

FCC TEST REPORT  
for  
UTONG (HK) COMMERCIAL LIMITED

Bluetooth Speaker  
Model No.: 74415

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

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Report Number : R011611732I  
Date of Test : Nov. 17~24, 2016  
Date of Report : Nov. 24, 2016

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**TEST REPORT**

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

**Measurement Procedure Used:**

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

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

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

Date of Test : Nov. 17~24, 2016

Prepared by : (Tested Engineer / Baron Wen)

Reviewer : (Project Manager / Dolly Mo)

Approved & Authorized Signer : (Manager / Tom Chen)

## 1. GENERAL INFORMATION

### 1.1 Description of Device (EUT)

EUT : Bluetooth Speaker

Model Number : 74415

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

Frequency : 2402~2480MHz

Antenna Specification : PCB Antenna: 1.2dBi

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

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

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

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

Date of receipt : Nov. 17, 2016

Date of Test : Nov. 17~24, 2016

## 1.2 Auxiliary Equipment Used during Test

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

## 1.3 Description of Test Facility

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

### **FCC-Registration No.: 752021**

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 752021, July 06, 2016.

### **IC-Registration No.: 8058A-1**

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

### **Test Location**

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

## 1.4 Measurement Uncertainty

Radiation Uncertainty : Ur = 4.1 dB (Horizontal)

Ur = 4.3 dB (Vertical)

Conduction Uncertainty : Uc = 3.4dB

## 2. Test Procedure

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

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

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

**Example:**

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

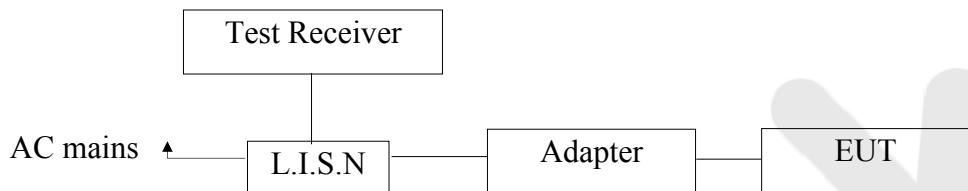
**ANSI STANDARD C63.10-2013 10.1.7 MEASUREMENT PROCEDURES:** The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation.

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

### 3. Conducted Emission

#### 3.1 Block Diagram of Test Setup

##### 3.1.1. Block diagram of connection between the EUT and simulators



#### 3.2 Power Line Conducted Emission Measurement Limits (15.207)

| Frequency<br>MHz | Limits dB( $\mu$ V) |               |
|------------------|---------------------|---------------|
|                  | Quasi-peak Level    | Average Level |
| 0.15 ~ 0.50      | 66 ~ 56*            | 56 ~ 46*      |
| 0.50 ~ 5.00      | 56                  | 46            |
| 5.00 ~ 30.00     | 60                  | 50            |

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

#### 3.3 Configuration of EUT on Measurement

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

#### 3.4 Operating Condition of EUT

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

### 3.5 Test Procedure

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

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

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

The test results are reported on Section 3.6.

#### Test Equipment

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

### 3.6 Power Line Conducted Emission Measurement Results

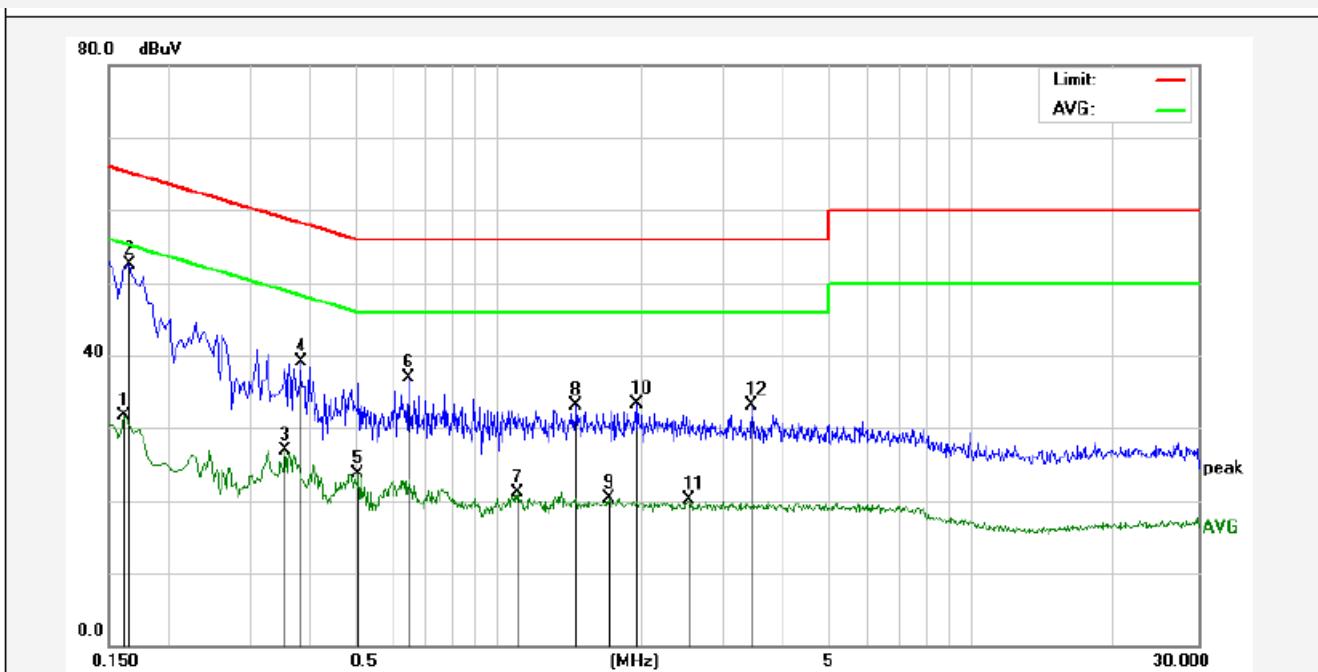
**PASS.**

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

Please refer the following pages.

**CONDUCTED EMISSION TEST DATA**

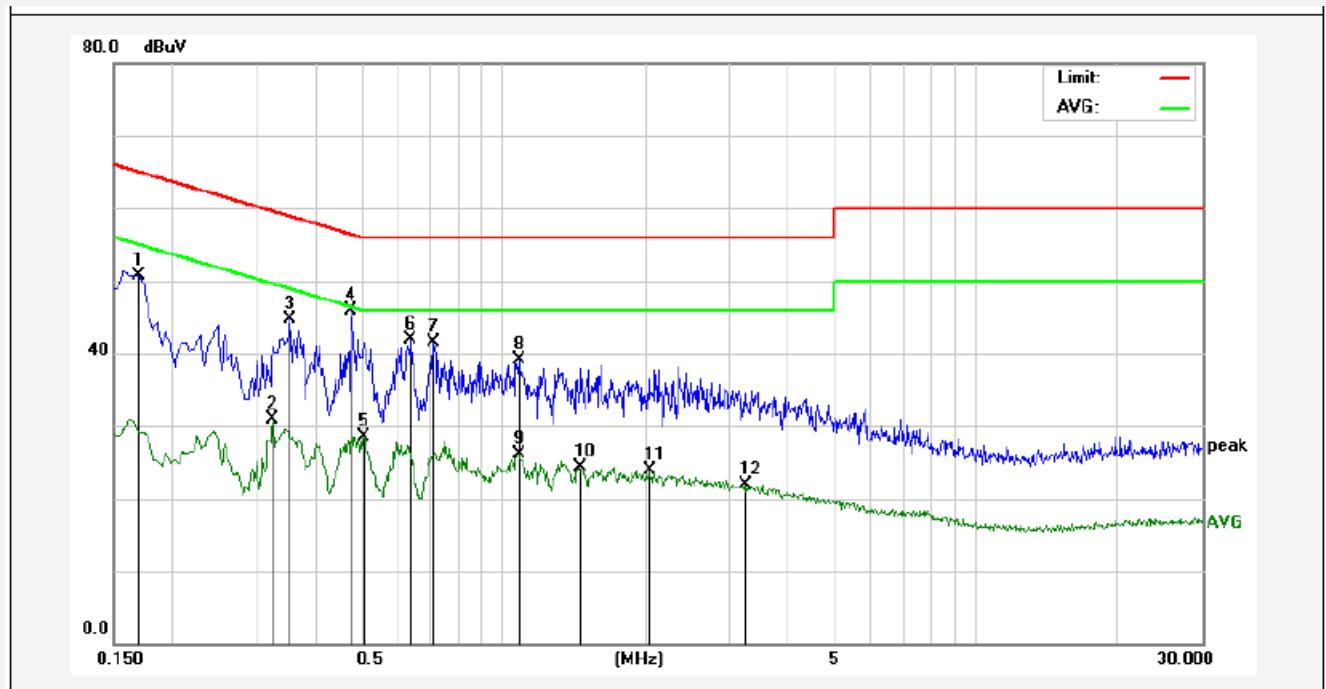
Test Site: 1# Shielded Room  
 Operating Condition: Charge+TX Mode  
 Test Specification: AC 120V, 60Hz for adapter  
 Comment: Live Line  
 Tem.:25°C Hum.:50%



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

**CONDUCTED EMISSION TEST DATA**

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



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

## 4. Radiation Interference

### 4.1 Requirements (15.247, 15.209):

#### 4.1.1. Test Limits (< 30 MHZ)

| Frequency<br>(MHz) | Field Strength<br>(microvolts/meter) | Measurement Distance<br>(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<br>of Fundamental:<br>@3M | FIELD STRENGTH<br>of Harmonics<br>54 dB $\mu$ V/m @3m | S15.209<br>30 - 88 MHz | 40 dB $\mu$ V/m |
|--|---|------------------------|-----------------|
| 902-928 MHZ                              |   | 88 - 216 MHz           | 43.5            |
| 2.4-2.4835 GHz                           |   | 216 - 960 MHz          | 46              |
| 94 dB $\mu$ V/m @3m                      |   | ABOVE 960 MHz          | 54dB $\mu$ V/m  |

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

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

### 4.2 Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.

For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.

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

#### For 30-1000MHz:

Set the spectrum analyzer as:

RBW = 120kHz, VBW =300kHz,

Detector= Quasi-Peak

Trace mode= Max hold.

Sweep- auto couple.

#### For Above 1GHz:

Set the spectrum analyzer as:

RBW = 1MHz, VBW =3MHz,

Detector= Peak

Trace mode= Max hold.

Sweep- auto couple.

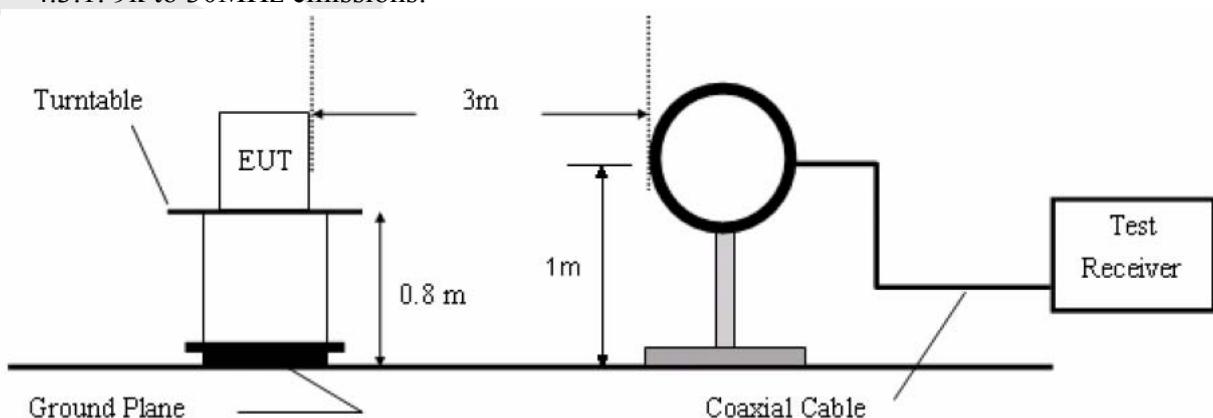
Set the spectrum analyzer as:  
RBW =1MHz, VBW =10Hz  
Detector= Peak for AV value  
Trace mode= Max hold.  
Sweep- auto couple.

