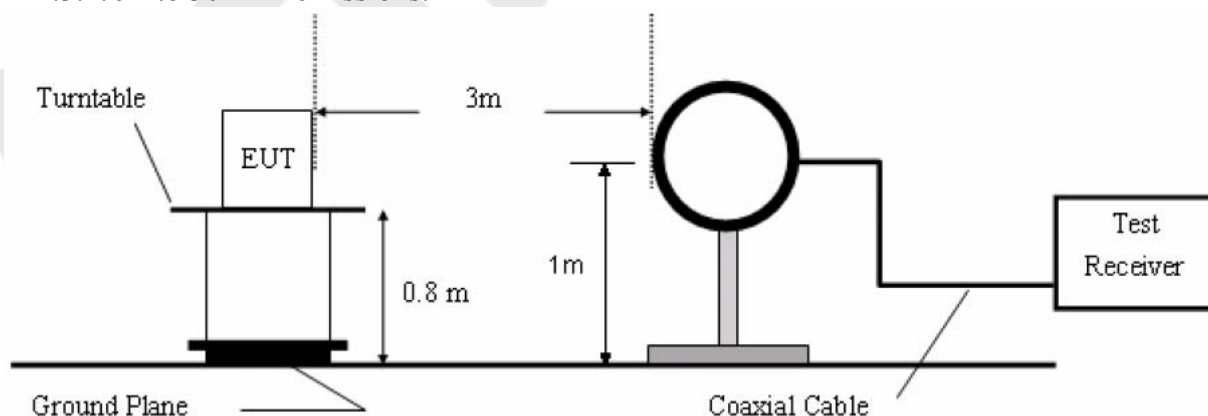
Trace mode= Max hold.  
Sweep- auto couple.

#### Test Equipment

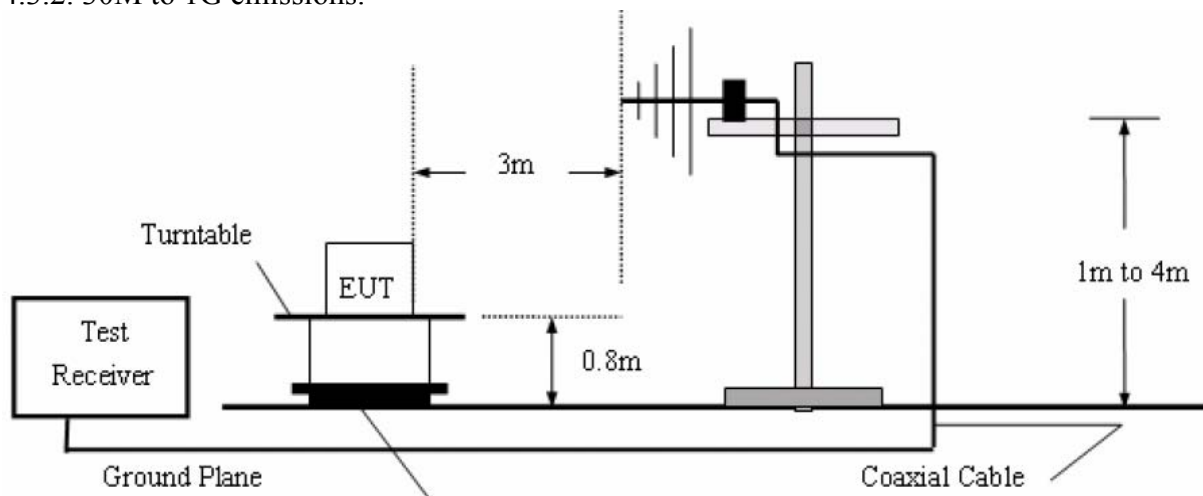
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Apr. 17, 2016	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 17, 2016	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 17, 2016	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 20, 2016	1 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 20, 2016	1 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 17, 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

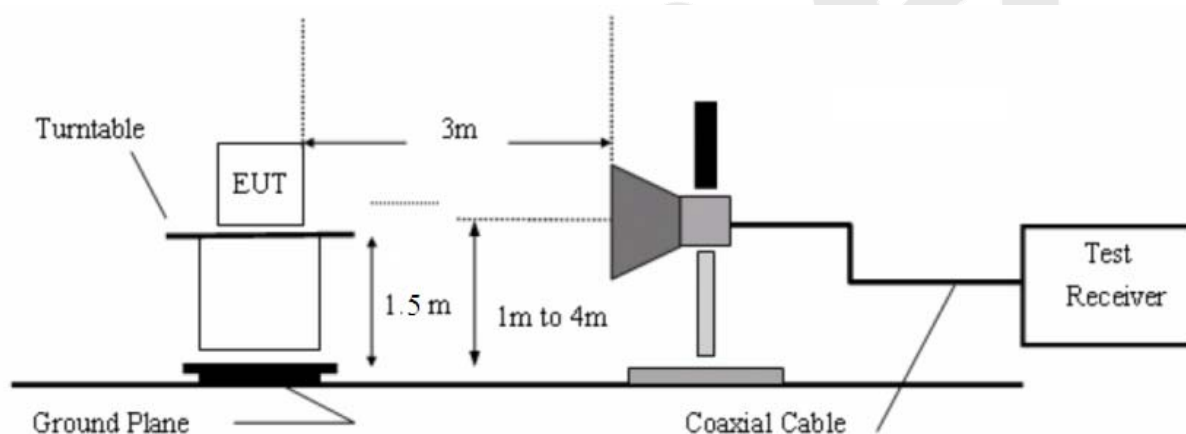
#### 4.3.1. 9k to 30MHz emissions:



#### 4.3.2. 30M to 1G emissions:



#### 4.3.3. 1G to 40G emissions:



### 4.4 Test Results

PASS.

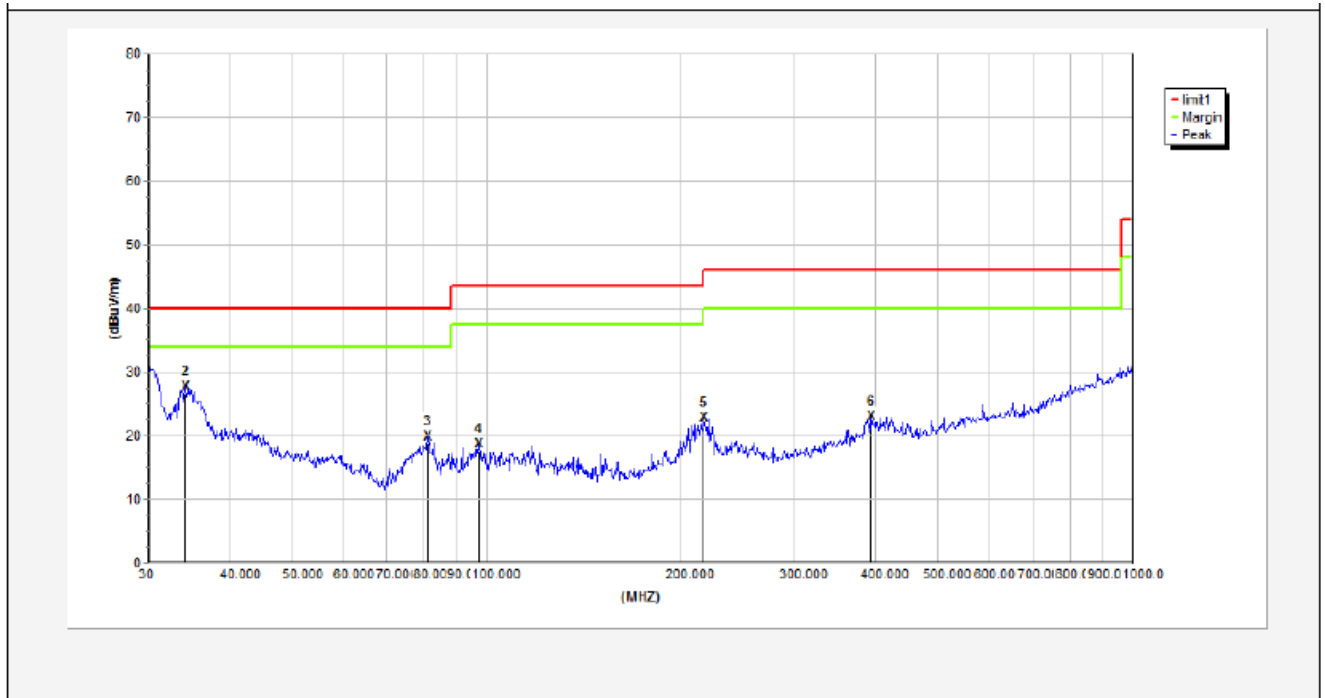
The EUT was tested on (Charging, BT Mode) modes, only the worst data of (Charging) is attached in the following pages.

Only the worst case (x orientation).

