

FCC TEST REPORT  
for  
TELEPHONE EST (HK) CO., LTD  
Bluetooth Speaker  
Model Number: X3  
FCC ID: 2ACE5X3

Prepared for : TELEPHONE EST (HK) CO., LTD  
Address : Room 709,7F, FuLi tianhe commercial building,  
Linhe East Road and tianhe district, Guangzhou, China

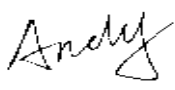


Prepared by : Keyway Testing Technology Co., Ltd.  
Address : Baishun Industrial Zone, Zhangmutou Town,  
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Report No. : 14KWE051289F  
Date of Test : May 12~14, 2014  
Date of Report : May 14,2014

## TABLE OF CONTENTS

| Test Report Declaration                               | Page |
|---|------|
| 1. TEST SUMMARY.....                                  | 4    |
| 2. GENERAL PRODUCT INFORMATION.....                   | 5    |
| 2.1. Product Function.....                            | 5    |
| 2.2. Description of Device (EUT).....                 | 5    |
| 2.3. Independent Operation Modes.....                 | 5    |
| 2.4. Difference between Model Numbers.....            | 5    |
| 2.5. Test Supporting System.....                      | 5    |
| 2.6. Test Facilities.....                             | 5    |
| 2.7. List of Test and Measurement Instruments.....    | 6    |
| 3. TEST SET-UP AND OPERATION MODES.....               | 7    |
| 3.1. Principle of Configuration Selection.....        | 7    |
| 3.2. Block Diagram of Test Set-up.....                | 7    |
| 3.3. Test Operation Mode and Test Software.....       | 7    |
| 3.4. Special Accessories and Auxiliary Equipment..... | 7    |
| 3.5. Countermeasures to Achieve EMC Compliance.....   | 7    |
| 4. EMISSION TEST RESULTS.....                         | 8    |
| 4.1. Radiated Emission Test.....                      | 8    |
| 5. 20DB OCCUPY BANDWIDTH.....                         | 14   |
| 5.1. Limits.....                                      | 14   |
| 5.2. Test setup.....                                  | 14   |
| 6. BAND EDGE COMPLIANCE TEST.....                     | 17   |
| 6.1. Limits.....                                      | 17   |
| 6.2. Test setup.....                                  | 17   |
| 7. ANTENNA REQUIREMENT:.....                          | 19   |
| 8. PHOTOGRAPHS OF TEST SET-UP.....                    | 19   |
| 9. PHOTOGRAPHS OF THE EUT.....                        | 19   |

# Keyway Testing Technology Co., Ltd.

|   |   |   |                 |
|---|---|---|-----------------|
| <b>Applicant:</b>   | TELEPHONE EST (HK) CO., LTD   |   |                 |
| <b>Address:</b>   | Room 709,7F, FuLi tianhe commercial building, Linhe East Road and tianhe district, Guangzhou, China |   |                 |
| <b>Manufacturer:</b>  | TELEPHONE EST (HK) CO., LTD   |   |                 |
| <b>Address:</b>   | Room 709,7F, FuLi tianhe commercial building, Linhe East Road and tianhe district, Guangzhou, China |   |                 |
| <b>E.U.T:</b>   | Bluetooth Speaker   |   |                 |
| <b>Model Number:</b>  | X3  |   |                 |
| <b>Trade Name:</b>  | -----   | <b>Serial No.:</b>  | -----           |
| <b>Date of Receipt:</b>   | May 12, 2014  | <b>Date of Test:</b>  | May 12~14, 2014 |
| <b>Test Specification:</b>  | FCC Part 15, Subpart C: Oct. 1, 2013<br>ANSI C63.4:2009   |   |                 |
| <b>Test Result:</b>   | The equipment under test was found to be compliance with the requirements of the standards applied. |   |                 |
|   | <b>Issue Date: May 14, 2013</b>   |   |                 |
| Tested by:  | Reviewed by:  | Approved by:  |                 |
|    |                  |  |                 |
| Andy Gao / Engineer   | Jade Yang / Supervisor  | Chris Du / Manager  |                 |
| <b>Other Aspects:</b>   | None.   |   |                 |
| <i>Abbreviations: OK/P=passed    fail/F=failed    n.a/N=not applicable    E.U.T=equipment under tested</i>  |   |   |                 |
| <i>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.</i> |   |   |                 |

## 1. TEST SUMMARY

| Test Items                   | Test Requirement               | Uncertainty        | Result |
|------------------------------|--------------------------------|--------------------|--------|
| Conducted Emissions          | 15.207<br>ANSI C63.4           | $\pm 2.6\text{dB}$ | PASS   |
| Radiated Emissions           | 15.209<br>15.249<br>ANSI C63.4 | $\pm 3.6\text{dB}$ | PASS   |
| 20dB Bandwidth               | 15.249<br>ANSI C63.4           | $\pm 1\text{kHz}$  | PASS   |
| Band Edge Compliance<br>Test | 15.249<br>ANSI C63.4           | $\pm 3.6\text{dB}$ | PASS   |
| Antenna Requirement          | 15.203<br>ANSI C63.4           | /                  | PASS   |

Note: N/A means not applicable.

## 2.GENERAL PRODUCT INFORMATION

### 2.1. Product Function

Refer to Technical Construction Form and User Manual.

