

FCC TEST REPORT(Bluetooth)  
for  
ACOUSTMAX INTERNATIONAL CO., LTD  
PORTABLE BLUETOOTH SPEAKER

Model Number : ROVE  
Series models: ROVE2, ROVE-MD, ROVE-XL, MROVE-BK,  
MROVE-RD, MROVE-SR, MROVE-XL  
FCC ID: 2AAIN-ROVE

Prepared for : ACOUSTMAX INTERNATIONAL CO., LTD  
Address : Unit D16/F Cheuk Nang Plaza 250 Hennessy Road  
Wanchai HongKong China

Prepared by : Keyway Testing Technology Co., Ltd.  
Address : Building 1, Baishun Industrial Zone, Zhangmutou Town,  
Dongguan, Guangdong, China

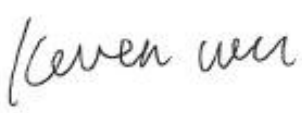
Tel: 86-769-8718 2258  
Fax: 86-769-8718 1058

Report No. : TR17080030-E-001  
Date of Test : Jul. 2~12, 2017  
Date of Report : Jul. 29, 2017

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## Keyway Testing Technology Co., Ltd.

|                                                                                                                                                                                                              |                                                                                                           |                                                                                       |                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------|
| <b>Applicant:</b>                                                                                                                                                                                            | ACOUSTMAX INTERNATIONAL CO., LTD                                                                          |                                                                                       |                 |
| <b>Address:</b>                                                                                                                                                                                              | Unit D16/F Cheuk Nang Plaza 250 Hennessy Road<br>WanchaiHongKong China                                    |                                                                                       |                 |
| <b>Manufacturer:</b>                                                                                                                                                                                         | Musilab Electronic (DongGuan) Co., Ltd                                                                    |                                                                                       |                 |
| <b>Address:</b>                                                                                                                                                                                              | No.5 Huanwei Street,Fugang,Qingxi Town,<br>Dongguan,Guangdong,China                                       |                                                                                       |                 |
| <b>E.U.T:</b>                                                                                                                                                                                                | PORTABLE BLUETOOTH SPEAKER                                                                                |                                                                                       |                 |
| <b>Model Number:</b>                                                                                                                                                                                         | ROVE                                                                                                      |                                                                                       |                 |
| <b>Series models:</b>                                                                                                                                                                                        | ROVE2, ROVE-MD, ROVE-XL, MROVE-BK, MROVE-RD,<br>MROVE-SR, MROVE-XL                                        |                                                                                       |                 |
| <b>Trade Name:</b>                                                                                                                                                                                           |  Serial No.: -----       |                                                                                       |                 |
| <b>Date of Receipt:</b>                                                                                                                                                                                      | Jul. 1, 2017                                                                                              | <b>Date of Test:</b>                                                                  | Jul. 2~12, 2017 |
| <b>Test Specification:</b>                                                                                                                                                                                   | FCC Part 15, Subpart C Section 15.247: 2017<br>ANSI C63.10:2013<br>KDB558074 D01 DTS Meas Guidance v03r05 |                                                                                       |                 |
| <b>Test Result:</b>                                                                                                                                                                                          | The equipment under test was found to be compliance with the requirements of the standards applied.       |                                                                                       |                 |
|                                                                                                                                                                                                              | <b>Issue Date: Aug. 10, 2017</b>                                                                          |                                                                                       |                 |
| Tested by:                                                                                                                                                                                                   | Reviewed by:                                                                                              | Approved by:                                                                          |                 |
|                                                                                                                           |                        |  |                 |
| Keven Wu / Engineer                                                                                                                                                                                          | Mark Li / Supervisor                                                                                      | 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)<br>15.209<br>15.247(d) | PASS   |
| 6dB&99% Bandwidth          | 15.247(a)(2)                     | PASS   |
| Power density              | 15.247(e)                        | PASS   |
| Maximum Peak Output Power  | 15.247(b)(3)                     | 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:          | PORTABLE BLUETOOTH SPEAKER                                                             |
| Model No.:             | ROVE                                                                                   |
| Series models:         | ROVE2, ROVE-MD, ROVE-XL, MROVE-BK, MROVE-RD, MROVE-SR, MROVE-XL                        |
| Model Difference:      | All the models are the same circuit and RF module, except the model names and colours. |
| Operation Frequency:   | BT: 2402MHz~2480MHz                                                                    |
| Channel numbers:       | BT: 40 Channels                                                                        |
| Modulation technology: | BT: GFSK                                                                               |
| Antenna Type:          | PCB Antenna                                                                            |
| Antenna gain:          | 1.0dBi                                                                                 |
| Power supply:          | DC 7.4V(Battery:2200mA) or DC 5V from adapter                                          |

| Operation Frequency each of channel |           |         |           |         |           |         |           |
|-------------------------------------|-----------|---------|-----------|---------|-----------|---------|-----------|
| Channel                             | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 0                                   | 2402MHz   | 10      | 2422MHz   | 20      | 2442MHz   | 30      | 2462MHz   |
| 1                                   | 2404MHz   | 11      | 2424MHz   | 21      | 2444MHz   | 31      | 2464MHz   |
| 2                                   | 2406MHz   | 12      | 2426MHz   | 22      | 2446MHz   | 32      | 2466MHz   |
| 3                                   | 2408MHz   | 13      | 2428MHz   | 23      | 2448MHz   | 33      | 2468MHz   |
| 4                                   | 2410MHz   | 14      | 2430MHz   | 24      | 2450MHz   | 34      | 2470MHz   |
| 5                                   | 2412MHz   | 15      | 2432MHz   | 25      | 2452MHz   | 35      | 2472MHz   |
| 6                                   | 2414MHz   | 16      | 2434MHz   | 26      | 2454MHz   | 36      | 2474MHz   |
| 7                                   | 2416MHz   | 17      | 2436MHz   | 27      | 2456MHz   | 37      | 2476MHz   |
| 8                                   | 2418MHz   | 18      | 2438MHz   | 28      | 2458MHz   | 38      | 2478MHz   |
| 9                                   | 2420MHz   | 19      | 2440MHz   | 29      | 2460MHz   | 39      | 2480MHz   |

## 2.3. Independent Operation Modes

The basic operation modes are:

2.3.1. EUT work BT mode, and Test Mode as below:

| Final Test Mode | Description |
|-----------------|-------------|
| Mode 1          | CH00        |
| Mode 2          | CH19        |
| Mode 3          | CH39        |
| Mode 4          | Link Mode   |

Remark: According to ANSI C63.10 standards, the test results are both the “worst case” and “worst setup”

## 2.4. TEST SITES

### 2.4.1. Test Facilities

Lab Qualifications :      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

## 2.5. List of Test and Measurement Instruments

### 2.5.1. 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. 08,17 | Apr. 08,18 |
| Artificial Mains Network       | Rohde&Schwarz | ENV216    | 101315     | Apr. 08,17 | Apr. 08,18 |
| Artificial Mains Network (AUX) | Rohde&Schwarz | ENV216    | 101314     | Apr. 08,17 | Apr. 08,18 |
| RF Cable                       | FUJIKURA      | 3D-2W     | 944 Cable  | Apr. 08,17 | Apr. 08,18 |

### 2.5.2. For radiated emission test

| Equipment                             | Manufacturer  | Model No.          | Serial No.           | Last Cal.  | Next Cal.  |
|---------------------------------------|---------------|--------------------|----------------------|------------|------------|
| EMI Test Receiver                     | Rohde&Schwarz | ESCI               | 101156               | Apr. 08,17 | Apr. 08,18 |
| System Simulator                      | Agilent       | E5515C             | GB43130245           | Apr. 08,17 | Apr. 08,18 |
| Power Splitter                        | Weinschel     | 1506A              | NW425                | Apr. 08,17 | Apr. 08,18 |
| Bilog Antenna                         | ETS-LINDGREEN | 3142D              | 135452               | Apr. 09,17 | Apr. 09,18 |
| Spectrum Analyzer                     | Agilent       | E4411B             | MY4511304            | Apr. 08,17 | Apr. 08,18 |
| Spectrum Analyzer                     | R&S           | FSV40              | 132.1.3008K39-100967 | Apr. 08,17 | Apr. 08,18 |
| 3m Semi-anechoic Chamber              | ETS-LINDGREEN | 966                | KW01                 | Apr. 09,17 | Apr. 09,18 |
| Signal Amplifier                      | SONOMA        | 310                | 187016               | Apr. 08,17 | Apr. 08,18 |
| Signal Amplifier                      | Agilent       | 8449B              | 3008A00251           | Apr. 08,17 | Apr. 08,18 |
| 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                          | DAZE          | ZN30701            | 11003                | Apr. 09,17 | Apr. 09,18 |
| Horn Antenna                          | SCHWARZBECK   | BBHA9170           | 9170-068             | Apr. 09,17 | Apr. 09,18 |
| Spectrum Analyzer                     | Agilent       | 8593E              | 3911A04271           | Apr. 08,17 | Apr. 08,18 |
| Spectrum Analyzer                     | Agilent       | E4408B             | MY44211125           | Apr. 08,17 | Apr. 08,18 |
| Signal Amplifier                      | DAZE          | ZN3380C            | 11001                | Apr. 08,17 | Apr. 08,18 |
| High Pass filter                      | Micro         | HPM50111           | 324216               | Apr. 08,17 | Apr. 08,18 |
| Filter                                | COM-MW        | ZBSF-C836.5-25-X   | KW032                | Apr. 08,17 | Apr. 08,18 |
| Filter                                | COM-MW        | ZBSF-C1747.5-75-X2 | KW035                | Apr. 08,17 | Apr. 08,18 |
| Filter                                | COM-MW        | ZBSF-C1880-60-X2   | KW037                | Apr. 08,17 | Apr. 08,18 |
| DC Power Supply                       | LongWei       | PS-305D            | 010964729            | Apr. 08,17 | Apr. 08,18 |
| Constant temperature and humidity box | GF            | GTH-800-40-1P      | MAA9906-005          | Apr. 08,17 | Apr. 08,18 |
| Splitter                              | Agilent       | 11636B             | 0025164              | Apr. 08,17 | Apr. 08,18 |
| Loop Antenna                          | ARA           | PLA-1030/B         | 1029                 | Apr. 08,17 | Apr. 08,18 |
| Power Meter                           | Anritsu       | ML2495A            | 1204003              | Apr. 08,17 | Apr. 08,18 |
| Power Sensor                          | Anritsu       | MA2411B            | 1126150              | Apr. 08,17 | Apr. 08,18 |

