# FCC Test Report

| | |
|---|---|
| **Report No.:** | RF181024C19 |
| **FCC ID:** | E2K-DWRFID1802 |
| **Test Model:** | DWRFID1802 |
| **Received Date:** | Oct. 24, 2018 |
| **Test Date:** | Dec. 27, 2018 ~ Jan. 02, 2019 |
| **Issued Date:** | Jan. 08, 2019 |
| **Applicant:** | Dell Inc. |
| **Address:** | One Dell Way, Round Rock, Texas 78682, USA |
| **Issued By:** | Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch |
| **Lab Address:** | No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan ( R.O.C ) |
| **Test Location:** | No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C. |
| **FCC Registration / Designation Number:** | 788550 / TW0003 |

Testing Laboratory
2021

## Table of Contents

## Release Control Record

| Issue No. | Description | Date Issued |
|---|---|---|
| RF181024C19 | Original Release | Jan. 08, 2019 |

## 1 Certificate of Conformity

| | |
|---|---|
| **Product:** | RFID 13.56MHz Wireless Module |
| **Brand:** | DELL |
| **Test Model:** | DWRFID1802 |
| **Sample Status:** | Production Unit |
| **Applicant:** | Dell Inc. |
| **Test Date:** | Dec. 27, 2018 ~ Jan. 02, 2019 |
| **Standards:** | 47 CFR FCC Part 15, Subpart C (Section 15.225)<br>47 CFR FCC Part 15, Subpart C (Section 15.215)<br>ANSI C63.10:2013 |

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

**Prepared by :** Rona Chen , **Date:** Jan. 08, 2019

Rona Chen / Specialist

**Approved by :** , **Date:** Jan. 08, 2019

Dylan Chiou / Project Engineer

## 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. Minimum passing margin is -7.33 dB at 0.17734 MHz. |
| 15.225 (a) | The field strength of any emissions within the band 13.553-13.567 MHz | Pass | Meet the requirement of limit. Minimum passing margin is -73.08 dB at 13.56 MHz. |
| 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. Minimum passing margin is -5.51 dB at 40.67 MHz. |
| 15.225 (e) | The frequency tolerance | Pass | Meet the requirement of limit. |
| 15.215 (c) | 20 dB Bandwidth | Pass | Meet the requirement of limit. |
| 15.203 | Antenna Requirement | Pass | No antenna connector is used. |

### 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** | **Expended Uncertainty (k=2) (±)** |
|---|---|---|
| Conducted Emissions at mains ports | 150 kHz ~ 30 MHz | 2.44 dB |
| Radiated Emissions up to 1 GHz | 30 MHz ~ 200 MHz | 2.93 dB |
| | 200 MHz ~ 1000 MHz | 2.95 dB |

### 2.2 Modification Record

There were no modifications required for compliance.

## 3 General Information

### 3.1 General Description of EUT

| | |
|---|---|
| **Product** | RFID 13.56MHz Wireless Module |
| **Brand** | DELL |
| **Test Model** | DWRFID1802 |
| **Status of EUT** | Production Unit |
| **Power Supply Rating** | 3.3 Vdc (Host equipment) |
| **Modulation Type** | ASK |
| **Data Rate** | Type A: 106 kbit/s<br>Type B: 106 kbit/s<br>Type F: 212 kbit/s, 424 kbit/s |
| **Operating Frequency** | 13.56 MHz |
| **Field Strength** | 50.92 dBμV/m @ 3m<br>10.92 dBμV/m @ 30m |
| **Antenna Type** | Refer to Note as below |
| **Accessory Device** | N/A |
| **Data Cable Supplied** | N/A |

Note:

1. The EUT is authorized for use in specific End-product and listed as below.

| Product | Brand | Model |
|---|---|---|
| Portable Computer – Tablet | DELL | T04J |

2. The antenna of EUT is listed as below.

| Manufacture | Model No. | Antenna Type | Antenna Gain (dBi) |
|---|---|---|---|
| Yageo | ANTA0DC12731NFCA1<br>(DC33002690L) | Loop Antenna | 0 |
| WNC | 81EAA815.G28<br>(DC33002870L) | Loop Antenna | 0 |

3. After the pretest, the EUT was placed stand alone as the worst case mode for final test.
4. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

## 3.2 Description of Test Modes

One channel was provided to this EUT:

| Channel | Frequency (MHz) |
|---|---|
| 1 | 13.56 |

### 3.2.1 Test Mode Applicability and Tested Channel Detail

| EUT Configure Mode | Applicable To | | | | Description |
|---|---|---|---|---|---|
| | RE | PLC | FS | EB | |
| A | √ | √ | √ | √ | EUT with WNC antenna |
| B | √ | √ | √ | √ | EUT with Yageo antenna |

Where **RE:** Radiated Emission **PLC:** Power Line Conducted Emission
**FS:** Frequency Stability **EB:** 20 dB Bandwidth measurement

**NOTE:**

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.
2. The EUT had been pre-tested on Type A, Type B, and Type F. The worst case was found when data rate was Type A . Therefore, Type A was chosen for final test.