### 2.2. Description of Device (EUT)

|                        |                          |
|------------------------|--------------------------|
| Description:           | Bluetooth Speaker        |
| M/N:                   | X3                       |
| Operation Frequency:   | 2402~2480MHz             |
| Channel numbers:       | 79                       |
| Channel separation:    | 1M                       |
| Modulation Technology: | GFSK, Pi/4DQPSK, 8-DQPSK |
| Antenna Type:          | PCB antenna              |
| Antenna Gain:          | 0dBi                     |
| Power Supply:          | DC 3.7V                  |

### 2.3. Independent Operation Modes

The basic operation modes are:

2.3.1. EUT work continues TX mode and frequency as below:

| Channel | Frequency |
|---------|-----------|
| Low     | 2402MHz   |
| Middle  | 2441MHz   |
| High    | 2480MHz   |

### 2.4. Difference between Model Numbers

Note: The products different for trade name and outlook colors.

### 2.5. Test Supporting System

|          |                     |
|----------|---------------------|
|          | Manufacturer: LEVEO |
| Notebook | M/N: G475           |
|          | S/N: GB144774       |

### 2.6. Test Facilities

|                    |   |  |
|--------------------|---|--|
| Lab Qualifications | : | Certificated by Industry Canada<br>Registration No.: 9868A<br>Date of registration: December 8, 2011 |
|                    |   | Certificated by FCC, USA<br>Registration No.: 370994<br>Date of registration: February 21, 2012      |

## 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     | May 9,14  | May 9,15  |
| Artificial Mains Network       | Rohde&Schwarz | ENV216    | 101315     | May 9,14  | May 9,15  |
| Artificial Mains Network (AUX) | Rohde&Schwarz | ENV216    | 101314     | May 9,14  | May 9,15  |
| RF Cable                       | FUJIKURA      | 3D-2W     | 944 Cable  | May 9,14  | May 9,15  |

### 2.7.2. For radiated emission test (Below 1GHz)

| Equipment                | Manufacturer  | Model No. | Serial No.   | Last Cal. | Next Cal. |
|--------------------------|---------------|-----------|--------------|-----------|-----------|
| EMI Test Receiver        | Rohde&Schwarz | ESCI      | 101156       | May 9,14  | May 9,15  |
| Bilog Antenna            | ETS-LINDGREN  | 3142D     | 00135452     | May 9,14  | May 9,15  |
| Spectrum Analyzer        | Agilent       | 8593E     | 3911A04271   | May 9,14  | May 9,15  |
| 3m Semi-anechoic Chamber | ETS-LINDGREN  | 966       | KW01         | May 9,14  | May 9,15  |
| Signal Amplifier         | SONOMA        | 310       | 187303       | May 9,14  | May 9,15  |
| RF Cable                 | IMRO          | IMRO-400  | 966 Cable 1# | May 9,14  | May 9,15  |
| MULTI-DEVICE Controller  | ETS-LINDGREN  | 2090      | 126913       | N/A       | N/A       |
| Antenna Holder           | ETS-LINDGREN  | 2070B     | 00109601     | N/A       | N/A       |

### 2.7.3. For above 1GHz radiated emission, band edge, 20dB bandwidth test

| Equipment                 | Manufacturer  | Model No. | Serial No.   | Last Cal. | Next Cal. |
|---------------------------|---------------|-----------|--------------|-----------|-----------|
| Horn Antenna              | DAZE          | ZN30701   | 11003        | May 9,14  | May 9,15  |
| Horn Antenna              | SCHWARZBECK   | BBHA9170  | 9170-068     | May 9,14  | May 9,15  |
| Spectrum Analyzer         | Agilent       | 8593E     | 3911A04271   | May 9,14  | May 9,15  |
| Spectrum Analyzer         | Agilent       | E4408B    | MY44211125   | May 9,14  | May 9,15  |
| Spectrum Analyzer         | Rohde&Schwarz | FSP       | 100394       | May 9,14  | May 9,15  |
| 3m Semi-anechoic Chamber  | ETS-LINDGREN  | 966       | KW01         | May 9,14  | May 9,15  |
| Signal Amplifier          | DAZE          | ZN3380C   | 11001        | May 9,14  | May 9,15  |
| Signal Amplifier          | Agilent       | 8449B     | 3008A00251   | May 9,14  | May 9,15  |
| High Pass filter          | Micro         | HPM50111  | 324216       | May 9,14  | May 9,15  |
| Power Meter               | R&S           | NRVS      | 101824       | May 9,14  | May 9,15  |
| Peak and Avg Power Sensor | Rohde&Schwarz | URV5-Z7   | 100655       | May 9,14  | May 9,15  |
| RF Cable                  | IMRO          | IMRO-400  | 966 Cable 1# | May 9,14  | May 9,15  |
| MULTI-DEVICE Controller   | ETS-LINDGREN  | 2090      | 126913       | N/A       | N/A       |
| Antenna Holder            | ETS-LINDGREN  | 2070B     | 00109601     | N/A       | N/A       |

### 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)*

Note: By preliminary testing three modulation of EUT transmitted status, it was found that “GFSK” modulation was the worst, then the final test was executed the worst condition and test data were recorded in this report. Test data as below.

| Frequency (MHz) | Axis      | Field Strength (dBuV/m) | Antenna Polarization |
|-----------------|-----------|-------------------------|----------------------|
| 2402            | GFSK      | 97.24                   | Vertical             |
| 2402            | Pi/4DQPSK | 95.06                   | Vertical             |
| 2402            | 8-DQPSK   | 95.59                   | Vertical             |

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

None.

