# FCC Test Report

| | |
|---|---|
| **Report No.:** | RFBDKX-WTW-P20070472 |
| **FCC ID:** | EMJDHSAP011D |
| **Test Model:** | HSA-P011D |
| **Received Date:** | Jul. 23, 2020 |
| **Test Date:** | Jul. 23 to Aug. 12, 2020 |
| **Issued Date:** | Aug. 13, 2020 |
| **Applicant:** | PRIMAX ELECTRONICS LTD. |
| **Address:** | No. 669, Ruey Kuang Road, Neihu, Taipei, 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 |
|---|---|---|
| RFBDKX-WTW-P20070472 | Original release. | Aug. 13, 2020 |

## 1 Certificate of Conformity

| | |
|---|---|
| **Product:** | Dongle |
| **Brand:** | hp |
| **Test Model:** | HSA-P011D |
| **Sample Status:** | Engineering sample |
| **Applicant:** | PRIMAX ELECTRONICS LTD. |
| **Test Date:** | Jul. 23 to Aug. 12, 2020 |
| **Standards:** | 47 CFR FCC Part 15, Subpart C (Section 15.249)<br>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:** Aug. 13, 2020

Jessica Cheng / Senior Specialist

**Approved by :** Rex. Lai , **Date:** Aug. 13, 2020

Rex Lai / Associate Technical Manager

## 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 | PASS | Meet the requirement of limit. Minimum passing margin is -11.72dB at 0.15000MHz. |
| 15.215 | Channel Bandwidth Measurement | - | |
| 15.209<br>15.249<br>15.249 (d) | Radiated Emission Test<br>Band Edge Measurement<br>Limit: 50dB less than the peak value of fundamental frequency or meet radiated emission limit in section 15.209 | PASS | Meet the requirement of limit. Minimum passing margin is -9.47dB at 85.78MHz. |
| 15.203 | Antenna Requirement | PASS | No antenna connector is used. |

Note:
1. For 2.4GHz band compliance with rule 15.249(d) of the band-edge items, the test plots were recorded in Annex A.
2. 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 | Frequency | Expanded Uncertainty (k=2) (±) |
|---|---|---|
| Conducted Emissions at mains ports | 150kHz ~ 30MHz | 3.00 dB |
| Conducted Emissions | 9kHz ~ 40GHz | 2.63 dB |
| Radiated Emissions up to 1 GHz | 9kHz ~ 30MHz | 2.61 dB |
| | 30MHz ~ 1000MHz | 5.43 dB |
| Radiated Emissions above 1 GHz | Above 1GHz | 5.42 dB |

### 2.2 Modification Record

There were no modifications required for compliance.

## 3 General Information

### 3.1 General Description of EUT

| | |
|---|---|
| Product | Dongle |
| Brand | hp |
| Test Model | HSA-P011D |
| Status of EUT | Engineering sample |
| Power Supply Rating | 5Vdc from host equipment |
| Modulation Type | GFSK |
| Operating Frequency | 2405MHz ~ 2474MHz |
| Number of Channel | 12 |
| Antenna Type | Printed antenna with -3.44dBi gain |
| Antenna Connector | N/A |
| Accessory Device | N/A |
| Data Cable Supplied | N/A |

Note: 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 Description of Test Modes

12 channels are provided to this EUT:

| CHANNEL | FREQ. (MHz) | CHANNEL | FREQ. (MHz) | CHANNEL | FREQ. (MHz) | CHANNEL | FREQ. (MHz) |
|---|---|---|---|---|---|---|---|
| 1 | 2405 | 4 | 2426 | 7 | 2442 | 10 | 2469 |
| 2 | 2407 | 5 | 2430 | 8 | 2447 | 11 | 2471 |
| 3 | 2418 | 6 | 2437 | 9 | 2458 | 12 | 2474 |

### 3.2.1 Test Mode Applicability and Tested Channel Detail

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

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 :** The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

**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 |
|---|---|---|---|
| - | 1 to 12 | 1, 7, 12 | 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 |
|---|---|---|---|
| - | 1 to 12 | 1 | GFSK |

**Power Line Conducted Emission Test:**

☒ 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 |
|---|---|---|---|
| - | 1 to 12 | 1 | 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 |
|---|---|---|---|
| - | 1 to 12 | 1, 7, 12 | GFSK |

**Test Condition:**

| Applicable To | Environmental Conditions | Input Power | Tested By |
|---|---|---|---|
| **RE≥1G** | 24deg. C, 61%RH | 120Vac, 60Hz (System) | Dalen Dai |
| **RE<1G** | 24deg. C, 61%RH | 120Vac, 60Hz (System) | Dalen Dai |
| **PLC** | 25deg. C, 75%RH | 120Vac, 60Hz (System) | Ian Chang |
| **APCM** | 25deg. C, 76%RH | 120Vac, 60Hz (System) | Pirar Hsieh |