**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 | Axis |
|---|---|---|---|---|
| A, B | 1 | 1 | ASK | Y |

**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 | Axis |
|---|---|---|---|---|
| A, B | 1 | 1 | ASK | Y |

**Frequency Stability:**

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

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

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type | Axis |
|---|---|---|---|---|
| A, B | 1 | 1 | ASK | Y |

**20 dB Bandwidth:**

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

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

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type | Axis |
|---|---|---|---|---|
| A, B | 1 | 1 | ASK | Y |

**Test Condition:**

| Applicable To | Environmental Conditions | Input Power | Tested By |
|---|---|---|---|
| RE | 25 deg. C, 65 % RH | 120 Vac, 60 Hz | Jisyong Wang |
| FS | 25 deg. C, 65 % RH | 120 Vac, 60 Hz | Jisyong Wang |
| PLC | 25 deg. C, 65 % RH | 120 Vac, 60 Hz | Thomas Wei |
| EB | 25 deg. C, 65 % RH | 120 Vac, 60 Hz | Jisyong Wang |

## 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.

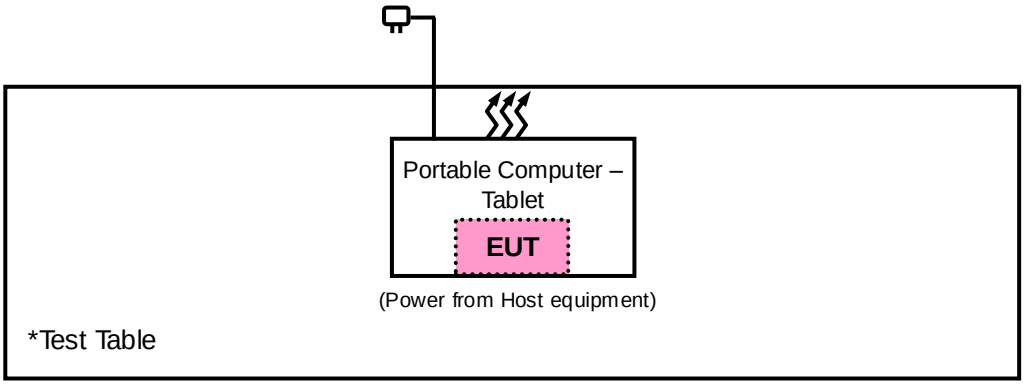
| No. | Product | Brand | Model No. | Serial No. | FCC ID |
|---|---|---|---|---|---|
| 1. | Portable Computer – Tablet | DELL | T04J | N/A | N/A |
| 2. | Adapter | DELL | AA45NM170 | N/A | N/A |

| No. | Signal Cable Description Of The Above Support Units |
|---|---|
| 1. | 0.85m shielded power cord |

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Items 1~2 was provided by client.

### 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 (15.225)**
**FCC Part 15, Subpart C (15.215)**
**KDB 414788 D01 Radiated Test Site v01r01**
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 Measurement

### 4.1.1 Limits of Radiated Emission Measurement

a. The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
b. 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.
c. 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.
d. 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 as below table:

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

**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 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

4.1.2 Test Instruments

| Description & Manufacturer | Model No. | Serial No. | Date of Calibration | Due Date of Calibration |
|---|---|---|---|---|
| Test Receiver Agilent | N9038A | MY51210203 | Mar. 16, 2018 | Mar. 15, 2019 |
| Spectrum Analyzer Agilent | N9010A | MY52220314 | Dec. 13, 2018 | Dec. 12, 2019 |
| Spectrum Analyzer ROHDE & SCHWARZ | FSU43 | 101261 | Jan. 11, 2018 | Jan. 10, 2019 |
| BILOG Antenna SCHWARZBECK | VULB 9168 | 9168-472 | Nov. 23, 2018 | Nov. 22, 2019 |
| Loop Antenna | EM-6879 | 269 | Sep. 07, 2018 | Sep. 06, 2019 |
| Preamplifier EMCI | EMC001340 | 980201 | Oct. 12, 2018 | Oct. 11, 2019 |
| Preamplifier EMCI | EMC 330H | 980112 | Oct. 12, 2018 | Oct. 11, 2019 |
| RF Coaxial Cable WOKEN | 8D-FB | Cable-Ch10-01 | Oct. 12, 2018 | Oct. 11, 2019 |
| Software BV ADT | E3 6.120103 | NA | NA | NA |
| Antenna Tower MF | MFA-440H | NA | NA | NA |
| Turn Table MF | MFT-201SS | NA | NA | NA |
| Antenna Tower &Turn Table Controller MF | MF-7802 | NA | NA | NA |
| Temperature & Humidity Chamber | GTH-120-40-CP-AR | MAA1306-019 | Sep. 05, 2018 | Sep. 04, 2019 |
| DC Power Supply Topward | 33010D | 807748 | Oct. 24, 2018 | Oct. 23, 2019 |
| Digital Multimeter Fluke | 87-III | 70360742 | Jun. 29, 2018 | Jun. 28, 2019 |

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.
3. The horn antenna and preamplifier (model: EMC 184045) are used only for the measurement of emission frequency above 1 GHz if tested.
4. The IC Site Registration No. is 7450F-10.