#### 3.4. Special Accessories and Auxiliary Equipment

None.

#### 3.5. Countermeasures to Achieve EMC Compliance

None.

## 4. EMISSION TEST RESULTS

### 4.1. Radiated Emission Test

#### 4.1.1. 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) |                                   |

#### 4.1.2. Fundamental and harmonics emission limits

| Fundamental<br>Frequency | Field Strength of Fundamental |                                 | Field Strength of Harmonics |                                 |
|--------------------------|-------------------------------|---------------------------------|-----------------------------|---------------------------------|
|                          | $\text{mV}/\text{m}$          | $\text{dB}\mu\text{V}/\text{m}$ | $\mu\text{V}/\text{m}$      | $\text{dB}\mu\text{V}/\text{m}$ |
| 902~928 MHz              | 50                            | 94                              | 500                         | 54                              |
| 2400~2483.5 MHz          | 50                            | 94                              | 500                         | 54                              |
| 5725~5875MHz             | 50                            | 94                              | 500                         | 54                              |
| 24.0~24.25GHz            | 250                           | 108                             | 2500                        | 68                              |

#### 4.1.3. 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.



#### 4.1.4. Test setup

The EUT was placed on a turn table which was 0.8 m 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.

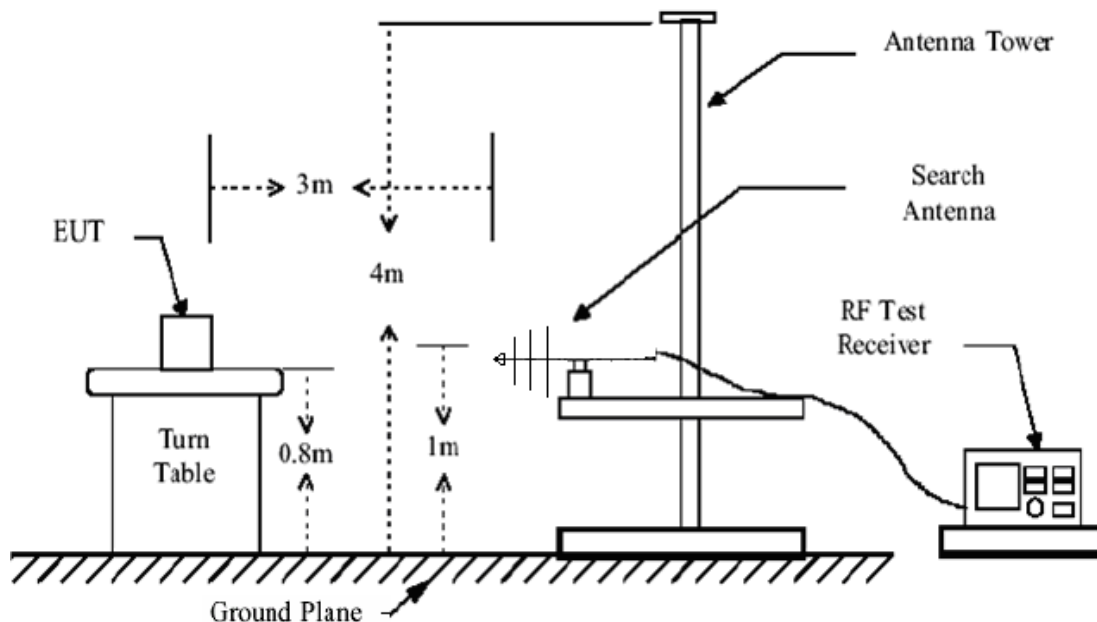
The frequency range from 30MHz to 10<sup>th</sup> harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Y axis" position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

The test data of the worst case condition(s) was reported on the following pages.

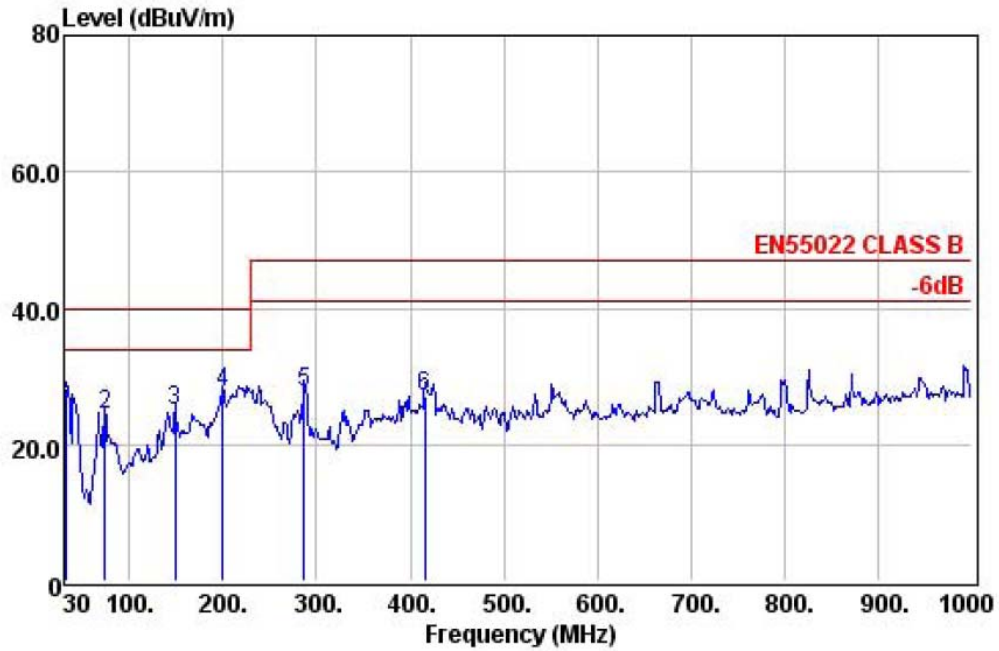
Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.

