

## FCC Test Report

**Report No.:** RF180718D12-3

**FCC ID:** PPQ-HUB01

**Test Model:** HUB01

**Received Date:** July 18, 2018

**Test Date:** Aug. 05 to Oct. 17, 2018

**Issued Date:** Oct. 26, 2018

**Applicant:** LITE-ON Technology Corp.

**Address:** Bldg. C, 90, Chien 1 Rd., Chung-Ho, New Taipei City, 23585, Taiwan

**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch  
Hsin Chu Laboratory

**Lab Address:** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,  
Taiwan R.O.C.

**Test Location:** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,  
Taiwan R.O.C.

**FCC Registration /  
Designation Number:** 723255 / TW2022



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## Table of Contents

|                                                                  |           |
|------------------------------------------------------------------|-----------|
| <b>Release Control Record .....</b>                              | <b>3</b>  |
| <b>1 Certificate of Conformity .....</b>                         | <b>4</b>  |
| <b>2 Summary of Test Results .....</b>                           | <b>5</b>  |
| 2.1 Measurement Uncertainty .....                                | 5         |
| 2.2 Modification Record .....                                    | 5         |
| <b>3 General Information .....</b>                               | <b>6</b>  |
| 3.1 General Description of EUT .....                             | 6         |
| 3.2 Description of Test Modes .....                              | 7         |
| 3.2.1 Test Mode Applicability and Tested Channel Detail .....    | 8         |
| 3.3 Description of Support Units .....                           | 9         |
| 3.3.1 Configuration of System under Test .....                   | 10        |
| 3.4 General Description of Applied Standards .....               | 11        |
| <b>4 Test Types and Results .....</b>                            | <b>12</b> |
| 4.1 Radiated Emission and Bandedge Measurement .....             | 12        |
| 4.1.1 Limits of Radiated Emission and Bandedge Measurement ..... | 12        |
| 4.1.2 Test Instruments .....                                     | 13        |
| 4.1.3 Test Procedures .....                                      | 15        |
| 4.1.4 Deviation from Test Standard .....                         | 15        |
| 4.1.5 Test Setup .....                                           | 16        |
| 4.1.6 EUT Operating Conditions .....                             | 17        |
| 4.1.7 Test Results .....                                         | 18        |
| 4.2 Conducted Emission Measurement .....                         | 23        |
| 4.2.1 Limits of Conducted Emission Measurement .....             | 23        |
| 4.2.2 Test Instruments .....                                     | 23        |
| 4.2.3 Test Procedures .....                                      | 24        |
| 4.2.4 Deviation from Test Standard .....                         | 24        |
| 4.2.5 Test Setup .....                                           | 24        |
| 4.2.6 EUT Operating Conditions .....                             | 24        |
| 4.2.7 Test Results .....                                         | 25        |
| <b>5 Pictures of Test Arrangements .....</b>                     | <b>27</b> |
| <b>Appendix – Information on the Testing Laboratories .....</b>  | <b>28</b> |

### Release Control Record

| Issue No.     | Description       | Date Issued   |
|---------------|-------------------|---------------|
| RF180718D12-3 | Original release. | Oct. 26, 2018 |

## 1 Certificate of Conformity

**Product:** Norman Hub

**Brand:**  **NORMAN®**

**Test Model:** HUB01

**Sample Status:** ENGINEERING SAMPLE

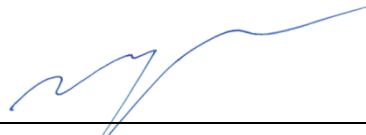
**Applicant:** LITE-ON Technology Corp.

**Test Date:** Aug. 05 to Oct. 17, 2018

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

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

**Prepared by :**  , **Date:** Oct. 26, 2018  
Claire Kuan / Specialist

**Approved by :**  , **Date:** Oct. 26, 2018  
May Chen / 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.<br>Minimum passing margin is -3.55dB at 0.42472MHz. |
| 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.<br>Minimum passing margin is -7.3dB at 2369.00MHz.  |

### 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) ( $\pm$ ) |
|------------------------------------|----------------|--------------------------------------|
| Conducted Emissions at mains ports | 150kHz ~ 30MHz | 1.84 dB                              |
| Radiated Emissions up to 1 GHz     | 30MHz ~ 1GHz   | 5.33 dB                              |
| Radiated Emissions above 1 GHz     | 1GHz ~ 6GHz    | 5.10 dB                              |
|                                    | 6GHz ~ 18GHz   | 4.85 dB                              |
|                                    | 18GHz ~ 40GHz  | 5.24 dB                              |

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

|                     |                                                                                   |
|---------------------|-----------------------------------------------------------------------------------|
| Product             | Norman Hub                                                                        |
| Brand               |  |
| Test Model          | HUB01                                                                             |
| Status of EUT       | ENGINEERING SAMPLE                                                                |
| Power Supply Rating | 5Vdc from power adapter                                                           |
| Modulation Type     | GFSK                                                                              |
| Transfer Rate       | 1Mbps                                                                             |
| Operating Frequency | 2415~2459MHz                                                                      |
| Number of Channel   | 3                                                                                 |
| Antenna Type        | Refer to Note                                                                     |
| Antenna Connector   | Refer to Note                                                                     |
| Accessory Device    | Adapter x 1                                                                       |
| Data Cable Supplied | USB Cable x 1 (Shielded, 1.0m)<br>RJ45 Cable x 1 (UnShielded, 1.0m)               |

Note:

1. Simultaneously transmission condition.

| Condition | Technology  |      |
|-----------|-------------|------|
| 1         | WLAN 2.4GHz | GFSK |