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

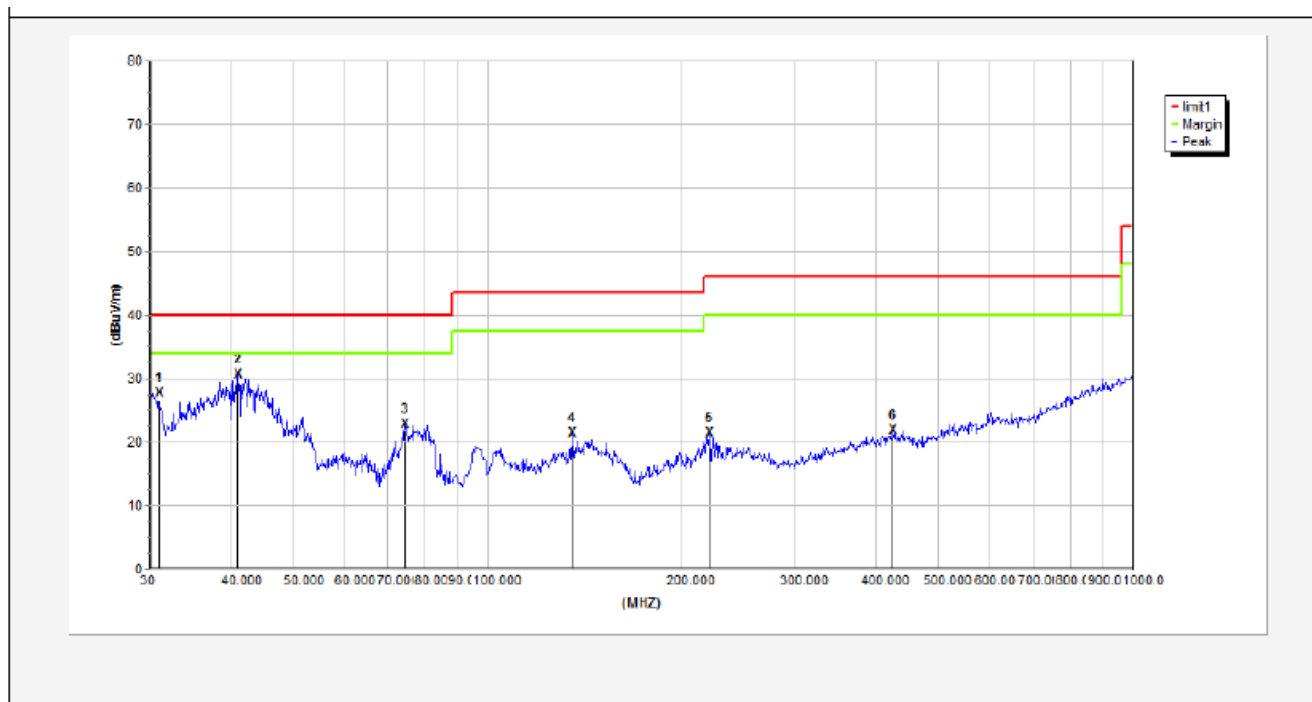
The test results of above 18000MHz are attenuated more than 20dB below the permissible limits, so the results don't record in the report.

Job No.:	011609852I	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:	Charging	Distance:	3m



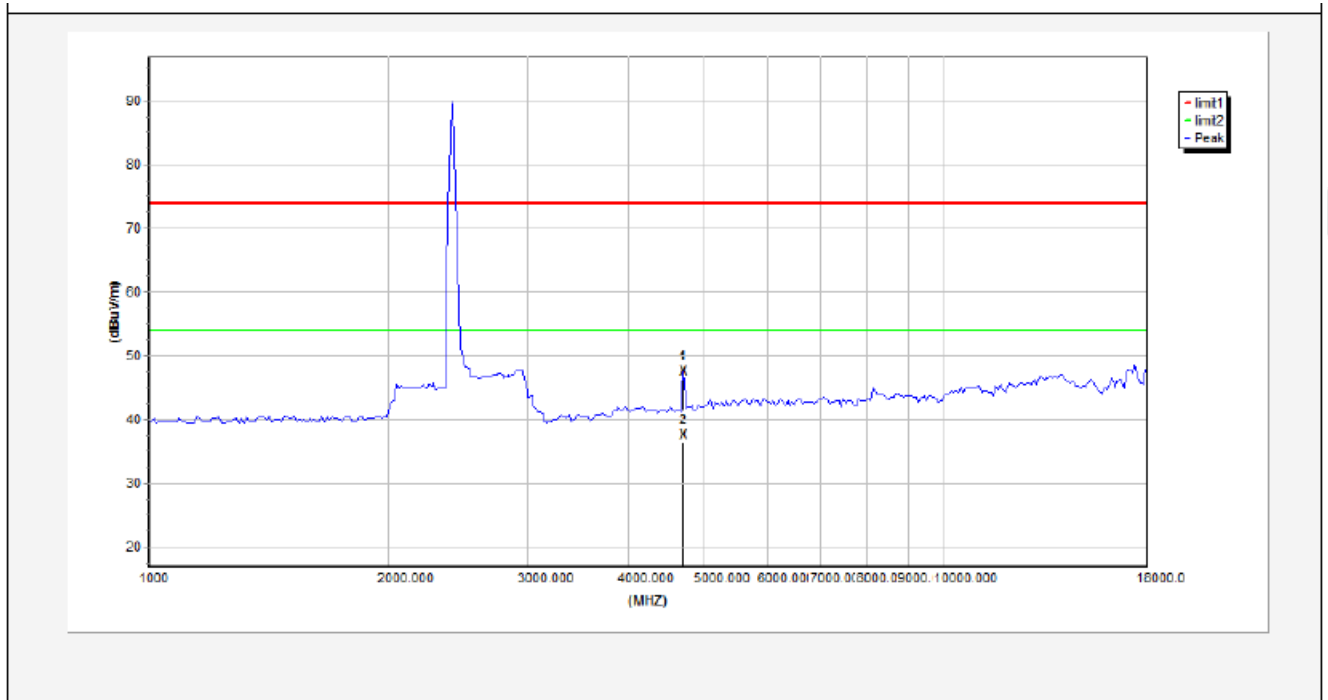
No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	30.0000	48.80	12.33	31.2	1.92	31.85	40.00	-8.15	peak	---	---
2	34.1561	42.31	12.31	29.04	1.99	27.57	40.00	-12.43	peak	---	---
3	80.9275	41.51	6.87	30.98	2.43	19.83	40.00	-20.17	peak	---	---
4	97.1148	39.53	7.98	31.49	2.6	18.62	43.50	-24.88	peak	---	---
5	216.7828	42.93	6.1	31.66	5.33	22.70	46.00	-23.30	peak	---	---
6	392.0951	35.97	11.97	31.21	6.21	22.94	46.00	-23.06	peak	---	---

Job No.:	011609852I	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:	Charging	Distance:	3m



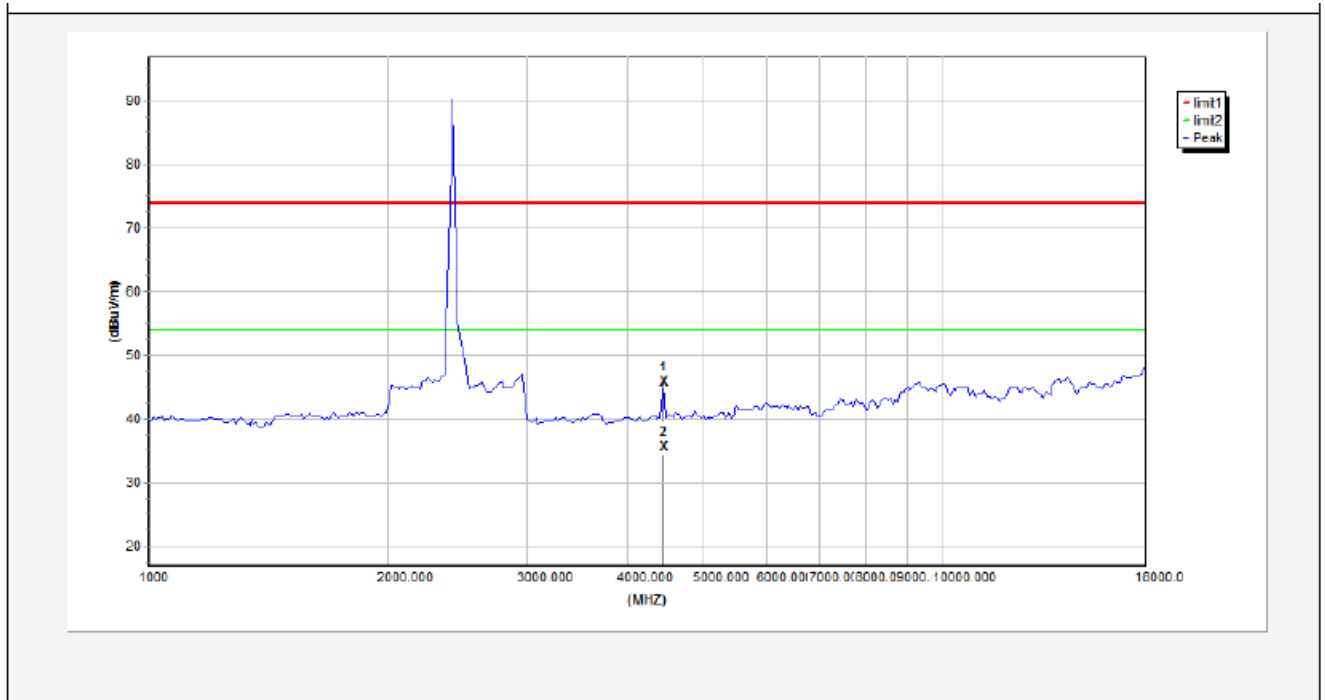
No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	30.2110	44.49	12.33	31.09	1.92	27.65	40.00	-12.35	peak	---	---
2	40.9881	41.32	13.57	26.4	2.06	30.55	40.00	-9.45	peak	---	---
3	74.3954	43.20	7.9	30.77	2.39	22.72	40.00	-17.28	peak	---	---
4	135.0320	39.56	8.56	31.62	4.91	21.41	43.50	-22.09	peak	---	---
5	220.6170	36.38	11.23	31.66	5.35	21.30	46.00	-24.70	peak	---	---
6	423.5403	32.99	13.57	31.16	6.32	21.72	46.00	-24.28	peak	---	---