2. Measurement Uncertainty:  $\pm 3.6$  dB at a level of confidence of 95%.



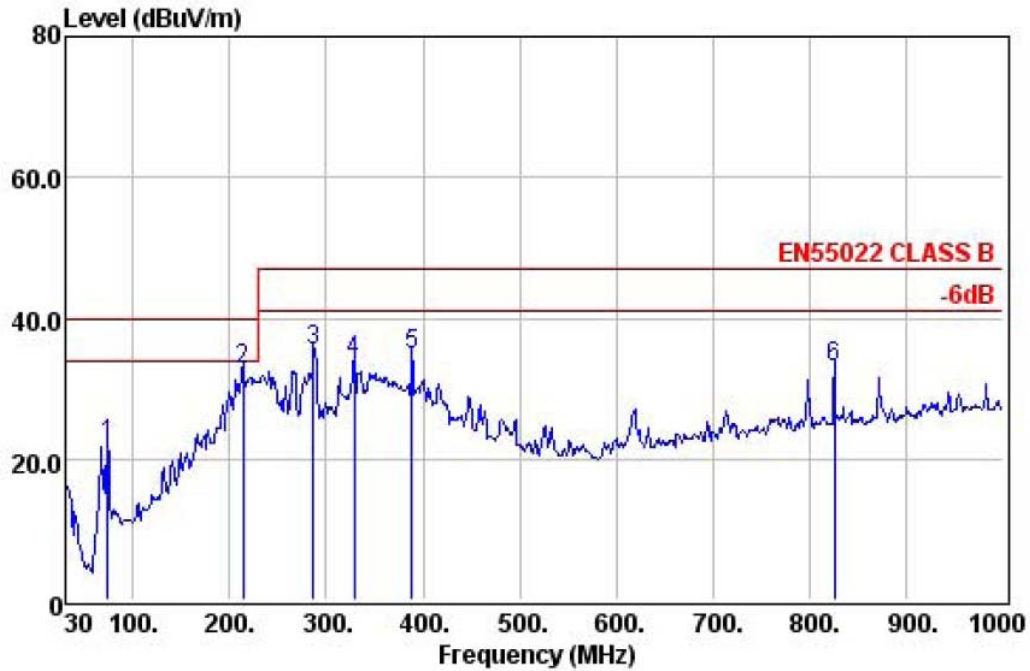
**Test Data**

Test mode: TX Mode  
 Polarization: VERTICAL



|   | Preamp Freq | Preamp Factor | Read Level | Cable Loss | Antenna Factor | Level  | Limit Line | Over Limit | Remark |
|---|-------------|---------------|------------|------------|----------------|--------|------------|------------|--------|
|   | MHz         | dB            | dBuV       | dB         | dB/m           | dBuV/m | dBuV/m     | dB         |        |
| 1 | 31.94       | 31.40         | 41.47      | 0.56       | 17.66          | 28.29  | 40.00      | -11.71     | QP     |
| 2 | 73.65       | 31.33         | 47.29      | 0.85       | 7.68           | 24.49  | 40.00      | -15.51     | QP     |
| 3 | 148.34      | 31.24         | 46.01      | 1.22       | 8.90           | 24.89  | 40.00      | -15.11     | QP     |
| 4 | 199.75      | 31.10         | 46.29      | 1.46       | 10.98          | 27.63  | 40.00      | -12.37     | QP     |
| 5 | 287.05      | 30.94         | 43.21      | 1.87       | 13.39          | 27.53  | 47.00      | -19.47     | QP     |
| 6 | 416.06      | 30.63         | 38.37      | 2.48       | 16.81          | 27.03  | 47.00      | -19.97     | QP     |

Test mode: TX Mode  
 Polarization: HORIZONTAL



|   | Preamp | Read   | CableAntenna |      | Limit  | Over   |        |        |        |
|---|--------|--------|--------------|------|--------|--------|--------|--------|--------|
|   | Freq   | Factor | Level        | Loss | Factor | Level  | Line   | Limit  | Remark |
|   | MHz    | dB     | dBuV         | dB   | dB/m   | dBuV/m | dBuV/m | dB     |        |
| 1 | 73.65  | 31.33  | 44.83        | 0.85 | 7.68   | 22.03  | 40.00  | -17.97 | QP     |
| 2 | 214.30 | 31.04  | 50.45        | 1.53 | 11.69  | 32.63  | 40.00  | -7.37  | QP     |
| 3 | 287.05 | 30.94  | 50.96        | 1.87 | 13.39  | 35.28  | 47.00  | -11.72 | QP     |
| 4 | 328.76 | 30.79  | 48.04        | 2.02 | 14.65  | 33.92  | 47.00  | -13.08 | QP     |
| 5 | 388.90 | 30.62  | 46.93        | 2.37 | 16.25  | 34.93  | 47.00  | -12.07 | QP     |
| 6 | 825.40 | 30.47  | 35.87        | 4.49 | 23.10  | 32.99  | 47.00  | -14.01 | QP     |