#### Test Equipment

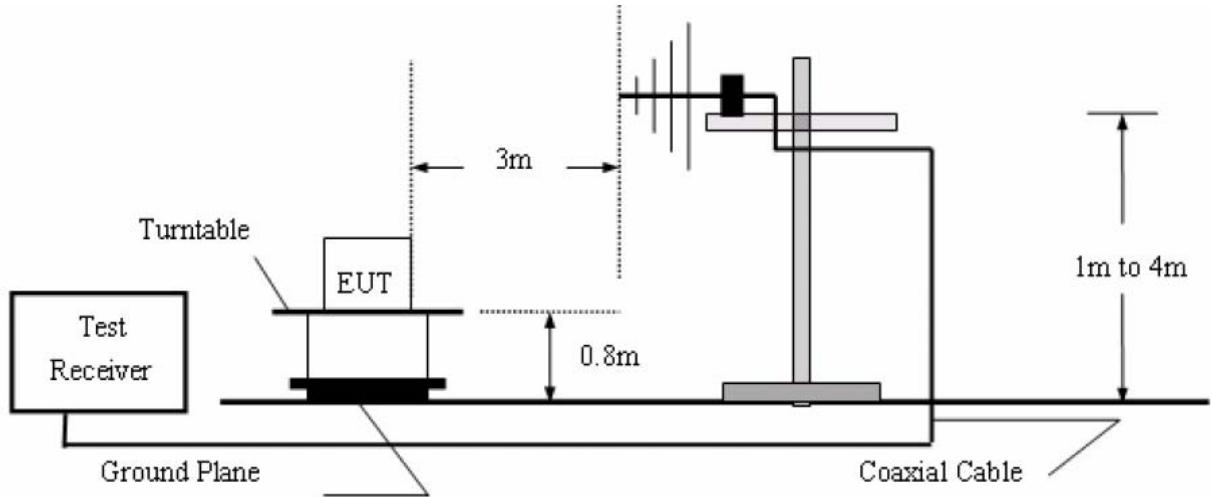
| Item | Equipment                      | Manufacturer            | Model No.     | Serial No.     | Last Cal.     | Cal. Interval |
|------|--------------------------------|-------------------------|---------------|----------------|---------------|---------------|
| 1.   | Spectrum Analysis              | Agilent                 | E4407B        | US39390582     | Apr. 16, 2016 | 1 Year        |
| 2.   | Preamplifier                   | Instruments corporation | EMC011830     | 980100         | Apr. 16, 2016 | 1 Year        |
| 3.   | EMI Test Receiver              | Rohde & Schwarz         | ESPI          | 101604         | Apr. 16, 2016 | 1 Year        |
| 4.   | Double Ridged Horn Antenna     | Instruments corporation | GTH-0118      | 351600         | Apr. 19, 2016 | 1 Year        |
| 5.   | Bilog Broadband Antenna        | Schwarzbeck             | VULB9163      | VULB 9163-289  | Apr. 19, 2016 | 1 Year        |
| 6.   | Pre-amplifier                  | SONOMA                  | 310N          | 186860         | Apr. 16, 2016 | 1 Year        |
| 7.   | EMI Test Software EZ-EMC       | SHURPLE                 | N/A           | N/A            | N/A           | N/A           |
| 8    | Power Sensor                   | DAER                    | RPR3006 W     | 15I00041SN0 46 | 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-1 50M8 | SE-0137        | Mar. 16, 2016 | 1 Year        |

#### 4.3 Test Configuration

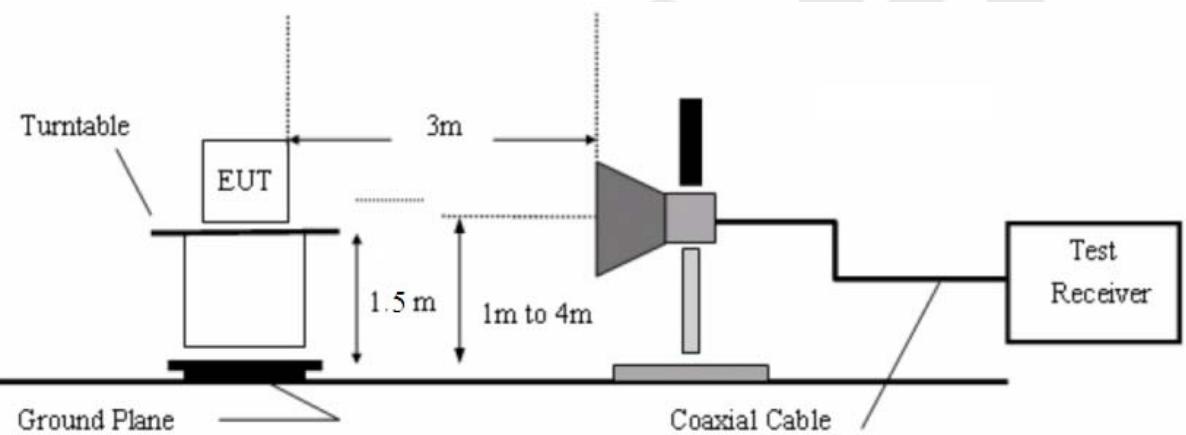
##### 4.3.1. 9k to 30MHz emissions:



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



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



### 4.4 Test Results

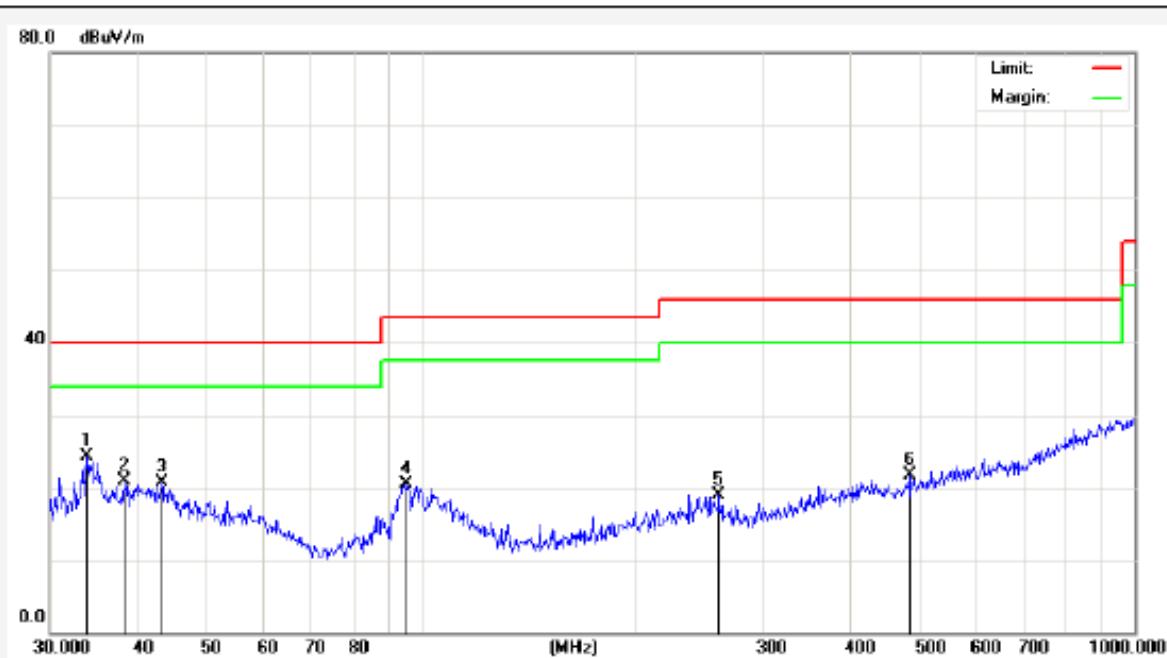
PASS.

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

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

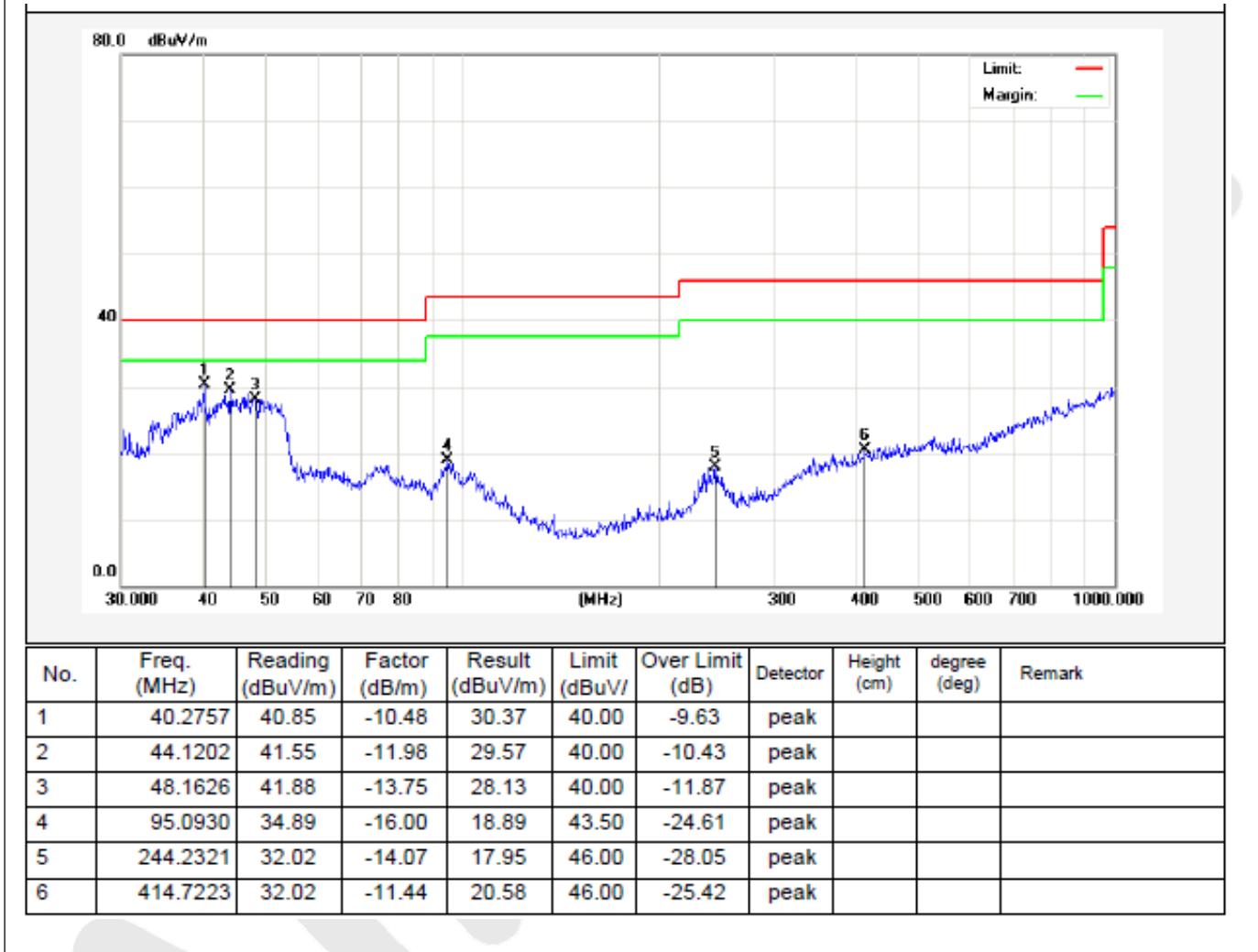
The test results of above 18000MHz are attenuated more than 20dB below the permissible limits, so the results don't record in the report.

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

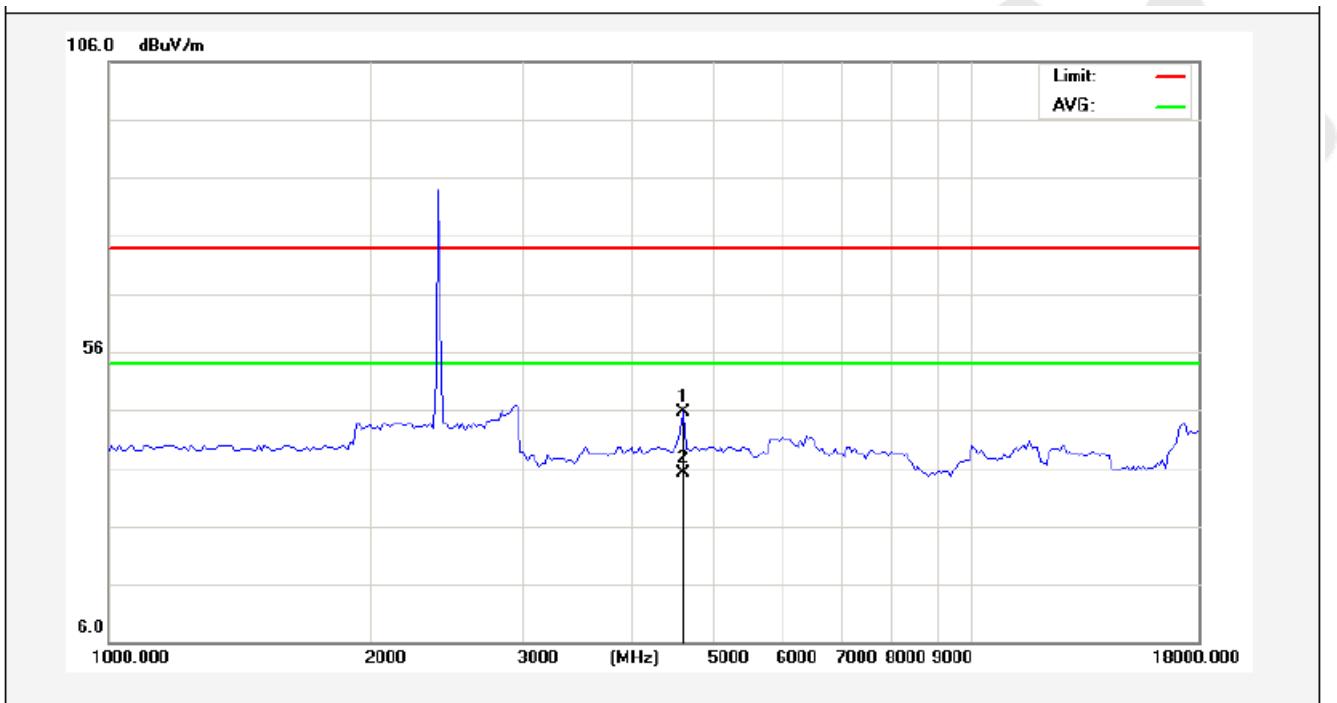


| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV) | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|-----|-------------|------------------|---------------|-----------------|--------------|-----------------|----------|-------------|--------------|--------|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

