

# FCC TEST REPORT(Bluetooth)

for

APAT ELECTRICAL LTD

Bluetooth Speaker

Model Number:TWIST-II

FCC ID: 2AEB3TWIST-II

Prepared for : APAT ELECTRICAL LTD

Address : Rm2406,Block A,HuangDu Plaza,3008YiaTian Road,  
Shenzhen, China

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Report No. : 16KWE104474F

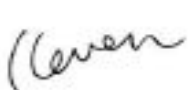
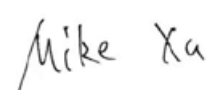
Date of Test : Sep. 14~Oct.11, 2016

Date of Report : Oct. 12, 2016

## TABLE OF CONTENTS

|                                                          |           |
|----------------------------------------------------------|-----------|
| Test Report Declaration                                  | Page      |
| <b>1. TEST SUMMARY .....</b>                             | <b>4</b>  |
| <b>2. GENERAL PRODUCT INFORMATION .....</b>              | <b>5</b>  |
| 2.1. Product Function.....                               | 5         |
| 2.2. Description of Device (EUT) .....                   | 5         |
| 2.3. Difference between Model Numbers .....              | 5         |
| 2.4. Independent Operation Modes .....                   | 5         |
| 2.5. Test Supporting System .....                        | 5         |
| 2.6. Test Facilities .....                               | 6         |
| 2.7. List of Test and Measurement Instruments .....      | 7         |
| <b>3. TEST SET-UP AND OPERATION MODES.....</b>           | <b>8</b>  |
| 3.1. Principle of Configuration Selection.....           | 8         |
| 3.2. Block Diagram of Test Set-up.....                   | 8         |
| 3.3. Test Operation Mode and Test Software .....         | 8         |
| 3.4. Special Accessories and Auxiliary Equipment.....    | 8         |
| 3.5. Countermeasures to Achieve EMC Compliance .....     | 8         |
| 3.6. Test Environment: .....                             | 8         |
| <b>4. MAXIMUM PEAK OUTPUT POWER.....</b>                 | <b>9</b>  |
| 4.1. Limits .....                                        | 9         |
| 4.2. Test Procedure.....                                 | 9         |
| 4.3. Test setup .....                                    | 9         |
| <b>5. EMISSION TEST RESULTS.....</b>                     | <b>15</b> |
| 5.1. Conducted Emission at the Mains Terminals Test..... | 15        |
| 5.2. Radiated Emission Test.....                         | 20        |
| <b>6. 20DB BANDWIDTH .....</b>                           | <b>46</b> |
| 6.1. Limits .....                                        | 46        |
| 6.2. Test setup .....                                    | 46        |
| <b>7. FREQUENCY SEPARATION.....</b>                      | <b>53</b> |
| 7.1. Limits .....                                        | 53        |
| 7.2. Test setup .....                                    | 53        |
| <b>8. NUMBER OF HOPPING FREQUENCY .....</b>              | <b>60</b> |
| 8.1. Limits .....                                        | 60        |
| 8.2. Test setup .....                                    | 60        |
| <b>9. DWELL TIME .....</b>                               | <b>62</b> |
| 9.1. Limits .....                                        | 62        |
| 9.2. Test setup .....                                    | 62        |
| <b>10. BAND EDGE COMPLIANCE TEST .....</b>               | <b>69</b> |
| 10.1. Limits .....                                       | 69        |
| 10.2. Test setup .....                                   | 69        |
| 10.3. TEST Procedure .....                               | 70        |
| <b>11. ANTENNA REQUIREMENTS .....</b>                    | <b>78</b> |
| 11.1. Limits .....                                       | 78        |
| 11.2. Result .....                                       | 78        |
| <b>12. PHOTOGRAPHS OF TEST SET-UP .....</b>              | <b>79</b> |
| <b>13. PHOTOGRAPHS OF THE EUT .....</b>                  | <b>81</b> |

## Keyway Testing Technology Co., Ltd.

|                                                                                                                                                                                                              |                                                                                                     |                                                                                       |                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------------|
| <b>Applicant:</b>                                                                                                                                                                                            | APAT ELECTRICAL LTD                                                                                 |                                                                                       |                      |
| <b>Address:</b>                                                                                                                                                                                              | Rm2406,Block A,HuangDu Plaza,3008YiaTian Road, Shenzhen, China                                      |                                                                                       |                      |
| <b>Manufacturer:</b>                                                                                                                                                                                         | APAT ELECTRICAL LTD                                                                                 |                                                                                       |                      |
| <b>Address:</b>                                                                                                                                                                                              | Rm2406,Block A,HuangDu Plaza,3008YiaTian Road, Shenzhen, China                                      |                                                                                       |                      |
| <b>E.U.T:</b>                                                                                                                                                                                                | Bluetooth Speaker                                                                                   |                                                                                       |                      |
| <b>Model Number:</b>                                                                                                                                                                                         | TWIST-II                                                                                            |                                                                                       |                      |
| <b>Serial Model:</b>                                                                                                                                                                                         | N/A                                                                                                 |                                                                                       |                      |
| <b>Trade Name:</b>                                                                                                                                                                                           | N/A                                                                                                 | <b>Serial No.:</b>                                                                    | -----                |
| <b>Date of Receipt:</b>                                                                                                                                                                                      | Sep. 13, 2016                                                                                       | <b>Date of Test:</b>                                                                  | Sep. 14~Oct.11, 2016 |
| <b>Test Specification:</b>                                                                                                                                                                                   | FCC Part 15, Subpart C Section 15.247: 2015<br>ANSI C63.10:2013                                     |                                                                                       |                      |
| <b>Test Result:</b>                                                                                                                                                                                          | The equipment under test was found to be compliance with the requirements of the standards applied. |                                                                                       |                      |
| <b>Issue Date: Oct.12, 2016</b>                                                                                                                                                                              |                                                                                                     |                                                                                       |                      |
| Tested by:                                                                                                                                                                                                   | Reviewed by:                                                                                        | Approved by:                                                                          |                      |
|                                                                                                                           |                  |  |                      |
| _____<br>Keven Wu / Engineer                                                                                                                                                                                 | _____<br>Mike Xu / Supervisor                                                                       | _____<br>Andy Gao / Supervisor                                                        |                      |
| <b>Other Aspects:</b>                                                                                                                                                                                        | None.                                                                                               |                                                                                       |                      |
| Abbreviations: OK/P=passed    fail/F=failed    n.a/N=not applicable    E.U.T=equipment under tested                                                                                                          |                                                                                                     |                                                                                       |                      |
| This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Keyway Testing Technology Co., Ltd. |                                                                                                     |                                                                                       |                      |

## 1. TEST SUMMARY

| Test Items                  | Test Requirement  | Result |
|-----------------------------|-------------------|--------|
| Conducted Emissions         | 15.207            | PASS   |
| Radiated Emissions          | 15.205(a)/15.209  | PASS   |
| 20dB Bandwidth              | 15.247(a)(1)      | PASS   |
| Frequency Separation        | 15.247(a)(1)      | PASS   |
| Maximum Peak Output Power   | 15.247(b)(1)      | PASS   |
| Number of Hopping Frequency | 15.247(a)(1)(iii) | PASS   |
| Dwell time                  | 15.247(a)(1)(iii) | PASS   |
| Emissions from out of band  | 15.247(d)         | PASS   |
| Antenna Requirement         | 15.203            | PASS   |

## 2.GENERAL PRODUCT INFORMATION

### 2.1.Product Function

Refer to Technical Construction Form and User Manual.

### 2.2. Description of Device (EUT)

|                         |                                                                           |
|-------------------------|---------------------------------------------------------------------------|
| Product Name:           | Bluetooth Speaker                                                         |
| Model No.:              | TWIST-II                                                                  |
| Serial Model:           | N/A                                                                       |
| Model Difference        | N/A                                                                       |
| Operation Frequency:    | 2402MHz ~2480MHz                                                          |
| Channel numbers:        | 79 Channels                                                               |
| Channel spacing         | 1MHz                                                                      |
| Modulation technology:  | BT(1Mbps): GFSK<br>BT EDR(2Mbps): $\pi/4$ -DQPSK<br>BT EDR(3Mbps): 8-DPSK |
| Bit Rate of Transmitter | 1Mbps/2Mbps/3Mbps                                                         |
| Antenna Type:           | PCB antenna                                                               |
| Antenna gain:           | 0.5dBi                                                                    |
| Power supply:           | DC 3.7V from Battery or DC 5V from adapter                                |
| Adapter:                | I/P:AC 100~240V 50/60Hz 0.15A<br>O/P:DC 5V 0.7A                           |

### 2.3. Difference between Model Numbers

None.

### 2.4. Independent Operation Modes

The basic operation modes are:

2.4.1. EUT work BT mode and Test mode as below:

| Pretest Mode | Description |
|--------------|-------------|
| Mode 1       | CH00        |
| Mode 2       | CH39        |
| Mode 3       | CH78        |
| Mode 4       | BT link     |

### 2.5. Test Supporting System

.N/A

## 2.6. Test Facilities

Lab Qualifications : 944 Shielded Room built by ETS-Lindgren, USA  
Date of completion: March 28, 2011

966 Chamber built by ETS-Lindgren, USA  
Date of completion: March 28, 2011

Certificated by TUV Rheinland, Germany.  
Registration No.: UA 50207153  
Date of registration: July 13, 2011

Certificated by UL, USA  
Registration No.: 100567-237  
Date of registration: September 1, 2011

Certificated by Intertek  
Registration No.: 2011-RTL-L1-31  
Date of registration: October 11, 2011

Certificated by Industry Canada  
Registration No.: 9868A  
Date of registration: December 8, 2011

Certificated by FCC, USA  
Registration No.: 370994  
Date of registration: February 21, 2012

Certificated by CNAS China  
Registration No.: CNAS L5783  
Date of registration: August 8, 2012

Name of Firm : Keyway Testing Technology Co., Ltd.

Site Location : Building 1, Baishun Industrial Zone, Zhangmutou  
Town, Dongguan, Guangdong, China

## 2.7. List of Test and Measurement Instruments

### 2.7.1. For conducted emission at the mains terminals test

| Equipment                | Manufacturer  | Model No. | Serial No. | Last Cal.  | Next Cal.  |
|--------------------------|---------------|-----------|------------|------------|------------|
| EMI Test Receiver        | Rohde&Schwarz | ESCI      | 101156     | Apr. 09,16 | Apr. 09,17 |
| Artificial Mains Network | Rohde&Schwarz | ENV216    | 101315     | Apr. 09,16 | Apr. 09,17 |
| RF Cable                 | FUJIKURA      | 3D-2W     | 944 Cable  | Apr. 09,16 | Apr. 09,17 |

### 2.7.2. For radiated emission test

| Equipment                             | Manufacturer  | Model No.     | Serial No.   | Last Cal.  | Next Cal.  |
|---------------------------------------|---------------|---------------|--------------|------------|------------|
| EMI Test Receiver                     | Rohde&Schwarz | ESCI          | 101156       | Apr. 09,16 | Apr. 08,17 |
| Bilog Antenna                         | ETS-LINDGREEN | 3142D         | 135452       | Apr. 09,16 | Apr. 08,17 |
| Spectrum Analyzer                     | Agilent       | E4411B        | MY4511304    | Apr. 09,16 | Apr. 08,17 |
| 3m Semi-anechoic Chamber              | ETS-LINDGREEN | 966           | KW01         | Apr. 09,16 | Apr. 08,17 |
| Signal Amplifier                      | SONOMA        | 310           | 187016       | Apr. 09,16 | Apr. 08,17 |
| Signal Amplifier                      | Agilent       | 8449B         | 3008A00251   | Apr. 09,16 | Apr. 08,17 |
| RF Cable                              | IMRO          | IMRO-400      | 966 Cable 1# | N/A        | N/A        |
| MULTI-DEVICE Controller               | ETS-LINDGREEN | 2090          | 126913       | N/A        | N/A        |
| Horn Antenna                          | SCHWARZBECK   | BBHA9170      | 9170-068     | Apr. 09,16 | Apr. 08,17 |
| Spectrum Analyzer                     | Agilent       | E4408B        | MY44211125   | Apr. 09,16 | Apr. 08,17 |
| High Pass filter                      | Micro         | HPM50111      | 324216       | Apr. 09,16 | Apr. 08,17 |
| Constant temperature and humidity box | GF            | GTH-800-40-1P | MAA9906-005  | Apr. 09,16 | Apr. 08,17 |
| Attenuation                           | MCE           | 24-10-34      | BN9258       | Apr. 02,16 | Apr. 01,17 |
| Loop Antenna                          | ARA           | PLA-1030/B    | 1029         | Apr. 02,16 | Apr. 01,17 |
| Spectrum Analyzer                     | Agilent       | N9020A        | MY56070279   | Jul.26,16  | Jul.25,17  |

### 3. TEST SET-UP AND OPERATION MODES

#### 3.1. Principle of Configuration Selection

**Emission:** The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

#### 3.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators



*(EUT: Bluetooth Speaker )*

#### 3.3. Test Operation Mode and Test Software

None.

#### 3.4. Special Accessories and Auxiliary Equipment

|          |                                                                                                                                               |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Adapter: | Manufacturer: Cenique Infotainment Group Limited<br>I/P: AC 100~240V 50/60Hz 0.15A<br>O/P: DC 5V 0.7A<br>DC Line: Unshielded, detachable 1.2m |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------|

#### 3.5. Countermeasures to Achieve EMC Compliance

None.

#### 3.6. Test Environment:

Ambient conditions in the test laboratory:

| Items            | Actual |
|------------------|--------|
| Temperature (°C) | 21~23  |
| Humidity (%RH)   | 50~65  |



## 4. MAXIMUM PEAK OUTPUT POWER

### 4.1. Limits

| FCC Part15 (15.247) , Subpart C |                   |                     |                       |        |
|---------------------------------|-------------------|---------------------|-----------------------|--------|
| Section                         | Test Item         | Limit               | Frequency Range (MHz) | Result |
| 15.247 (b)(i)                   | Peak Output Power | 0.125 w or 20.96dBm | 2400-2483.5           | PASS   |

### 4.2. Test Procedure

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- Spectrum Setting : RBW > the 20 dB bandwidth of the emission being measured  
Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel  
VBW  $\geq$  RBW  
Sweep = auto  
Detector function = peak  
Trace = max hold

### 4.3. Test setup



Test data:

| 1Mbps        |                 |                         |             |
|--------------|-----------------|-------------------------|-------------|
| Test Channel | Frequency (MHz) | Peak Output Power (dBm) | LIMIT (dBm) |
| CH00         | 2402            | -1.081                  | 30          |
| CH39         | 2441            | -0.291                  | 30          |
| CH78         | 2480            | 0.002                   | 30          |
| 2Mbps        |                 |                         |             |
| CH00         | 2402            | -0.817                  | 20.96       |
| CH39         | 2441            | -0.041                  | 20.96       |
| CH78         | 2480            | 0.086                   | 20.96       |
| 3Mbps        |                 |                         |             |
| CH00         | 2402            | -0.905                  | 20.96       |
| CH39         | 2441            | -0.043                  | 20.96       |
| CH78         | 2480            | 0.462                   | 20.96       |

CH00 -1Mbps



CH39 -1Mbps



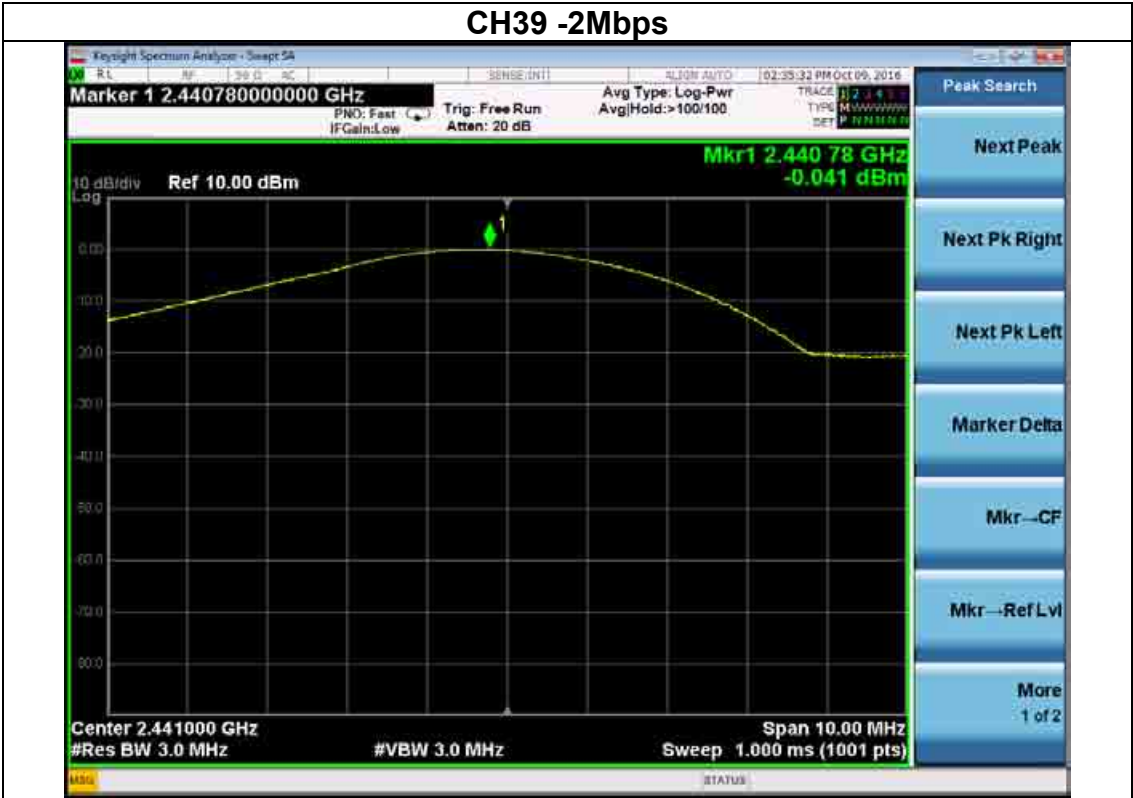
CH78 -1Mbps



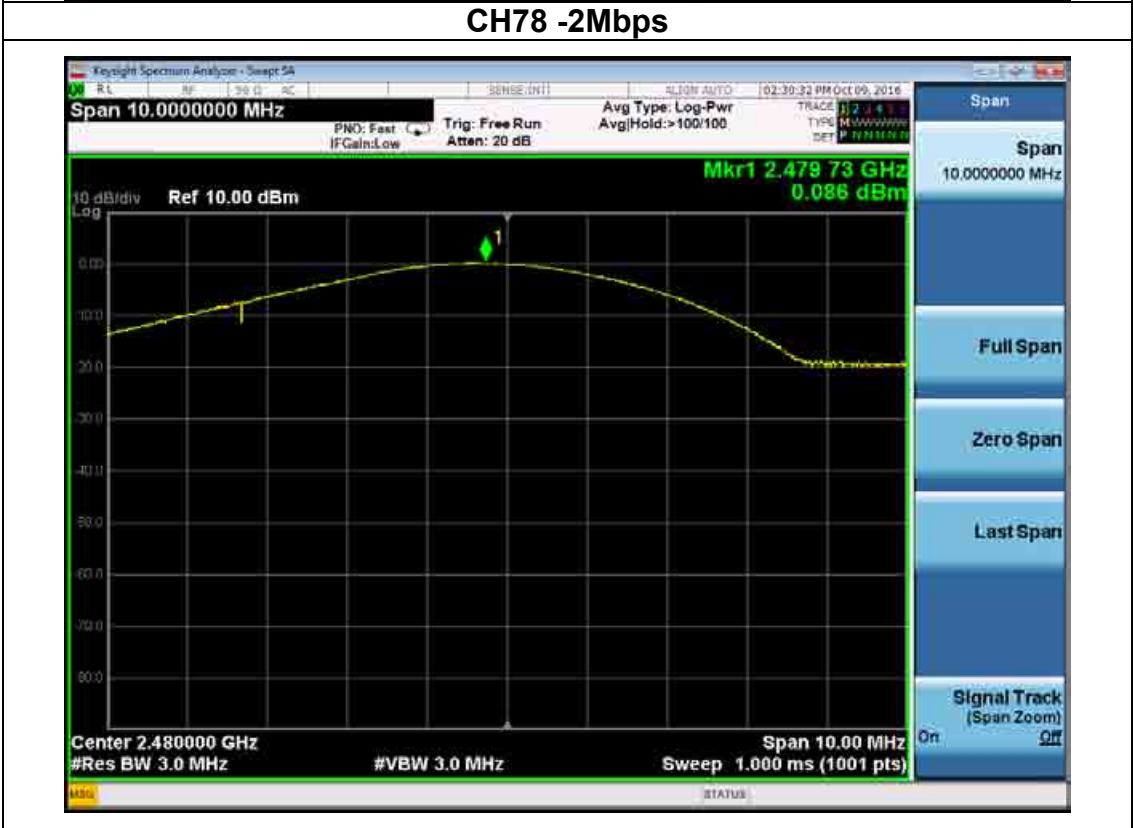
CH00 -2Mbps



CH39 -2Mbps



CH78 -2Mbps



CH00 -3Mbps



CH39 -3Mbps





## 5. EMISSION TEST RESULTS

### 5.1. Conducted Emission at the Mains Terminals Test

#### 5.1.1. Limit 15.207 limits

| FREQUENCY OF EMISSION (MHz) | CONDUCTED LIMIT (dB $\mu$ V) |          |
|-----------------------------|------------------------------|----------|
|                             | Quasi-peak                   | Average  |
| 0.15-0.5                    | 66 to 56                     | 56 to 46 |
| 0.5-5                       | 56                           | 46       |
| 5-30                        | 60                           | 50       |

#### 5.1.2. Test Setup

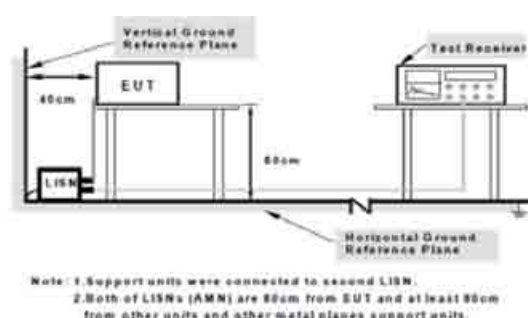
The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the center so as to form a bundle no longer than 0.4 m.

The EUT was kept 0.4 m from any other earthed conducting surface. Both sides of AC line were checked to find out the maximum conducted emission levels according to the test procedure during the conducted emission test.

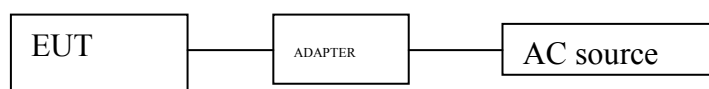
The frequency range from 150 kHz to 30 MHz was investigated.

The bandwidth of the test receiver was set at 9 kHz.

Pretest for all mode, The test data of the worst case condition(s) was reported on the following page.



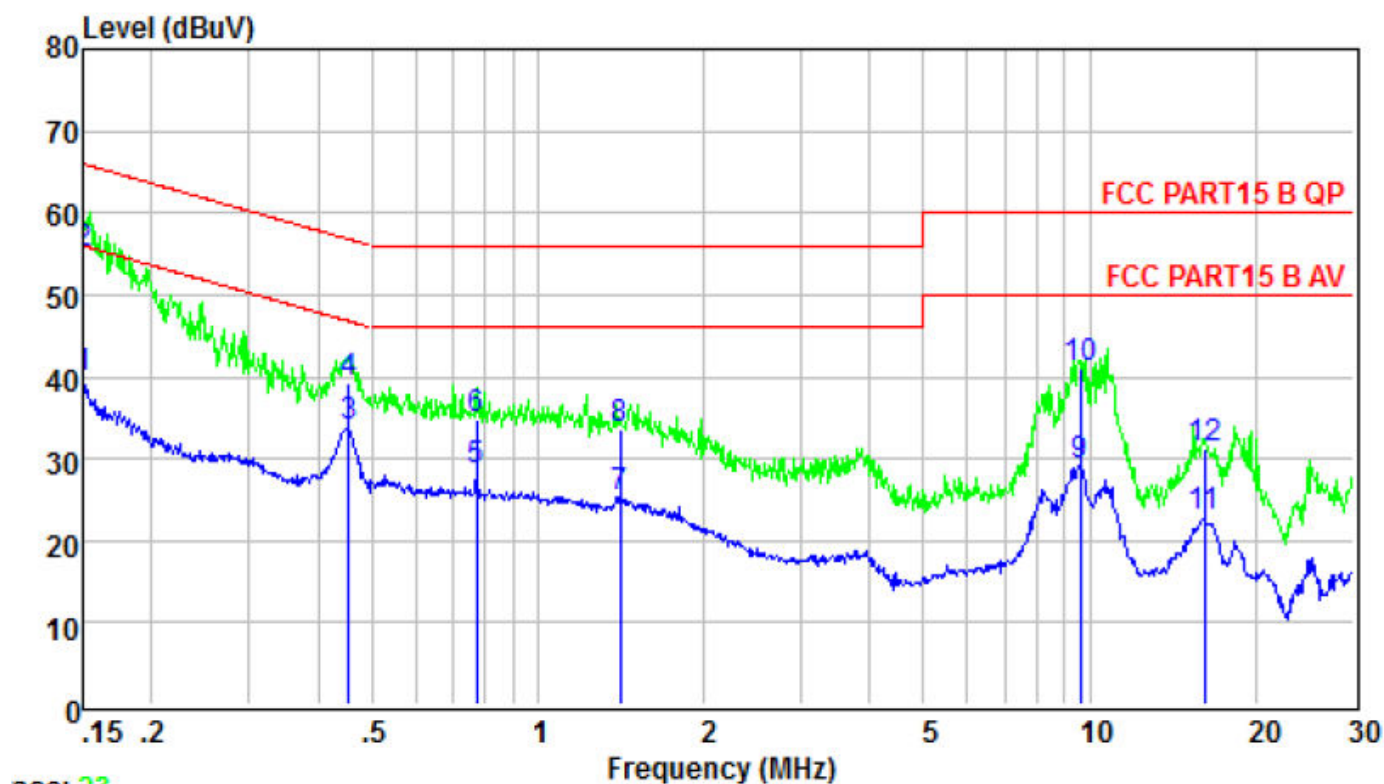
Block diagram of Test Setup





## 5.1.3. Test result

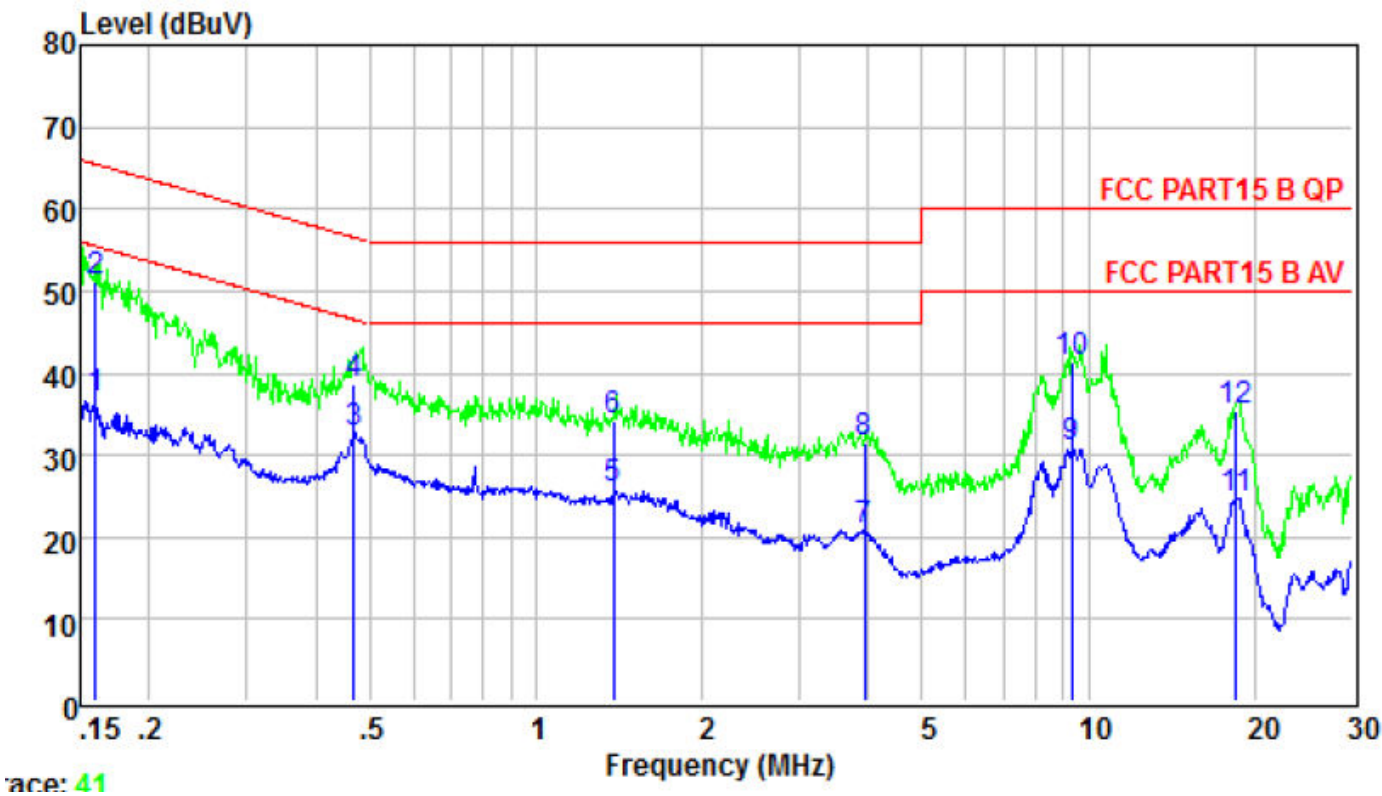
|                |                                    |                     |          |
|----------------|------------------------------------|---------------------|----------|
| EUT :          | Bluetooth Speaker                  | Model Name :        | TWIST-II |
| Temperature :  | 26 °C                              | Relative Humidity : | 54%      |
| Pressure :     | 1010hPa                            | Phase :             | L        |
| Test Voltage : | DC 5V from Adapter<br>AC 120V/60Hz | Test Mode :         | Mode 4   |



|    | Freq   | Level | Limit | Over   | Remark  |
|----|--------|-------|-------|--------|---------|
|    | MHz    | dBuV  | Line  | Limit  |         |
|    |        |       | dBuV  | dB     |         |
| 1  | 0.150  | 39.82 | 56.00 | -16.18 | Average |
| 2  | 0.150  | 54.96 | 66.00 | -11.04 | QP      |
| 3  | 0.454  | 34.01 | 46.80 | -12.79 | Average |
| 4  | 0.454  | 39.25 | 56.80 | -17.55 | QP      |
| 5  | 0.775  | 28.68 | 46.00 | -17.32 | Average |
| 6  | 0.775  | 34.65 | 56.00 | -21.35 | QP      |
| 7  | 1.411  | 25.29 | 46.00 | -20.71 | Average |
| 8  | 1.411  | 33.54 | 56.00 | -22.46 | QP      |
| 9  | 9.603  | 29.29 | 50.00 | -20.71 | Average |
| 10 | 9.603  | 40.91 | 60.00 | -19.09 | QP      |
| 11 | 16.140 | 22.96 | 50.00 | -27.04 | Average |
| 12 | 16.140 | 31.32 | 60.00 | -28.68 | QP      |