## 3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

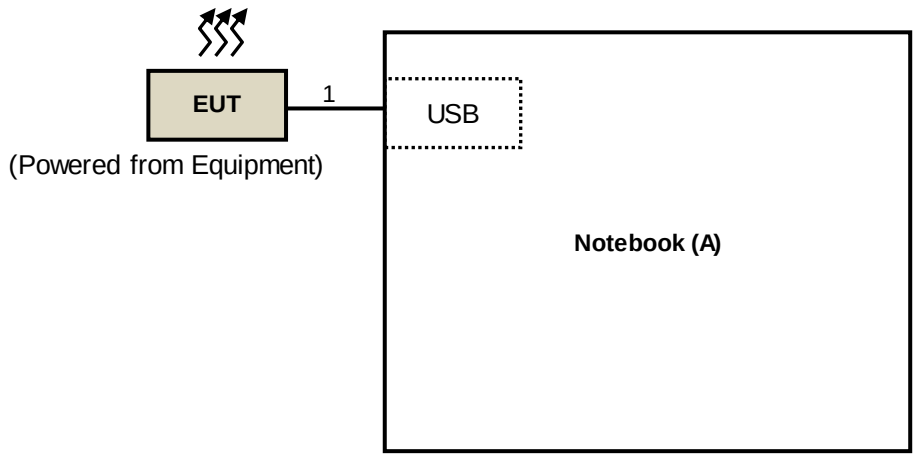
| ID | Product | Brand | Model No. | Serial No. | FCC ID | Remarks |
|---|---|---|---|---|---|---|
| A. | Notebook PC | Lenovo | 80WG | YD01YRC9 | N/A | Provided by Lab |

Note: All power cords of the above support units are non-shielded (1.8m).

| No. | Cable Descriptions | Qty. | Length (m) | Shielding (Yes/ No) | Cores (Qty.) | Remarks |
|---|---|---|---|---|---|---|
| 1. | USB Type A to A cable | 1 | 1.0 | Y | 0 | Provided by Lab |

**NOTE:** The core(s) is(are) originally attached to the cable(s)

### 3.3.1 Configuration of System under Test



## 3.4 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

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| HP Preamplifier | 8447D | 2432A03504 | Feb. 19, 2020 | Feb. 18, 2021 |
| HP Preamplifier | 8449B | 3008A01201 | Feb. 20, 2020 | Feb. 19, 2021 |
| MITEQ Preamplifier | AMF-6F-260400-33-8P | 892164 | Feb. 19, 2020 | Feb. 18, 2021 |
| Agilent TEST RECEIVER | N9038A | MY51210129 | Mar. 18, 2020 | Mar. 17, 2021 |
| Schwarzbeck Antenna | VULB 9168 | 139 | Nov. 7, 2019 | Nov. 6, 2020 |
| Schwarzbeck Antenna | VHBA 9123 | 480 | Jun. 3, 2019 | Jun. 2, 2021 |
| Schwarzbeck Horn Antenna | BBHA-9170 | 212 | Nov. 24, 2019 | Nov. 23, 2020 |
| Schwarzbeck Horn Antenna | BBHA 9120-D1 | D130 | Nov. 24, 2019 | Nov. 23, 2020 |
| ADT. Turn Table | TT100 | 0306 | NA | NA |
| ADT. Tower | AT100 | 0306 | NA | NA |
| Software | Radiated_V7.6.15.9.5 | NA | NA | NA |
| SUHNER RF cable With 4dB PAD | SF102 | Cable-CH6-01 | Jul. 9, 2020 | Jul. 8, 2021 |
| SUHNER RF cable With 3/4dB PAD | SF102 | Cable-CH8-3.6m | Jul. 9, 2020 | Jul. 8, 2021 |
| KEYSIGHT MIMO Powermeasurement Test set | U2021XA | U2021XA-001 | Jun. 16, 2020 | Jun. 15, 2021 |
| KEYSIGHT Spectrum Analyzer | N9030A | MY54490260 | Jul. 22, 2020 | Jul. 21, 2021 |
| Loop Antenna EMCI | LPA600 | 270 | Aug. 23, 2019 | Aug. 22, 2021 |
| EMCO Horn Antenna | 3115 | 00028257 | Nov. 24, 2019 | Nov. 23, 2020 |
| Highpass filter Wainwright Instruments | WHK 3.1/18G-10SS | SN 8 | NA | NA |
| ROHDE & SCHWARZ Spectrum Analyzer | FSV40 | 101042 | Sep. 23, 2019 | Sep. 22, 2020 |

**NOTE:** 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 horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in Chamber No. 6.

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:**

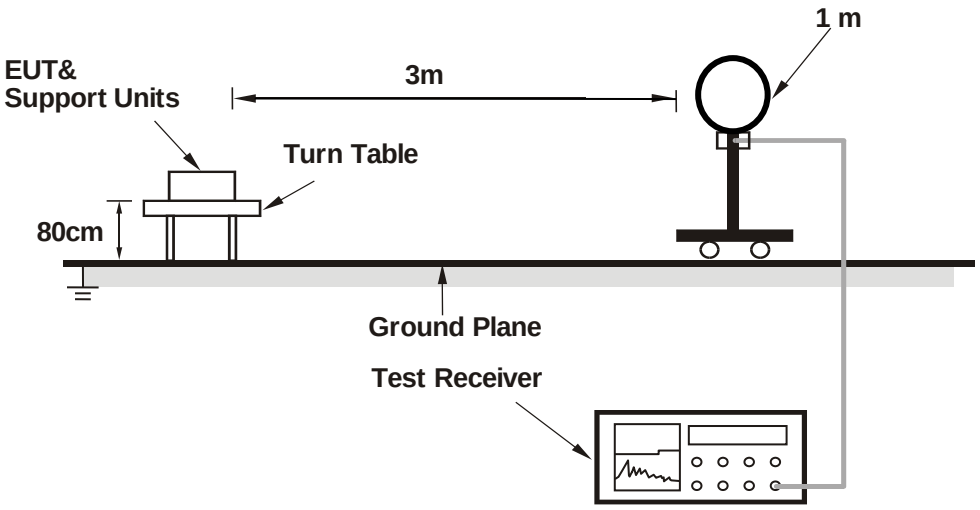
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

