

# TEST REPORT

## CERTIFICATE OF CONFORMITY

**Standard:** 47 CFR FCC Part 15, Subpart C (Section 15.249)  
**Report No.:** RFBUIY-WTW-P23090524-1  
**FCC ID:** XGB-MWBB0003  
**Product:** Wireless mouse  
**Brand:** TURTLE BEACH  
**Model No.:** MWBB0003  
**Received Date:** 2023/9/25  
**Test Date:** 2023/10/13 ~ 2023/10/18  
**Issued Date:** 2023/11/14  
**Applicant:** Voyetra Turtle Beach, Inc.  
**Address:** 44 South Broadway, 4th Floor White Plains NY 10601 USA  
**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  
**Test Location:** No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan  
**FCC Registration /** 198487 / TW2021  
**Designation Number:**

Approved by: \_\_\_\_\_

*Jeremy Lin*

Jeremy Lin / Project Engineer

, Date: \_\_\_\_\_

2023/11/14

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Prepared by : Jessica Cheng / Senior Specialist

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## Release Control Record

| Issue No.              | Description       | Date Issued |
|------------------------|-------------------|-------------|
| RFBUIY-WTW-P23090524-1 | Original release. | 2023/11/14  |

## 1 Certificate

**Product:** Wireless mouse

**Brand:** TURTLE BEACH

**Test Model:** MWBB0003

**Sample Status:** Engineering sample

**Applicant:** Voyetra Turtle Beach, Inc.

**Test Date:** 2023/10/13 ~ 2023/10/18

**Standard:** 47 CFR FCC Part 15, Subpart C (Section 15.249)

**Measurement procedure:** 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.

## 2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C (Section 15.249) |                                |        |                                                    |
|------------------------------------------------|--------------------------------|--------|----------------------------------------------------|
| Standard / Clause                              | Test Item                      | Result | Remark                                             |
| 15.207                                         | AC Power Conducted Emissions   | Pass   | Minimum passing margin is -11.95 dB at 0.15719 MHz |
| 15.209 / 15.249(d)                             | Radiated Emissions below 1 GHz | Pass   | Minimum passing margin is -5.5 dB at 56.77 MHz     |
| 15.209 / 15.249(a) / 15.249(d) / 15.249(e)     | Radiated Emissions above 1 GHz | Pass   | Minimum passing margin is -12.3 dB at 2440.00 MHz  |
| 15.215 (c)                                     | 20 dB Bandwidth                | Pass   | Meet the requirement of limit.                     |
| 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:

| Parameter                      | Specification   | Expanded Uncertainty<br>(k=2)<br>(±) |
|--------------------------------|-----------------|--------------------------------------|
| AC Power Conducted Emissions   | 9 kHz ~ 30 MHz  | 2.90 dB                              |
| Unwanted Emissions below 1 GHz | 9 kHz ~ 30 MHz  | 2.38 dB                              |
|                                | 30 MHz ~ 1 GHz  | 5.7 dB                               |
| Radiated Emissions below 1 GHz | 9 kHz ~ 30 MHz  | 2.38 dB                              |
|                                | 30 MHz ~ 1 GHz  | 5.7 dB                               |
| Radiated Emissions above 1 GHz | 1 GHz ~ 6 GHz   | 4.83 dB                              |
|                                | 6 GHz ~ 18 GHz  | 5.37 dB                              |
|                                | 18 GHz ~ 40 GHz | 5.24 dB                              |

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

### 2.2 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

### 3 General Information

#### 3.1 General Description

|                               |                                           |
|-------------------------------|-------------------------------------------|
| Product                       | Wireless mouse                            |
| Brand                         | TURTLE BEACH                              |
| Test Model                    | MWBB0003                                  |
| Status of EUT                 | Engineering sample                        |
| Power Supply Rating           | 3.7Vdc from battery or 5Vdc from USB port |
| Modulation Type               | GFSK                                      |
| Operating Frequency           | 2.403 GHz ~ 2.48 GHz                      |
| Number of Channel             | 78                                        |
| Field Strength Of Fundamental | 81.7 dBuV/m at 3 meters                   |

Note:

1. The EUT uses following accessory.

|           |               |
|-----------|---------------|
| USB Cable | Shielded 1.8m |
|-----------|---------------|

2. EUT has two colors of black and white for marketing requirement.

3. There are Bluetooth and GFSK technology used for the EUT.

4. Bluetooth and GFSK technology can not transmit at same time.

5. 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.

### 3.2 Antenna Description of EUT

1. The antenna information is listed as below.

| Gain (dBi) | Antenna Type | Connector Type |
|------------|--------------|----------------|
| 2.5        | Chip         | N/A            |

\* 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.

### 3.3 Channel List

78 channels are provided to this EUT:

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

### 3.4 Test Mode Applicability and Tested Channel Detail

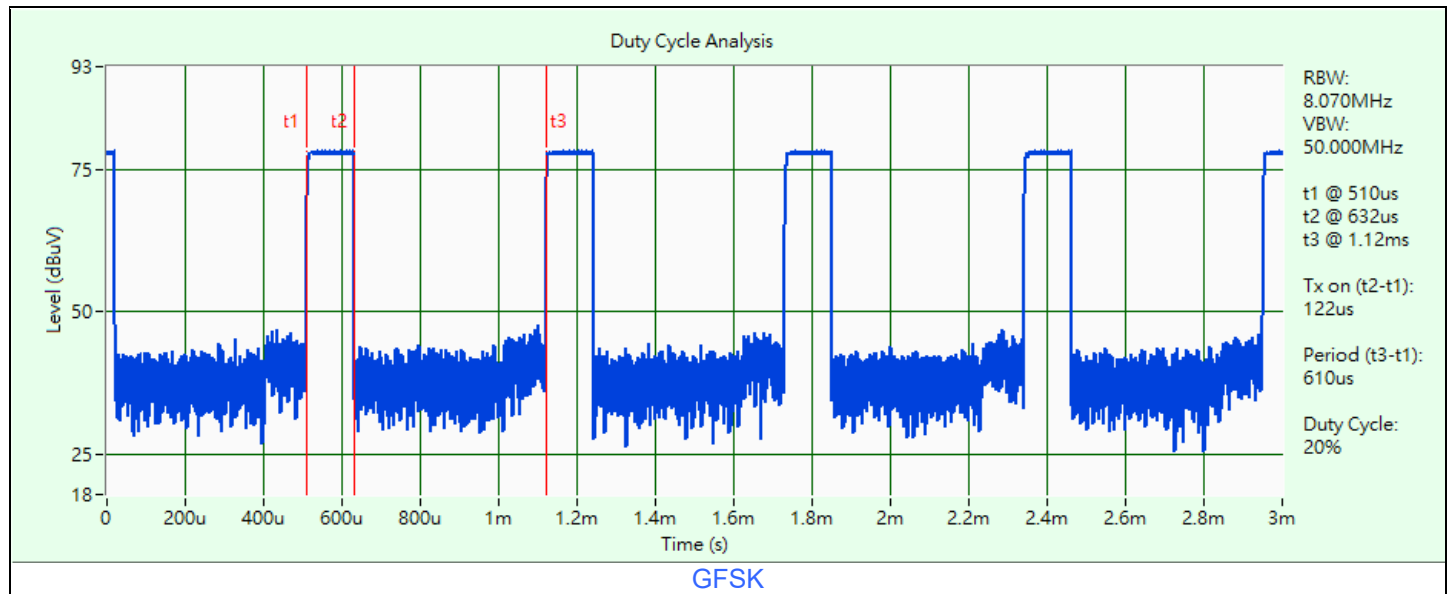
|             |                                                                                                                                                                                      |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pre-Scan:   | 1. For Unwanted Emission below 1 GHz has Charging with NB/ Charging with Adapter mode of power supply. Pre-scan and find the worst charging case as a representative test condition. |
| Worst Case: | 1. For Unwanted Emission below 1 GHz Charging with NB mode is the worst charging case of power supply.                                                                               |

Following channel(s) was (were) selected for the final test as listed below:

| Test Item                      | EUT Configure Mode | Tested Channel        | Modulation | Data Rate Parameter |
|--------------------------------|--------------------|-----------------------|------------|---------------------|
| AC Power Conducted Emissions   | B                  | -                     | -          | -                   |
|                                | C                  | -                     | -          | -                   |
| 20 dB Bandwidth                | A                  | 0, 37, 77             | GFSK       | 1Mb/s               |
| Radiated Emissions below 1 GHz | A                  | 37                    | GFSK       | 1Mb/s               |
|                                | B                  | -                     | -          | -                   |
| Radiated Emissions above 1 GHz | A                  | 0, 37, 77             | GFSK       | 1Mb/s               |
| EUT Configure Mode:            | A                  | EUT only              |            |                     |
|                                | B                  | Charging with NB      |            |                     |
|                                | C                  | Charging with Adapter |            |                     |

### 3.5 Duty Cycle of Test Signal

**GFSK:** Duty cycle =  $0.122 \text{ ms} / 0.61 \text{ ms} \times 100\% = 20.0\%$



### 3.6 Test Program Used and Operation Descriptions

Controlling software (Pxi\_Link\_Emi\_Tool) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