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

2. The EUT could be supplied with a power adapter as the following table:

| No. | Brand                                           | Model No.          | Spec.                                                                                         | Plug |
|-----|-------------------------------------------------|--------------------|-----------------------------------------------------------------------------------------------|------|
| 1   | Shenzhen Keyu Power Supply Technology Co., Ltd. | KA0601A-0501000BSU | Input: 100-240V, 50/60Hz, 0.2A Max<br>Output: 5V, 1000mA<br>DC output cable: Unshielded, 1.0m | UK   |
| 2   | Shenzhen Keyu Power Supply Technology Co., Ltd. | KA0601A-0501000EUU | Input: 100-240V, 50/60Hz, 0.2A Max<br>Output: 5V, 1000mA<br>DC output cable: Unshielded, 1.0m | EU   |
| 3   | Shenzhen Keyu Power Supply Technology Co., Ltd. | KA0601A-0501000USU | Input: 100-240V, 50/60Hz, 0.2A Max<br>Output: 5V, 1000mA<br>DC output cable: Unshielded, 1.0m | FCC  |

Note:

1. The adapter 1, 2 is as same as adapter 3; except for plug shape is different.

2. From the above adapters, Adapter 3 was selected as representative adapter for the test and its data was recorded in this report.

3. The antenna provided to the EUT, please refer to the following table:

| Brand    | Model  | Antenna Gain (dBi) | Frequency range(GHz) | Antenna Type | Connector Type |
|----------|--------|--------------------|----------------------|--------------|----------------|
| Unictron | AA055A | 2.5                | 2.4-2.4835           | Chip Antenna | NA             |

4. 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

3 channels are provided to this EUT:

| Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|
| 15      | 2415 MHz  | 39      | 2439 MHz  |
| 59      | 2459 MHz  |         |           |

### 3.2.1 Test Mode Applicability and Tested Channel Detail

| EUT CONFIGURE MODE | APPLICABLE TO |       |     | DESCRIPTION |
|--------------------|---------------|-------|-----|-------------|
|                    | RE $\geq$ 1G  | RE<1G | PLC |             |
| -                  | √             | √     | √   | -           |

Where **RE $\geq$ 1G**: Radiated Emission above 1GHz & Bandedge Measurement  
**RE<1G**: Radiated Emission below 1GHz  
**PLC**: Power Line Conducted Emission

**NOTE:** The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane for below 1GHz and Y-plane for above 1GHz.**

#### **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.

| AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|-------------------|----------------|-----------------|
| 15 to 59          | 15, 39, 59     | 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.

| AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|-------------------|----------------|-----------------|
| 15 to 59          | 39             | 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.

| AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|-------------------|----------------|-----------------|
| 15 to 59          | 39             | GFSK            |

#### **Test Condition:**

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER  | TESTED BY     |
|---------------|--------------------------|--------------|---------------|
| RE $\geq$ 1G  | 25deg. C, 65%RH          | 120Vac, 60Hz | Steven Chiang |
| RE<1G         | 25deg. C, 65%RH          | 120Vac, 60Hz | Steven Chiang |
| PLC           | 24deg. C, 73%RH          | 120Vac, 60Hz | Andy Ho       |

### 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.

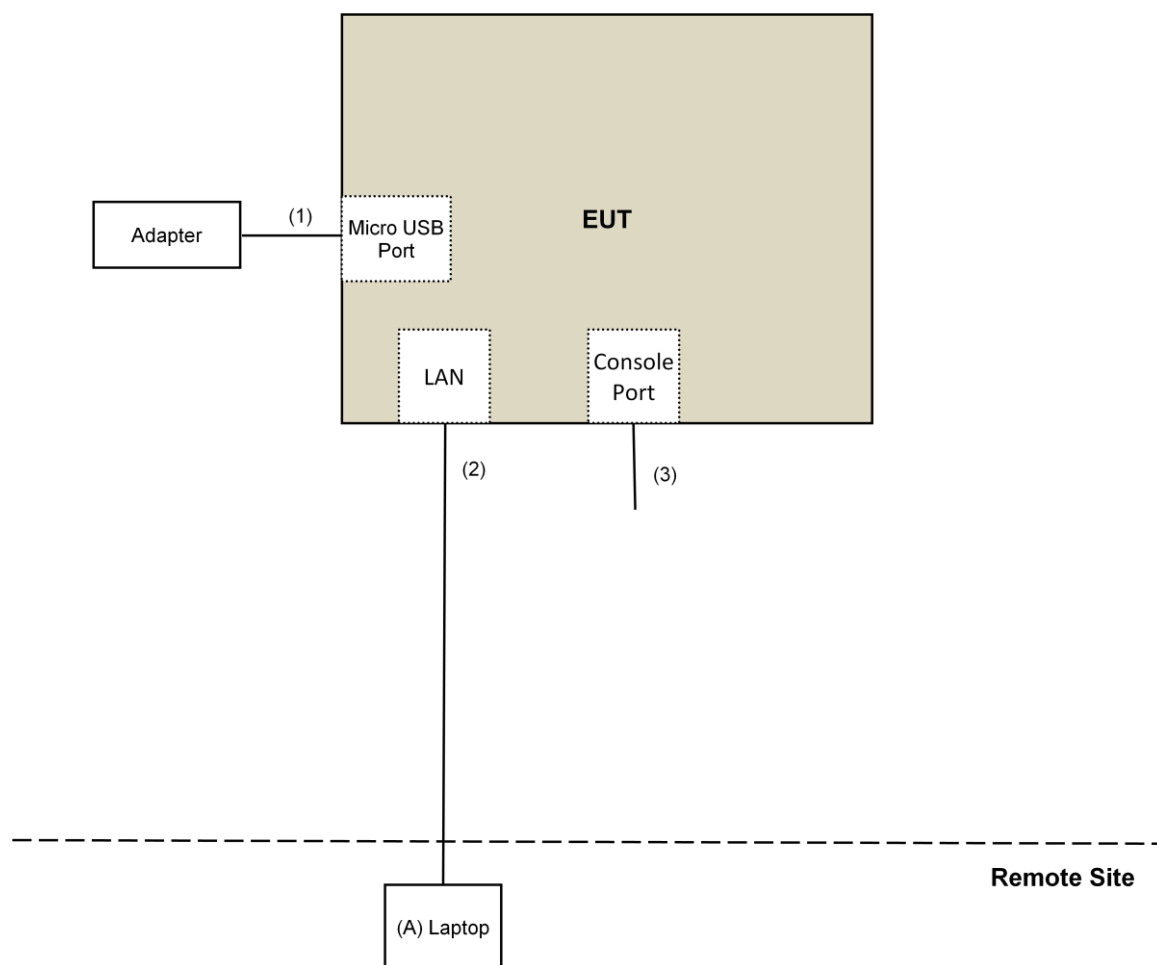
| ID | Product | Brand | Model No. | Serial No. | FCC ID  | Remarks         |
|----|---------|-------|-----------|------------|---------|-----------------|
| A. | Laptop  | DELL  | E6420     | B92T3R1    | FCC DoC | Provided by Lab |