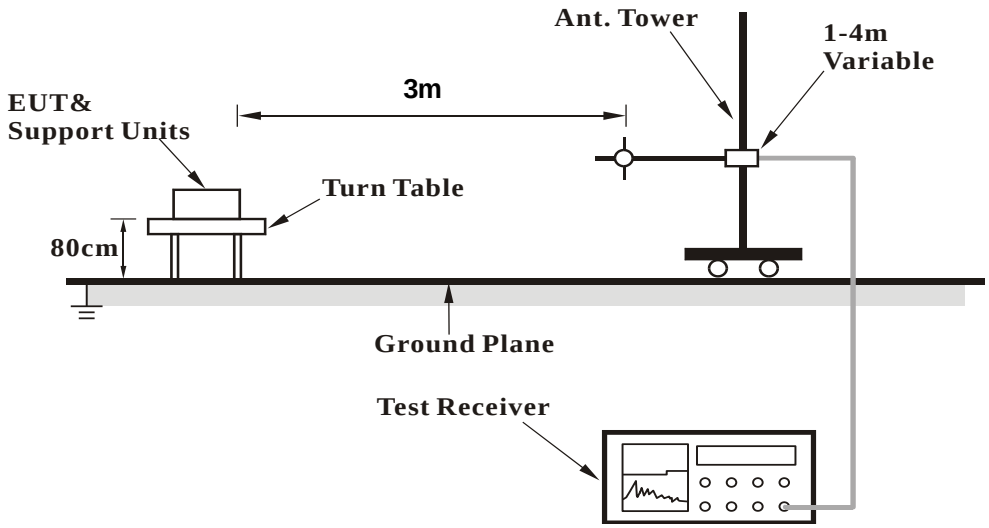
No deviation.

4.1.5 Test Setup

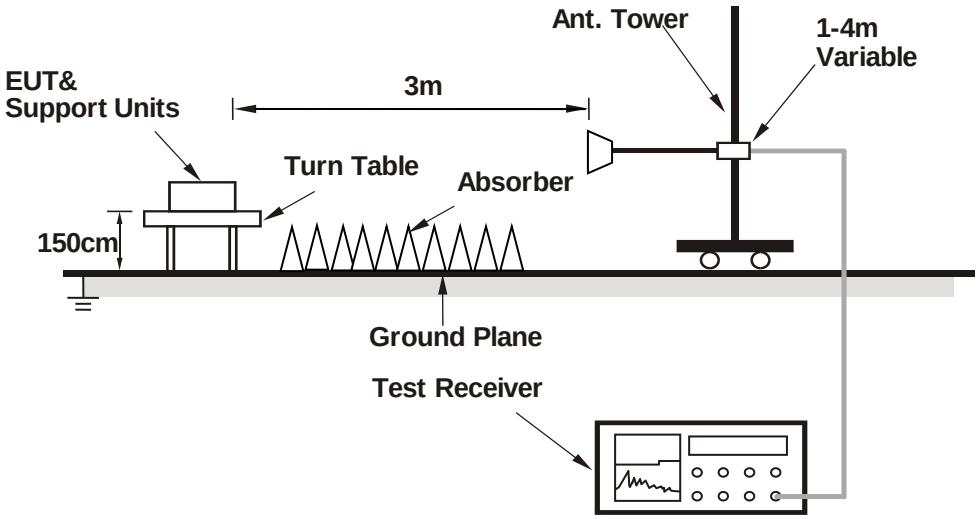
**For Radiated emission below 30MHz**




**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

a. Connected the EUT to Notebook.
b. Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

**ABOVE 1GHz DATA**

| | | | |
|---|---|---|---|
| **Channel** | TX Channel 1 | **Detector Function** | Peak (PK)<br>Average (AV) |
| **Frequency Range** | 1GHz ~ 25GHz | | |

| 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 | 46.78 PK | 74.00 | -27.22 | 1.03 H | 274 | 46.39 | 0.39 |
| 2 | 2390.00 | 33.19 AV | 54.00 | -20.81 | 1.03 H | 274 | 32.80 | 0.39 |
| 3 | 2400.00 | 64.12 PK | 74.00 | -9.88 | 1.03 H | 274 | 63.68 | 0.44 |
| 4 | 2400.00 | 33.97 AV | 54.00 | -20.03 | 1.03 H | 274 | 33.53 | 0.44 |
| 5 | *2405.00 | 89.32 PK | 114.00 | -24.68 | 1.03 H | 274 | 88.88 | 0.44 |
| 6 | *2405.00 | 82.72 AV | 94.00 | -11.28 | 1.03 H | 274 | 82.28 | 0.44 |
| 7 | 4810.00 | 49.24 PK | 74.00 | -24.76 | 1.16 H | 137 | 41.43 | 7.81 |
| 8 | 4810.00 | 42.64 AV | 54.00 | -11.36 | 1.16 H | 137 | 34.83 | 7.81 |
| **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 | 46.36 PK | 74.00 | -27.64 | 1.00 V | 291 | 45.97 | 0.39 |
| 2 | 2390.00 | 32.27 AV | 54.00 | -21.73 | 1.00 V | 291 | 31.88 | 0.39 |
| 3 | 2400.00 | 63.74 PK | 74.00 | -10.26 | 1.00 V | 291 | 63.30 | 0.44 |
| 4 | 2400.00 | 32.86 AV | 54.00 | -21.14 | 1.00 V | 291 | 32.42 | 0.44 |
| 5 | *2405.00 | 88.55 PK | 114.00 | -25.45 | 1.00 V | 291 | 88.11 | 0.44 |
| 6 | *2405.00 | 81.95 AV | 94.00 | -12.05 | 1.00 V | 291 | 81.51 | 0.44 |
| 7 | 4810.00 | 49.05 PK | 74.00 | -24.95 | 1.42 V | 163 | 41.24 | 7.81 |
| 8 | 4810.00 | 42.45 AV | 54.00 | -11.55 | 1.42 V | 163 | 34.64 | 7.81 |