### 3.7 Connection Diagram of EUT and Peripheral Devices

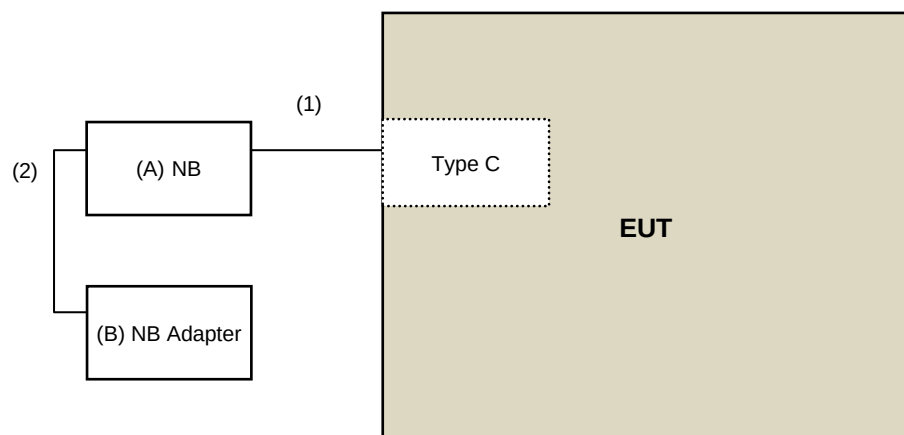
Mode A



----- Remote Site



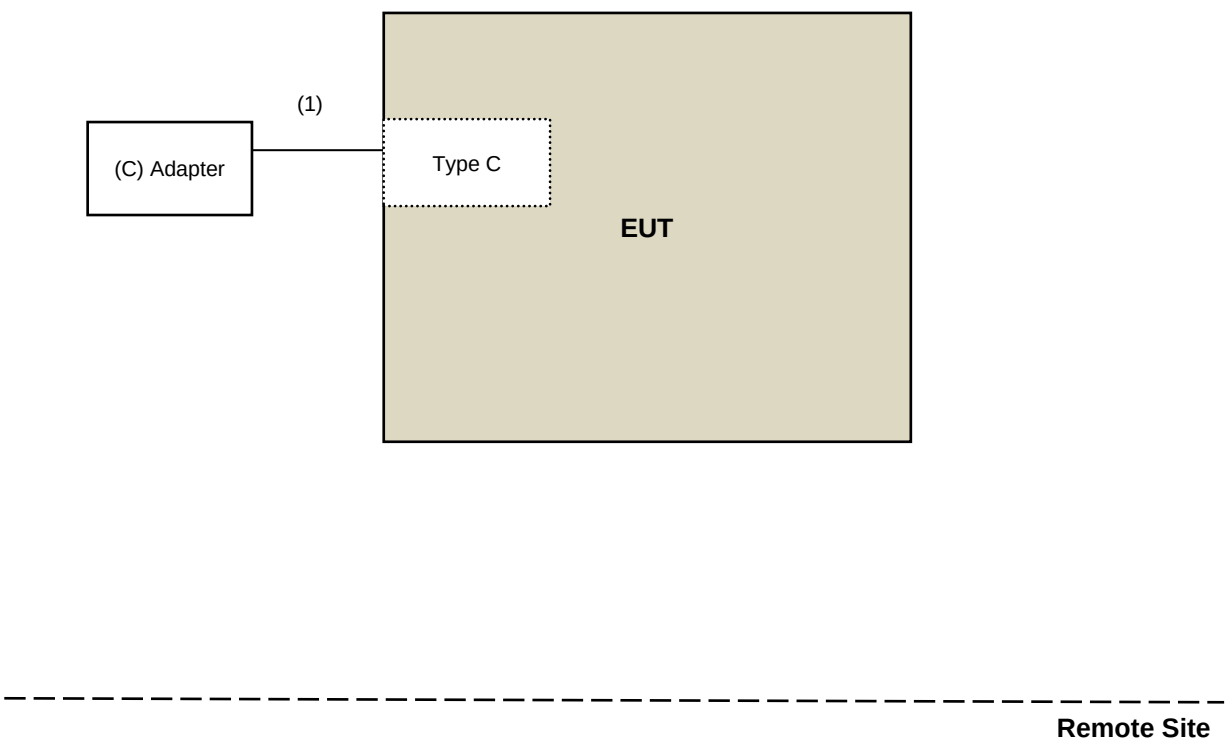
Mode B



----- Remote Site



Mode C



### 3.8 Configuration of Peripheral Devices and Cable Connections

| ID | Product    | Brand  | Model No.    | Serial No. | FCC ID | Remarks         |
|----|------------|--------|--------------|------------|--------|-----------------|
| A  | NB         | Lenovo | 80WG         | YD01YRC9   | N/A    | Provided by Lab |
| B  | NB Adapter | Lenovo | ADLX65CLGU2A | N/A        | N/A    | Provided by Lab |
| C  | Adapter    | Apple  | A1385        | N/A        | N/A    | Provided by Lab |

| ID | Cable Descriptions  | Qty. | Length (m) | Shielding (Yes/No) | Cores (Qty.) | Remarks               |
|----|---------------------|------|------------|--------------------|--------------|-----------------------|
| 1  | USB cable           | 1    | 1.8        | Y                  | 0            | Supplied by applicant |
| 2  | NB Adapter DC cable | 1    | 1.9        | N                  | 0            | Provided by Lab       |

## 4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### 4.1 AC Power Conducted Emissions

| Description<br>Manufacturer          | Model No.     | Serial No.    | Calibrated<br>Date | Calibrated<br>Until |
|--------------------------------------|---------------|---------------|--------------------|---------------------|
| 50 ohm terminal resistance<br>LYNICS | 0900510       | E1-011285     | 2023/9/21          | 2024/9/20           |
|                                      |               | E1-011286     | 2023/9/21          | 2024/9/20           |
| 50 ohm terminal resistance<br>SUHNER | 65BNC-5001    | E1-010789     | 2023/6/16          | 2024/6/15           |
| EMI Test Receiver<br>R&S             | ESCI          | 100412        | 2023/8/23          | 2024/8/22           |
|                                      | ESCS 30       | 100276        | 2023/4/20          | 2024/4/19           |
| Fixed Attenuator<br>STI              | STI02-2200-10 | NO.1          | 2023/9/13          | 2024/9/12           |
| LISN<br>R&S                          | ENV216        | 101196        | 2023/5/22          | 2024/5/21           |
|                                      |               | 101197        | 2023/7/12          | 2024/7/11           |
| LISN<br>Schwarzbeck                  | NNLK 8121     | 8121-731      | 2023/6/9           | 2024/6/8            |
|                                      |               | 8121-00759    | 2023/8/21          | 2024/8/20           |
|                                      |               | 8121-808      | 2023/5/2           | 2024/5/1            |
|                                      | NNLK 8129     | 8129229       | 2023/6/27          | 2024/6/26           |
| RF Coaxial Cable<br>PEWC             | 5D-FB         | Cable-CO10-01 | 2023/2/8           | 2024/2/7            |
| Software<br>BVADT                    | Cond_V7.3.7.4 | N/A           | N/A                | N/A                 |

Notes:

1. The test was performed in Linkou Conduction 10.
2. Tested Date: 2023/10/14

## 4.2 Radiated Emissions below 1 GHz

| Description<br>Manufacturer                  | Model No.        | Serial No.   | Calibrated<br>Date | Calibrated<br>Until |
|----------------------------------------------|------------------|--------------|--------------------|---------------------|
| Bi_Log Antenna<br>Schwarzbeck                | VULB 9168        | 137          | 2023/10/13         | 2024/10/12          |
| Coupling / Decoupling Network<br>Schwarzbeck | CDNE-M2          | 00097        | 2023/5/25          | 2024/5/24           |
|                                              | CDNE-M3          | 00091        | 2023/5/25          | 2024/5/24           |
| Loop Antenna<br>EMCI                         | LPA600           | 270          | 2023/9/4           | 2024/9/3            |
| MXE EMI Receiver<br>Agilent                  | N9038A           | MY51210129   | 2023/3/24          | 2024/3/23           |
|                                              |                  | MY51210137   | 2023/6/5           | 2024/6/4            |
| Preamplifier<br>EMCI                         | EMC001340        | 980269       | 2023/6/27          | 2024/6/26           |
| Preamplifier<br>HP                           | 8447D            | 2432A03504   | 2023/2/16          | 2024/2/15           |
| RF Coaxial Cable<br>Pacific                  | 8D-FB            | Cable-CH6-02 | 2023/6/27          | 2024/6/26           |
| Signal Analyzer<br>R&S                       | FSV40            | 101544       | 2023/5/9           | 2024/5/8            |
| Software<br>BVADT                            | Radiated_V8.7.08 | N/A          | N/A                | N/A                 |
| Tower<br>ADT                                 | AT100            | 0306         | N/A                | N/A                 |
| Turn Table<br>ADT                            | TT100            | 0306         | N/A                | N/A                 |