Note:

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

| ID | Descriptions  | Qty. | Length (m) | Shielding (Yes/No) | Cores (Qty.) | Remarks            |
|----|---------------|------|------------|--------------------|--------------|--------------------|
| 1. | USB Cable     | 1    | 1          | Yes                | 0            | Supplied by client |
| 2. | RJ-45 Cable   | 1    | 10         | No                 | 0            | Provided by Lab    |
| 3. | Console Cable | 1    | 1.5        | No                 | 0            | Provided by Lab    |

### 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

For below 1GHz test:

| DESCRIPTION & MANUFACTURER                     | MODEL NO.            | SERIAL NO.  | CALIBRATED DATE | CALIBRATED UNTIL |
|------------------------------------------------|----------------------|-------------|-----------------|------------------|
| Test Receiver<br>Keysight                      | N9038A               | MY54450088  | July 05, 2018   | July 04, 2019    |
| Pre-Amplifier<br>EMCI                          | EMC001340            | 980142      | Feb. 09, 2018   | Feb. 08, 2019    |
| Loop Antenna <sup>(*)</sup><br>Electro-Metrics | EM-6879              | 264         | Dec. 16, 2016   | Dec. 15, 2018    |
| RF Cable                                       | NA                   | LOOPCAB-001 | Jan. 15, 2018   | Jan. 14, 2019    |
| RF Cable                                       | NA                   | LOOPCAB-002 | Jan. 15, 2018   | Jan. 14, 2019    |
| Pre-Amplifier<br>Mini-Circuits                 | ZFL-1000VH2B         | AMP-ZFL-01  | Nov. 09, 2017   | Nov. 08, 2018    |
| Trilog Broadband Antenna<br>SCHWARZBECK        | VULB 9168            | 9168-406    | Nov. 29, 2017   | Nov. 28, 2018    |
| RF Cable                                       | 8D                   | 966-4-1     | Mar. 21, 2018   | Mar. 20, 2019    |
| RF Cable                                       | 8D                   | 966-4-2     | Mar. 21, 2018   | Mar. 20, 2019    |
| RF Cable                                       | 8D                   | 966-4-3     | Mar. 21, 2018   | Mar. 20, 2019    |
| Fixed attenuator<br>Mini-Circuits              | UNAT-5+              | PAD-3m-4-01 | Oct. 03, 2017   | Oct. 02, 2018    |
| Software                                       | ADT_Radiated_V8.7.08 | NA          | NA              | NA               |

**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 calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in 966 Chamber No. 4.
4. The CANADA Site Registration No. is 20331-2
5. Loop antenna was used for all emissions below 30 MHz.
6. Tested Date: Sep. 07, 2018

For above 1GHz test:

| DESCRIPTION & MANUFACTURER                          | MODEL NO.            | SERIAL NO.  | CALIBRATED DATE | CALIBRATED UNTIL |
|-----------------------------------------------------|----------------------|-------------|-----------------|------------------|
| Test Receiver<br>Keysight                           | N9038A               | MY54450088  | July 05, 2018   | July 04, 2019    |
| Horn_Antenna<br>SCHWARZBECK                         | BBHA 9120D           | 9120D-783   | Dec. 12, 2017   | Dec. 11, 2018    |
| Pre-Amplifier<br>Mini-Circuits                      | ZVA-183-S+           | AMP-ZVA-03  | May 10, 2018    | May 09, 2019     |
| RF Cable                                            | EMC104-SM-SM-1200    | 160923      | Jan. 29, 2018   | Jan. 28, 2019    |
| RF Cable                                            | EMC104-SM-SM-2000    | 150318      | Jan. 29, 2018   | Jan. 28, 2019    |
| RF Cable                                            | EMC104-SM-SM-5000    | 150321      | Jan. 29, 2018   | Jan. 28, 2019    |
| Pre-Amplifier<br>EMCI                               | EMC184045SE          | 980387      | Jan. 29, 2018   | Jan. 28, 2019    |
| Horn_Antenna<br>SCHWARZBECK                         | BBHA 9170            | BBHA9170608 | Dec. 14, 2017   | Dec. 13, 2018    |
| RF Cable                                            | EMC102-KM-KM-1200    | 160925      | Jan. 29, 2018   | Jan. 28, 2019    |
| Software                                            | ADT_Radiated_V8.7.08 | NA          | NA              | NA               |
| Boresight Antenna Tower &<br>Turn Table<br>Max-Full | MF-7802BS            | MF780208530 | NA              | NA               |

