

## FCC Test Report

**Report No.:** RF190329C01B

**FCC ID:** HFS-A5QB

**Test Model:** A5QB

**Received Date:** Nov. 15, 2019

**Test Date:** Dec. 04 ~Dec. 16, 2019

**Issued Date:** Dec. 17, 2019

**Applicant:** QUANTA COMPUTER INC.

**Address:** 188, WEN HUA 2ND RD., GUISHAN DIST., TAO YUAN CITY 33377,  
TAIWAN

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

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

**Test Location:** No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City  
33383, TAIWAN

**FCC Registration /** 788550 / TW0003  
**Designation Number:**



This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification. The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

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### Release Control Record

| Issue No.    | Description       | Date Issued   |
|--------------|-------------------|---------------|
| RF190329C01B | Original release. | Dec. 17, 2019 |

## 1 Certificate of Conformity

**Product:** server

**Brand:** Quanta computer Inc

**Test Model:** A5QB

**Sample Status:** Engineering sample

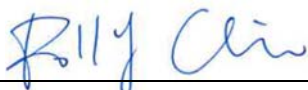
**Applicant:** QUANTA COMPUTER INC.

**Test Date:** Dec. 04 ~Dec. 16, 2019

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.225)  
47 CFR FCC Part 15, Subpart C (Section 15.215)  
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 :**



Polly Chien / Specialist

**Date:**

Dec. 17, 2019

**Approved by :**



Bruce Chen / Senior Project Engineer

**Date:**

Dec. 17, 2019

## 2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C (Section 15.225, 15.215) |                                                                                              |        |                                                                                    |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------|--------|------------------------------------------------------------------------------------|
| FCC Clause                                             | Test Item                                                                                    | Result | Remarks                                                                            |
| 15.207                                                 | Conducted emission test                                                                      | Pass   | Meet the requirement of limit.<br>Minimum passing margin is -2.61dB at 13.55800MHz |
| 15.225 (a)                                             | The field strength of any emissions within the band 13.553-13.567 MHz                        | Pass   | Meet the requirement of limit.<br>Minimum passing margin is -65.10dB at 13.56MHz.  |
| 15.225 (b)                                             | The field strength of any emissions within the bands 13.410-13.553 MHz and 13.567-13.710 MHz | Pass   | Meet the requirement of limit.                                                     |
| 15.225 (c)                                             | The field strength of any emissions within the bands 13.110-13.410 MHz and 13.710-14.010 MHz | Pass   | Meet the requirement of limit.                                                     |
| 15.225 (d)                                             | The field strength of any emissions appearing outside of the 13.110-14.010 MHz band          | Pass   | Meet the requirement of limit.<br>Minimum passing margin is -0.28dB at 152.22MHz.  |
| 15.225 (e)                                             | The frequency tolerance                                                                      | Pass   | Meet the requirement of limit.                                                     |
| 15.215 (c)                                             | 20dB Bandwidth                                                                               | Pass   | Meet the requirement of limit.                                                     |
| 15.203                                                 | Antenna Requirement                                                                          | Pass   | No antenna connector is used.                                                      |

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

### 2.1 Measurement Uncertainty

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

| Measurement                        | Frequency       | Expanded Uncertainty (k=2) (±) |
|------------------------------------|-----------------|--------------------------------|
| Conducted Emissions at mains ports | 150kHz ~ 30MHz  | 2.79 dB                        |
| Radiated Emissions up to 1 GHz     | 9kHz ~ 30MHz    | 3.04 dB                        |
|                                    | 30MHz ~ 200MHz  | 2.93 dB                        |
|                                    | 200MHz ~1000MHz | 2.95 dB                        |

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

|                     |                        |
|---------------------|------------------------|
| Product             | server                 |
| Brand               | Quanta computer Inc    |
| Test Model          | A5QB                   |
| Sample Status       | Engineering sample     |
| Nominal Voltage     | 12Vdc, 170A (from PSU) |
| Modulation Type     | ASK                    |
| Operating Frequency | 13.56MHz               |
| Data Rate           | 424 kbit/s             |
| Field Strength      | 58.90dBuV/m (3m)       |
| Antenna Type        | Loop Antenna           |
| Antenna Connector   | NA                     |
| Accessory Device    | Refer to note          |
| Cable Supplied      | NA                     |

Note:

1. The EUT uses the following components.

| Type         | Vendor         | Specification / Model                                          |
|--------------|----------------|----------------------------------------------------------------|
| MB           | -              | MP-10031601-XXX (X can be any alphanumeric character or blank) |
|              | -              | MP-10033750-XXX (X can be any alphanumeric character or blank) |
| CPU          | Intel          | Xeon series up to 2.5GHz                                       |
| DIMM         | Samsung        | Memory, DDR4, 21300(2666MHz), 32GB                             |
| 2.5" HDD/SSD | Samsung        | SSD, SATA, 2.5", 240GB                                         |
|              | Intel          | SSD, PCI-e/NVMe, 2.5", 1TB                                     |
| Add on card  | Annapurna      | K2X-N                                                          |
|              |                | K2T-QB                                                         |
|              |                | K2C-AB                                                         |
|              | NVIDIA         | GPU Tesla/T4                                                   |
| NFC Module   | Smart Approach | SM-MFAD4-C02                                                   |

2. The EUT uses the following PSU. (Support unit)

| Product | Brand | Model  | Description                                   |
|---------|-------|--------|-----------------------------------------------|
| PSU     | AcBel | FSE023 | Input: 200V~240V 50/60Hz ,10A<br>Output:1600W |

#### 3.2 Description of Test Modes

1 channel is provided to this EUT

| Channel | Freq. (MHz) |
|---------|-------------|
| 1       | 13.56       |

### 3.2.1 Test Mode Applicability and Tested Channel Data

| EUT Configure Mode | Applicable to |     |    |    | Description |
|--------------------|---------------|-----|----|----|-------------|
|                    | RE            | PLC | FS | EB |             |
| -                  | √             | √   | √  | √  | -           |

Where RE: Radiated Emission  
FS: Frequency Stability

PLC: Power Line Conducted Emission  
EB: 20dB Bandwidth measurement

#### Radiated 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                 | 1              | ASK             |

#### 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                 | 1              | ASK             |

#### Frequency Stability:

- ☒ 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                 | 1              | ASK             |

#### 20dB Bandwidth:

- ☒ 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                 | 1              | ASK             |

#### Test Condition:

| Applicable to | Environmental Conditions | Input Power (System) | Tested by    |
|---------------|--------------------------|----------------------|--------------|
| RE            | 21 deg. C, 67% RH        | 220 Vac, 60 Hz       | Tim Chen     |
| PLC           | 25 deg. C, 65% RH        | 220 Vac, 60 Hz       | Jisyong Wang |
| FS            | 21 deg. C, 68% RH        | 12Vdc                | Tim Chen     |
| EB            | 23 deg. C, 66% RH        | 220 Vac, 60 Hz       | Tim Chen     |

### 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.

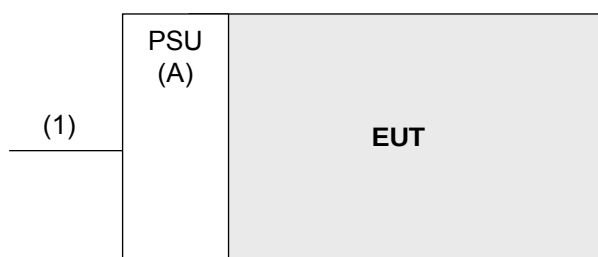
| ID | Product | Brand | Model No. | Serial No. | FCC ID | Remarks            |
|----|---------|-------|-----------|------------|--------|--------------------|
| A. | PSU     | AcBel | FSE023    | NA         | NA     | Provided by client |

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. | DC power Cable | 1    | 1          | N                  | 0            | Provided by client |

#### 3.3.1 Configuration of System under Test



### 3.4 General Description of Applied Standards and references

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

**FCC Part 15, Subpart C (15.225)**

**FCC Part 15, Subpart C (15.215)**

ANSI C63.10-2013

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

**References Test Guidance :**

**KDB 414788 D01 Radiated Test Site v01r01**

All test items have been performed as a reference to the above KDB test guidance.