**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 factor is calculated from following formula:
   20 log(Duty cycle) = 20 log(0.51 ms / 1.085 ms) = -6.6 dB
   Please see page 19 for plotted duty.

| Channel | TX Channel 7 | Detector Function | Peak (PK)<br>Average (AV) |
|---|---|---|---|
| Frequency Range | 1GHz ~ 25GHz | | |

| 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 | *2442.00 | 88.84 PK | 114.00 | -25.16 | 1.06 H | 277 | 88.34 | 0.50 |
| 2 | *2442.00 | 82.24 AV | 94.00 | -11.76 | 1.06 H | 277 | 81.74 | 0.50 |
| 3 | 4884.00 | 49.03 PK | 74.00 | -24.97 | 1.20 H | 132 | 41.30 | 7.73 |
| 4 | 4884.00 | 42.43 AV | 54.00 | -11.57 | 1.20 H | 132 | 34.70 | 7.73 |
| **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 | *2442.00 | 88.13 PK | 114.00 | -25.87 | 1.01 V | 288 | 87.63 | 0.50 |
| 2 | *2442.00 | 81.53 AV | 94.00 | -12.47 | 1.01 V | 288 | 81.03 | 0.50 |
| 3 | 4884.00 | 48.86 PK | 74.00 | -25.14 | 1.39 V | 157 | 41.13 | 7.73 |
| 4 | 4884.00 | 42.26 AV | 54.00 | -11.74 | 1.39 V | 157 | 34.53 | 7.73 |

**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 factor is calculated from following formula:
   20 log(Duty cycle) = 20 log(0.51 ms / 1.085 ms) = -6.6 dB
   Please see page 19 for plotted duty.

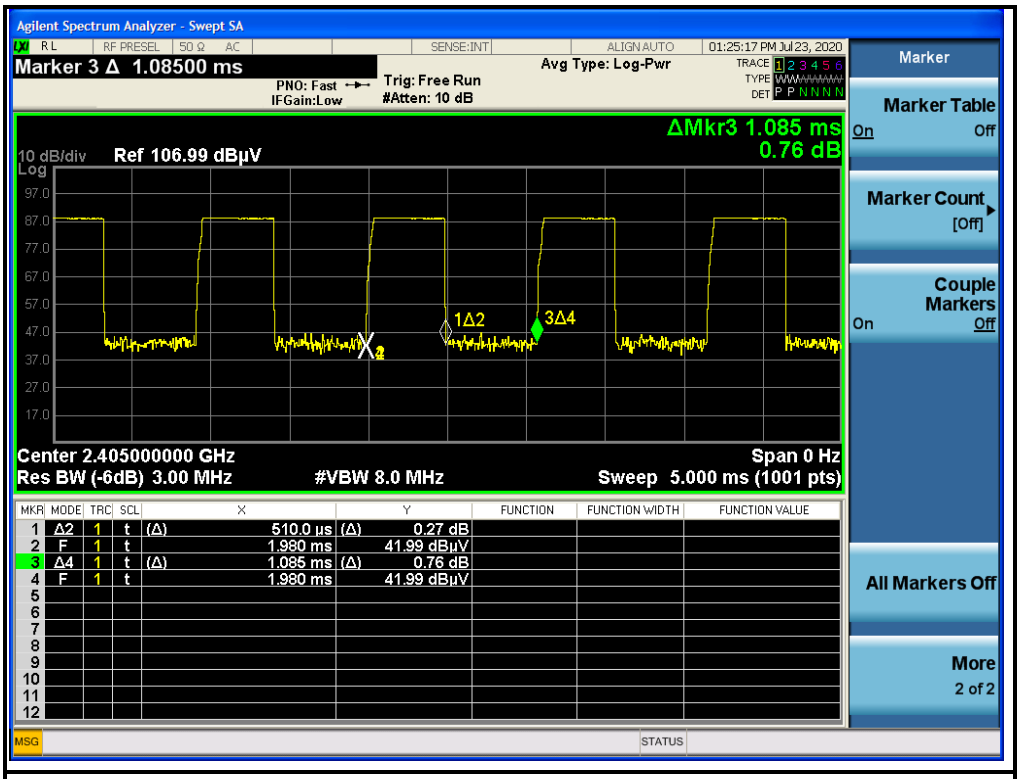
| Channel | TX Channel 12 | Detector Function | Peak (PK)<br>Average (AV) |
|---|---|---|---|
| Frequency Range | 1GHz ~ 25GHz | | |