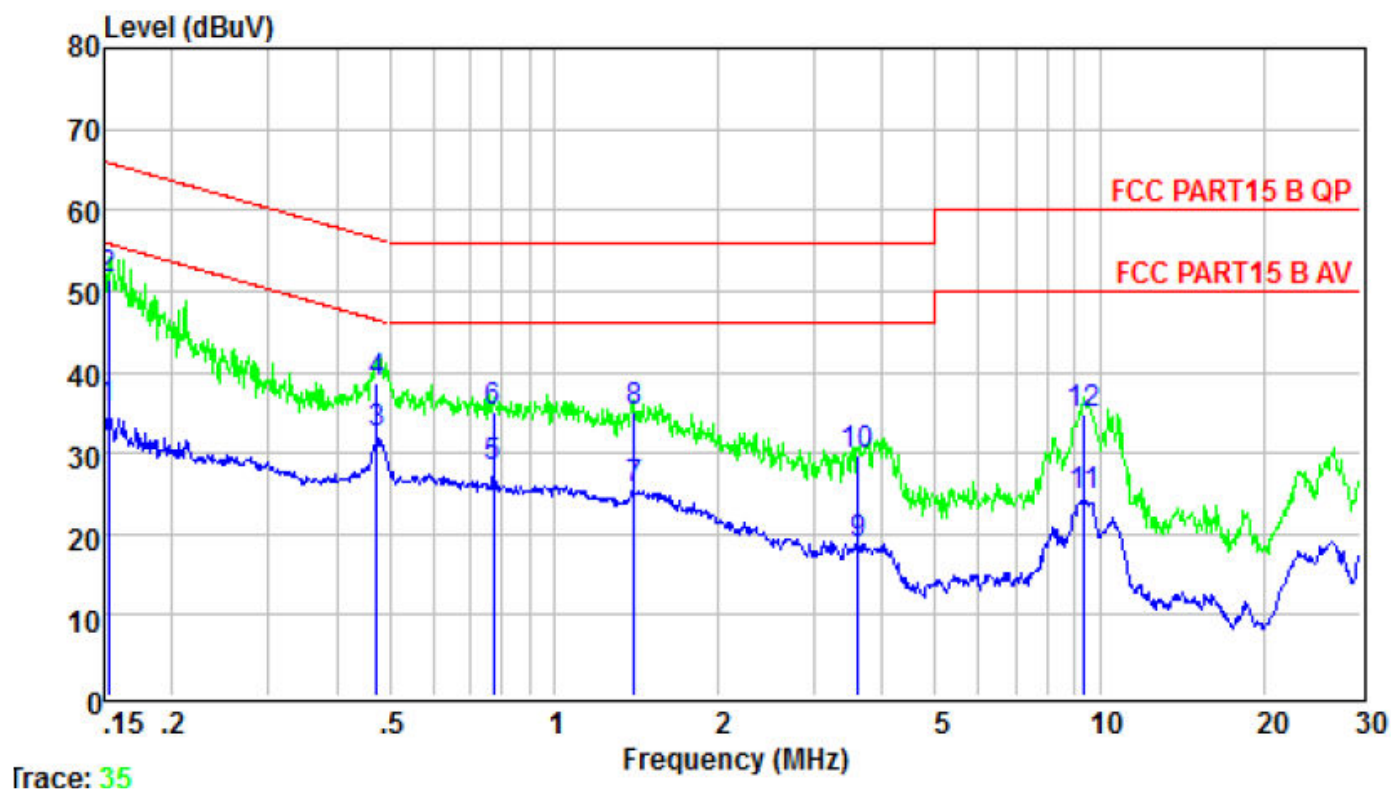


|                |                                      |                     |          |
|----------------|--------------------------------------|---------------------|----------|
| EUT :          | BLUETOOTH SPEAKER                    | Model Name :        | TWIST-II |
| Temperature :  | 26 °C                                | Relative Humidity : | 54%      |
| Pressure :     | 1010hPa                              | Phase :             | N        |
| Test Voltage : | DC 5.0V from Adapter<br>AC 120V/60Hz | Test Mode :         | Mode 4   |



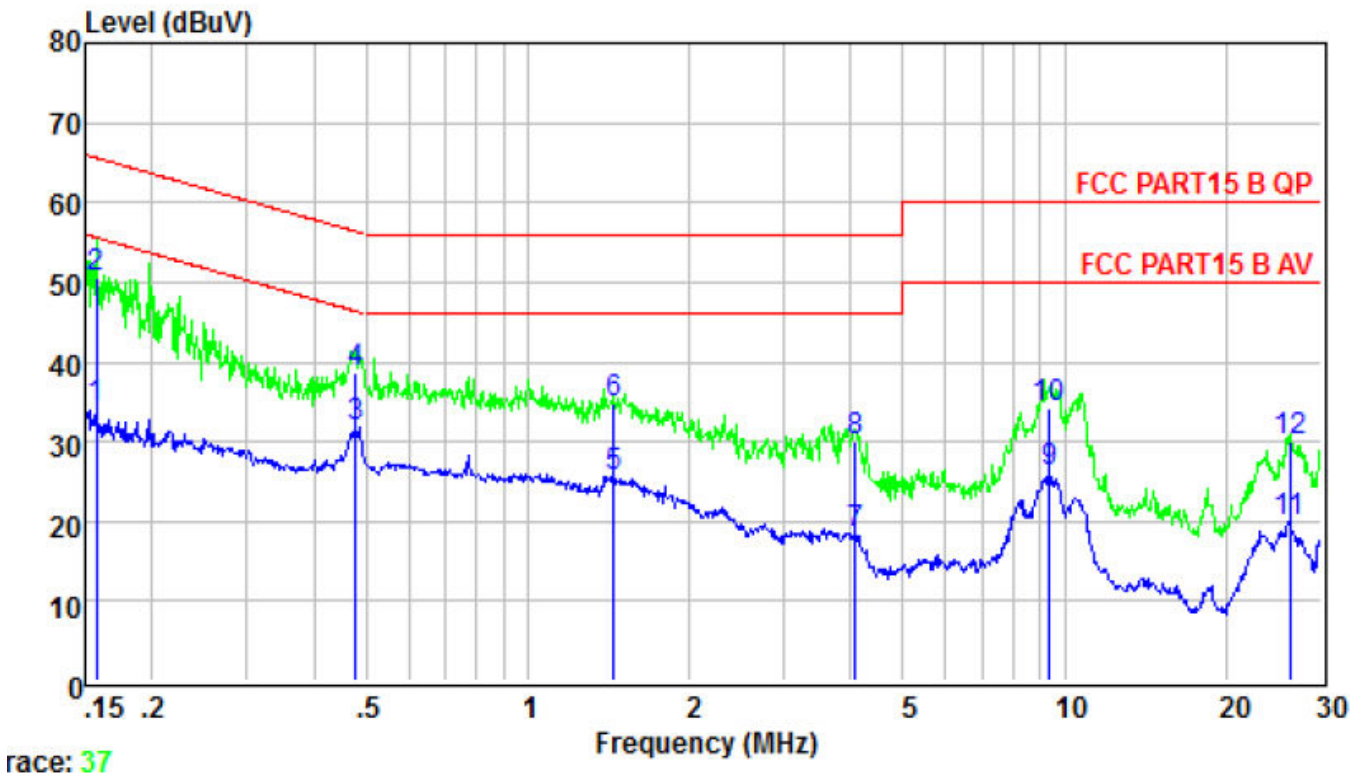
|    | Freq   | Level | Limit | Over   | Remark  |
|----|--------|-------|-------|--------|---------|
|    | MHz    | dBuV  | Line  | Limit  |         |
|    |        |       | dBuV  | dB     |         |
| 1  | 0.160  | 36.87 | 55.47 | -18.60 | Average |
| 2  | 0.160  | 51.23 | 65.47 | -14.24 | QP      |
| 3  | 0.469  | 32.78 | 46.54 | -13.76 | Average |
| 4  | 0.469  | 38.56 | 56.54 | -17.98 | QP      |
| 5  | 1.381  | 25.73 | 46.00 | -20.27 | Average |
| 6  | 1.381  | 34.34 | 56.00 | -21.66 | QP      |
| 7  | 3.922  | 20.76 | 46.00 | -25.24 | Average |
| 8  | 3.922  | 31.56 | 56.00 | -24.44 | QP      |
| 9  | 9.302  | 30.97 | 50.00 | -19.03 | Average |
| 10 | 9.302  | 41.36 | 60.00 | -18.64 | QP      |
| 11 | 18.524 | 24.77 | 50.00 | -25.23 | Average |
| 12 | 18.524 | 35.44 | 60.00 | -24.56 | QP      |

|                |                                    |                     |          |
|----------------|------------------------------------|---------------------|----------|
| EUT :          | BLUETOOTH SPEAKER                  | Model Name :        | TWIST-II |
| Temperature :  | 26 °C                              | Relative Humidity : | 54%      |
| Pressure :     | 1010hPa                            | Phase :             | L        |
| Test Voltage : | DC 5V from Adapter<br>AC 240V/60Hz | Test Mode :         | Mode 4   |



|    | Freq  | Level | Limit | Over   | Remark  |
|----|-------|-------|-------|--------|---------|
|    | MHz   | dBuV  | Line  | Limit  |         |
|    |       |       | dBuV  | dB     |         |
| 1  | 0.152 | 35.40 | 55.87 | -20.47 | Average |
| 2  | 0.152 | 51.35 | 65.87 | -14.52 | QP      |
| 3  | 0.474 | 32.45 | 46.45 | -14.00 | Average |
| 4  | 0.474 | 38.52 | 56.45 | -17.93 | QP      |
| 5  | 0.775 | 28.39 | 46.00 | -17.61 | Average |
| 6  | 0.775 | 34.96 | 56.00 | -21.04 | QP      |
| 7  | 1.403 | 25.46 | 46.00 | -20.54 | Average |
| 8  | 1.403 | 35.13 | 56.00 | -20.87 | QP      |
| 9  | 3.603 | 18.71 | 46.00 | -27.29 | Average |
| 10 | 3.603 | 29.67 | 56.00 | -26.33 | QP      |
| 11 | 9.352 | 24.75 | 50.00 | -25.25 | Average |
| 12 | 9.352 | 34.87 | 60.00 | -25.13 | QP      |

|                |                                    |                     |          |
|----------------|------------------------------------|---------------------|----------|
| EUT :          | Bluetooth Speaker                  | Model Name :        | TWIST-II |
| Temperature :  | 26 °C                              | Relative Humidity : | 54%      |
| Pressure :     | 1010hPa                            | Phase :             | N        |
| Test Voltage : | DC 5V from Adapter<br>AC 240V/60Hz | Test Mode :         | Mode 4   |



|    | Freq   | Level | Limit | Over   | Remark  |
|----|--------|-------|-------|--------|---------|
|    | MHz    | dBuV  | Line  | Limit  |         |
|    |        |       | dBuV  | dB     |         |
| 1  | 0.157  | 34.07 | 55.60 | -21.53 | Average |
| 2  | 0.157  | 50.56 | 65.60 | -15.04 | QP      |
| 3  | 0.479  | 31.81 | 46.36 | -14.55 | Average |
| 4  | 0.479  | 38.59 | 56.36 | -17.77 | QP      |
| 5  | 1.449  | 25.62 | 46.00 | -20.38 | Average |
| 6  | 1.449  | 34.66 | 56.00 | -21.34 | QP      |
| 7  | 4.070  | 18.49 | 46.00 | -27.51 | Average |
| 8  | 4.070  | 30.04 | 56.00 | -25.96 | QP      |
| 9  | 9.352  | 26.10 | 50.00 | -23.90 | Average |
| 10 | 9.352  | 34.12 | 60.00 | -25.88 | QP      |
| 11 | 26.278 | 20.05 | 50.00 | -29.95 | Average |
| 12 | 26.278 | 30.01 | 60.00 | -29.99 | QP      |

## 5.2. Radiated Emission Test

### 5.2.1. Limit 15.209 limits

| FREQUENCY<br>MHz | DISTANCE<br>Meters | FIELD STRENGTHS LIMIT                                                                             |                                   |
|------------------|--------------------|---------------------------------------------------------------------------------------------------|-----------------------------------|
|                  |                    | $\mu\text{V}/\text{m}$                                                                            | $\text{dB}(\mu\text{V})/\text{m}$ |
| 30 ~ 88          | 3                  | 100                                                                                               | 40.0                              |
| 88 ~ 216         | 3                  | 150                                                                                               | 43.5                              |
| 216 ~ 960        | 3                  | 200                                                                                               | 46.0                              |
| 960 ~ 1000       | 3                  | 500                                                                                               | 54.0                              |
| Above 1000       | 3                  | 74.0 $\text{dB}(\mu\text{V})/\text{m}$ (Peak)<br>54.0 $\text{dB}(\mu\text{V})/\text{m}$ (Average) |                                   |

### 5.2.2. Restricted bands of operation

| MHz                        | MHz                   | MHz             | GHz              |
|----------------------------|-----------------------|-----------------|------------------|
| 0.090 - 0.110              | 16.42 - 16.423        | 399.9 - 410     | 4.5 - 5.15       |
| <sup>1</sup> 0.495 - 0.505 | 16.69475 - 16.69525   | 608 - 614       | 5.35 - 5.46      |
| 2.1735 - 2.1905            | 16.80425 - 16.80475   | 960 - 1240      | 7.25 - 7.75      |
| 4.125 - 4.128              | 25.5 - 25.67          | 1300 - 1427     | 8.025 - 8.5      |
| 4.17725 - 4.17775          | 37.5 - 38.25          | 1435 - 1626.5   | 9.0 - 9.2        |
| 4.20725 - 4.20775          | 73 - 74.6             | 1645.5 - 1646.5 | 9.3 - 9.5        |
| 6.215 - 6.218              | 74.8 - 75.2           | 1660 - 1710     | 10.6 - 12.7      |
| 6.26775 - 6.26825          | 108 - 121.94          | 1718.8 - 1722.2 | 13.25 - 13.4     |
| 6.31175 - 6.31225          | 123 - 138             | 2200 - 2300     | 14.47 - 14.5     |
| 8.291 - 8.294              | 149.9 - 150.05        | 2310 - 2390     | 15.35 - 16.2     |
| 8.362 - 8.366              | 156.52475 - 156.52525 | 2483.5 - 2500   | 17.7 - 21.4      |
| 8.37625 - 8.38675          | 156.7 - 156.9         | 2690 - 2900     | 22.01 - 23.12    |
| 8.41425 - 8.41475          | 162.0125 - 167.17     | 3260 - 3267     | 23.6 - 24.0      |
| 12.29 - 12.293             | 167.72 - 173.2        | 3332 - 3339     | 31.2 - 31.8      |
| 12.51975 - 12.52025        | 240 - 285             | 3345.8 - 3358   | 36.43 - 36.5     |
| 12.57675 - 12.57725        | 322 - 335.4           | 3600 - 4400     | ( <sup>2</sup> ) |

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

### 5.2.3. Test setup

The EUT was placed on a turn table which was 0.8 m above the ground blow 1G and 1.5m above 1G. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector.

The bandwidth of the EMI test receiver is set at 120kHz for frequency range from 30MHz to 1000 MHz.

The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz, the EUT was placed on a turn table which was 1.5 m above the ground, for all test, used peak detector.

The frequency range from 30MHz to 10<sup>th</sup> harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.

2. Measurement Uncertainty:  $\pm 3.2$  dB at a level of confidence of 95%.

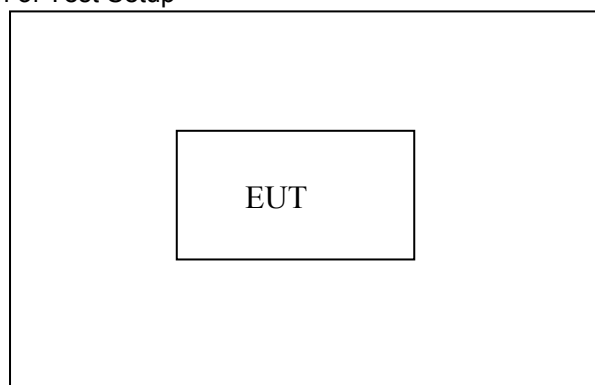
3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.

4. For emissions below 1GHz, pretest for all mode, The test data of the worst case condition(s) was reported on the following pages.

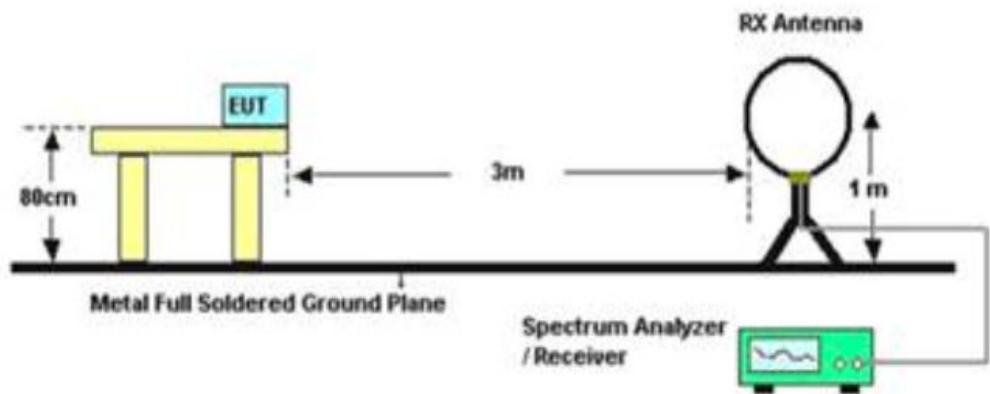
5. EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation).

6. We pretest all modulation, the worst data was show in the report.

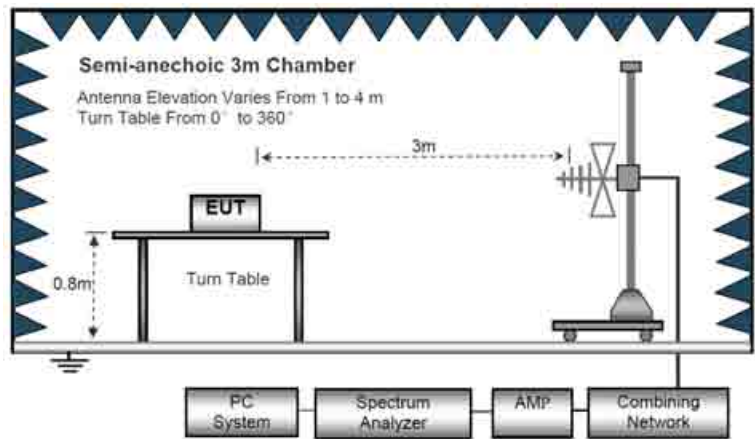
Block diagram of Test Setup



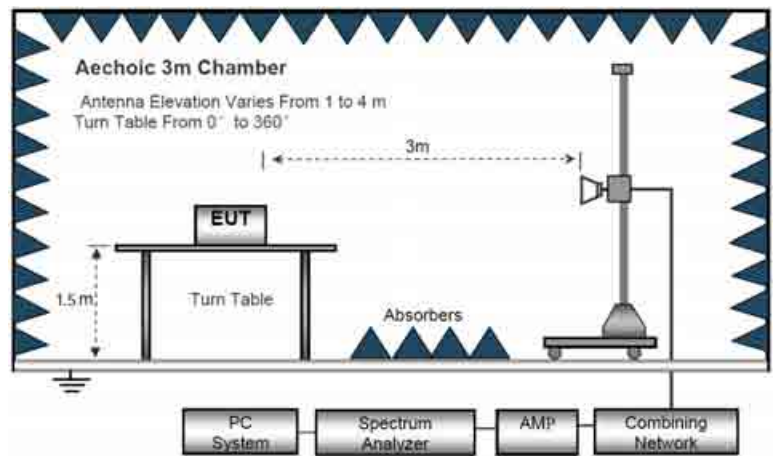
Radiated Emission Test-Up Frequency Below 30MHz



30MHz- 1GHz



Above 1GHz



**Below 30MHz**

| Freq. | Reading  | Limit    | Margin | State    |
|-------|----------|----------|--------|----------|
| (MHz) | (dBuV/m) | (dBuV/m) | (dB)   | P/F      |
| --    | --       | --       | --     | <b>P</b> |
| --    | --       | --       | --     | <b>P</b> |

**Note:**

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $40 \log (\text{specific distance}/\text{test distance})$ (dB);

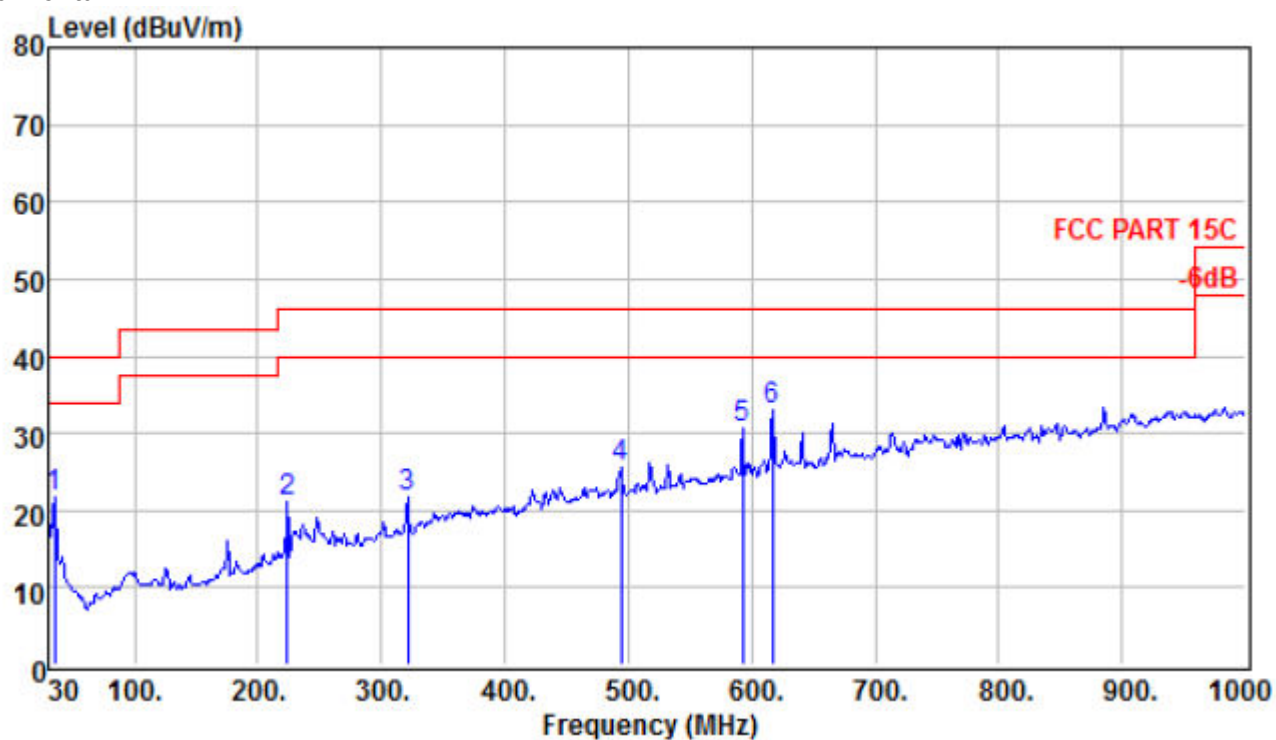
Limit line = specific limits(dBuv) + distance extrapolation factor.



|                |                   |                     |          |
|----------------|-------------------|---------------------|----------|
| EUT :          | Bluetooth Speaker | Model Name :        | TWIST-II |
| Temperature :  | 20 °C             | Relative Humidity : | 48%      |
| Pressure :     | 1010hPa           | Test Mode :         | TX       |
| Test Voltage : | DC 3.7V           |                     |          |

## 30- 1GHz

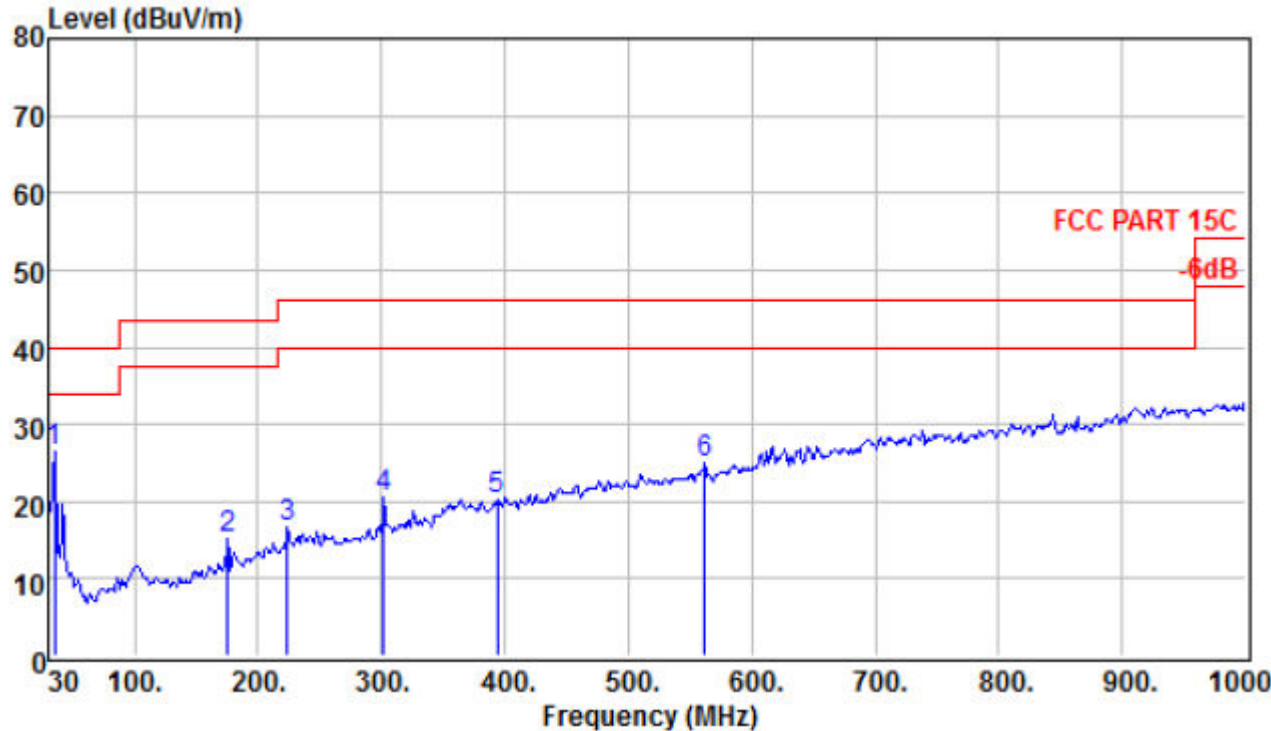
## Horizontal



|   | Freq    | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark |
|---|---------|------------|---------------|----------------|------------|--------|------------|------------|--------|
|   | MHz     | dBuV       | dB            | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |        |
| 1 | 34.850  | 36.48      | 31.38         | 15.94          | 0.56       | 21.60  | 40.00      | -18.40     | QP     |
| 2 | 224.000 | 38.39      | 30.95         | 12.15          | 1.53       | 21.12  | 46.00      | -24.88     | QP     |
| 3 | 321.000 | 36.22      | 30.84         | 14.39          | 2.02       | 21.79  | 46.00      | -24.21     | QP     |
| 4 | 493.660 | 34.70      | 30.59         | 18.60          | 2.77       | 25.48  | 46.00      | -20.52     | QP     |
| 5 | 592.600 | 37.61      | 30.68         | 20.36          | 3.29       | 30.58  | 46.00      | -15.42     | QP     |
| 6 | 616.850 | 39.27      | 30.64         | 21.07          | 3.38       | 33.08  | 46.00      | -12.92     | QP     |