Job No.:	011609852I	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



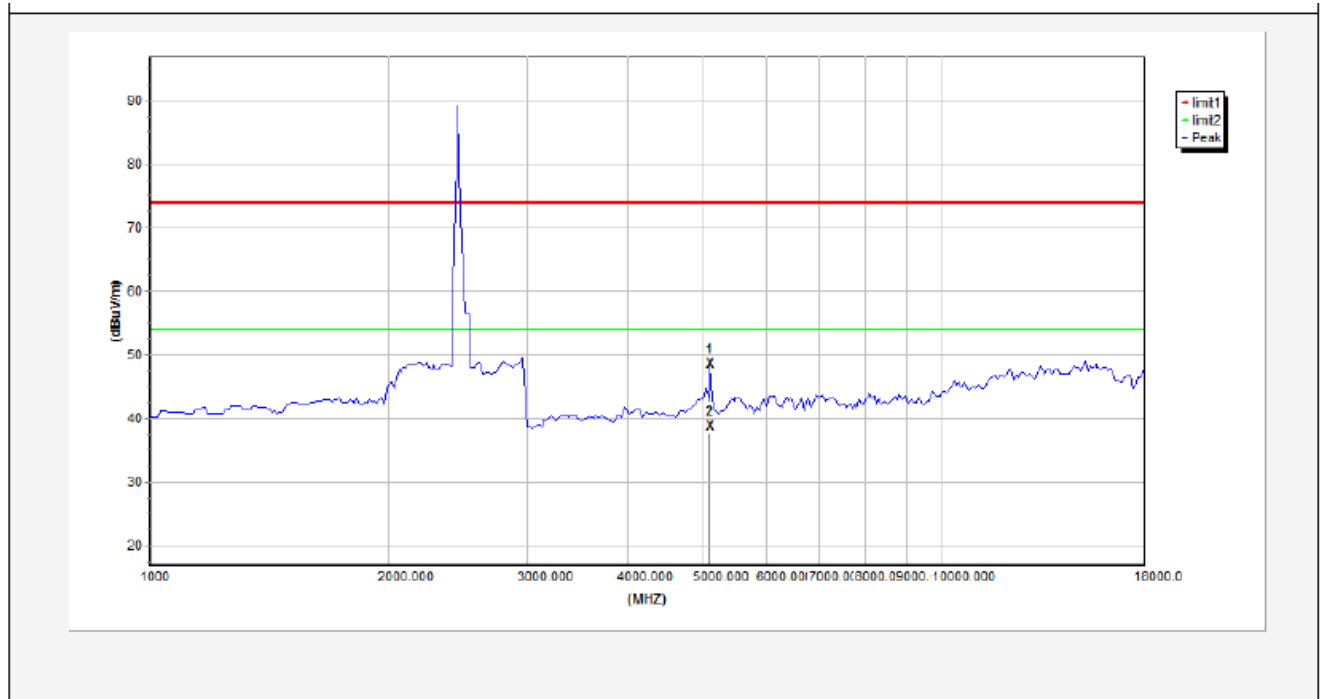
No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	4697.5000	47.46	3.11	16.26	16.26	44.35	74.00	-26.54	peak	---	---
2	4697.5000	37.46	3.11	16.26	16.26	34.35	54.00	-16.54	AVG	---	---

Job No.:	011609852I	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



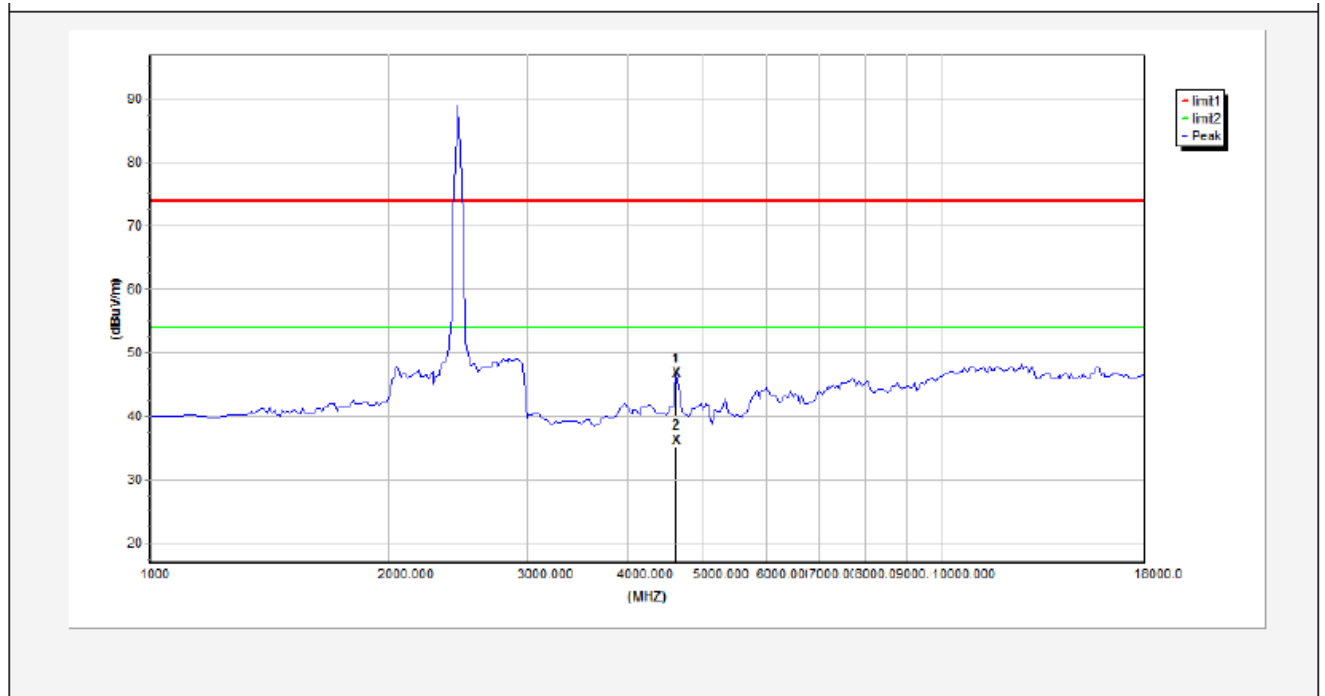
No.	Freq. (MHz)	Reading (dBuV/m)	Antenna (dB/m)	Amp. (dB/m)	Cable (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)
1	4442.5000	45.65	2.68	15.07	15.07	42.97	74.00	-28.35	peak	---	---
2	4442.5000	35.44	2.68	15.07	15.07	32.76	54.00	-18.56	AVG	---	---

Job No.:	011609852I	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



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	---	---

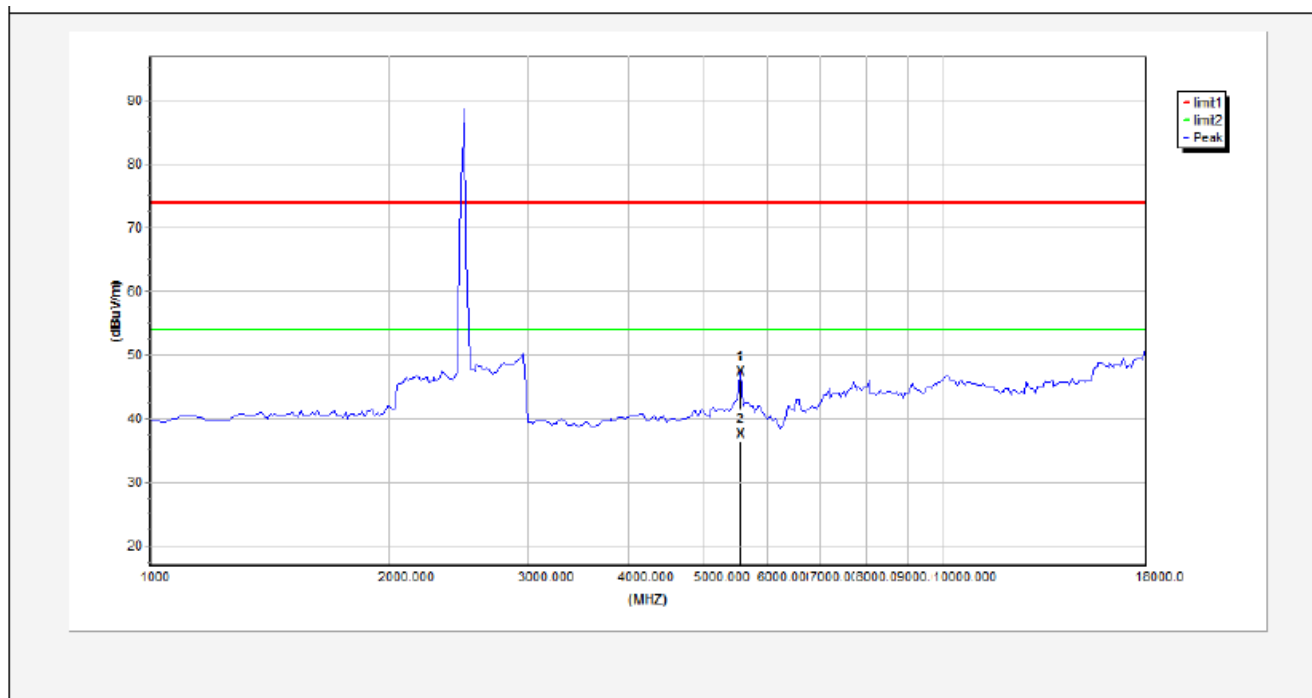
Job No.:	011609852I	Polarization:	Vertical
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V Battery inside
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3( C)/55%RH
Test Mode:	TX(2441 MHz)	Distance:	3m