### Notes:

1. The test was performed in Linkou 966 Chamber 6 (CH 6).
2. Tested Date: 2023/10/13

#### 4.3 Radiated 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          | 2023/5/25          | 2024/5/24           |
| Boresight antenna tower fixture<br>BV | BAF-02              | 6            | N/A                | N/A                 |
| High Pass Filter<br>Wainwright        | WHK 3.1/18G-10SS    | SN 8         | 2023/5/25          | 2024/5/24           |
| Horn Antenna<br>EMCO                  | 3115                | 00028257     | 2022/11/13         | 2023/11/12          |
| Horn Antenna<br>ETS-Lindgren          | 3117-PA             | 00215857     | 2022/11/13         | 2023/11/12          |
| Horn Antenna<br>Schwarzbeck           | BBHA 9170           | 212          | 2022/10/20         | 2023/10/19          |
| MXE EMI Receiver<br>Agilent           | N9038A              | MY51210129   | 2023/3/24          | 2024/3/23           |
|                                       |                     | MY51210137   | 2023/6/5           | 2024/6/4            |
| Notch Filter<br>Micro-Tronics         | BRC50703-01         | 010          | 2023/5/25          | 2024/5/24           |
| Preamplifier<br>EMCI                  | EMC0126545          | 980076       | 2023/2/16          | 2024/2/15           |
|                                       | EMC184045B          | 980175       | 2023/9/2           | 2024/9/1            |
|                                       |                     | 980235       | 2023/2/16          | 2024/2/15           |
| Preamplifier<br>HP                    | 8449B               | 3008A01201   | 2023/2/16          | 2024/2/15           |
| RF Coaxial Cable<br>EMCI              | EMC102-KM-KM-1000   | 200310       | 2023/3/12          | 2024/3/11           |
|                                       | EMC104              | 190801       | 2023/9/13          | 2024/9/12           |
|                                       |                     | 190804       | 2023/9/13          | 2024/9/12           |
| RF Coaxial Cable<br>HUBER+SUHNER      | SF-104              | Cable-CH6-01 | 2023/9/13          | 2024/9/12           |
| Signal Analyzer<br>R&S                | FSV40               | 101042       | 2023/9/5           | 2024/9/4            |
|                                       |                     | 101544       | 2023/5/9           | 2024/5/8            |
| Software<br>BVADT                     | Radiated_V7.7.1.1.1 | N/A          | N/A                | N/A                 |
| Tower<br>ADT                          | AT100               | 0306         | N/A                | N/A                 |
| Turn Table<br>ADT                     | TT100               | 0306         | N/A                | N/A                 |

#### Notes:

1. The test was performed in Linkou 966 Chamber 6 (CH 6).
2. Tested Date: 2023/10/13

#### 4.4 20 dB Bandwidth

| Description<br>Manufacturer     | Model No.                        | Serial No. | Calibrated<br>Date | Calibrated<br>Until |
|---------------------------------|----------------------------------|------------|--------------------|---------------------|
| PXA Signal Analyzer<br>Keysight | N9030A                           | MY54490260 | 2023/7/13          | 2024/7/12           |
| Signal Analyzer<br>R&S          | FSV40                            | 101042     | 2023/9/5           | 2024/9/4            |
|                                 |                                  | 101544     | 2023/5/9           | 2024/5/8            |
| Software                        | ADT_RF Test Software<br>V6.6.5.4 | N/A        | N/A                | N/A                 |

Notes:

1. The test was performed in LK - Oven
2. Tested Date: 2023/10/18

## 5 Limits of Test Items

### 5.1 AC Power Conducted Emissions

| Frequency (MHz) | Conducted Limit (dBuV) |         |
|-----------------|------------------------|---------|
|                 | Quasi-peak             | Average |
| 0.15 - 0.5      | 66 - 56                | 56 - 46 |
| 0.50 - 5.0      | 56                     | 46      |
| 5.0 - 30.0      | 60                     | 50      |

Notes:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

### 5.2 Radiated Emissions below 1 GHz

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

| 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                             |

Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

### 5.3 Radiated Emissions above 1 GHz

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) |
|-----------------------|--------------------------------------------------|------------------------------------------------|
| 2400 ~ 2483.5 MHz     | 50                                               | 500                                            |

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) |
|-------------------|-----------------------------------|-------------------------------|
| Above 960         | 500                               | 3                             |

Notes:

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 1000 MHz, 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 20 dB under any condition of modulation.

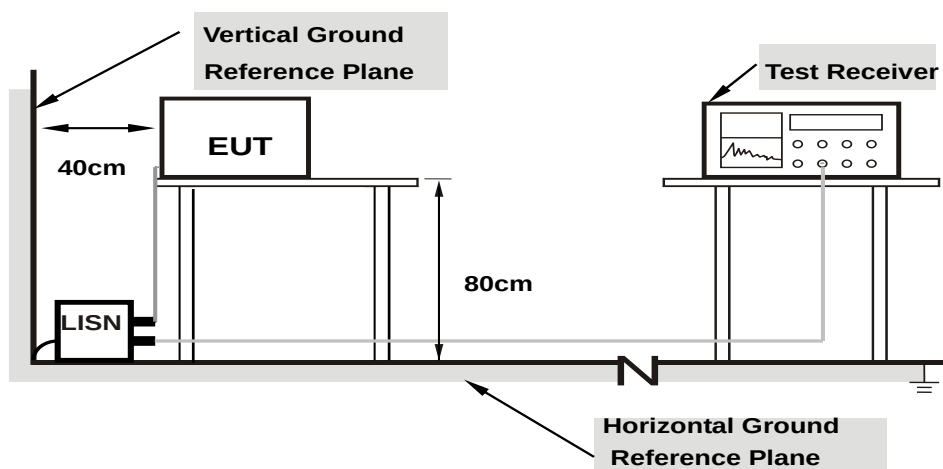
### 5.4 20 dB Bandwidth

The 20dB bandwidth shall be specified in operating frequency band.

## 6 Test Arrangements

### 6.1 AC Power Conducted Emissions

#### 6.1.1 Test Setup



**Note: 1. Support units were connected to second LISN.**

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

#### 6.1.2 Test Procedure

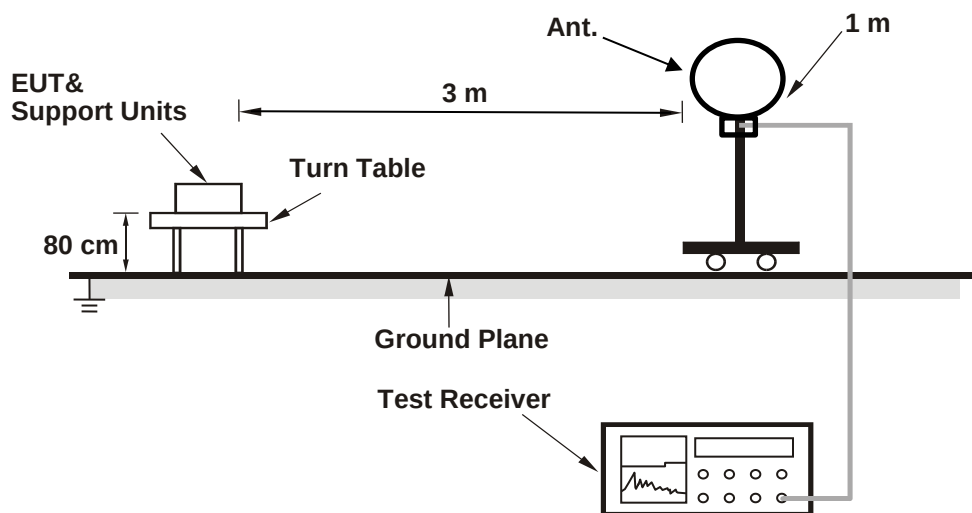
- The EUT was placed on a 0.8 meter to the top of table and placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50 uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

Note: The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz-30 MHz.

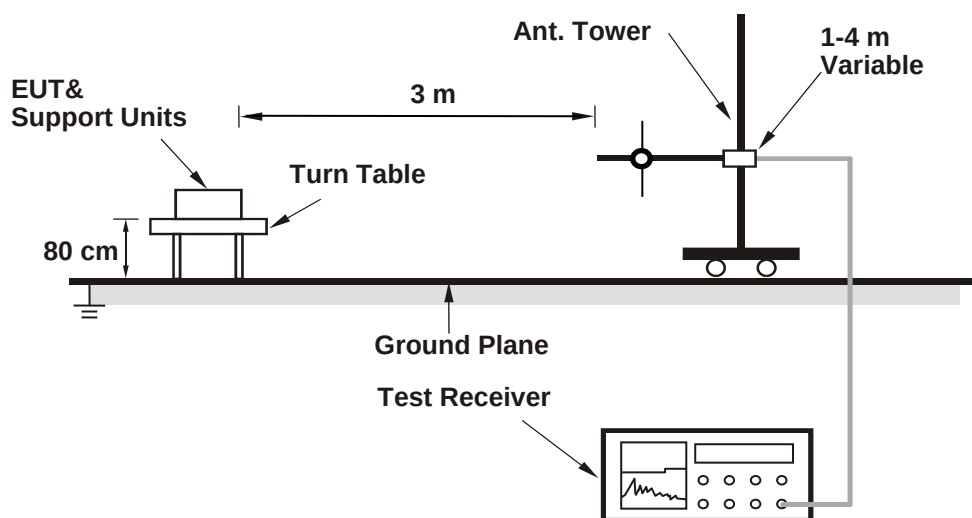
## 6.2 Radiated Emissions below 1 GHz

### 6.2.1 Test Setup

#### For Radiated emission below 30 MHz



#### For Radiated emission above 30 MHz



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

## 6.2.2 Test Procedure

### For Radiated emission below 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters 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. 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, except for the frequency band (9 kHz to 90 kHz and 110 kHz to 490 kHz) set to average detect function and peak detect function.

#### Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 200 Hz at frequency below 150 kHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz or 10 kHz at frequency (150 kHz to 30 MHz).
3. All modes of operation were investigated and the worst-case emissions are reported.

### For Radiated emission above 30 MHz

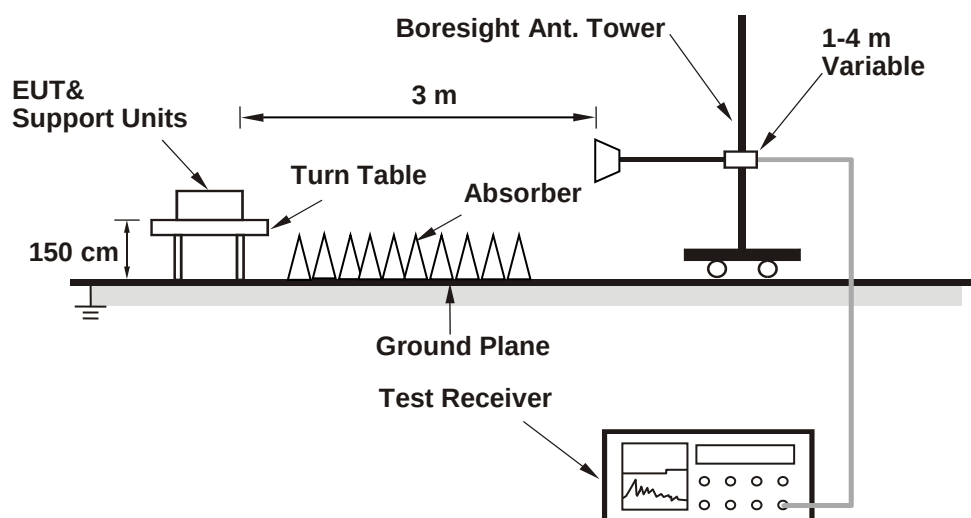
- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the 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.

#### Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

## 6.3 Radiated Emissions above 1 GHz

### 6.3.1 Test Setup



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

### 6.3.2 Test Procedure

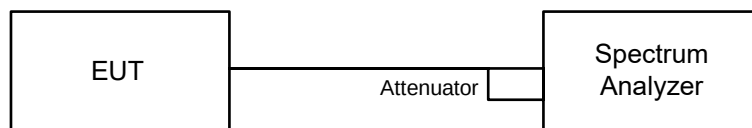
- The EUT was placed on the top of a rotating table 1.5 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 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.
- 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.
- The test-receiver system was set to peak and average detects 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.

#### Notes:

- 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 (AV) at frequency above 1 GHz.
- For fundamental and harmonic signal measurement, the resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle  $< 98\%$ ) or 10 Hz (Duty cycle  $\geq 98\%$ ) for Average detection (AV) at frequency above 1 GHz.
- According to ANSI C63.10 section 6.6.4 and 4.1.4.2.2. For fundamental and harmonic signal measurement, according to ANSI C63.10 section 7.5, the average value = peak value + duty cycle correction factor. For duty cycle correction factor values, see the Test Signal Duty Cycle section in this report.
- All modes of operation were investigated and the worst-case emissions are reported.

## 6.4 20 dB Bandwidth

### 6.4.1 Test Setup



### 6.4.2 Test Procedure

- Set RBW = approximately 1% of the emission bandwidth.
- Set the VBW > RBW.
- Detector = Peak.
- Trace mode = max hold.
- Measure the maximum width of the emission that is 20 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

## 7 Test Results of Test Item

### 7.1 AC Power Conducted Emissions

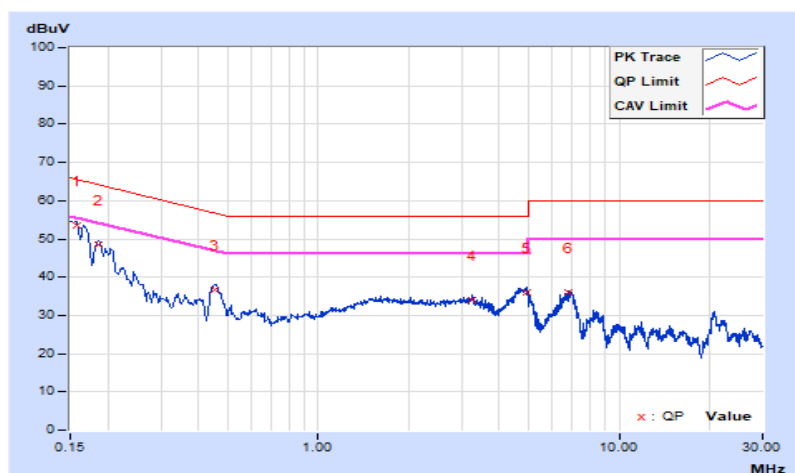
#### Mode B

|                 |                  |                                          |                                       |
|-----------------|------------------|------------------------------------------|---------------------------------------|
| Frequency Range | 150 kHz ~ 30 MHz | Detector Function & Resolution Bandwidth | Quasi-Peak (QP) / Average (AV), 9 kHz |
| Input Power     | 120 Vac, 60 Hz   | Environmental Conditions                 | 25°C, 75% RH                          |
| Tested By       | Jed Wu           |                                          |                                       |

| Phase Of Power : Line (L) |                 |                        |                      |       |                       |       |              |       |             |        |
|---------------------------|-----------------|------------------------|----------------------|-------|-----------------------|-------|--------------|-------|-------------|--------|
| No                        | Frequency (MHz) | Correction Factor (dB) | Reading Value (dBuV) |       | Emission Level (dBuV) |       | Limit (dBuV) |       | Margin (dB) |        |
|                           |                 |                        | Q.P.                 | AV.   | Q.P.                  | AV.   | Q.P.         | AV.   | Q.P.        | AV.    |
| 1                         | 0.15719         | 9.99                   | 43.67                | 23.80 | 53.66                 | 33.79 | 65.61        | 55.61 | -11.95      | -21.82 |
| 2                         | 0.18508         | 9.99                   | 38.60                | 20.10 | 48.59                 | 30.09 | 64.25        | 54.25 | -15.66      | -24.16 |
| 3                         | 0.45097         | 9.96                   | 26.76                | 20.96 | 36.72                 | 30.92 | 56.86        | 46.86 | -20.14      | -15.94 |
| 4                         | 3.25334         | 10.05                  | 23.93                | 18.78 | 33.98                 | 28.83 | 56.00        | 46.00 | -22.02      | -17.17 |
| 5                         | 4.93507         | 10.11                  | 25.99                | 18.67 | 36.10                 | 28.78 | 56.00        | 46.00 | -19.90      | -17.22 |
| 6                         | 6.74431         | 10.20                  | 25.69                | 20.14 | 35.89                 | 30.34 | 60.00        | 50.00 | -24.11      | -19.66 |

#### Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

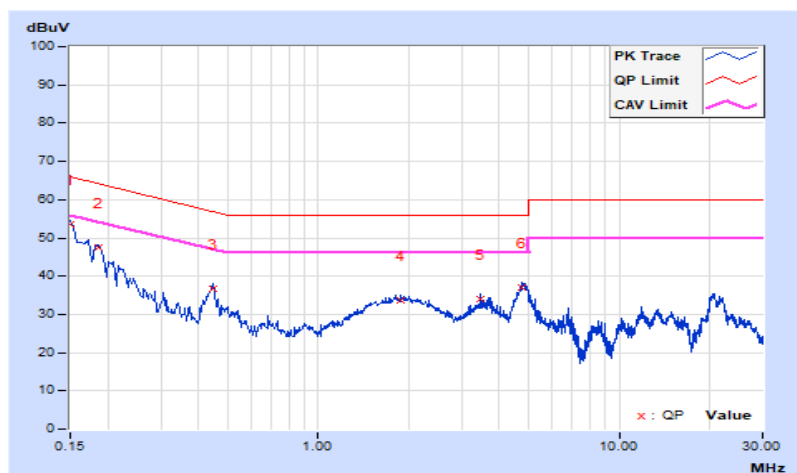


|                 |                  |                                          |                                       |
|-----------------|------------------|------------------------------------------|---------------------------------------|
| Frequency Range | 150 kHz ~ 30 MHz | Detector Function & Resolution Bandwidth | Quasi-Peak (QP) / Average (AV), 9 kHz |
| Input Power     | 120 Vac, 60 Hz   | Environmental Conditions                 | 25°C, 75% RH                          |
| Tested By       | Jed Wu           |                                          |                                       |

| Phase Of Power : Neutral (N) |                 |                        |                      |       |                       |       |              |       |             |        |
|------------------------------|-----------------|------------------------|----------------------|-------|-----------------------|-------|--------------|-------|-------------|--------|
| No                           | Frequency (MHz) | Correction Factor (dB) | Reading Value (dBuV) |       | Emission Level (dBuV) |       | Limit (dBuV) |       | Margin (dB) |        |
|                              |                 |                        | Q.P.                 | AV.   | Q.P.                  | AV.   | Q.P.         | AV.   | Q.P.        | AV.    |
| 1                            | 0.15000         | 9.96                   | 43.64                | 25.17 | 53.60                 | 35.13 | 66.00        | 56.00 | -12.40      | -20.87 |
| 2                            | 0.18508         | 9.95                   | 37.38                | 19.91 | 47.33                 | 29.86 | 64.25        | 54.25 | -16.92      | -24.39 |
| 3                            | 0.44625         | 9.95                   | 26.85                | 20.18 | 36.80                 | 30.13 | 56.94        | 46.94 | -20.14      | -16.81 |
| 4                            | 1.87667         | 10.04                  | 23.70                | 19.13 | 33.74                 | 29.17 | 56.00        | 46.00 | -22.26      | -16.83 |
| 5                            | 3.44107         | 10.08                  | 23.85                | 18.71 | 33.93                 | 28.79 | 56.00        | 46.00 | -22.07      | -17.21 |
| 6                            | 4.75908         | 10.12                  | 26.99                | 19.29 | 37.11                 | 29.41 | 56.00        | 46.00 | -18.89      | -16.59 |

#### Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



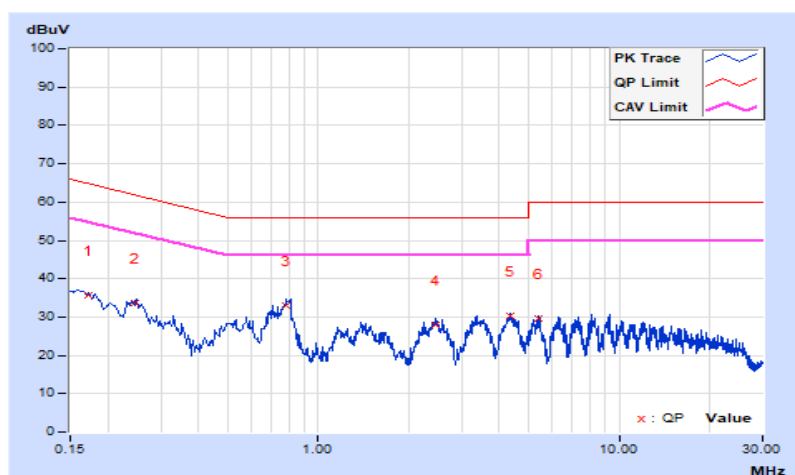
## Mode C

|                 |                  |                                          |                                       |
|-----------------|------------------|------------------------------------------|---------------------------------------|
| Frequency Range | 150 kHz ~ 30 MHz | Detector Function & Resolution Bandwidth | Quasi-Peak (QP) / Average (AV), 9 kHz |
| Input Power     | 120 Vac, 60 Hz   | Environmental Conditions                 | 25°C, 75% RH                          |
| Tested By       | Jed Wu           |                                          |                                       |

| Phase Of Power : Line (L) |                 |                        |                      |       |                       |       |              |       |             |        |
|---------------------------|-----------------|------------------------|----------------------|-------|-----------------------|-------|--------------|-------|-------------|--------|
| No                        | Frequency (MHz) | Correction Factor (dB) | Reading Value (dBuV) |       | Emission Level (dBuV) |       | Limit (dBuV) |       | Margin (dB) |        |
|                           |                 |                        | Q.P.                 | AV.   | Q.P.                  | AV.   | Q.P.         | AV.   | Q.P.        | AV.    |
| 1                         | 0.17283         | 9.99                   | 25.60                | 7.55  | 35.59                 | 17.54 | 64.82        | 54.82 | -29.23      | -37.28 |
| 2                         | 0.24777         | 9.98                   | 23.64                | 9.00  | 33.62                 | 18.98 | 61.83        | 51.83 | -28.21      | -32.85 |
| 3                         | 0.78550         | 9.97                   | 23.17                | 18.20 | 33.14                 | 28.17 | 56.00        | 46.00 | -22.86      | -17.83 |
| 4                         | 2.45159         | 10.04                  | 17.79                | 12.66 | 27.83                 | 22.70 | 56.00        | 46.00 | -28.17      | -23.30 |
| 5                         | 4.34842         | 10.08                  | 20.24                | 15.24 | 30.32                 | 25.32 | 56.00        | 46.00 | -25.68      | -20.68 |
| 6                         | 5.39892         | 10.13                  | 19.62                | 14.71 | 29.75                 | 24.84 | 60.00        | 50.00 | -30.25      | -25.16 |

### Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

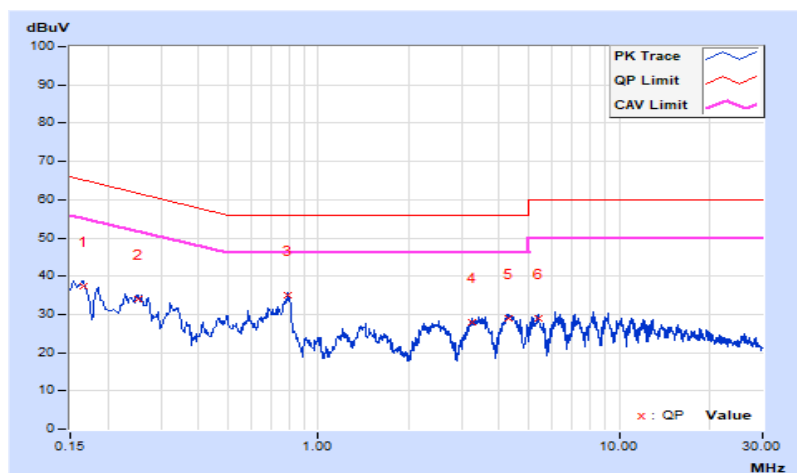


|                 |                  |                                          |                                       |
|-----------------|------------------|------------------------------------------|---------------------------------------|
| Frequency Range | 150 kHz ~ 30 MHz | Detector Function & Resolution Bandwidth | Quasi-Peak (QP) / Average (AV), 9 kHz |
| Input Power     | 120 Vac, 60 Hz   | Environmental Conditions                 | 25°C, 75% RH                          |
| Tested By       | Jed Wu           |                                          |                                       |

| Phase Of Power : Neutral (N) |                 |                        |                      |       |                       |       |              |       |             |        |
|------------------------------|-----------------|------------------------|----------------------|-------|-----------------------|-------|--------------|-------|-------------|--------|
| No                           | Frequency (MHz) | Correction Factor (dB) | Reading Value (dBuV) |       | Emission Level (dBuV) |       | Limit (dBuV) |       | Margin (dB) |        |
|                              |                 |                        | Q.P.                 | AV.   | Q.P.                  | AV.   | Q.P.         | AV.   | Q.P.        | AV.    |
| 1                            | 0.16526         | 9.96                   | 27.35                | 7.34  | 37.31                 | 17.30 | 65.20        | 55.20 | -27.89      | -37.90 |
| 2                            | 0.25125         | 9.95                   | 24.10                | 6.11  | 34.05                 | 16.06 | 61.72        | 51.72 | -27.67      | -35.66 |
| 3                            | 0.79724         | 9.96                   | 25.07                | 18.10 | 35.03                 | 28.06 | 56.00        | 46.00 | -20.97      | -17.94 |
| 4                            | 3.23379         | 10.07                  | 17.73                | 12.88 | 27.80                 | 22.95 | 56.00        | 46.00 | -28.20      | -23.05 |
| 5                            | 4.30540         | 10.10                  | 18.72                | 14.12 | 28.82                 | 24.22 | 56.00        | 46.00 | -27.18      | -21.78 |
| 6                            | 5.41457         | 10.14                  | 18.80                | 14.15 | 28.94                 | 24.29 | 60.00        | 50.00 | -31.06      | -25.71 |

#### Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



## 7.2 Radiated Emissions below 1 GHz

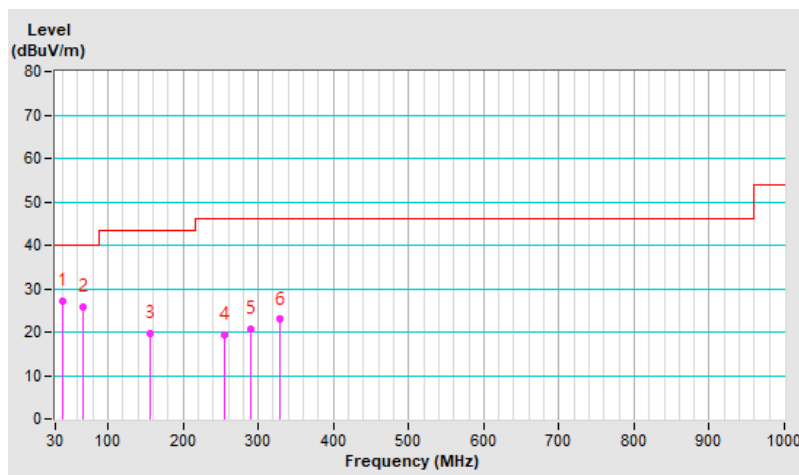
### Mode A

|                 |                |                               |                               |
|-----------------|----------------|-------------------------------|-------------------------------|
| RF Mode         | GFSK           | Channel                       | CH 37 : 2440 MHz              |
| Frequency Range | 30 MHz ~ 1 GHz | Detector Function & Bandwidth | QP: RB=120kHz, DET=Quasi-Peak |
| Input Power     | 3.7 Vdc        | Environmental Conditions      | 25°C, 75% RH                  |
| Tested By       | Jed Wu         |                               |                               |

| 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                                                    | 38.78           | 27.2 QP                 | 40.0           | -12.8       | 1.89 H             | 210                  | 37.0             | -9.8                     |
| 2                                                    | 66.47           | 25.8 QP                 | 40.0           | -14.2       | 1.42 H             | 134                  | 36.0             | -10.2                    |
| 3                                                    | 155.23          | 19.8 QP                 | 43.5           | -23.7       | 1.37 H             | 257                  | 28.1             | -8.3                     |
| 4                                                    | 255.91          | 19.4 QP                 | 46.0           | -26.6       | 1.05 H             | 360                  | 27.8             | -8.4                     |
| 5                                                    | 290.74          | 20.8 QP                 | 46.0           | -25.2       | 1.12 H             | 215                  | 27.4             | -6.6                     |
| 6                                                    | 328.03          | 22.9 QP                 | 46.0           | -23.1       | 1.73 H             | 291                  | 28.3             | -5.4                     |

#### 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 frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.

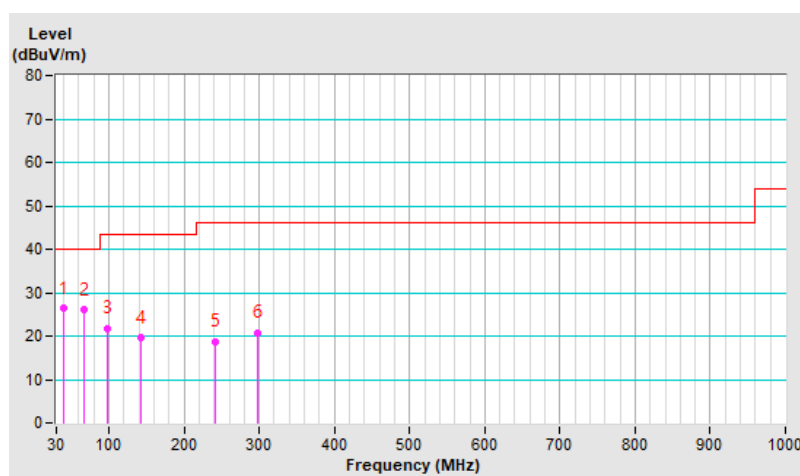


|                 |                |                               |                               |
|-----------------|----------------|-------------------------------|-------------------------------|
| RF Mode         | GFSK           | Channel                       | CH 37 : 2440 MHz              |
| Frequency Range | 30 MHz ~ 1 GHz | Detector Function & Bandwidth | QP: RB=120kHz, DET=Quasi-Peak |
| Input Power     | 3.7 Vdc        | Environmental Conditions      | 25°C, 75% RH                  |
| Tested By       | Jed Wu         |                               |                               |

| 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                                                  | 39.41           | 26.3 QP                 | 40.0           | -13.7       | 1.23 V             | 242                  | 36.1             | -9.8                     |
| 2                                                  | 66.52           | 26.0 QP                 | 40.0           | -14.0       | 1.43 V             | 176                  | 36.2             | -10.2                    |
| 3                                                  | 97.08           | 21.7 QP                 | 43.5           | -21.8       | 1.58 V             | 335                  | 35.7             | -14.0                    |
| 4                                                  | 143.15          | 19.5 QP                 | 43.5           | -24.0       | 1.27 V             | 3                    | 28.3             | -8.8                     |
| 5                                                  | 240.68          | 18.6 QP                 | 46.0           | -27.4       | 1.09 V             | 320                  | 27.6             | -9.0                     |
| 6                                                  | 297.04          | 20.7 QP                 | 46.0           | -25.3       | 1.56 V             | 149                  | 27.2             | -6.5                     |

#### 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 frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.



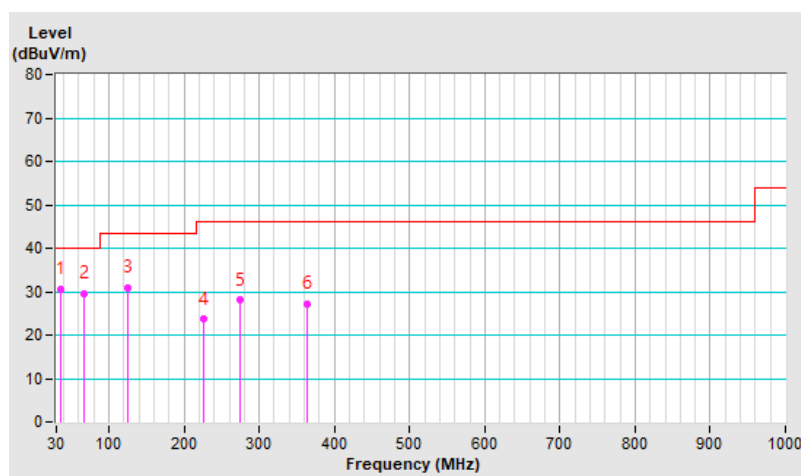
## Mode B

|                 |                |                               |                               |
|-----------------|----------------|-------------------------------|-------------------------------|
| Frequency Range | 30 MHz ~ 1 GHz | Detector Function & Bandwidth | QP: RB=120kHz, DET=Quasi-Peak |
| Input Power     | 120 Vac, 60 Hz | Environmental Conditions      | 25°C, 75% RH                  |
| Tested By       | Jed Wu         |                               |                               |

| 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                                                    | 36.26           | 30.6 QP                 | 40.0           | -9.4        | 1.93 H             | 45                   | 40.8             | -10.2                    |
| 2                                                    | 66.42           | 29.5 QP                 | 40.0           | -10.5       | 1.71 H             | 322                  | 39.7             | -10.2                    |
| 3                                                    | 125.88          | 30.8 QP                 | 43.5           | -12.7       | 1.46 H             | 266                  | 41.0             | -10.2                    |
| 4                                                    | 224.97          | 23.6 QP                 | 46.0           | -22.4       | 1.65 H             | 176                  | 34.4             | -10.8                    |
| 5                                                    | 275.02          | 28.0 QP                 | 46.0           | -18.0       | 1.24 H             | 151                  | 35.1             | -7.1                     |
| 6                                                    | 364.60          | 27.1 QP                 | 46.0           | -18.9       | 1.53 H             | 226                  | 32.1             | -5.0                     |

### 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 frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.

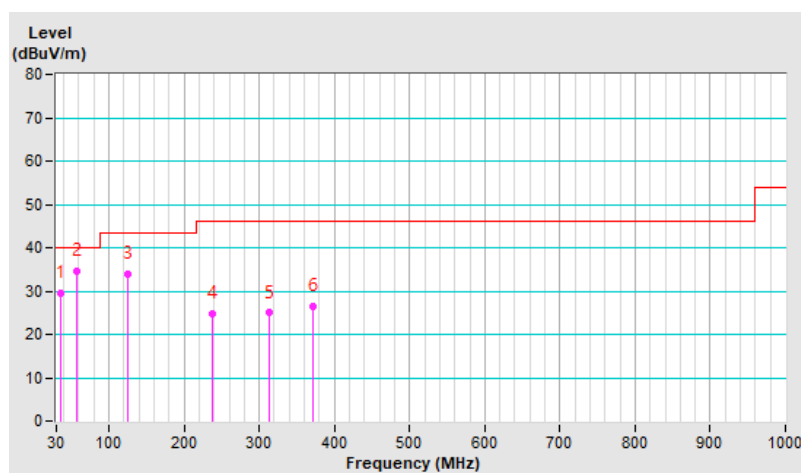


|                 |                |                               |                               |
|-----------------|----------------|-------------------------------|-------------------------------|
| Frequency Range | 30 MHz ~ 1 GHz | Detector Function & Bandwidth | QP: RB=120kHz, DET=Quasi-Peak |
| Input Power     | 120 Vac, 60 Hz | Environmental Conditions      | 25°C, 75% RH                  |
| Tested By       | Jed Wu         |                               |                               |

| 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                                                  | 36.30           | 29.5 QP                 | 40.0           | -10.5       | 1.24 V             | 258                  | 39.7             | -10.2                    |
| 2                                                  | 56.77           | 34.5 QP                 | 40.0           | -5.5        | 1.11 V             | 226                  | 43.8             | -9.3                     |
| 3                                                  | 125.84          | 33.9 QP                 | 43.5           | -9.6        | 1.36 V             | 192                  | 44.1             | -10.2                    |
| 4                                                  | 237.14          | 24.8 QP                 | 46.0           | -21.2       | 1.48 V             | 355                  | 34.3             | -9.5                     |
| 5                                                  | 314.16          | 25.0 QP                 | 46.0           | -21.0       | 1.76 V             | 204                  | 30.8             | -5.8                     |
| 6                                                  | 371.00          | 26.5 QP                 | 46.0           | -19.5       | 1.51 V             | 187                  | 31.4             | -4.9                     |

#### 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 of frequency range 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.



