

## FCC Test Report

**Report No.:** RFBDYV-WTW-P22080963-1

**FCC ID:** PRDMU113

**Product:** HP 250 Dual Mouse

**Brand:** hp

**Test Model:** TPA-A002M

**Received Date:** 2022/8/30

**Test Date:** 2022/9/3 ~ 2022/10/4

**Issued Date:** 2022/10/19

**Applicant:** Acrox Technologies Co., Ltd

**Address:** 4F., No. 89, Minshan St., Neihu Dist., Taipei City 114, Taiwan, R.O.C.

**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch  
Lin Kou Laboratories

**Lab Address:** No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan

**FCC Registration /  
Designation Number:** 198487 / TW2021



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### Release Control Record

| Issue No.              | Description       | Date Issued |
|------------------------|-------------------|-------------|
| RFBDYV-WTW-P22080963-1 | Original release. | 2022/10/19  |

## 1 Certificate of Conformity

**Product:** HP 250 Dual Mouse

**Brand:** hp

**Test Model:** TPA-A002M

**Sample Status:** Engineering sample

**Applicant:** Acrox Technologies Co., Ltd

**Test Date:** 2022/9/3 ~ 2022/10/4

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.249)  
ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

**Prepared by :**

*Jessica Cheng*

**Date:**

2022/10/19

Jessica Cheng / Senior Specialist

**Approved by :**

*Jeremy Lin*

**Date:**

2022/10/19

Jeremy Lin / Project Engineer

## 2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C (SECTION 15.249) |  |        |  |
|--|--|--------|--|
| FCC Clause                                     | Test Item                                  | Result | Remarks  |
| 15.207   | AC Power Conducted Emission                | N/A    | Power supply is 1.5Vdc from battery  |
| 15.215   | Channel Bandwidth Measurement              | PASS   | Meet the requirement of limit.   |
| 15.209<br>15.249 (a)<br>15.249 (d)             | Radiated Emission and Bandedge Measurement | PASS   | Meet the requirement of limit.<br>Minimum passing margin is -13.7dB at 2390.00MHz. |
| 15.203   | Antenna Requirement                        | PASS   | No antenna connector is used.  |

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

### 2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Measurement                     | Specification   | Expanded Uncertainty (k=2)<br>(±) |
|---------------------------------|-----------------|-----------------------------------|
| Conducted Out of Band Emissions | 9 kHz ~ 40 GHz  | 2.63 dB                           |
| Unwanted Emissions below 1 GHz  | 9 kHz ~ 30 MHz  | 2.38 dB                           |
|                                 | 30 MHz ~ 1 GHz  | 5.62 dB                           |
| Unwanted Emissions above 1 GHz  | 1 GHz ~ 6 GHz   | 4.61 dB                           |
|                                 | 6 GHz ~ 18 GHz  | 5.41 dB                           |
|                                 | 18 GHz ~ 40 GHz | 5.14 dB                           |

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

|                     |                                 |
|---------------------|---------------------------------|
| Product             | HP 250 Dual Mouse               |
| Brand               | hp                              |
| Test Model          | TPA-A002M                       |
| Status of EUT       | Engineering sample              |
| Power Supply Rating | 1.5Vdc from battery             |
| Modulation Type     | GFSK                            |
| Operating Frequency | 2402MHz ~ 2480MHz               |
| Number of Channel   | 79                              |
| Field Strength      | 67.4dBuV/m (3m)                 |
| Antenna Type        | PIFA antenna with -0.61dBi gain |
| Antenna Connector   | N/A                             |
| Accessory Device    | N/A                             |
| Data Cable Supplied | N/A                             |

Note:

1. There are Bluetooth and SRD technology used for the EUT.
2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.
3. Due to radiated measurements are made and the antenna gain is already accounted for this device, so provide an antenna datasheet and/or antenna measurement report is not required. The antenna dimensions and pictures (include antenna wire length if have) are stated in EUT photo exhibit.
4. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

### 3.2 Description of Test Modes

79 channels are provided to this EUT:

| Channel | Freq. (MHz) | Channel | Freq. (MHz) | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|---------|-------------|---------|-------------|---------|-------------|---------|-------------|
| 0       | 2402        | 20      | 2422        | 40      | 2442        | 60      | 2462        |
| 1       | 2403        | 21      | 2423        | 41      | 2443        | 61      | 2463        |
| 2       | 2404        | 22      | 2424        | 42      | 2444        | 62      | 2464        |
| 3       | 2405        | 23      | 2425        | 43      | 2445        | 63      | 2465        |
| 4       | 2406        | 24      | 2426        | 44      | 2446        | 64      | 2466        |
| 5       | 2407        | 25      | 2427        | 45      | 2447        | 65      | 2467        |
| 6       | 2408        | 26      | 2428        | 46      | 2448        | 66      | 2468        |
| 7       | 2409        | 27      | 2429        | 47      | 2449        | 67      | 2469        |
| 8       | 2410        | 28      | 2430        | 48      | 2450        | 68      | 2470        |
| 9       | 2411        | 29      | 2431        | 49      | 2451        | 69      | 2471        |
| 10      | 2412        | 30      | 2432        | 50      | 2452        | 70      | 2472        |
| 11      | 2413        | 31      | 2433        | 51      | 2453        | 71      | 2473        |
| 12      | 2414        | 32      | 2434        | 52      | 2454        | 72      | 2474        |
| 13      | 2415        | 33      | 2435        | 53      | 2455        | 73      | 2475        |
| 14      | 2416        | 34      | 2436        | 54      | 2456        | 74      | 2476        |
| 15      | 2417        | 35      | 2437        | 55      | 2457        | 75      | 2477        |
| 16      | 2418        | 36      | 2438        | 56      | 2458        | 76      | 2478        |
| 17      | 2419        | 37      | 2439        | 57      | 2459        | 77      | 2479        |
| 18      | 2420        | 38      | 2440        | 58      | 2460        | 78      | 2480        |
| 19      | 2421        | 39      | 2441        | 59      | 2461        |         |             |