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	---	---

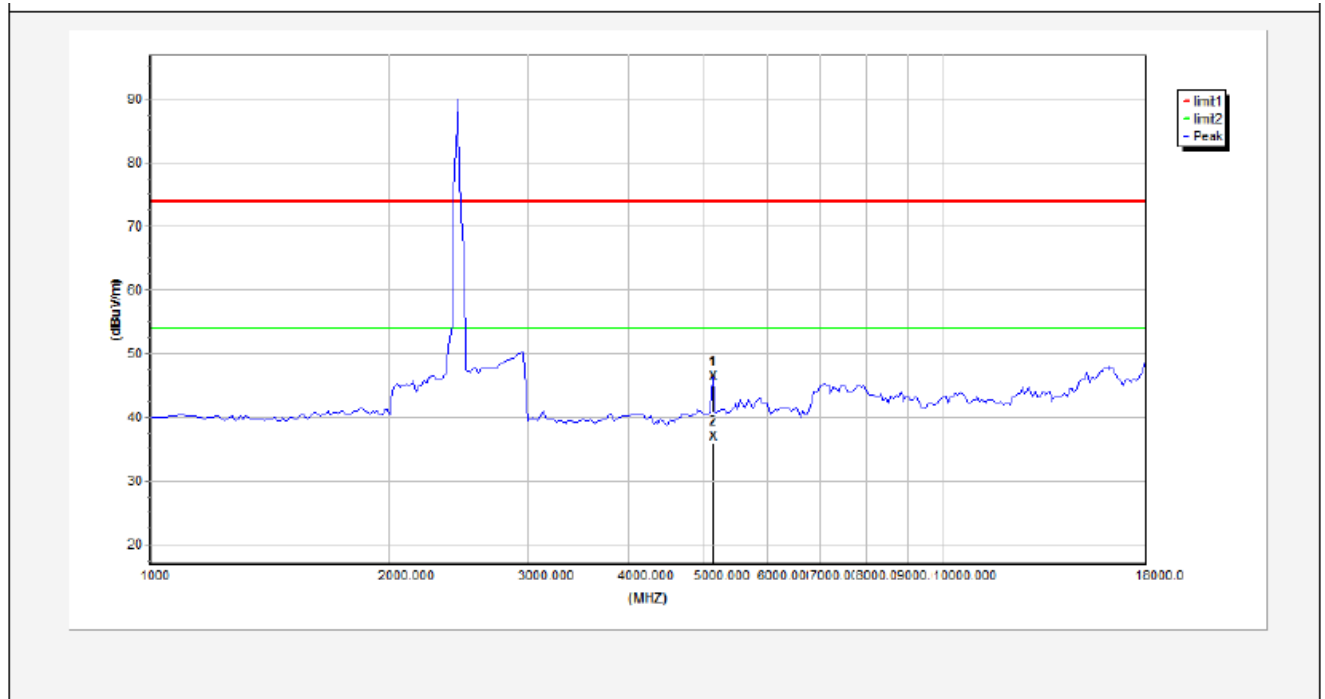


Job No.:	011609852I	Polarization:	Horizontal
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 3.7V Battery inside
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3( C)/55%RH
Test Mode:	TX(2480 MHz)	Distance:	3m



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.:	011609852I	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



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	---	---

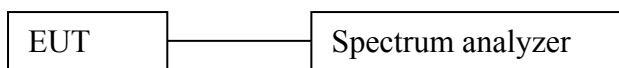
## 5. CHANNEL SEPARATION TEST

### 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 = 100 kHz.
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. 17, 2016	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 17, 2016	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 17, 2016	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 20, 2016	1 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 20, 2016	1 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 17, 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

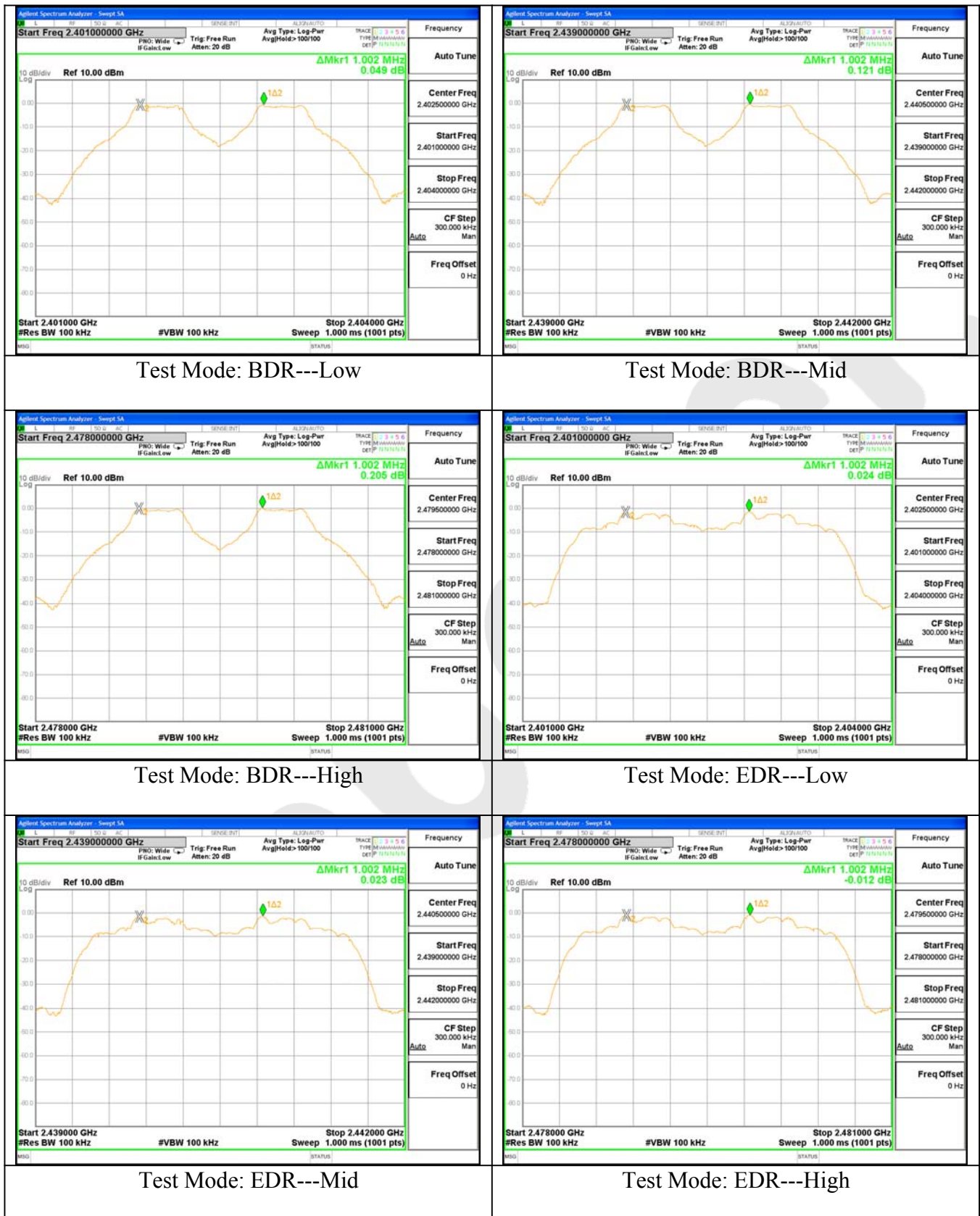
#### 5.4 Test Results

Test Item : Frequency Separation      Test Mode : CH Low ~ CH High  
Test Voltage : AC 120V, 60Hz for adapter      Temperature : 24°C  
Test Result : PASS      Humidity : 55%RH

Channel	Frequency (MHz)	Separation Read Value (kHz)	Limit (kHz)	Modulation Mode	Test Result
Low	2401	1002	927.3	BDR	PASS
Mid	2441	1002	919.9	BDR	PASS
High	2480	1002	928.3	BDR	PASS
Low	2401	1002	844.7	EDR	PASS
Mid	2441	1002	840.7	EDR	PASS
High	2480	1002	840.7	EDR	PASS

Remark:

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



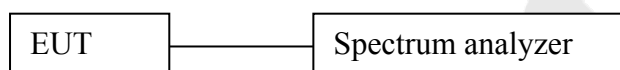
## 6. 20DB BANDWIDTH TEST

### 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

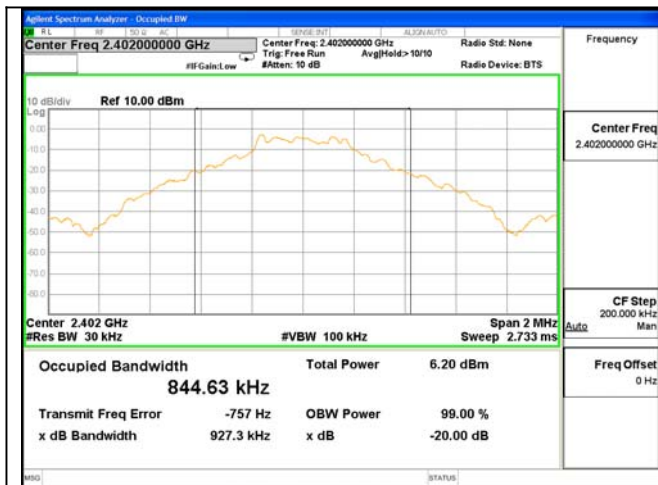
Same as the equipment listed in 5.3.