**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 966 Chamber No. 4.
3. The CANADA Site Registration No. is 20331-2
4. Loop antenna was used for all emissions below 30 MHz.
5. Tested Date: Oct. 17, 2018

#### 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:**

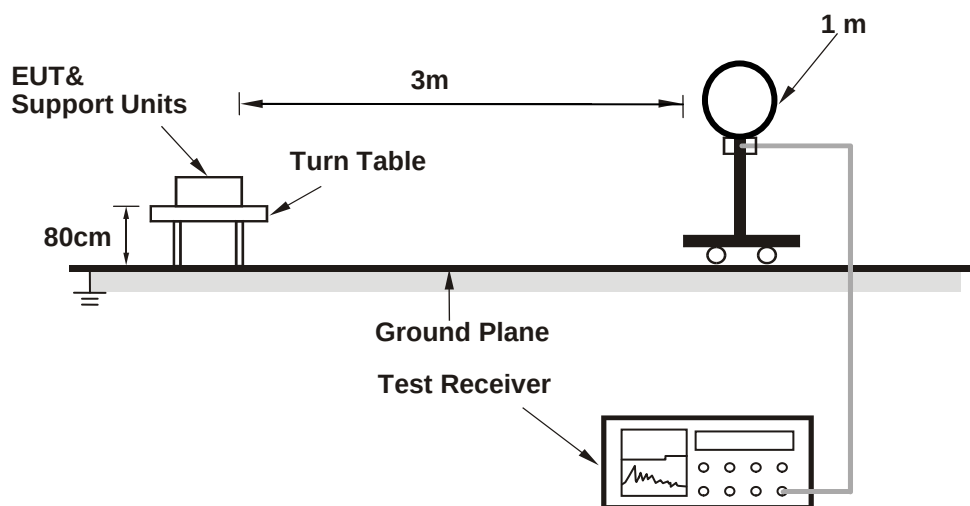
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz 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

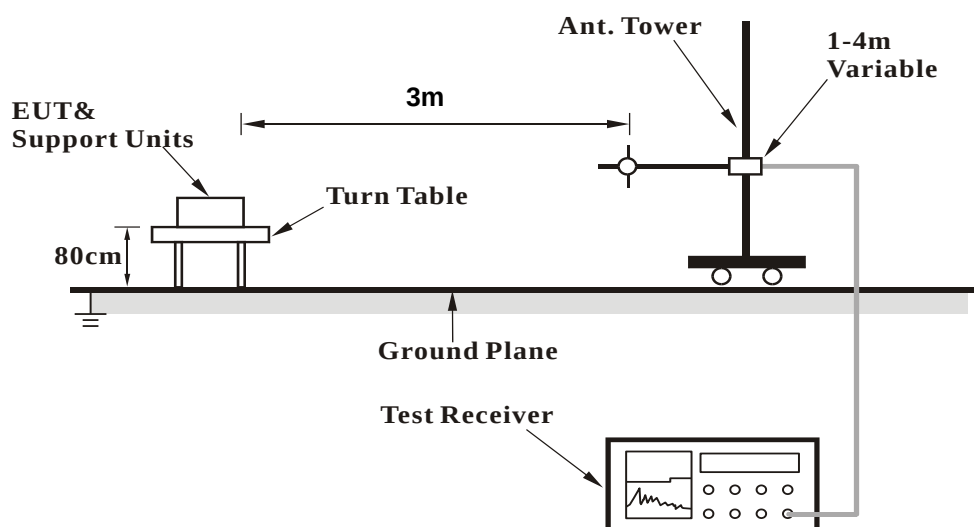
No deviation.

#### 4.1.5 Test Setup

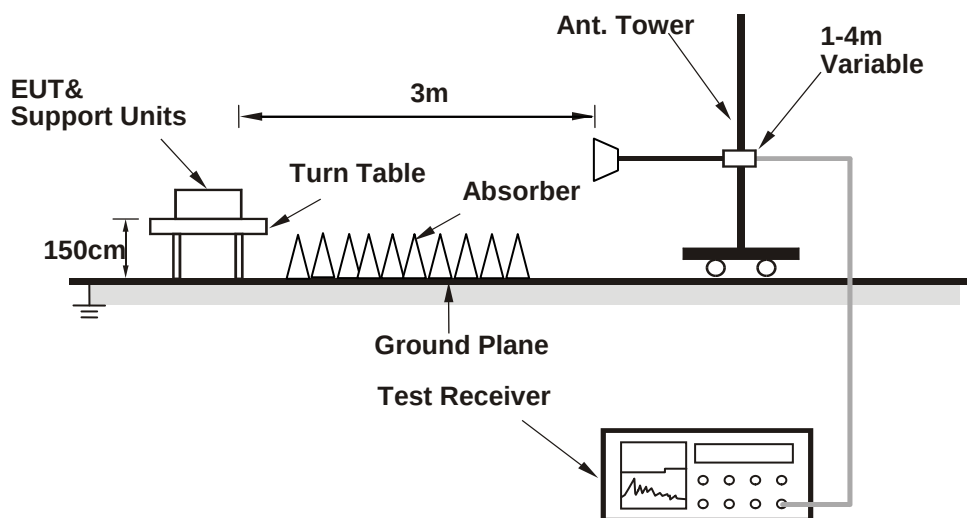
##### For Radiated emission below 30MHz



##### 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

Controlling software (Console Port use "Test command") has been activated to set the EUT on specific status.