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

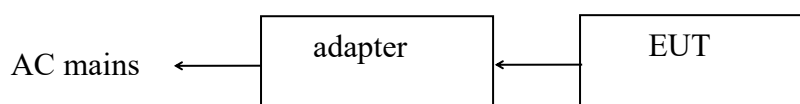
#### 3.1. Principle of Configuration Selection

**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

Conducted Emission:



Radiated Emission:



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

| Final Test Mode | Description |
|-----------------|-------------|
| Mode 1          | CH00        |
| Mode 2          | CH19        |
| Mode 3          | CH39        |
| Mode 4          | Link Mode   |
| Test Software   | BlueTest3   |

#### 3.4. Special Accessories and Auxiliary Equipment

|          |                                                                                |
|----------|--------------------------------------------------------------------------------|
| Adapter: | Model:BSY012U050200U U1USB<br>INPUT:AC 100-120V, 60Hz, 0.3A<br>OUTPUT:DC 5V/2A |
|----------|--------------------------------------------------------------------------------|

#### 3.5. Countermeasures to Achieve EMC Compliance

N/A.

## 4. EMISSION TEST RESULTS

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

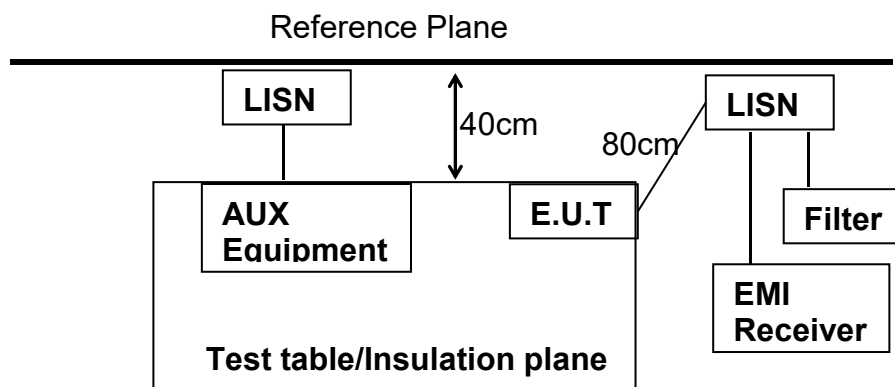
#### 4.1.1. Limit 15.207 limits

| Frequency<br>MHz | Limit (dBuV) |          |
|------------------|--------------|----------|
|                  | Quasi-peak   | Average  |
| 0.15-0.5         | 66 to 56     | 56 to 46 |
| 0.5-5            | 56           | 46       |
| 5-30             | 60           | 50       |

NOTE: 1.The lower limit shall apply at the transition frequencies.  
2.The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.

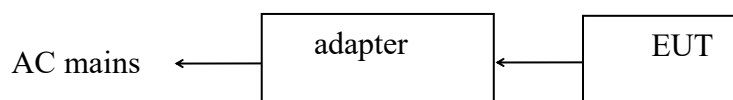
#### 4.1.2. Test Setup

- 1.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.
- 2.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.
- 3.The frequency range from 150 kHz to 30 MHz was investigated.
- 4.The bandwidth of the test receiver was set at 9 kHz.
- 5.Pretest for all mode, The test data of the worst case condition(s) was reported on the following page.

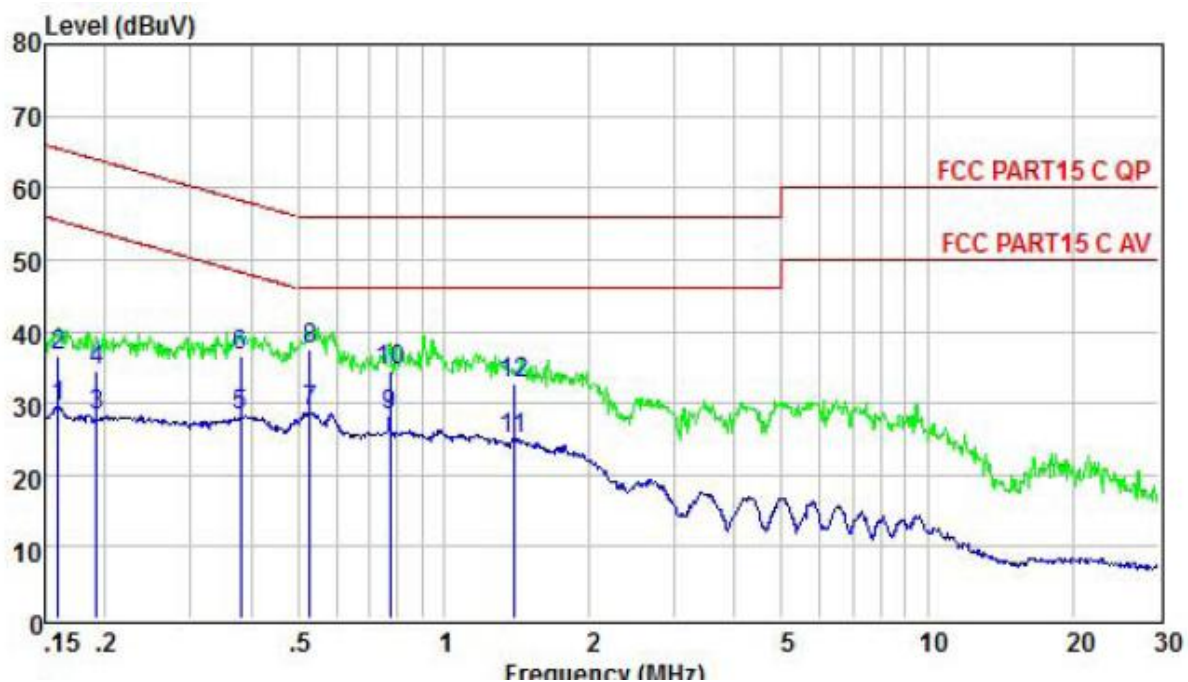


Remark: E.U.T. :Equipment Under Test  
LISN: Line Impedance Stabilization Network  
Test table height: 0.8m.

#### Test block

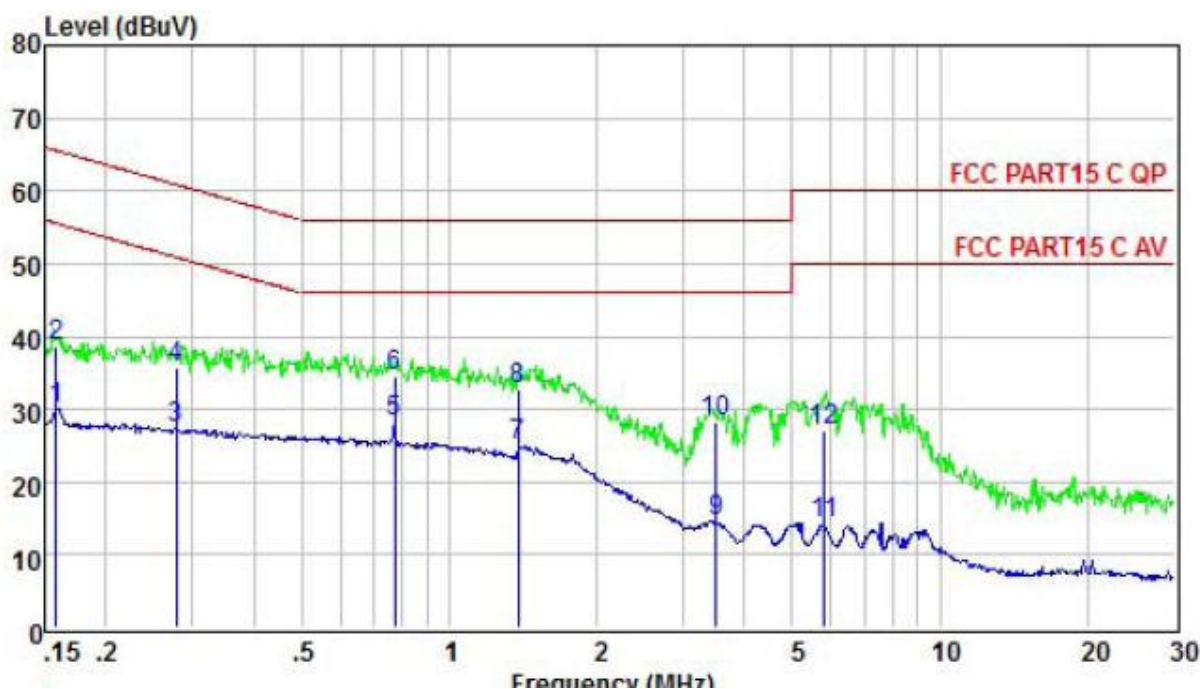


|                |                                      |                     |        |
|----------------|--------------------------------------|---------------------|--------|
| EUT :          | PORTABLE BLUETOOTH SPEAKER           | Model Name :        | ROVE   |
| Temperature :  | 26 °C         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



|    | Freq  | Level | Limit | Over   | Remark  |
|----|-------|-------|-------|--------|---------|
|    | MHz   | dBuV  | Line  | Limit  |         |
|    |       |       |       | dB     |         |
| 1  | 0.160 | 29.59 | 55.47 | -25.88 | Average |
| 2  | 0.160 | 36.69 | 65.47 | -28.78 | QP      |
| 3  | 0.191 | 28.26 | 53.98 | -25.72 | Average |
| 4  | 0.191 | 34.59 | 63.98 | -29.39 | QP      |
| 5  | 0.381 | 28.34 | 48.25 | -19.91 | Average |
| 6  | 0.381 | 36.69 | 58.25 | -21.56 | QP      |
| 7  | 0.529 | 28.70 | 46.00 | -17.30 | Average |
| 8  | 0.529 | 37.58 | 56.00 | -18.42 | QP      |
| 9  | 0.775 | 28.20 | 46.00 | -17.80 | Average |
| 10 | 0.775 | 34.59 | 56.00 | -21.41 | QP      |
| 11 | 1.396 | 25.03 | 46.00 | -20.97 | Average |
| 12 | 1.396 | 32.68 | 56.00 | -23.32 | QP      |