### 6.4 Test Results

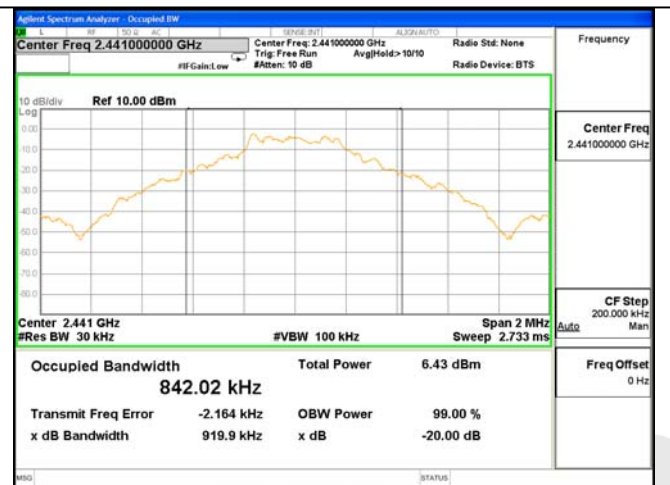
Test Item	: 20dB BW	Test Mode	: CH Low ~ CH High
Test Voltage	: AC 120V, 60Hz for adapter	Temperature	: 24°C
Test Result	: PASS	Humidity	: 55%RH

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

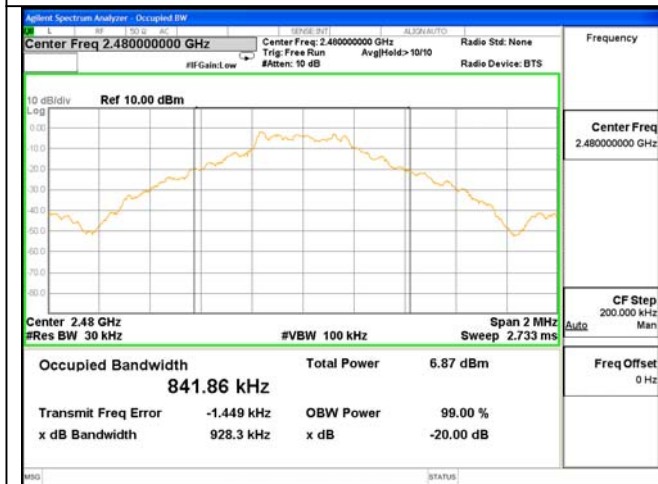
Remark: The EDR was tested on ( $\pi/4$ DQPSK, 8DPSK) modes, only the worst data of ( $\pi/4$ DQPSK) is attached in the following pages.



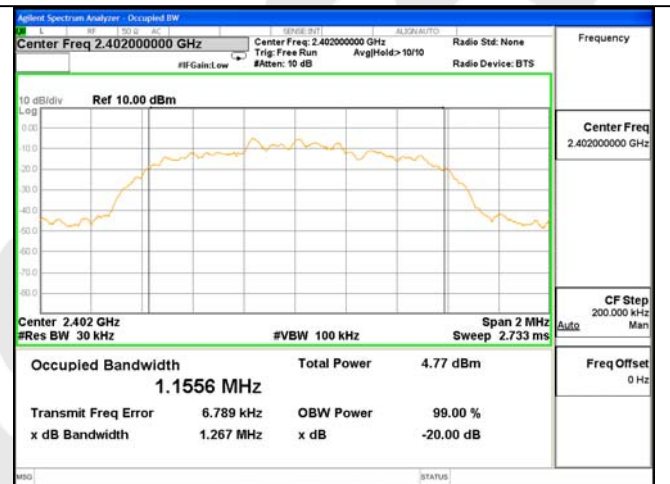
Test Mode: BDR---Low



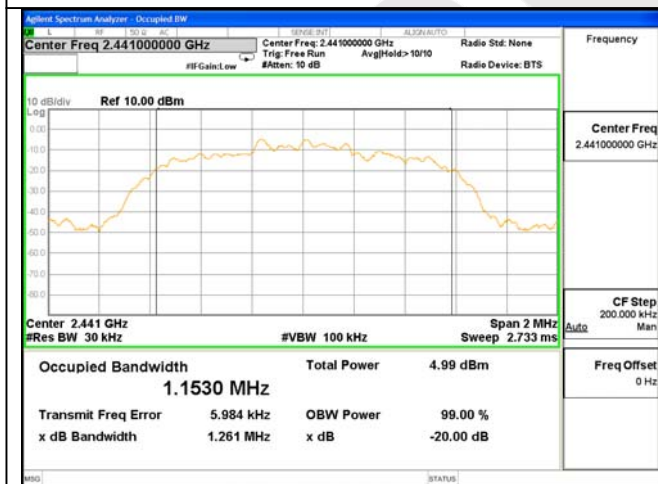
Test Mode: BDR---Mid



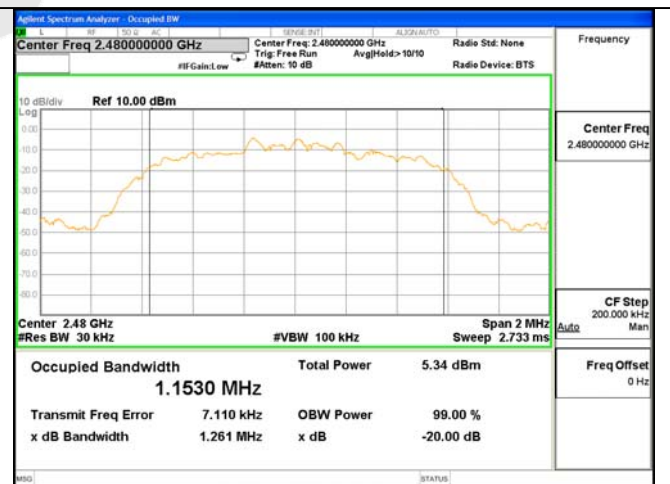
Test Mode: BDR---High



Test Mode: EDR---Low



Test Mode: EDR---Mid



Test Mode: EDR---High



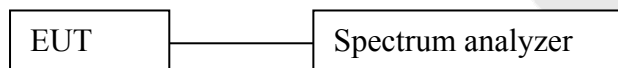
## 7. QUANTITY OF HOPPING CHANNEL TEST

### 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

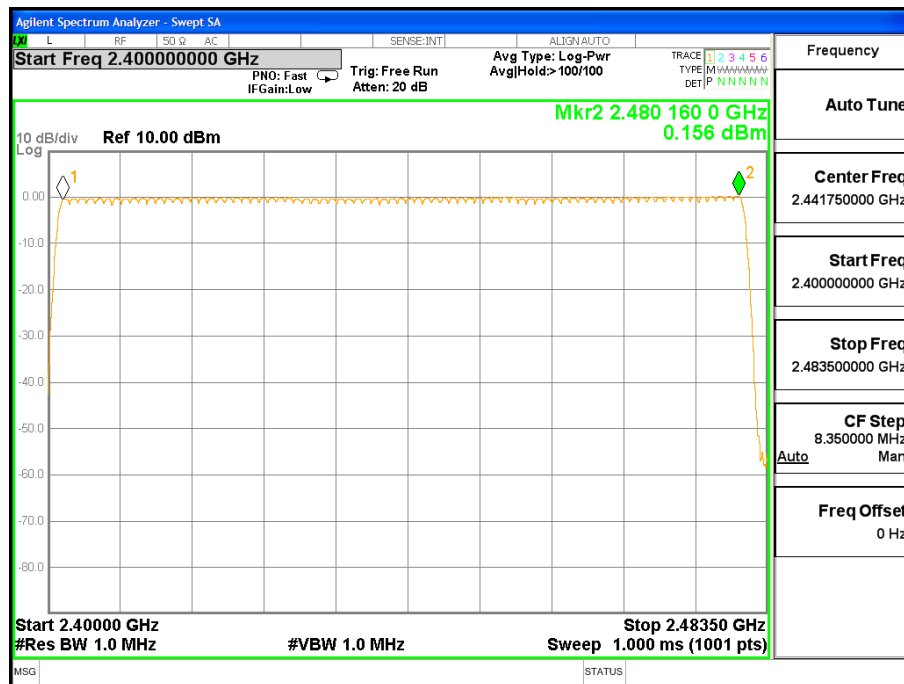
Same as the equipment listed in 5.3.

### 7.4 Test Results

Test Item	: Number of Hopping Frequency	Test Mode	: CH Low ~ CH High
Test Voltage	: AC 120V, 60Hz for adapter	Temperature	: 24℃
Test Result	: PASS	Humidity	: 55%RH

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





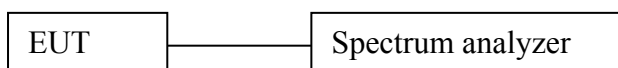
## 8. DWELL TIME TEST

### 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	:	AC 120V, 60Hz for adapter	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	0.374	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
3DH1	0.364	time slot length *1600/2 /79 * 31.6	116.48	0.4	EDR
3DH3	1.620	time slot length *1600/4 /79 * 31.6	259.20	0.4	EDR
3DH5	2.855	time slot length *1600/6 /79 * 31.6	304.53	0.4	EDR

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



Test Mode: BDR---DH1



Test Mode: BDR---DH3



Test Mode: BDR---DH5



Test Mode: EDR---3DH1



Test Mode: EDR---3DH1



Test Mode: EDR---3DH3

## 9. MAXIMUM PEAK OUTPUT POWER TEST

### 9.1 Measurement Procedure

- Check the calibration of the measuring instrument(SA) using either an internal calibrator or a known signal from an external generator.
- 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.
- The center frequency of the spectrum analyzer is set to the fundamental frequency and using proper RBW and VBW setting.
- Measure the captured power within the band and recording the plot.
- Repeat above procedures until all frequencies required were complete.