#### 4.1.7 Test Results

##### Above 1GHz Data :

|                        |               |                          |              |
|------------------------|---------------|--------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 15 | <b>DETECTOR FUNCTION</b> | Peak (PK)    |
| <b>FREQUENCY RANGE</b> | 1GHz ~ 25GHz  |                          | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |             |                         |                |             |                    |                      |                  |                          |
|-----------------------------------------------------|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| NO.                                                 | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1                                                   | 2369.00     | 57.1 PK                 | 74.0           | -16.9       | 1.42 H             | 17                   | 59.2             | -2.1                     |
| 2                                                   | 2369.00     | 45.5 AV                 | 54.0           | -8.5        | 1.42 H             | 17                   | 47.6             | -2.1                     |
| 3                                                   | 2400.00     | 55.2 PK                 | 74.0           | -18.8       | 1.42 H             | 17                   | 57.4             | -2.2                     |
| 4                                                   | 2400.00     | 43.9 AV                 | 54.0           | -10.1       | 1.42 H             | 17                   | 46.1             | -2.2                     |
| 5                                                   | *2415.00    | 86.8 PK                 | 114.0          | -27.2       | 1.42 H             | 17                   | 89.2             | -2.4                     |
| 6                                                   | *2415.00    | 65.8 AV                 | 94.0           | -28.2       | 1.42 H             | 17                   | 68.2             | -2.4                     |
| 7                                                   | 4830.00     | 45.8 PK                 | 74.0           | -28.2       | 2.17 H             | 344                  | 44.0             | 1.8                      |
| 8                                                   | 4830.00     | 34.7 AV                 | 54.0           | -19.3       | 2.17 H             | 344                  | 32.9             | 1.8                      |
| 9                                                   | 7245.00     | 48.1 PK                 | 74.0           | -25.9       | 1.75 H             | 88                   | 40.1             | 8.0                      |
| 10                                                  | 7245.00     | 37.6 AV                 | 54.0           | -16.4       | 1.75 H             | 88                   | 29.6             | 8.0                      |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |             |                         |                |             |                    |                      |                  |                          |
| NO.                                                 | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1                                                   | 2369.00     | 57.7 PK                 | 74.0           | -16.3       | 2.43 V             | 89                   | 59.8             | -2.1                     |
| 2                                                   | 2369.00     | 46.7 AV                 | 54.0           | -7.3        | 2.43 V             | 89                   | 48.8             | -2.1                     |
| 3                                                   | 2400.00     | 56.1 PK                 | 74.0           | -17.9       | 2.43 V             | 89                   | 58.3             | -2.2                     |
| 4                                                   | 2400.00     | 44.5 AV                 | 54.0           | -9.5        | 2.43 V             | 89                   | 46.7             | -2.2                     |
| 5                                                   | *2415.00    | 92.1 PK                 | 114.0          | -21.9       | 2.43 V             | 89                   | 94.5             | -2.4                     |
| 6                                                   | *2415.00    | 71.1 AV                 | 94.0           | -22.9       | 2.43 V             | 89                   | 73.5             | -2.4                     |
| 7                                                   | 4830.00     | 44.3 PK                 | 74.0           | -29.7       | 1.56 V             | 106                  | 42.5             | 1.8                      |
| 8                                                   | 4830.00     | 33.8 AV                 | 54.0           | -20.2       | 1.56 V             | 106                  | 32.0             | 1.8                      |
| 9                                                   | 7245.00     | 48.2 PK                 | 74.0           | -25.8       | 1.20 V             | 219                  | 40.2             | 8.0                      |
| 10                                                  | 7245.00     | 37.6 AV                 | 54.0           | -16.4       | 1.20 V             | 219                  | 29.6             | 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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.

|                        |               |                              |              |
|------------------------|---------------|------------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 39 | <b>DETECTOR<br/>FUNCTION</b> | Peak (PK)    |
| <b>FREQUENCY RANGE</b> | 1GHz ~ 25GHz  |                              | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |                |                               |                   |                |                          |                            |                        |                                |
|-----------------------------------------------------|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | *2439.00       | 87.5 PK                       | 114.0             | -26.5          | 1.49 H                   | 13                         | 90.1                   | -2.6                           |
| 2                                                   | *2439.00       | 66.6 AV                       | 94.0              | -27.4          | 1.49 H                   | 13                         | 69.2                   | -2.6                           |
| 3                                                   | 4878.00        | 45.7 PK                       | 74.0              | -28.3          | 2.15 H                   | 320                        | 43.7                   | 2.0                            |
| 4                                                   | 4878.00        | 34.5 AV                       | 54.0              | -19.5          | 2.15 H                   | 320                        | 32.5                   | 2.0                            |
| 5                                                   | 7317.00        | 48.6 PK                       | 74.0              | -25.4          | 1.36 H                   | 254                        | 40.2                   | 8.4                            |
| 6                                                   | 7317.00        | 37.6 AV                       | 54.0              | -16.4          | 1.36 H                   | 254                        | 29.2                   | 8.4                            |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |                |                               |                   |                |                          |                            |                        |                                |
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | *2439.00       | 92.7 PK                       | 114.0             | -21.3          | 2.43 V                   | 86                         | 95.3                   | -2.6                           |
| 2                                                   | *2439.00       | 71.9 AV                       | 94.0              | -22.1          | 2.43 V                   | 86                         | 74.5                   | -2.6                           |
| 3                                                   | 4878.00        | 43.9 PK                       | 74.0              | -30.1          | 1.51 V                   | 27                         | 41.9                   | 2.0                            |
| 4                                                   | 4878.00        | 32.8 AV                       | 54.0              | -21.2          | 1.51 V                   | 27                         | 30.8                   | 2.0                            |
| 5                                                   | 7317.00        | 48.2 PK                       | 74.0              | -25.8          | 1.19 V                   | 233                        | 39.8                   | 8.4                            |
| 6                                                   | 7317.00        | 37.1 AV                       | 54.0              | -16.9          | 1.19 V                   | 233                        | 28.7                   | 8.4                            |