Test mode: 2402MHz  
Polarization: VERTICAL

|   | Freq     | Preamp Factor | Read Level | Cable Loss | Antenna Factor | Level  | Limit Line | Over Limit | Remark  |
|---|----------|---------------|------------|------------|----------------|--------|------------|------------|---------|
|   | MHz      | dB            | dBuV       | dB         | dB/m           | dBuV/m | dBuV/m     | dB         |         |
| 1 | 2402.00  | 26.32         | 79.20      | 7.34       | 28.72          | 88.94  | 94.00      | -5.06      | Average |
| 2 | 2402.00  | 26.32         | 87.50      | 7.34       | 28.72          | 97.24  | 114.00     | -16.76     | Peak    |
| 3 | 2955.00  | 26.48         | 38.36      | 9.74       | 29.88          | 51.50  | 74.00      | -22.50     | Peak    |
| 4 | 4804.00  | 27.49         | 32.78      | 11.96      | 32.94          | 50.19  | 74.00      | -23.81     | Peak    |
| 5 | 6134.00  | 27.73         | 24.50      | 16.60      | 35.39          | 48.76  | 74.00      | -25.24     | Peak    |
| 6 | 8225.00  | 28.17         | 21.99      | 16.70      | 36.58          | 47.10  | 74.00      | -26.90     | Peak    |
| 7 | 11880.00 | 28.99         | 18.05      | 17.34      | 39.52          | 45.92  | 74.00      | -28.08     | Peak    |

Test mode: 2402MHz  
Polarization: HORIZONTAL

|   | Freq     | Preamp Factor | Read Level | Cable Loss | Antenna Factor | Level  | Limit Line | Over Limit | Remark  |
|---|----------|---------------|------------|------------|----------------|--------|------------|------------|---------|
|   | MHz      | dB            | dBuV       | dB         | dB/m           | dBuV/m | dBuV/m     | dB         |         |
| 1 | 2402.00  | 26.32         | 79.41      | 7.34       | 28.72          | 89.15  | 94.00      | -4.85      | Average |
| 2 | 2402.00  | 26.32         | 87.43      | 7.34       | 28.72          | 97.17  | 114.00     | -16.83     | Peak    |
| 3 | 4804.00  | 27.49         | 32.28      | 11.96      | 32.94          | 49.69  | 74.00      | -24.31     | Peak    |
| 4 | 7205.00  | 27.94         | 22.40      | 16.61      | 37.28          | 48.35  | 74.00      | -25.65     | Peak    |
| 5 | 10486.00 | 28.85         | 20.92      | 17.06      | 39.17          | 48.30  | 74.00      | -25.70     | Peak    |
| 6 | 14294.00 | 29.44         | 18.34      | 19.55      | 41.80          | 50.25  | 74.00      | -23.75     | Peak    |
| 7 | 15756.00 | 29.66         | 18.94      | 20.48      | 39.38          | 49.14  | 74.00      | -24.86     | Peak    |

Test mode: 2441MHz  
Polarization: VERTICAL

|   | Freq     | Preamp Factor | Read Level | Cable Loss | Antenna Factor | Level  | Limit Line | Over Limit | Remark  |
|---|----------|---------------|------------|------------|----------------|--------|------------|------------|---------|
|   | MHz      | dB            | dBuV       | dB         | dB/m           | dBuV/m | dBuV/m     | dB         |         |
| 1 | 2441.00  | 26.33         | 79.76      | 7.48       | 28.76          | 89.67  | 94.00      | -4.33      | Average |
| 2 | 2441.00  | 26.33         | 87.00      | 7.48       | 28.76          | 96.91  | 114.00     | -17.09     | Peak    |
| 3 | 4882.00  | 27.53         | 27.51      | 12.14      | 33.11          | 45.23  | 74.00      | -28.77     | Peak    |
| 4 | 6406.00  | 27.78         | 21.62      | 16.60      | 35.76          | 46.20  | 74.00      | -27.80     | Peak    |
| 5 | 9517.00  | 28.61         | 19.43      | 16.92      | 38.01          | 45.75  | 74.00      | -28.25     | Peak    |
| 6 | 12135.00 | 29.03         | 18.68      | 17.49      | 39.43          | 46.57  | 74.00      | -27.43     | Peak    |
| 7 | 14634.00 | 29.49         | 17.17      | 19.77      | 40.04          | 47.49  | 74.00      | -26.51     | Peak    |