### 3.2.1 Test Mode Applicability and Tested Channel Detail

| EUT Configure Mode | Applicable To |       |      |      | Description |
|--------------------|---------------|-------|------|------|-------------|
|                    | RE≥1G         | RE<1G | PLC  | APCM |             |
| -                  | √             | √     | Note | √    | -           |

Where **RE≥1G**: Radiated Emission above 1GHz & Bandedge Measurement      **RE<1G**: Radiated Emission below 1GHz  
**PLC**: Power Line Conducted Emission      **APCM**: Antenna Port Conducted Measurement  
**NOTE**: No need to concern of Conducted Emission due to the EUT is powered by battery

#### **Radiated Emission Test (Above 1GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type |
|--------------------|-------------------|----------------|-----------------|
| -                  | 0 to 78           | 0, 38, 78      | GFSK            |

#### **Radiated Emission Test (Below 1GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type |
|--------------------|-------------------|----------------|-----------------|
| -                  | 0 to 78           | 0              | GFSK            |

#### **Antenna Port Conducted Measurement:**

- This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type |
|--------------------|-------------------|----------------|-----------------|
| -                  | 0 to 78           | 0, 38, 78      | GFSK            |

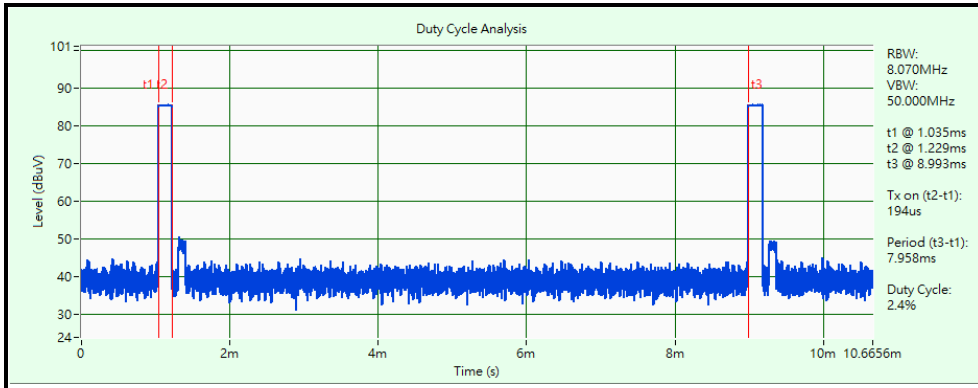
#### **Test Condition:**

| Applicable To | Environmental Conditions | Input Power | Tested By |
|---------------|--------------------------|-------------|-----------|
| RE≥1G         | 25deg. C, 72%RH          | 1.5Vdc      | Ian Chang |
| RE<1G         | 25deg. C, 72%RH          | 1.5Vdc      | Ian Chang |
| APCM          | 25deg. C, 76%RH          | 1.5Vdc      | Dalen Dai |



### 3.3 Duty Cycle of Test Signal

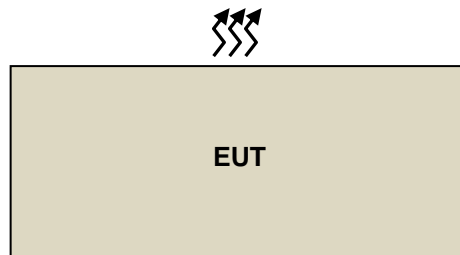
Duty cycle correction factor =  $20 \log(\text{Duty cycle}) = 20 \log(0.024) = -32.4\text{dB}$



### 3.4 Description of Support Units

The EUT has been tested as an independent unit together without other necessary accessories or support units.