| 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 | *2474.00 | 87.82 PK | 114.00 | -26.18 | 1.02 H | 275 | 87.18 | 0.64 |
| 2 | *2474.00 | 81.22 AV | 94.00 | -12.78 | 1.02 H | 275 | 80.58 | 0.64 |
| 3 | 2483.50 | 59.54 PK | 74.00 | -14.46 | 1.02 H | 275 | 58.85 | 0.69 |
| 4 | 2483.50 | 33.73 AV | 54.00 | -20.27 | 1.02 H | 275 | 33.04 | 0.69 |
| 5 | 4948.00 | 48.96 PK | 74.00 | -25.04 | 1.18 H | 135 | 41.23 | 7.73 |
| 6 | 4948.00 | 42.36 AV | 54.00 | -11.64 | 1.18 H | 135 | 34.63 | 7.73 |
| **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 | *2474.00 | 86.93 PK | 114.00 | -27.07 | 1.41 V | 290 | 86.29 | 0.64 |
| 2 | *2474.00 | 80.33 AV | 94.00 | -13.67 | 1.41 V | 290 | 79.69 | 0.64 |
| 3 | 2483.50 | 59.11 PK | 74.00 | -14.89 | 1.41 V | 290 | 58.42 | 0.69 |
| 4 | 2483.50 | 33.45 AV | 54.00 | -20.55 | 1.41 V | 290 | 32.76 | 0.69 |
| 5 | 4948.00 | 48.80 PK | 74.00 | -25.20 | 1.40 V | 166 | 41.07 | 7.73 |
| 6 | 4948.00 | 42.20 AV | 54.00 | -11.80 | 1.40 V | 166 | 34.47 | 7.73 |

**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 factor is calculated from following formula:
   20 log(Duty cycle) = 20 log(0.51 ms / 1.085 ms) = -6.6 dB
   Please see page 19 for plotted duty.

## Duty Cycle




20 log(Duty cycle) = 20 log(0.51 ms / 1.085 ms) = -6.6 dB

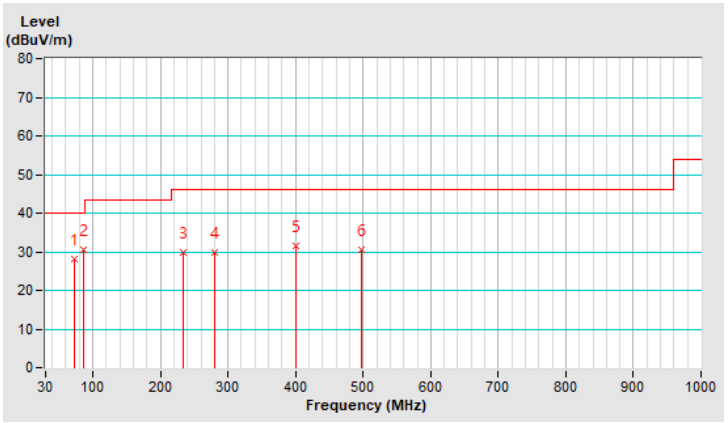
## BELOW 1GHz WORST-CASE DATA

| CHANNEL | TX Channel 1 | DETECTOR FUNCTION | Quasi-Peak (QP) |
|---|---|---|---|
| FREQUENCY RANGE | 9kHz ~ 1GHz | | |

| 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 | 72.00 | 28.29 QP | 40.00 | -11.71 | 1.44 H | 360 | 37.74 | -9.45 |
| **2** | **85.78** | **30.53 QP** | **40.00** | **-9.47** | **1.07 H** | **186** | **42.95** | **-12.42** |
| 3 | 233.85 | 29.91 QP | 46.00 | -16.09 | 1.59 H | 241 | 37.73 | -7.82 |
| 4 | 279.92 | 29.82 QP | 46.00 | -16.18 | 1.68 H | 196 | 34.67 | -4.85 |
| 5 | 400.01 | 31.63 QP | 46.00 | -14.37 | 2.17 H | 106 | 33.86 | -2.23 |
| 6 | 498.07 | 30.48 QP | 46.00 | -15.52 | 1.85 H | 238 | 30.51 | -0.03 |

**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 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

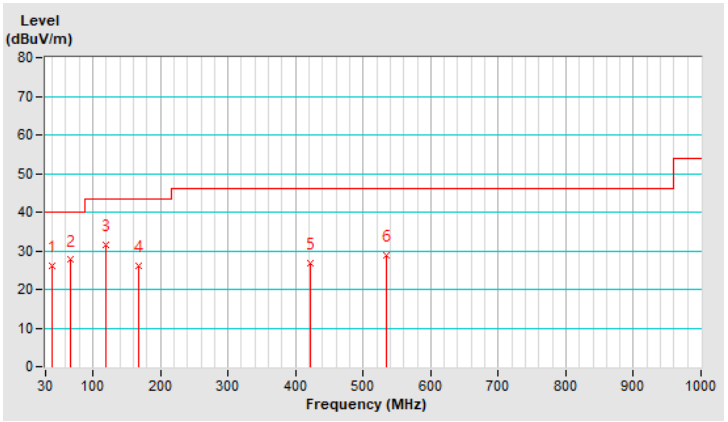


| CHANNEL | TX Channel 1 | DETECTOR FUNCTION | Quasi-Peak (QP) |
|---|---|---|---|
| FREQUENCY RANGE | 9kHz ~ 1GHz | | |

| 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 | 39.36 | 26.02 QP | 40.00 | -13.98 | 1.23 V | 259 | 33.83 | -7.81 |
| 2 | 66.62 | 27.66 QP | 40.00 | -12.34 | 1.56 V | 128 | 35.95 | -8.29 |
| 3 | 120.02 | 31.56 QP | 43.50 | -11.94 | 1.91 V | 360 | 40.53 | -8.97 |
| 4 | 168.03 | 26.07 QP | 43.50 | -17.43 | 1.62 V | 81 | 32.50 | -6.43 |
| 5 | 421.25 | 26.83 QP | 46.00 | -19.17 | 2.10 V | 20 | 28.40 | -1.57 |
| 6 | 534.88 | 28.73 QP | 46.00 | -17.27 | 1.87 V | 329 | 28.22 | 0.51 |

**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 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



## 4.2 Conducted Emission Measurement

### 4.2.1 Limits of Conducted Emission Measurement

| 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 |

Note: 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 0.50MHz.