Vertical



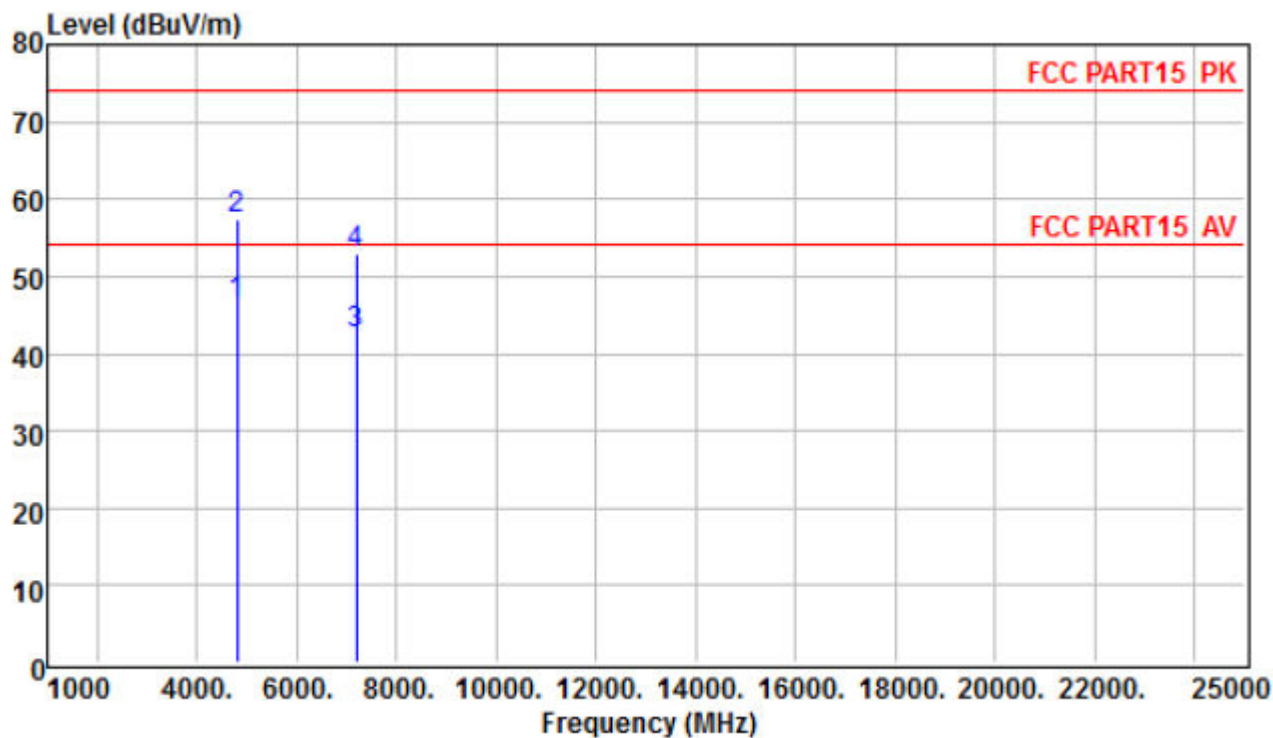
|   | Freq    | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark |
|---|---------|------------|---------------|----------------|------------|--------|------------|------------|--------|
|   | MHz     | dBuV       | dB            | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |        |
| 1 | 34.850  | 41.25      | 31.38         | 15.94          | 0.56       | 26.37  | 40.00      | -13.63     | QP     |
| 2 | 175.500 | 34.75      | 31.17         | 10.27          | 1.39       | 15.24  | 43.50      | -28.26     | QP     |
| 3 | 224.000 | 34.05      | 30.95         | 12.15          | 1.53       | 16.78  | 46.00      | -29.22     | QP     |
| 4 | 301.600 | 35.77      | 30.92         | 13.84          | 1.94       | 20.63  | 46.00      | -25.37     | QP     |
| 5 | 393.750 | 32.17      | 30.63         | 16.27          | 2.37       | 20.18  | 46.00      | -25.82     | QP     |
| 6 | 561.560 | 33.05      | 30.88         | 19.64          | 3.12       | 24.93  | 46.00      | -21.07     | QP     |

**NOTE:**  
Absolute Level= ReadingLevel+antenna Factor+cable loss-preamp factor,  
Over Limit= Absolute Level – Limit  
3Mbps(High channel) is the worst mode,only worst case is presented in the report.

## Above 1GHz

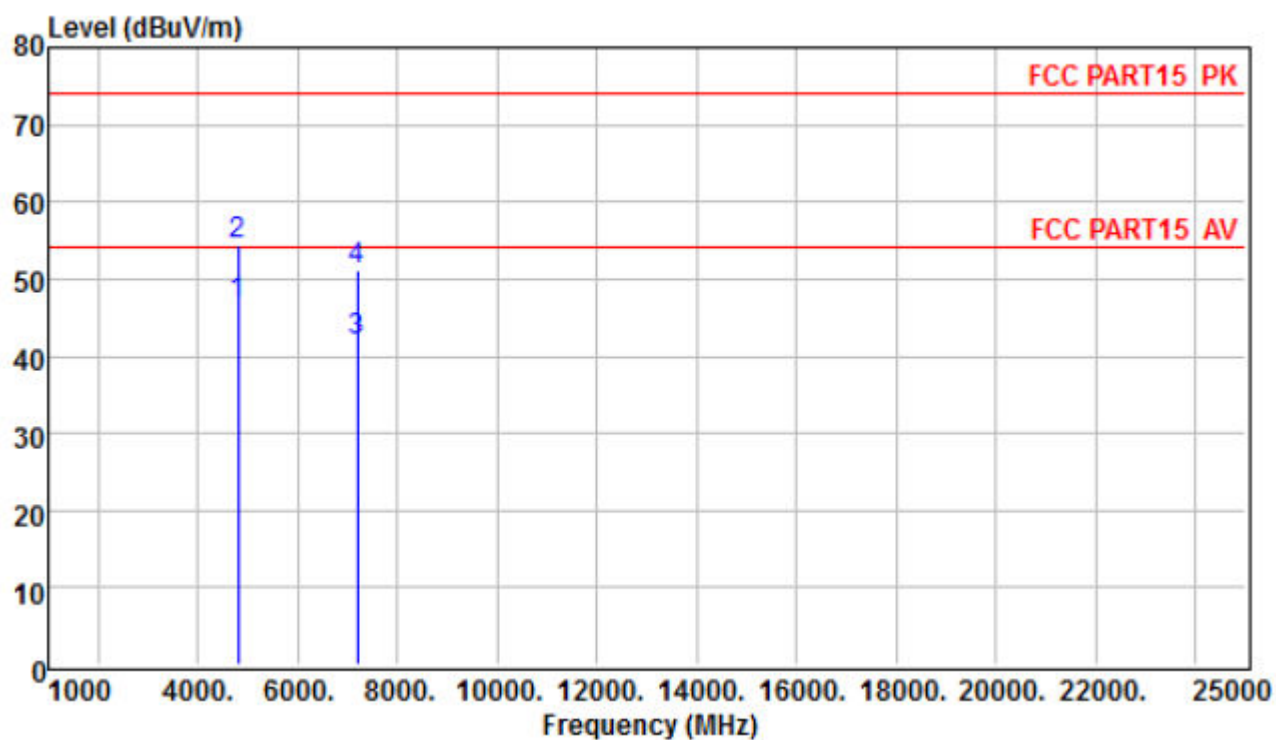
|                |                   |                     |            |
|----------------|-------------------|---------------------|------------|
| EUT :          | Bluetooth Speaker | Model Name :        | TWIST-II   |
| Temperature :  | 20 °C             | Relative Humidity : | 48%        |
| Pressure :     | 1010hPa           | Test Mode :         | 1Mbps-2402 |
| Test Voltage : | DC 3.7V           |                     |            |

## Vertical



|   | Freq     | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       | dB            | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4804.000 | 29.08      | 27.49         | 32.94          | 11.96      | 46.49  | 54.00      | -7.51      | Average |
| 2 | 4804.000 | 39.91      | 27.49         | 32.94          | 11.96      | 57.32  | 74.00      | -16.68     | Peak    |
| 3 | 7206.000 | 28.49      | 27.94         | 25.28          | 16.61      | 42.44  | 54.00      | -11.56     | Average |
| 4 | 7206.000 | 39.05      | 27.94         | 25.28          | 16.61      | 53.00  | 74.00      | -21.00     | Peak    |

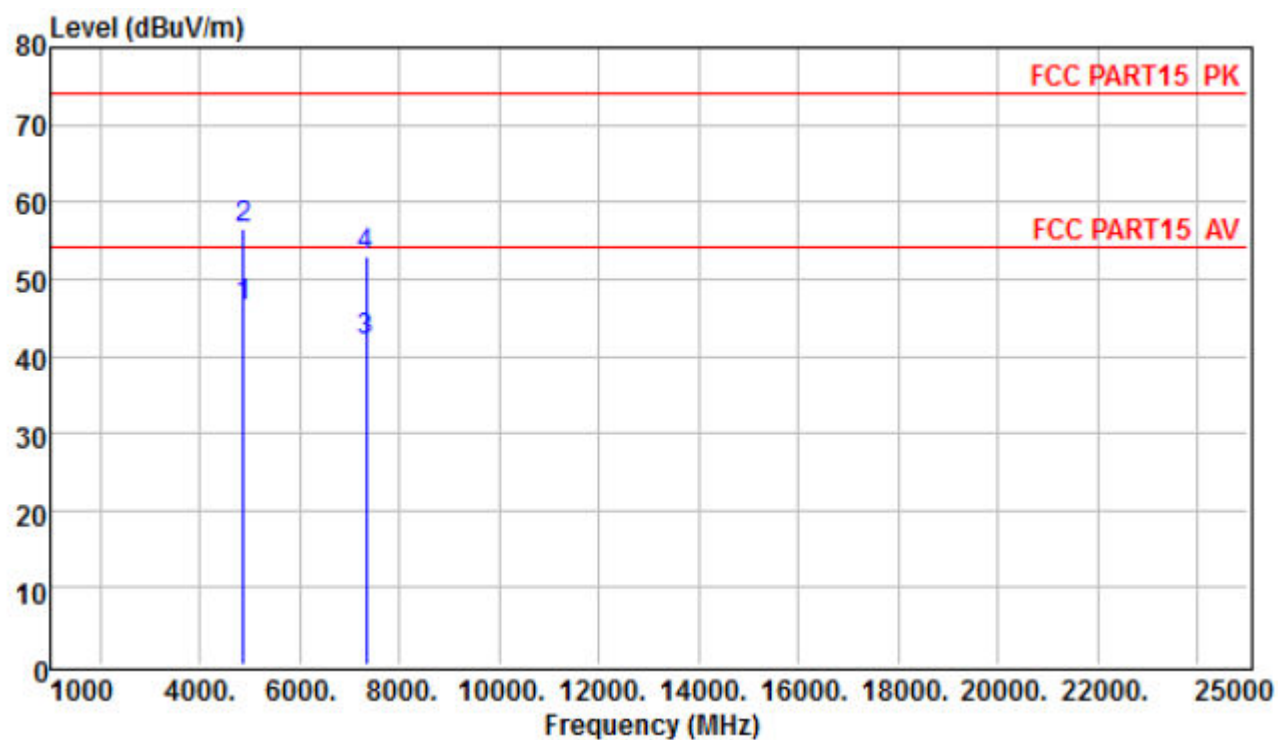
## Horizontal



|   | Freq     | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       | dB            | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4804.000 | 29.15      | 27.49         | 32.94          | 11.96      | 46.56  | 54.00      | -7.44      | Average |
| 2 | 4804.000 | 36.93      | 27.49         | 32.94          | 11.96      | 54.34  | 74.00      | -19.66     | Peak    |
| 3 | 7206.000 | 28.10      | 27.94         | 25.28          | 16.61      | 42.05  | 54.00      | -11.95     | Average |
| 4 | 7206.000 | 37.11      | 27.94         | 25.28          | 16.61      | 51.06  | 74.00      | -22.94     | Peak    |

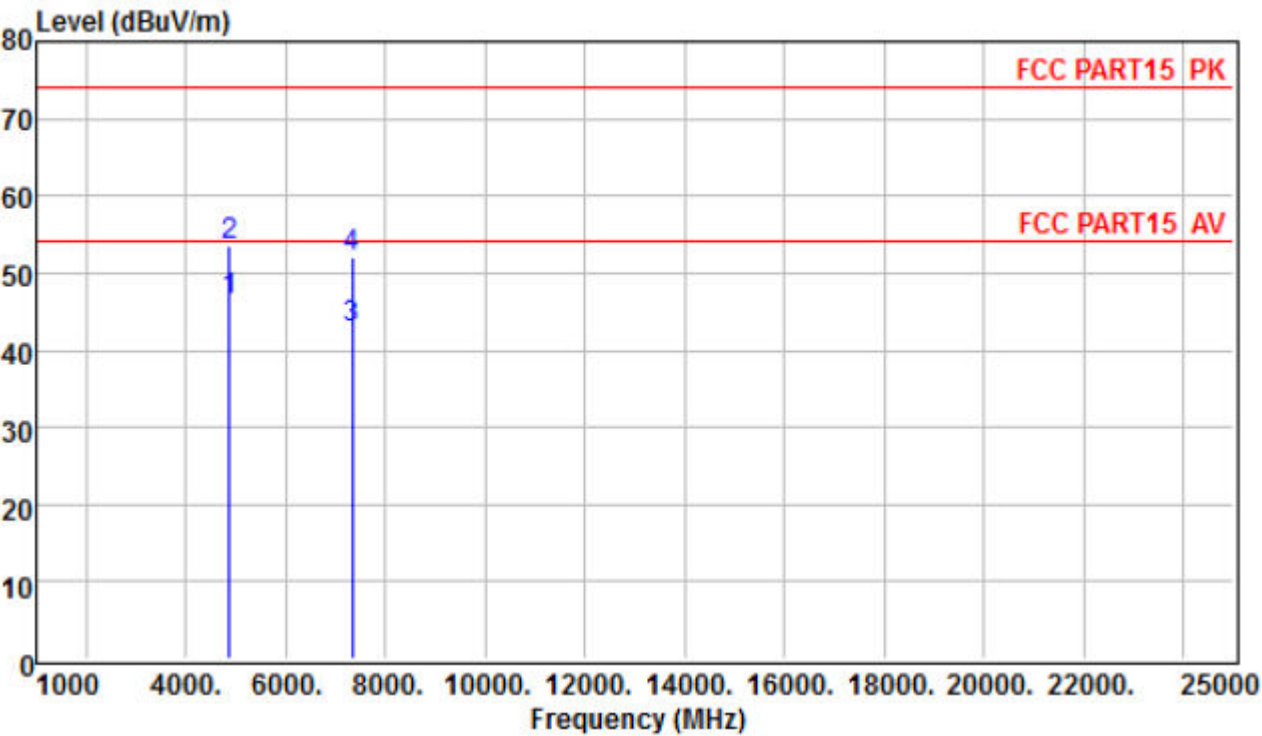
|                |                   |                     |             |
|----------------|-------------------|---------------------|-------------|
| EUT :          | Bluetooth Speaker | Model Name :        | TWIST-II    |
| Temperature :  | 20 °C             | Relative Humidity : | 48%         |
| Pressure :     | 1010hPa           | Test Mode :         | 1Mbps -2441 |
| Test Voltage : | DC 3.7V           |                     |             |

## Vertical



|   | Freq     | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       | dB            | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4882.000 | 29.77      | 27.53         | 32.11          | 12.14      | 46.49  | 54.00      | -7.51      | Average |
| 2 | 4882.000 | 39.73      | 27.53         | 32.11          | 12.14      | 56.45  | 74.00      | -17.55     | Peak    |
| 3 | 7323.000 | 28.99      | 27.96         | 24.33          | 16.62      | 41.98  | 54.00      | -12.02     | Average |
| 4 | 7323.000 | 39.99      | 27.96         | 24.33          | 16.62      | 52.98  | 74.00      | -21.02     | Peak    |

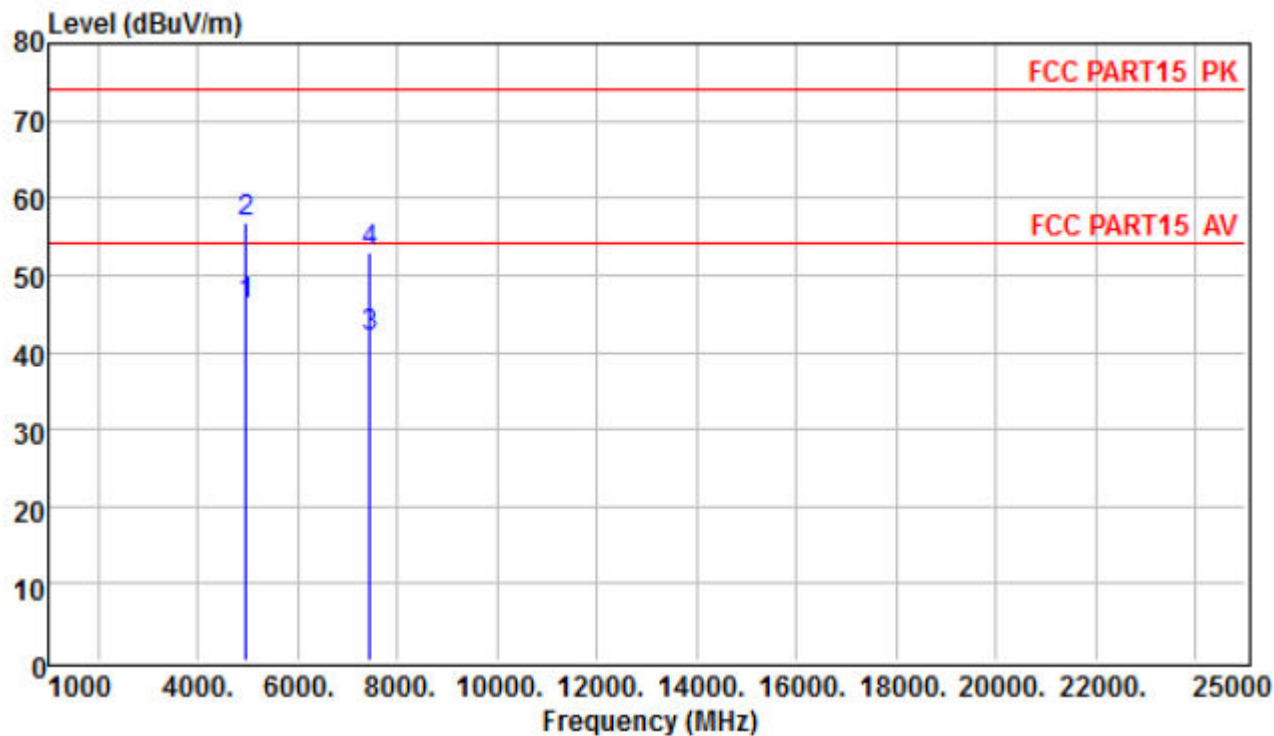
Horizontal



|   | Freq     | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       | dB            | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4882.000 | 29.73      | 27.53         | 32.11          | 12.14      | 46.45  | 54.00      | -7.55      | Average |
| 2 | 4882.000 | 36.72      | 27.53         | 32.11          | 12.14      | 53.44  | 74.00      | -20.56     | Peak    |
| 3 | 7323.000 | 29.88      | 27.96         | 24.33          | 16.62      | 42.87  | 54.00      | -11.13     | Average |
| 4 | 7323.000 | 38.99      | 27.96         | 24.33          | 16.62      | 51.98  | 74.00      | -22.02     | Peak    |

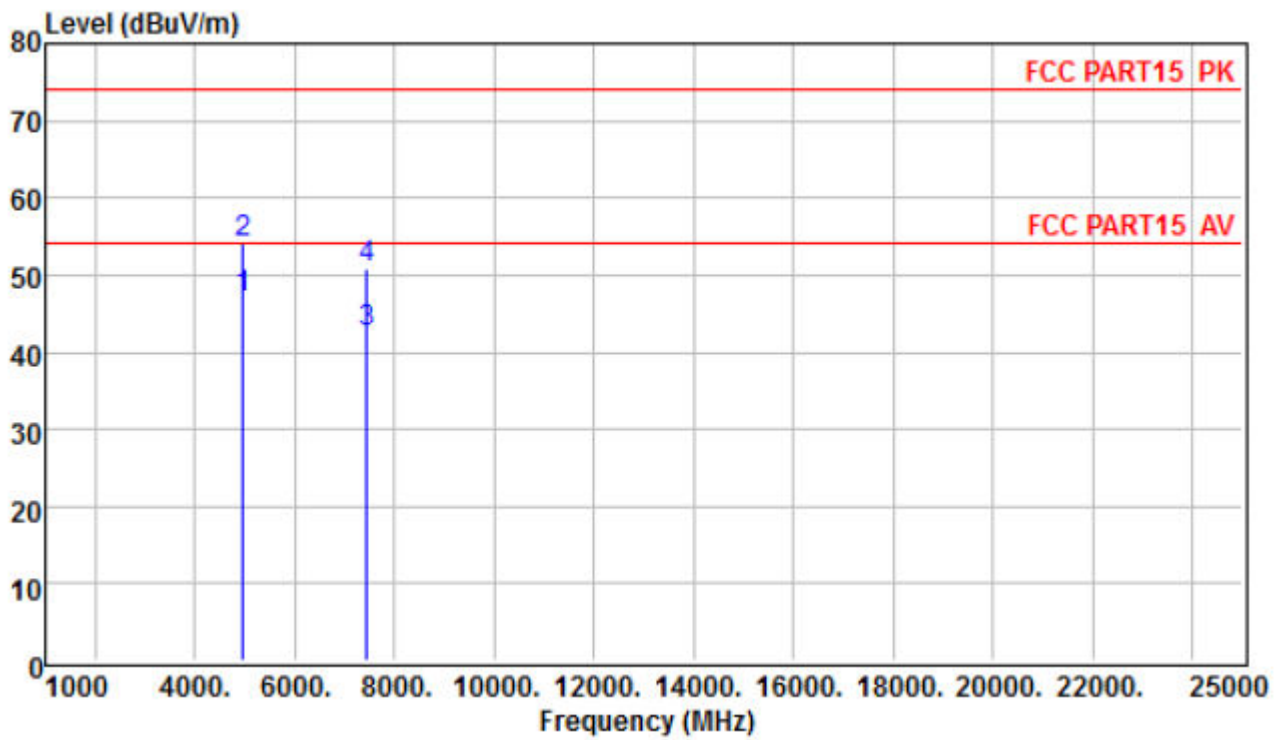
|                |                   |                     |             |
|----------------|-------------------|---------------------|-------------|
| EUT :          | Bluetooth Speaker | Model Name :        | TWIST-II    |
| Temperature :  | 20 °C             | Relative Humidity : | 48%         |
| Pressure :     | 1010hPa           | Test Mode :         | 1Mbps -2480 |
| Test Voltage : | DC 3.7V           |                     |             |

Vertical



|   | Freq     | Read Level | Preamplifier Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       | dB                  | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4960.000 | 29.88      | 27.58               | 31.32          | 12.36      | 45.98  | 54.00      | -8.02      | Average |
| 2 | 4960.000 | 40.77      | 27.58               | 31.32          | 12.36      | 56.87  | 74.00      | -17.13     | Peak    |
| 3 | 7440.000 | 28.86      | 27.99               | 24.38          | 16.62      | 41.87  | 54.00      | -12.13     | Average |
| 4 | 7440.000 | 39.86      | 27.99               | 24.38          | 16.62      | 52.87  | 74.00      | -21.13     | Peak    |

Horizontal

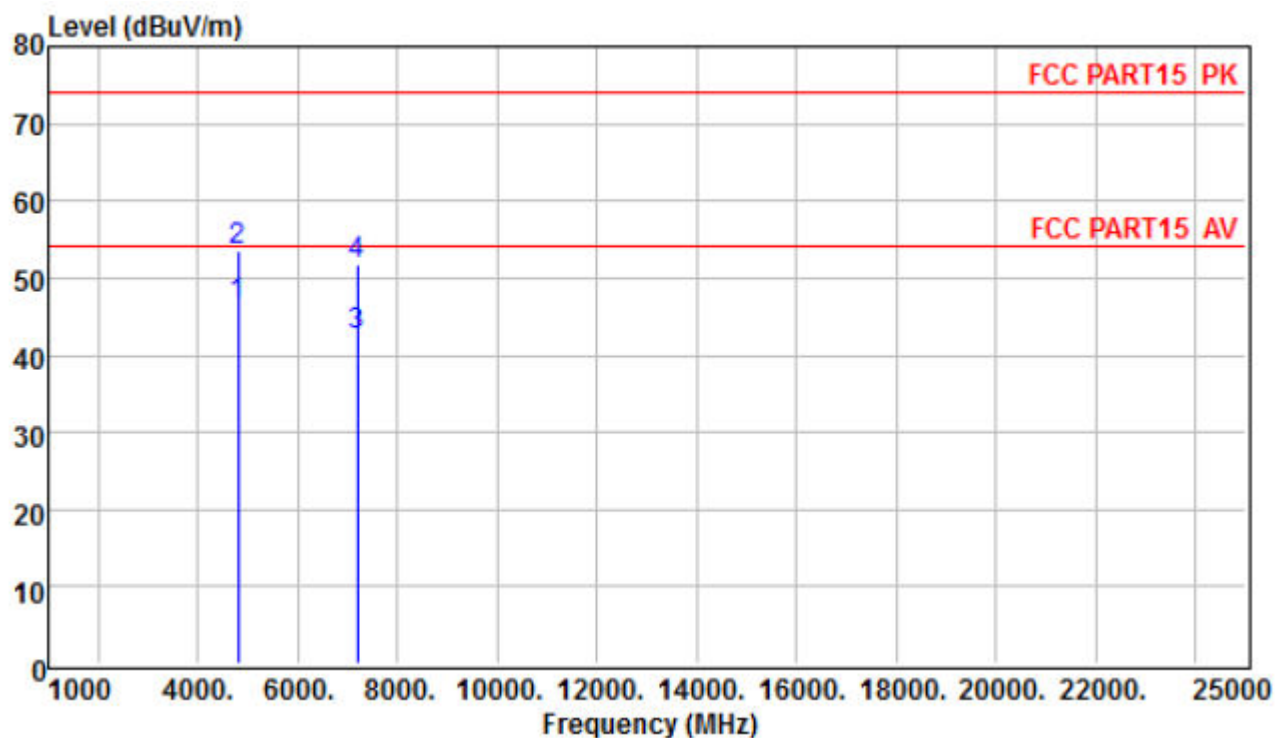


|   | Freq     | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       | dB            | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4960.000 | 30.75      | 27.58         | 31.32          | 12.36      | 46.85  | 54.00      | -7.15      | Average |
| 2 | 4960.000 | 37.88      | 27.58         | 31.32          | 12.36      | 53.98  | 74.00      | -20.02     | Peak    |
| 3 | 7440.000 | 29.66      | 27.99         | 24.38          | 16.62      | 42.67  | 54.00      | -11.33     | Average |
| 4 | 7440.000 | 37.86      | 27.99         | 24.38          | 16.62      | 50.87  | 74.00      | -23.13     | Peak    |



|                |                   |                     |            |
|----------------|-------------------|---------------------|------------|
| EUT :          | Bluetooth Speaker | Model Name :        | TWIST-II   |
| Temperature :  | 20 °C             | Relative Humidity : | 48%        |
| Pressure :     | 1010hPa           | Test Mode :         | 2Mbps-2402 |
| Test Voltage : | DC 3.7V           |                     |            |