4.1.3 Test Procedures

**For Radiated Emission below 30 MHz**

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 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. Both 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 9 kHz at frequency below 30 MHz.

**For Radiated Emission above 30 MHz**

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

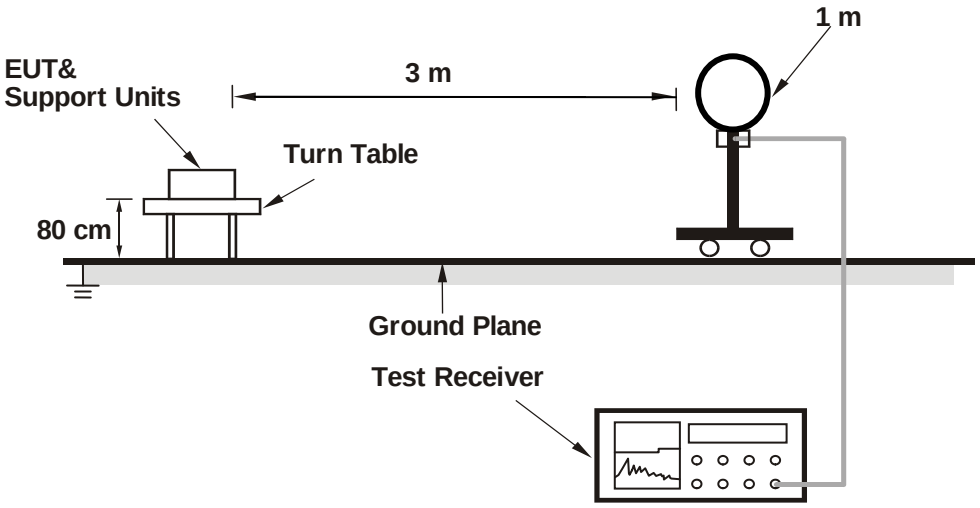
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.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

4.1.4 Deviation from Test Standard

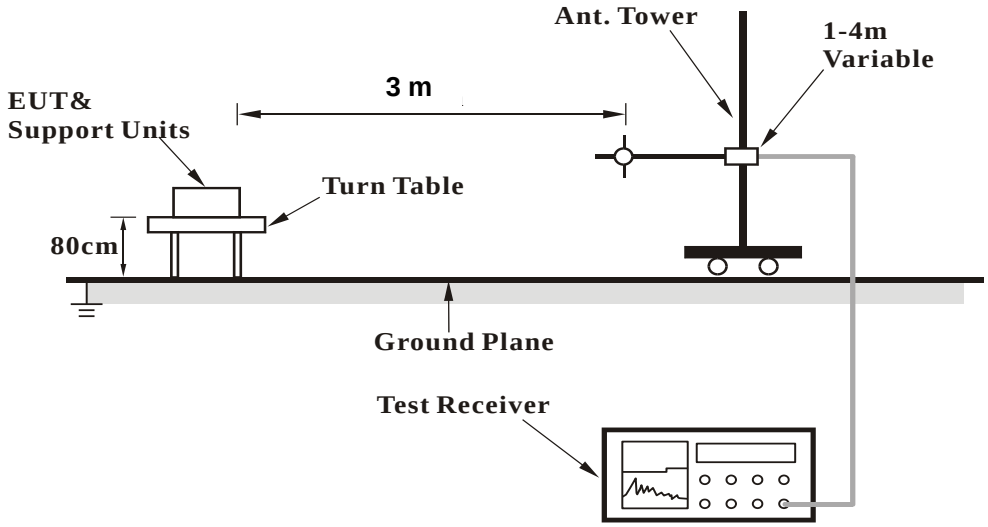
No deviation.