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



|    | Freq  | Level | Limit | Over   | Remark  |
|----|-------|-------|-------|--------|---------|
|    | MHz   | dBuV  | dBuV  | dB     |         |
| 1  | 0.158 | 30.17 | 55.56 | -25.39 | Average |
| 2  | 0.158 | 38.55 | 65.56 | -27.01 | QP      |
| 3  | 0.277 | 27.31 | 50.90 | -23.59 | Average |
| 4  | 0.277 | 35.69 | 60.90 | -25.21 | QP      |
| 5  | 0.775 | 28.17 | 46.00 | -17.83 | Average |
| 6  | 0.775 | 34.58 | 56.00 | -21.42 | QP      |
| 7  | 1.381 | 24.88 | 46.00 | -21.12 | Average |
| 8  | 1.381 | 32.69 | 56.00 | -23.31 | QP      |
| 9  | 3.491 | 14.60 | 46.00 | -31.40 | Average |
| 10 | 3.491 | 28.12 | 56.00 | -27.88 | QP      |
| 11 | 5.805 | 14.33 | 50.00 | -35.67 | Average |
| 12 | 5.805 | 26.99 | 60.00 | -33.01 | QP      |

## 4.2. Radiated Emission Test

### 4.2.1. Limit 15.209 limits

| Frequency<br>MHZ | Distance<br>Meters | Filed Strengths Limit                                                 |                                   |
|------------------|--------------------|-----------------------------------------------------------------------|-----------------------------------|
|                  |                    | $\mu\text{V/m}$                                                       | $\text{dB}(\mu\text{V})/\text{m}$ |
| 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                  | 74.0dB( $\mu\text{V}$ )/m(Peak)<br>54.0dB( $\mu\text{V}$ )/m(Average) |                                   |

### 4.2.2. Restricted bands of operation

| MHz                                                                                                                                                                                                                             | MHz                 | MHz           | GHz         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------|-------------|
| 0.009-0.110                                                                                                                                                                                                                     | 16.42-16.423        | 399.9-410     | 4.5-5.15    |
| 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     |             |
| 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. |                     |               |             |

### 4.2.3. Test setup

The EUT was placed on a turn table which was 0.8 m (above 1GHz, the table was 1.5m) above the ground. 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, Both PK and AV measure, PK detector is used.

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%.

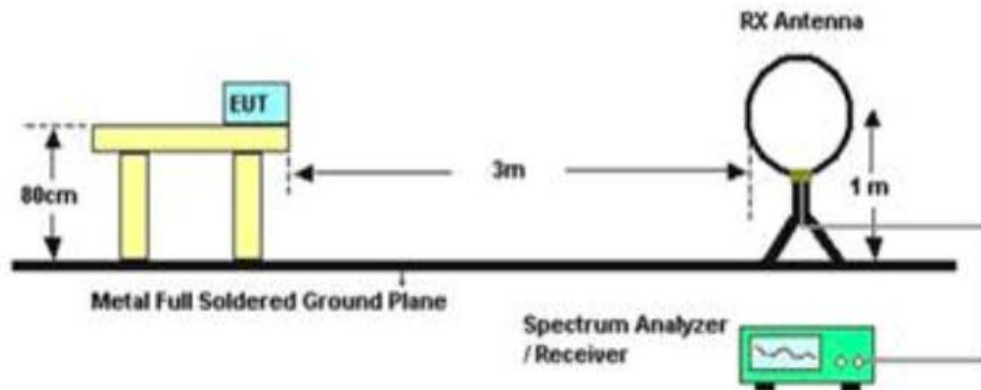
3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.

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

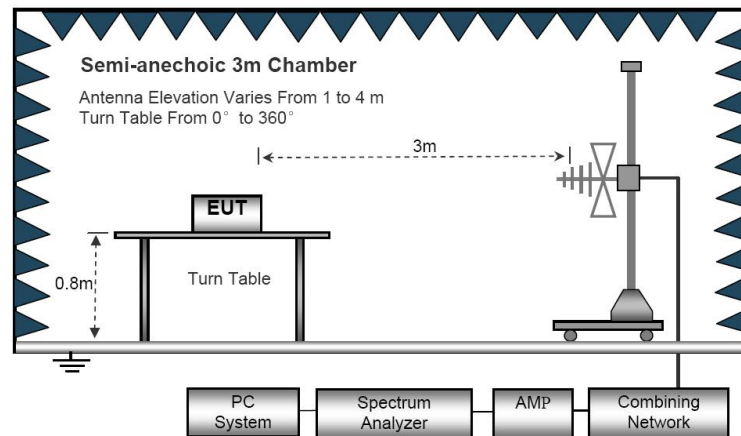
5. For Both PK and AV value above 1GHz, PK detector is used.

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

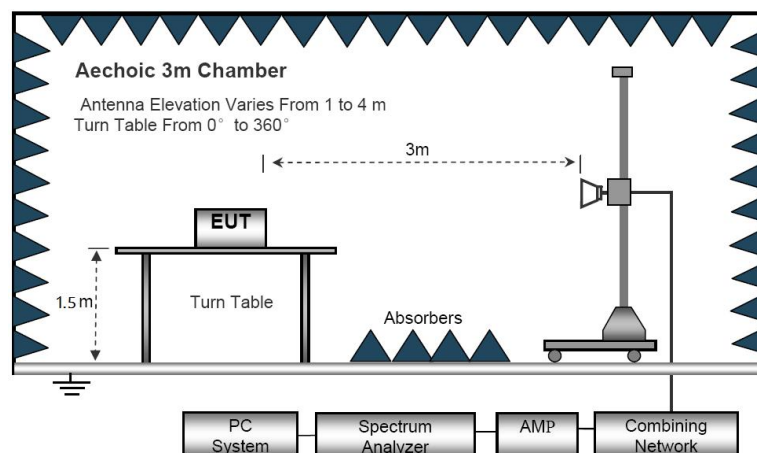
## Radiated Emission Test-Up Frequency Below 30MHz



## 30MHz- 1GHz



## Above 1GHz



**Below 30MHz**

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

**Note:**

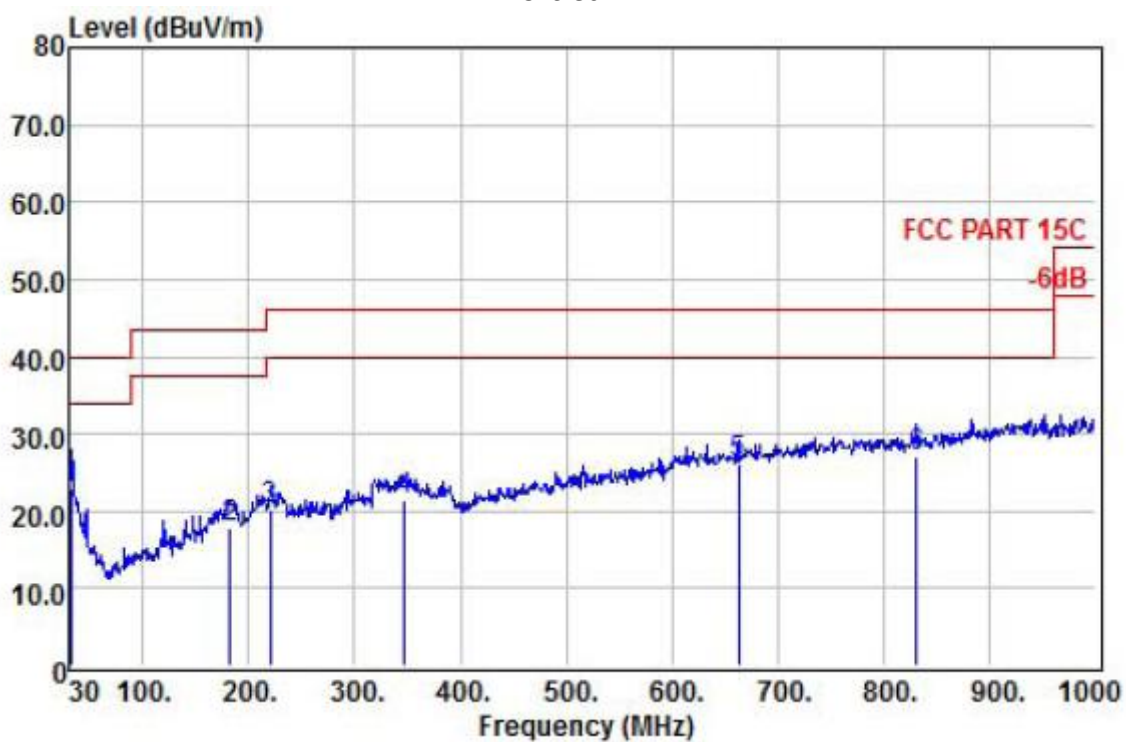
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