### 4.2.2 Test Instruments

| Description & Manufacturer | Model No. | Serial No. | Cal. Date | Cal. Due |
|---|---|---|---|---|
| ROHDE & SCHWARZ TEST RECEIVER | ESCS30 | 100276 | Apr. 16, 2020 | Apr. 15, 2021 |
| SCHWARZBECK Artificial Mains Network (for EUT) | NSLK 8128 | 8128-244 | Nov. 11, 2019 | Nov. 10, 2020 |
| LISN With Adapter (for EUT) | AD10 | C05Ada-001 | Nov. 11, 2019 | Nov. 10, 2020 |
| ROHDE & SCHWARZ Artificial Mains Network (for peripheral) | ESH3-Z5 | 100220 | Nov. 18, 2019 | Nov. 17, 2020 |
| Software | Cond_V7.3.7.4 | NA | NA | NA |
| RF cable (JYEBAO) With 10dB PAD | 5D-FB | Cable-C05.01 | Jan. 30, 2020 | Jan. 29, 2021 |
| LYNICS Terminator (For R&S LISN) | 0900510 | E1-01-305 | Feb. 17, 2020 | Feb. 16, 2021 |

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 Shielded Room No. 5. (Conduction 5)
3. The VCCI Site Registration No. C-11093.
4. The Industry Canada Reference No. IC 3789-5.

4.2.3 Test Procedures

a. The EUT was 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/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

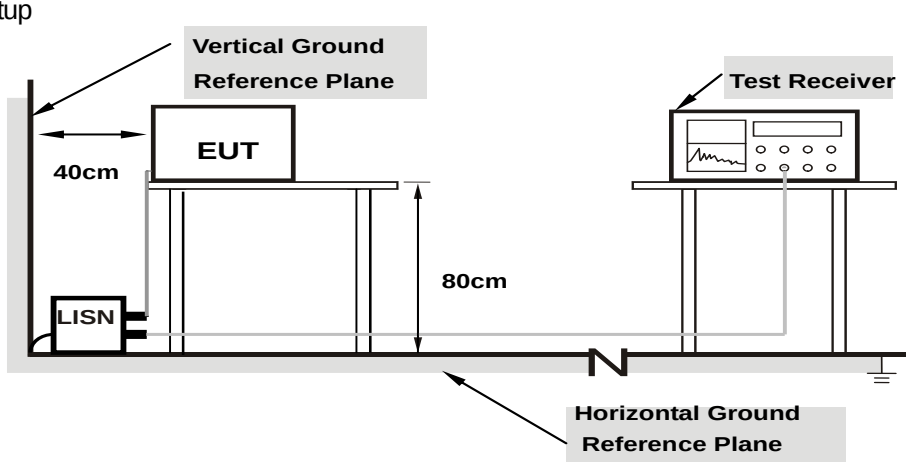
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 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).

4.2.6 EUT Operating Conditions

Same as item 4.1.6.

4.2.7 Test Results

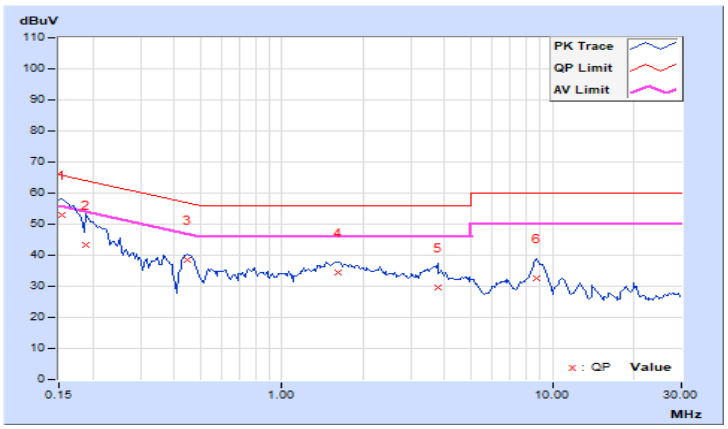
**Channel 1**

| Phase | Line (L) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|---|---|---|---|

| 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 | 0.15391 | 9.90 | 43.11 | 23.06 | 53.01 | 32.96 | 65.79 | 55.79 | -12.78 | -22.83 |
| 2 | 0.18906 | 9.90 | 33.49 | 11.90 | 43.39 | 21.80 | 64.08 | 54.08 | -20.69 | -32.28 |
| 3 | 0.44688 | 9.91 | 28.49 | 20.78 | 38.40 | 30.69 | 56.93 | 46.93 | -18.53 | -16.24 |
| 4 | 1.62109 | 10.00 | 24.49 | 17.32 | 34.49 | 27.32 | 56.00 | 46.00 | -21.51 | -18.68 |
| 5 | 3.75781 | 10.14 | 19.66 | 10.85 | 29.80 | 20.99 | 56.00 | 46.00 | -26.20 | -25.01 |
| 6 | 8.73438 | 10.44 | 22.28 | 14.97 | 32.72 | 25.41 | 60.00 | 50.00 | -27.28 | -24.59 |