## 4 Test Types and Results

### 4.1 Radiated Emission Measurement

#### 4.1.1 Limits of Radiated Emission Measurement

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

| 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.    | Cal. Date     | Cal. Due      |
|------------------------------------------------|----------------|---------------|---------------|---------------|
| Test Receiver<br>Agilent                       | N9038A         | MY51210203    | Mar. 18, 2019 | Mar. 17, 2020 |
| Spectrum Analyzer<br>Agilent                   | N9010A         | MY52220207    | Dec. 26, 2018 | Dec. 25, 2019 |
| BILOG Antenna<br>SCHWARZBECK                   | VULB 9168      | 9168-472      | Nov. 08, 2019 | Nov. 07, 2020 |
| Loop Antenna<br>TESEQ                          | HLA 6121       | 45745         | Jul. 01, 2019 | Jun. 30, 2020 |
| Preamplifier<br>EMCI                           | EMC 330H       | 980112        | Oct. 08, 2019 | Oct. 07, 2020 |
| RF Coaxial Cable<br>WOKEN                      | 8D-FB          | Cable-Ch10-01 | Oct. 08, 2019 | Oct. 07, 2020 |
| Software<br>BV ADT                             | E3<br>6.120103 | NA            | NA            | NA            |
| Antenna Tower<br>MF                            | MFA-440H       | NA            | NA            | NA            |
| Turn Table<br>MF                               | MFT-201SS      | NA            | NA            | NA            |
| Antenna Tower & Turn Table<br>Controller<br>MF | MF-7802        | 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 test was performed in HwaYa Chamber 10.

#### 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 or except (9-90 kHz, 110-490 kHz) for Average 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.
2. There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

##### 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:

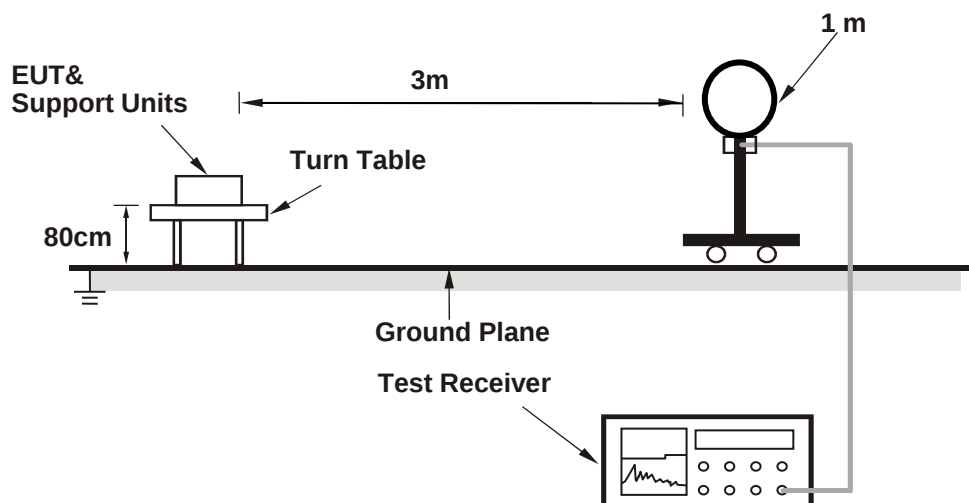
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle < 98%) or 10Hz (Duty cycle  $\geq 98\%$ ) 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

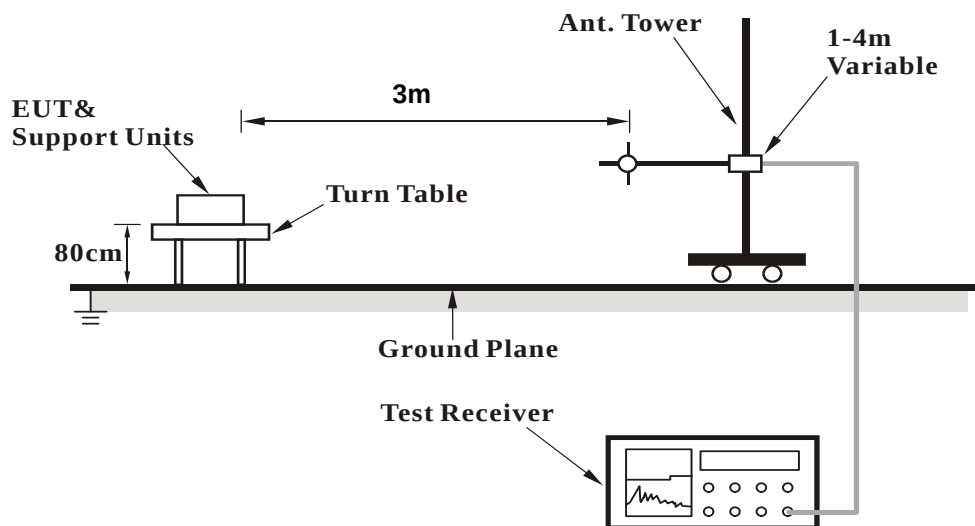
No deviation.

#### 4.1.5 Test Set Up

##### For Radiated emission below 30MHz



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



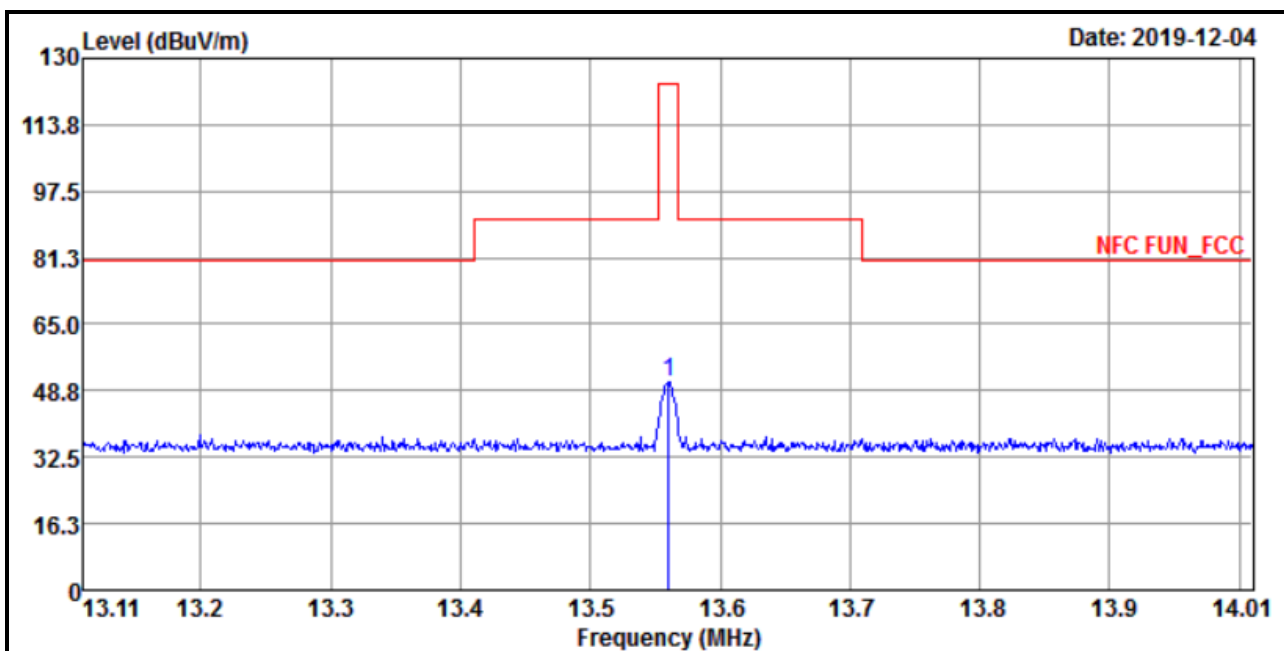
For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.1.6 EUT Operating Conditions

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

#### 4.1.7 Test Results

| EUT Test Condition       |                    | Measurement Detail |                     |
|--------------------------|--------------------|--------------------|---------------------|
| Channel                  | Channel 1          | Frequency Range    | 13.553 ~ 13.567 MHz |
| Input Power              | 220 Vac, 60 Hz     | Detector Function  | Quasi-Peak          |
| Environmental Conditions | 21 deg. C, 67 % RH | Tested By          | Tim Chen            |



| Antenna Polarity & Test Distance: Loop Antenna Parallel at 3 m |                         |                   |               |                |             |                     |                      |        |
|----------------------------------------------------------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| Frequency (MHz)                                                | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 13.56                                                          | 50.73                   | 28.88             | 21.85         | 124            | -73.27      | 100                 | 0                    | QP     |