4.1.5 Test Set Up

**<Radiated Emission below 30 MHz>**




**<Radiated Emission 30 MHz to 1 GHz>**




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

KDB 414788 OATs and Chamber Correlation Justification

- Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

- Open-field site and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

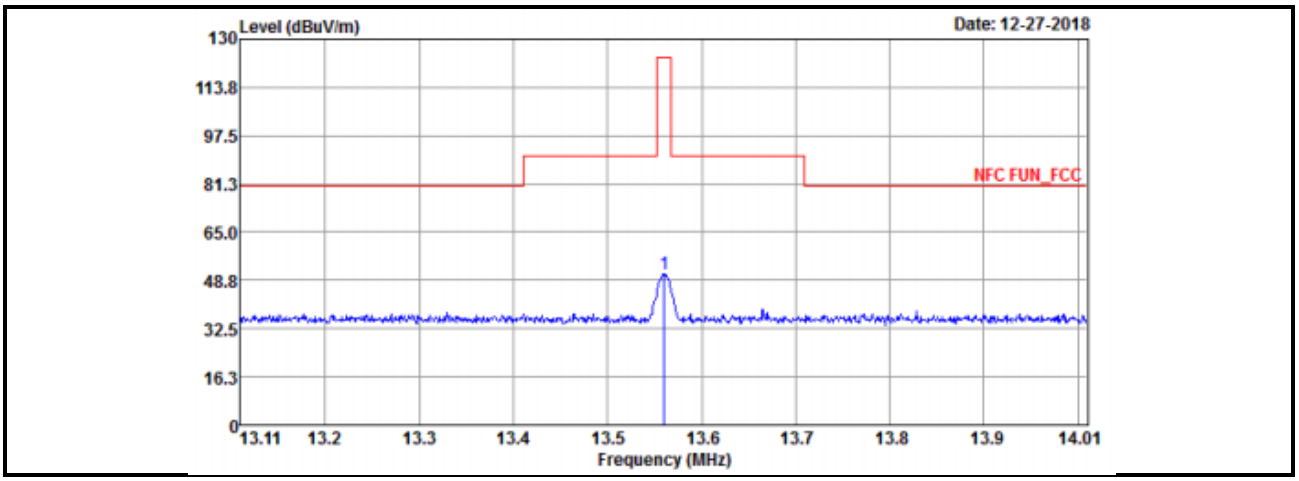
4.1.6 EUT Operating Conditions

a. Placed the EUT on the testing table.
b. Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

**Mode A**

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| **Channel** | Channel 1 | **Frequency Range** | 13.553 ~ 13.567 MHz |
| **Input Power** | 120 Vac, 60 Hz | **Detector Function** | Quasi-Peak |
| **Environmental Conditions** | 25 deg. C, 65 % RH | **Tested By** | Jisyong Wang |




| Antenna Polarity & Test Distance: Loop Antenna Open at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Limit (dBuV/m) | Margin (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 13.56 | 50.92 | 71.47 | 124 | -73.08 | 20.5 | 0.31 | 41.36 | 100 | 360 | QP |

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. 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:

13.56 MHz = 15848 uV/m 30m

= 84 dBuV/m 30m

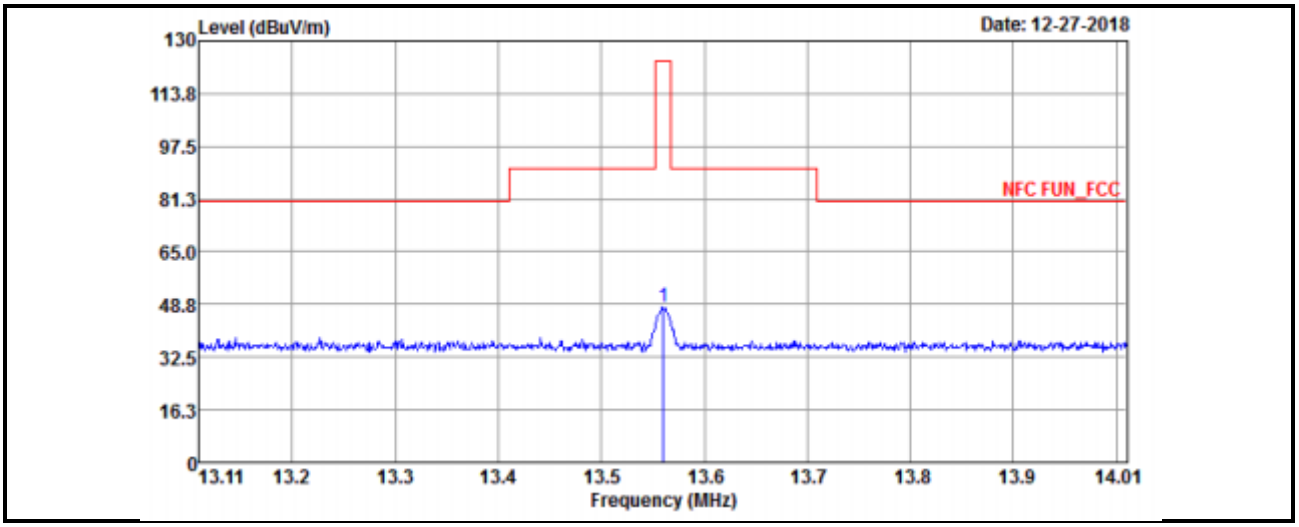
= $84+20\log(30/3)^2$ 3m

= 124 dBuV/m

| Antenna Polarity & Test Distance: Loop Antenna Open at 30 m | | | | |
|---|---|---|---|---|
| Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
| 13.56 | 10.92 | 84 | -73.08 | QP |