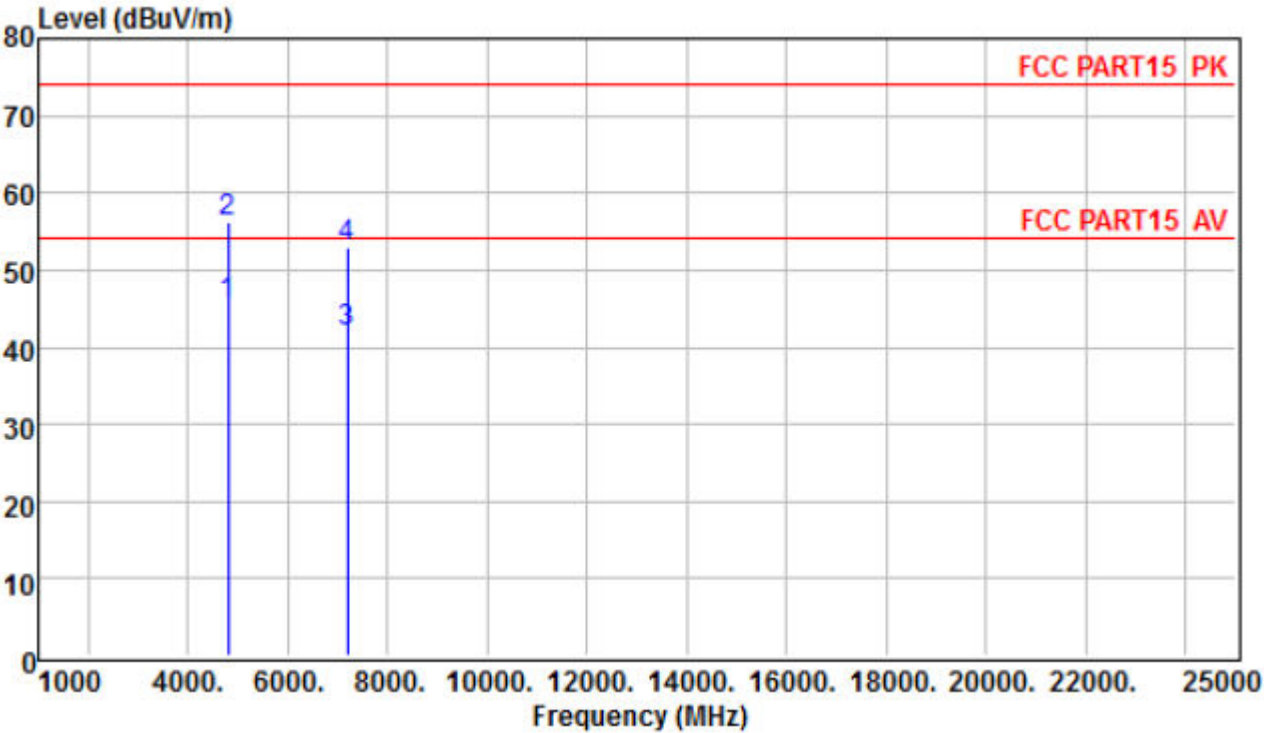
## Vertical



|   | Freq     | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       | dB            | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4804.000 | 29.03      | 27.49         | 32.94          | 11.96      | 46.44  | 54.00      | -7.56      | Average |
| 2 | 4804.000 | 36.15      | 27.49         | 32.94          | 11.96      | 53.56  | 74.00      | -20.44     | Peak    |
| 3 | 7206.000 | 28.70      | 27.94         | 25.28          | 16.61      | 42.65  | 54.00      | -11.35     | Average |
| 4 | 7206.000 | 37.70      | 27.94         | 25.28          | 16.61      | 51.65  | 74.00      | -22.35     | Peak    |



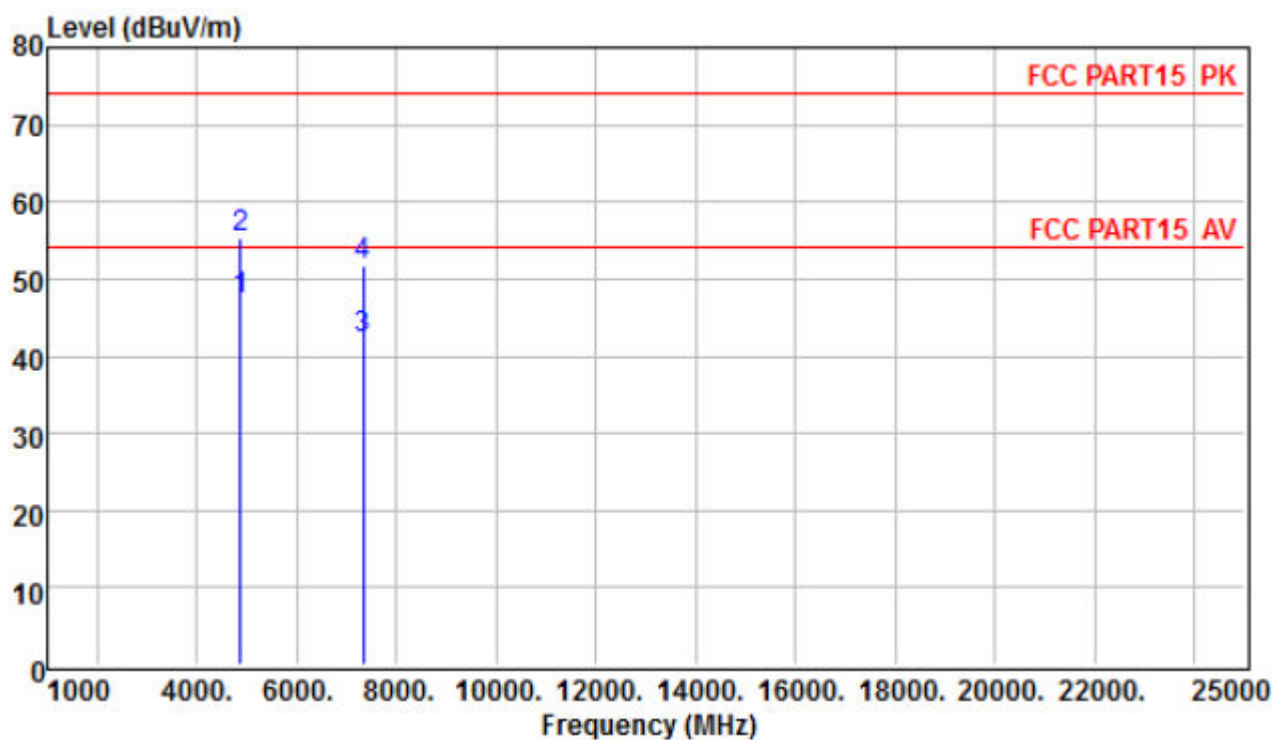
Horizontal



|   | Freq     | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       | dB            | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4804.000 | 28.04      | 27.49         | 32.94          | 11.96      | 45.45  | 54.00      | -8.55      | Average |
| 2 | 4804.000 | 38.93      | 27.49         | 32.94          | 11.96      | 56.34  | 74.00      | -17.66     | Peak    |
| 3 | 7206.000 | 28.03      | 27.94         | 25.28          | 16.61      | 41.98  | 54.00      | -12.02     | Average |
| 4 | 7206.000 | 38.91      | 27.94         | 25.28          | 16.61      | 52.86  | 74.00      | -21.14     | Peak    |

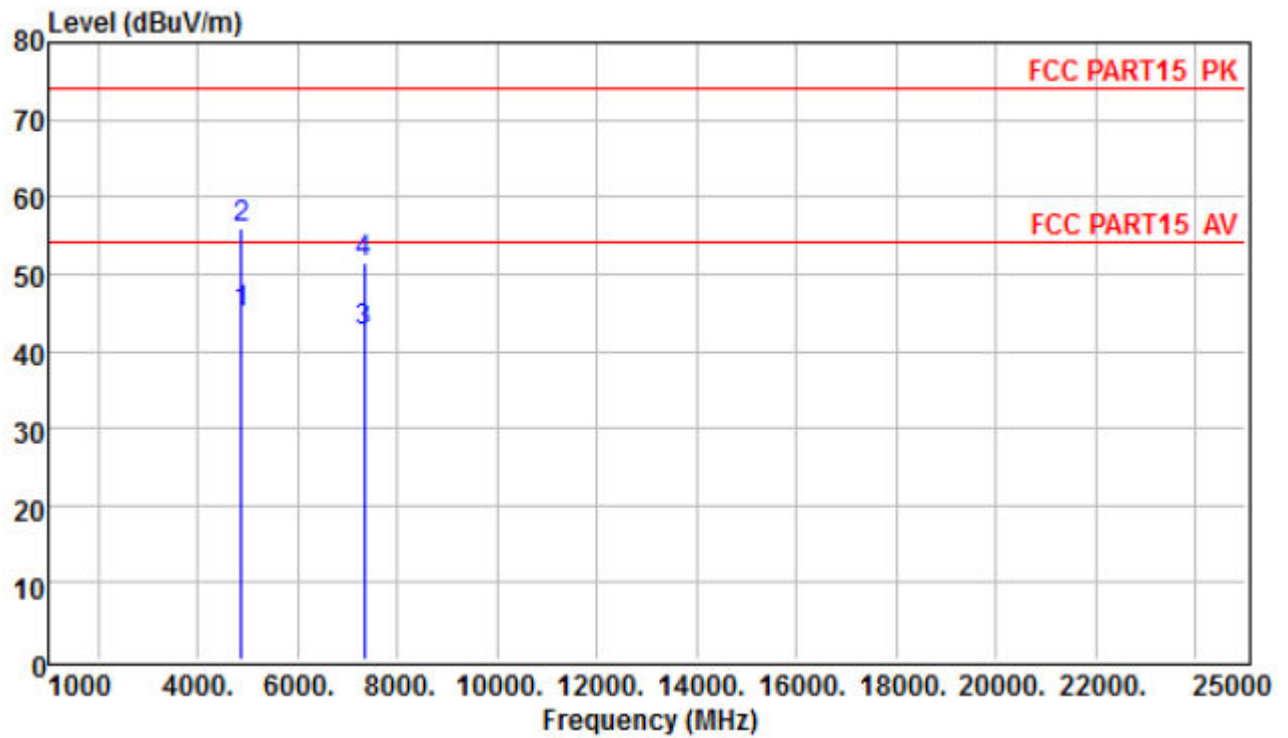
|                |                   |                     |             |
|----------------|-------------------|---------------------|-------------|
| EUT :          | Bluetooth Speaker | Model Name :        | TWIST-II    |
| Temperature :  | 20 °C             | Relative Humidity : | 48%         |
| Pressure :     | 1010hPa           | Test Mode :         | 2Mbps -2441 |
| Test Voltage : | DC 3.7V           |                     |             |

## Vertical



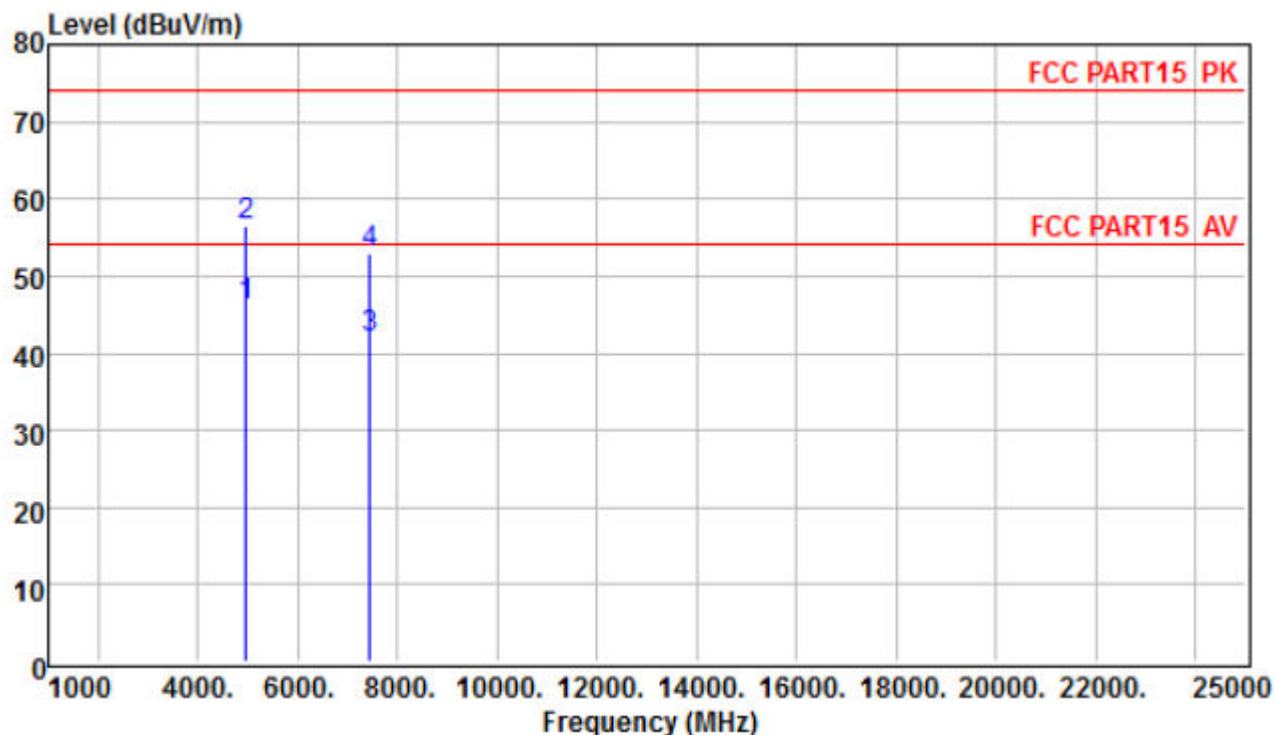
|   | Freq     | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Limit Line | Over Limit | Remark         |
|---|----------|------------|---------------|----------------|------------|------------|------------|----------------|
|   | MHz      | dBuV       | dB            | dB/m           | dB         | dBuV/m     | dB         |                |
| 1 | 4882.000 | 30.62      | 27.53         | 32.11          | 12.14      | 47.34      | 54.00      | -6.66 Average  |
| 2 | 4882.000 | 38.73      | 27.53         | 32.11          | 12.14      | 55.45      | 74.00      | -18.55 Peak    |
| 3 | 7323.000 | 29.17      | 27.96         | 24.33          | 16.62      | 42.16      | 54.00      | -11.84 Average |
| 4 | 7323.000 | 38.88      | 27.96         | 24.33          | 16.62      | 51.87      | 74.00      | -22.13 Peak    |

## Horizontal



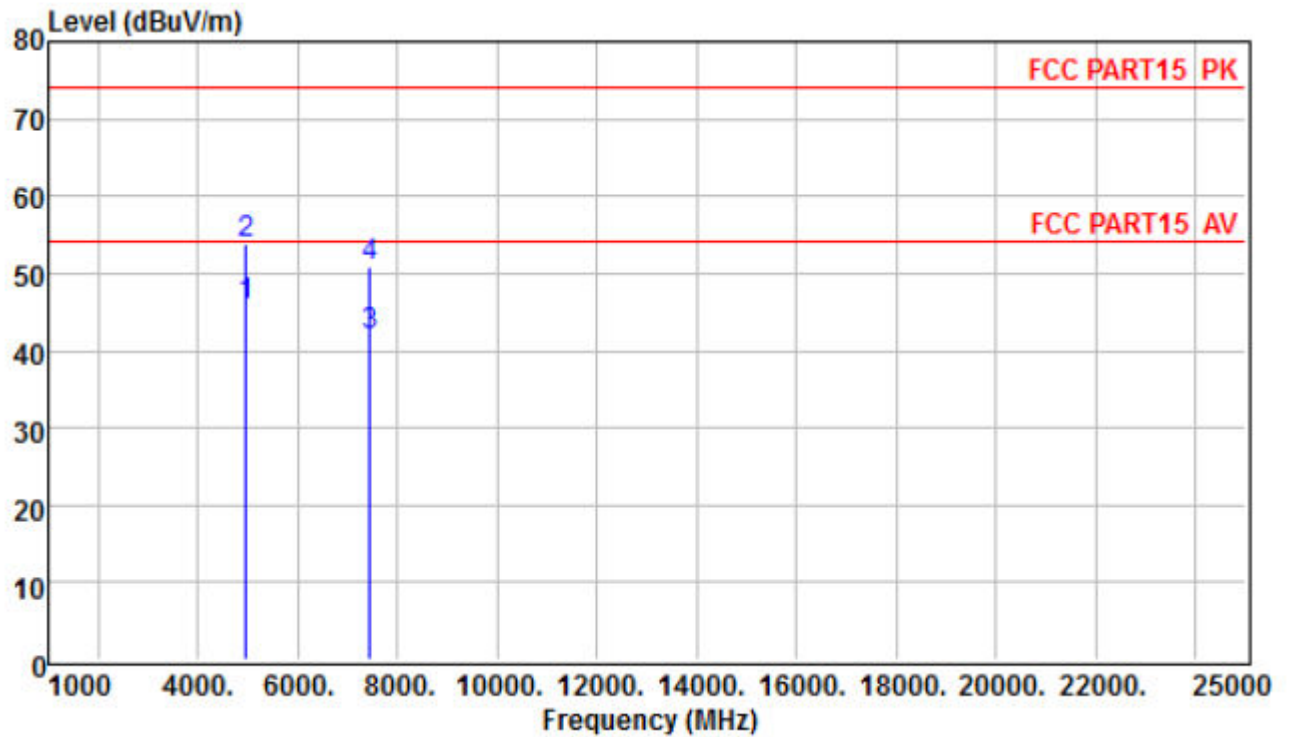
|   | Freq     | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       | dB            | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4882.000 | 28.26      | 27.53         | 32.11          | 12.14      | 44.98  | 54.00      | -9.02      | Average |
| 2 | 4882.000 | 39.31      | 27.53         | 32.11          | 12.14      | 56.03  | 74.00      | -17.97     | Peak    |
| 3 | 7323.000 | 29.68      | 27.96         | 24.33          | 16.62      | 42.67  | 54.00      | -11.33     | Average |
| 4 | 7323.000 | 38.46      | 27.96         | 24.33          | 16.62      | 51.45  | 74.00      | -22.55     | Peak    |

|                |                   |                     |             |
|----------------|-------------------|---------------------|-------------|
| EUT :          | Bluetooth Speaker | Model Name :        | TWIST-II    |
| Temperature :  | 20 °C             | Relative Humidity : | 48%         |
| Pressure :     | 1010hPa           | Test Mode :         | 2Mbps -2480 |
| Test Voltage : | DC 3.7V           |                     |             |

**Vertical**

|   | Freq     | Read Level | Preamplifier Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       | dB                  | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4960.000 | 30.13      | 27.58               | 31.32          | 12.36      | 46.23  | 54.00      | -7.77      | Average |
| 2 | 4960.000 | 40.33      | 27.58               | 31.32          | 12.36      | 56.43  | 74.00      | -17.57     | Peak    |
| 3 | 7440.000 | 28.86      | 27.99               | 24.38          | 16.62      | 41.87  | 54.00      | -12.13     | Average |
| 4 | 7440.000 | 39.96      | 27.99               | 24.38          | 16.62      | 52.97  | 74.00      | -21.03     | Peak    |

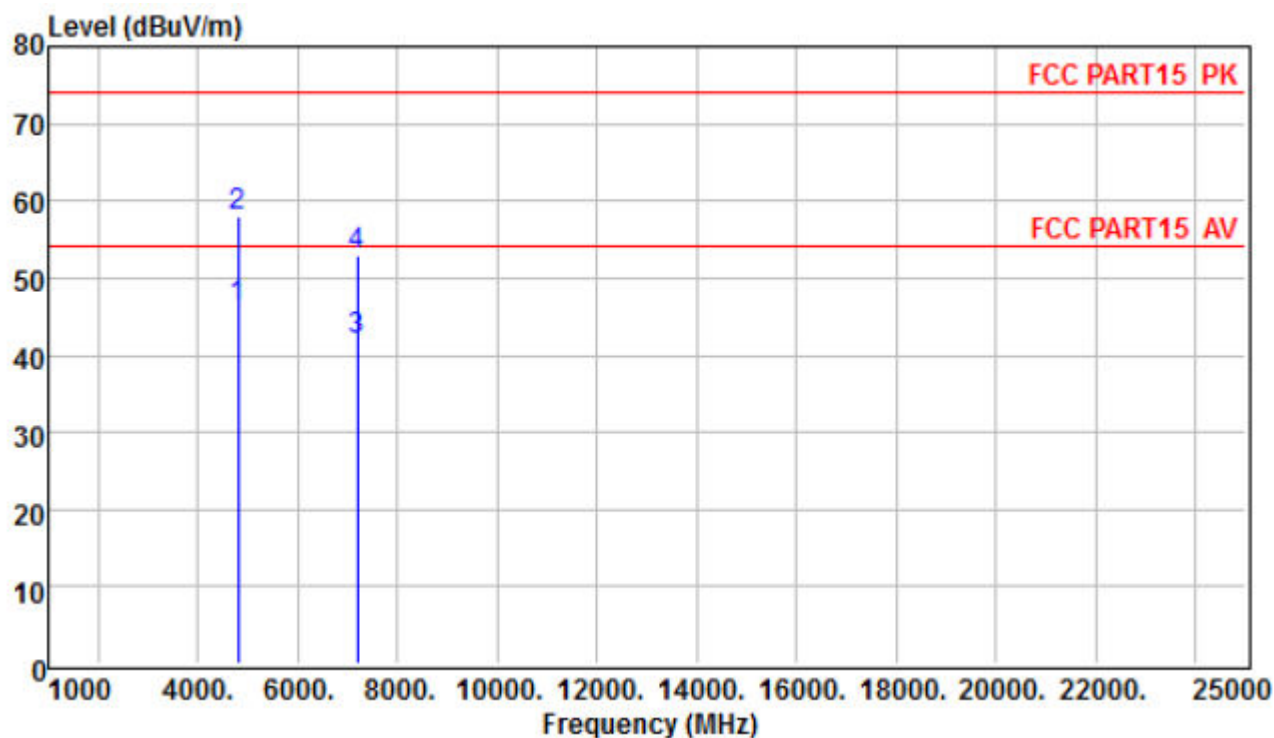
## Horizontal



|   | Freq     | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       | dB            | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4960.000 | 29.77      | 27.58         | 31.32          | 12.36      | 45.87  | 54.00      | -8.13      | Average |
| 2 | 4960.000 | 37.87      | 27.58         | 31.32          | 12.36      | 53.97  | 74.00      | -20.03     | Peak    |
| 3 | 7440.000 | 28.86      | 27.99         | 24.38          | 16.62      | 41.87  | 54.00      | -12.13     | Average |
| 4 | 7440.000 | 37.86      | 27.99         | 24.38          | 16.62      | 50.87  | 74.00      | -23.13     | Peak    |

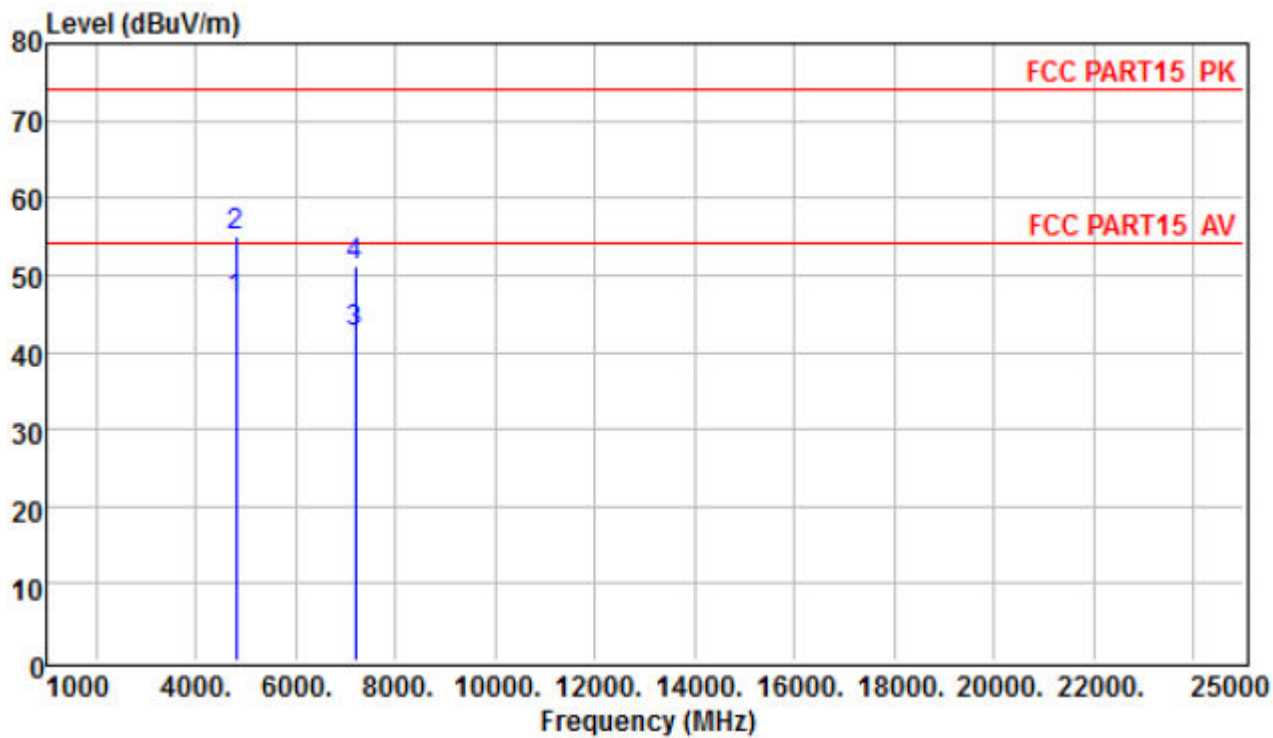
|                |                   |                     |            |
|----------------|-------------------|---------------------|------------|
| EUT :          | Bluetooth Speaker | Model Name :        | TWIST-II   |
| Temperature :  | 20 °C             | Relative Humidity : | 48%        |
| Pressure :     | 1010hPa           | Test Mode :         | 3Mbps-2402 |
| Test Voltage : | DC 3.7V           |                     |            |

## Vertical



|   | Freq     | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       |               | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4804.000 | 28.57      | 27.49         | 32.94          | 11.96      | 45.98  | 54.00      | -8.02      | Average |
| 2 | 4804.000 | 40.55      | 27.49         | 32.94          | 11.96      | 57.96  | 74.00      | -16.04     | Peak    |
| 3 | 7206.000 | 27.92      | 27.94         | 25.28          | 16.61      | 41.87  | 54.00      | -12.13     | Average |
| 4 | 7206.000 | 39.03      | 27.94         | 25.28          | 16.61      | 52.98  | 74.00      | -21.02     | Peak    |

Horizontal

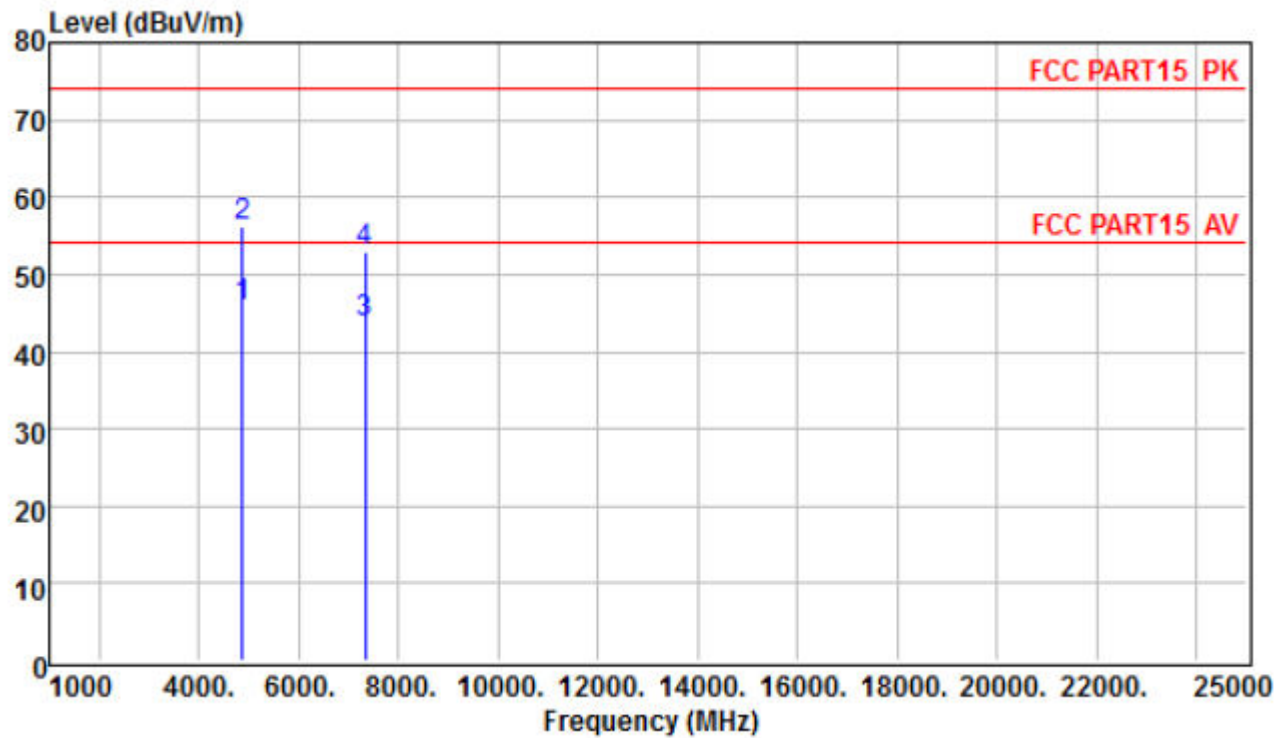


|   | Freq     | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       | dB            | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4804.000 | 29.15      | 27.49         | 32.94          | 11.96      | 46.56  | 54.00      | -7.44      | Average |
| 2 | 4804.000 | 37.74      | 27.49         | 32.94          | 11.96      | 55.15  | 74.00      | -18.85     | Peak    |
| 3 | 7206.000 | 28.72      | 27.94         | 25.28          | 16.61      | 42.67  | 54.00      | -11.33     | Average |
| 4 | 7206.000 | 37.17      | 27.94         | 25.28          | 16.61      | 51.12  | 74.00      | -22.88     | Peak    |



|                |                   |                     |             |
|----------------|-------------------|---------------------|-------------|
| EUT :          | Bluetooth Speaker | Model Name :        | TWIST-II    |
| Temperature :  | 20 °C             | Relative Humidity : | 48%         |
| Pressure :     | 1010hPa           | Test Mode :         | 3Mbps -2441 |
| Test Voltage : | DC 3.7V           |                     |             |