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

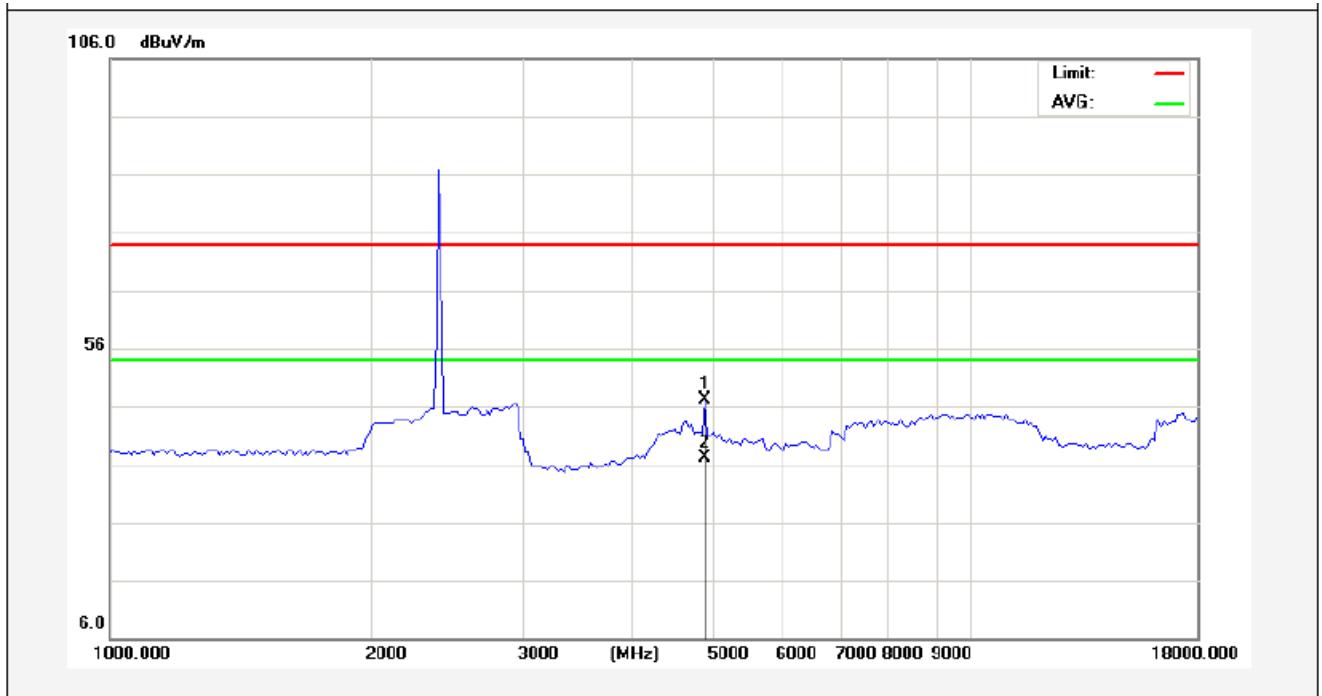


|            |                             |                     |                        |
|------------|-----------------------------|---------------------|------------------------|
| Job No.:   | 011611732I                  | Polarization:       | Horizontal             |
| Standard:  | (RE)FCC PART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



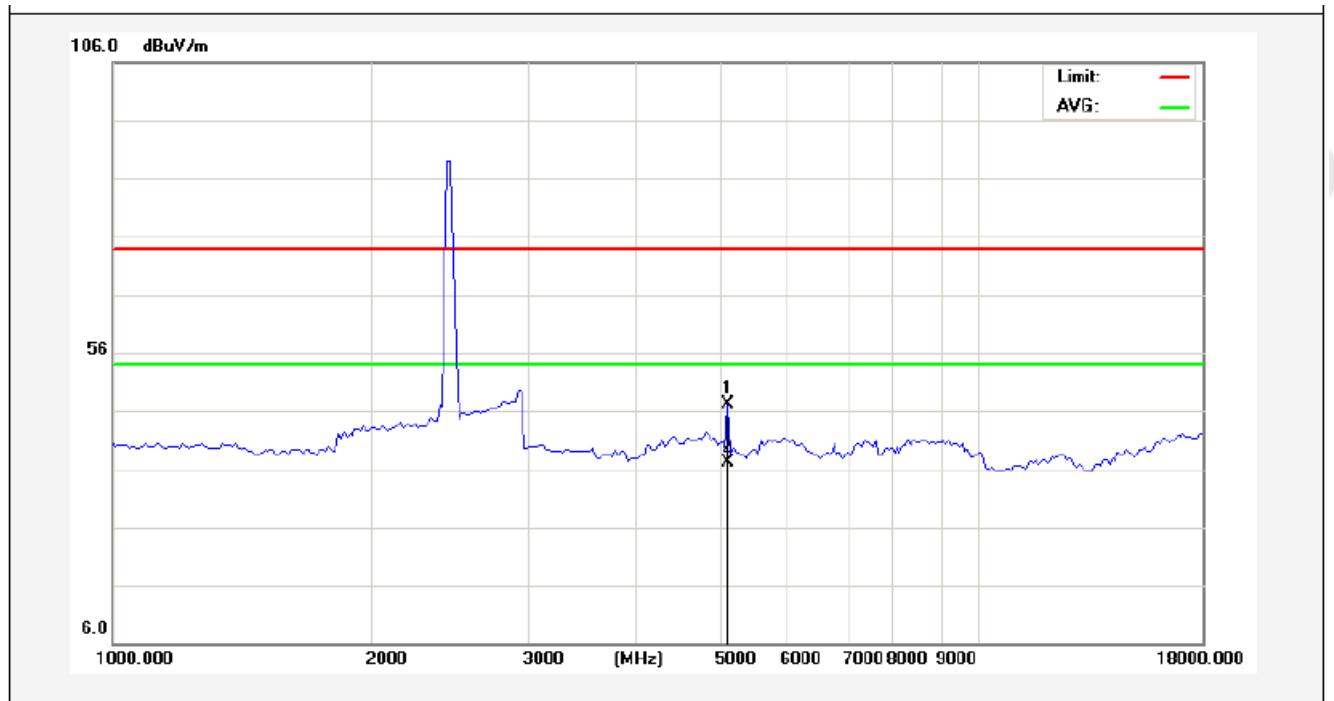
| Frequency | CableLoss | AntFactor | PreampFactor | ReadLevel  | Level        | Limit        | Over Limit | Remark |
|-----------|-----------|-----------|--------------|------------|--------------|--------------|------------|--------|
| MHz       | dB        | dB/m      | dB           | dB $\mu$ V | dB $\mu$ V/m | dB $\mu$ V/m | dB         |        |
| 4612.500  | 2.24      | 30.60     | 32.50        | 45.34      | 45.68        | 74.00        | -28.32     | Peak   |
| 4612.500  | 2.24      | 30.60     | 32.50        | 34.89      | 35.23        | 54.00        | -18.77     | AV     |

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



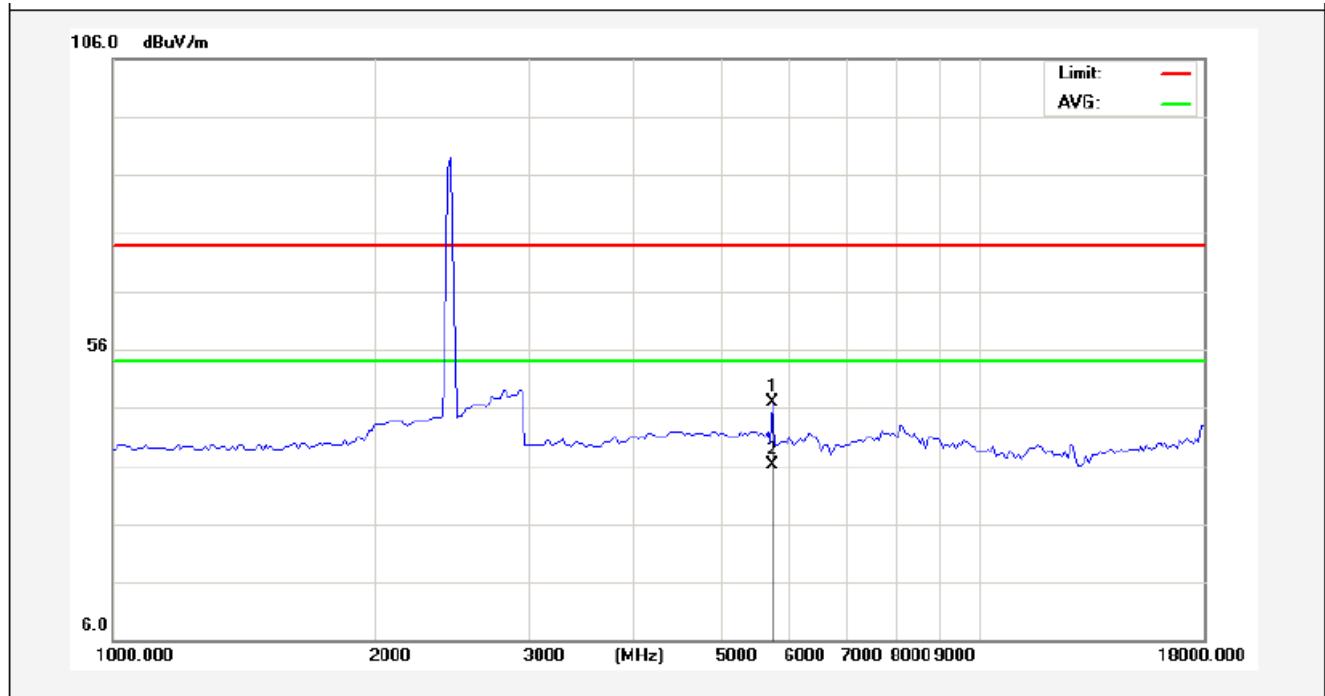
| Frequency | CableLoss | AntFactor | PreampFactor | ReadLevel  | Level        | Limit        | Over Limit | Remark |
|-----------|-----------|-----------|--------------|------------|--------------|--------------|------------|--------|
| MHz       | dB        | dB/m      | dB           | dB $\mu$ V |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

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



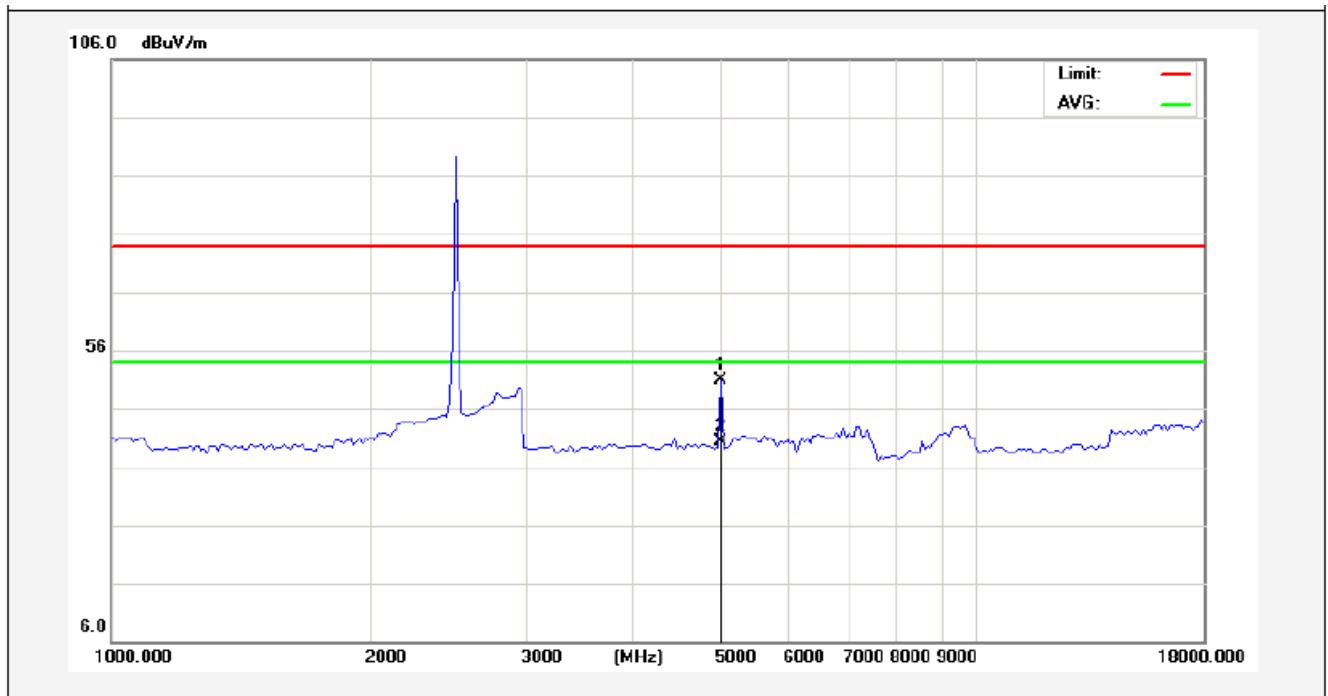
| Frequency | CableLoss | AntFactor | PreampFactor | ReadLevel  | Level        | Limit        | Over Limit | Remark |
|-----------|-----------|-----------|--------------|------------|--------------|--------------|------------|--------|
| MHz       | dB        | dB/m      | dB           | dB $\mu$ V | dB $\mu$ V/m | dB $\mu$ V/m | dB         |        |
| 5122.500  | 2.26      | 30.50     | 32.50        | 46.99      | 47.25        | 74.00        | -26.75     | Peak   |
| 5122.500  | 2.26      | 30.50     | 32.50        | 36.95      | 37.21        | 54.00        | -16.79     | AV     |