Test mode: 2441MHz

Polarization: HORIZONTAL

|   | Preamp<br>Freq | Factor | Read<br>Level | CableAntenna<br>Loss | Factor | Level  | Limit<br>Line | Over<br>Limit | Remark  |
|---|----------------|--------|---------------|----------------------|--------|--------|---------------|---------------|---------|
|   | MHz            | dB     | dBuV          | dB                   | dB/m   | dBuV/m | dBuV/m        | dB            |         |
| 1 | 2441.00        | 26.33  | 79.90         | 7.48                 | 28.76  | 89.81  | 94.00         | -4.19         | Average |
| 2 | 2441.00        | 26.33  | 87.35         | 7.48                 | 28.76  | 97.26  | 114.00        | -16.74        | Peak    |
| 3 | 4882.00        | 27.53  | 28.21         | 12.14                | 33.11  | 45.93  | 74.00         | -28.07        | Peak    |
| 4 | 6304.00        | 27.76  | 22.69         | 16.60                | 35.62  | 47.15  | 74.00         | -26.85        | Peak    |
| 5 | 9670.00        | 28.67  | 20.30         | 16.94                | 38.14  | 46.71  | 74.00         | -27.29        | Peak    |
| 6 | 11557.00       | 28.96  | 18.34         | 17.28                | 39.85  | 46.51  | 74.00         | -27.49        | Peak    |
| 7 | 12917.00       | 29.18  | 16.71         | 18.14                | 40.50  | 46.17  | 74.00         | -27.83        | Peak    |

Test mode: 2480MHz

Polarization: VERTICAL

|   | Preamp<br>Freq | Factor | Read<br>Level | CableAntenna<br>Loss | Factor | Level  | Limit<br>Line | Over<br>Limit | Remark  |
|---|----------------|--------|---------------|----------------------|--------|--------|---------------|---------------|---------|
|   | MHz            | dB     | dBuV          | dB                   | dB/m   | dBuV/m | dBuV/m        | dB            |         |
| 1 | 2480.00        | 26.34  | 78.56         | 7.57                 | 28.79  | 88.58  | 94.00         | -5.42         | Average |
| 2 | 2480.00        | 26.34  | 87.20         | 7.57                 | 28.79  | 97.22  | 114.00        | -16.78        | Peak    |
| 3 | 2955.00        | 26.48  | 36.06         | 9.74                 | 29.88  | 49.20  | 74.00         | -24.80        | Peak    |
| 4 | 4960.00        | 27.58  | 33.57         | 12.36                | 33.32  | 51.67  | 74.00         | -22.33        | Peak    |
| 5 | 6814.00        | 27.86  | 23.40         | 16.60                | 36.71  | 48.85  | 74.00         | -25.15        | Peak    |
| 6 | 9755.00        | 28.70  | 22.65         | 16.94                | 38.21  | 49.10  | 74.00         | -24.90        | Peak    |
| 7 | 14005.00       | 29.40  | 15.80         | 19.37                | 43.50  | 49.27  | 74.00         | -24.73        | Peak    |

Test mode: 2480MHz

Polarization: HORIZONTAL

|   | Preamp<br>Freq | Factor | Read<br>Level | CableAntenna<br>Loss | Factor | Level  | Limit<br>Line | Over<br>Limit | Remark  |
|---|----------------|--------|---------------|----------------------|--------|--------|---------------|---------------|---------|
|   | MHz            | dB     | dBuV          | dB                   | dB/m   | dBuV/m | dBuV/m        | dB            |         |
| 1 | 2480.00        | 26.34  | 78.76         | 7.57                 | 28.79  | 88.78  | 94.00         | -5.22         | Average |
| 2 | 2480.00        | 26.34  | 86.86         | 7.57                 | 28.79  | 96.88  | 114.00        | -17.12        | Peak    |
| 3 | 4960.00        | 27.58  | 31.31         | 12.36                | 33.32  | 49.41  | 74.00         | -24.59        | Peak    |
| 4 | 6729.00        | 27.85  | 24.65         | 16.60                | 36.48  | 49.88  | 74.00         | -24.12        | Peak    |
| 5 | 9330.00        | 28.53  | 22.50         | 16.91                | 37.79  | 48.67  | 74.00         | -25.33        | Peak    |
| 6 | 11795.00       | 28.98  | 21.28         | 17.33                | 39.61  | 49.24  | 74.00         | -24.76        | Peak    |
| 7 | 14124.00       | 29.42  | 19.92         | 19.44                | 42.80  | 52.74  | 74.00         | -21.26        | Peak    |