### 7.3 Radiated Emissions above 1 GHz

#### Mode A

|                 |                |                               |                                                                     |
|-----------------|----------------|-------------------------------|---------------------------------------------------------------------|
| RF Mode         | GFSK           | Channel                       | CH 0 : 2403 MHz                                                     |
| Frequency Range | 1 GHz ~ 25 GHz | Detector Function & Bandwidth | PK: RB=1 MHz, VB=3 MHz, DET=Peak<br>AV: RB=1 MHz, VB=3 MHz, DET=RMS |
| Input Power     | 3.7 Vdc        | Environmental Conditions      | 25°C, 75% RH                                                        |
| Tested By       | Ian Chang      |                               |                                                                     |

| 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         | 53.3 PK                 | 74.0           | -20.7       | 1.52 H             | 39                   | 54.5             | -1.2                     |
| 2                                                    | 2390.00         | 40.8 AV                 | 54.0           | -13.2       | 1.52 H             | 39                   | 42.0             | -1.2                     |
| 3                                                    | 2400.00         | 45.5 PK                 | 74.0           | -28.5       | 1.52 H             | 39                   | 46.8             | -1.3                     |
| 4                                                    | 2400.00         | 31.5 AV                 | 54.0           | -22.5       | 1.52 H             | 39                   | 32.8             | -1.3                     |
| 5                                                    | *2403.00        | 95.3 PK                 | 114.0          | -18.7       | 1.52 H             | 39                   | 96.6             | -1.3                     |
| 6                                                    | *2403.00        | 81.3 AV                 | 94.0           | -12.7       | 1.52 H             | 39                   | 82.6             | -1.3                     |
| 7                                                    | 4806.00         | 48.4 PK                 | 74.0           | -25.6       | 1.63 H             | 258                  | 40.3             | 8.1                      |
| 8                                                    | 4806.00         | 34.4 AV                 | 54.0           | -19.6       | 1.63 H             | 258                  | 26.3             | 8.1                      |
| 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         | 52.1 PK                 | 74.0           | -21.9       | 3.98 V             | 117                  | 53.3             | -1.2                     |
| 2                                                    | 2390.00         | 39.8 AV                 | 54.0           | -14.2       | 3.98 V             | 117                  | 41.0             | -1.2                     |
| 3                                                    | 2400.00         | 45.1 PK                 | 74.0           | -28.9       | 3.98 V             | 117                  | 46.4             | -1.3                     |
| 4                                                    | 2400.00         | 31.1 AV                 | 54.0           | -22.9       | 3.98 V             | 117                  | 32.4             | -1.3                     |
| 5                                                    | *2403.00        | 94.9 PK                 | 114.0          | -19.1       | 3.98 V             | 117                  | 96.2             | -1.3                     |
| 6                                                    | *2403.00        | 80.9 AV                 | 94.0           | -13.1       | 3.98 V             | 117                  | 82.2             | -1.3                     |
| 7                                                    | 4806.00         | 47.5 PK                 | 74.0           | -26.5       | 1.85 V             | 247                  | 39.4             | 8.1                      |
| 8                                                    | 4806.00         | 33.5 AV                 | 54.0           | -20.5       | 1.85 V             | 247                  | 25.4             | 8.1                      |

#### 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:  

$$20 \log(\text{Duty cycle}) = 20 \log(0.122 \text{ ms} / 0.61 \text{ ms}) = -14.0 \text{ dB}$$

|                        |                |                                          |                                                                     |
|------------------------|----------------|------------------------------------------|---------------------------------------------------------------------|
| <b>RF Mode</b>         | GFSK           | <b>Channel</b>                           | CH 37 : 2440 MHz                                                    |
| <b>Frequency Range</b> | 1 GHz ~ 25 GHz | <b>Detector Function &amp; Bandwidth</b> | PK: RB=1 MHz, VB=3 MHz, DET=Peak<br>AV: RB=1 MHz, VB=3 MHz, DET=RMS |
| <b>Input Power</b>     | 3.7 Vdc        | <b>Environmental Conditions</b>          | 25°C, 75% RH                                                        |
| <b>Tested By</b>       | Ian Chang      |                                          |                                                                     |

| 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        | 95.7 PK                 | 114.0          | -18.3       | 1.50 H             | 41                   | 96.7             | -1.0                     |
| 2                                                    | *2440.00        | 81.7 AV                 | 94.0           | -12.3       | 1.50 H             | 41                   | 82.7             | -1.0                     |
| 3                                                    | 4880.00         | 48.5 PK                 | 74.0           | -25.5       | 1.58 H             | 124                  | 40.5             | 8.0                      |
| 4                                                    | 4880.00         | 34.5 AV                 | 54.0           | -19.5       | 1.58 H             | 124                  | 26.5             | 8.0                      |
| 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        | 95.1 PK                 | 114.0          | -18.9       | 3.89 V             | 115                  | 96.1             | -1.0                     |
| 2                                                    | *2440.00        | 81.1 AV                 | 94.0           | -12.9       | 3.89 V             | 115                  | 82.1             | -1.0                     |
| 3                                                    | 4880.00         | 47.6 PK                 | 74.0           | -26.4       | 2.31 V             | 125                  | 39.6             | 8.0                      |
| 4                                                    | 4880.00         | 33.6 AV                 | 54.0           | -20.4       | 2.31 V             | 125                  | 25.6             | 8.0                      |

**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:  

$$20 \log(\text{Duty cycle}) = 20 \log(0.122 \text{ ms} / 0.61 \text{ ms}) = -14.0 \text{ dB}$$

|                 |                |                               |                                                                     |
|-----------------|----------------|-------------------------------|---------------------------------------------------------------------|
| RF Mode         | GFSK           | Channel                       | CH 77 : 2480 MHz                                                    |
| Frequency Range | 1 GHz ~ 25 GHz | Detector Function & Bandwidth | PK: RB=1 MHz, VB=3 MHz, DET=Peak<br>AV: RB=1 MHz, VB=3 MHz, DET=RMS |
| Input Power     | 3.7 Vdc        | Environmental Conditions      | 25°C, 75% RH                                                        |
| Tested By       | Ian Chang      |                               |                                                                     |

| 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        | 94.5 PK                 | 114.0          | -19.5       | 1.30 H             | 40                   | 95.5             | -1.0                     |
| 2                                                    | *2480.00        | 80.5 AV                 | 94.0           | -13.5       | 1.30 H             | 40                   | 81.5             | -1.0                     |
| 3                                                    | 2483.50         | 41.3 PK                 | 74.0           | -32.7       | 1.30 H             | 40                   | 42.2             | -0.9                     |
| 4                                                    | 2483.50         | 27.3 AV                 | 54.0           | -26.7       | 1.30 H             | 40                   | 28.2             | -0.9                     |
| 5                                                    | 4960.00         | 48.2 PK                 | 74.0           | -25.8       | 1.39 H             | 63                   | 40.2             | 8.0                      |
| 6                                                    | 4960.00         | 34.2 AV                 | 54.0           | -19.8       | 1.39 H             | 63                   | 26.2             | 8.0                      |
| 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        | 93.9 PK                 | 114.0          | -20.1       | 3.94 V             | 112                  | 94.9             | -1.0                     |
| 2                                                    | *2480.00        | 79.9 AV                 | 94.0           | -14.1       | 3.94 V             | 112                  | 80.9             | -1.0                     |
| 3                                                    | 2483.50         | 40.7 PK                 | 74.0           | -33.3       | 3.94 V             | 112                  | 41.6             | -0.9                     |
| 4                                                    | 2483.50         | 26.7 AV                 | 54.0           | -27.3       | 3.94 V             | 112                  | 27.6             | -0.9                     |
| 5                                                    | 4960.00         | 47.6 PK                 | 74.0           | -26.4       | 1.85 V             | 228                  | 39.6             | 8.0                      |
| 6                                                    | 4960.00         | 33.6 AV                 | 54.0           | -20.4       | 1.85 V             | 228                  | 25.6             | 8.0                      |