**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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.

|                        |               |                              |              |
|------------------------|---------------|------------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 59 | <b>DETECTOR<br/>FUNCTION</b> | Peak (PK)    |
| <b>FREQUENCY RANGE</b> | 1GHz ~ 25GHz  |                              | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |                |                               |                   |                |                          |                            |                        |                                |
|-----------------------------------------------------|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | *2459.00       | 88.0 PK                       | 114.0             | -26.0          | 1.45 H                   | 25                         | 90.6                   | -2.6                           |
| 2                                                   | *2459.00       | 67.0 AV                       | 94.0              | -27.0          | 1.45 H                   | 25                         | 69.6                   | -2.6                           |
| 3                                                   | 2483.50        | 55.8 PK                       | 74.0              | -18.2          | 1.45 H                   | 25                         | 58.2                   | -2.4                           |
| 4                                                   | 2483.50        | 44.2 AV                       | 54.0              | -9.8           | 1.45 H                   | 25                         | 46.6                   | -2.4                           |
| 5                                                   | 4918.00        | 45.8 PK                       | 74.0              | -28.2          | 2.12 H                   | 332                        | 43.8                   | 2.0                            |
| 6                                                   | 4918.00        | 35.1 AV                       | 54.0              | -18.9          | 2.12 H                   | 332                        | 33.1                   | 2.0                            |
| 7                                                   | 7377.00        | 48.9 PK                       | 74.0              | -25.1          | 1.33 H                   | 256                        | 40.3                   | 8.6                            |
| 8                                                   | 7377.00        | 38.3 AV                       | 54.0              | -15.7          | 1.33 H                   | 256                        | 29.7                   | 8.6                            |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |                |                               |                   |                |                          |                            |                        |                                |
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | *2459.00       | 93.7 PK                       | 114.0             | -20.3          | 2.42 V                   | 87                         | 96.3                   | -2.6                           |
| 2                                                   | *2459.00       | 72.8 AV                       | 94.0              | -21.2          | 2.42 V                   | 87                         | 75.4                   | -2.6                           |
| 3                                                   | 2483.50        | 56.1 PK                       | 74.0              | -17.9          | 2.42 V                   | 87                         | 58.5                   | -2.4                           |
| 4                                                   | 2483.50        | 44.5 AV                       | 54.0              | -9.5           | 2.42 V                   | 87                         | 46.9                   | -2.4                           |
| 5                                                   | 4918.00        | 44.3 PK                       | 74.0              | -29.7          | 1.55 V                   | 21                         | 42.3                   | 2.0                            |
| 6                                                   | 4918.00        | 33.7 AV                       | 54.0              | -20.3          | 1.55 V                   | 21                         | 31.7                   | 2.0                            |
| 7                                                   | 7377.00        | 48.5 PK                       | 74.0              | -25.5          | 1.23 V                   | 221                        | 39.9                   | 8.6                            |
| 8                                                   | 7377.00        | 37.6 AV                       | 54.0              | -16.4          | 1.23 V                   | 221                        | 29.0                   | 8.6                            |

**REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.

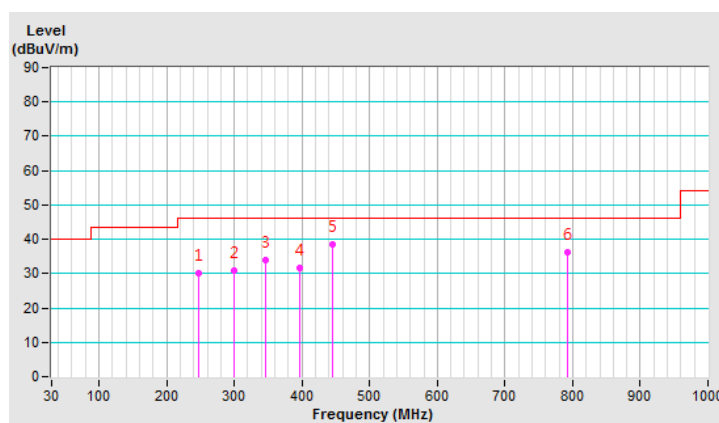
#### Below 1GHz Data:

|                        |               |                              |                 |
|------------------------|---------------|------------------------------|-----------------|
| <b>CHANNEL</b>         | TX Channel 39 | <b>DETECTOR<br/>FUNCTION</b> | Quasi-Peak (QP) |
| <b>FREQUENCY RANGE</b> | 9kHz ~ 1GHz   |                              |                 |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |                |                               |                   |                |                          |                            |                        |                                |
|-----------------------------------------------------|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | 247.50         | 30.2 QP                       | 46.0              | -15.8          | 1.00 H                   | 37                         | 39.1                   | -8.9                           |
| 2                                                   | 300.00         | 30.9 QP                       | 46.0              | -15.1          | 1.00 H                   | 76                         | 38.0                   | -7.1                           |
| 3                                                   | 346.49         | 34.0 QP                       | 46.0              | -12.0          | 1.00 H                   | 201                        | 39.8                   | -5.8                           |
| 4                                                   | 395.98         | 31.8 QP                       | 46.0              | -14.2          | 1.00 H                   | 61                         | 36.1                   | -4.3                           |
| 5                                                   | 445.50         | 38.5 QP                       | 46.0              | -7.5           | 2.00 H                   | 325                        | 41.2                   | -2.7                           |
| 6                                                   | 791.98         | 36.1 QP                       | 46.0              | -9.9           | 2.00 H                   | 335                        | 32.3                   | 3.8                            |

#### REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The 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.

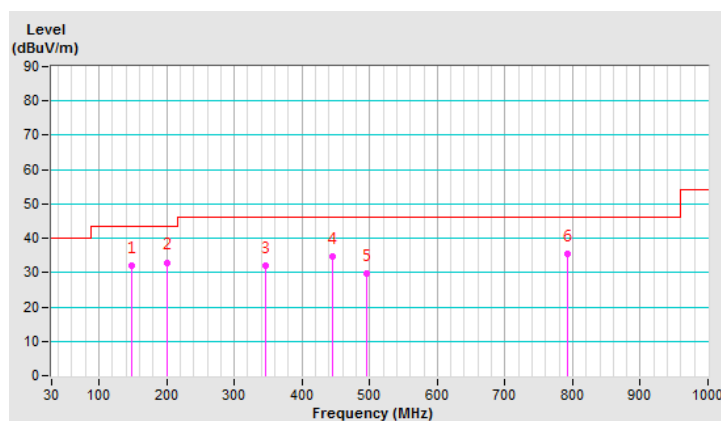


|                        |               |                              |                 |
|------------------------|---------------|------------------------------|-----------------|
| <b>CHANNEL</b>         | TX Channel 39 | <b>DETECTOR<br/>FUNCTION</b> | Quasi-Peak (QP) |
| <b>FREQUENCY RANGE</b> | 9kHz ~ 1GHz   |                              |                 |

| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M |                |                               |                   |                |                          |                            |                        |                                |
|---------------------------------------------------|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| NO.                                               | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                 | 148.51         | 31.9 QP                       | 43.5              | -11.6          | 1.00 V                   | 40                         | 39.6                   | -7.7                           |
| 2                                                 | 199.99         | 33.0 QP                       | 43.5              | -10.5          | 1.00 V                   | 1                          | 44.1                   | -11.1                          |
| 3                                                 | 346.51         | 31.9 QP                       | 46.0              | -14.1          | 1.00 V                   | 305                        | 37.7                   | -5.8                           |
| 4                                                 | 445.50         | 34.8 QP                       | 46.0              | -11.2          | 1.50 V                   | 303                        | 37.5                   | -2.7                           |
| 5                                                 | 494.97         | 29.8 QP                       | 46.0              | -16.2          | 1.00 V                   | 103                        | 31.6                   | -1.8                           |
| 6                                                 | 791.96         | 35.5 QP                       | 46.0              | -10.5          | 1.00 V                   | 9                          | 31.7                   | 3.8                            |

#### REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The 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. | CALIBRATED DATE | CALIBRATED UNTIL |
|--------------------------------------------------------------------|-------------------------|------------|-----------------|------------------|
| Test Receiver<br>R&S                                               | ESCS 30                 | 847124/029 | Nov. 01, 2017   | Oct. 31, 2018    |
| Line-Impedance<br>Stabilization Network (for<br>EUT)<br>R&S        | ESH3-Z5                 | 848773/004 | Nov. 15, 2017   | Nov. 14, 2018    |
| Line-Impedance<br>Stabilization Network<br>(for Peripheral)<br>R&S | ENV216                  | 100072     | June 04, 2018   | June 03, 2019    |
| 50 ohms Terminator                                                 | N/A                     | EMC-04     | Nov. 01, 2017   | Oct. 31, 2018    |
| RF Cable                                                           | 5D-FB                   | COCCAB-001 | Sep. 29, 2017   | Sep. 28, 2018    |
| Fixed attenuator<br>EMCI                                           | STI02-2200-10           | 003        | Mar. 16, 2018   | Mar. 15, 2019    |
| Software<br>BVADT                                                  | BVADT_Cond_<br>V7.3.7.4 | NA         | NA              | NA               |

**Note:**

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Conduction 1.
3. Tested Date: Aug. 05, 2018

#### 4.2.3 Test Procedures

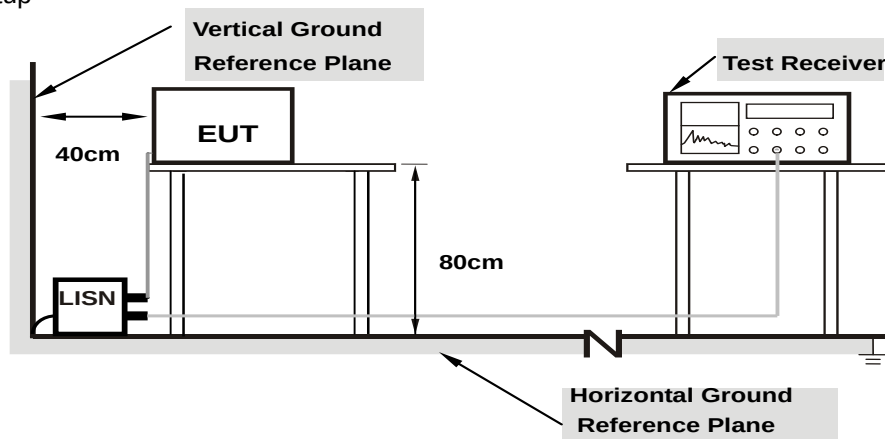
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- 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 4.1.6.