## 5. 20DB OCCUPY BANDWIDTH

### 5.1. 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

### 5.2. 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 339 bytes DH5 packages at maximum power.

2. Set the spectrum analyzer:

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

RBW =100kHz

VBW =100kHz

Sweep=auto

Detector function=peak

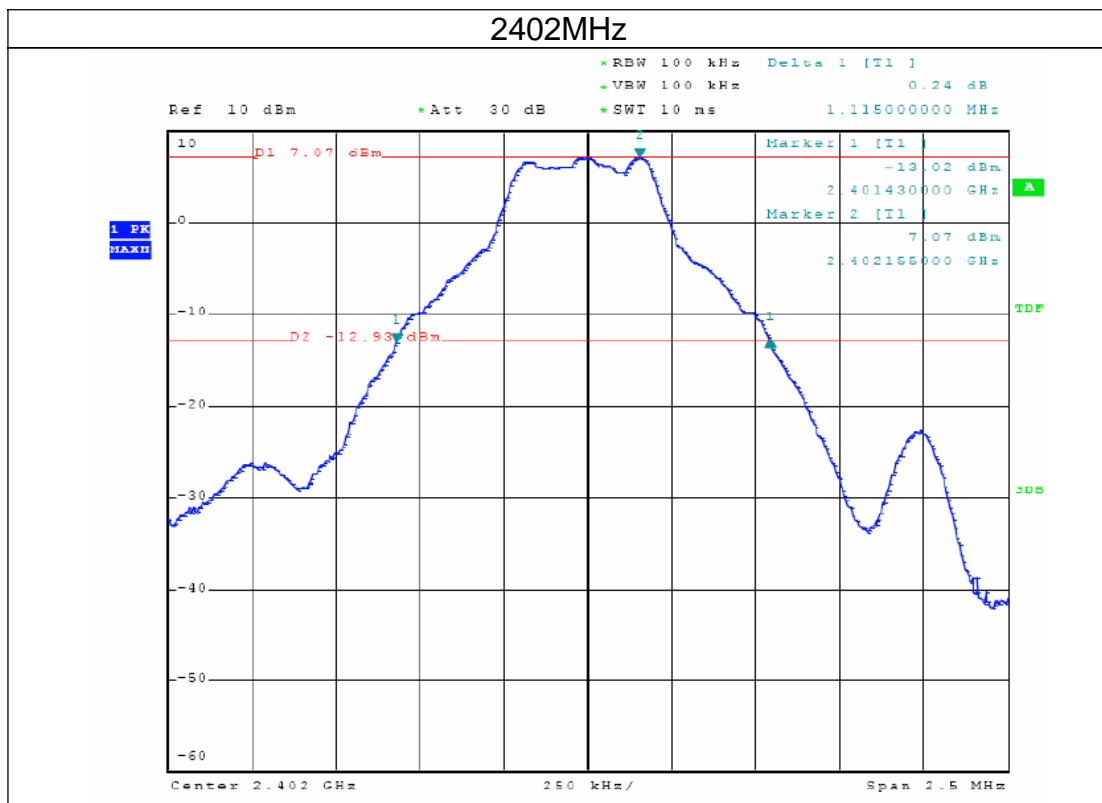
Trace=max hold

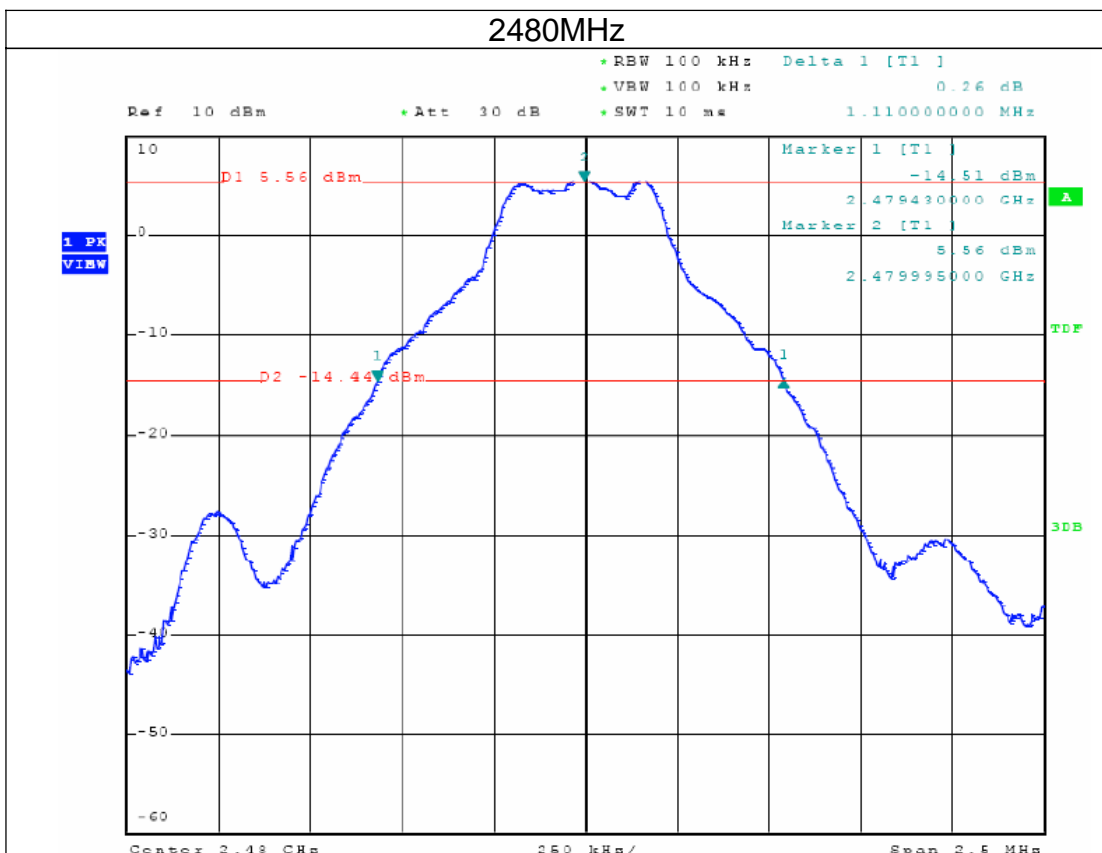
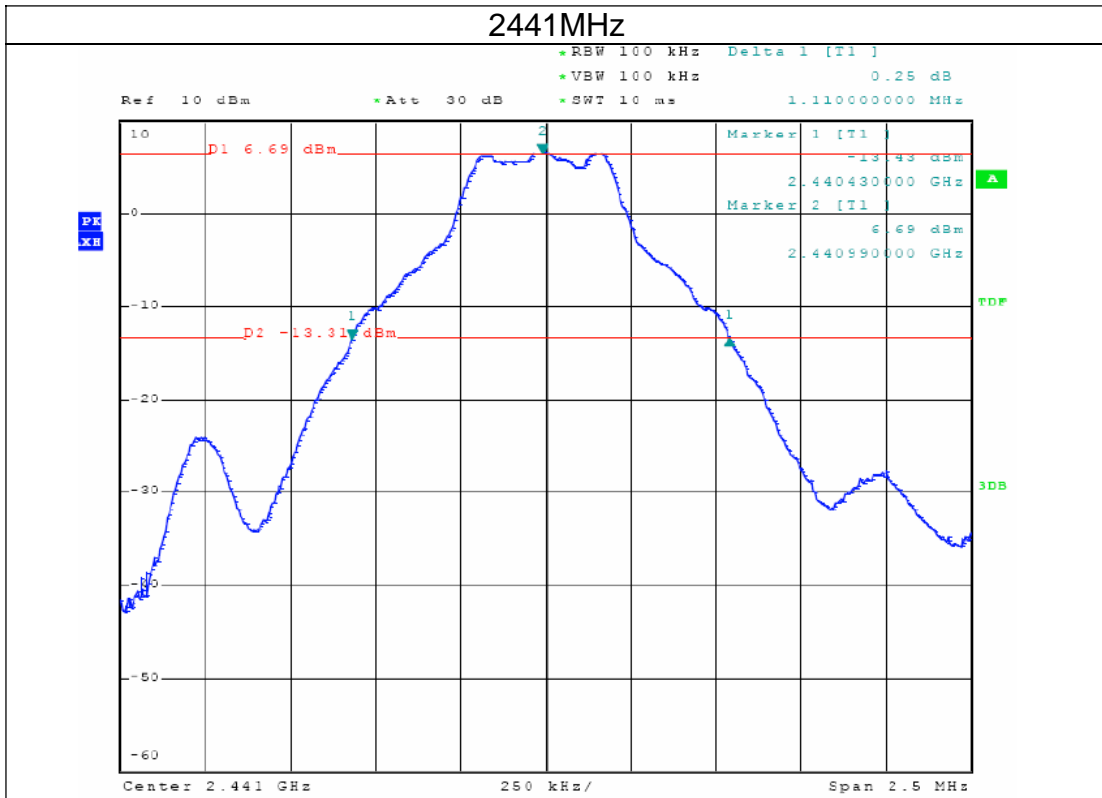
For pretest, the worst mode was GFSK, the data only show the GFSK mode.