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

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

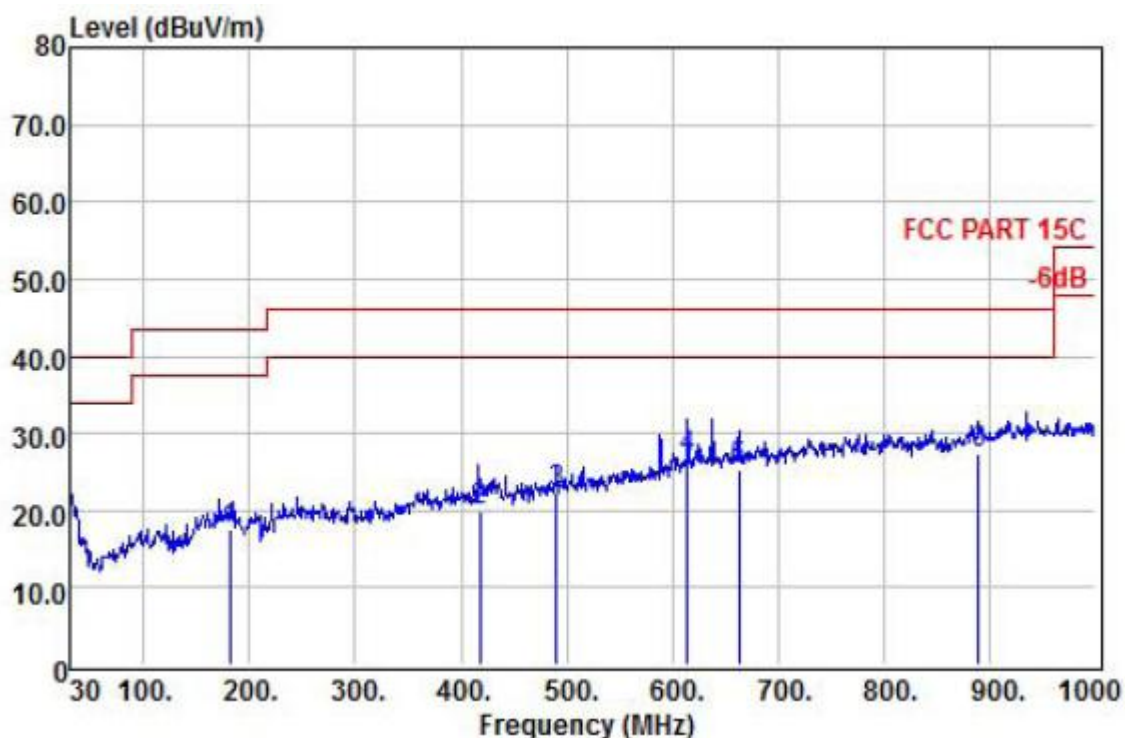
| Below 1GHz     |                            |                     |             |
|----------------|----------------------------|---------------------|-------------|
| EUT :          | PORTABLE BLUETOOTH SPEAKER | Model Name :        | ROVE        |
| Temperature :  | 20 °C                      | Relative Humidity : | 48%         |
| Pressure :     | 1010hPa                    | Test Mode :         | Mode 1-GFSK |
| Test Voltage : | DC 7.4V                    |                     |             |

## Vertical



|   | Freq   | ReadAntenna<br>Level | Antenna<br>Factor | Cable<br>Loss | Level  | Limit<br>Line | Over<br>Limit | Remark |
|---|--------|----------------------|-------------------|---------------|--------|---------------|---------------|--------|
|   | MHz    | dBuV                 | dB/m              | dB            | dBuV/m | dBuV/m        | dB            |        |
| 1 | 32.91  | 5.69                 | 17.08             | 0.27          | 23.04  | 40.00         | -16.96        | QP     |
| 2 | 182.29 | 7.36                 | 10.33             | 0.25          | 17.94  | 43.50         | -25.56        | QP     |
| 3 | 220.12 | 7.85                 | 11.97             | 0.40          | 20.22  | 46.00         | -25.78        | QP     |
| 4 | 347.19 | 5.29                 | 15.39             | 0.77          | 21.45  | 46.00         | -24.55        | QP     |
| 5 | 663.41 | 3.14                 | 21.72             | 1.19          | 26.05  | 46.00         | -19.95        | QP     |
| 6 | 831.22 | 2.63                 | 23.10             | 1.48          | 27.21  | 46.00         | -18.79        | QP     |

## Horizontal



|   | Freq   | ReadAntenna | Cable  |      | Limit  | Over   |           |
|---|--------|-------------|--------|------|--------|--------|-----------|
|   | MHz    | Level       | Factor | Loss | Line   | Limit  | Remark    |
|   | MHz    | dBuV        | dB/m   | dB   | dBuV/m | dBuV/m | dB        |
| 1 | 182.29 | 7.00        | 10.33  | 0.25 | 17.58  | 43.50  | -25.92 QP |
| 2 | 418.00 | 2.05        | 16.88  | 0.96 | 19.89  | 46.00  | -26.11 QP |
| 3 | 490.75 | 2.72        | 18.55  | 1.16 | 22.43  | 46.00  | -23.57 QP |
| 4 | 613.94 | 4.61        | 20.99  | 1.14 | 26.74  | 46.00  | -19.26 QP |
| 5 | 663.41 | 2.50        | 21.72  | 1.19 | 25.41  | 46.00  | -20.59 QP |
| 6 | 890.39 | 2.00        | 23.81  | 1.60 | 27.41  | 46.00  | -18.59 QP |

NOTE: Absolute Level= Reading Level+antenna Factor+cable loss,

Over Limit= Absolute Level – Limit;

Mode 1 is the worst mode. Only worst case is presented in the report .

| Above 1GHz     |                            |                     |             |
|----------------|----------------------------|---------------------|-------------|
| EUT :          | PORTABLE BLUETOOTH SPEAKER | Model Name :        | ROVE        |
| Temperature :  | 20 °C                      | Relative Humidity : | 48%         |
| Pressure :     | 1010hPa                    | Test Mode :         | Mode 1-GFSK |
| Test Voltage : | DC 7.4V                    |                     |             |

| 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)   |               |            |
| TX-2402   |               |                |            |               |                |          |        |               |            |
| 4804      | 29.86         | 32.94          | 11.94      | 27.49         | 47.25          | 54       | -6.75  | Average       | Vertical   |
| 4804      | 39.67         | 32.94          | 11.94      | 27.49         | 57.06          | 74       | -16.94 | peak          | Vertical   |
| 7206      | 30.12         | 25.28          | 18.04      | 27.94         | 45.50          | 54       | -8.50  | Average       | Vertical   |
| 7206      | 41.67         | 25.28          | 18.04      | 27.94         | 57.05          | 74       | -16.95 | peak          | Vertical   |
| 4804      | 29.87         | 32.94          | 11.94      | 27.49         | 47.26          | 54       | -6.74  | Average       | Horizontal |
| 4804      | 40.28         | 32.94          | 11.94      | 27.49         | 57.67          | 74       | -16.33 | peak          | Horizontal |
| 7206      | 29.88         | 25.28          | 18.04      | 27.94         | 45.26          | 54       | -8.74  | Average       | Horizontal |
| 7206      | 41.58         | 25.28          | 18.04      | 27.94         | 56.96          | 74       | -17.04 | peak          | Horizontal |
| TX-2440   |               |                |            |               |                |          |        |               |            |
| 4880      | 29.89         | 32.11          | 12.15      | 27.53         | 46.62          | 54       | -7.38  | Average       | Vertical   |
| 4880      | 39.97         | 32.11          | 12.15      | 27.53         | 56.70          | 74       | -17.30 | peak          | Vertical   |
| 7320      | 30.66         | 24.33          | 18.09      | 27.96         | 45.12          | 54       | -8.88  | Average       | Vertical   |
| 7320      | 41.67         | 24.33          | 18.09      | 27.96         | 56.13          | 74       | -17.87 | peak          | Vertical   |
| 4880      | 30.67         | 32.11          | 12.15      | 27.53         | 47.40          | 54       | -6.60  | Average       | Horizontal |
| 4880      | 40.65         | 32.11          | 12.15      | 27.53         | 57.38          | 74       | -16.62 | peak          | Horizontal |
| 7320      | 29.45         | 24.33          | 18.09      | 27.96         | 43.91          | 54       | -10.09 | Average       | Horizontal |
| 7320      | 39.86         | 24.33          | 18.09      | 27.96         | 54.32          | 74       | -19.68 | peak          | Horizontal |
| TX-2480   |               |                |            |               |                |          |        |               |            |
| 4960      | 30.08         | 31.32          | 12.31      | 27.58         | 46.13          | 54       | -7.87  | Average       | Vertical   |
| 4960      | 40.82         | 31.32          | 12.31      | 27.58         | 56.87          | 74       | -17.13 | peak          | Vertical   |
| 7440      | 30.01         | 24.38          | 18.16      | 27.99         | 44.56          | 54       | -9.44  | Average       | Vertical   |
| 7440      | 40.29         | 24.38          | 18.16      | 27.99         | 54.84          | 74       | -19.16 | peak          | Vertical   |
| 4960      | 29.68         | 31.32          | 12.31      | 27.58         | 45.73          | 54       | -8.27  | Average       | Horizontal |
| 4960      | 40.78         | 31.32          | 12.31      | 27.58         | 56.83          | 74       | -17.17 | peak          | Horizontal |
| 7440      | 30.21         | 24.38          | 18.16      | 27.99         | 44.76          | 54       | -9.24  | Average       | Horizontal |
| 7440      | 40.44         | 24.38          | 18.16      | 27.99         | 54.99          | 74       | -19.01 | peak          | Horizontal |

NOTE: 1. Absolute Level= ReadingLevel+antenna Factor+cable loss-preamp factor.

2. Over Limit= Absolute Level – Limit.

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

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

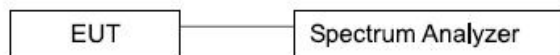
## 5. BAND EDGE COMPLIANCE TEST

### 5.1. Limits

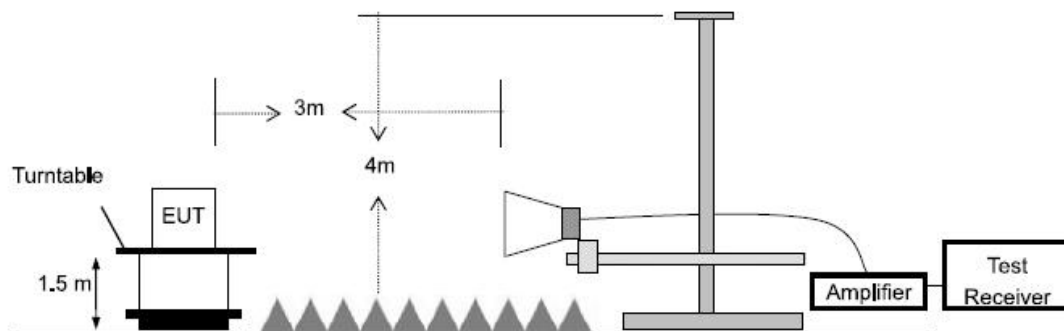
All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 30dB below the fundamental emissions, or comply with 15.209 limits.