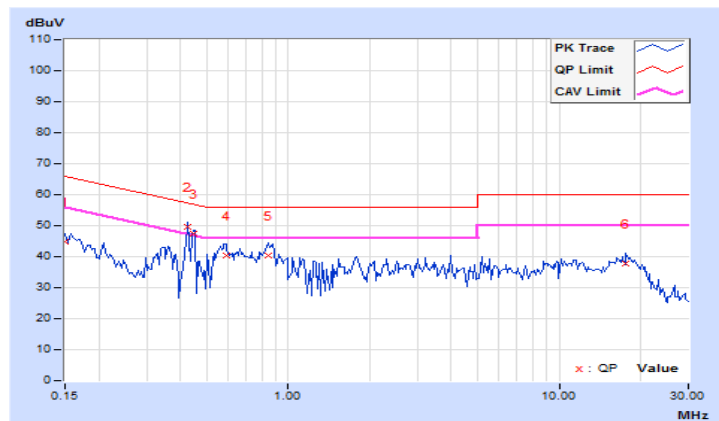
#### 4.2.7 Test Results

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

| No       | Freq.<br>[MHz] | Corr.<br>Factor | Reading Value<br>[dB (uV)] |              | Emission Level<br>[dB (uV)] |              | Limit<br>[dB (uV)] |              | Margin<br>(dB) |              |
|----------|----------------|-----------------|----------------------------|--------------|-----------------------------|--------------|--------------------|--------------|----------------|--------------|
|          |                | (dB)            | Q.P.                       | AV.          | Q.P.                        | AV.          | Q.P.               | AV.          | Q.P.           | AV.          |
|          |                |                 |                            |              |                             |              |                    |              |                |              |
| 1        | 0.15000        | 10.05           | 34.82                      | 20.85        | 44.87                       | 30.90        | 66.00              | 56.00        | -21.13         | -25.10       |
| <b>2</b> | <b>0.42472</b> | <b>10.12</b>    | <b>39.52</b>               | <b>33.69</b> | <b>49.64</b>                | <b>43.81</b> | <b>57.36</b>       | <b>47.36</b> | <b>-7.72</b>   | <b>-3.55</b> |
| 3        | 0.44756        | 10.12           | 37.41                      | 32.24        | 47.53                       | 42.36        | 56.92              | 46.92        | -9.39          | -4.56        |
| 4        | 0.59141        | 10.14           | 30.07                      | 23.88        | 40.21                       | 34.02        | 56.00              | 46.00        | -15.79         | -11.98       |
| 5        | 0.84922        | 10.16           | 30.38                      | 21.93        | 40.54                       | 32.09        | 56.00              | 46.00        | -15.46         | -13.91       |
| 6        | 17.69531       | 11.24           | 26.69                      | 18.65        | 37.93                       | 29.89        | 60.00              | 50.00        | -22.07         | -20.11       |

#### 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.

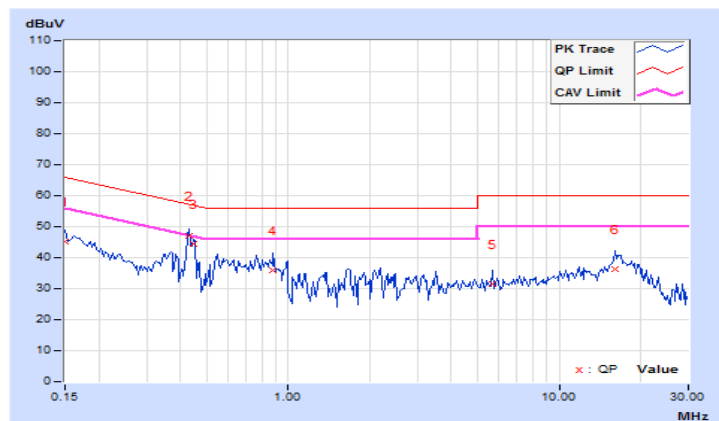


|       |             |                   |                                |
|-------|-------------|-------------------|--------------------------------|
| Phase | Neutral (N) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|-------|-------------|-------------------|--------------------------------|

| No | Freq.<br>[MHz] | Corr.  | Reading Value |       | Emission Level |       | Limit     |       | Margin |        |
|----|----------------|--------|---------------|-------|----------------|-------|-----------|-------|--------|--------|
|    |                | Factor | [dB (uV)]     |       | [dB (uV)]      |       | [dB (uV)] |       | (dB)   |        |
|    |                | (dB)   | Q.P.          | AV.   | Q.P.           | AV.   | Q.P.      | AV.   | Q.P.   | AV.    |
| 1  | 0.15000        | 9.95   | 35.14         | 18.92 | 45.09          | 28.87 | 66.00     | 56.00 | -20.91 | -27.13 |
| 2  | 0.42838        | 10.02  | 37.06         | 28.79 | 47.08          | 38.81 | 57.28     | 47.28 | -10.20 | -8.47  |
| 3  | 0.44688        | 10.02  | 34.29         | 26.34 | 44.31          | 36.36 | 56.93     | 46.93 | -12.62 | -10.57 |
| 4  | 0.87656        | 10.04  | 25.94         | 18.88 | 35.98          | 28.92 | 56.00     | 46.00 | -20.02 | -17.08 |
| 5  | 5.71484        | 10.29  | 21.08         | 11.21 | 31.37          | 21.50 | 60.00     | 50.00 | -28.63 | -28.50 |
| 6  | 16.00000       | 10.93  | 25.47         | 14.18 | 36.40          | 25.11 | 60.00     | 50.00 | -23.60 | -24.89 |

#### 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.



## 5 Pictures of Test Arrangements

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

## Appendix – Information on 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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**Hsin Chu EMC/RF/Telecom Lab**

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

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

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