Using the following spectrum analyzer settings:

- Span= approximately 5 times the 20dB bandwidth, centered on a hopping channel
- Set the RBW = 3 MHz.
- Set the VBW = 3 MHz.
- Sweep time = auto couple.
- Detector function = peak.
- Trace mode = max hold.
- 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 : AC 120V, 60Hz for adapter      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	0.929	-0.320	1000	PASS	BDR
2441	0.940	-0.269	1000	PASS	BDR
2480	1.062	<b>0.262</b>	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 ( $\pi/4$ DQPSK, 8DPSK) modes, only the worst data of ( $\pi/4$ DQPSK) is attached in the following pages.



## 10. BAND EDGE TEST

### 10.1 Measurement Procedure

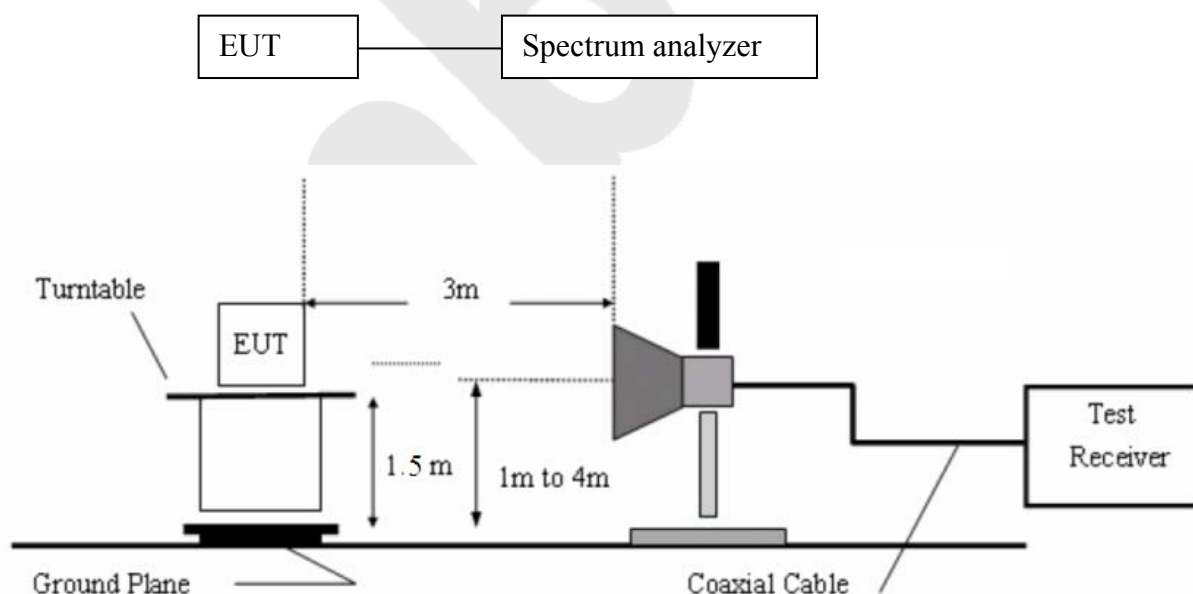
#### A) Conducted Emission method:

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.

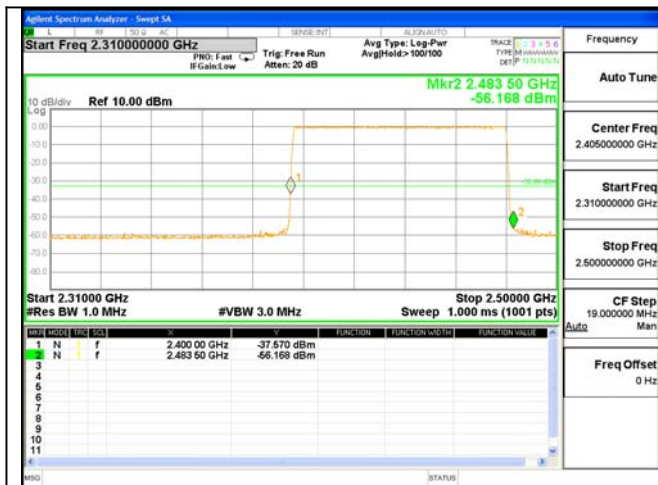
Please refer the following data.

Test Item	: Band edge	Test Mode	: CH Low ~ CH High
Test Voltage	: AC 120V, 60Hz for adapter	Temperature	: 24°C
Test Result	: PASS	Humidity	: 55%RH

#### For Hopping Mode:

Remark: The EDR was tested on ( $\pi/4$ DQPSK, 8DPSK) modes, only the worst data of ( $\pi/4$ DQPSK) 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 : AC 120V, 60Hz for adapter	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	50.17	39.22	74.00	54.00	BDR
	V	52.43	41.41	74.00	54.00	EDR
>2483.5	V	52.01	40.31	74.00	54.00	BDR
	V	48.98	38.87	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	49.59	38.37	74.00	54.00	BDR
	H	51.24	40.21	74.00	54.00	EDR
>2483.5	H	51.72	39.59	74.00	54.00	BDR
	H	48.15	38.21	74.00	54.00	EDR

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



Test Mode: BDR



Test Mode: BDR



Test Mode: EDR



Test Mode: EDR

## 11. ANTENNA APPLICATION

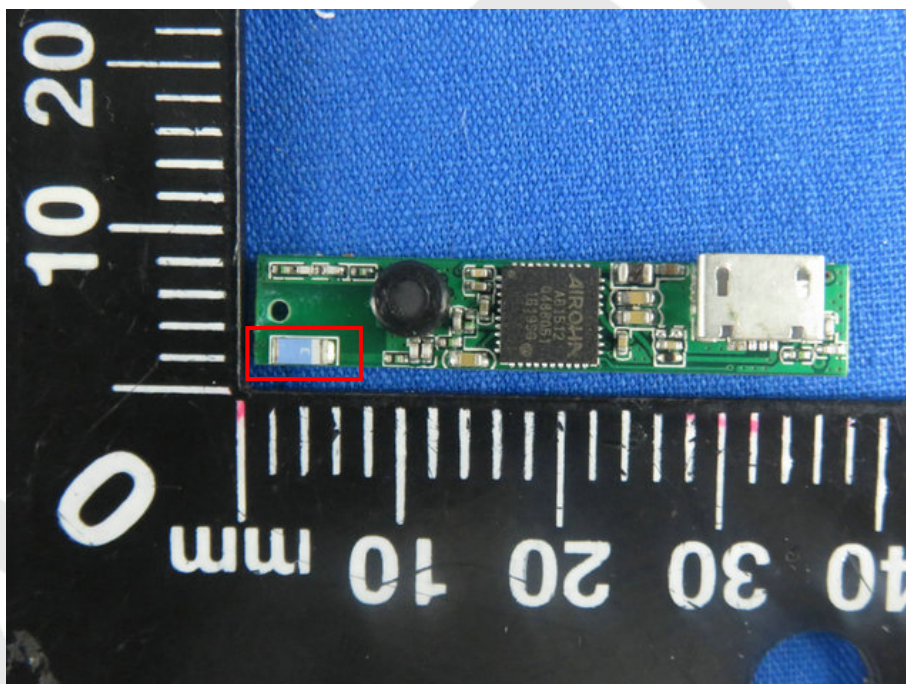
### 11.1 Antenna requirement

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

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 Ceramic Antenna, The antenna's gain is 2 dBi and meets the requirement.