### 5.2. Test setup

For Conducted Test



For Radiated emission Test

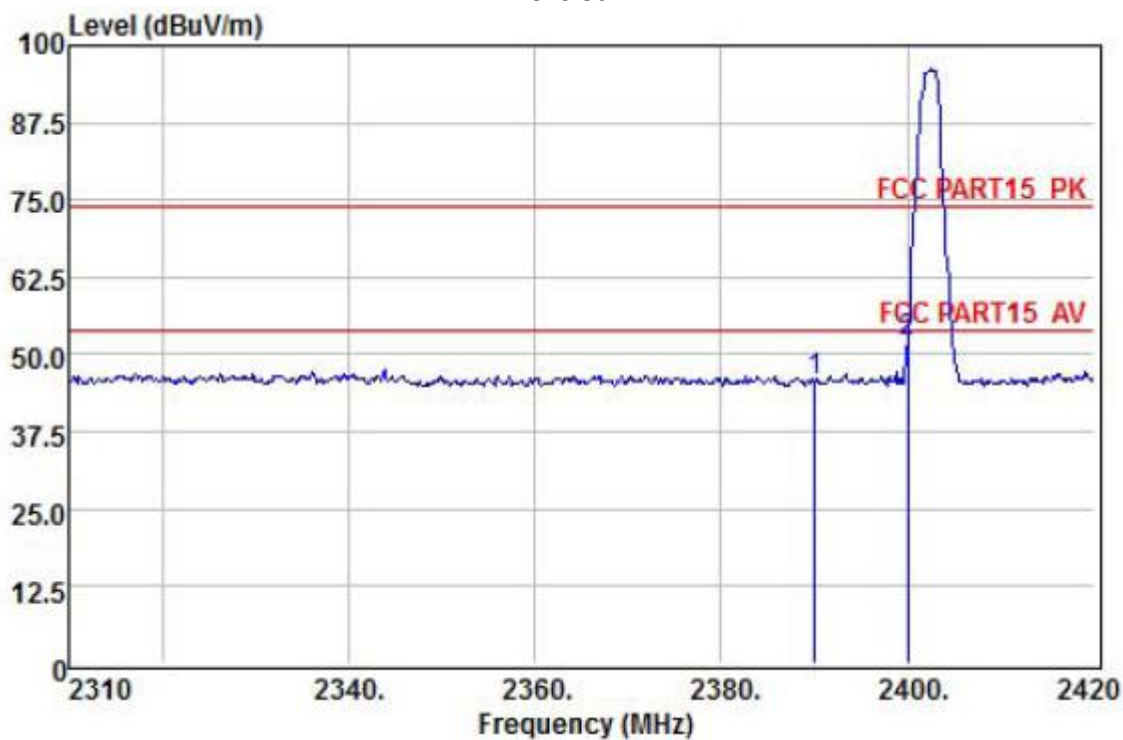


## 5.3. TEST Procedure

| For Conducted Test         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 1.                         | The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100KHz. The video bandwidth is set to 300KHz.                                                                                                                                                                                                                                                                                                                                     |          |
| 2.                         | The spectrum from 30MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.                                                                                                                                                                                                                                                                                                                                                          |          |
| EMI Test receiver          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Setting  |
| Attenuation                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Auto     |
| RBW                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 100KHz   |
| VBW                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 300KHz   |
| Detector                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Peak     |
| trace                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Max hold |
| For Radiated emission Test |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |
| 1.                         | The EUT was placed on a styrofoam table which is 1.5m above ground plane.                                                                                                                                                                                                                                                                                                                                                                                                        |          |
| 2.                         | The measurement procedure at the band edges was simplified by performing the measurement in just one plot. Both, the in-band-emission and the unwanted emission were be encompassed by the span. After trace stabilization, the maxium peak was be determined by a peak detector and the value was marked by an appropriate limit line. The second limit line, which is 20dB below the first, marks the limits for the emissions in the unrestricted band next to the band edge. |          |
| 3.                         | The measurements were performed at the lower end of the 2.4GHz band.                                                                                                                                                                                                                                                                                                                                                                                                             |          |
| 4.                         | Use the following spectrum analyzer settings                                                                                                                                                                                                                                                                                                                                                                                                                                     |          |
| EMI Test receiver          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Setting  |
| Attenuation                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Auto     |
| RBW                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1MHz     |
| VBW                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 10Hz     |
| Detector                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Average  |
| trace                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Max hold |

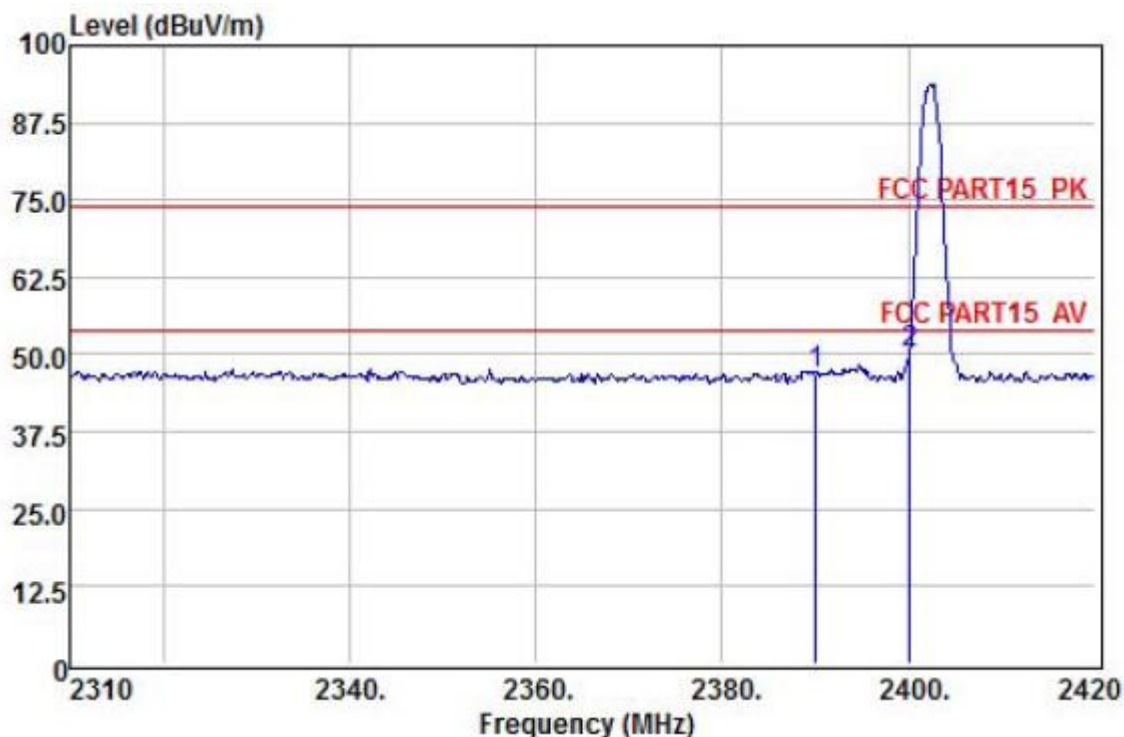
**For radiated Bandedge test as follows:**

|                |                            |                     |         |
|----------------|----------------------------|---------------------|---------|
| EUT :          | PORTABLE BLUETOOTH SPEAKER | Model Name :        | ROVE    |
| Temperature :  | 20 °C                      | Relative Humidity : | 48%     |
| Pressure :     | 1010hPa                    | Test Mode :         | TX-2402 |
| Test Voltage : | DC 7.4V                    |                     |         |

**Vertical**

|   | Freq    | ReadAntenna<br>Level | Antenna<br>Factor | Cable<br>Loss | Preamp<br>Factor | Level  | Limit<br>Line | Over<br>Limit | Remark |
|---|---------|----------------------|-------------------|---------------|------------------|--------|---------------|---------------|--------|
|   | MHz     | dBuV                 | dB/m              | dB            | dB               | dBuV/m | dBuV/m        | dB            |        |
| 1 | 2390.00 | 39.86                | 28.72             | 3.36          | 26.32            | 45.62  | 74.00         | -28.38        | Peak   |
| 2 | 2400.00 | 46.11                | 28.72             | 3.38          | 26.32            | 51.89  | 74.00         | -22.11        | Peak   |

## Horizontal



|   | Freq    | ReadAntenna | Cable | Preamp |       | Limit  | Over   |             |
|---|---------|-------------|-------|--------|-------|--------|--------|-------------|
|   | Level   | Factor      | Loss  | Factor | Level | Line   | Limit  | Remark      |
|   | MHz     | dBuV        | dB/m  | dB     | dB    | dBuV/m | dBuV/m | dB          |
| 1 | 2390.00 | 41.16       | 28.72 | 3.36   | 26.32 | 46.92  | 74.00  | -27.08 Peak |
| 2 | 2400.09 | 44.45       | 28.72 | 3.38   | 26.32 | 50.23  | 74.00  | -23.77 Peak |