#### 3.4.1 Configuration of System under Test



### 3.5 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart C (15.249)**

ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

## 4 Test Types and Results

### 4.1 Radiated Emission and Bandedge Measurement

#### 4.1.1 Limits of Radiated Emission and Bandedge Measurement

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following

| Fundamental Frequency | Field Strength of Fundamental (millivolts/meter) | Field Strength of Harmonics (microvolts/meter) |
|-----------------------|--|--|
| 902 ~ 928 MHz         | 50   | 500  |
| 2400 ~ 2483.5 MHz     | 50   | 500  |
| 5725 ~ 5875 MHz       | 50   | 500  |
| 24 ~ 24.25 GHz        | 250  | 2500   |

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

| Frequencies (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|-------------------|-----------------------------------|-------------------------------|
| 0.009 ~ 0.490     | 2400/F(kHz)                       | 300                           |
| 0.490 ~ 1.705     | 24000/F(kHz)                      | 30                            |
| 1.705 ~ 30.0      | 30                                | 30                            |
| 30 ~ 88           | 100                               | 3                             |
| 88 ~ 216          | 150                               | 3                             |
| 216 ~ 960         | 200                               | 3                             |
| Above 960         | 500                               | 3                             |

#### NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

#### 4.1.2 Test Instruments

##### Unwanted Emissions below 1 GHz

| Description<br>Manufacturer               | Model No.        | Serial No.   | Calibrated<br>Date | Calibrated<br>Until |
|---|------------------|--------------|--------------------|---------------------|
| LOOP ANTENNA<br>EMCI                      | LPA600           | 270          | 2021/9/2           | 2023/9/1            |
| Bi_Log Antenna<br>Schwarzbeck             | VULB 9168        | 137          | 2021/10/27         | 2022/10/26          |
| Coupling/Dcoupling Network<br>Schwarzbeck | CDNE-M2          | 00097        | 2022/6/1           | 2023/5/31           |
|   | CDNE-M3          | 00091        | 2022/6/1           | 2023/5/31           |
| Pre_Amplifier<br>EMCI                     | EMC001340        | 980269       | 2022/6/28          | 2023/6/27           |
| Pre_Amplifier<br>HP                       | 8447D            | 2432A03504   | 2022/2/17          | 2023/2/16           |
| RF Coaxial Cable<br>Pacific               | 8D-FB            | Cable-CH6-02 | 2022/6/30          | 2023/6/29           |
| Software<br>BVADT                         | Radiated_V8.7.08 | N/A          | N/A                | N/A                 |
| Spectrum Analyzer<br>R&S                  | FSV40            | 101544       | 2022/5/9           | 2023/5/8            |
| Test Receiver<br>Agilent                  | N9038A           | MY51210129   | 2022/4/8           | 2023/4/7            |
|   |                  | MY51210137   | 2022/6/9           | 2023/6/8            |
| Tower<br>ADT                              | AT100            | 0306         | N/A                | N/A                 |
| Turn Table<br>ADT                         | TT100            | 0306         | N/A                | N/A                 |

##### Notes:

1. The calibration interval of the above test instruments is 12/24 months and the calibrations are traceable to NML/ROC and NIST/USA
2. The test was performed in Linkou 966 Chamber 6 (CH 6).
3. Tested Date: 2022/9/3

Unwanted Emissions above 1 GHz

| Description<br>Manufacturer                | Model No.           | Serial No.               | Calibrated<br>Date | Calibrated<br>Until |
|--|---------------------|--------------------------|--------------------|---------------------|
| Band Pass Filter<br>MICRO-TRONICS          | BRM17690            | 005                      | 2022/5/26          | 2023/5/25           |
| Boresight antenna tower fixture<br>BV      | BAF-02              | 6                        | N/A                | N/A                 |
| High Pass Filter<br>Wainwright Instruments | WHK 3.1/18G-10SS    | SN 8                     | 2022/5/26          | 2023/5/25           |
| Horn Antenna<br>EMCO                       | 3115                | 00027024                 | 2021/11/14         | 2022/11/13          |
|  |                     | 00028257                 | 2021/11/14         | 2022/11/13          |
| Horn Antenna ETS-Lindgren                  | 3117-PA             | 00215857                 | 2021/11/14         | 2022/11/13          |
| Horn Antenna Schwarzbeck                   | BBHA 9170           | 212                      | 2021/10/13         | 2022/10/12          |
| Notch Filter MICRO-TRONICS                 | BRC50703-01         | 010                      | 2022/5/26          | 2023/5/25           |
| Pre-amplifier HP                           | 8449B               | 3008A01201               | 2022/2/17          | 2023/2/16           |
| Pre-amplifier (18GHz-40GHz)<br>EMCI        | EMC184045B          | 980175                   | 2022/9/3           | 2023/9/2            |
| Pre_Amplifier<br>EMCI                      | EMC0126545          | 980076                   | 2022/2/17          | 2023/2/16           |
|  | EMC184045B          | 980235                   | 2022/2/17          | 2023/2/16           |
| RF Coaxial Cable<br>EM                     | EM102-KMKM-3.5+1M   | EM102-KMKM-<br>3.5+1M-01 | 2022/7/7           | 2023/7/6            |
| RF Coaxial Cable<br>HUBER SUHNER           | SF-104              | Cable-CH6-01             | 2022/9/20          | 2023/9/19           |
| Software<br>BVADT                          | Radiated_V7.7.1.1.1 | N/A                      | N/A                | N/A                 |
|  | Radiated_V8.7.08    | N/A                      | N/A                | N/A                 |
| Spectrum Analyzer<br>Agilent               | E4446A              | MY51100009               | 2022/6/27          | 2023/6/26           |
| Spectrum Analyzer<br>KEYSIGHT              | N9030A              | MY54490260               | 2022/7/14          | 2023/7/13           |
| Spectrum Analyzer R&S                      | FSV40               | 101042                   | 2022/9/5           | 2023/9/4            |
|  |                     | 101544                   | 2022/5/9           | 2023/5/8            |
| Test Receiver Agilent                      | N9038A              | MY51210129               | 2022/4/8           | 2023/4/7            |
|  |                     | MY51210137               | 2022/6/9           | 2023/6/8            |
| Tower ADT                                  | AT100               | 0306                     | N/A                | N/A                 |
| Turn Table ADT                             | TT100               | 0306                     | N/A                | N/A                 |