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



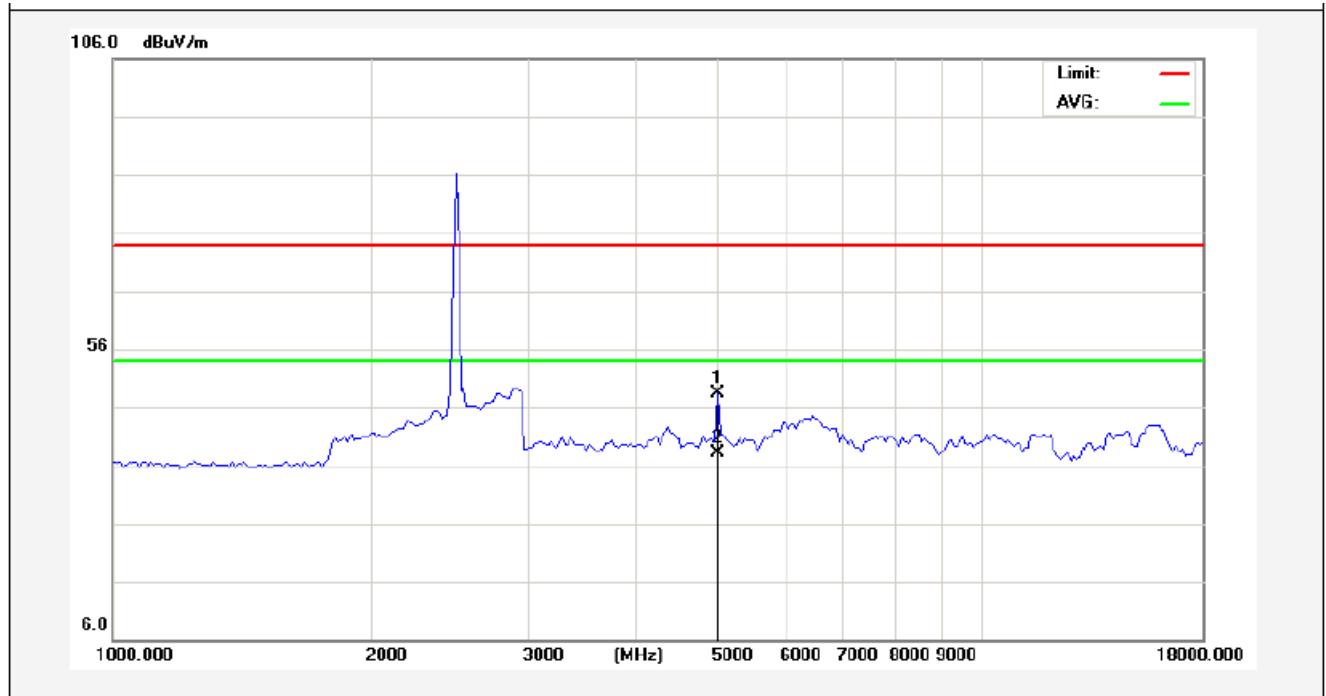
| Frequency | CableLoss | AntFactor | PreampFactor | ReadLevel  | Level        | Limit        | Over Limit | Remark |
|-----------|-----------|-----------|--------------|------------|--------------|--------------|------------|--------|
| MHz       | dB        | dB/m      | dB           | dB $\mu$ V | dB $\mu$ V/m | dB $\mu$ V/m | dB         |        |
| 5760.000  | 2.18      | 30.44     | 32.50        | 46.72      | 46.84        | 74.00        | -27.16     | Peak   |
| 5760.000  | 2.18      | 30.44     | 32.50        | 36.09      | 36.21        | 54.00        | -17.79     | AV     |

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



| Frequency | CableLoss | AntFactor | PreampFactor | ReadLevel  | Level        | Limit        | Over Limit | Remark |
|-----------|-----------|-----------|--------------|------------|--------------|--------------|------------|--------|
| MHz       | dB        | dB/m      | dB           | dB $\mu$ V | dB $\mu$ V/m | dB $\mu$ V/m | dB         |        |
| 5037.500  | 2.21      | 30.45     | 32.50        | 50.71      | 50.87        | 74.00        | -23.13     | Peak   |
| 5037.500  | 2.21      | 30.45     | 32.50        | 40.18      | 40.34        | 54.00        | -13.66     | AV     |

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



| Frequency | CableLoss | AntFactor | PreampFactor | ReadLevel  | Level        | Limit        | Over Limit | Remark |
|-----------|-----------|-----------|--------------|------------|--------------|--------------|------------|--------|
| MHz       | dB        | dB/m      | dB           | dB $\mu$ V | dB $\mu$ V/m | dB $\mu$ V/m | dB         |        |
| 4995.000  | 2.23      | 30.45     | 32.50        | 48.28      | 48.46        | 74.00        | -25.54     | Peak   |
| 4995.000  | 2.23      | 30.45     | 32.50        | 38.03      | 38.21        | 54.00        | -15.79     | AV     |

**Radiated Band Edge:**

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

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

Remark:

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

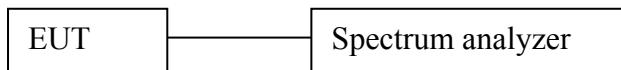
## 5. CHANNEL SEPARATION TEST

### 5.1 Measurement Procedure

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

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

### 5.2 Test SET-UP



### 5.3 Test Equipment

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

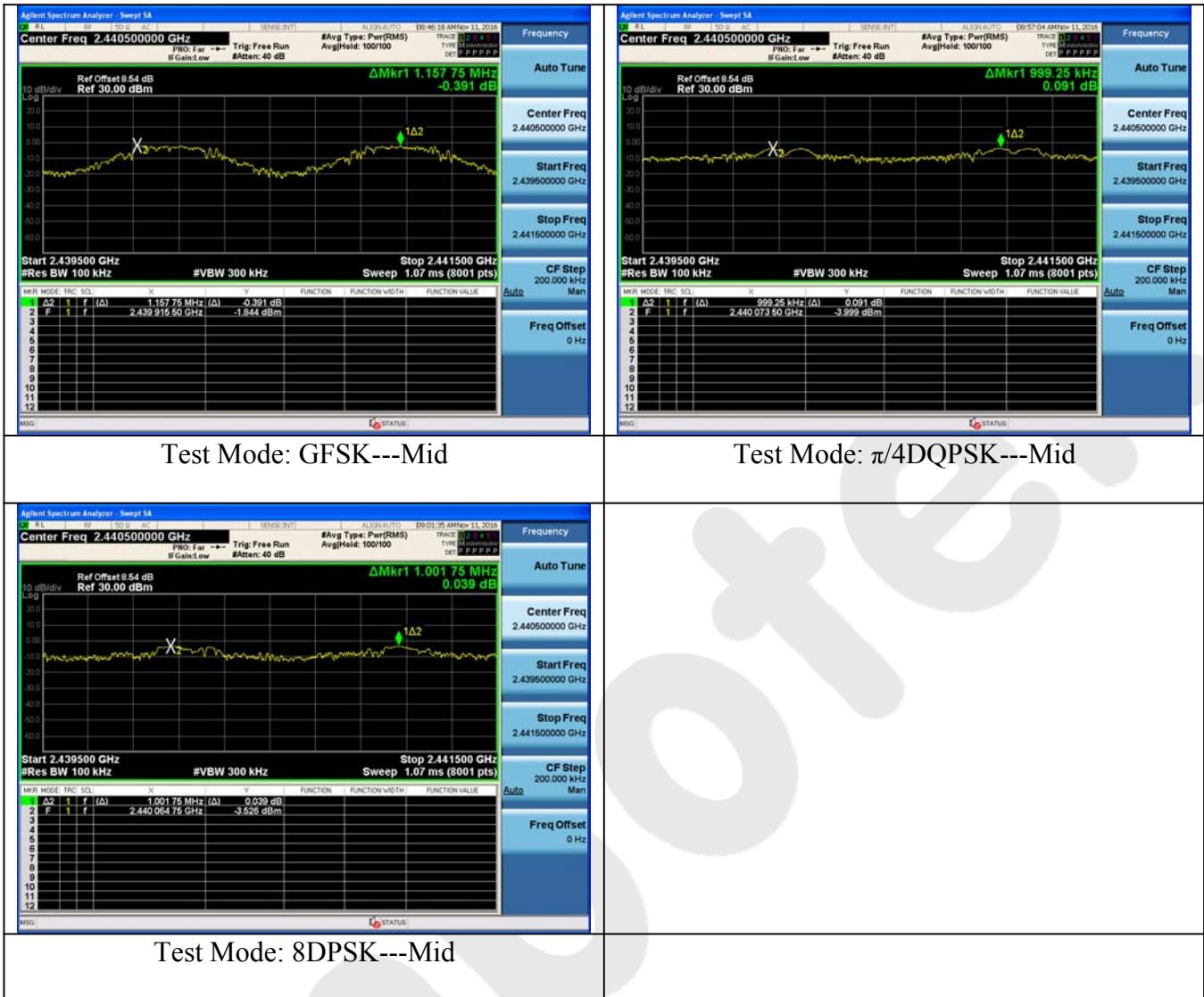
#### 5.4 Test Results

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

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

Remark:

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



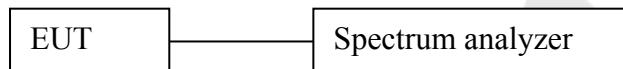
## 6. 20DB BANDWIDTH TEST

### 6.1 Measurement Procedure

Using the following spectrum analyzer settings:

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

### 6.2 Test SET-UP



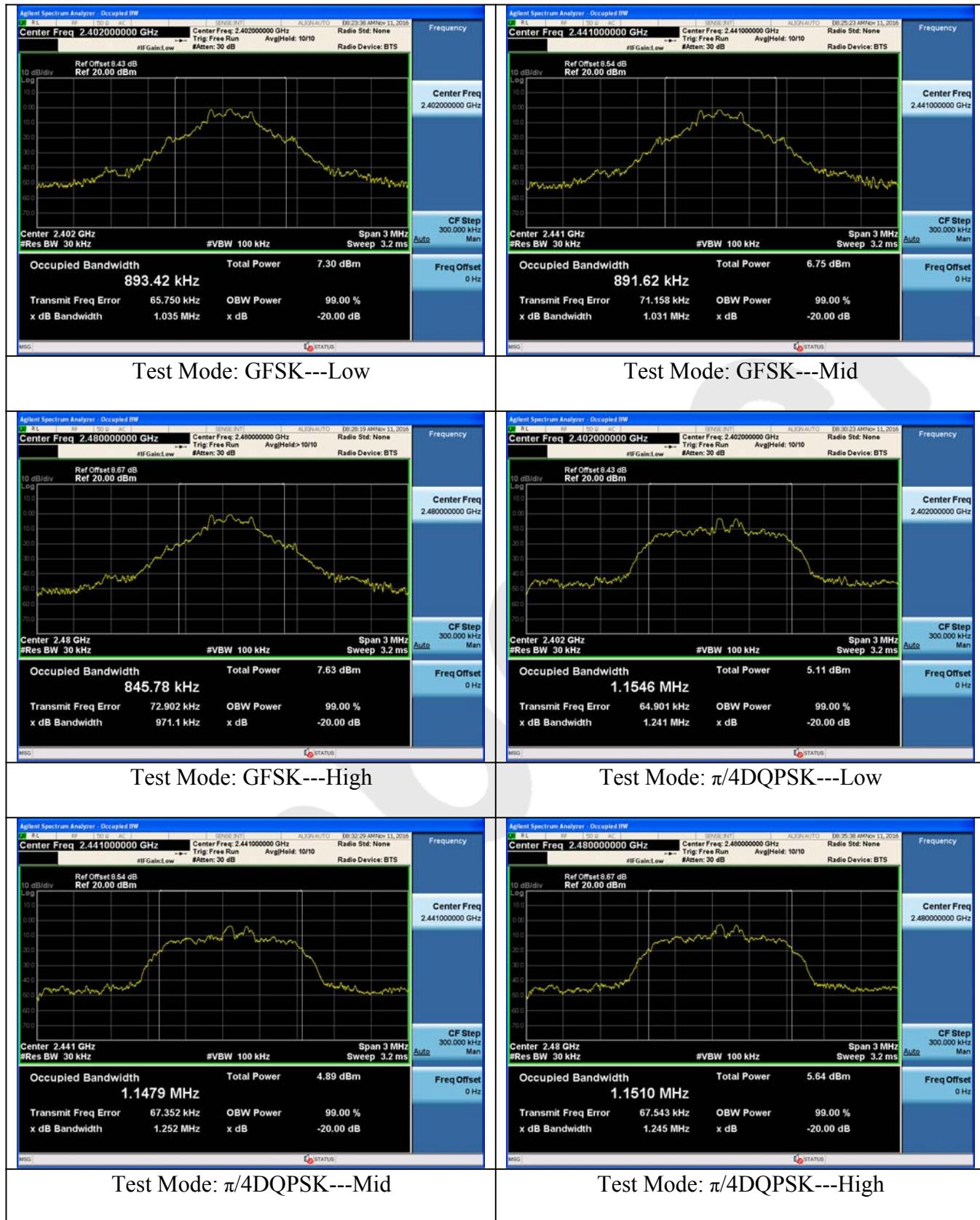
### 6.3 Test Equipment

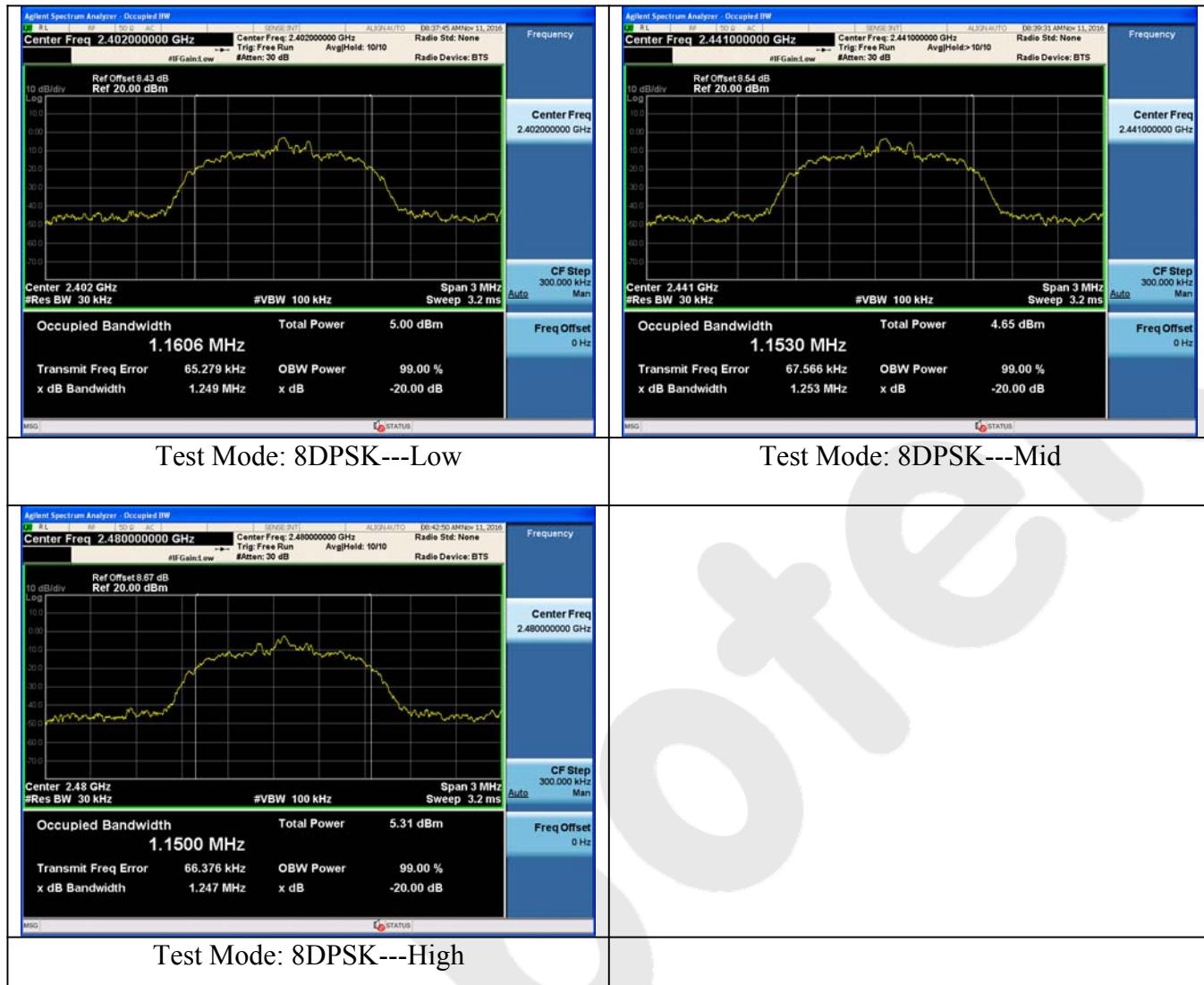
Same as the equipment listed in 5.3.

### 6.4 Test Results

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

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





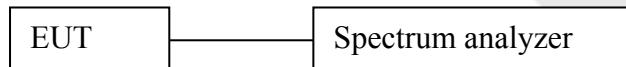
## 7. QUANTITY OF HOPPING CHANNEL TEST

### 7.1 Measurement Procedure

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

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

### 7.2 Test SET-UP



### 7.3 Test Equipment

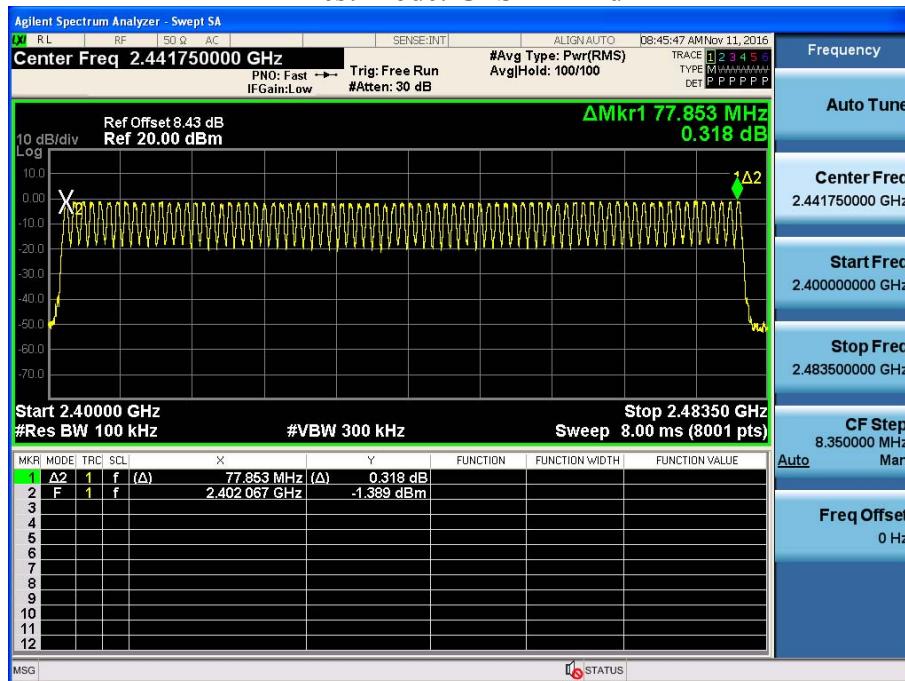
Same as the equipment listed in 5.3.

### 7.4 Test Results

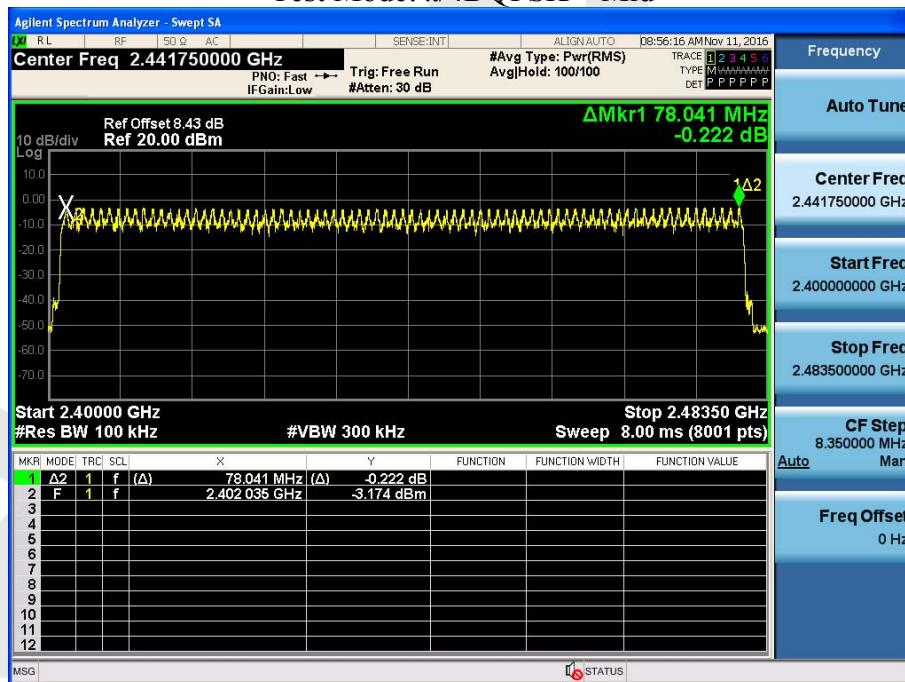
|              |                               |             |                    |
|--------------|-------------------------------|-------------|--------------------|
| Test Item    | : Number of Hopping Frequency | Test Mode   | : CH Low ~ CH High |
| Test Voltage | : DC 3.7V Battery inside      |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

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

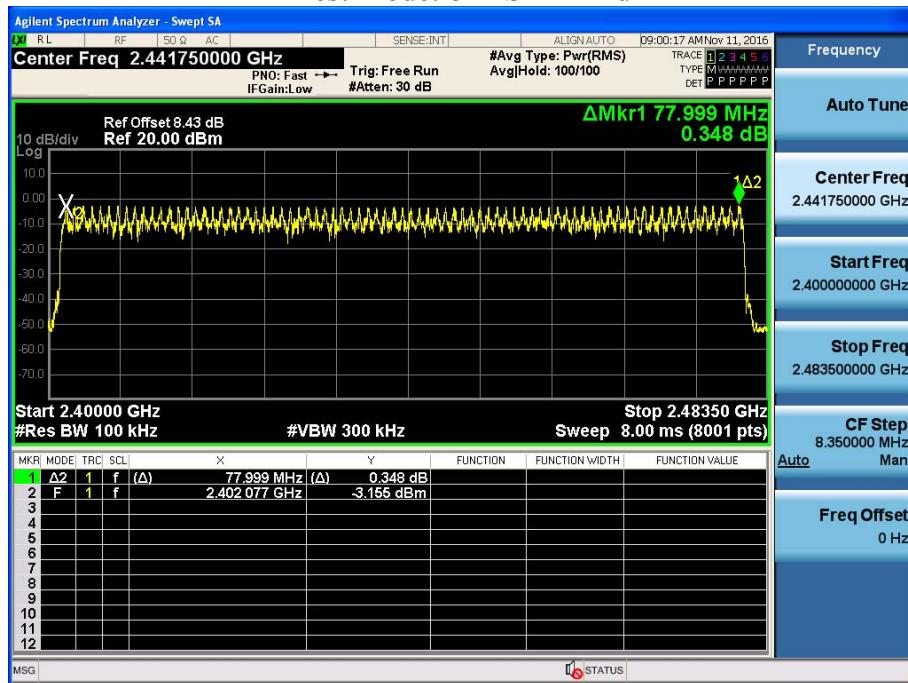
Test Mode: GFSK---Mid



Test Mode: π/4DQPSK---Mid



Test Mode: 8DPSK---Mid



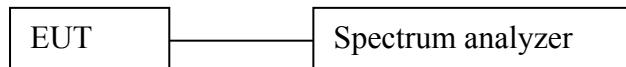
## 8. DWELL TIME TEST

### 8.1 Measurement Procedure

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

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

### 8.2 Test SET-UP



### 8.3 Test Equipment

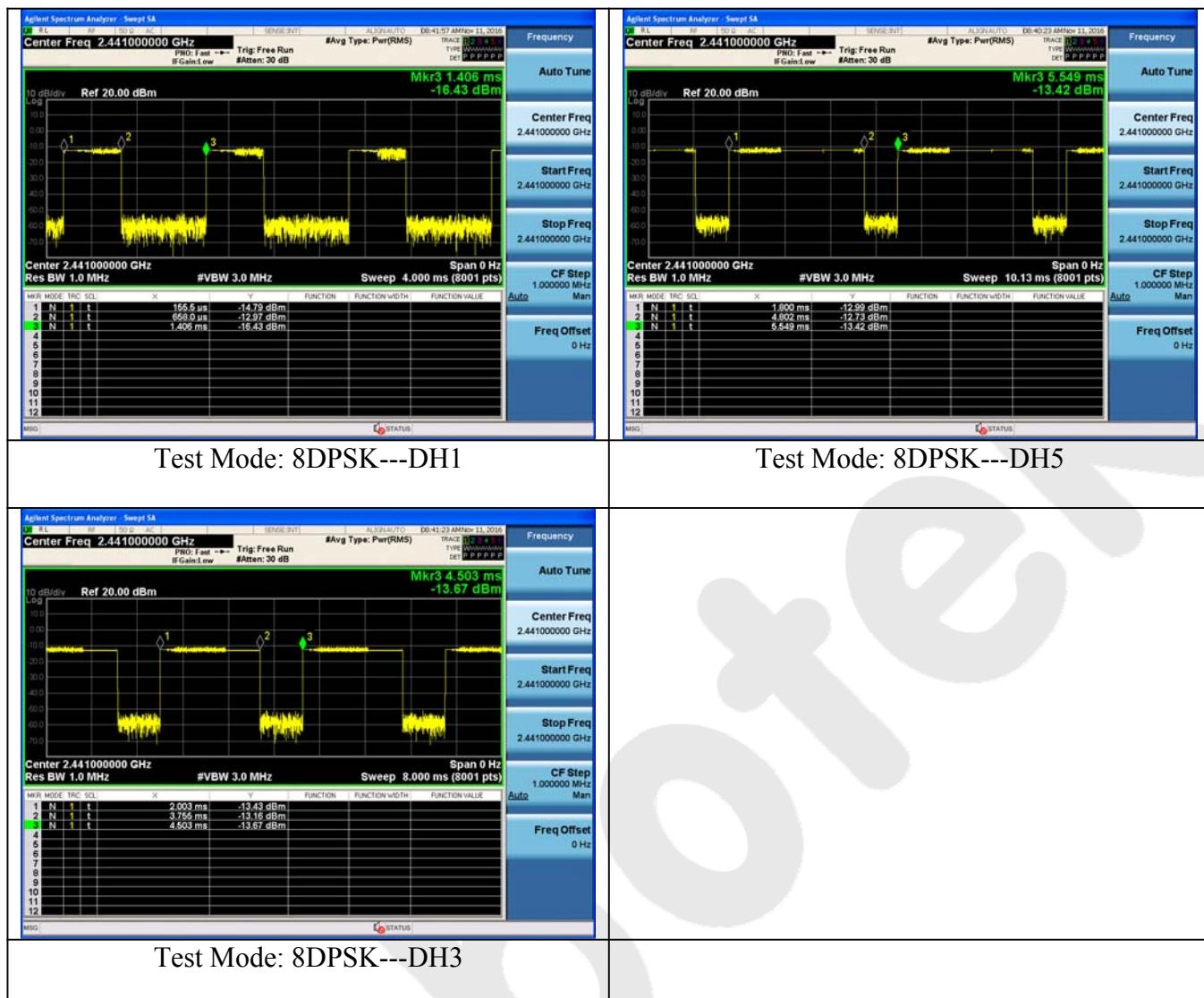
Same as the equipment listed in 5.3.