NOTE: 1.Absolute Level= Reading Level+antenna Factor+cable loss-preamp factor,

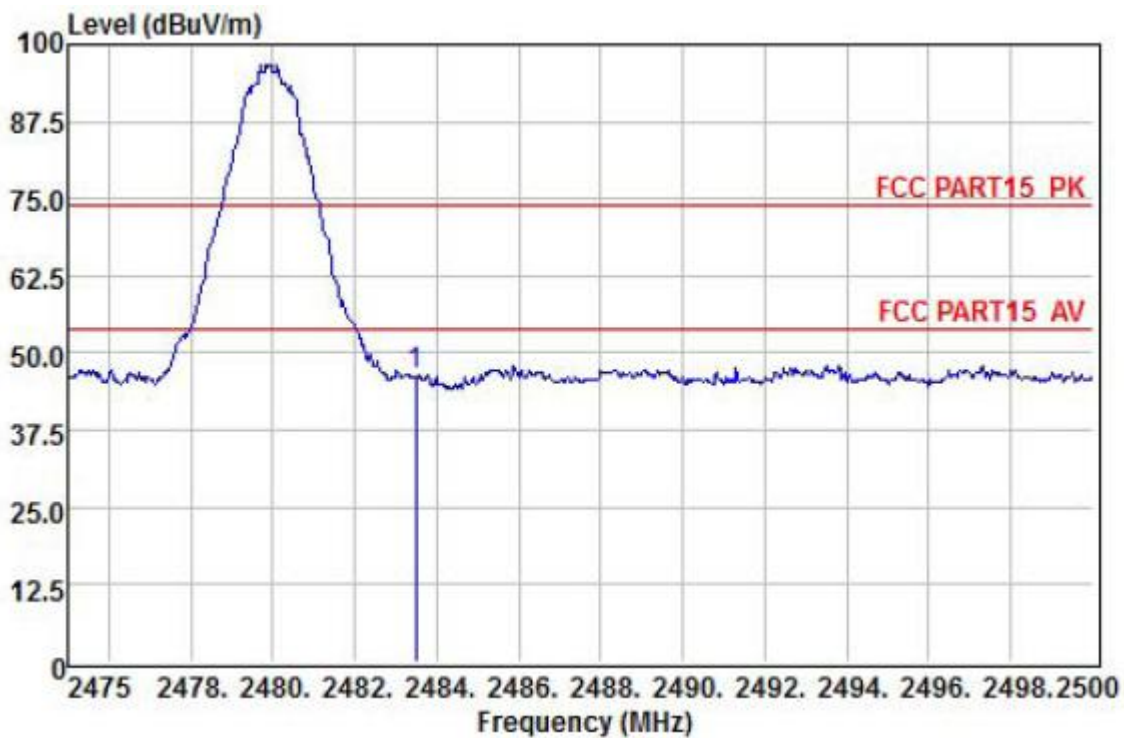
Over Limit= Absolute Level – Limit;

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

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

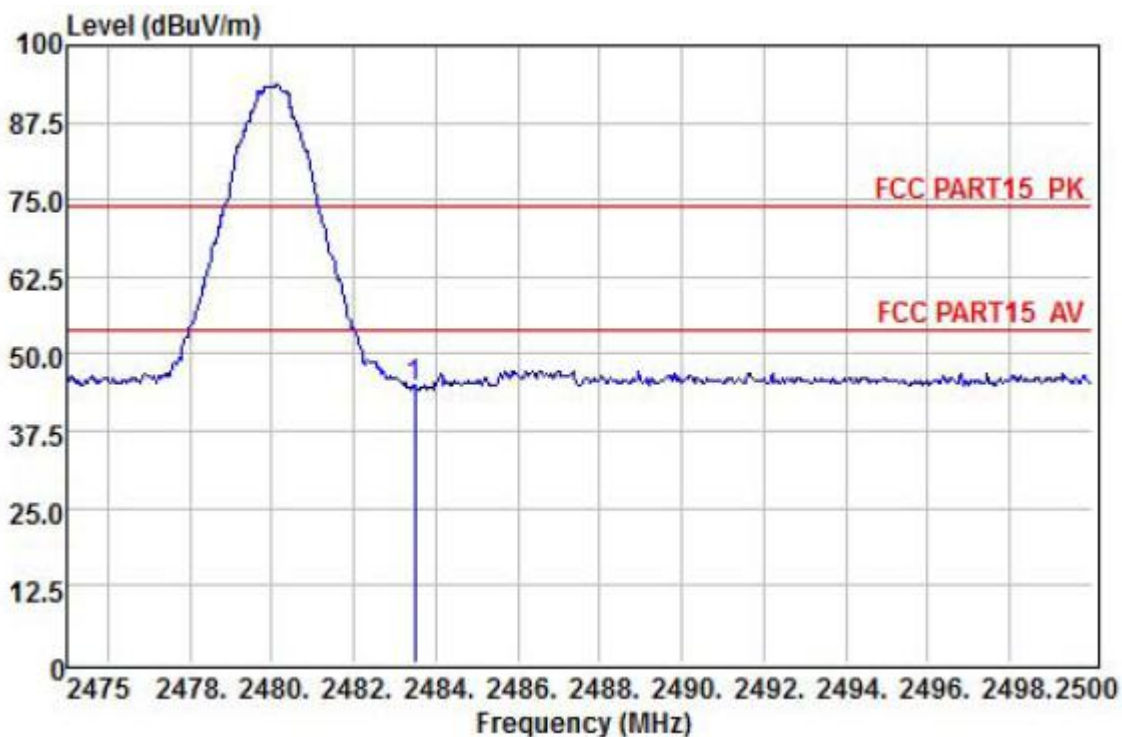
|                |                            |                     |         |
|----------------|----------------------------|---------------------|---------|
| EUT :          | PORTABLE BLUETOOTH SPEAKER | Model Name :        | ROVE    |
| Temperature :  | 20 °C                      | Relative Humidity : | 48%     |
| Pressure :     | 1010hPa                    | Test Mode :         | TX-2480 |
| Test Voltage : | DC 7.4V                    |                     |         |

## Vertical



|   | Freq    | Read<br>Level | Antenna<br>Factor | Cable<br>Loss | Preamp<br>Factor | Level  | Limit<br>Line | Over<br>Limit | Remark |
|---|---------|---------------|-------------------|---------------|------------------|--------|---------------|---------------|--------|
|   | MHz     | dBuV          | dB/m              | dB            | dB               | dBuV/m | dBuV/m        | dB            |        |
| 1 | 2483.50 | 40.59         | 28.79             | 3.48          | 26.34            | 46.52  | 74.00         | -27.48        | Peak   |

## Horizontal



|   | Freq    | ReadAntenna | Cable | Preamp |       | Limit  | Over   |             |
|---|---------|-------------|-------|--------|-------|--------|--------|-------------|
|   | Level   | Factor      | Loss  | Factor | Level | Line   | Limit  | Remark      |
|   | MHz     | dBuV        | dB/m  | dB     | dB    | dBuV/m | dBuV/m | dB          |
| 1 | 2483.50 | 38.61       | 28.79 | 3.48   | 26.34 | 44.54  | 74.00  | -29.46 Peak |

NOTE: 1.Absolute Level= Reading Level+antenna Factor+cable loss-preamp factor,

Over Limit= Absolute Level – Limit;

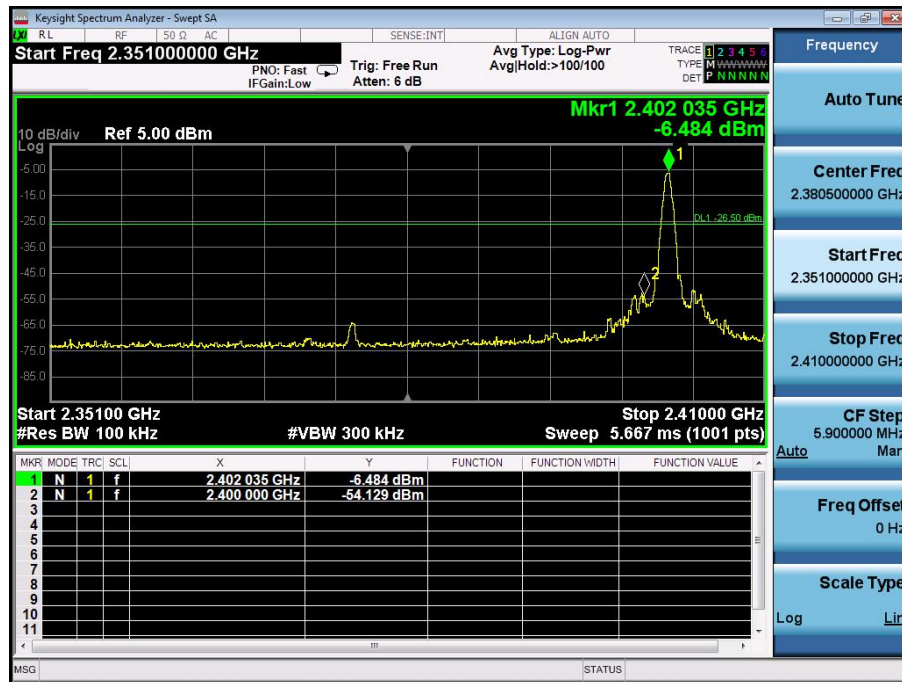
2.The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has not to be reported.