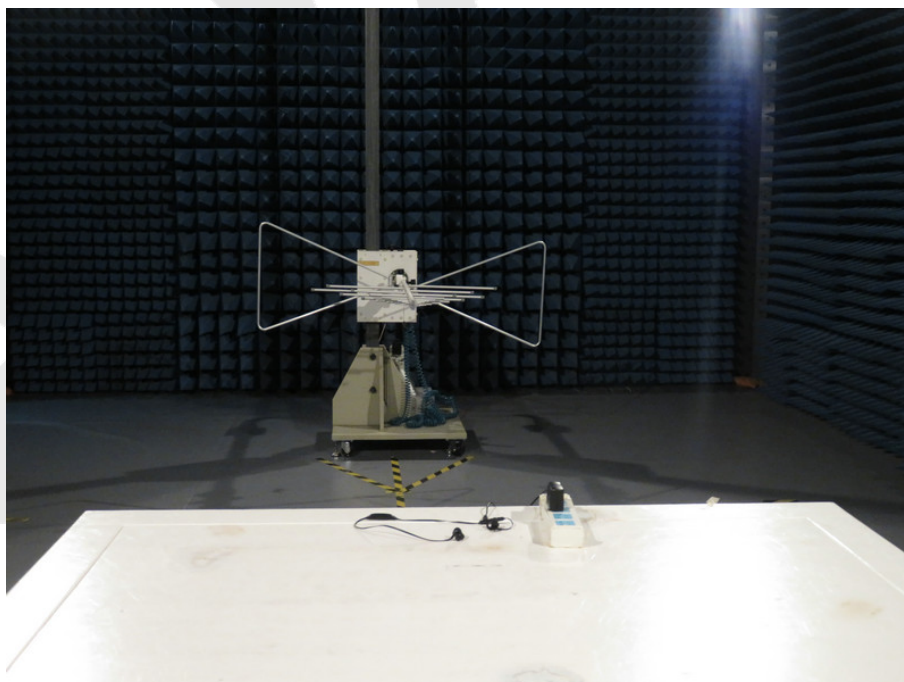


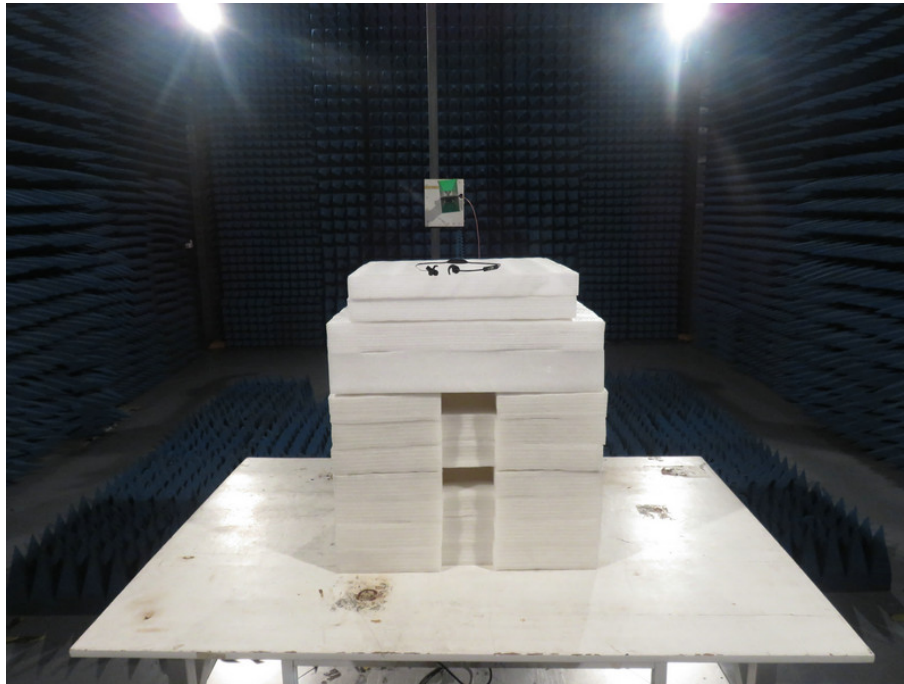
## 12. PHOTOGRAPH

### 12.1 Photo of Power Line Conducted Emission Measurement



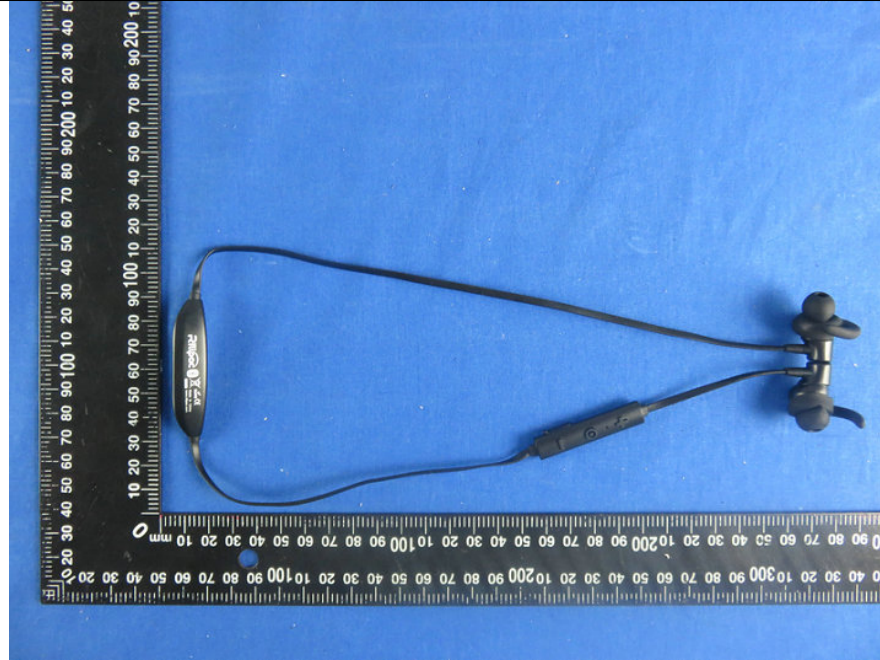
### 12.2 Photo of Radiation Emission Test