Notes:

1. The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Linkou 966 Chamber 6 (CH 6).
3. Tested Date: 2022/9/29

#### 4.1.3 Test Procedures

##### **For Radiated emission below 30MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

##### **NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

##### **For Radiated emission above 30MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

##### **Note:**

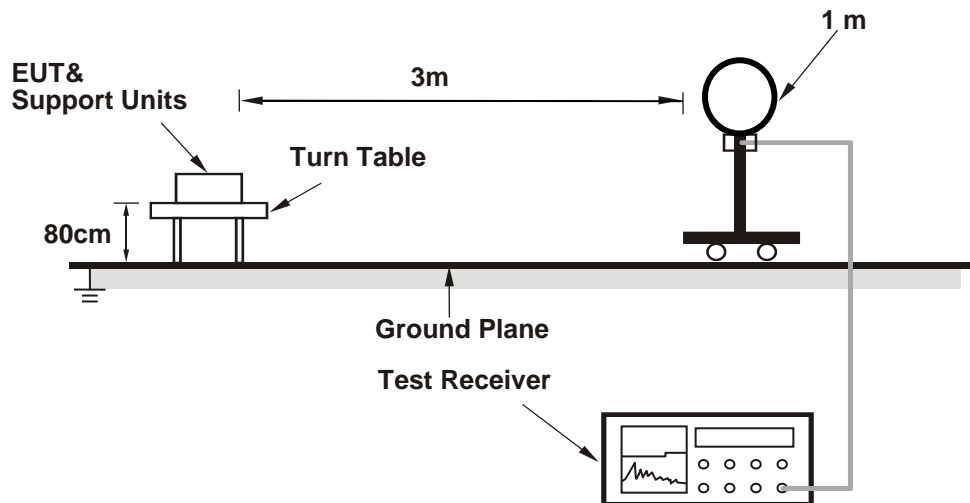
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) and Average detection at frequency above 1GHz. For fundamental and harmonic signal measurement, according to ANSI C63.10 section 7.5, the average value = peak value + duty factor. The duty factor refer to Chapter 3.3 of this report.
3. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 Deviation from Test Standard

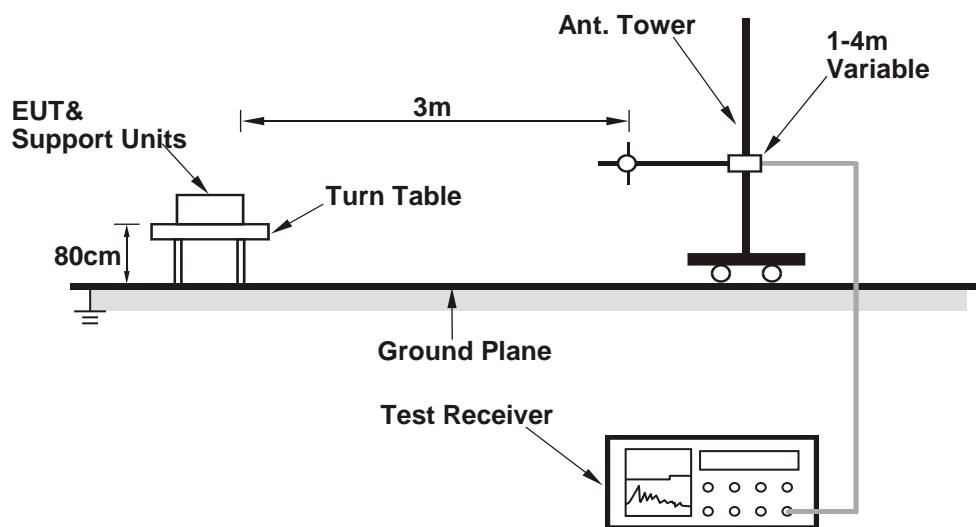
No deviation.