Test data:

| Channel Frequency (MHz) | 20dB Bandwidth (MHz) | Limit (MHz) |
|-------------------------|----------------------|-------------|
| 2402                    | 1.12                 | N/A         |
| 2441                    | 1.11                 | N/A         |
| 2480                    | 1.11                 | N/A         |

Test plot as follows:







## 6. BAND EDGE COMPLIANCE TEST

### 6.1. 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 20dB below the fundamental emissions, or comply with 15.209 limits.

### 6.2. Test setup

The EUT was placed on a turn table which was 0.8 m 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 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.

For pretest, the worst mode was GFSK, the data only show the GFSK mode.

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

For radiated test as follows:

Unhopping

|      | Frequency (MHz) | Antenna polarization (H/V) | Band edge | Limit (dBuV/m) |       |
|------|-----------------|----------------------------|-----------|----------------|-------|
|      |                 |                            | PK        | PK             | AV    |
| GFSK | <2400           | H                          | 49.87     | 74.00          | 54.00 |
|      | <2400           | V                          | 50.21     | 74.00          | 54.00 |
|      | >2483.5         | H                          | 50.92     | 74.00          | 54.00 |
|      | >2483.5         | V                          | 50.26     | 74.00          | 54.00 |

Hopping

|      | Frequency (MHz) | Antenna polarization (H/V) | Band edge | Limit (dBuV/m) |       |
|------|-----------------|----------------------------|-----------|----------------|-------|
|      |                 |                            | PK        | PK             | AV    |
| GFSK | <2400           | H                          | 50.04     | 74.00          | 54.00 |
|      | <2400           | V                          | 50.27     | 74.00          | 54.00 |
|      | >2483.5         | H                          | 49.76     | 74.00          | 54.00 |
|      | >2483.5         | V                          | 50.05     | 74.00          | 54.00 |

## 7. ANTENNA REQUIREMENT:

|                       |  |
|-----------------------|--|
| Standard requirement: | FCC Part15 C Section 15.203 /249(c)  |
| 15.203 requirement:   | An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. |
| 15.249 requirement:   | Antenna gain must be at least 33 dBi. Alternatively, the main lobe beamwidth must not exceed 3.5 degrees. The beamwidth limit shall apply to both the azimuth and elevation planes. At antenna gains over 33 dBi or beamwidths narrower than 3.5 degrees, power must be reduced to ensure that the field strength does not exceed 2500 millivolts/meter.   |
| E.U.T Antenna:        | The antenna is PCB antenna, the best case gain of the antenna is 0dBi  |

## 8. PHOTOGRAPHS OF TEST SET-UP

Please see annex.

## 9. PHOTOGRAPHS OF THE EUT

Please see annex.

END