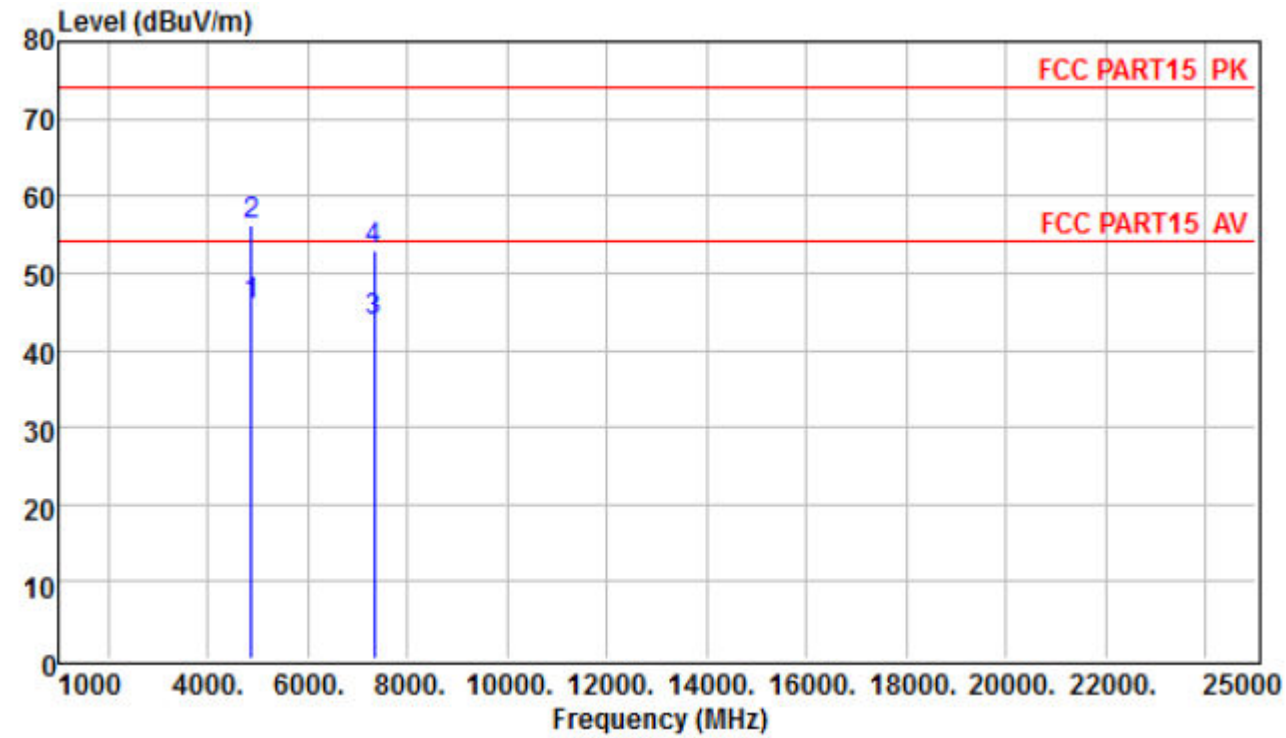
Vertical



|   | Freq     | Read Level | Preamplifier Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       | dB                  | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4882.000 | 29.15      | 27.53               | 32.11          | 12.14      | 45.87  | 54.00      | -8.13      | Average |
| 2 | 4882.000 | 39.15      | 27.53               | 32.11          | 12.14      | 55.87  | 74.00      | -18.13     | Peak    |
| 3 | 7323.000 | 30.57      | 27.96               | 24.33          | 16.62      | 43.56  | 54.00      | -10.44     | Average |
| 4 | 7323.000 | 38.68      | 27.96               | 24.33          | 16.62      | 51.67  | 74.00      | -22.33     | Peak    |



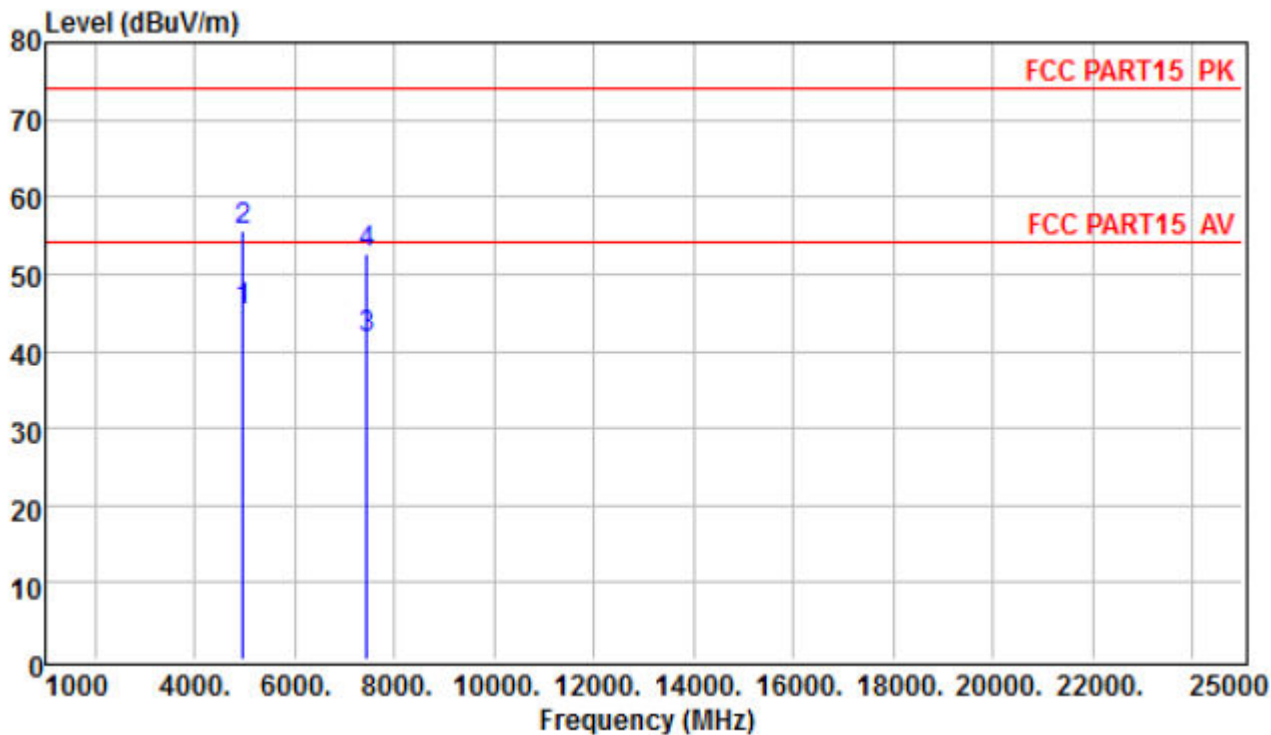
Horizontal



|   | Freq     | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit  | Over Limit | Remark  |
|---|----------|------------|---------------|----------------|------------|--------|--------|------------|---------|
|   | MHz      | dBuV       | dB            | dB/m           | dB         | dBuV/m | dBuV/m | dB         |         |
| 1 | 4882.000 | 29.16      | 27.53         | 32.11          | 12.14      | 45.88  | 54.00  | -8.12      | Average |
| 2 | 4882.000 | 39.62      | 27.53         | 32.11          | 12.14      | 56.34  | 74.00  | -17.66     | Peak    |
| 3 | 7323.000 | 30.77      | 27.96         | 24.33          | 16.62      | 43.76  | 54.00  | -10.24     | Average |
| 4 | 7323.000 | 39.88      | 27.96         | 24.33          | 16.62      | 52.87  | 74.00  | -21.13     | Peak    |

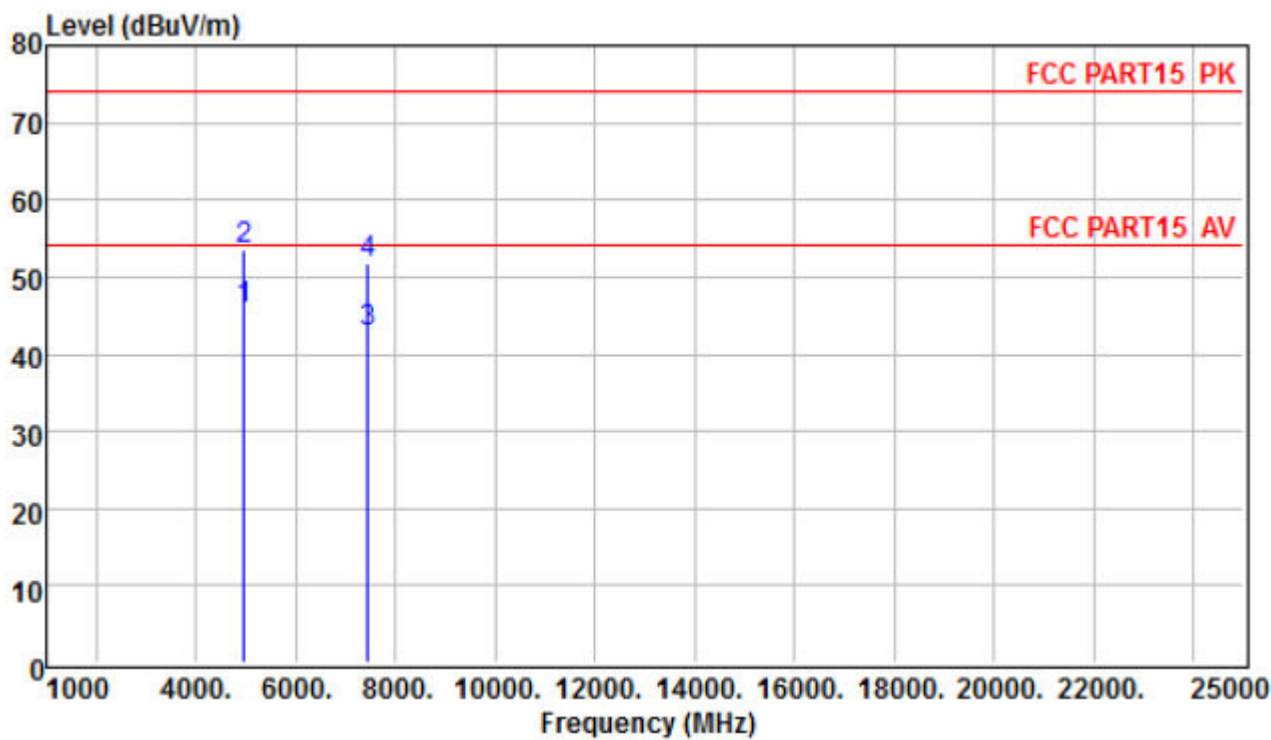
|                |                   |                     |             |
|----------------|-------------------|---------------------|-------------|
| EUT :          | Bluetooth Speaker | Model Name :        | TWIST-II    |
| Temperature :  | 20 °C             | Relative Humidity : | 48%         |
| Pressure :     | 1010hPa           | Test Mode :         | 3Mbps -2480 |
| Test Voltage : | DC 3.7V           |                     |             |

Vertical



|   | Freq     | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       | dB            | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4960.000 | 29.24      | 27.58         | 31.32          | 12.36      | 45.34  | 54.00      | -8.66      | Average |
| 2 | 4960.000 | 39.57      | 27.58         | 31.32          | 12.36      | 55.67  | 74.00      | -18.33     | Peak    |
| 3 | 7440.000 | 28.75      | 27.99         | 24.38          | 16.62      | 41.76  | 54.00      | -12.24     | Average |
| 4 | 7440.000 | 39.64      | 27.99         | 24.38          | 16.62      | 52.65  | 74.00      | -21.35     | Peak    |

Horizontal



|   | Freq     | Read Level | Preamp Factor | Antenna Factor | Cable Loss | Level  | Limit Line | Over Limit | Remark  |
|---|----------|------------|---------------|----------------|------------|--------|------------|------------|---------|
|   | MHz      | dBuV       | dB            | dB/m           | dB         | dBuV/m | dBuV/m     | dB         |         |
| 1 | 4960.000 | 29.77      | 27.58         | 31.32          | 12.36      | 45.87  | 54.00      | -8.13      | Average |
| 2 | 4960.000 | 37.35      | 27.58         | 31.32          | 12.36      | 53.45  | 74.00      | -20.55     | Peak    |
| 3 | 7440.000 | 29.86      | 27.99         | 24.38          | 16.62      | 42.87  | 54.00      | -11.13     | Average |
| 4 | 7440.000 | 38.64      | 27.99         | 24.38          | 16.62      | 51.65  | 74.00      | -22.35     | Peak    |

NOTE:

Absolute Level= ReadingLevel+antenna Factor+cable loss-preamp factor,

Over Limit= Absolute Level – Limit

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has not to be reported.

EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation)

For radiated bandedge test as follows:

| Frequency         | Meter Reading | antenna Factor | cable loss | preamp factor | Emission Level | Limits   | Margin | Detector Type | Comment    |
|-------------------|---------------|----------------|------------|---------------|----------------|----------|--------|---------------|------------|
| (MHz)             | (dBμV)        | (dB)           | (dB)       | (dB)          | (dBμV/m)       | (dBμV/m) | (dB)   |               |            |
| 1Mbps Non-hopping |               |                |            |               |                |          |        |               |            |
| 2390              | 34.23         | 30.44          | 8.94       | 26.32         | 47.29          | 74       | -26.71 | peak          | Vertical   |
| 2390              | 35.56         | 30.44          | 8.94       | 26.32         | 48.62          | 74       | -25.38 | peak          | Horizontal |
| 2483.5            | 35.53         | 30.05          | 9.07       | 26.34         | 48.31          | 74       | -25.69 | peak          | Vertical   |
| 2483.5            | 36.87         | 30.05          | 9.07       | 26.34         | 49.65          | 74       | -24.35 | peak          | Horizontal |
| 1Mbps hopping     |               |                |            |               |                |          |        |               |            |
| 2390              | 36.02         | 30.44          | 8.94       | 26.32         | 49.08          | 74       | -24.92 | peak          | Vertical   |
| 2390              | 35.87         | 30.44          | 8.94       | 26.32         | 48.93          | 74       | -25.07 | peak          | Horizontal |
| 2483.5            | 36.11         | 30.05          | 9.07       | 26.34         | 48.89          | 74       | -25.11 | peak          | Vertical   |
| 2483.5            | 36.09         | 30.05          | 9.07       | 26.34         | 48.87          | 74       | -25.13 | peak          | Horizontal |
| 2Mbps Non-hopping |               |                |            |               |                |          |        |               |            |
| 2390              | 35.88         | 30.44          | 8.94       | 26.32         | 48.94          | 74       | -25.06 | peak          | Vertical   |
| 2390              | 35.76         | 30.44          | 8.94       | 26.32         | 48.82          | 74       | -25.18 | peak          | Horizontal |
| 2483.5            | 36.83         | 30.05          | 9.07       | 26.34         | 49.61          | 74       | -24.39 | peak          | Vertical   |
| 2483.5            | 36.14         | 30.05          | 9.07       | 26.34         | 48.92          | 74       | -25.08 | peak          | Horizontal |
| 2Mbps hopping     |               |                |            |               |                |          |        |               |            |
| 2390              | 36.23         | 30.44          | 8.94       | 26.32         | 49.29          | 74       | -24.71 | peak          | Vertical   |
| 2390              | 35.12         | 30.44          | 8.94       | 26.32         | 48.18          | 74       | -25.82 | peak          | Horizontal |
| 2483.5            | 36.05         | 30.05          | 9.07       | 26.34         | 48.83          | 74       | -25.17 | peak          | Vertical   |
| 2483.5            | 36.45         | 30.05          | 9.07       | 26.34         | 49.23          | 74       | -24.77 | peak          | Horizontal |
| 3Mbps Non-hopping |               |                |            |               |                |          |        |               |            |
| 2390              | 36.32         | 30.44          | 8.94       | 26.32         | 49.38          | 74       | -24.62 | peak          | Vertical   |
| 2390              | 34.11         | 30.44          | 8.94       | 26.32         | 47.17          | 74       | -26.83 | peak          | Horizontal |
| 2483.5            | 35.07         | 30.05          | 9.07       | 26.34         | 47.85          | 74       | -26.15 | peak          | Vertical   |
| 2483.5            | 36.12         | 30.05          | 9.07       | 26.34         | 48.9           | 74       | -25.1  | peak          | Horizontal |
| 3Mbps hopping     |               |                |            |               |                |          |        |               |            |
| 2390              | 35.86         | 30.44          | 8.94       | 26.32         | 48.92          | 74       | -25.08 | peak          | Vertical   |
| 2390              | 34.81         | 30.44          | 8.94       | 26.32         | 47.87          | 74       | -26.13 | peak          | Horizontal |
| 2483.5            | 35.02         | 30.05          | 9.07       | 26.34         | 47.8           | 74       | -26.2  | peak          | Vertical   |
| 2483.5            | 35.76         | 30.05          | 9.07       | 26.34         | 48.54          | 74       | -25.46 | peak          | Horizontal |

If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

**Spurious Emission in Restricted Band:(1-25G)**

All the modulation modes have been tested and all other emissions more than 20dB below the limit, the worst result was report as below:

| Polar<br>(H/V)    | Frequency | Meter<br>Reading | antenna<br>Factor | cable<br>loss | preamp<br>factor | Emission<br>Level | Limits   | Margin | Detector<br>Type |
|-------------------|-----------|------------------|-------------------|---------------|------------------|-------------------|----------|--------|------------------|
|                   | (MHz)     | (dBuV)           | (dB)              | (dB)          | (dB)             | (dBuV/m)          | (dBuV/m) | (dB)   |                  |
| 1Mbps Non-hopping |           |                  |                   |               |                  |                   |          |        |                  |
| Vertical          | 3265.000  | 34.11            | 30.26             | 10.68         | 26.63            | 48.42             | 74       | -25.58 | Pk               |
| Horizontal        | 3265.000  | 35.09            | 30.26             | 10.68         | 26.63            | 49.4              | 74       | -24.6  | PK               |
| Vertical          | 4037.000  | 35.12            | 31.55             | 10.52         | 27.02            | 50.17             | 74       | -23.83 | Pk               |
| Horizontal        | 4037.000  | 33.04            | 31.55             | 10.52         | 27.02            | 48.09             | 74       | -25.91 | PK               |
| 1Mbps hopping     |           |                  |                   |               |                  |                   |          |        |                  |
| Vertical          | 3352.000  | 34.24            | 30.34             | 10.78         | 26.67            | 48.69             | 74       | -25.31 | Pk               |
| Horizontal        | 3352.000  | 33.02            | 30.34             | 10.78         | 26.67            | 47.47             | 74       | -26.53 | PK               |
| Vertical          | 4137.000  | 33.12            | 30.69             | 10.95         | 27.08            | 47.68             | 74       | -26.32 | Pk               |
| Horizontal        | 4137.000  | 34.43            | 30.69             | 10.95         | 27.08            | 48.99             | 74       | -25.01 | PK               |

## 6. 20DB BANDWIDTH

### 6.1. Limits

According to FCC Section 15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth( $10 \cdot \log 1\% = 20\text{dB}$ )taking the RF output power

### 6.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode transmitting.

2. Set the spectrum analyzer:

Span: approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel

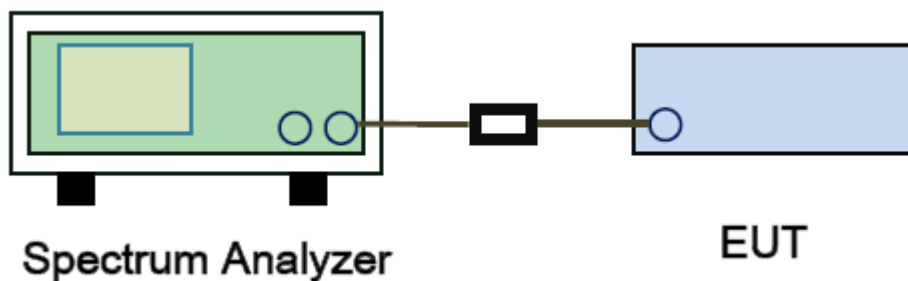
RBW  $\geq 1\%$  of the 20dB bandwidth

VBW  $\geq$  RBW

Sweep=auto

Detector function=peak

Trace=max hold



Test data:

|               |                         |                     |          |
|---------------|-------------------------|---------------------|----------|
| EUT :         | Bluetooth Speaker       | Model Name :        | TWIST-II |
| Temperature : | 25 °C                   | Relative Humidity : | 60%      |
| Pressure :    | 1012 hPa                | Test Voltage :      | DC 3.7V  |
| Test Mode :   | CH00 / CH39 /C78(1Mbps) |                     |          |

| Frequency | 20dB Bandwidth (kHz) | Result |
|-----------|----------------------|--------|
| 2402 MHz  | 908.4                | PASS   |
| 2441 MHz  | 870.6                | PASS   |
| 2480 MHz  | 868.4                | PASS   |

Test plot as follows:



CH39 -1Mbps



CH78 -1Mbps





|               |                         |                     |          |
|---------------|-------------------------|---------------------|----------|
| EUT :         | BLUETOOTH SPEAKER       | Model Name :        | TWIST-II |
| Temperature : | 25 °C                   | Relative Humidity : | 60%      |
| Pressure :    | 1012 hPa                | Test Voltage :      | DC 3.7V  |
| Test Mode :   | CH00 / CH39 /C78(2Mbps) |                     |          |

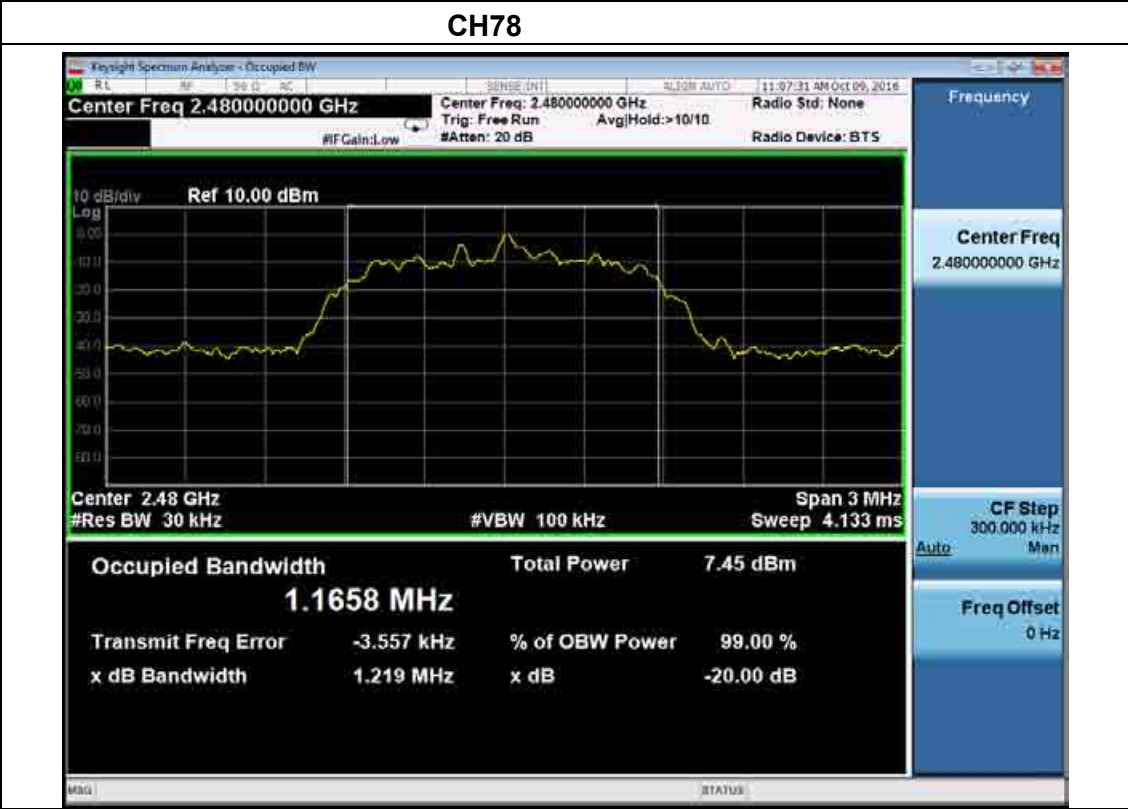
| Frequency | 20dB Bandwidth (MHz) | Result |
|-----------|----------------------|--------|
| 2402 MHz  | 1.216                | PASS   |
| 2441 MHz  | 1.217                | PASS   |
| 2480 MHz  | 1.219                | PASS   |



CH39



CH78



|               |                          |                     |          |
|---------------|--------------------------|---------------------|----------|
| EUT :         | BLUETOOTH SPEAKER        | Model Name :        | TWIST-II |
| Temperature : | 25 °C                    | Relative Humidity : | 60%      |
| Pressure :    | 1012 hPa                 | Test Voltage :      | DC 3.7V  |
| Test Mode :   | CH00 / CH39 /CH78(3Mbps) |                     |          |

| Frequency | 20dB Bandwidth (MHz) | Result |
|-----------|----------------------|--------|
| 2402 MHz  | 1.205                | PASS   |
| 2441 MHz  | 1.207                | PASS   |
| 2480 MHz  | 1.207                | PASS   |



CH39



CH78



## 7. FREQUENCY SEPARATION

### 7.1. Limits

According to FCC Section 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

### 7.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode .

2. Set the spectrum analyzer:

Span: wide enough to capture the peaks of two adjacent channels

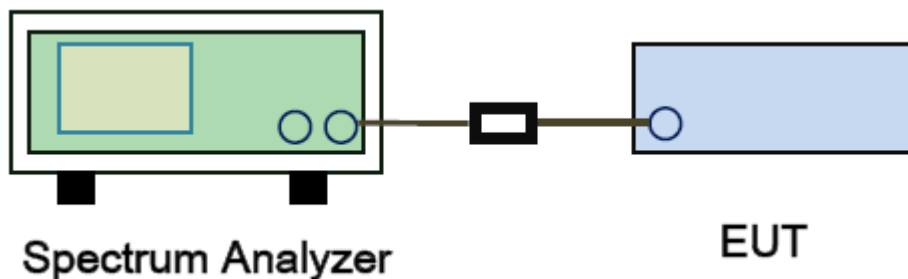
RBW  $\geq 1\%$  of the span(30KHz)

VBW  $\geq$  RBW(100KHz)

Sweep=auto

Detector function=peak

Trace=max hold



Test data:

|               |                          |                     |          |
|---------------|--------------------------|---------------------|----------|
| EUT :         | Bluetooth Speaker        | Model Name :        | TWIST-II |
| Temperature : | 24 °C                    | Relative Humidity : | 58%      |
| Pressure :    | 1010hPa                  | Test Voltage :      | DC 3.7V  |
| Test Mode :   | CH00 / CH39 /CH78(1Mbps) |                     |          |

| Frequency | Ch. Separation (MHz) | Limit (KHz) | Result   |
|-----------|----------------------|-------------|----------|
| 2402 MHz  | 1.000                | 908.4       | Complies |
| 2441 MHz  | 1.000                | 870.6       | Complies |
| 2480 MHz  | 1.000                | 868.4       | Complies |

### Ch. Separation Limits: > 20dB bandwidth

Test plot as follows:





CH39



CH78



|               |                          |                     |          |
|---------------|--------------------------|---------------------|----------|
| EUT :         | BLUETOOTH SPEAKER        | Model Name :        | TWIST-II |
| Temperature : | 24 °C                    | Relative Humidity : | 58%      |
| Pressure :    | 1010 hPa                 | Test Voltage :      | DC 3.7V  |
| Test Mode :   | CH00 / CH39 /CH78(2Mbps) |                     |          |

| Frequency | Ch. Separation (MHz) | Limit (KHz) | Result   |
|-----------|----------------------|-------------|----------|
| 2402 MHz  | 1.000                | 810.667     | Complies |
| 2441 MHz  | 1.000                | 811.333     | Complies |
| 2480 MHz  | 1.000                | 812.667     | Complies |

Ch. Separation Limits: >2/3 of 20dB bandwidth





CH39 -2Mbps



CH78 -2Mbps



|               |                          |                     |          |
|---------------|--------------------------|---------------------|----------|
| EUT :         | BLUETOOTH SPEAKER        | Model Name :        | TWIST-II |
| Temperature : | 24 °C                    | Relative Humidity : | 58%      |
| Pressure :    | 1010 hPa                 | Test Voltage :      | DC 3.7V  |
| Test Mode :   | CH00 / CH39 /CH78(3Mbps) |                     |          |

| Frequency | Ch. Separation (MHz) | Limit (KHz) | Result   |
|-----------|----------------------|-------------|----------|
| 2402 MHz  | 1.000                | 803.333     | Complies |
| 2441 MHz  | 1.000                | 804.667     | Complies |
| 2480 MHz  | 1.000                | 804.667     | Complies |

Ch. Separation Limits: >2/3 of 20dB bandwidth



CH39 -3Mbps



CH78 -3Mbps



8. NUMBER OF HOPPING FREQUENCY

8.1. Limits

According to FCC Section 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

8.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode .

2. Set the spectrum analyzer:

Span: the frequency band of operation

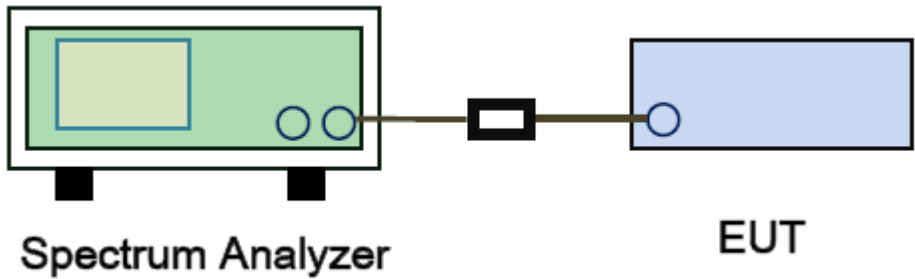
RBW =100KHz

VBW=300KHz

Sweep=auto

Detector function=peak

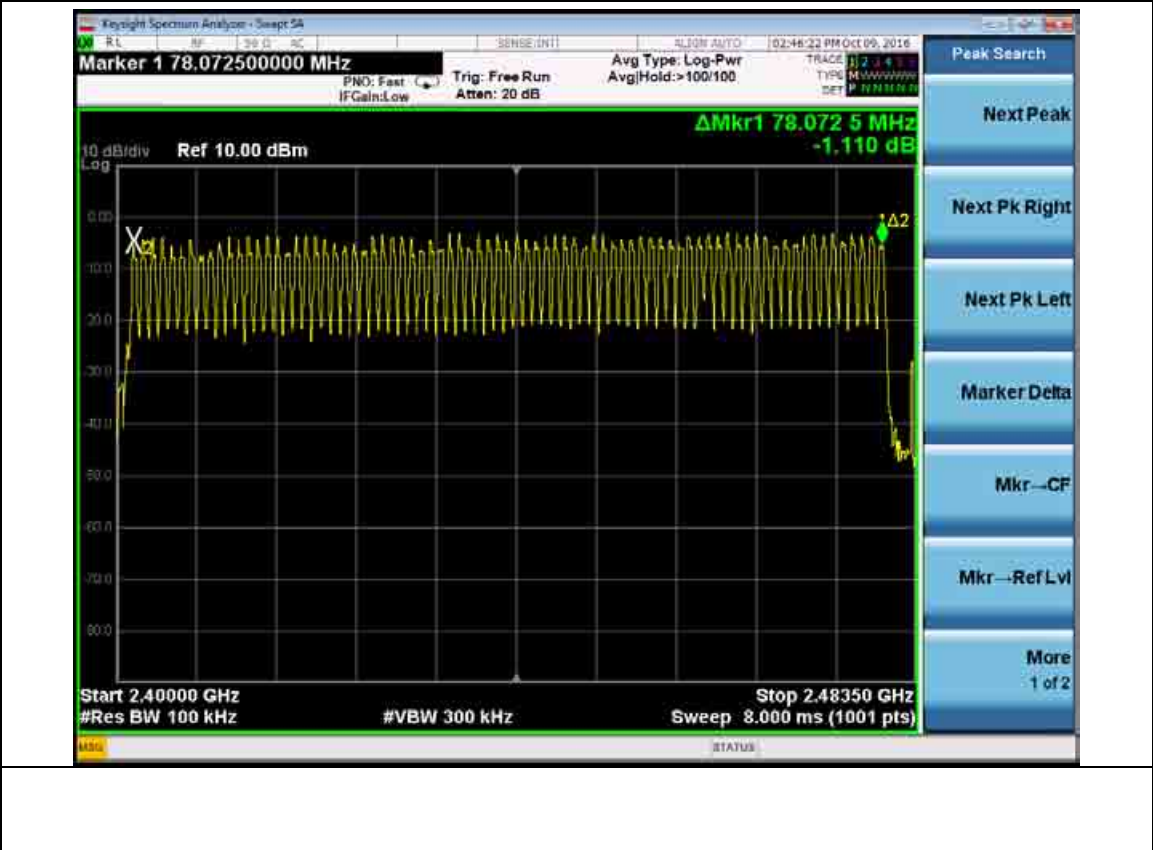
Trace=max hold



Test data:

| Measured channel numbers | Limit     | Result |
|--------------------------|-----------|--------|
| 79                       | $\geq 15$ | PASS   |

Test plot as follows:



## 9. DWELL TIME

### 9.1. Limits

According to FCC Section 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### 9.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode power.

2. Set the spectrum analyzer:

Span= 0Hz, RBW =1000 kHz, VBW = 3000 kHz

Use a video trigger with the trigger level set to enable triggering only on full pulses.

Detector function=peak, Sweep Time is more than once pulse time.

Set the EUT for DH5, DH3 and DH1 packet transmitting

Measure the maximum time duration of one single pulse.

A Period Time = (channel number)\*0.4

DH1 Time Slot: Reading \* (1600/2)\*31.6/(channel number)

DH3 Time Slot: Reading \* (1600/4)\*31.6/(channel number)

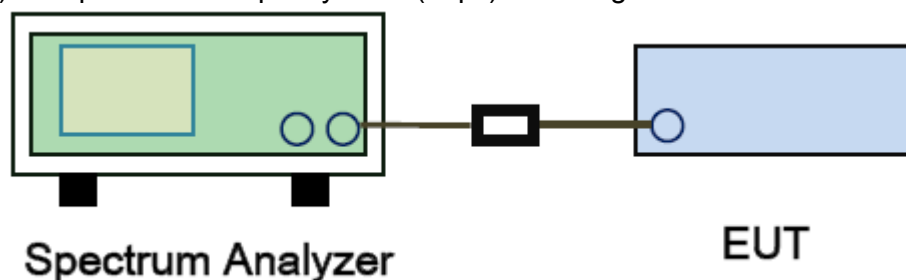
DH5 Time Slot: Reading \* (1600/6)\*31.6/(channel number)

BT hopping rate is 1600 hops/s with 6 slots in 79 hopping channels.

With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s),

Hops Over Occupancy Time comes to (1600 / 6 / 79) x (0.4 x 79) = 106.67 hops.

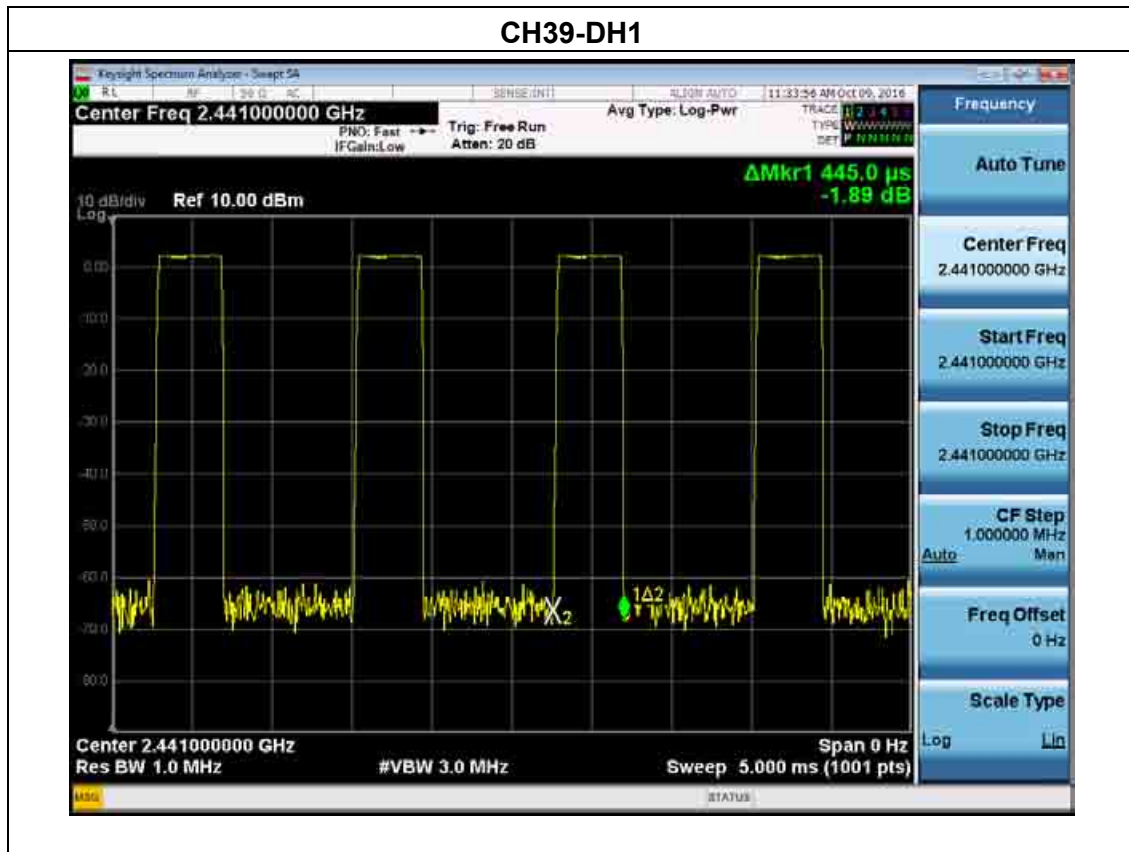
Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time



Test data:

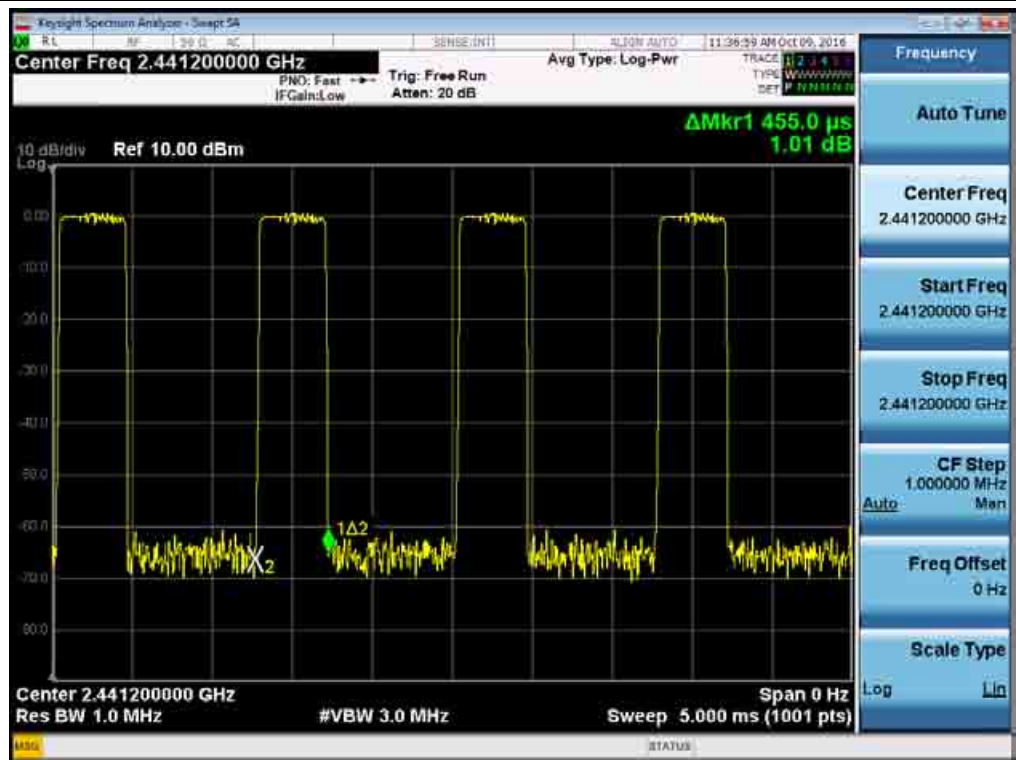
| Data Packet | Frequency | Pulse Duration | Dwell Time | Limits |
|-------------|-----------|----------------|------------|--------|
|             |           | (ms)           | (s)        | (s)    |
| DH1         | 2441 MHz  | 0.45           | 0.14       | 0.4    |
| 2DH1        | 2441 MHz  | 0.46           | 0.15       | 0.4    |
| 3DH1        | 2441 MHz  | 0.46           | 0.15       | 0.4    |

Test plot as follows as below:

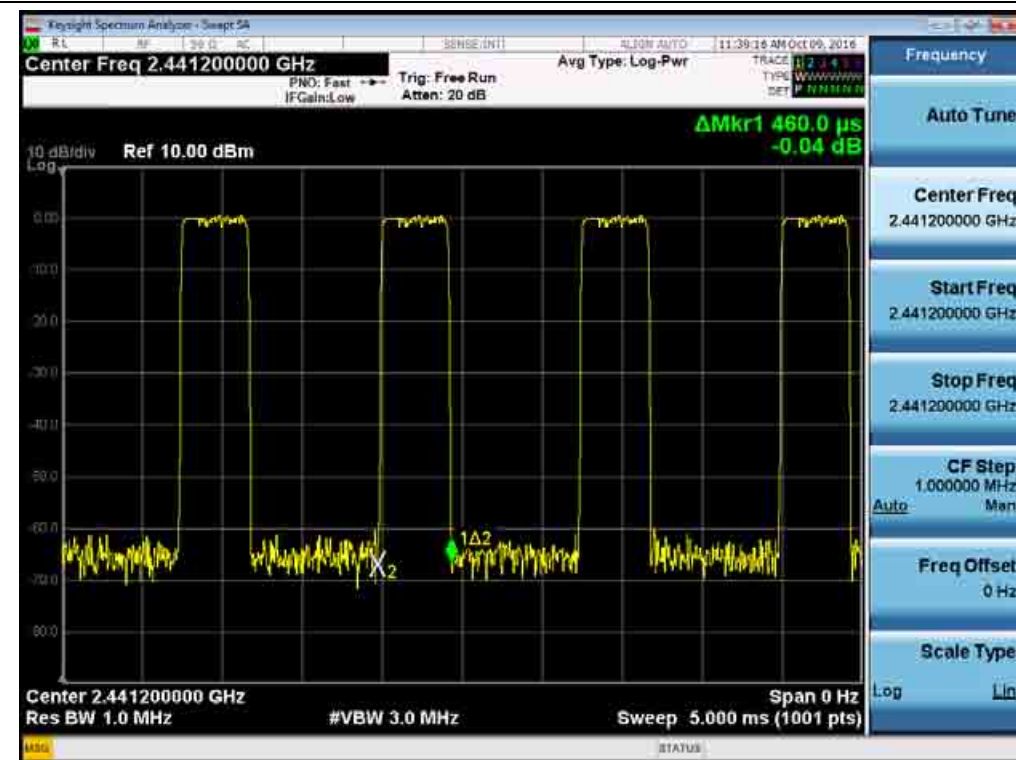




CH39-2DH1

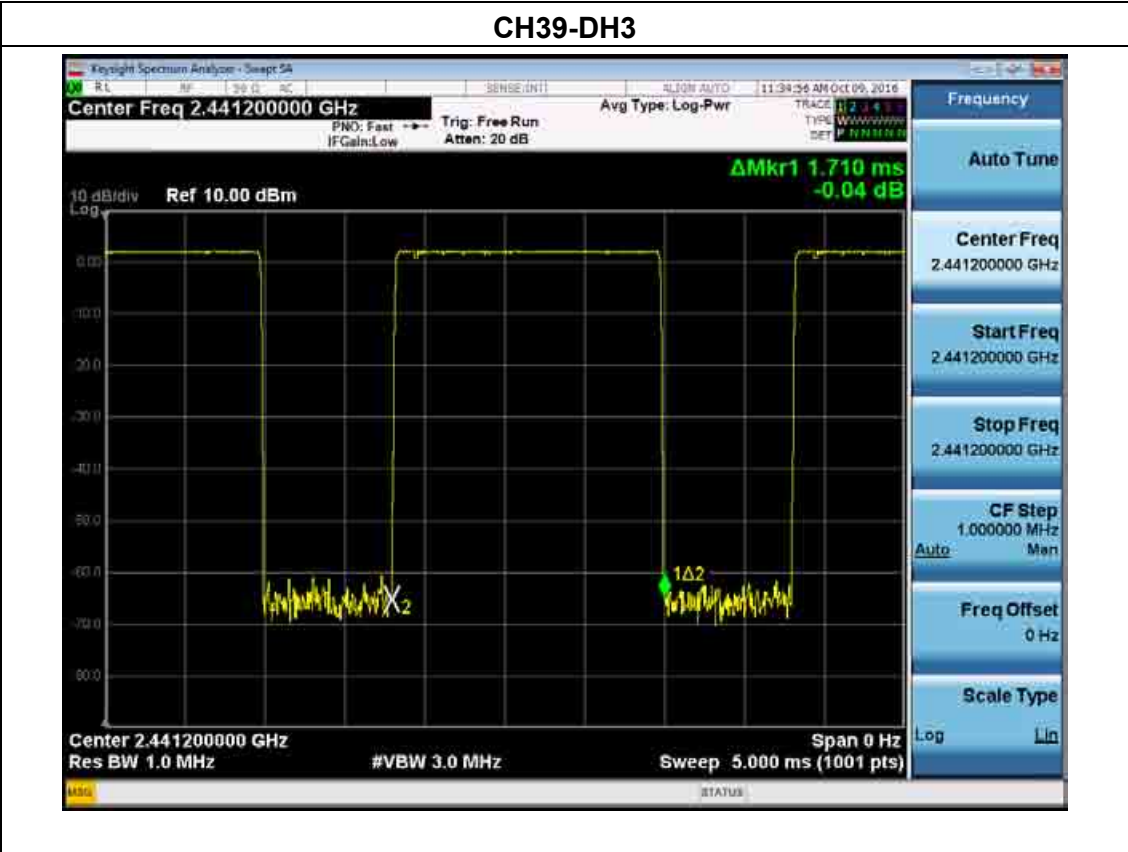


CH39-3DH1

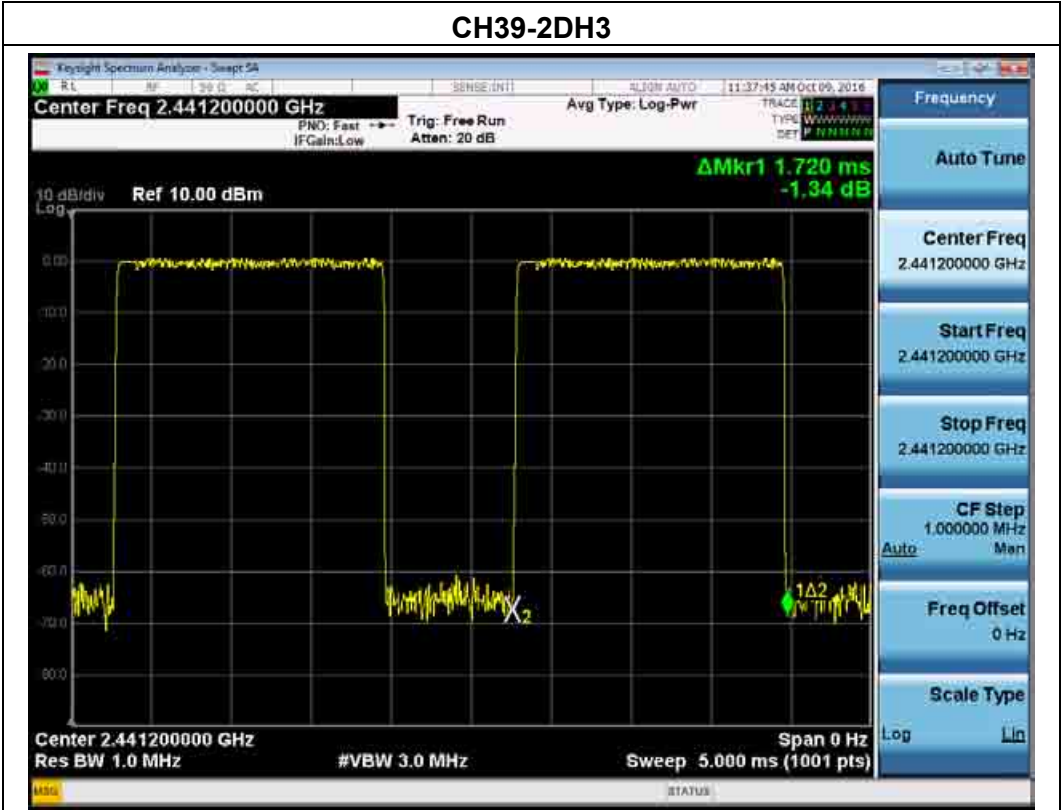




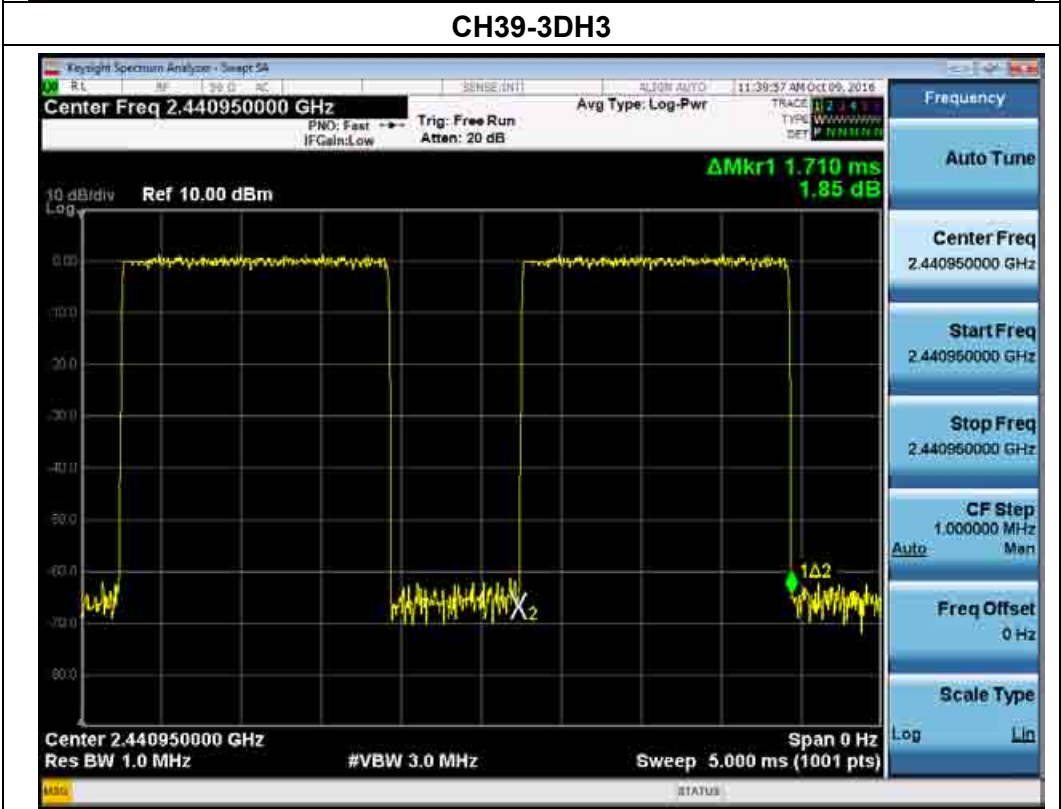
| Data Packet | Frequency | Pulse Duration | Dwell Time | Limits |
|-------------|-----------|----------------|------------|--------|
|             |           | (ms)           | (s)        | (s)    |
| DH3         | 2441 MHz  | 1.71           | 0.27       | 0.4    |
| 2DH3        | 2441 MHz  | 1.72           | 0.28       | 0.4    |
| 3DH3        | 2441 MHz  | 1.71           | 0.27       | 0.4    |



CH39-2DH3

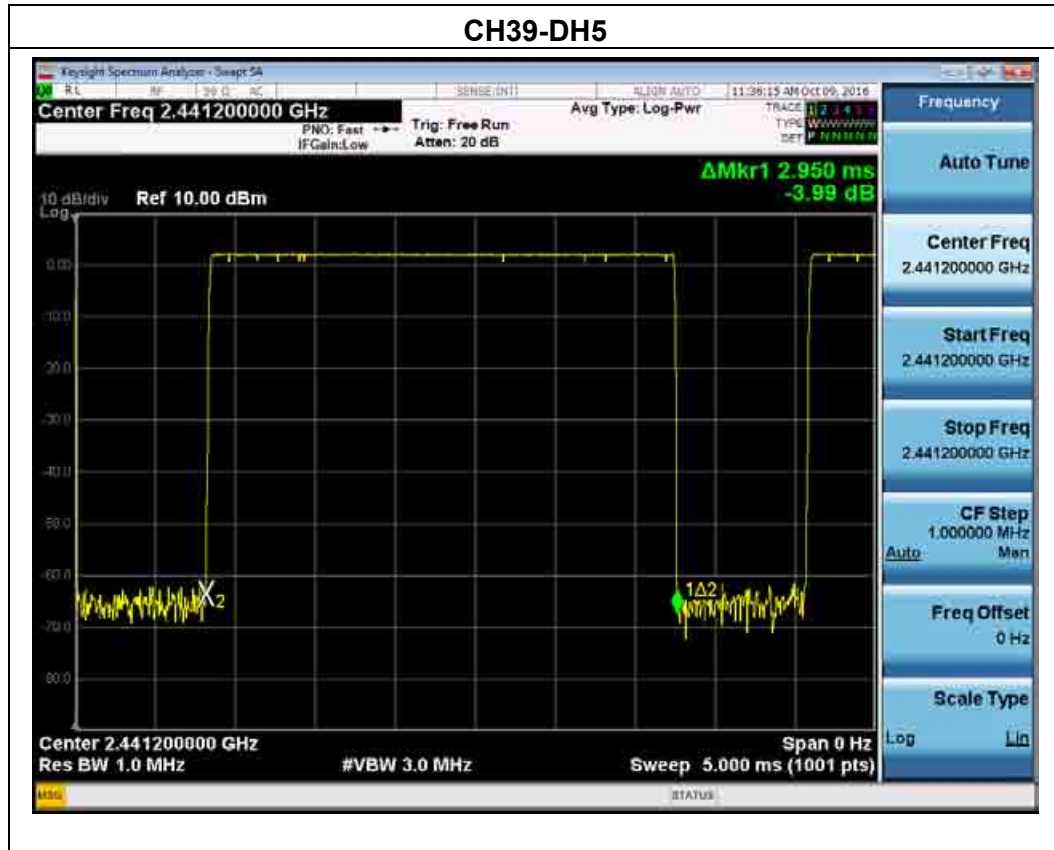


CH39-3DH3

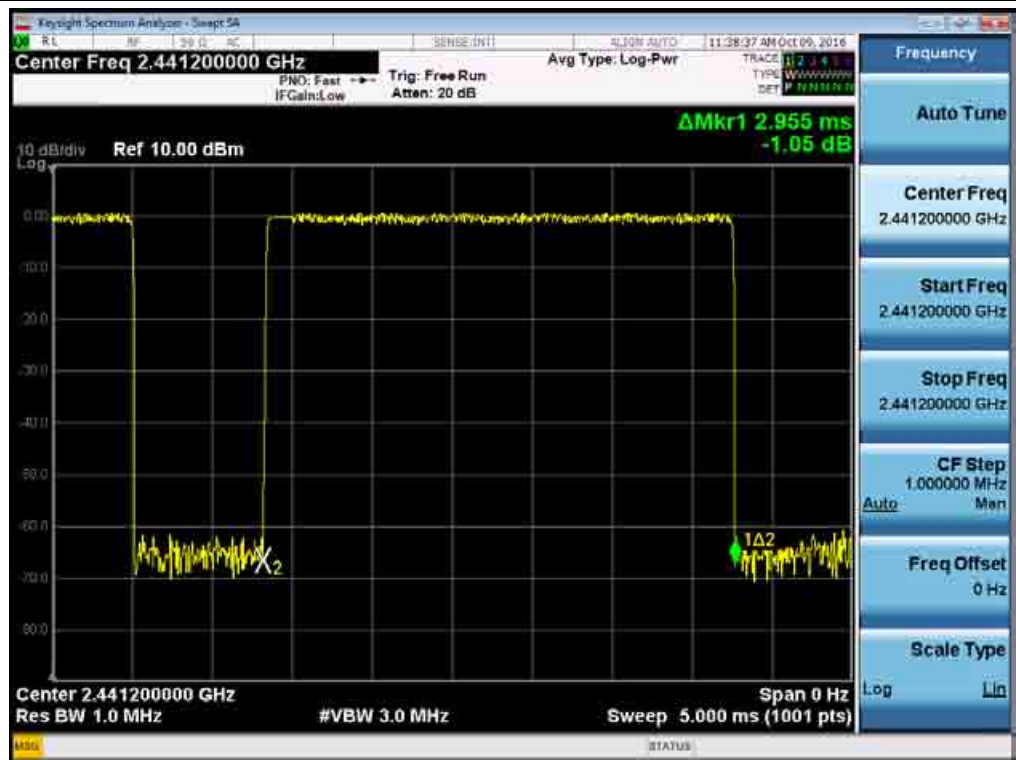


| Data Packet | Frequency | Pulse Duration | Dwell Time | Limits |
|-------------|-----------|----------------|------------|--------|
|             |           | (ms)           | (s)        | (s)    |
| DH5         | 2441 MHz  | 2.95           | 0.31       | 0.4    |
| 2DH5        | 2441 MHz  | 2.96           | 0.32       | 0.4    |
| 3DH5        | 2441 MHz  | 2.95           | 0.31       | 0.4    |

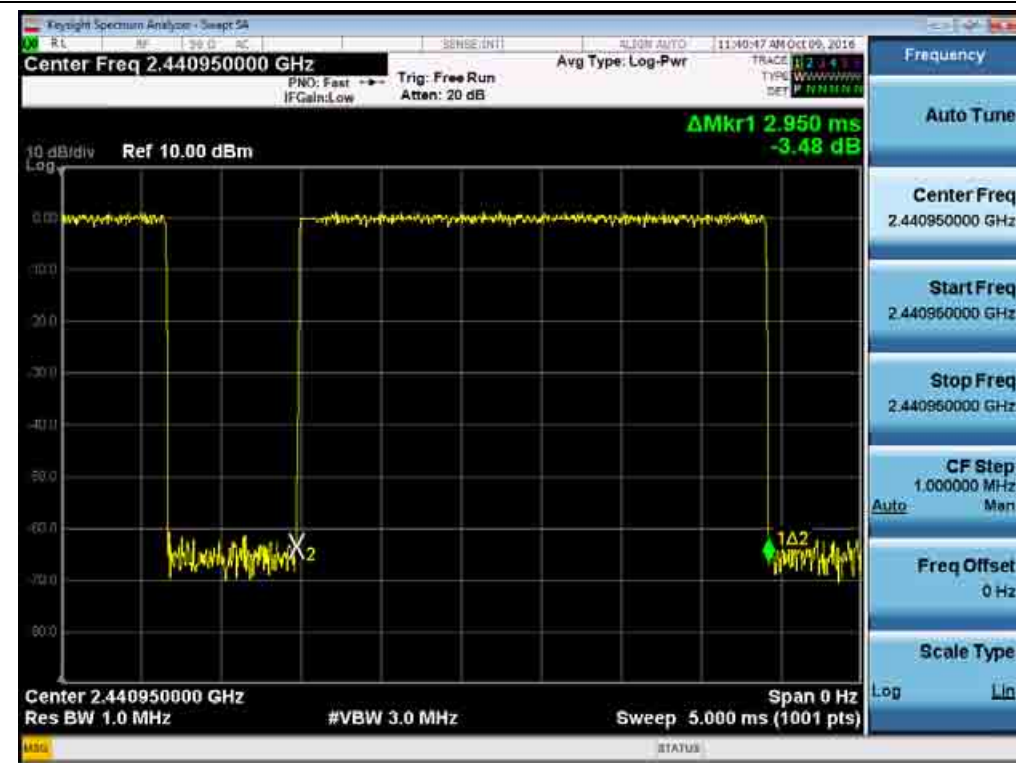
## CH39-DH5



CH39-2DH5



CH39-3DH5

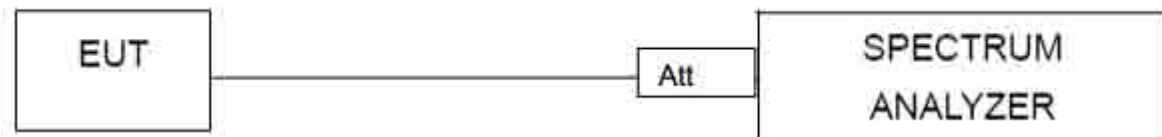


## 10. BAND EDGE COMPLIANCE TEST

### 10.1. Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. 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) (see §15.205(c)).