**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

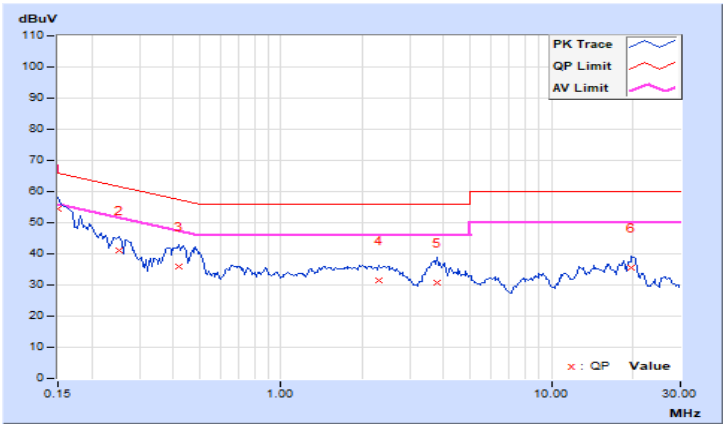


| Phase | Neutral (N) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|---|---|---|---|

| 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** | **9.92** | **44.36** | **28.18** | **54.28** | **38.10** | **66.00** | **56.00** | **-11.72** | **-17.90** |
| 2 | 0.25156 | 9.93 | 31.28 | 16.30 | 41.21 | 26.23 | 61.71 | 51.71 | -20.50 | -25.48 |
| 3 | 0.41953 | 9.94 | 26.09 | 11.81 | 36.03 | 21.75 | 57.46 | 47.46 | -21.43 | -25.71 |
| 4 | 2.29688 | 10.07 | 21.59 | 15.75 | 31.66 | 25.82 | 56.00 | 46.00 | -24.34 | -20.18 |
| 5 | 3.76953 | 10.16 | 20.76 | 12.65 | 30.92 | 22.81 | 56.00 | 46.00 | -25.08 | -23.19 |
| 6 | 19.82031 | 11.15 | 24.42 | 19.19 | 35.57 | 30.34 | 60.00 | 50.00 | -24.43 | -19.66 |

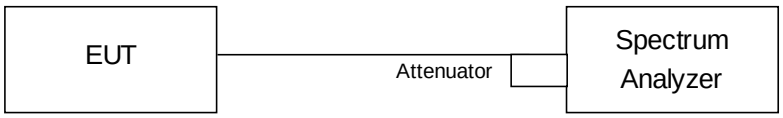
**Remarks:**

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



## 4.3 Channel Bandwidth

### 4.3.1 Test Setup




### 4.3.2 Test Instruments

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| ROHDE & SCHWARZ Spectrum Analyzer | FSV40 | 101042 | Sep. 23, 2019 | Sep. 22, 2020 |

**NOTE:** The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.

### 4.3.3 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.

### 4.3.4 Deviation from Test Standard

No deviation.