#### 4.1.5 Test Setup

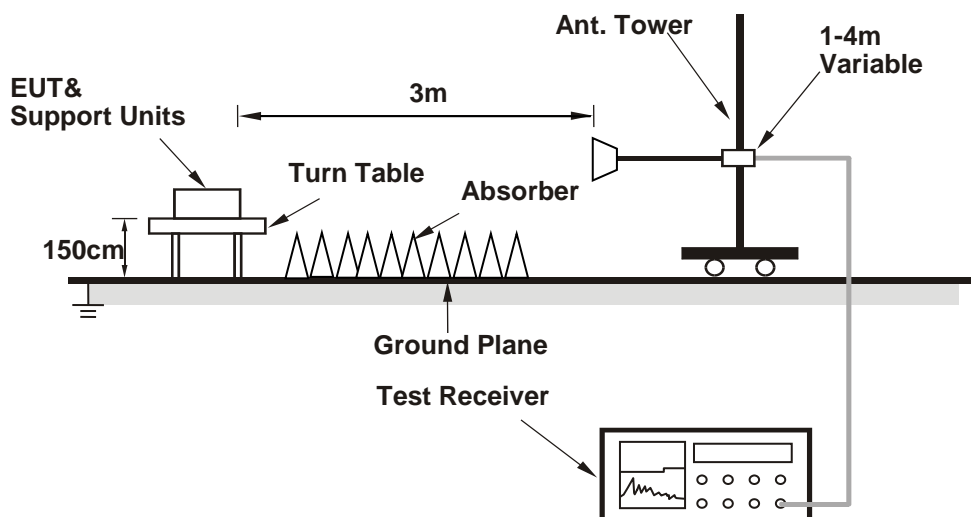
##### For Radiated emission below 30MHz



##### For Radiated emission 30MHz to 1GHz



**For Radiated emission above 1GHz**



For the actual test configuration, please refer to the attached file (Test Setup Photo).

**4.1.6 EUT Operating Conditions**

Set the EUT under transmission condition continuously at specific channel frequency.



#### 4.1.7 Test Results

#### ABOVE 1GHz DATA

|                        |                |  |   |
|------------------------|----------------|--|---|
| <b>RF Mode</b>         | TX GFSK        | <b>Channel</b>                           | CH 0 : 2402 MHz   |
| <b>Frequency Range</b> | 1 GHz ~ 25 GHz | <b>Detector Function &amp; Bandwidth</b> | (PK) RB = 1 MHz, VB = 3 MHz<br>(AV) RB = 1 MHz, VB = 3 MHz<br>(RMS) |

| Antenna Polarity & Test Distance : Horizontal at 3 m |                 |                         |                |              |                    |                      |                  |                          |
|--|-----------------|-------------------------|----------------|--------------|--------------------|----------------------|------------------|--------------------------|
| No   | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB)  | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1  | 2390.00         | 52.5 PK                 | 74.0           | -21.5        | 1.13 H             | 57                   | 53.8             | -1.3                     |
| 2  | <b>2390.00</b>  | <b>40.3 AV</b>          | <b>54.0</b>    | <b>-13.7</b> | <b>1.13 H</b>      | <b>57</b>            | <b>41.6</b>      | <b>-1.3</b>              |
| 3  | 2400.00         | 55.8 PK                 | 74.0           | -18.2        | 1.13 H             | 57                   | 57.2             | -1.4                     |
| 4  | 2400.00         | 23.4 AV                 | 54.0           | -30.6        | 1.13 H             | 57                   | 24.8             | -1.4                     |
| 5  | *2402.00        | 99.8 PK                 | 114.0          | -14.2        | 1.13 H             | 57                   | 101.2            | -1.4                     |
| 6  | *2402.00        | 67.4 AV                 | 94.0           | -26.6        | 1.13 H             | 57                   | 68.8             | -1.4                     |
| 7  | 4804.00         | 49.9 PK                 | 74.0           | -24.1        | 2.85 H             | 171                  | 43.3             | 6.6                      |
| 8  | 4804.00         | 17.5 AV                 | 54.0           | -36.5        | 2.85 H             | 171                  | 10.9             | 6.6                      |

| Antenna Polarity & Test Distance : Vertical at 3 m |                 |                         |                |             |                    |                      |                  |                          |
|--|-----------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No   | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1  | 2390.00         | 51.4 PK                 | 74.0           | -22.6       | 1.02 V             | 89                   | 52.7             | -1.3                     |
| 2  | 2390.00         | 39.5 AV                 | 54.0           | -14.5       | 1.02 V             | 89                   | 40.8             | -1.3                     |
| 3  | 2400.00         | 45.7 PK                 | 74.0           | -28.3       | 1.02 V             | 89                   | 47.1             | -1.4                     |
| 4  | 2400.00         | 13.3 AV                 | 54.0           | -40.7       | 1.02 V             | 89                   | 14.7             | -1.4                     |
| 5  | *2402.00        | 89.7 PK                 | 114.0          | -24.3       | 1.02 V             | 89                   | 91.1             | -1.4                     |
| 6  | *2402.00        | 57.3 AV                 | 94.0           | -36.7       | 1.02 V             | 89                   | 58.7             | -1.4                     |
| 7  | 4804.00         | 51.7 PK                 | 74.0           | -22.3       | 1.47 V             | 231                  | 45.1             | 6.6                      |
| 8  | 4804.00         | 19.3 AV                 | 54.0           | -34.7       | 1.47 V             | 231                  | 12.7             | 6.6                      |

#### Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " \* ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:  

$$20 \log(\text{Duty cycle}) = 20 \log(0.024) = -32.4\text{dB}$$

|                        |                |  |   |
|------------------------|----------------|--|---|
| <b>RF Mode</b>         | TX GFSK        | <b>Channel</b>                           | CH 38 : 2440 MHz  |
| <b>Frequency Range</b> | 1 GHz ~ 25 GHz | <b>Detector Function &amp; Bandwidth</b> | (PK) RB = 1 MHz, VB = 3 MHz<br>(AV) RB = 1 MHz, VB = 3 MHz<br>(RMS) |

**Antenna Polarity & Test Distance : Horizontal at 3 m**

| No | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
|----|-----------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| 1  | *2440.00        | 99.0 PK                 | 114.0          | -15.0       | 1.10 H             | 73                   | 100.3            | -1.3                     |
| 2  | *2440.00        | 66.6 AV                 | 94.0           | -27.4       | 1.10 H             | 73                   | 67.9             | -1.3                     |
| 3  | 4880.00         | 50.4 PK                 | 74.0           | -23.6       | 2.78 H             | 164                  | 43.6             | 6.8                      |
| 4  | 4880.00         | 18.0 AV                 | 54.0           | -36.0       | 2.78 H             | 164                  | 11.2             | 6.8                      |

**Antenna Polarity & Test Distance : Vertical at 3 m**

| No | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
|----|-----------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| 1  | *2440.00        | 89.2 PK                 | 114.0          | -24.8       | 1.06 V             | 96                   | 90.5             | -1.3                     |
| 2  | *2440.00        | 56.8 AV                 | 94.0           | -37.2       | 1.06 V             | 96                   | 58.1             | -1.3                     |
| 3  | 4880.00         | 51.6 PK                 | 74.0           | -22.4       | 1.55 V             | 220                  | 44.8             | 6.8                      |
| 4  | 4880.00         | 19.2 AV                 | 54.0           | -34.8       | 1.55 V             | 220                  | 12.4             | 6.8                      |

**Remarks:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " \* " : Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:  
 $20 \log(\text{Duty cycle}) = 20 \log(0.024) = -32.4\text{dB}$

|                        |                |  |   |
|------------------------|----------------|--|---|
| <b>RF Mode</b>         | TX GFSK        | <b>Channel</b>                           | CH 78 : 2480 MHz  |
| <b>Frequency Range</b> | 1 GHz ~ 25 GHz | <b>Detector Function &amp; Bandwidth</b> | (PK) RB = 1 MHz, VB = 3 MHz<br>(AV) RB = 1 MHz, VB = 3 MHz<br>(RMS) |

**Antenna Polarity & Test Distance : Horizontal at 3 m**

| No | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
|----|-----------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| 1  | *2480.00        | 98.1 PK                 | 114.0          | -15.9       | 1.56 H             | 69                   | 99.3             | -1.2                     |
| 2  | *2480.00        | 65.7 AV                 | 94.0           | -28.3       | 1.56 H             | 69                   | 66.9             | -1.2                     |
| 3  | 2483.50         | 58.8 PK                 | 74.0           | -15.2       | 1.56 H             | 69                   | 60.0             | -1.2                     |
| 4  | 2483.50         | 26.4 AV                 | 54.0           | -27.6       | 1.56 H             | 69                   | 27.6             | -1.2                     |
| 5  | 4960.00         | 50.9 PK                 | 74.0           | -23.1       | 2.85 H             | 158                  | 44.0             | 6.9                      |
| 6  | 4960.00         | 18.5 AV                 | 54.0           | -35.5       | 2.85 H             | 158                  | 11.6             | 6.9                      |

**Antenna Polarity & Test Distance : Vertical at 3 m**

| No | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
|----|-----------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| 1  | *2480.00        | 88.7 PK                 | 114.0          | -25.3       | 1.05 V             | 89                   | 89.9             | -1.2                     |
| 2  | *2480.00        | 56.3 AV                 | 94.0           | -37.7       | 1.05 V             | 89                   | 57.5             | -1.2                     |
| 3  | 2483.50         | 53.9 PK                 | 74.0           | -20.1       | 1.05 V             | 89                   | 55.1             | -1.2                     |
| 4  | 2483.50         | 21.5 AV                 | 54.0           | -32.5       | 1.05 V             | 89                   | 22.7             | -1.2                     |
| 5  | 4960.00         | 51.8 PK                 | 74.0           | -22.2       | 1.47 V             | 219                  | 44.9             | 6.9                      |
| 6  | 4960.00         | 19.4 AV                 | 54.0           | -34.6       | 1.47 V             | 219                  | 12.5             | 6.9                      |