Remarks: Emission Level at 30m = Emission Level at 3m + $20\log(3/30)^2$

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| **Channel** | Channel 1 | **Frequency Range** | 13.553 ~ 13.567 MHz |
| **Input Power** | 120 Vac, 60 Hz | **Detector Function** | Quasi-Peak |
| **Environmental Conditions** | 25 deg. C, 65 % RH | **Tested By** | Jisyong Wang |




| Antenna Polarity & Test Distance: Loop Antenna Close at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Read Level (dBuV)** | **Limit (dBuV/m)** | **Margin (dB)** | **Antenna Factor (dB/m)** | **Cable Loss (dB)** | **Preamp Factor (dB)** | **Antenna Height (cm)** | **Table Angle (Degree)** | **Remark** |
| 13.56 | 47.74 | 68.29 | 124 | -76.26 | 20.5 | 0.31 | 41.36 | 100 | 0 | QP |

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. 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)

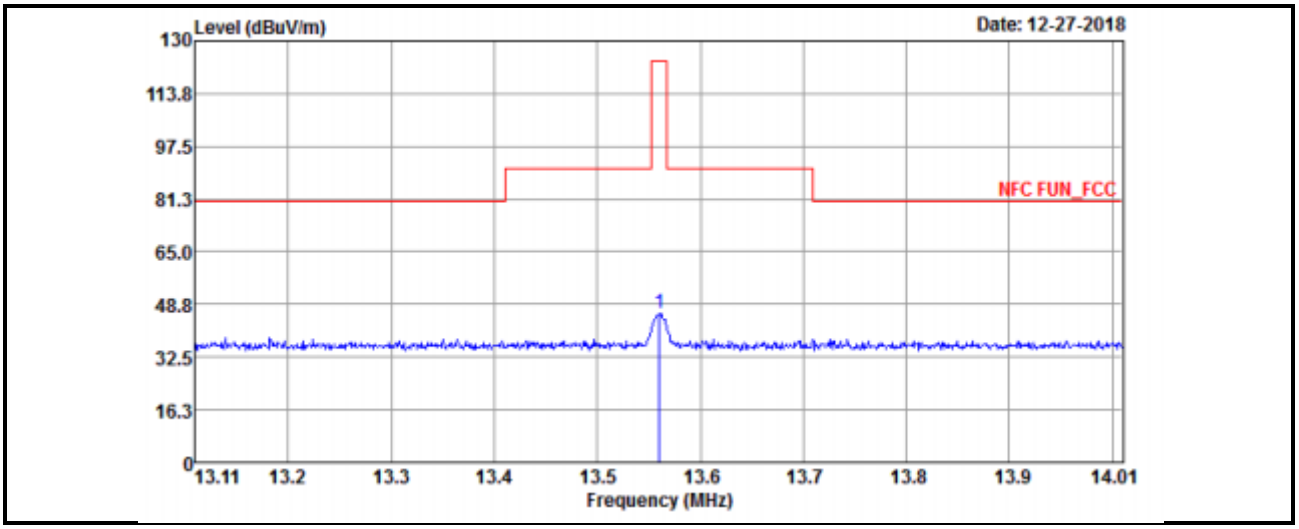
Example:

13.56 MHz = 15848 uV/m 30m
= 84 dBuV/m 30m
= $84+20\log(30/3)^2$ 3m
= 124 dBuV/m

| Antenna Polarity & Test Distance: Loop Antenna Close at 30 m | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Remark** |
| 13.56 | 7.74 | 84 | -76.26 | QP |

Remarks: Emission Level at 30m = Emission Level at 3m + $20\log(3/30)^2$

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| **Channel** | Channel 1 | **Frequency Range** | 13.553 ~ 13.567 MHz |
| **Input Power** | 120 Vac, 60 Hz | **Detector Function** | Quasi-Peak |
| **Environmental Conditions** | 25 deg. C, 65 % RH | **Tested By** | Jisyong Wang |




| Antenna Polarity & Test Distance: Loop Antenna Ground-parallel at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Read Level (dBuV)** | **Limit (dBuV/m)** | **Margin (dB)** | **Antenna Factor (dB/m)** | **Cable Loss (dB)** | **Preamp Factor (dB)** | **Antenna Height (cm)** | **Table Angle (Degree)** | **Remark** |
| 13.56 | 45.86 | 66.41 | 124 | -78.14 | 20.5 | 0.31 | 41.36 | 100 | 0 | QP |