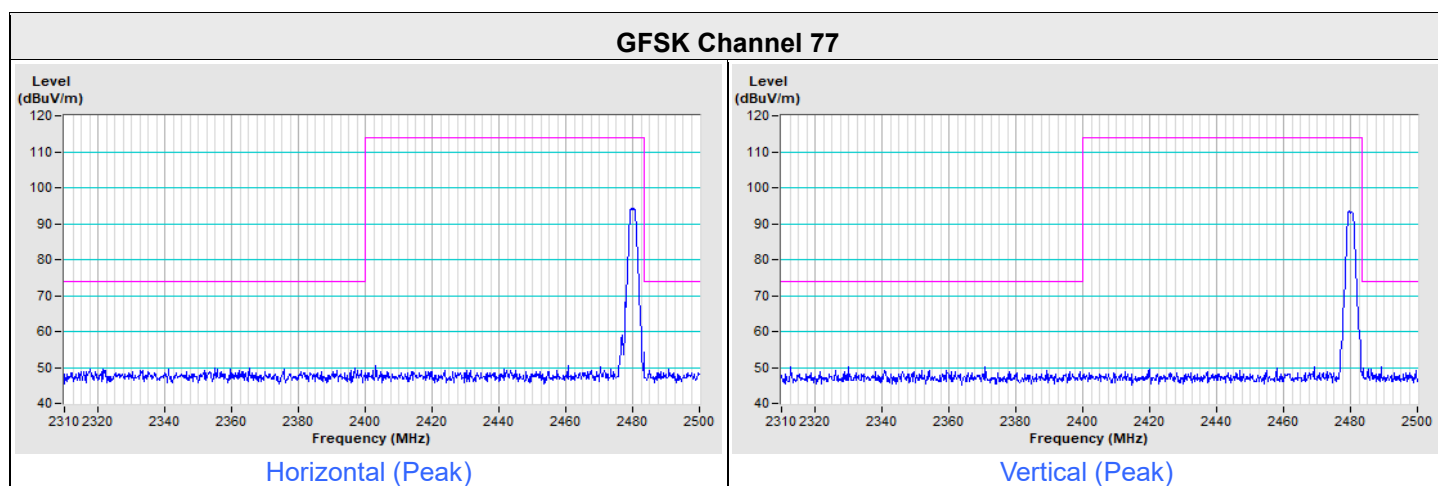
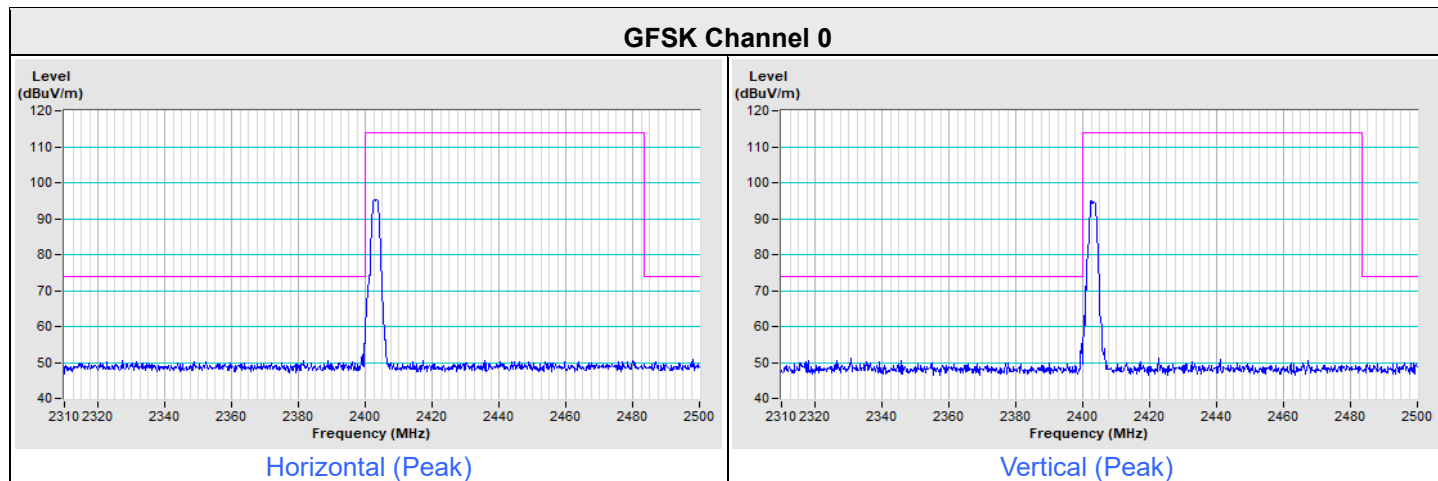
**Remarks:**

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:  
 $20 \log(\text{Duty cycle}) = 20 \log(0.122 \text{ ms} / 0.61 \text{ ms}) = -14.0 \text{ dB}$

## Mode A

### Plot of Band Edge

|                 |                    |                               |                                  |
|-----------------|--------------------|-------------------------------|----------------------------------|
| Frequency Range | 2.31 GHz ~ 2.5 GHz | Detector Function & Bandwidth | PK: RB=1 MHz, VB=3 MHz, DET=Peak |
|-----------------|--------------------|-------------------------------|----------------------------------|



## 7.4 20 dB Bandwidth

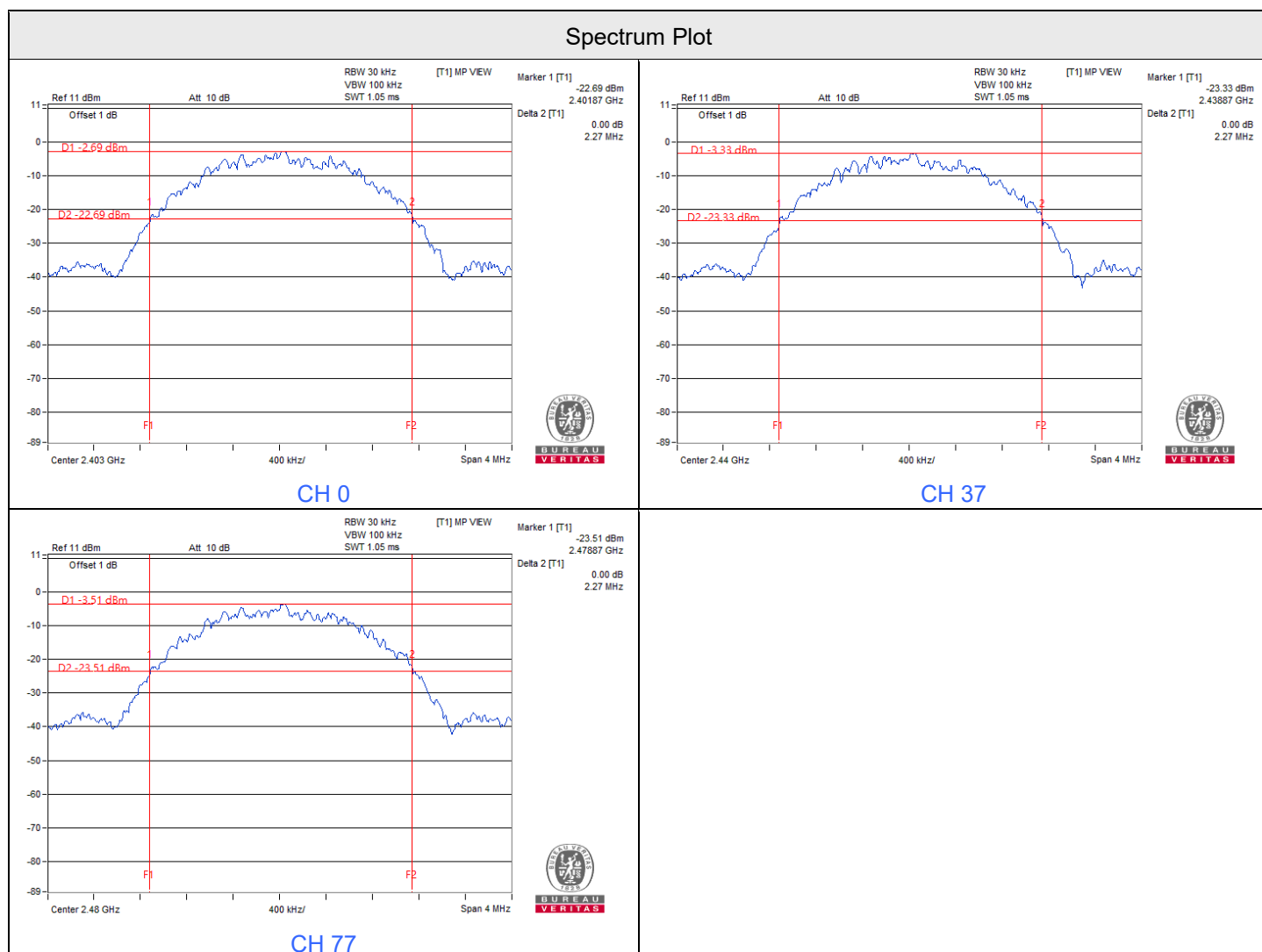
### Mode A

|              |         |                           |              |            |           |
|--------------|---------|---------------------------|--------------|------------|-----------|
| Input Power: | 3.7 Vdc | Environmental Conditions: | 25°C, 76% RH | Tested By: | Dalen Dai |
|--------------|---------|---------------------------|--------------|------------|-----------|

| Channel | Channel Frequency (MHz) | 20 dB Bandwidth (MHz) | Measured Frequencies |          | Operating Frequency Band (MHz) | Test Result |
|---------|-------------------------|-----------------------|----------------------|----------|--------------------------------|-------------|
|         |                         |                       | FL (MHz)             | FH (MHz) |                                |             |
| 0       | 2403                    | 2.27                  | 2401.87              | 2404.14  | 2400 ~ 2483.5                  | Pass        |
| 37      | 2440                    | 2.27                  | 2438.87              | 2441.14  |                                | Pass        |
| 77      | 2480                    | 2.27                  | 2478.87              | 2481.14  |                                | Pass        |

#### Notes:

1. FL is the lowest frequency of the 20 dB bandwidth of power envelope.
2. FH is the highest frequency of the 20 dB bandwidth of power envelope.



## 8 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo)

## 9 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.

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

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