### 8.4 Test Results

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

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





## 9. MAXIMUM PEAK OUTPUT POWER TEST

### 9.1 Measurement Procedure

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

Using the following spectrum analyzer settings:

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

### 9.2 Test SET-UP



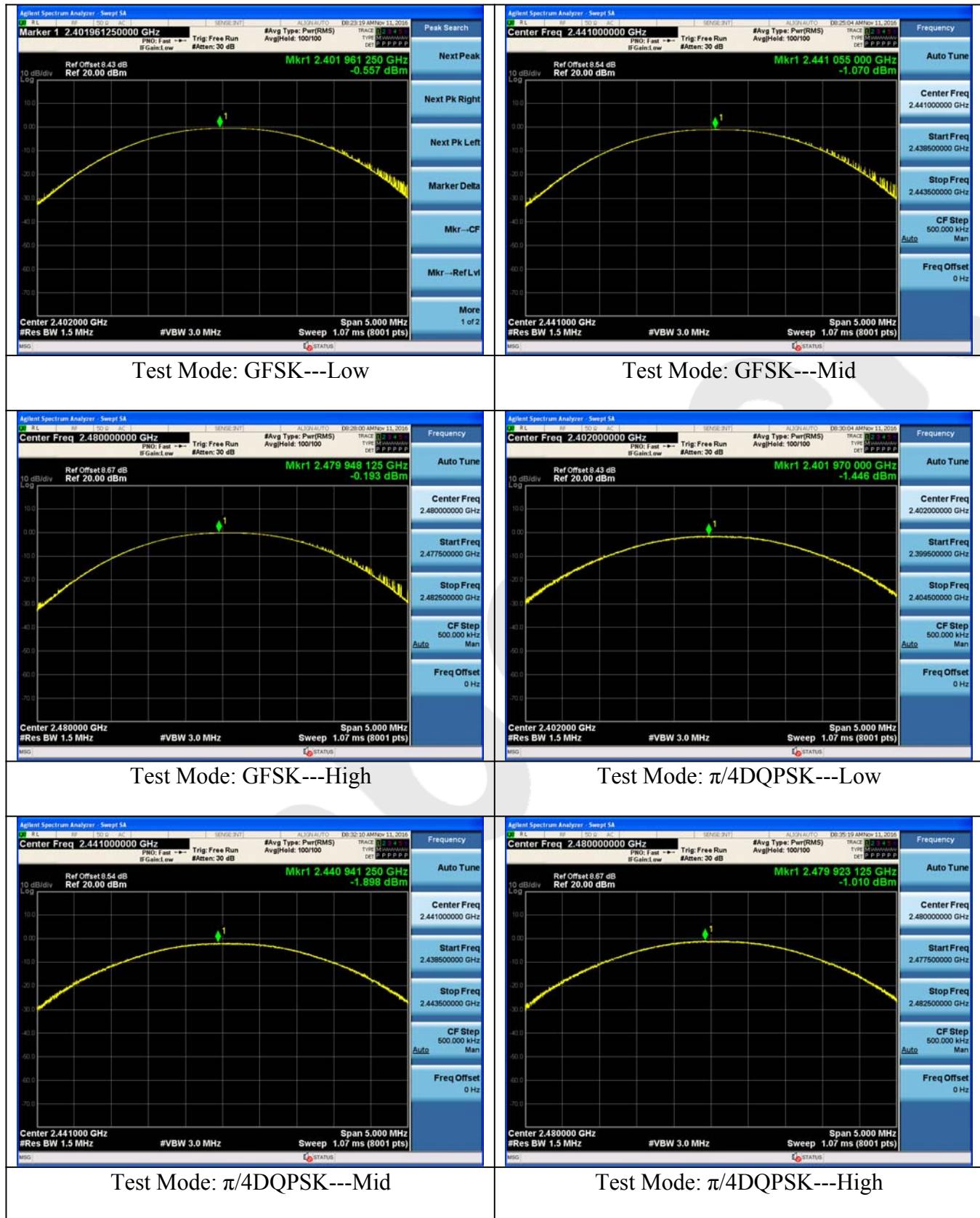
### 9.3 Test Equipment

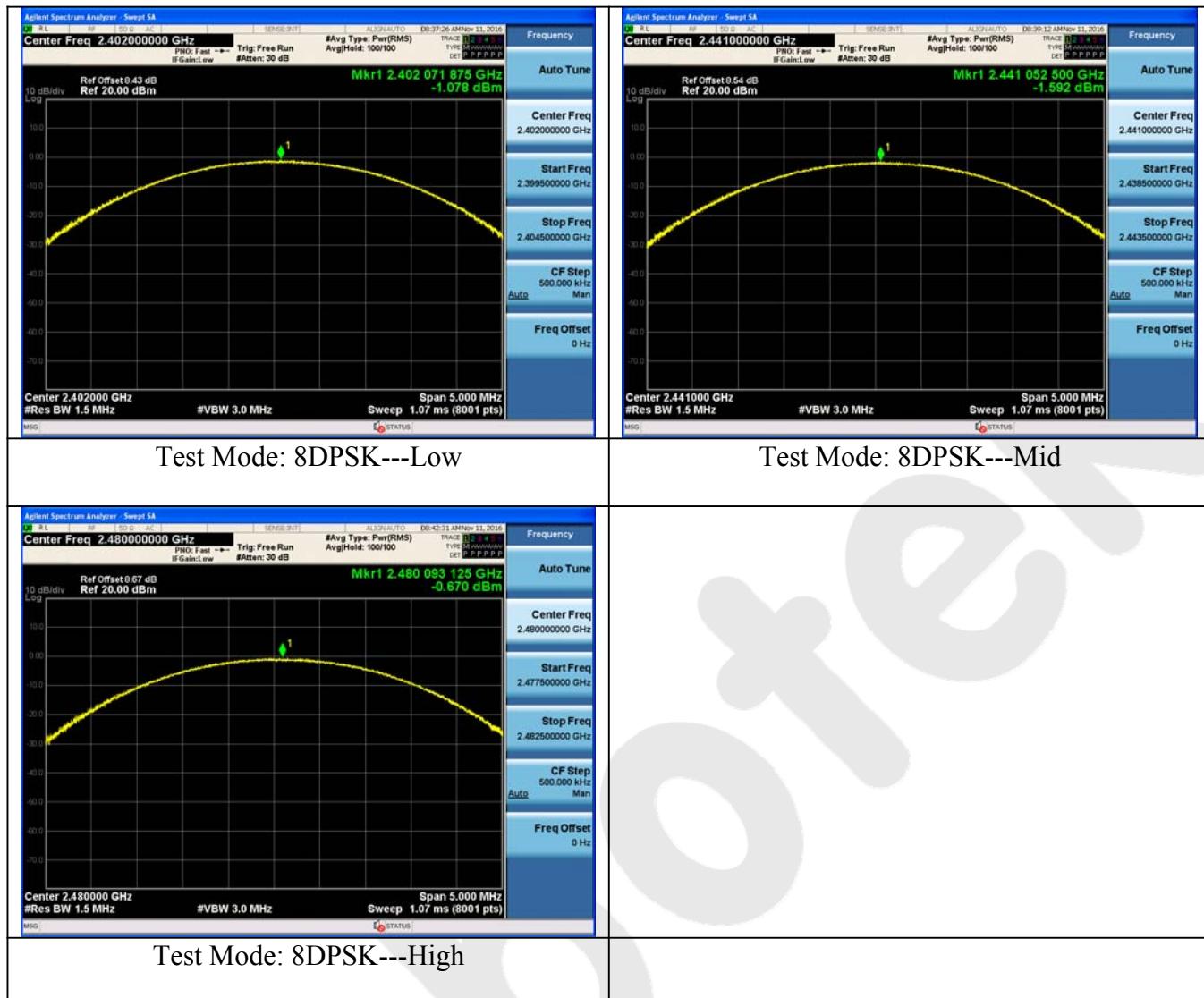
Same as the equipment listed in 5.3.

## 9.4 Test Results

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

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



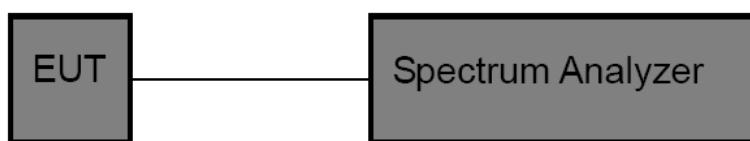


## 10. 100KHZ BANDWIDTH OF FREQUENCY BAND EDGE REQUIREMENT

### 10.1. Test Standard and Limit

|               |  |
|---------------|--|
| Test Standard | FCC Part15 C Section 15.247 (d)  |
| Test Limit    | in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a). |

### 10.2. Test Setup



### 10.3. Test Procedure

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

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

### 10.4 Test Results

Pass.

Please refer the following data.