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. 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)

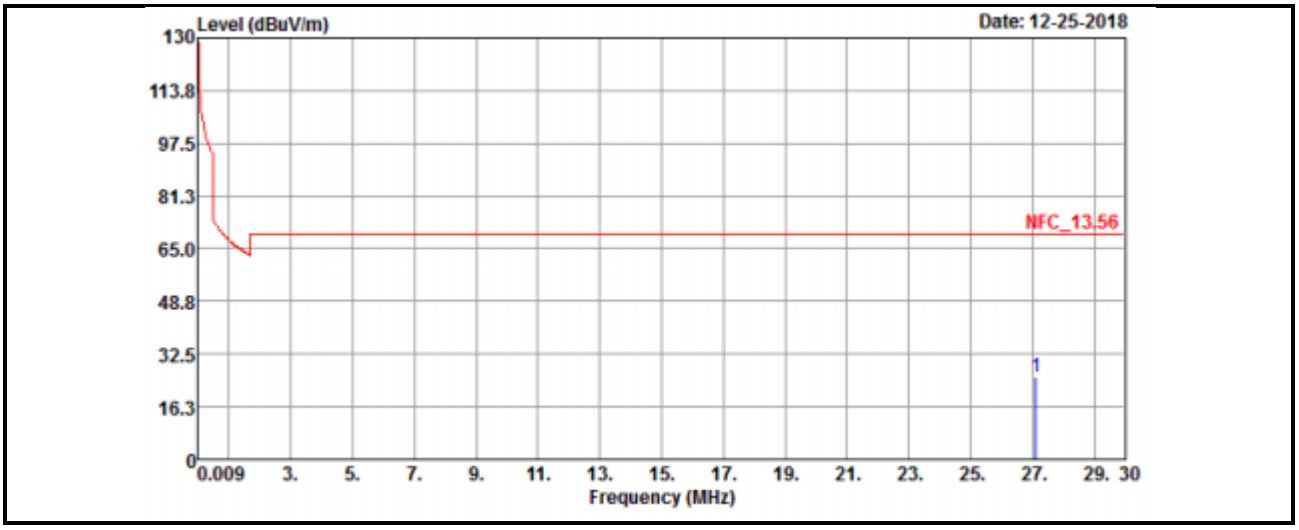
Example:

13.56 MHz = 15848 uV/m 30m
= 84 dBuV/m 30m
= $84+20\log(30/3)^2$ 3m
= 124 dBuV/m

| Antenna Polarity & Test Distance: Loop Antenna Ground-parallel at 30 m | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Remark** |
| 13.56 | 5.86 | 84 | -78.14 | QP |

Remarks: Emission Level at 30m = Emission Level at 3m + $20\log(3/30)^2$

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| **Channel** | Channel 1 | **Frequency Range** | Below 30 MHz |
| **Input Power** | 120 Vac, 60 Hz | **Detector Function** | Quasi-Peak |
| **Environmental Conditions** | 25 deg. C, 65 % RH | **Tested By** | Jisyong Wang |




| Antenna Polarity & Test Distance: Loop Antenna Open at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Read Level (dBuV)** | **Limit (dBuV/m)** | **Margin (dB)** | **Antenna Factor (dB/m)** | **Cable Loss (dB)** | **Preamp Factor (dB)** | **Antenna Height (cm)** | **Table Angle (Degree)** | **Remark** |
| 27.12 | 25.62 | 31.02 | 69.54 | -43.92 | 35.55 | 0.38 | 41.33 | 100 | 0 | QP |

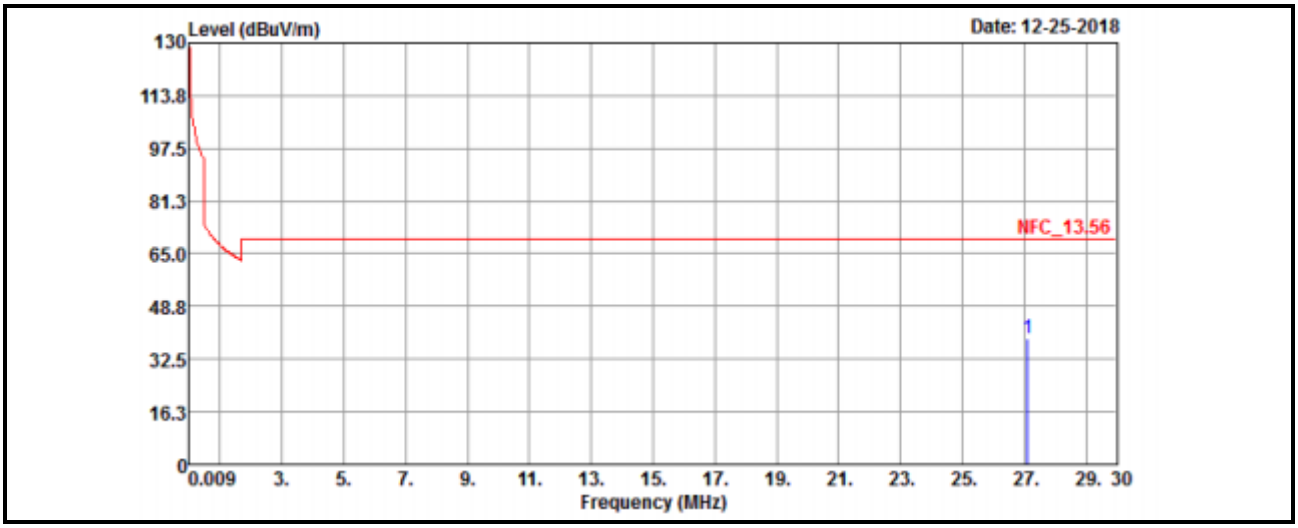
Remarks:

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.

| Antenna Polarity & Test Distance: Loop Antenna Open at 30 m | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Remark** |
| 27.12 | -14.38 | 29.54 | -43.92 | QP |

Remarks: Emission Level at 30m = Emission Level at 3m + $20\log(3/30)^2$

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| **Channel** | Channel 1 | **Frequency Range** | Below 30 MHz |
| **Input Power** | 120 Vac, 60 Hz | **Detector Function** | Quasi-Peak |
| **Environmental Conditions** | 25 deg. C, 65 % RH | **Tested By** | Jisyong Wang |




| Antenna Polarity & Test Distance: Loop Antenna Close at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Read Level (dBuV)** | **Limit (dBuV/m)** | **Margin (dB)** | **Antenna Factor (dB/m)** | **Cable Loss (dB)** | **Preamp Factor (dB)** | **Antenna Height (cm)** | **Table Angle (Degree)** | **Remark** |
| 27.12 | 38.99 | 44.39 | 69.54 | -30.55 | 35.55 | 0.38 | 41.33 | 100 | 360 | QP |

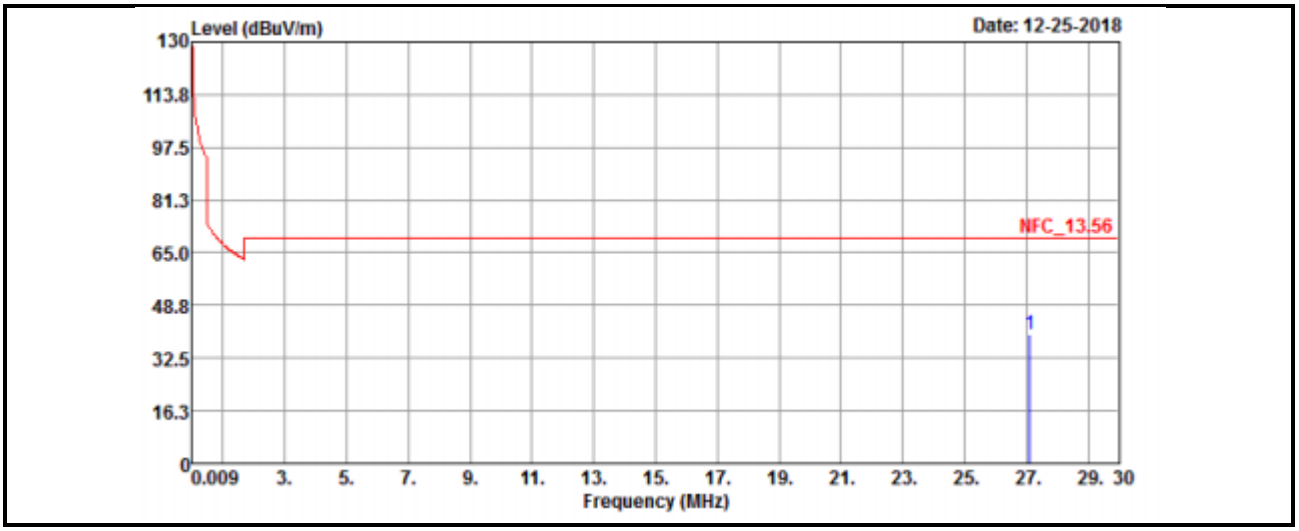
Remarks:

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.

| Antenna Polarity & Test Distance: Loop Antenna Close at 30 m | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Remark** |
| 27.12 | -1.01 | 29.54 | -30.55 | QP |