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

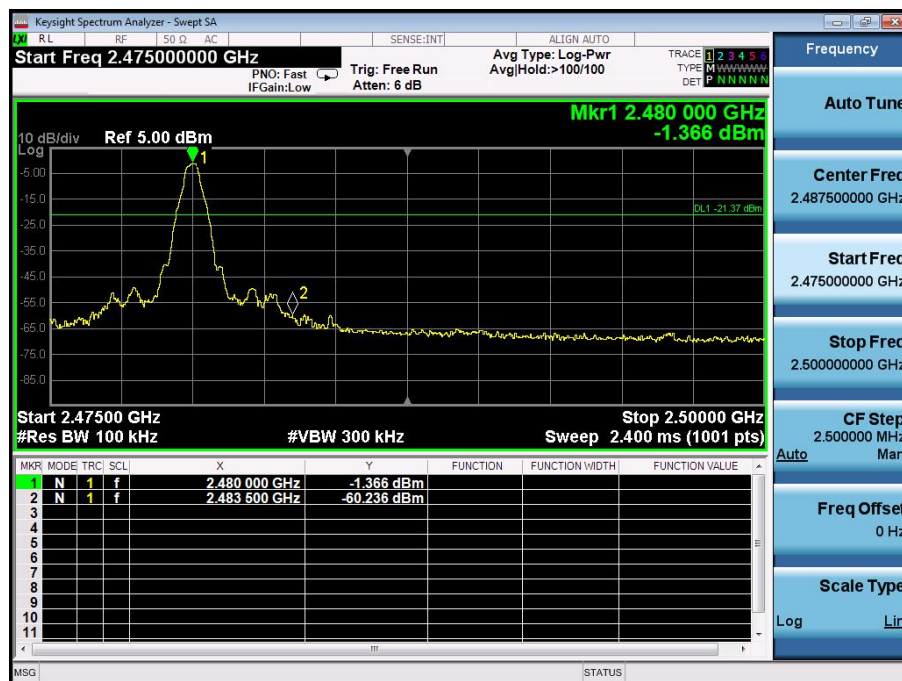
## conduction band-edge

| Frequency Band | Delta Peak to band emission (dBc) | >Limit (dBc) | Result |
|----------------|-----------------------------------|--------------|--------|
| Left-band      | 47.65                             | 20           | Pass   |
| Right-band     | 58.87                             | 20           | Pass   |

## Left Side



## Right Side



## 6. 6DB OCCUPY BANDWIDTH

### 6.1. Limits

For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

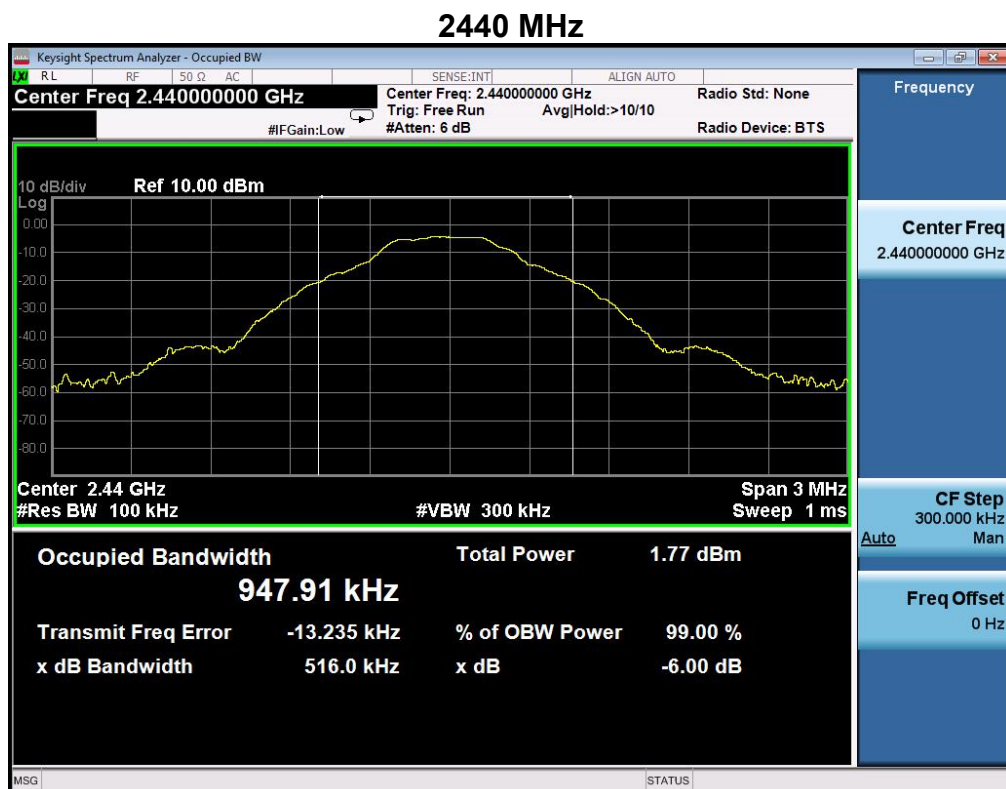
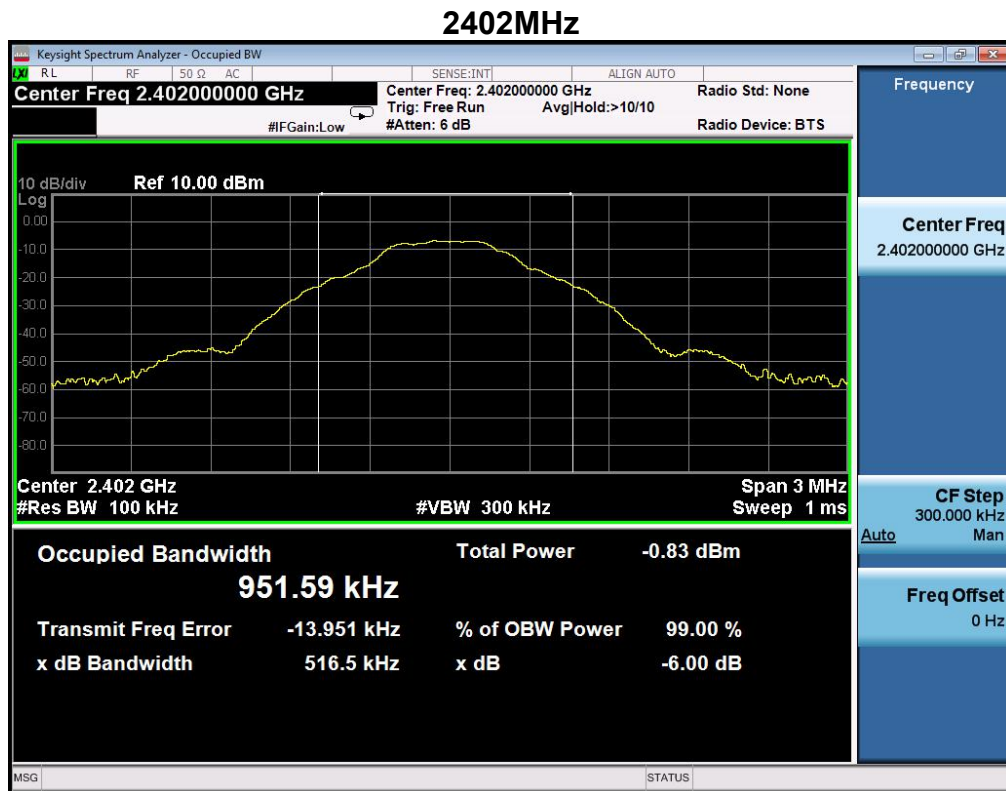
### 6.2. TEST PROCEDURE

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

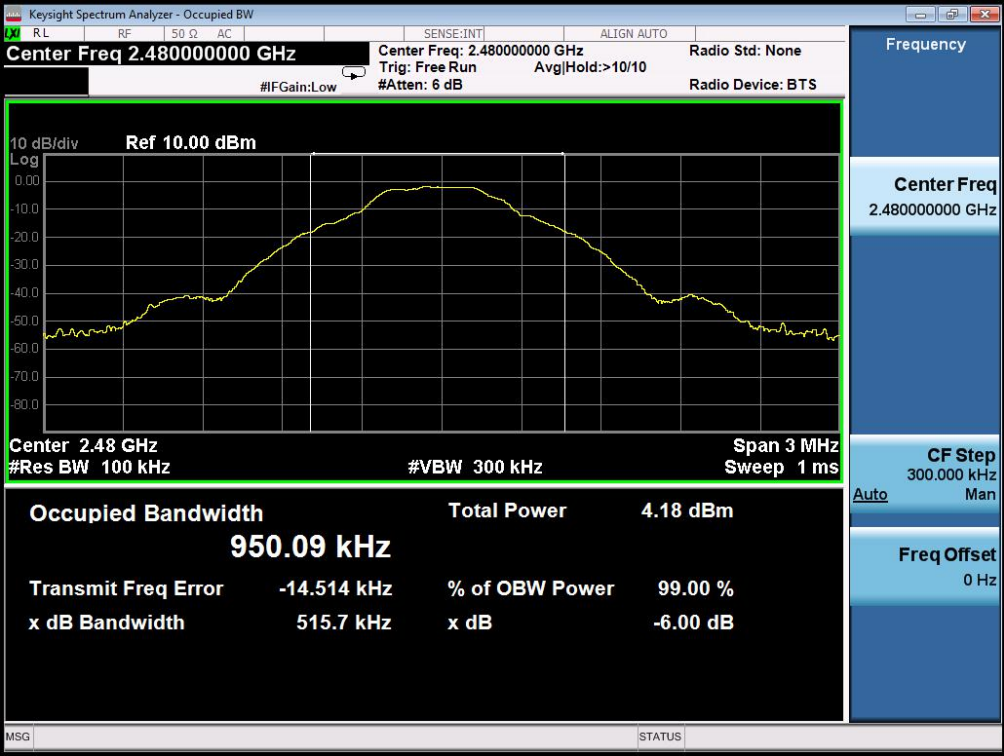
Test data:

| Channel Frequency (MHz) | 6dB Bandwidth (KHz) | Limit (KHz) | Result |
|-------------------------|---------------------|-------------|--------|
| 2402                    | 516.5               | 500         | Pass   |
| 2440                    | 516.0               | 500         | Pass   |
| 2480                    | 515.7               | 500         | Pass   |

Test plot as follows:



2480 MHz



## 7. OUTPUT POWER TEST

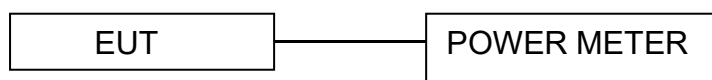
### 7.1. Limits

For systems using digital modulation in the 2400~2483.5MHz, The out put Power shall not exceed 1W (30dBm)

### 7.2. Test setup

1. The Transmitter output (antenna port) was connected to the power meter.
2. Turn on the EUT and power meter and then record the power value.
3. Repeat above procedures on all channels needed to be tested.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.