Remarks:

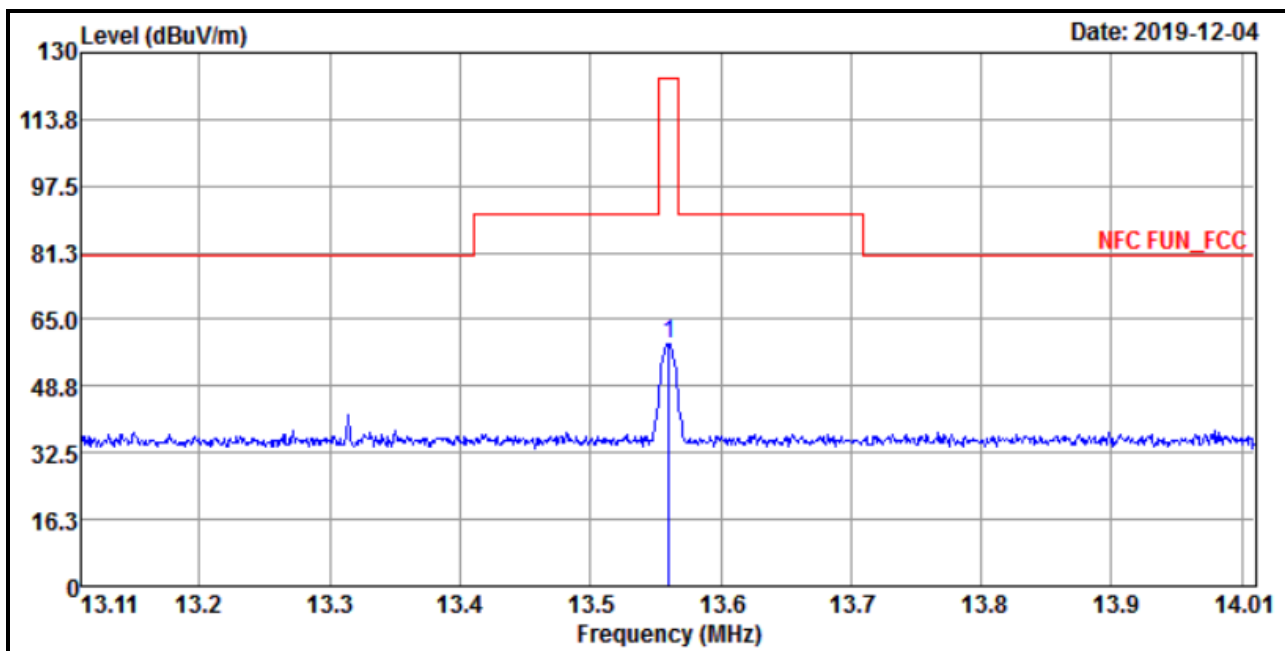
1. Emission level (dBuV/m) = Raw Value (dBuV) + Factor (dB/m)
2. The other emission levels were very low against the limit.
3. Margin value = Emission level – Limit value.
4. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

$$\begin{aligned}
 13.56 \text{ MHz} &= 15848 \text{ uV/m} && 30\text{m} \\
 &= 84 \text{ dBuV/m} && 30\text{m} \\
 &= 84 + 20\log(30/3)^2 && 3\text{m} \\
 &= 124 \text{ dBuV/m}
 \end{aligned}$$

| EUT Test Condition       |                    | Measurement Detail |                     |
|--------------------------|--------------------|--------------------|---------------------|
| Channel                  | Channel 1          | Frequency Range    | 13.553 ~ 13.567 MHz |
| Input Power              | 220 Vac, 60 Hz     | Detector Function  | Quasi-Peak          |
| Environmental Conditions | 21 deg. C, 67 % RH | Tested By          | Tim Chen            |



| Antenna Polarity & Test Distance: Loop Antenna Perpendicular at 3 m |                         |                   |               |                |             |                     |                      |        |
|---------------------------------------------------------------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| Frequency (MHz)                                                     | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 13.56                                                               | 58.90                   | 37.05             | 21.85         | 124            | -65.10      | 100                 | 360                  | QP     |

Remarks:

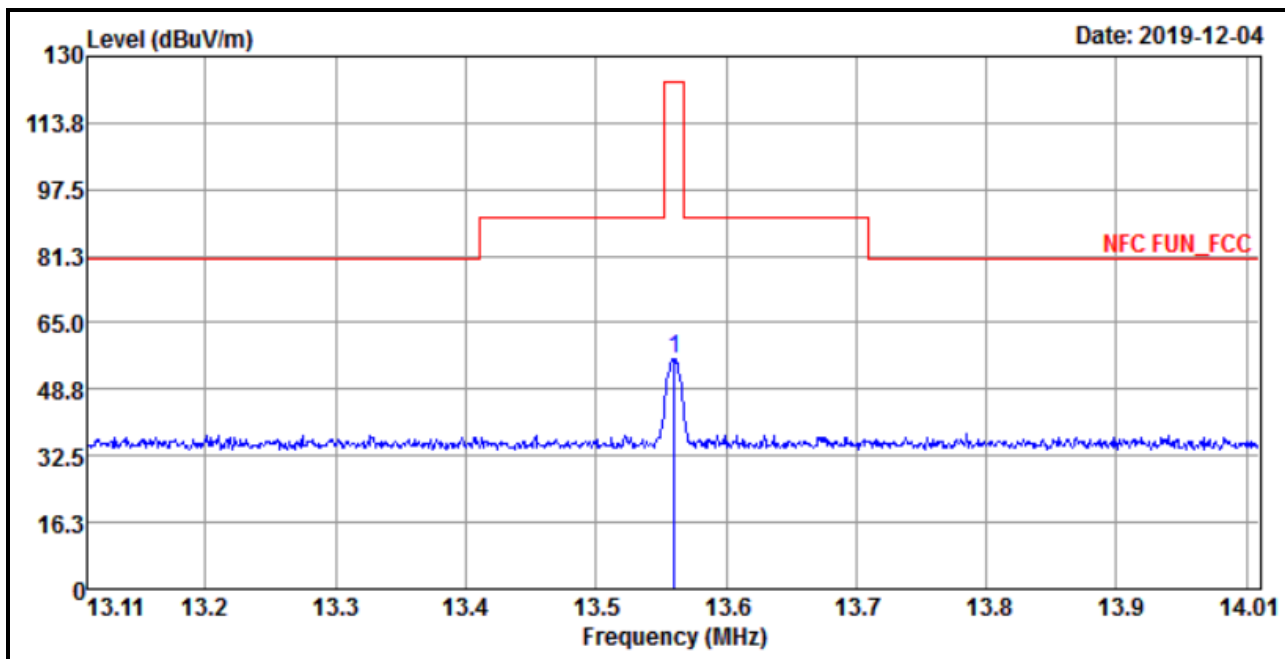
1. Emission level (dBuV/m) = Raw Value (dBuV) + Factor (dB/m)
2. The other emission levels were very low against the limit.
3. Margin value = Emission level – Limit value.
4. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

$$\begin{aligned}
 13.56 \text{ MHz} &= 15848 \text{ uV/m} & 30\text{m} \\
 &= 84 \text{ dBuV/m} & 30\text{m} \\
 &= 84 + 20\log(30/3)^2 & 3\text{m} \\
 &= 124 \text{ dBuV/m}
 \end{aligned}$$

| EUT Test Condition       |                    | Measurement Detail |                     |
|--------------------------|--------------------|--------------------|---------------------|
| Channel                  | Channel 1          | Frequency Range    | 13.553 ~ 13.567 MHz |
| Input Power              | 220 Vac, 60 Hz     | Detector Function  | Quasi-Peak          |
| Environmental Conditions | 21 deg. C, 67 % RH | Tested By          | Tim Chen            |



| Antenna Polarity & Test Distance: Loop Antenna Ground-parallel at 3 m |                         |                   |               |                |             |                     |                      |        |
|-----------------------------------------------------------------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| Frequency (MHz)                                                       | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 13.56                                                                 | 56.05                   | 34.2              | 21.85         | 124            | -67.95      | 100                 | 0                    | QP     |