**Remarks:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " \* ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:  

$$20 \log(\text{Duty cycle}) = 20 \log(0.024) = -32.4\text{dB}$$

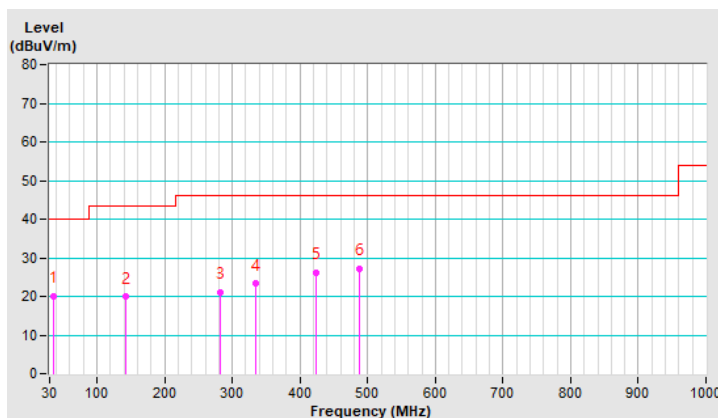
### BELOW 1GHz WORST-CASE DATA

|                        |               |  |                  |
|------------------------|---------------|--|------------------|
| <b>RF Mode</b>         | TX GFSK       | <b>Channel</b>                           | CH 0 : 2402 MHz  |
| <b>Frequency Range</b> | 9 kHz ~ 1 GHz | <b>Detector Function &amp; Bandwidth</b> | (QP) RB = 120kHz |

| Antenna Polarity & Test Distance : Horizontal at 3 m |                 |                         |                |             |                    |                      |                  |                          |
|--|-----------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No   | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1  | 35.38           | 20.1 QP                 | 40.0           | -19.9       | 1.58 H             | 188                  | 30.2             | -10.1                    |
| 2  | 142.13          | 19.9 QP                 | 43.5           | -23.6       | 1.42 H             | 310                  | 28.5             | -8.6                     |
| 3  | 282.83          | 21.1 QP                 | 46.0           | -24.9       | 1.37 H             | 208                  | 27.5             | -6.4                     |
| 4  | 334.34          | 23.3 QP                 | 46.0           | -22.7       | 1.96 H             | 8                    | 28.2             | -4.9                     |
| 5  | 424.11          | 26.1 QP                 | 46.0           | -19.9       | 1.83 H             | 51                   | 29.0             | -2.9                     |
| 6  | 488.62          | 27.1 QP                 | 46.0           | -18.9       | 1.20 H             | 171                  | 28.7             | -1.6                     |

**Remarks:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

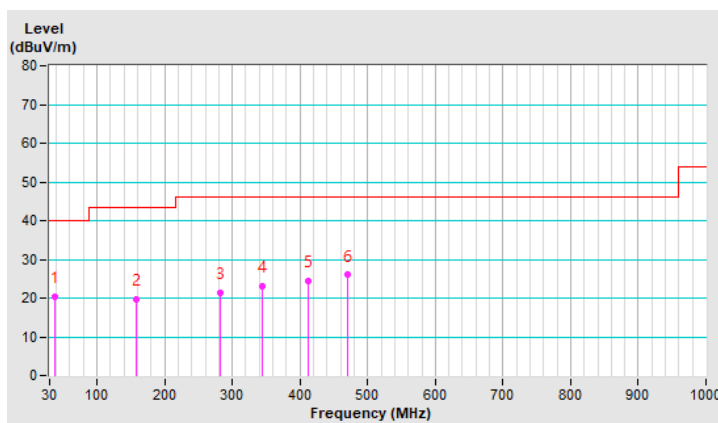


|                        |               |  |                  |
|------------------------|---------------|--|------------------|
| <b>RF Mode</b>         | TX GFSK       | <b>Channel</b>                           | CH 0 : 2402 MHz  |
| <b>Frequency Range</b> | 9 kHz ~ 1 GHz | <b>Detector Function &amp; Bandwidth</b> | (QP) RB = 120kHz |

| Antenna Polarity & Test Distance : Vertical at 3 m |                 |                         |                |             |                    |                      |                  |                          |
|--|-----------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No   | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1  | 36.84           | 20.4 QP                 | 40.0           | -19.6       | 1.49 V             | 0                    | 30.3             | -9.9                     |
| 2  | 158.23          | 19.6 QP                 | 43.5           | -23.9       | 1.27 V             | 360                  | 27.7             | -8.1                     |
| 3  | 281.38          | 21.5 QP                 | 46.0           | -24.5       | 1.76 V             | 221                  | 27.9             | -6.4                     |
| 4  | 344.67          | 23.0 QP                 | 46.0           | -23.0       | 1.83 V             | 179                  | 28.0             | -5.0                     |
| 5  | 411.45          | 24.4 QP                 | 46.0           | -21.6       | 1.69 V             | 194                  | 27.8             | -3.4                     |
| 6  | 471.11          | 26.0 QP                 | 46.0           | -20.0       | 1.34 V             | 276                  | 27.8             | -1.8                     |

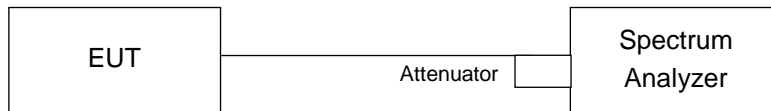
**Remarks:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



## 4.2 Channel Bandwidth

### 4.2.1 Test Setup



### 4.2.2 Test Instruments

| Description & Manufacturer | Model No. | Serial No. | Calibrated Date | Calibrated Until |
|----------------------------|-----------|------------|-----------------|------------------|
| Spectrum Analyzer<br>R&S   | FSV40     | 101544     | 2022/5/9        | 2023/5/8         |

- NOTE:**
1. The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.
  2. The test was performed in LK - Oven
  3. Tested Date: 2022/10/4

### 4.2.3 Test Procedure

- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
- d. Repeat above procedures until all frequencies measured were complete.