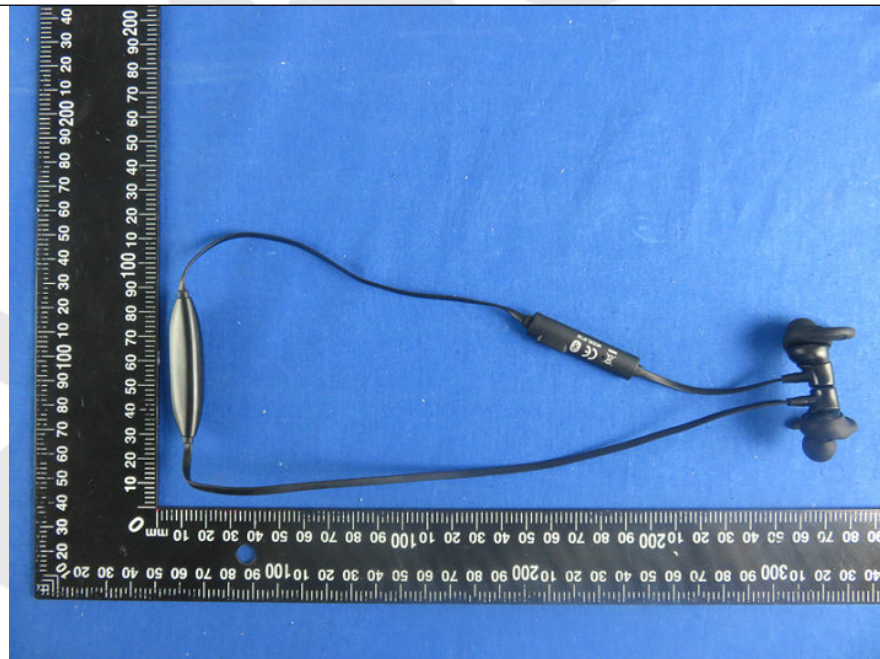


## APPENDIX I (EXTERNAL PHOTOS)

1. Figure  
The EUT-Top View

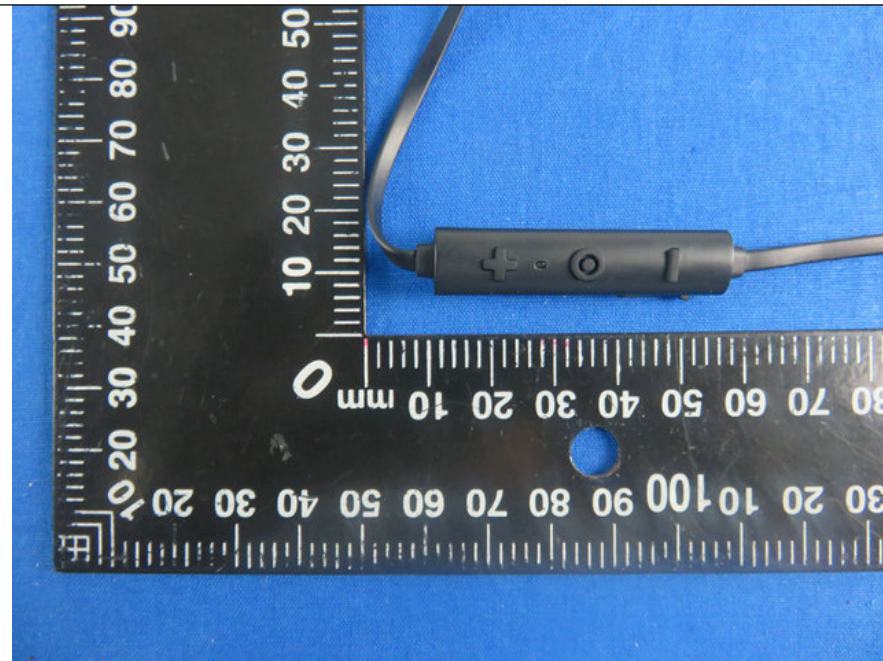


2. Figure  
The EUT-Bottom View

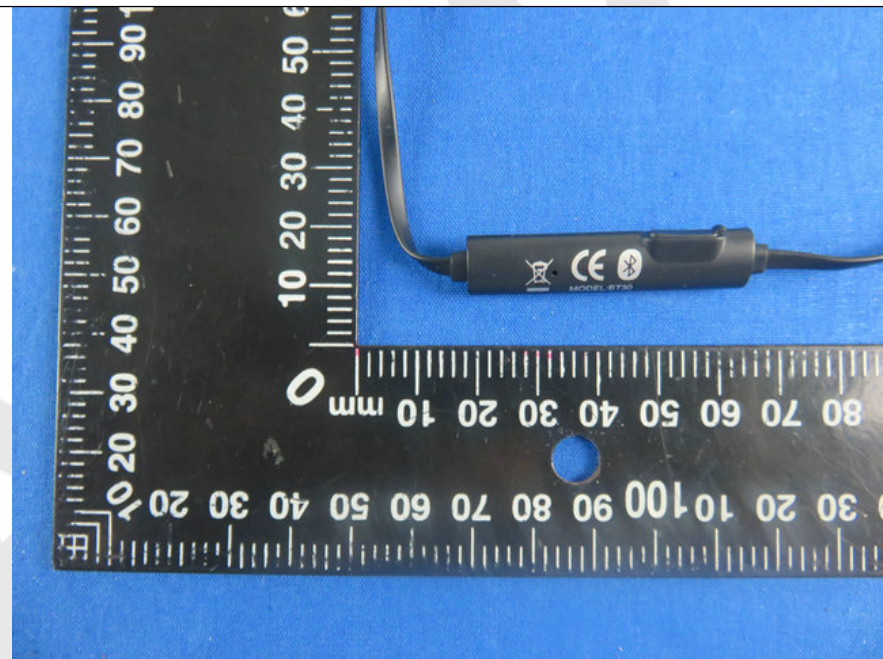




3. Figure  
The EUT-Front View

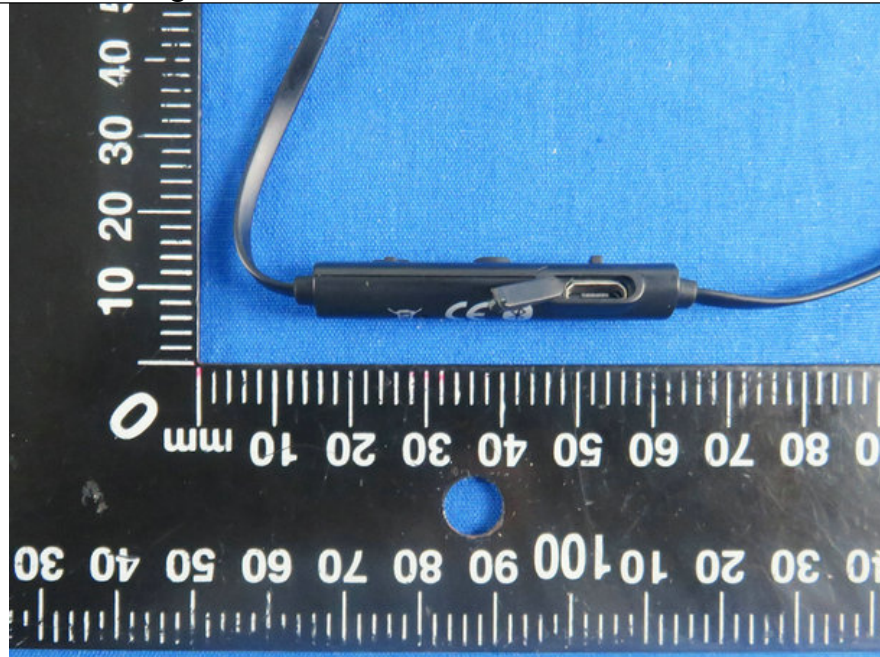


4. Figure  
The EUT-Back View

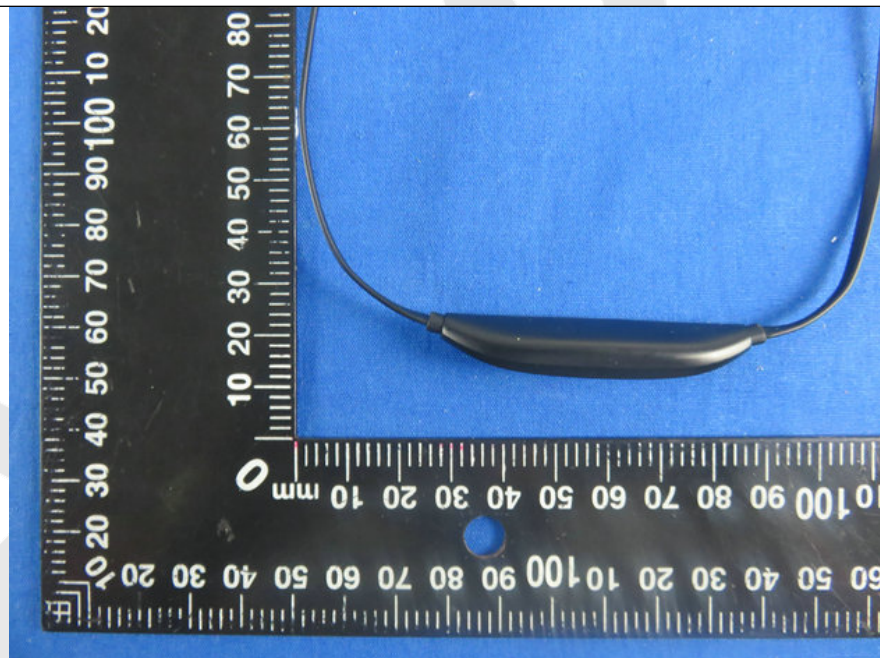




5. Figure  
The EUT-Right View

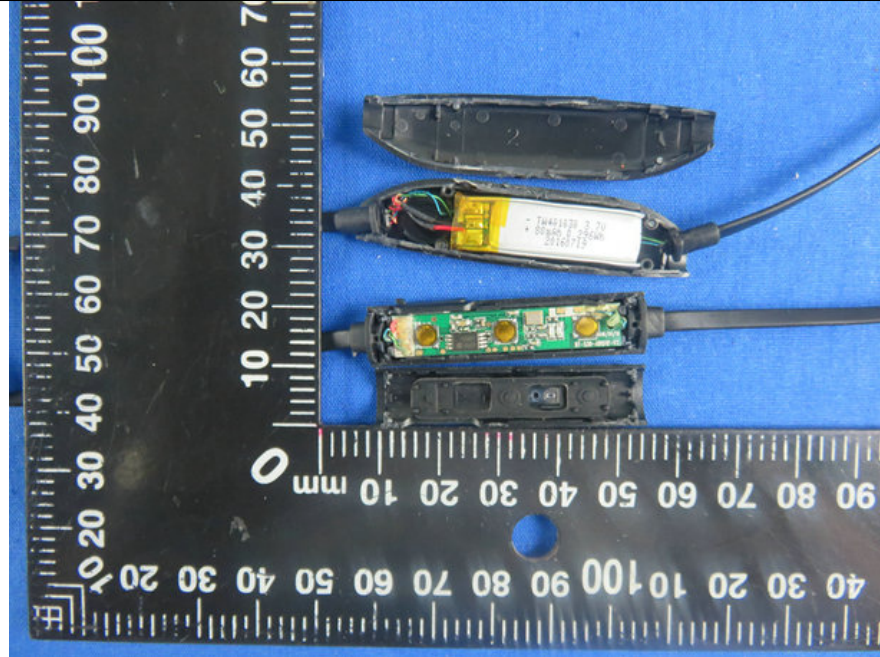


6. Figure  
The EUT- Left View

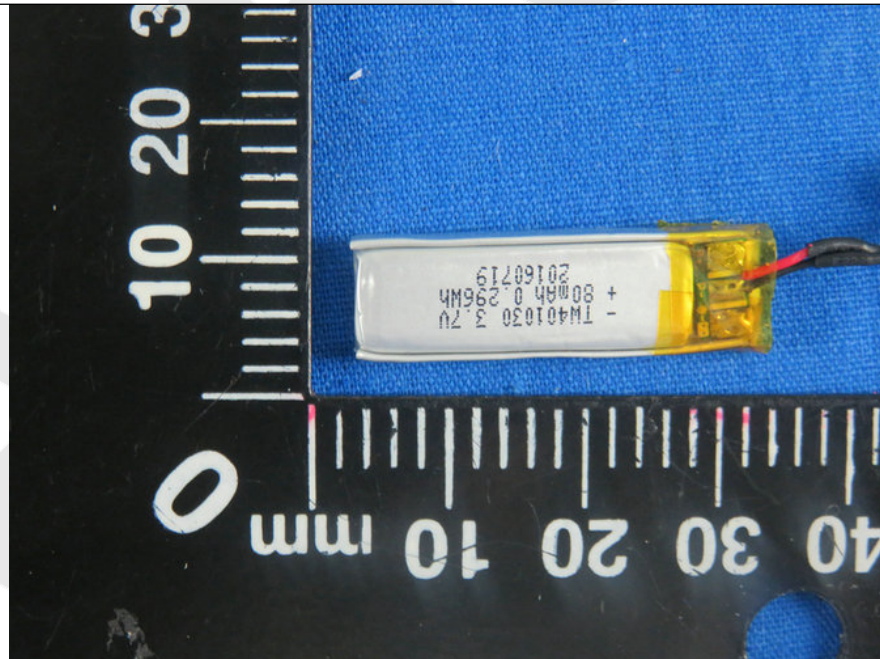


## APPENDIX II (INTERNAL PHOTOS)

1. Figure  
The EUT-Inside View

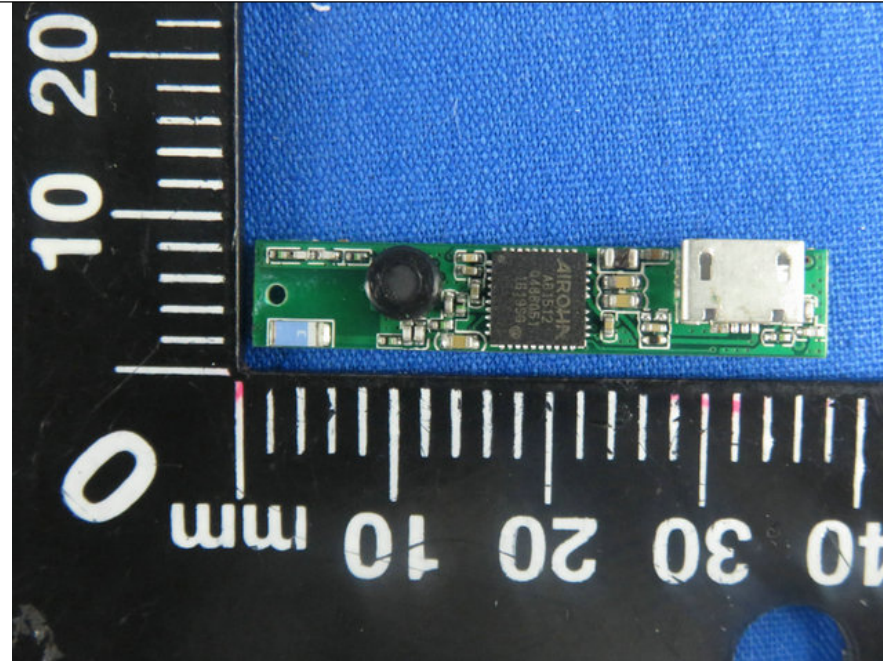


2. Figure  
The EUT-Inside View





3. Figure  
PCB of the EUT-Front View



4. Figure  
PCB of the EUT-Back View