Remarks:

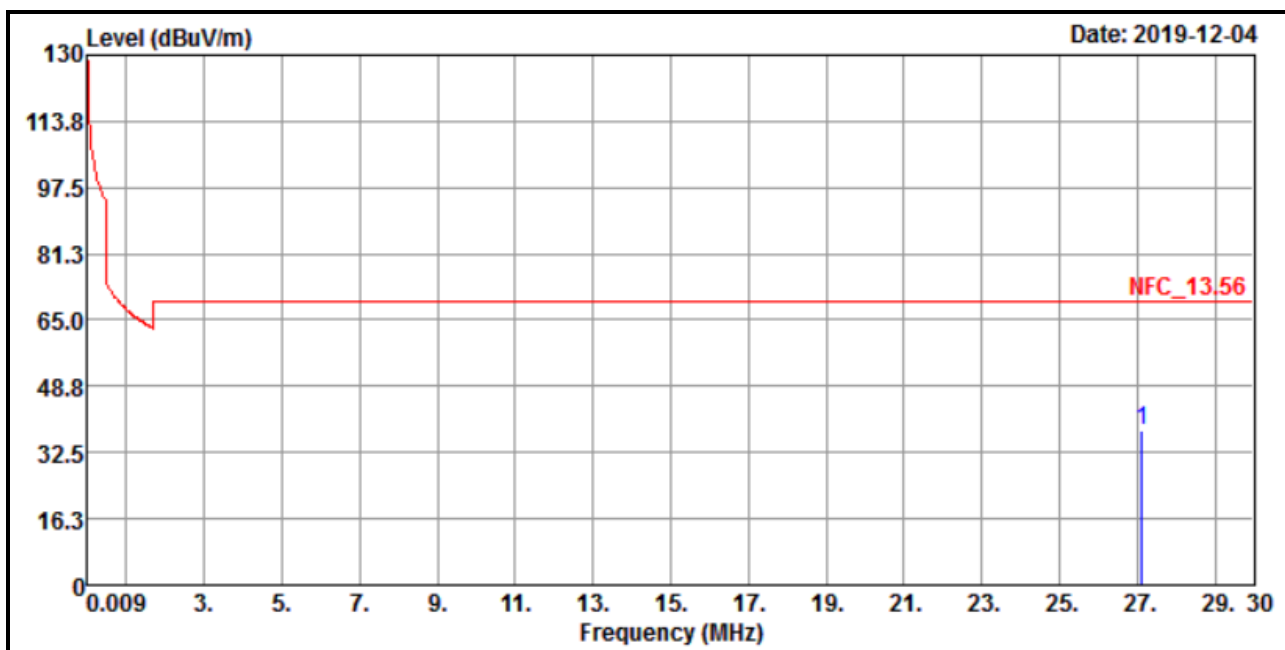
1. Emission level (dBuV/m) = Raw Value (dBuV) + Factor (dB/m)
2. The other emission levels were very low against the limit.
3. Margin value = Emission level – Limit value.
4. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

$$\begin{aligned}
 13.56 \text{ MHz} &= 15848 \text{ uV/m} && 30\text{m} \\
 &= 84 \text{ dBuV/m} && 30\text{m} \\
 &= 84 + 20\log(30/3)^2 && 3\text{m} \\
 &= 124 \text{ dBuV/m}
 \end{aligned}$$

| EUT Test Condition       |                    | Measurement Detail |              |
|--------------------------|--------------------|--------------------|--------------|
| Channel                  | Channel 1          | Frequency Range    | Below 30 MHz |
| Input Power              | 220 Vac, 60 Hz     | Detector Function  | Quasi-Peak   |
| Environmental Conditions | 21 deg. C, 67 % RH | Tested By          | Tim Chen     |



| Antenna Polarity & Test Distance: Loop Antenna Parallel at 3 m |                         |                   |               |                |             |                     |                      |        |
|----------------------------------------------------------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| Frequency (MHz)                                                | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 27.12                                                          | 37.88                   | 15.72             | 22.16         | 69.54          | -31.66      | 100                 | 360                  | QP     |

Remarks:

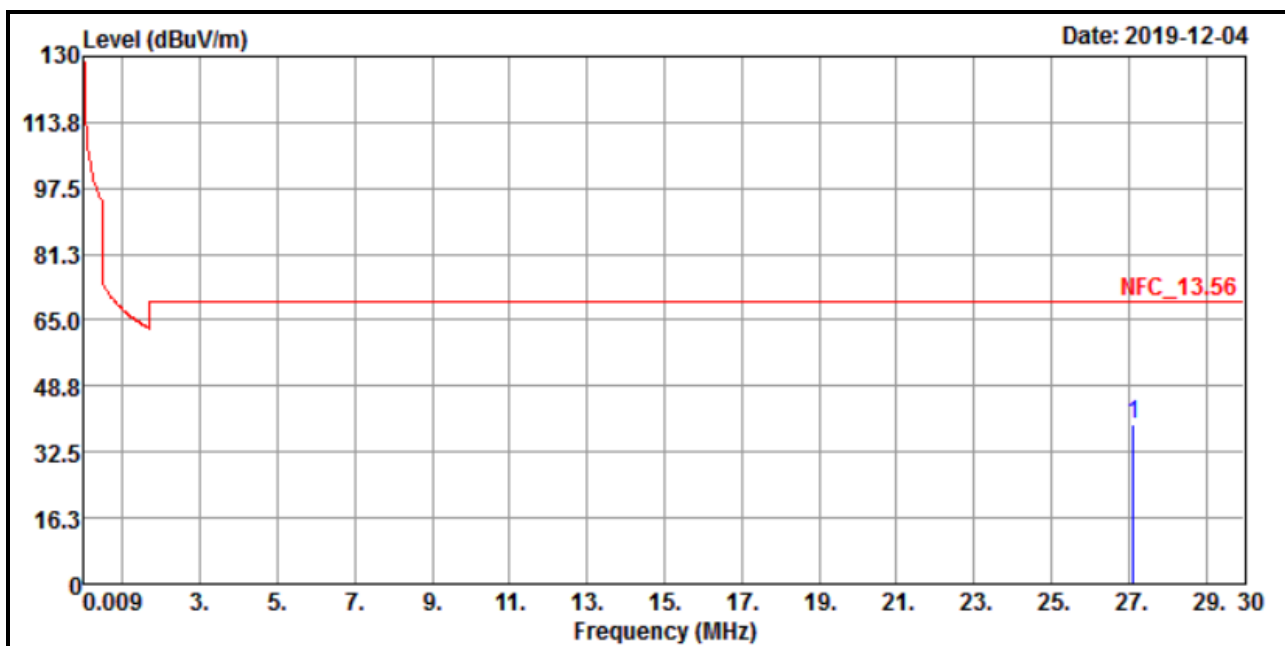
1. Emission level (dBuV/m) = Raw Value (dBuV) + Factor (dB/m)
2. The other emission levels were very low against the limit.
3. Margin value = Emission level – Limit value.