### 4.2.4 Deviation from Test Standard

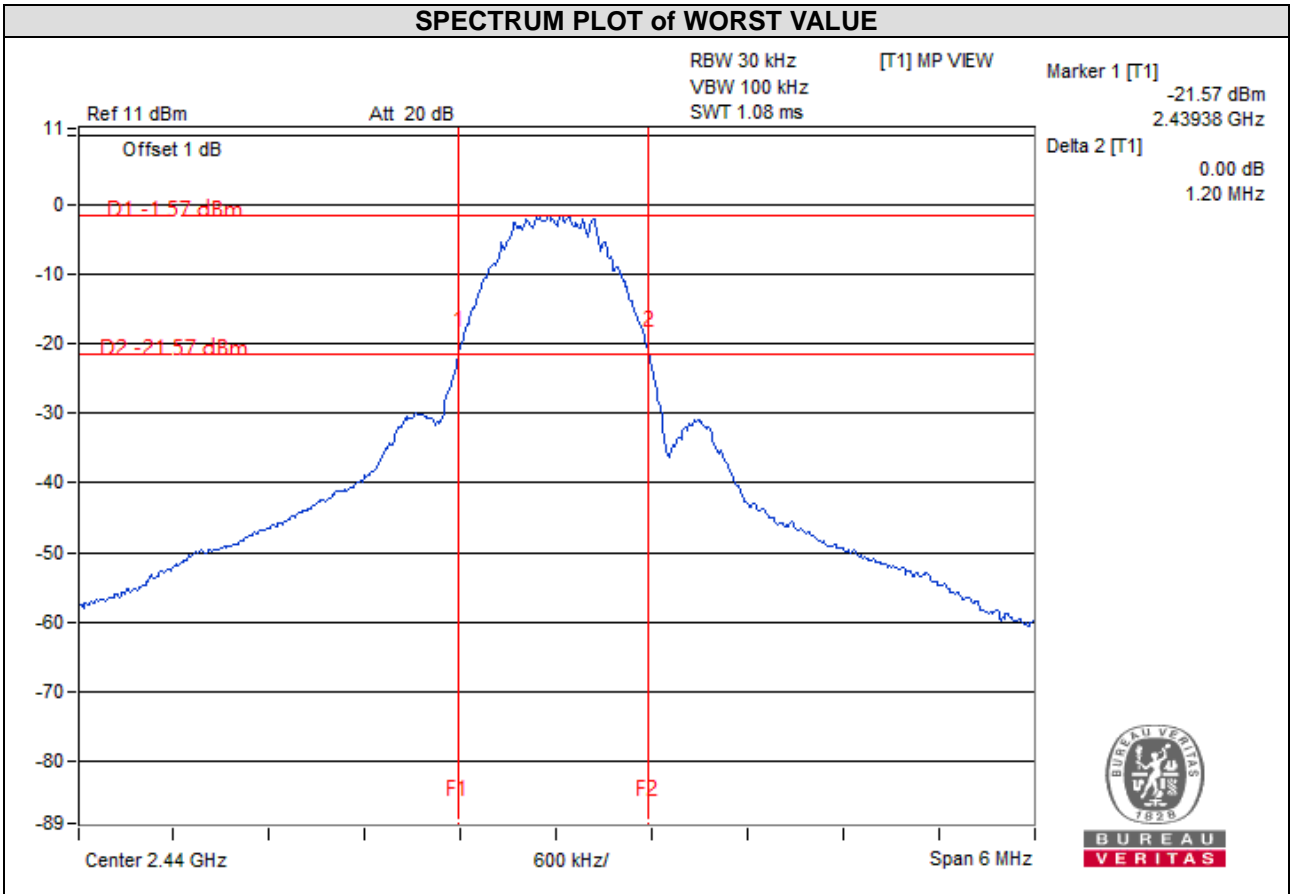
No deviation.

### 4.2.5 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.2.6 Test Results

| Channel | Frequency (MHz) | 20dB Bandwidth (MHz) |
|---------|-----------------|----------------------|
| 0       | 2402            | 1.19                 |
| 38      | 2440            | 1.2                  |
| 78      | 2480            | 1.18                 |



## 5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).



## Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

**Lin Kou EMC/RF Lab**

Tel: 886-2-26052180

Fax: 886-2-26051924

**Hsin Chu EMC/RF/Telecom Lab**

Tel: 886-3-6668565

Fax: 886-3-6668323

**Hwa Ya EMC/RF/Safety Lab**

Tel: 886-3-3183232

Fax: 886-3-3270892

**Email:** [service.adt@tw.bureauveritas.com](mailto:service.adt@tw.bureauveritas.com)

**Web Site:** [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

The address and road map of all our labs can be found in our web site also.

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