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

### For Hopping Mode

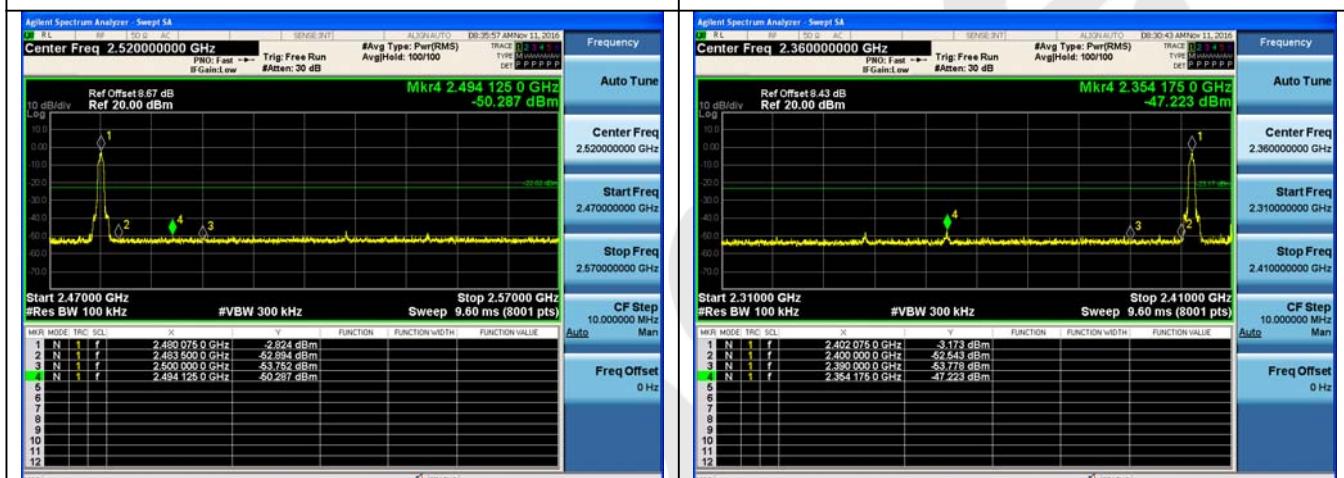


### For Non-Hopping Mode:



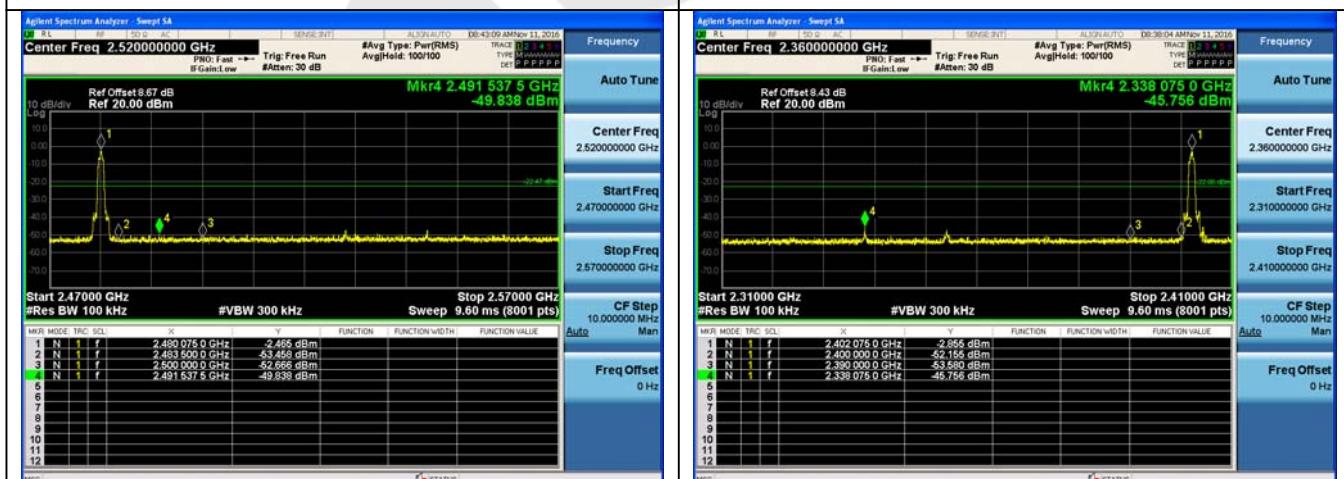
Test Mode: GFSK

Test Mode: GFSK



Test Mode:  $\pi/4$ DQPSK

Test Mode:  $\pi/4$ DQPSK



Test Mode: 8DPSK

Test Mode: 8DPSK

## 11. ANTENNA APPLICATION

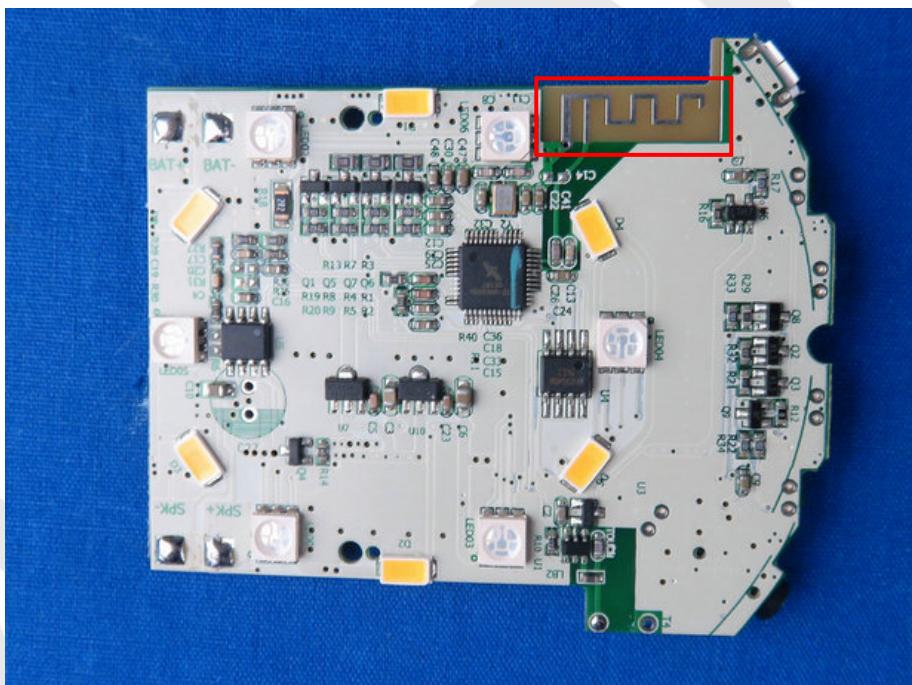
### 11.1 Antenna requirement

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

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

### 11.2 Result

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

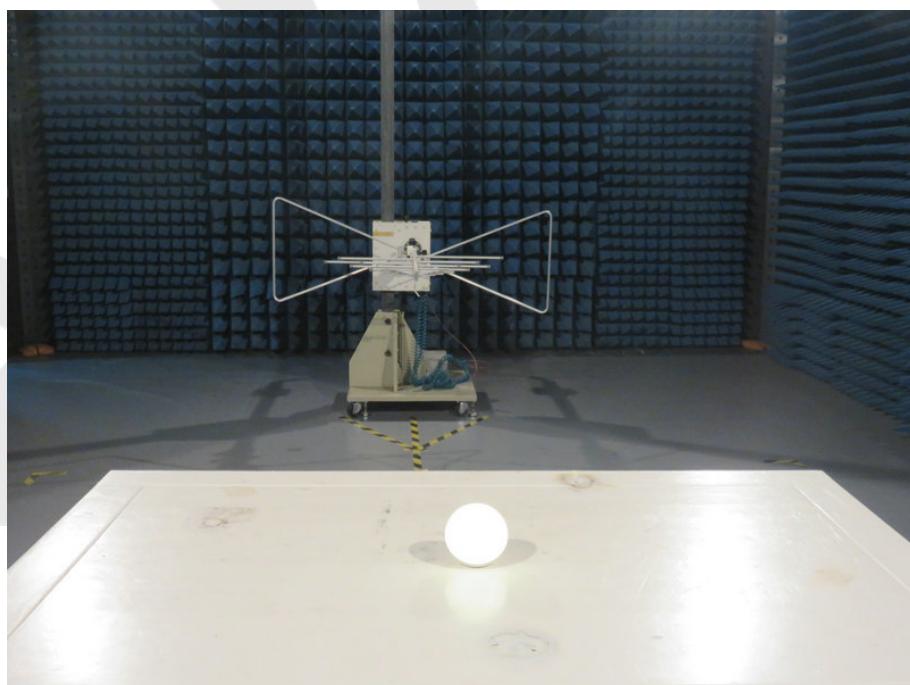


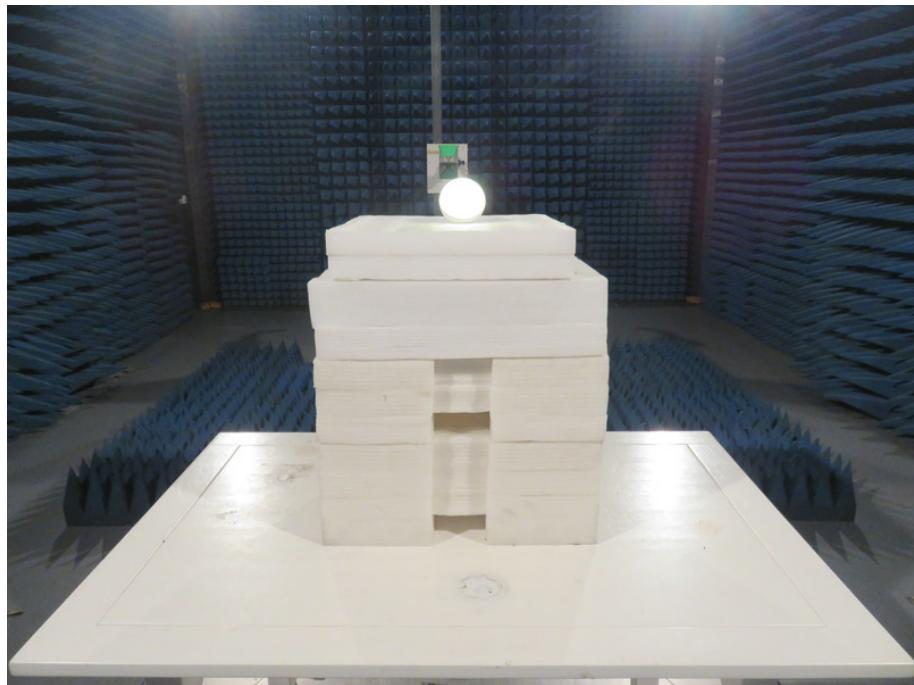