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

$$\begin{aligned}
 1.705 \text{ MHz} \sim 30 \text{ MHz} &= 30 \text{ uV/m} && 30\text{m} \quad (\text{except } 13.110\text{MHz} \sim 14.010\text{MHz}) \\
 &= 29.54 \text{ dBuV/m} && 30\text{m} \\
 &= 29.54 + 20 \log(30/3)^2 && 3\text{m} \\
 &= 69.54 \text{ dBuV/m} && 3\text{m}
 \end{aligned}$$

| EUT Test Condition       |                    | Measurement Detail |              |
|--------------------------|--------------------|--------------------|--------------|
| Channel                  | Channel 1          | Frequency Range    | Below 30 MHz |
| Input Power              | 220 Vac, 60 Hz     | Detector Function  | Quasi-Peak   |
| Environmental Conditions | 21 deg. C, 67 % RH | Tested By          | Tim Chen     |



| Antenna Polarity & Test Distance: Loop Antenna Perpendicular at 3 m |                         |                   |               |                |             |                     |                      |        |
|---------------------------------------------------------------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| Frequency (MHz)                                                     | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 27.12                                                               | 39.42                   | 17.26             | 22.16         | 69.54          | -30.12      | 100                 | 0                    | QP     |

Remarks:

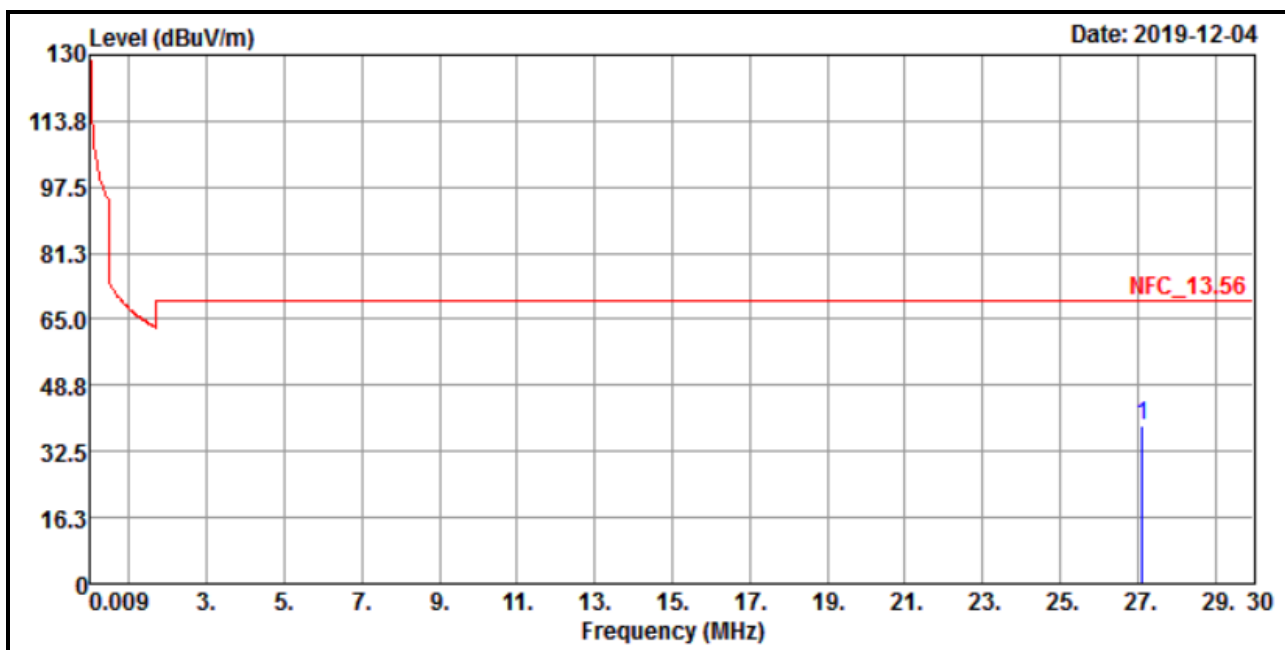
1. Emission level (dBuV/m) = Raw Value (dBuV) + Factor (dB/m)
2. The other emission levels were very low against the limit.
3. Margin value = Emission level – Limit value.

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

$$\begin{aligned}
 1.705 \text{ MHz} \sim 30 \text{ MHz} &= 30 \text{ uV/m} && 30\text{m} \quad (\text{except } 13.110\text{MHz} \sim 14.010\text{MHz}) \\
 &= 29.54 \text{ dBuV/m} && 30\text{m} \\
 &= 29.54 + 20 \log(30/3)^2 && 3\text{m} \\
 &= 69.54 \text{ dBuV/m} && 3\text{m}
 \end{aligned}$$

| EUT Test Condition       |                    | Measurement Detail |              |
|--------------------------|--------------------|--------------------|--------------|
| Channel                  | Channel 1          | Frequency Range    | Below 30 MHz |
| Input Power              | 220 Vac, 60 Hz     | Detector Function  | Quasi-Peak   |
| Environmental Conditions | 21 deg. C, 67 % RH | Tested By          | Tim Chen     |



| Antenna Polarity & Test Distance: Loop Antenna Ground-parallel at 3 m |                         |                   |               |                |             |                     |                      |        |
|-----------------------------------------------------------------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| Frequency (MHz)                                                       | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 27.12                                                                 | 39.05                   | 16.89             | 22.16         | 69.54          | -30.49      | 100                 | 0                    | QP     |

Remarks:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Factor (dB/m)
2. The other emission levels were very low against the limit.
3. Margin value = Emission level – Limit value.

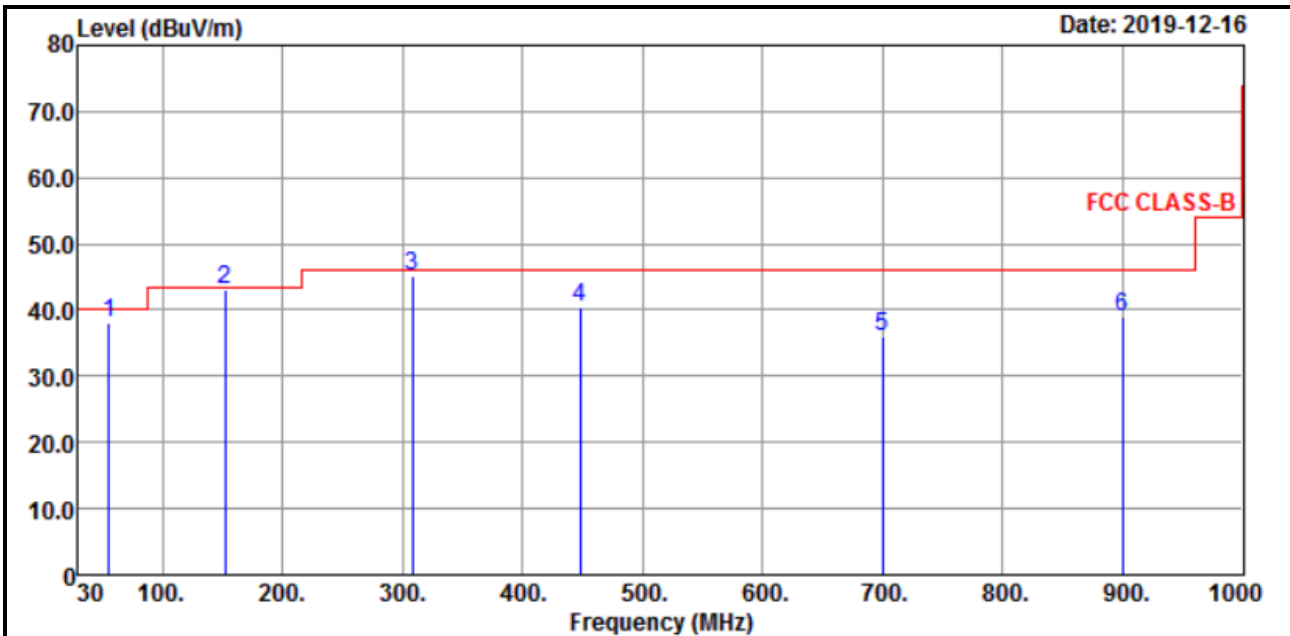
The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