### 10.2. Test setup



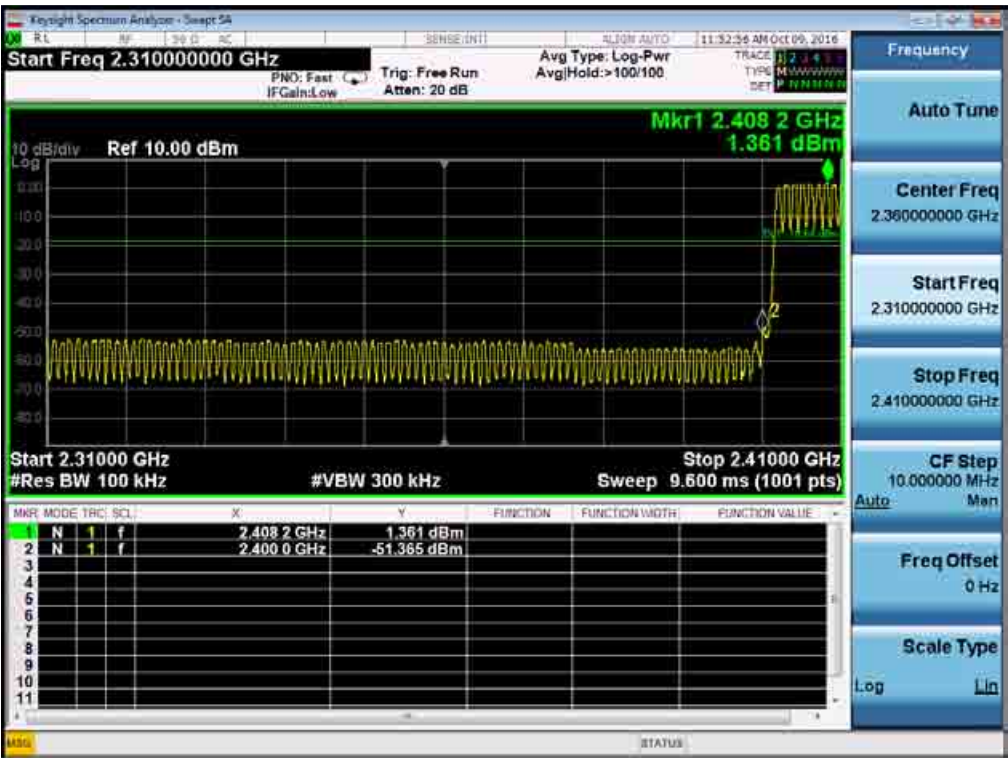
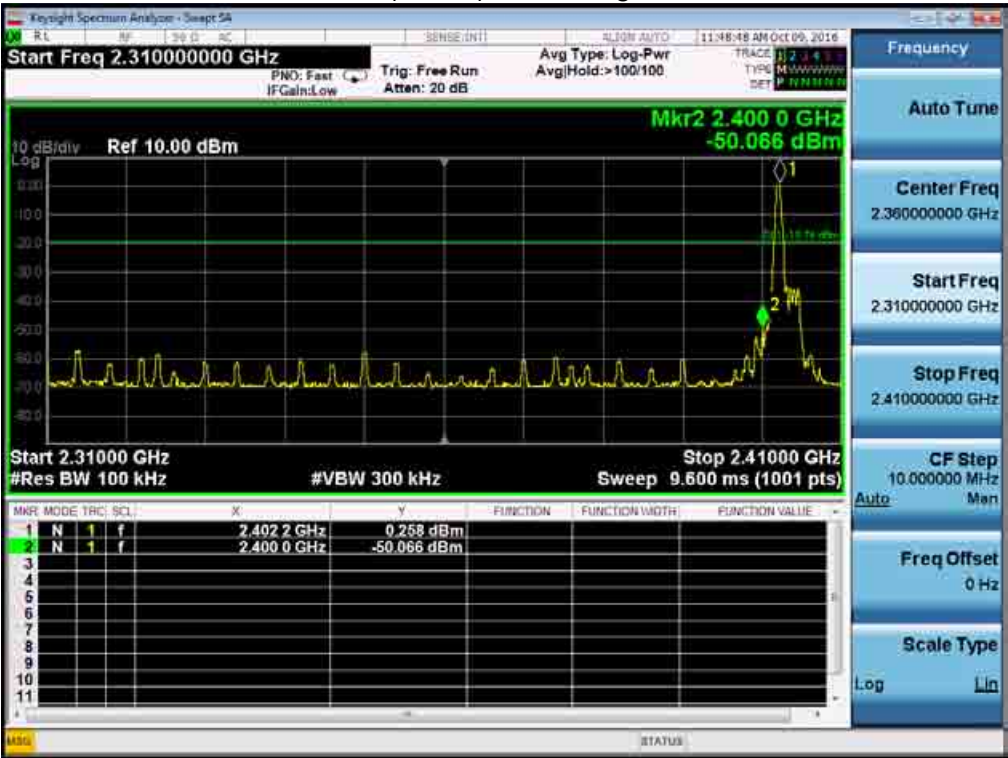
### 10.3. TEST Procedure

- a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- c) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- d) Measure 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.
- e) Repeat above procedures until all measured frequencies were complete.

For conducted test:

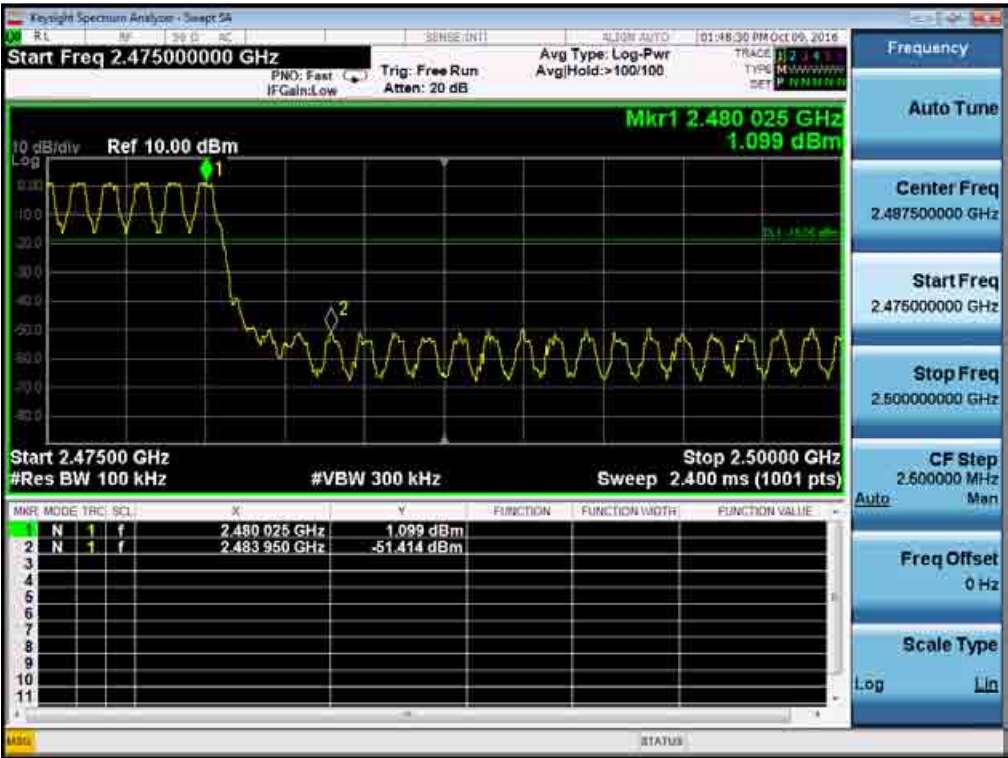
| Frequency Band             | Delta Peak to band emission (dBc) | > Limit (dBc) | Result |
|----------------------------|-----------------------------------|---------------|--------|
| GFSK Non-hopping           |                                   |               |        |
| Left band                  | 50.324                            | 20            | Pass   |
| Right band                 | 62.148                            | 20            | Pass   |
| $\pi/4$ -DQPSK Non-hopping |                                   |               |        |
| Left band                  | 50.637                            | 20            | Pass   |
| Right band                 | 62.242                            | 20            | Pass   |
| 8DPSK Non-hopping          |                                   |               |        |
| Left band                  | 50.22                             | 20            | Pass   |
| Right band                 | 60.134                            | 20            | Pass   |
| GFSK hopping               |                                   |               |        |
| Left band                  | 52.726                            | 20            | Pass   |
| Right band                 | 52.513                            | 20            | Pass   |
| $\pi/4$ -DQPSK hopping     |                                   |               |        |
| Left band                  | 52.547                            | 20            | Pass   |
| Right band                 | 59.044                            | 20            | Pass   |
| 8DPSK hopping              |                                   |               |        |
| Left band                  | 56.998                            | 20            | Pass   |
| Right band                 | 59.916                            | 20            | Pass   |

BDR mode (GFSK): Band Edge-Left Side

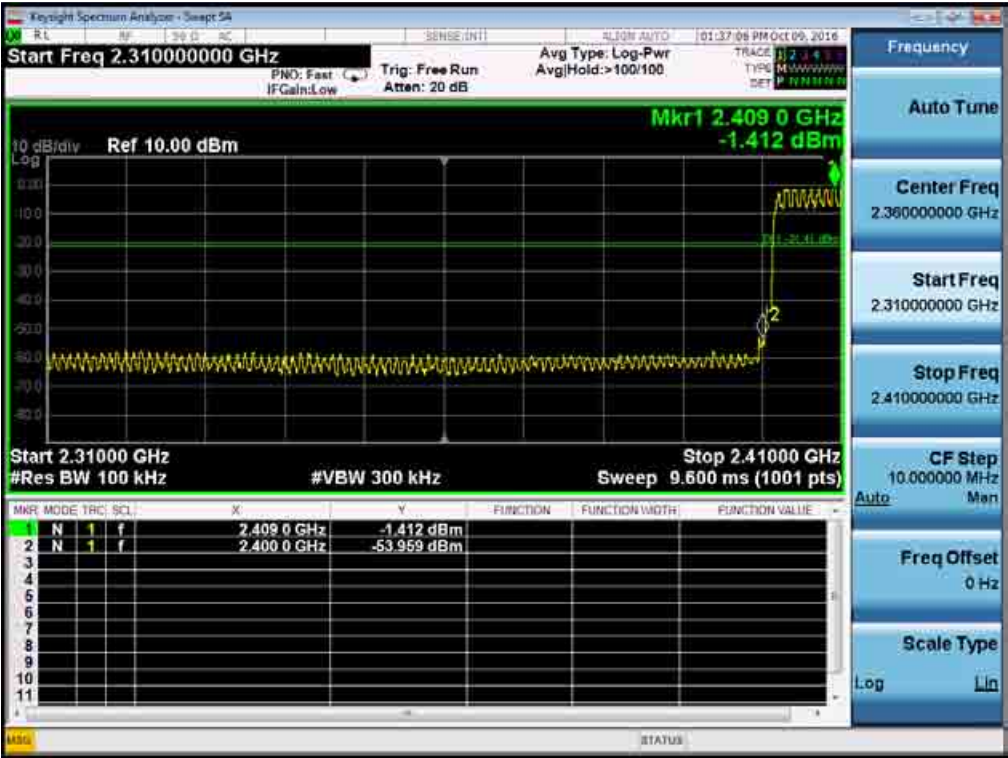
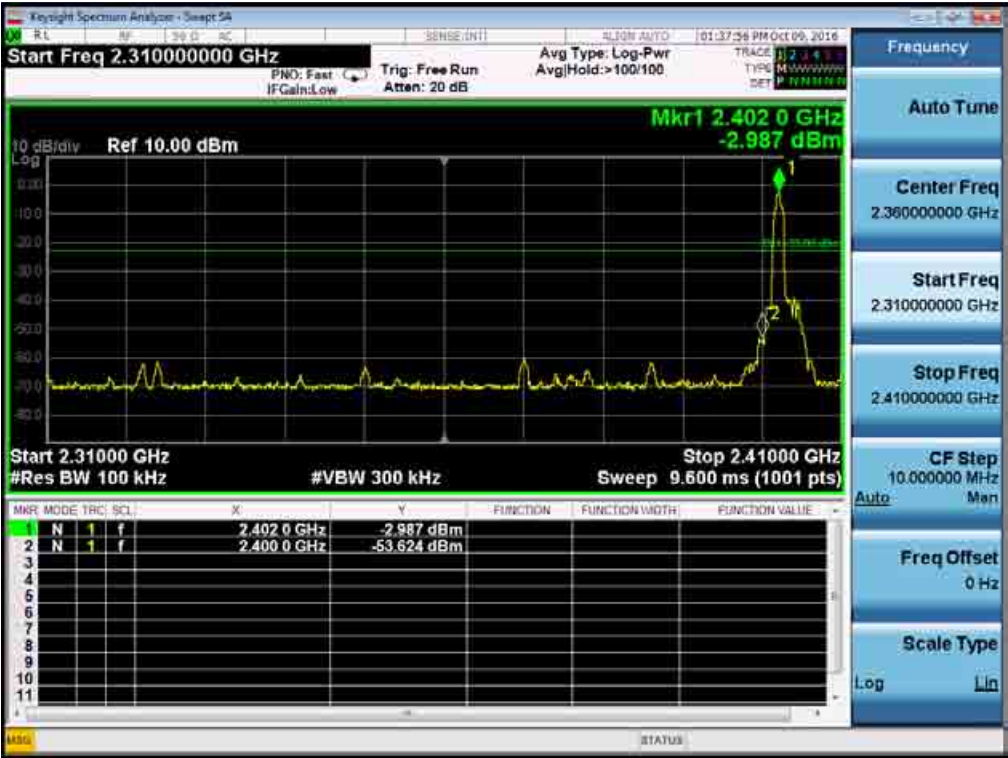




BDR mode (GFSK): Band Edge-Right Side



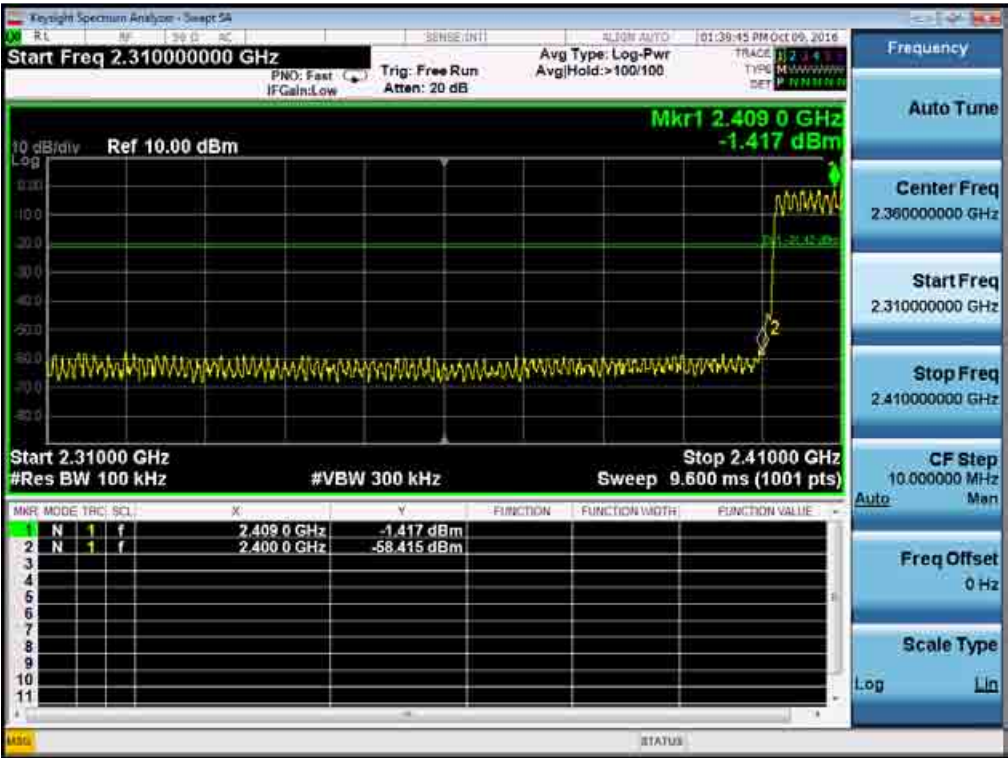
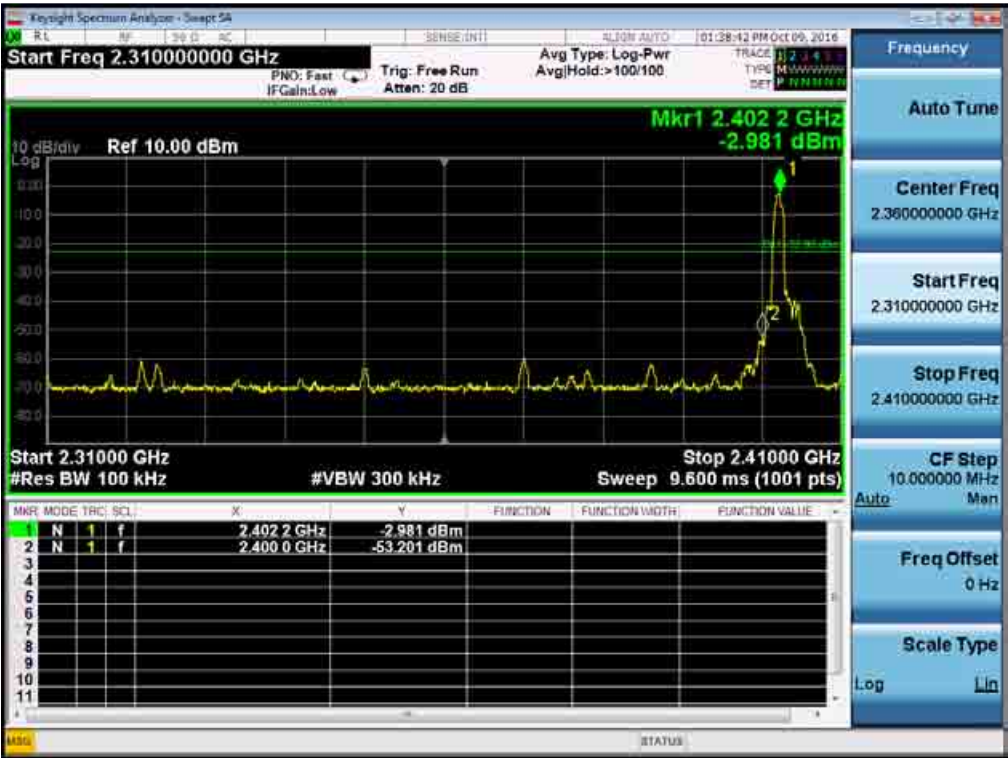
EDR mode (  $\pi$ /4-DQPSK): Band Edge-Left Side



EDR mode (  $\pi/4$ -DQPSK): Band Edge- Right Side

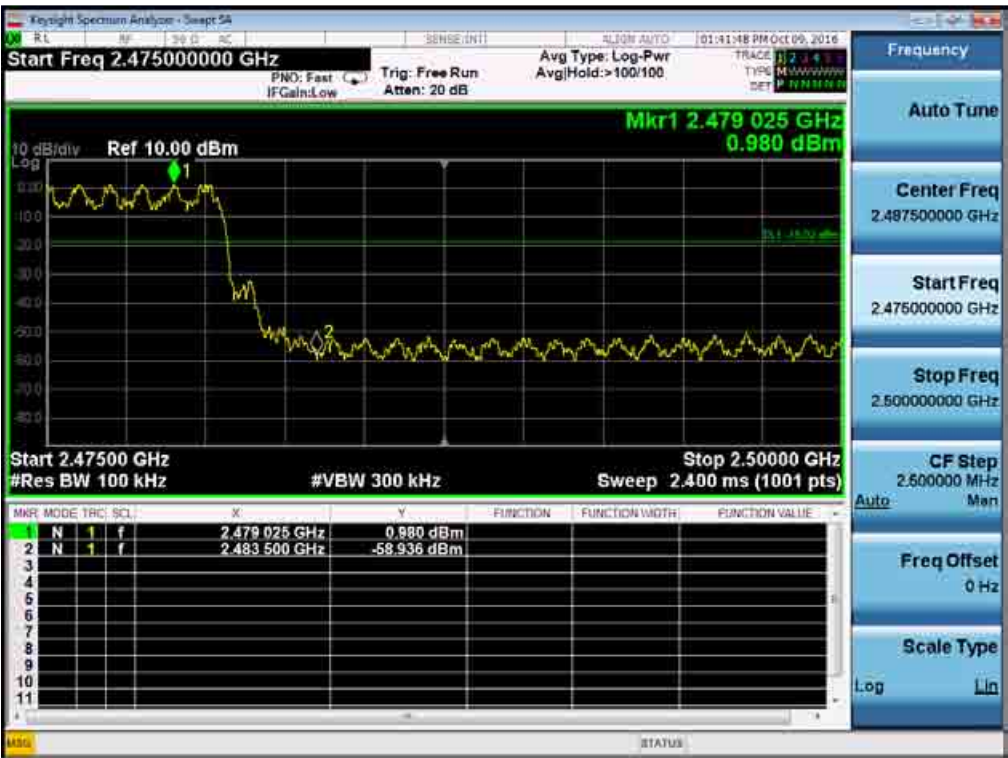


EDR mode(8DPSK): Band Edge-Left Side





EDR mode(8DPSK): Band Edge-Right Side



NOTE:  
Hopping enabled and disabled have evaluated, and the worst data was reported

## 11. ANTENNA REQUIREMENTS

### 11.1.Limits

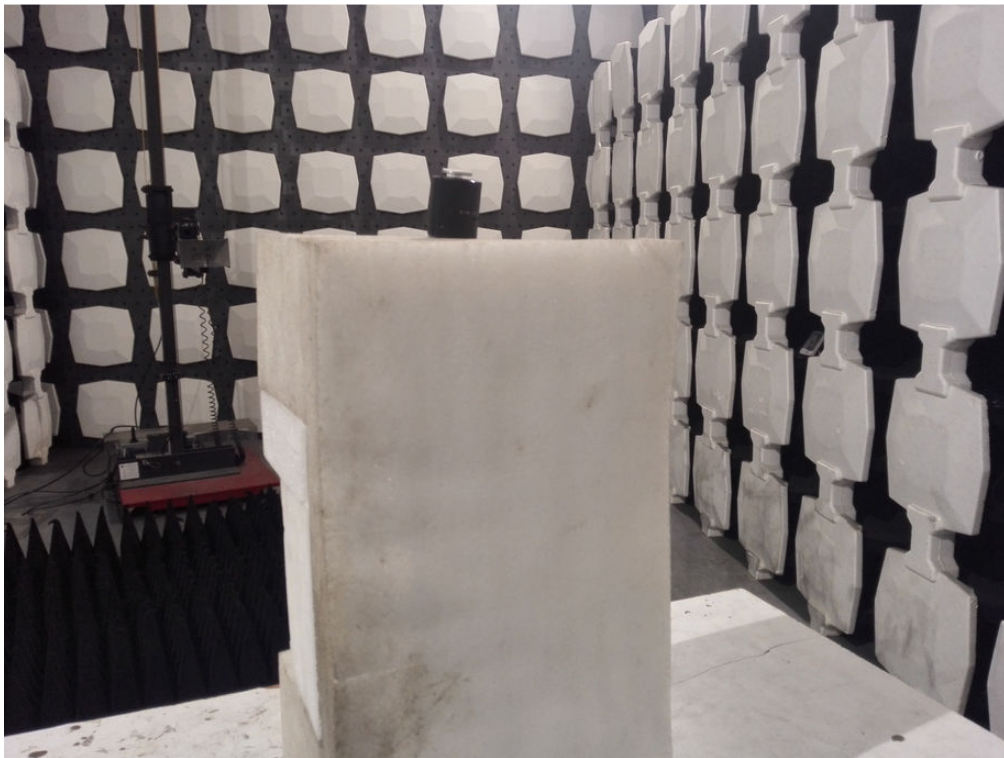
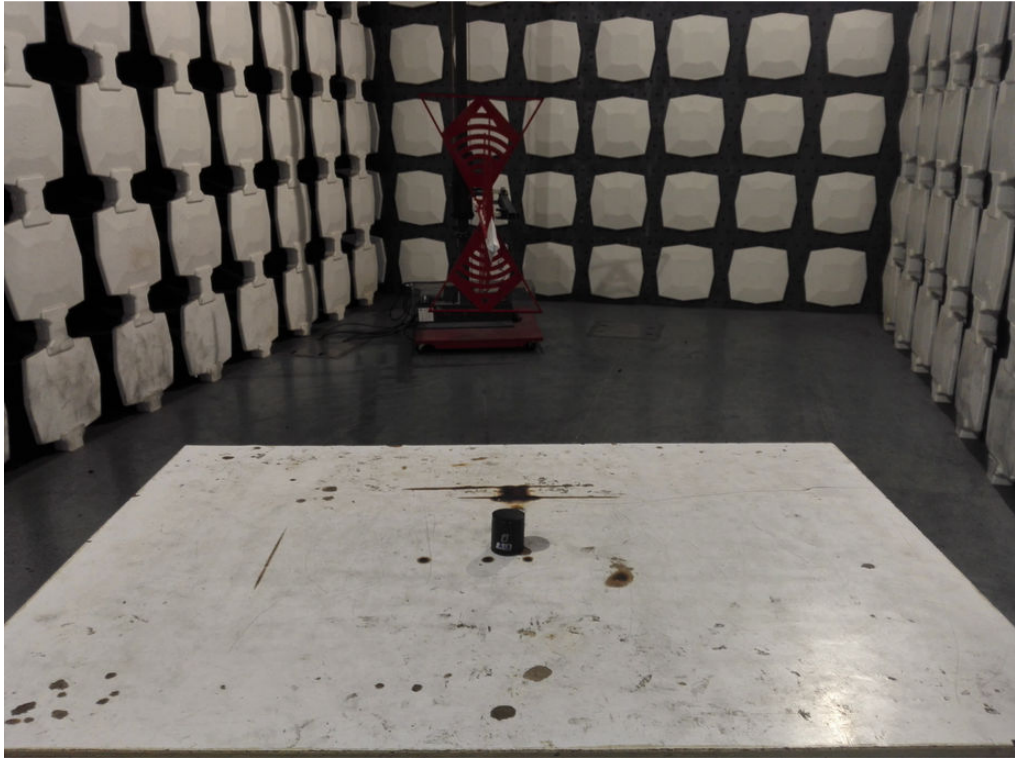
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### 11.2. Result

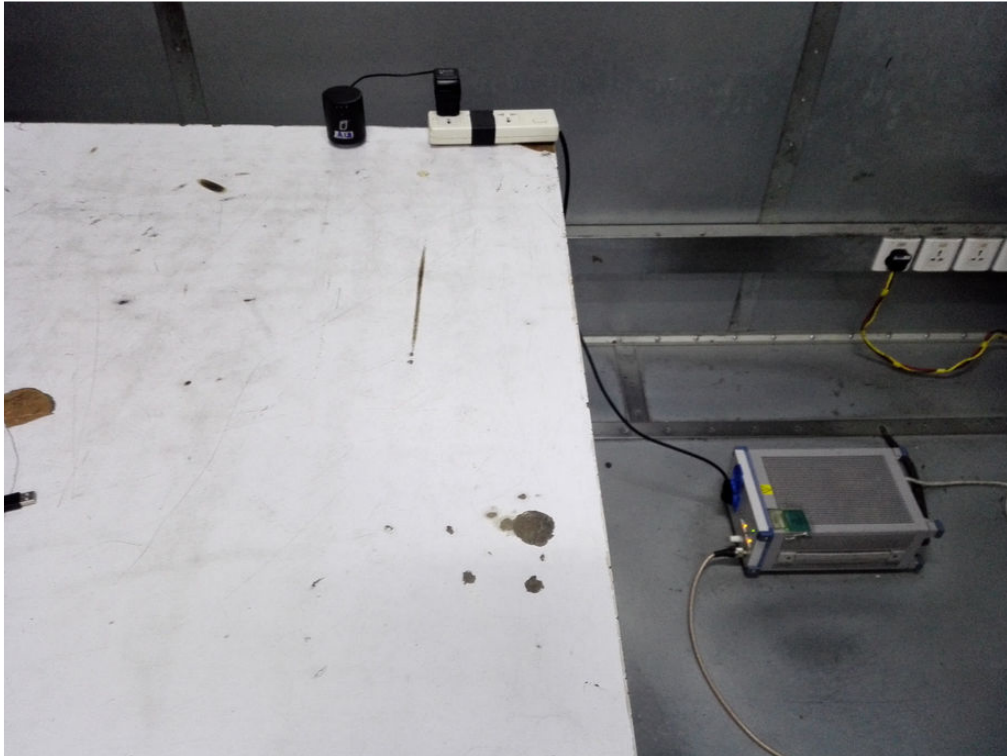
The antennas used for this product is PCB antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 0.5dBi.