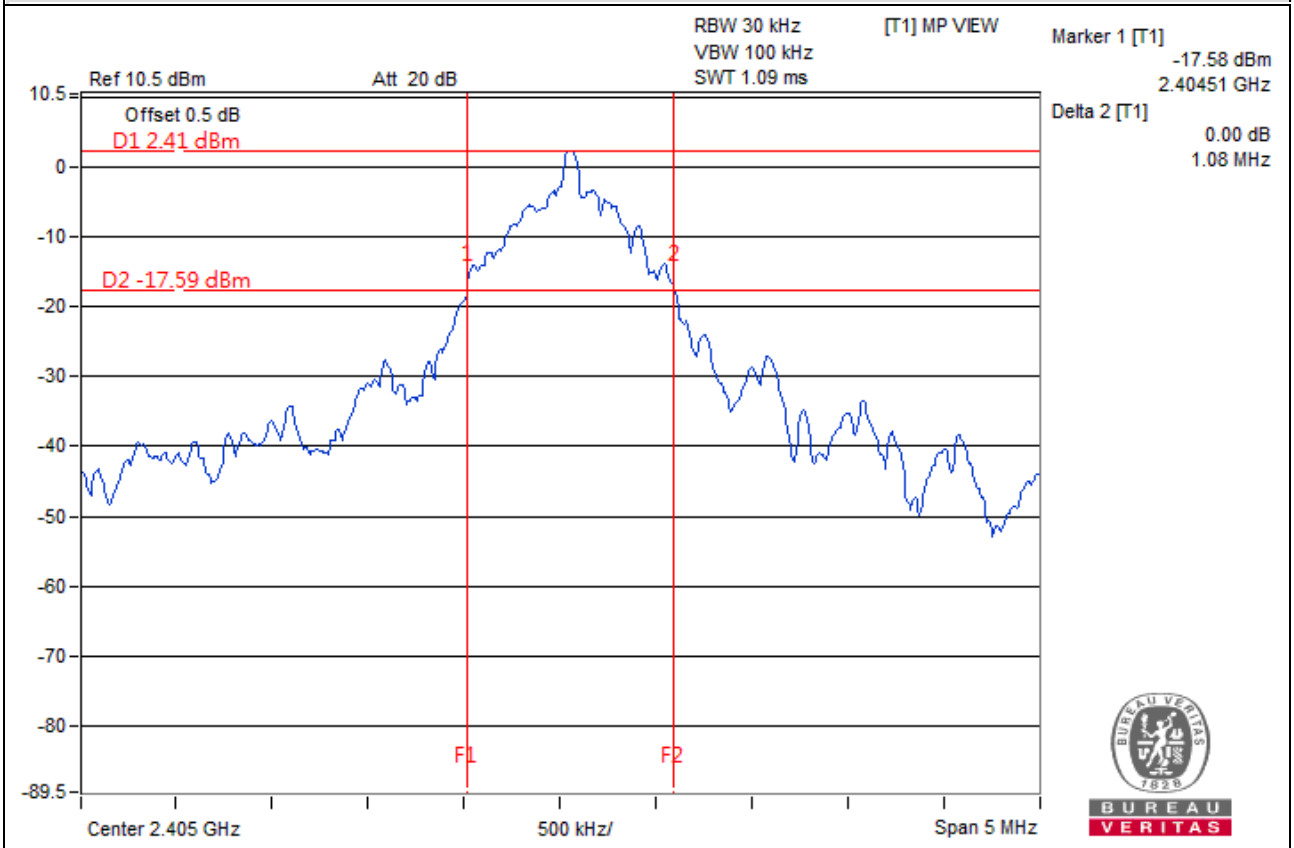
### 4.3.5 EUT Operating Condition

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

4.3.6 Test Results

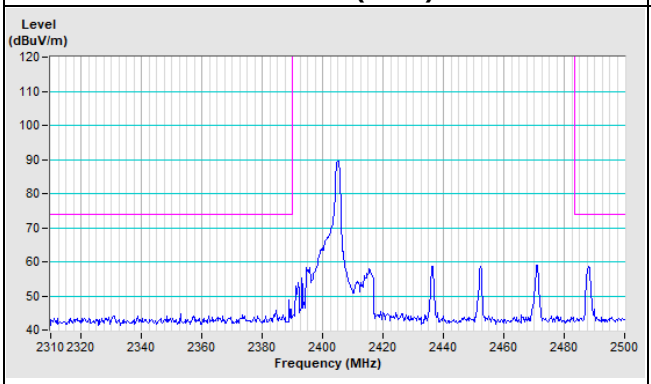
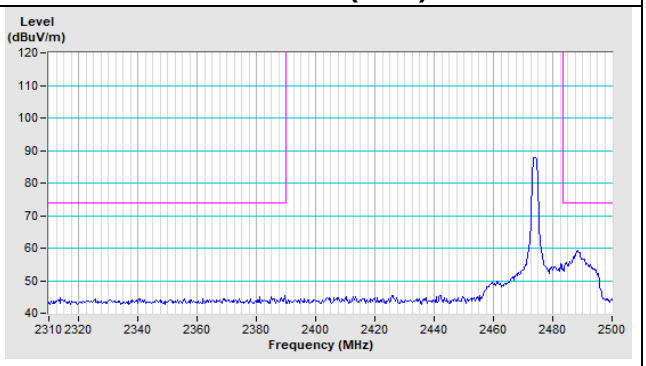
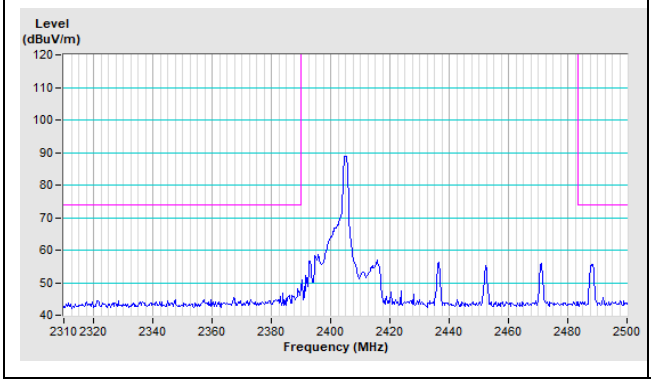
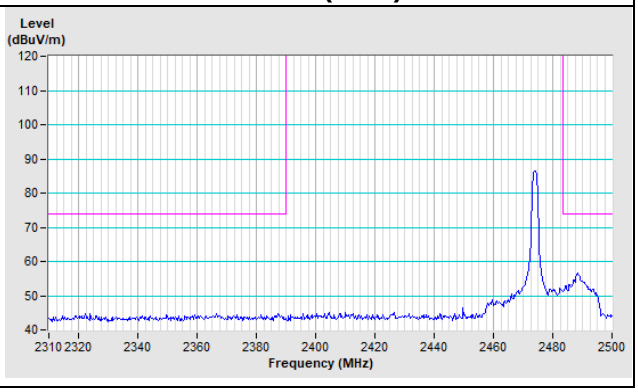
| CHANNEL | FREQUENCY (MHz) | 20dB BANDWIDTH (MHz) |
|---|---|---|
| 1 | 2405 | 1.08 |
| 7 | 2442 | 1.08 |
| 12 | 2474 | 1.07 |

**SPECTRUM PLOT of WORST VALUE**



## Annex A- Band Edge Measurement

The average value is calculated from following formula: 20 log(Duty cycle) = 20 log(0.51 ms / 1.085 ms) = -6.6 dB, so there is no average band-edge plots.

| Channel 1 | Channel 12 |
|---|---|
| Horizontal (Peak) | Horizontal (Peak) |
|  |  |
| Vertical (Peak) | Vertical (Peak) |
|  |  |

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

**--- END ---**