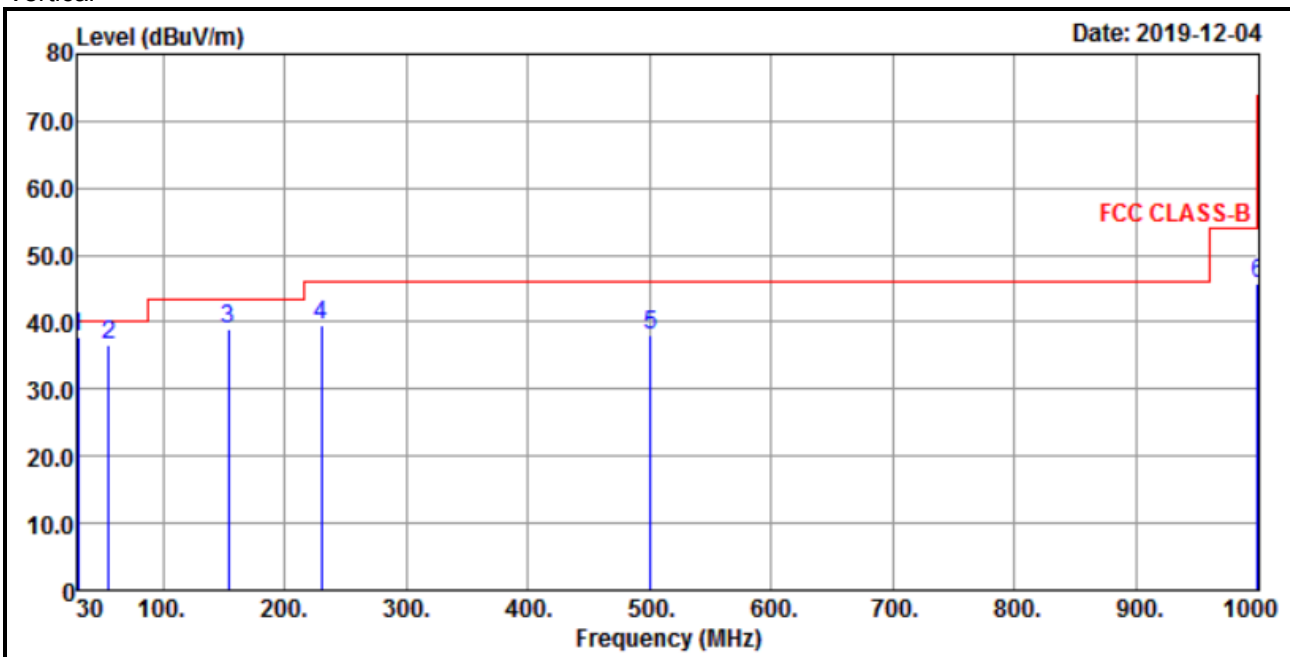
$$\begin{aligned}
 1.705 \text{ MHz} \sim 30 \text{ MHz} &= 30 \text{ uV/m} && 30\text{m} \quad (\text{except } 13.110\text{MHz} \sim 14.010\text{MHz}) \\
 &= 29.54 \text{ dBuV/m} && 30\text{m} \\
 &= 29.54 + 20 \log(30/3)^2 && 3\text{m} \\
 &= 69.54 \text{ dBuV/m} && 3\text{m}
 \end{aligned}$$

| EUT Test Condition       |                    | Measurement Detail |                |
|--------------------------|--------------------|--------------------|----------------|
| Channel                  | Channel 1          | Frequency Range    | Below 1000 MHz |
| Input Power              | 220 Vac, 60 Hz     | Detector Function  | Quasi-Peak     |
| Environmental Conditions | 21 deg. C, 67 % RH | Tested By          | Tim Chen       |

#### Horizontal



#### Vertical



| Antenna Polarity & Test Distance: Horizontal at 3 m |                         |                   |               |                |             |                     |                      |        |
|-----------------------------------------------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| Frequency (MHz)                                     | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 55.22                                               | 38.02                   | 49.95             | -11.93        | 40             | -1.98       | 168                 | 203                  | Peak   |
| 152.22                                              | 43.22                   | 54.93             | -11.71        | 43.5           | -0.28       | 180                 | 122                  | QP     |
| 308.39                                              | 45.16                   | 56.01             | -10.85        | 46             | -0.84       | 100                 | 226                  | QP     |
| 448.07                                              | 40.42                   | 46.90             | -6.48         | 46             | -5.58       | 177                 | 103                  | Peak   |
| 700.27                                              | 35.92                   | 36.57             | -0.65         | 46             | -10.08      | 103                 | 164                  | Peak   |
| 900.09                                              | 39.00                   | 36.02             | 2.98          | 46             | -7.00       | 118                 | 222                  | Peak   |
| Antenna Polarity & Test Distance: Vertical at 3 m   |                         |                   |               |                |             |                     |                      |        |
| Frequency (MHz)                                     | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 30.03                                               | 37.74                   | 50.63             | -12.89        | 40             | -2.26       | 121                 | 48                   | Peak   |
| 55.22                                               | 36.65                   | 48.58             | -11.93        | 40             | -3.35       | 100                 | 126                  | QP     |
| 154.16                                              | 38.93                   | 50.49             | -11.56        | 43.5           | -4.57       | 106                 | 241                  | Peak   |
| 229.82                                              | 39.69                   | 54.27             | -14.58        | 46             | -6.31       | 116                 | 138                  | Peak   |
| 500.45                                              | 38.11                   | 43.55             | -5.44         | 46             | -7.89       | 129                 | 304                  | Peak   |
| 1000.00                                             | 45.90                   | 41.92             | 3.98          | 54             | -8.10       | 133                 | 155                  | Peak   |

Remarks:

1. Emission Level = Read Level + Factor
2. Margin value = Emission level – Limit value.
3. The other emission levels were very low against the limit.
4. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)  
– Pre-Amplifier Factor (dB)

## 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      |
|------------------------------------------|--------------------------|----------------|---------------|---------------|
| Test Receiver<br>ROHDE & SCHWARZ         | ESR3                     | 102412         | Feb. 14, 2019 | Feb. 13, 2020 |
| RF signal cable (with 10dB PAD)<br>Woken | 5D-FB                    | Cable-cond2-01 | Sep. 05, 2019 | Sep. 04, 2020 |
| LISN<br>ROHDE & SCHWARZ<br>(EUT)         | ESH2-Z5                  | 100100         | Jan. 30, 2019 | Jan. 29, 2020 |
| LISN<br>ROHDE & SCHWARZ<br>(Peripheral)  | ESH3-Z5                  | 100312         | Aug. 13, 2019 | Aug. 12, 2020 |
| Software<br>ADT                          | BV ADT_Cond_<br>V7.3.7.4 | 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 test was performed in HwaYa Shielded Room 2.  
3. The VCCI Site Registration No. is C-12047.

### 4.2.3 Test Procedures

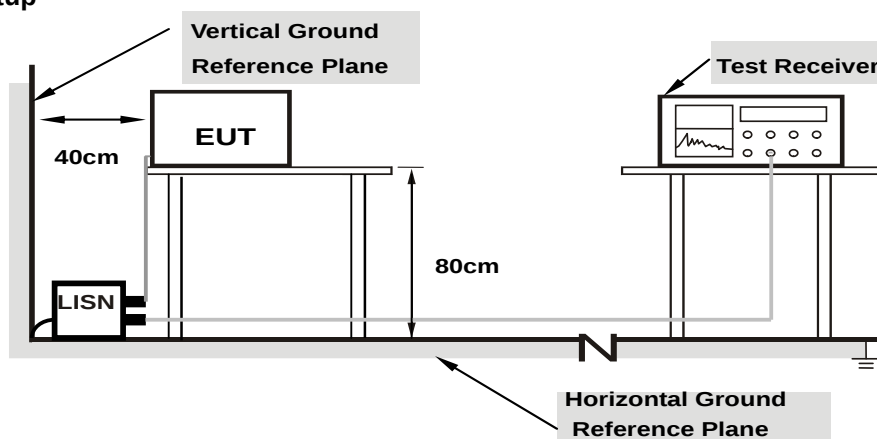
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