## 12. PHOTOGRAPHS OF TEST SET-UP

Radiated Emission Test



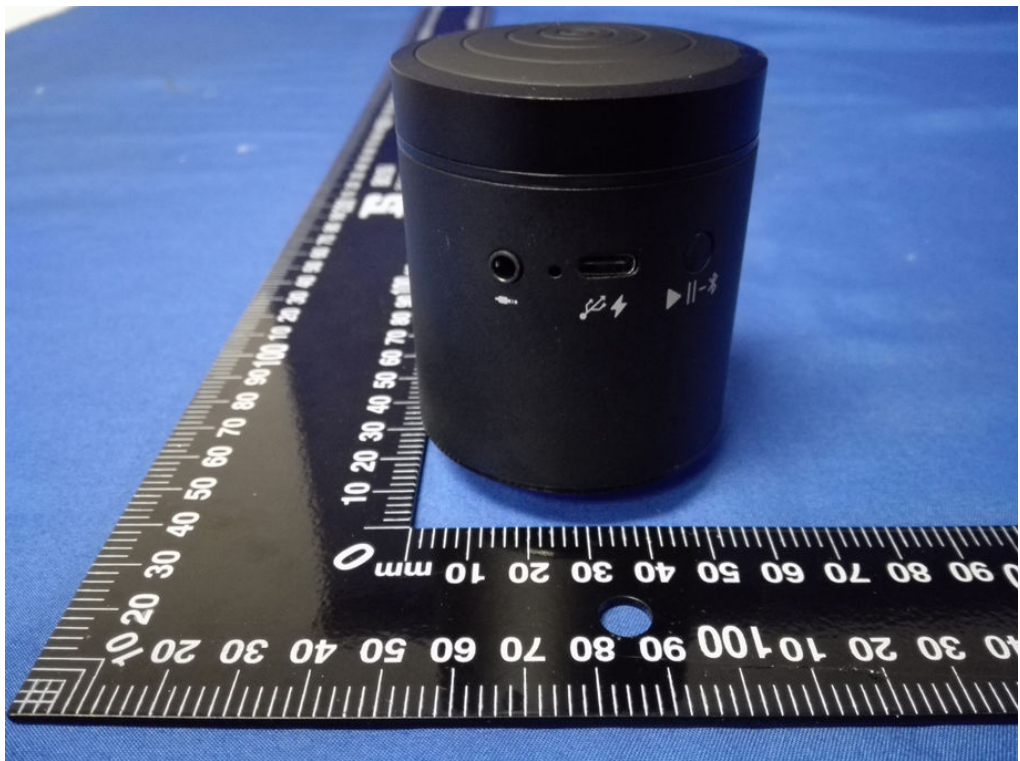
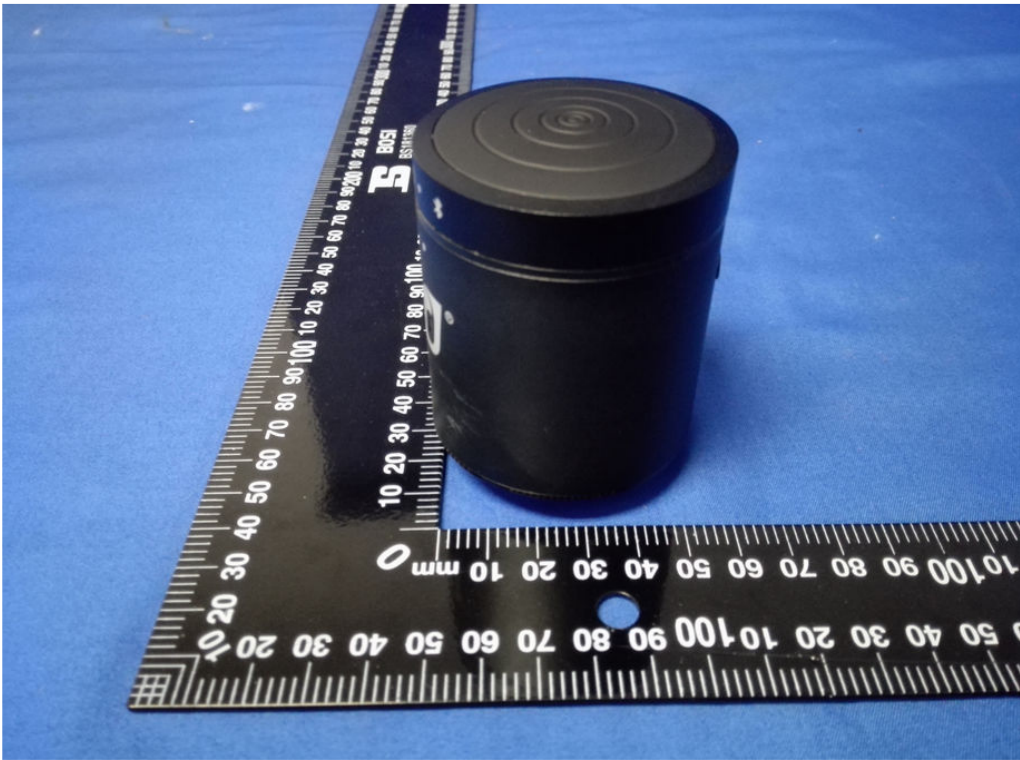
## Conducted Emission



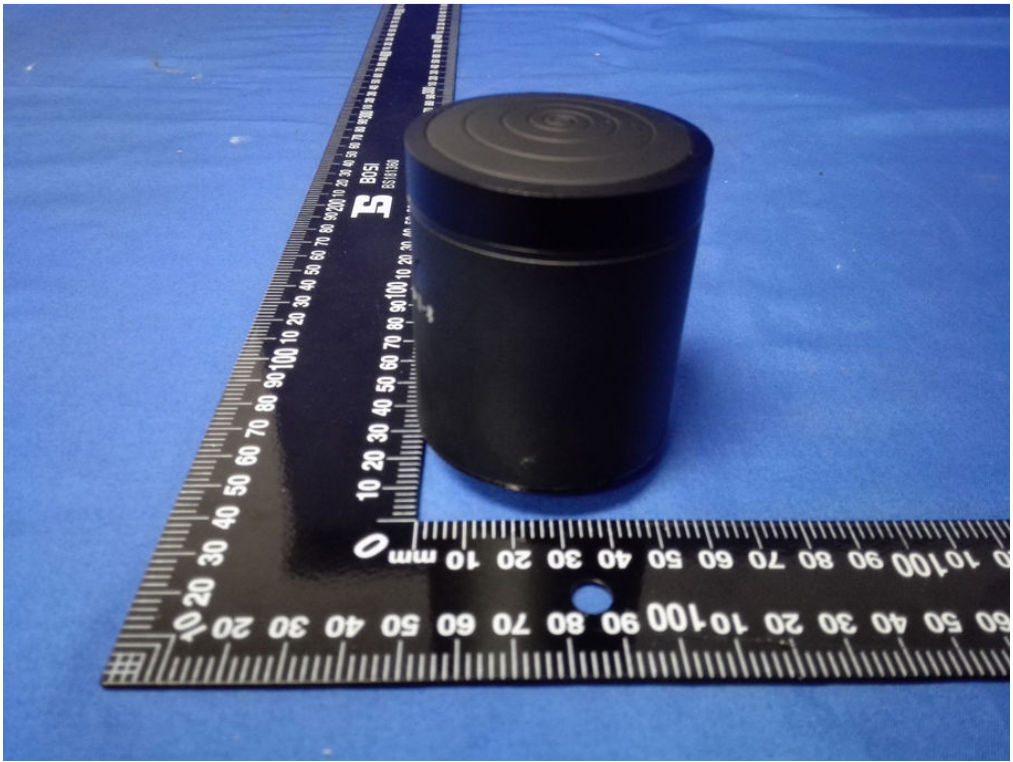


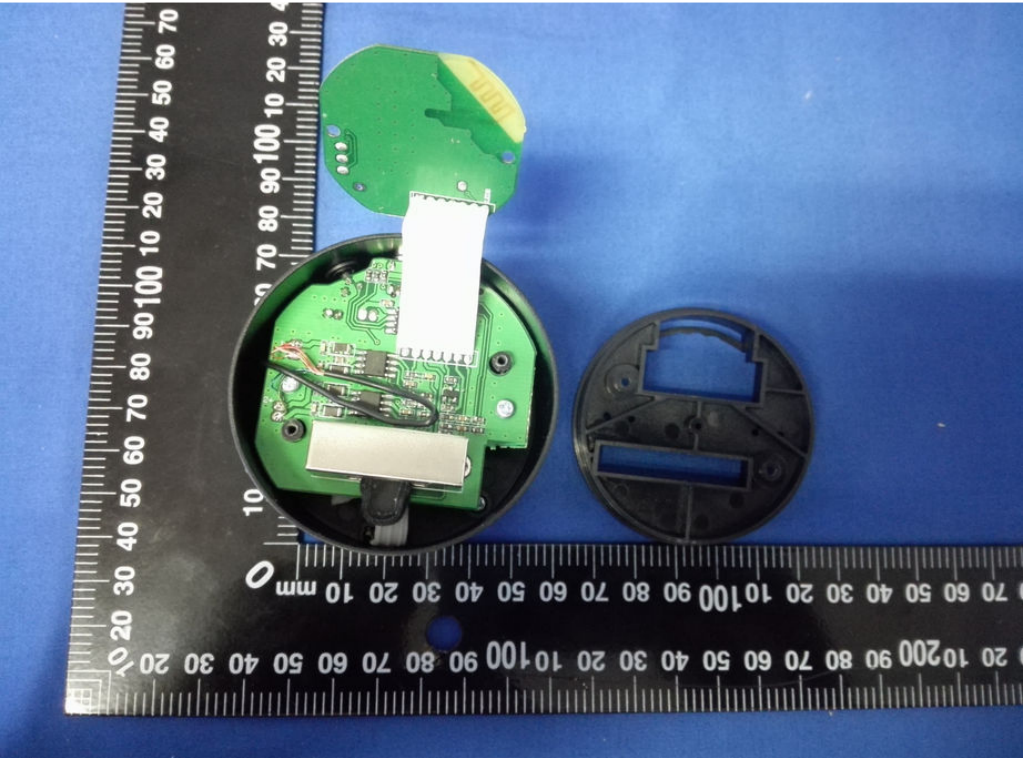
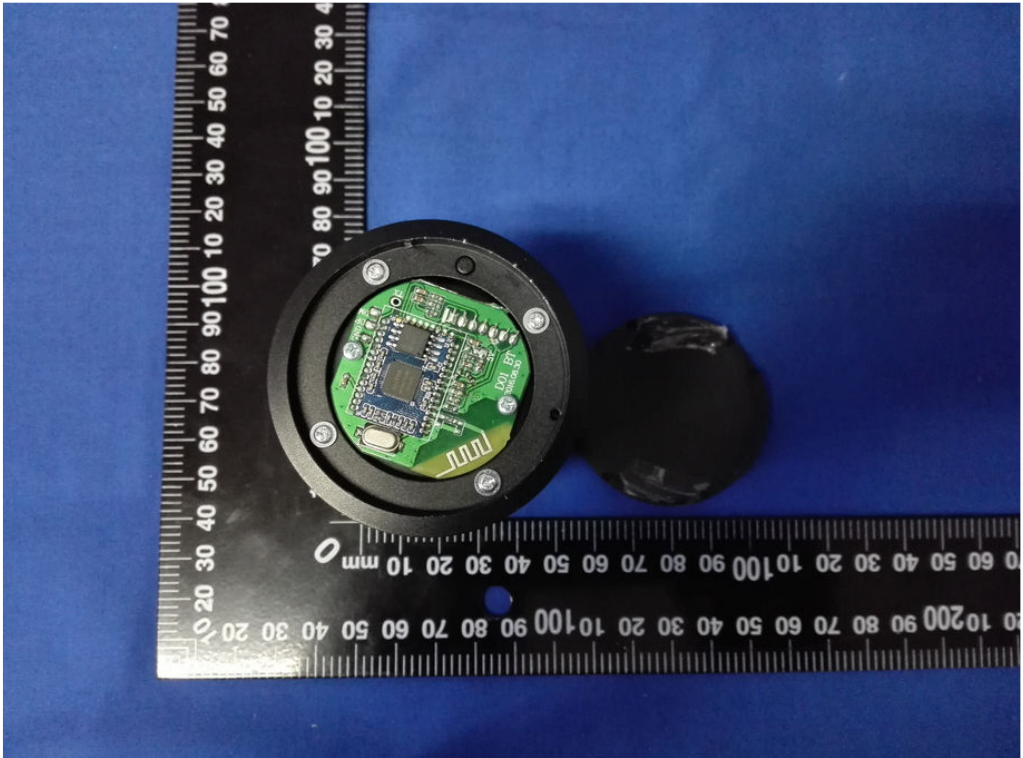
### 13. PHOTOGRAPHS OF THE EUT



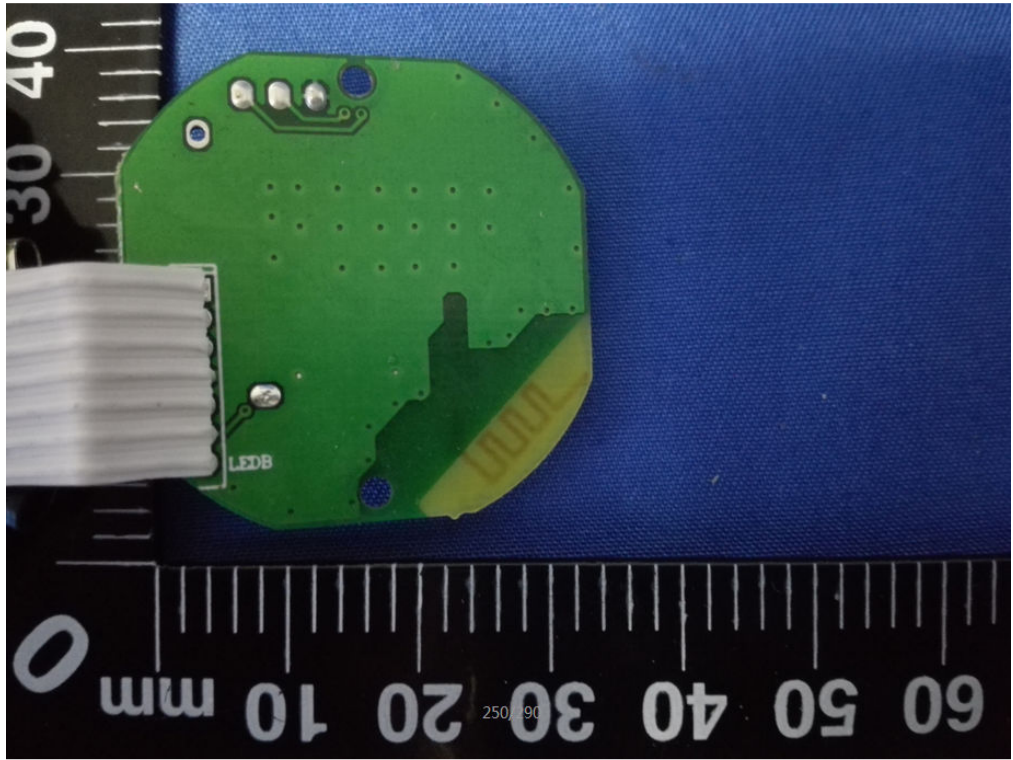
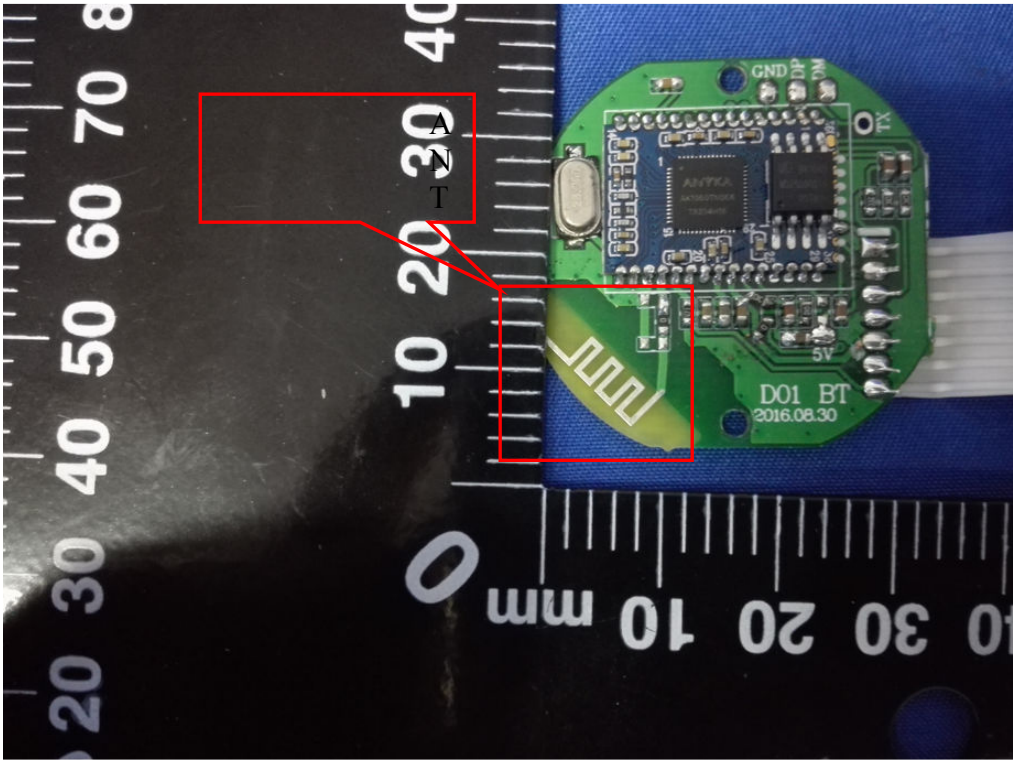


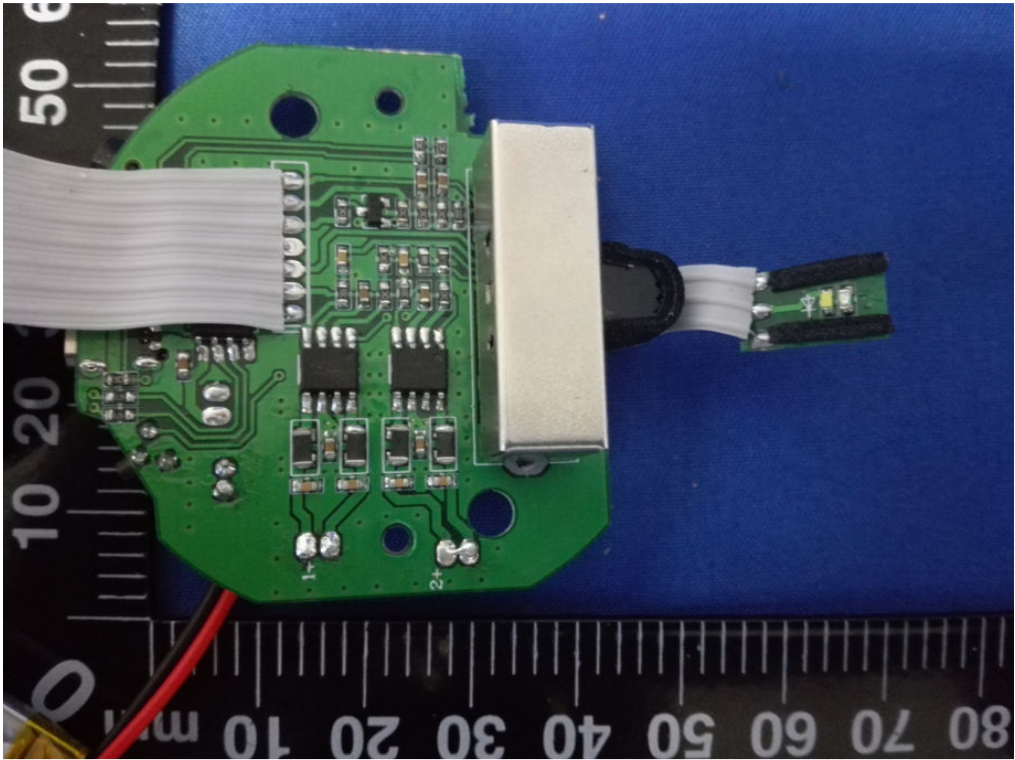
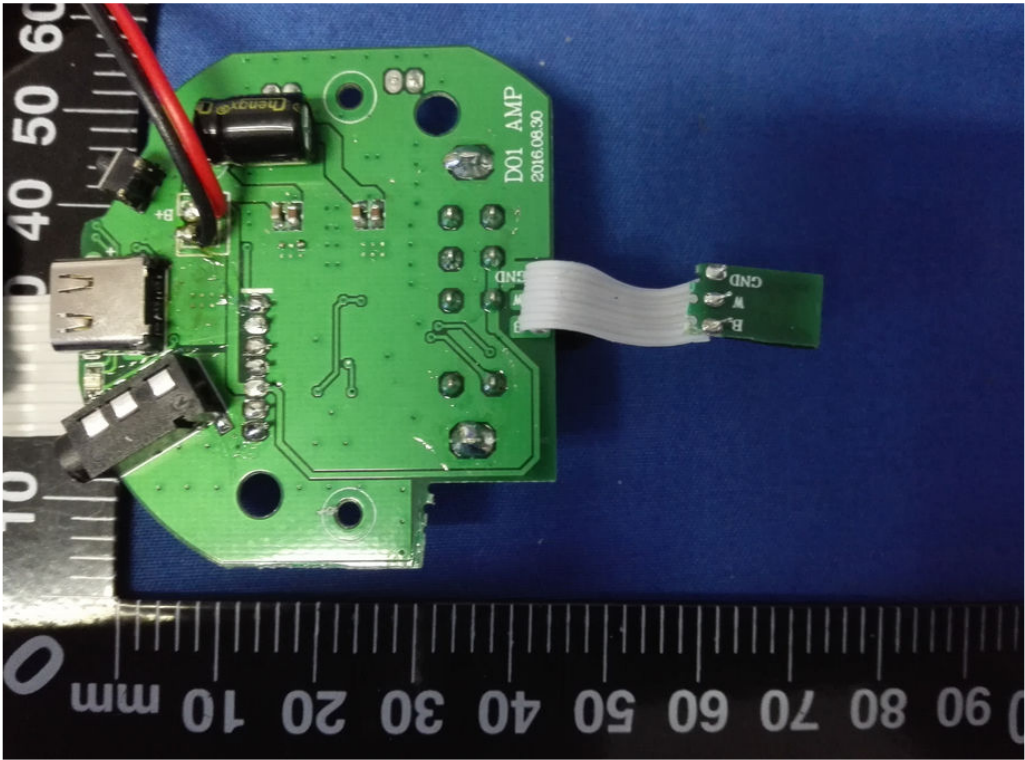




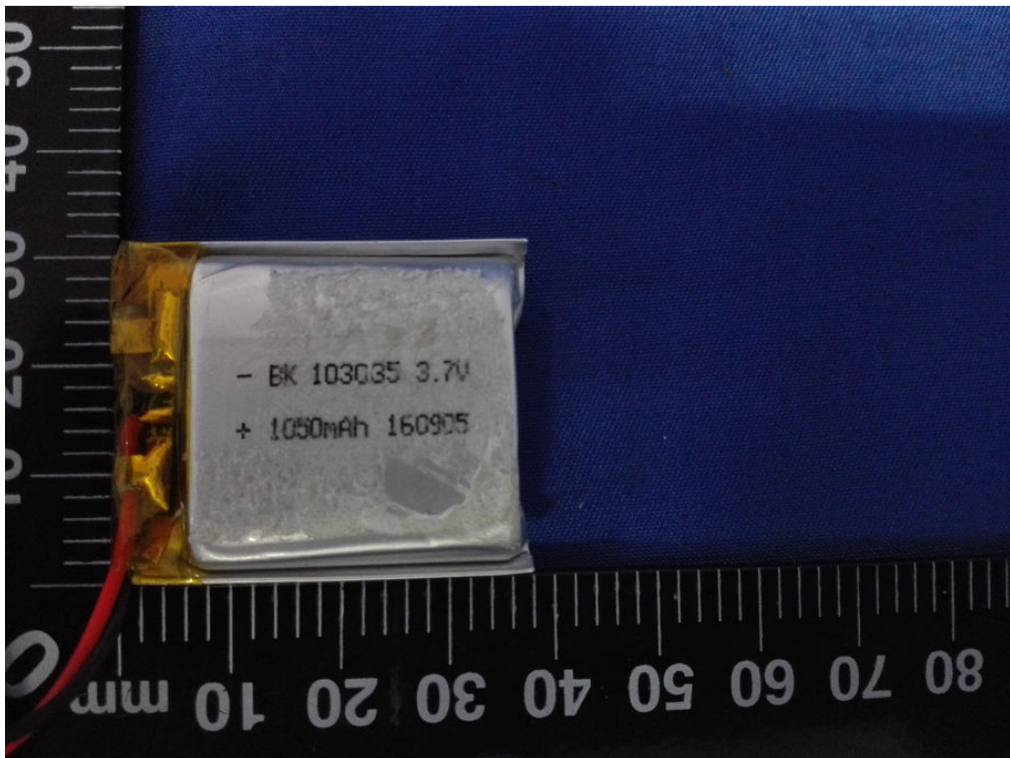
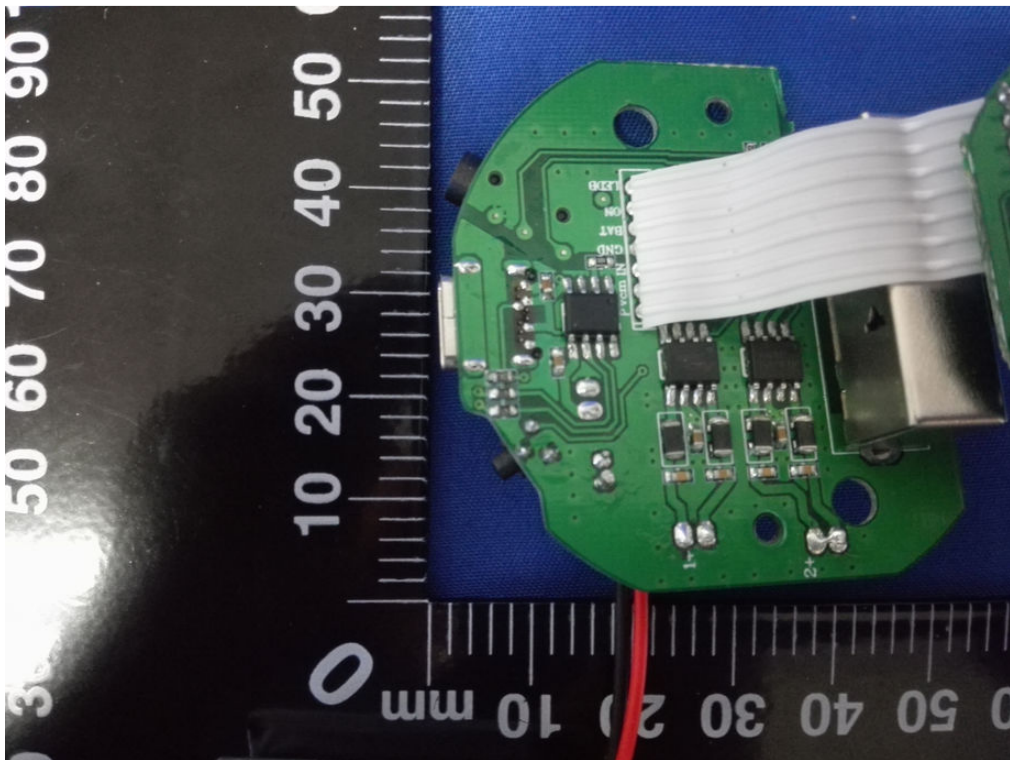












-----End-----