### 7.3. Test result

| Frequency<br>(MHz) | Maximum<br>Conducted Output<br>Power (dBm) | Limit<br>(dBm) |
|--------------------|--------------------------------------------|----------------|
| 2402               | -1.02                                      | 30             |
| 2440               | -0.58                                      | 30             |
| 2480               | 1.28                                       | 30             |

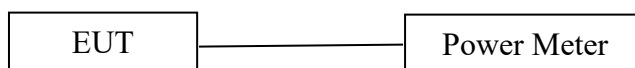
## 8. POWER SPECTRAL DENSITY TEST

### 8.1. Limits

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

### 8.2. Test setup

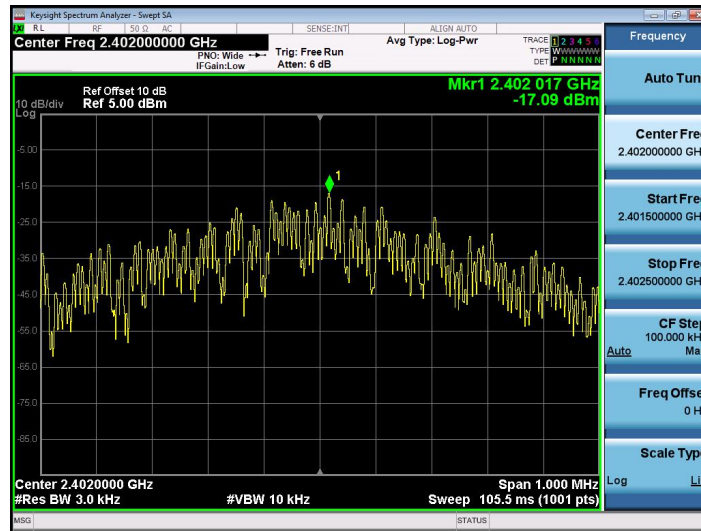
1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
4. Set the VBW  $\geq 3 \text{ RBW}$
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



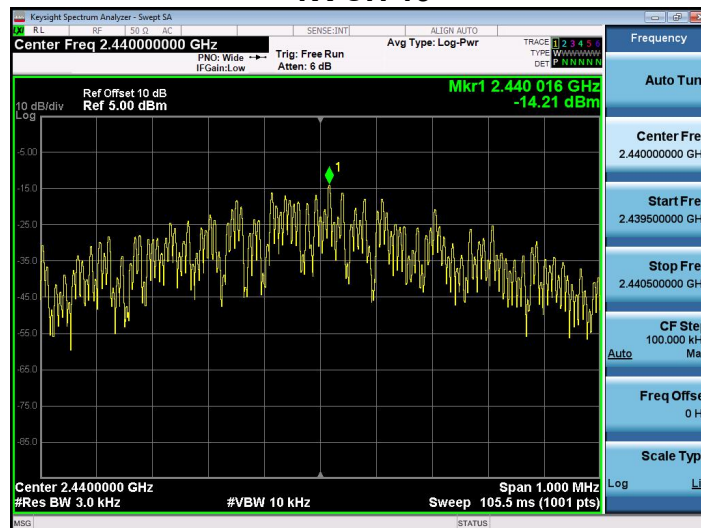
### 8.3. Test result

| Channel Frequency (MHz) | Power density (dBm/3kHz) | Limit (dBm/3kHz) | Result |
|-------------------------|--------------------------|------------------|--------|
| 2402                    | -17.09                   | 8                | Pass   |
| 2440                    | -14.21                   | 8                | Pass   |
| 2480                    | -11.85                   | 8                | Pass   |

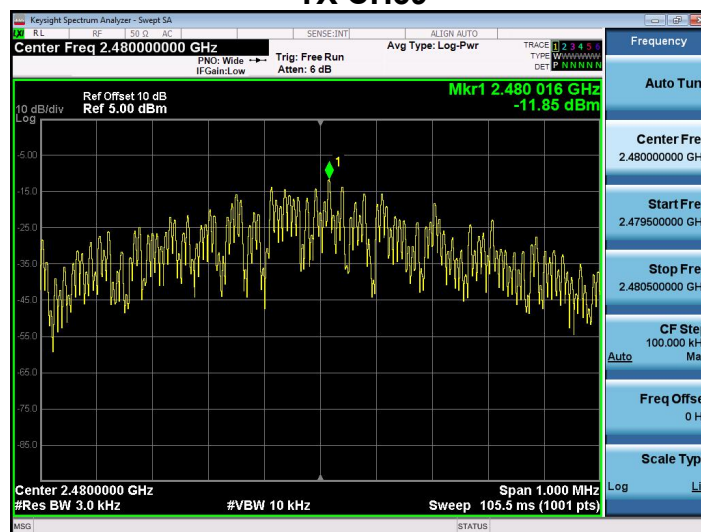
## TX CH00



## TX CH 19



## TX CH39



## 9. ANTENNA REQUIREMENTS

### 9.1. 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.

### 9.2. Result

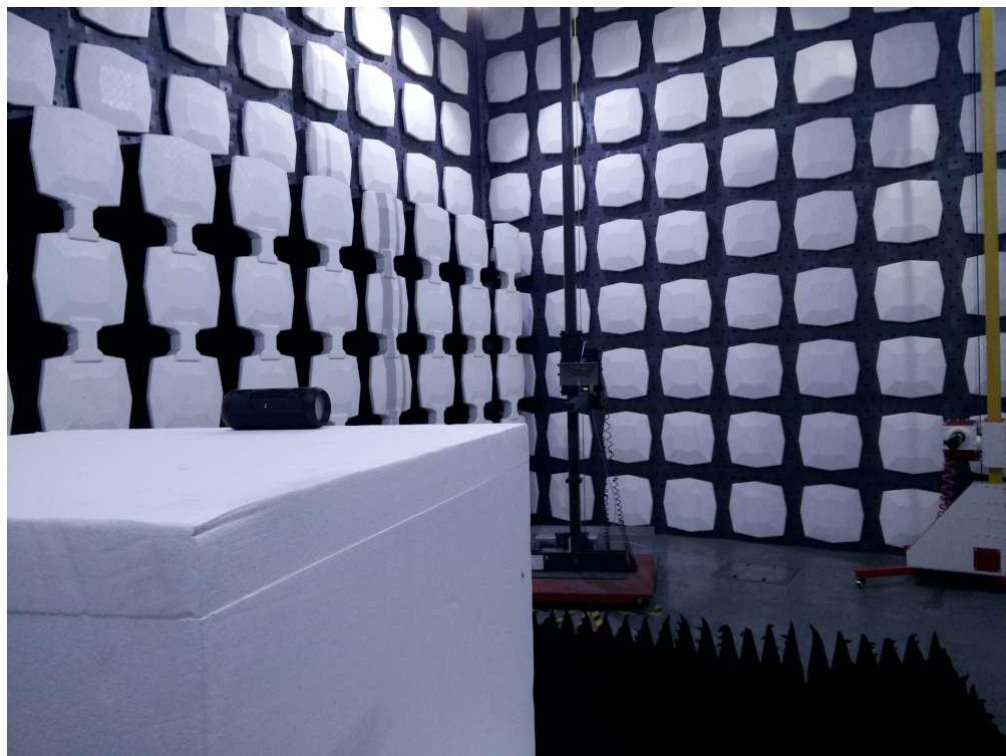
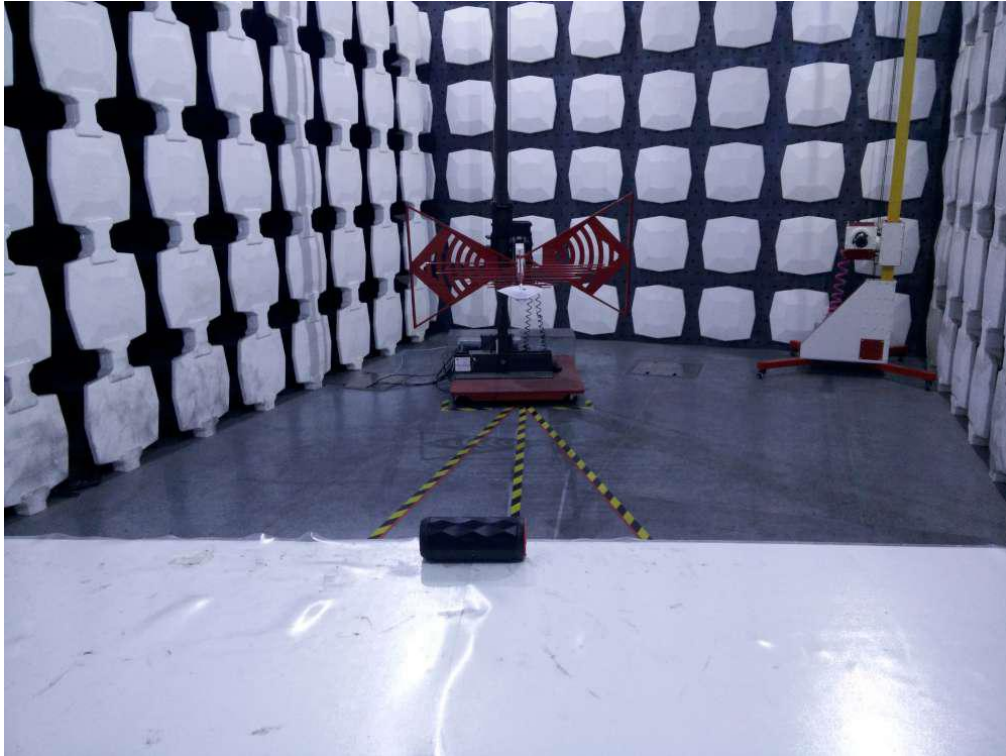
The antennas used for this product is PCB antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 1.0dBi.

## 10.PHOTOGRAPHS OF TEST SET-UP

### Conducted Emission



# Radiated Emission Test



## 11. PHOTOGRAPHS OF THE EUT



\*\*\* the end of report \*\*\*