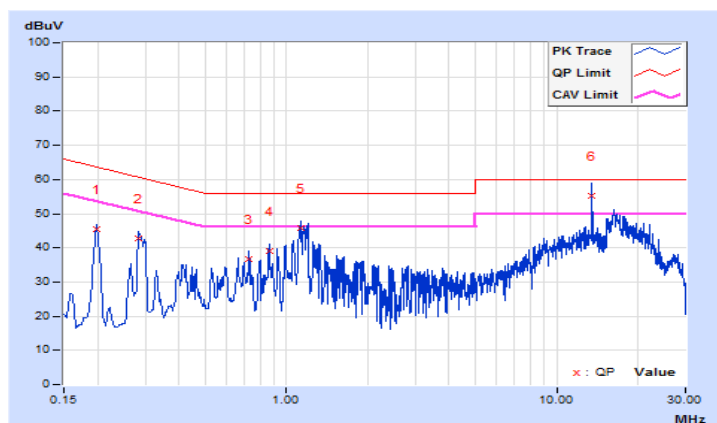
## 4.2.7 Test Results

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

| No | Freq.<br>[MHz] | Corr.<br>Factor<br>(dB) | Reading Value<br>[dB (uV)] |       | Emission Level<br>[dB (uV)] |       | Limit<br>[dB (uV)] |       | Margin<br>(dB) |        |
|----|----------------|-------------------------|----------------------------|-------|-----------------------------|-------|--------------------|-------|----------------|--------|
|    |                |                         |                            |       |                             |       |                    |       |                |        |
|    |                |                         | Q.P.                       | AV.   | Q.P.                        | AV.   | Q.P.               | AV.   | Q.P.           | AV.    |
| 1  | 0.19800        | 10.12                   | 35.50                      | 30.81 | 45.62                       | 40.93 | 63.69              | 53.69 | -18.07         | -12.76 |
| 2  | 0.28200        | 10.14                   | 32.74                      | 26.33 | 42.88                       | 36.47 | 60.76              | 50.76 | -17.88         | -14.29 |
| 3  | 0.72600        | 10.19                   | 26.63                      | 21.28 | 36.82                       | 31.47 | 56.00              | 46.00 | -19.18         | -14.53 |
| 4  | 0.86200        | 10.21                   | 28.98                      | 22.73 | 39.19                       | 32.94 | 56.00              | 46.00 | -16.81         | -13.06 |
| 5  | 1.13000        | 10.23                   | 35.54                      | 27.19 | 45.77                       | 37.42 | 56.00              | 46.00 | -10.23         | -8.58  |
| 6  | 13.55800       | 10.49                   | 44.57                      | 36.37 | 55.06                       | 46.86 | 60.00              | 50.00 | -4.94          | -3.14  |

### 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.

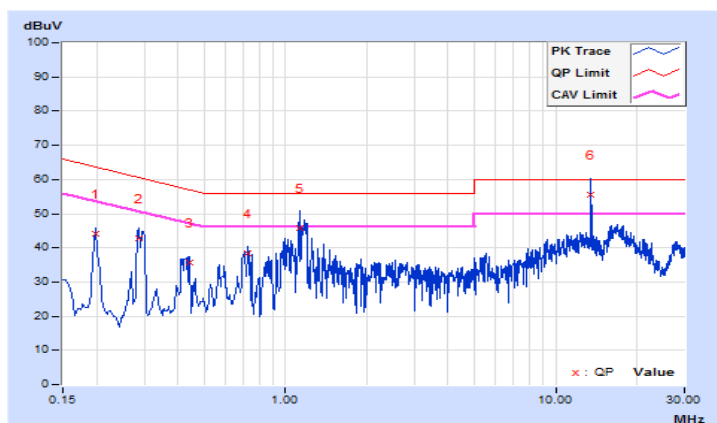


|       |             |                   |                                |
|-------|-------------|-------------------|--------------------------------|
| Phase | Neutral (N) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|-------|-------------|-------------------|--------------------------------|

| No | Freq.<br>[MHz] | Corr.<br>Factor<br>(dB) | Reading Value |       | Emission Level |       | Limit     |       | Margin |        |
|----|----------------|-------------------------|---------------|-------|----------------|-------|-----------|-------|--------|--------|
|    |                |                         | [dB (uV)]     |       | [dB (uV)]      |       | [dB (uV)] |       | (dB)   |        |
|    |                |                         | Q.P.          | AV.   | Q.P.           | AV.   | Q.P.      | AV.   | Q.P.   | AV.    |
| 1  | 0.19800        | 10.18                   | 33.99         | 30.62 | 44.17          | 40.80 | 63.69     | 53.69 | -19.52 | -12.89 |
| 2  | 0.28600        | 10.20                   | 32.68         | 26.31 | 42.88          | 36.51 | 60.64     | 50.64 | -17.76 | -14.13 |
| 3  | 0.43945        | 10.22                   | 25.49         | 18.46 | 35.71          | 28.68 | 57.07     | 47.07 | -21.36 | -18.39 |
| 4  | 0.72600        | 10.25                   | 28.13         | 21.20 | 38.38          | 31.45 | 56.00     | 46.00 | -17.62 | -14.55 |
| 5  | 1.13000        | 10.29                   | 35.45         | 29.15 | 45.74          | 39.44 | 56.00     | 46.00 | -10.26 | -6.56  |
| 6  | 13.55800       | 10.62                   | 44.86         | 36.77 | 55.48          | 47.39 | 60.00     | 50.00 | -4.52  | -2.61  |

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.

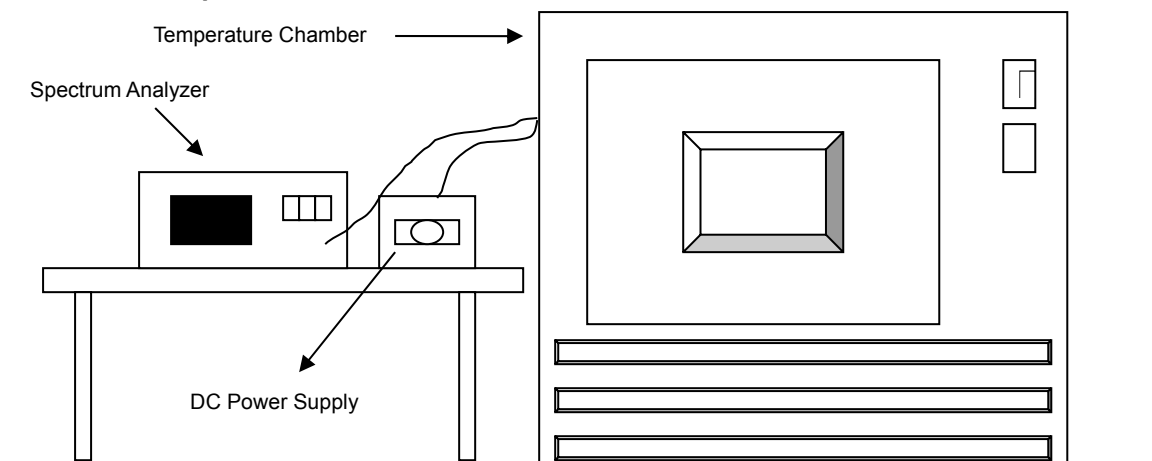


### 4.3 Frequency Stability

#### 4.3.1 Limits of Frequency Stability Measurement

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of  $-20$  degrees to  $50$  degrees C at normal supply voltage, and for a variation in the primary supply voltage from  $85\%$  to  $115\%$  of the rated supply voltage at a temperature of  $20$  degrees C.

#### 4.3.2 Test Setup



#### 4.3.3 Test Instruments

| Description & Manufacturer                             | Model No. | Serial No. | Cal. Date     | Cal. Due      |
|--------------------------------------------------------|-----------|------------|---------------|---------------|
| Spectrum Analyzer<br>ROHDE & SCHWARZ                   | FSP40     | 100039     | Jun. 12, 2019 | Jun. 11, 2020 |
| Standard Temperature<br>And Humidity Chamber<br>TERCHY | MHU-225AU | 920842     | May 31, 2019  | May 30, 2020  |
| Digital Multimeter<br>Fluke                            | 87-III    | 70360742   | Jun. 27, 2019 | Jun. 26, 2020 |
| DC Power Supply<br>Topward                             | 6306A     | 727263     | NA            | NA            |
| True RMS Clamp Meter<br>Fluke                          | 325       | 31130711WS | May 21, 2019  | May 20, 2020  |

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

#### 4.3.4 Test Procedure

- The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
- Turned the EUT on and coupled its output to a spectrum analyzer.
- Turned the EUT off and set the chamber to the highest temperature specified.
- Allowed sufficient time (approximately 30 min) for the temperature of the chamber to stabilize then turned the EUT on and measured the operating frequency after 2, 5, and 10 minutes.
- Repeat step (d) with the temperature chamber set to the next desired temperature until measurements down to the lowest specified temperature have been completed.
- The test chamber was allowed to stabilize at  $+20$  degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from  $85\%$  to  $115\%$  and the frequency record.

#### 4.3.5 Deviation from Test Standard

No deviation.

#### 4.3.6 EUT Operating Conditions

Same as Item 4.1.6.