## 12. PHOTOGRAPH

### 12.1 Photo of Power Line Conducted Emission Measurement



### 12.2 Photo of Radiation Emission Test



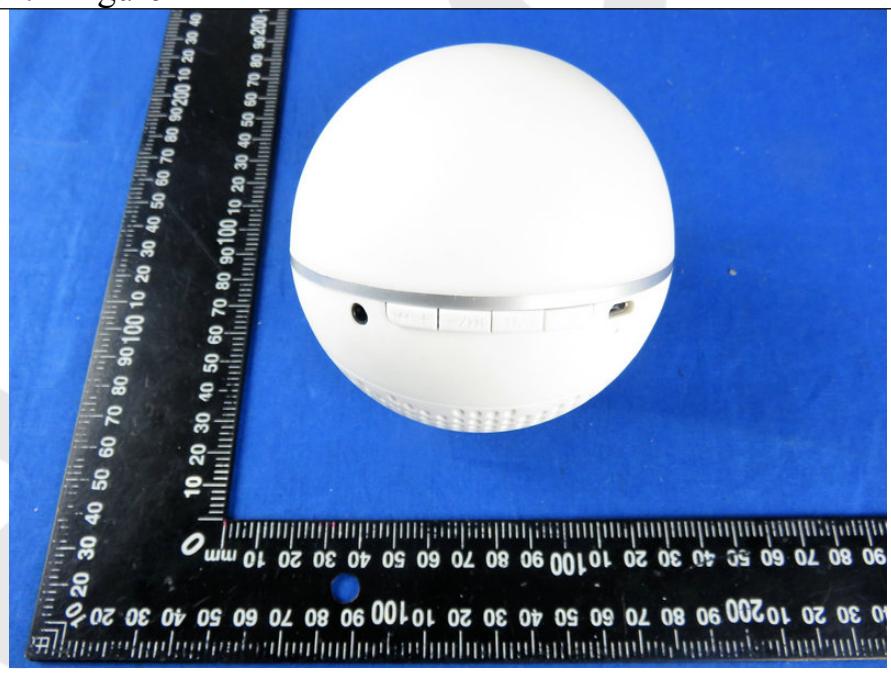


## APPENDIX I (EXTERNAL PHOTOS)

1. Figure



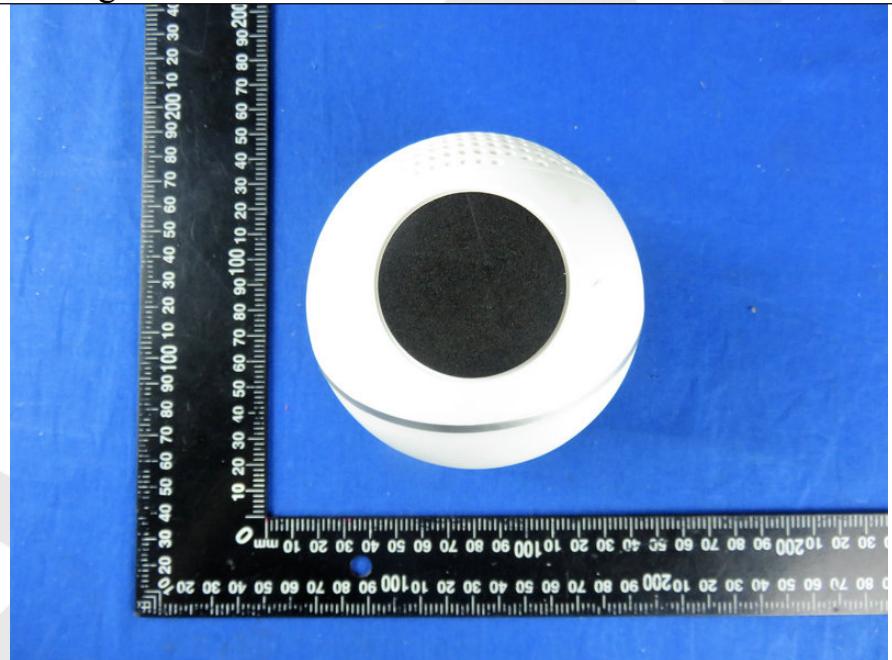
2. Figure



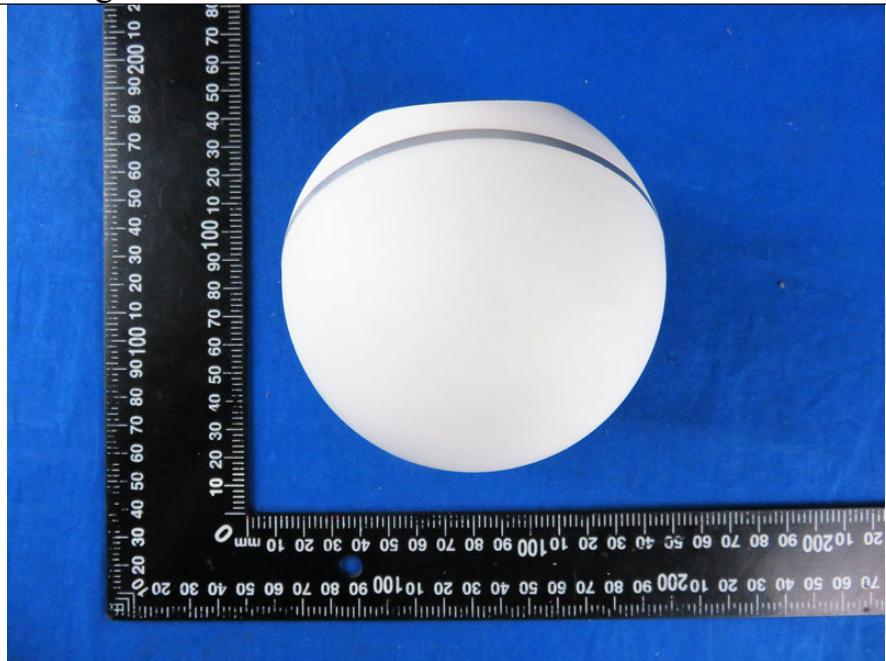
3. Figure



4. Figure



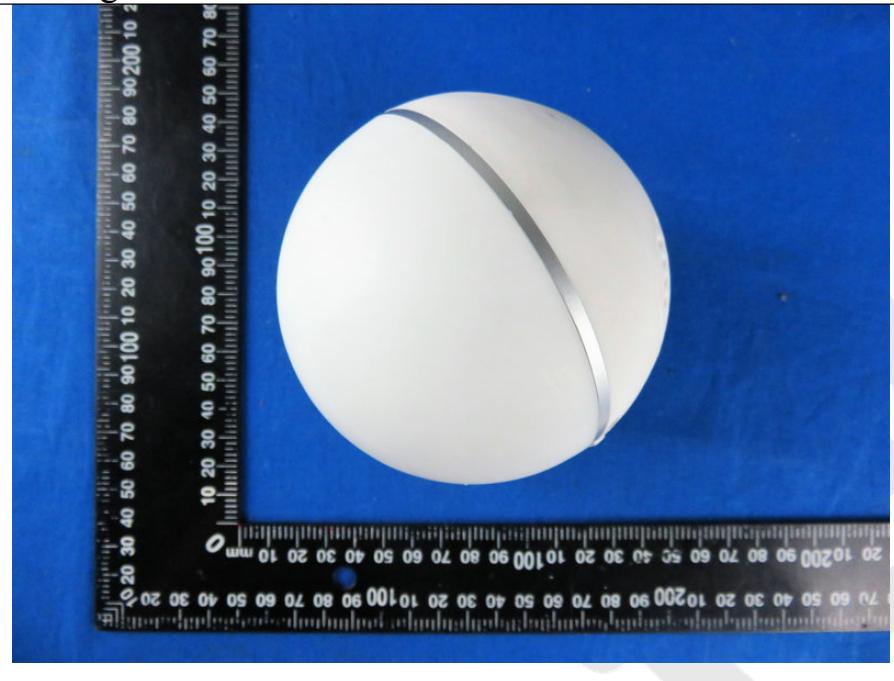
5. Figure



6. Figure

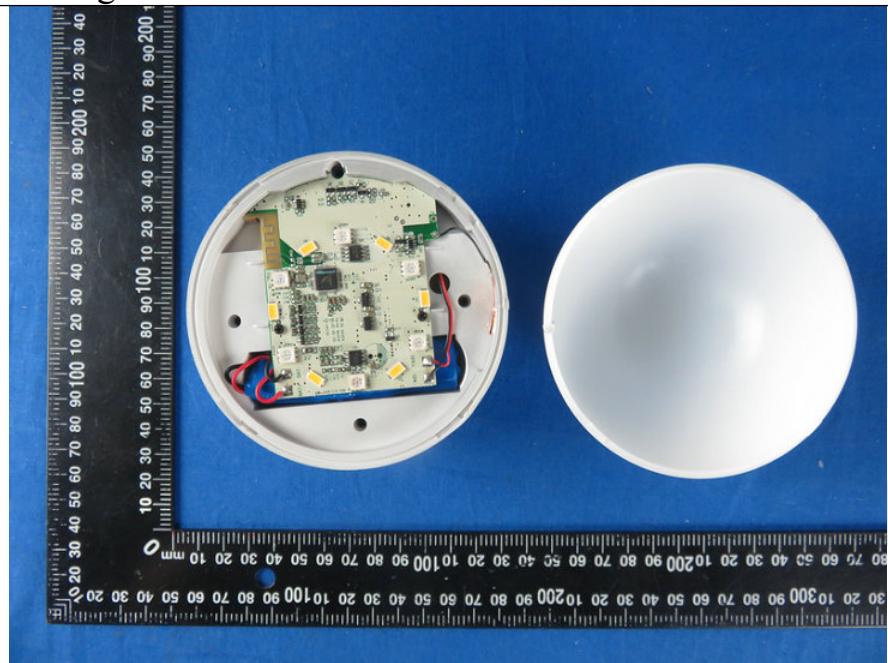


7. Figure

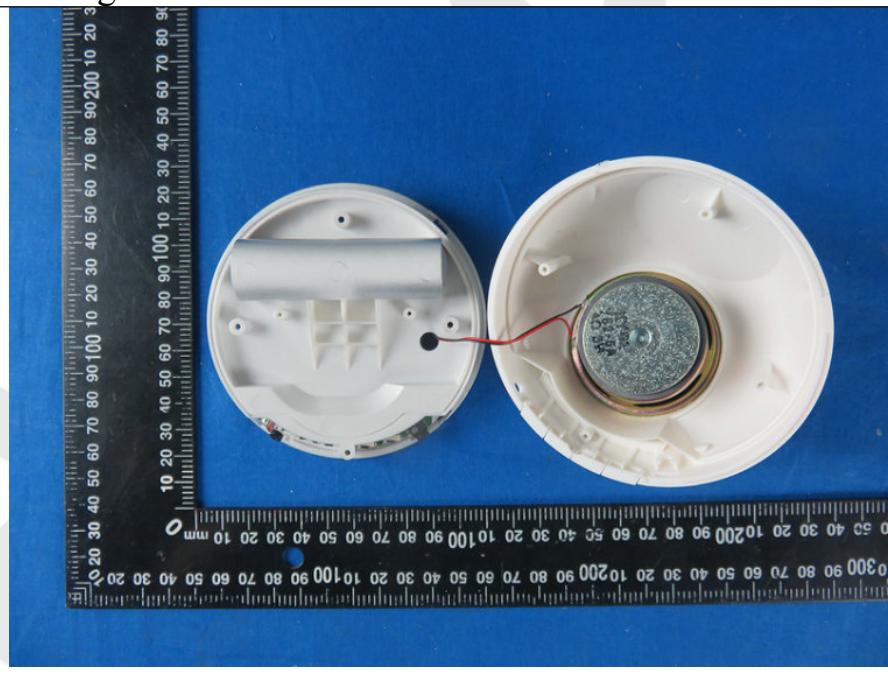


## APPENDIX II (INTERNAL PHOTOS)

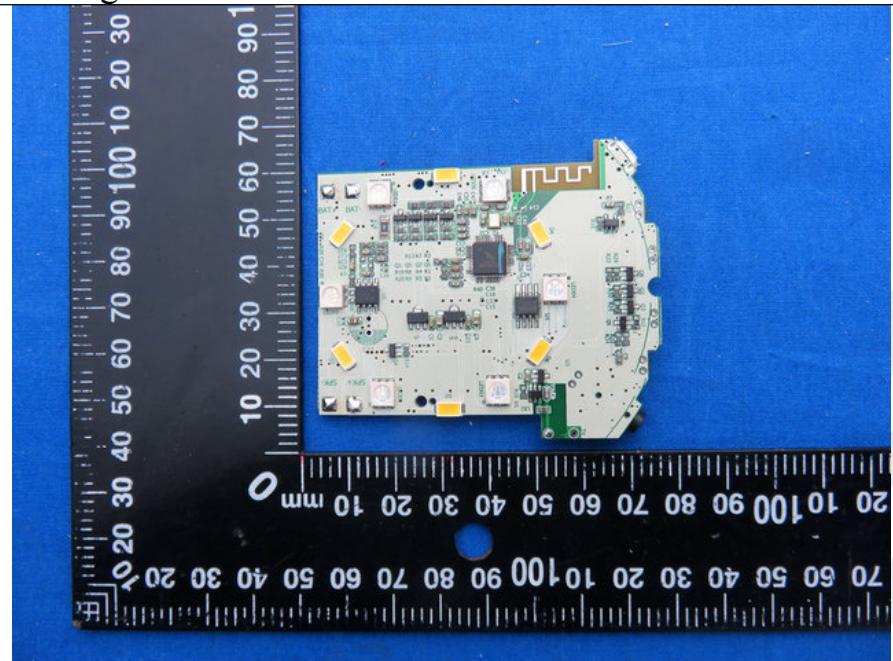
1. Figure



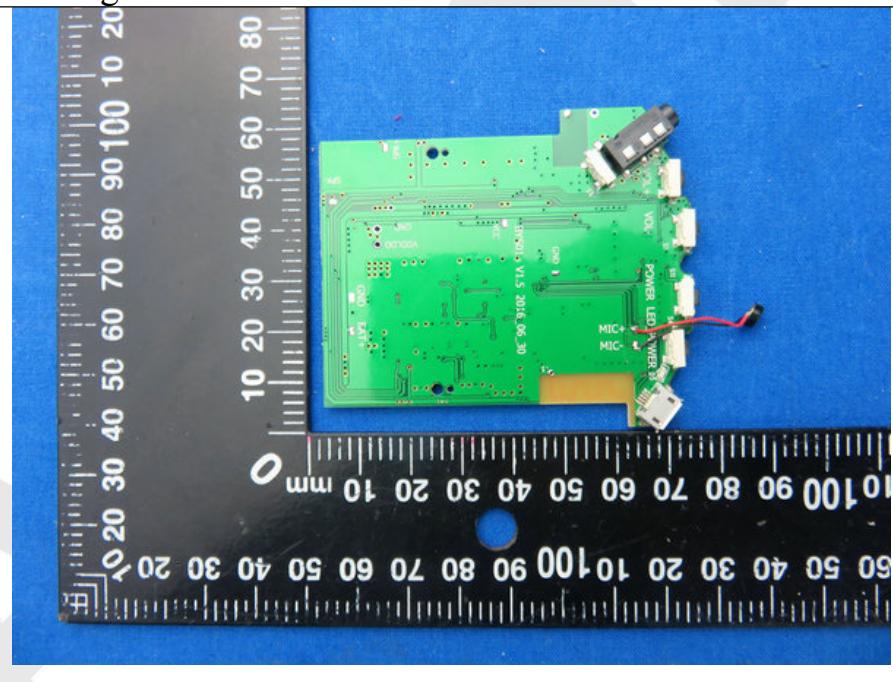
2. Figure



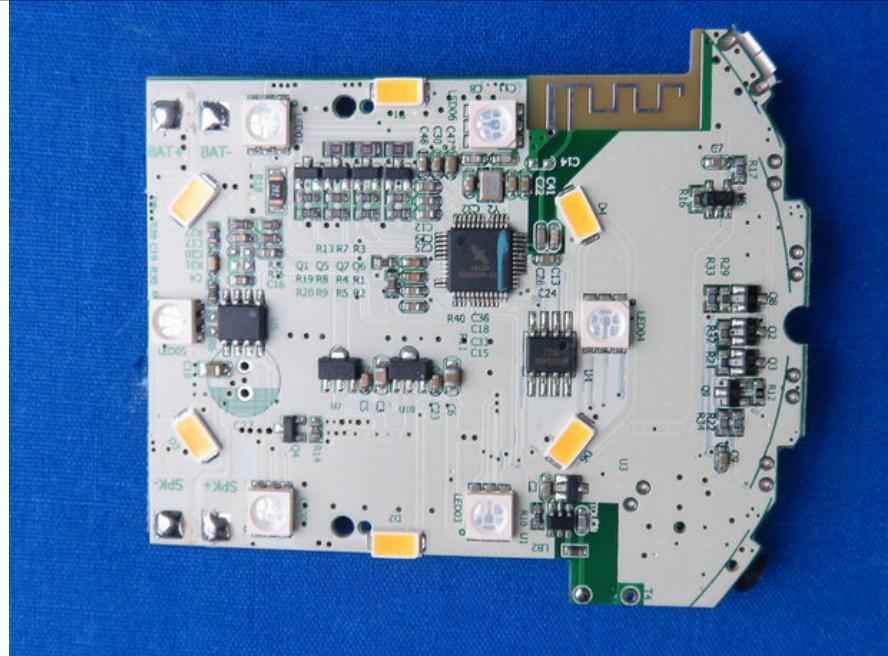
3. Figure



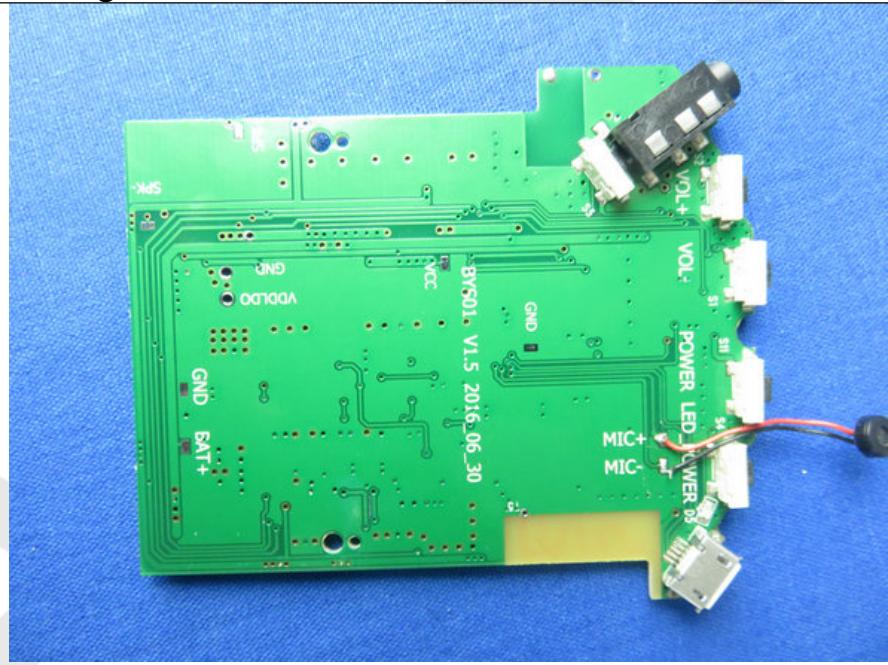
4. Figure



5. Figure



6. Figure



7. Figure