#### 4.3.7 Test Result

| Frequency Stability Versus Temp. |                          |                       |                    |                       |                    |                       |                    |                       |                    |
|----------------------------------|--------------------------|-----------------------|--------------------|-----------------------|--------------------|-----------------------|--------------------|-----------------------|--------------------|
| TEMP.<br>(°C)                    | Power<br>Supply<br>(Vdc) | 0 Minute              |                    | 2 Minute              |                    | 5 Minute              |                    | 10 Minute             |                    |
|                                  |                          | Measured<br>Frequency | Frequency<br>Drift | Measured<br>Frequency | Frequency<br>Drift | Measured<br>Frequency | Frequency<br>Drift | Measured<br>Frequency | Frequency<br>Drift |
|                                  |                          | (MHz)                 | %                  | (MHz)                 | %                  | (MHz)                 | %                  | (MHz)                 | %                  |
| 50                               | 12                       | 13.56004              | 0.00029            | 13.56003              | 0.00022            | 13.56003              | 0.00022            | 13.56003              | 0.00022            |
| 40                               | 12                       | 13.56004              | 0.00029            | 13.56004              | 0.00029            | 13.56004              | 0.00029            | 13.56004              | 0.00029            |
| 30                               | 12                       | 13.56001              | 0.00007            | 13.56001              | 0.00007            | 13.56001              | 0.00007            | 13.56001              | 0.00007            |
| 20                               | 12                       | 13.56                 | 0.00000            | 13.56001              | 0.00007            | 13.55999              | -0.00007           | 13.56001              | 0.00007            |
| 10                               | 12                       | 13.56001              | 0.00007            | 13.56002              | 0.00015            | 13.56002              | 0.00015            | 13.56001              | 0.00007            |
| 0                                | 12                       | 13.55996              | -0.00029           | 13.55996              | -0.00029           | 13.55996              | -0.00029           | 13.55996              | -0.00029           |
| -10                              | 12                       | 13.55994              | -0.00044           | 13.55993              | -0.00052           | 13.55994              | -0.00044           | 13.55994              | -0.00044           |
| -20                              | 12                       | 13.56002              | 0.00015            | 13.56002              | 0.00015            | 13.56002              | 0.00015            | 13.56003              | 0.00022            |

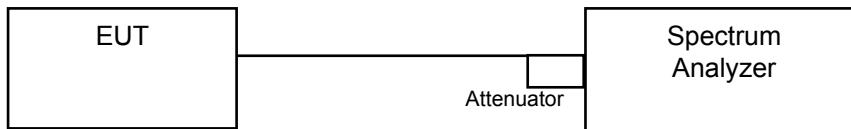
| Frequency Stability Versus Voltage |                          |                       |                    |                       |                    |                       |                    |                       |                    |
|------------------------------------|--------------------------|-----------------------|--------------------|-----------------------|--------------------|-----------------------|--------------------|-----------------------|--------------------|
| TEMP.<br>(°C)                      | Power<br>Supply<br>(Vdc) | 0 Minute              |                    | 2 Minute              |                    | 5 Minute              |                    | 10 Minute             |                    |
|                                    |                          | Measured<br>Frequency | Frequency<br>Drift | Measured<br>Frequency | Frequency<br>Drift | Measured<br>Frequency | Frequency<br>Drift | Measured<br>Frequency | Frequency<br>Drift |
|                                    |                          | (MHz)                 | %                  | (MHz)                 | %                  | (MHz)                 | %                  | (MHz)                 | %                  |
| 20                                 | 13.8                     | 13.56                 | 0.00000            | 13.56001              | 0.00007            | 13.55999              | -0.00007           | 13.56001              | 0.00007            |
|                                    | 12                       | 13.56                 | 0.00000            | 13.56001              | 0.00007            | 13.55999              | -0.00007           | 13.56001              | 0.00007            |
|                                    | 10.2                     | 13.56                 | 0.00000            | 13.56001              | 0.00007            | 13.55999              | -0.00007           | 13.56001              | 0.00007            |

#### 4.4 20dB Bandwidth

##### 4.4.1 Limits of 20dB Bandwidth Measurement

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

##### 4.4.2 Test Setup



##### 4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

##### 4.4.4 Test Procedures

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 1kHz RBW and 3kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

##### 4.4.5 Deviation from Test Standard

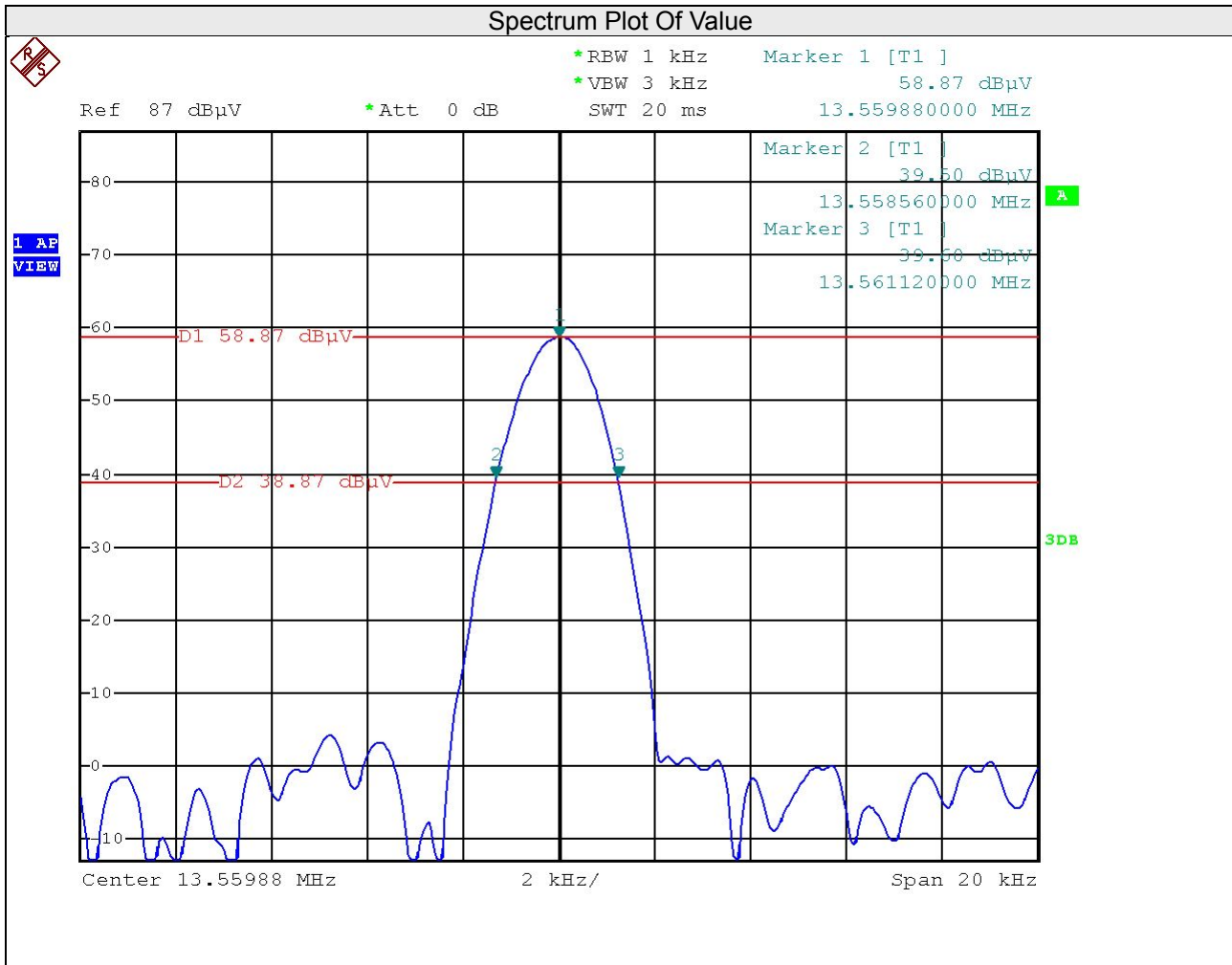
No deviation.

##### 4.4.6 EUT Operating Conditions

Same as Item 4.1.6.

#### 4.4.7 Test Results

| 20dBc point (Low) | 20dBc point (High) | Operating frequency band (MHz) | 20dBc Bandwidth (kHz) | Pass / Fail |
|-------------------|--------------------|--------------------------------|-----------------------|-------------|
| 13.5586 MHz       | 13.56112 MHz       | 13.553~13.567                  | 2.56                  | Pass        |



## 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 and approved according to ISO/IEC 17025.

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

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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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