Remarks: Emission Level at 30m = Emission Level at 3m + $20\log(3/30)^2$

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| **Channel** | Channel 1 | **Frequency Range** | Below 30 MHz |
| **Input Power** | 120 Vac, 60 Hz | **Detector Function** | Quasi-Peak |
| **Environmental Conditions** | 25 deg. C, 65 % RH | **Tested By** | Jisyong Wang |




| Antenna Polarity & Test Distance: Loop Antenna Ground-parallel at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Read Level (dBuV)** | **Limit (dBuV/m)** | **Margin (dB)** | **Antenna Factor (dB/m)** | **Cable Loss (dB)** | **Preamp Factor (dB)** | **Antenna Height (cm)** | **Table Angle (Degree)** | **Remark** |
| 27.12 | 39.98 | 45.38 | 69.54 | -29.56 | 35.55 | 0.38 | 41.33 | 100 | 0 | QP |

Remarks:

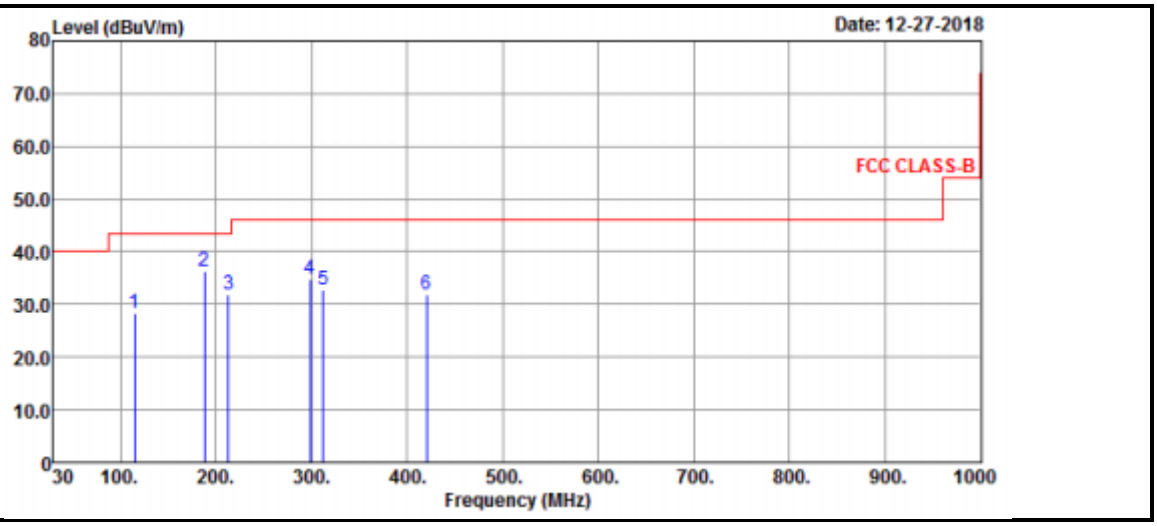
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

| Antenna Polarity & Test Distance: Loop Antenna Ground-parallel at 30 m | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Remark** |
| 27.12 | -0.02 | 29.54 | -29.56 | QP |

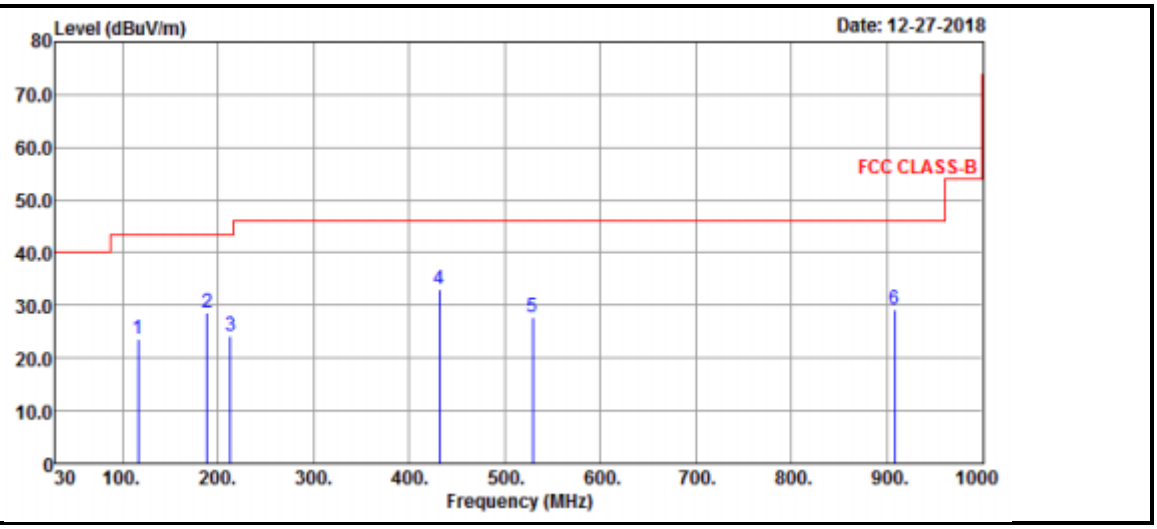
Remarks: Emission Level at 30m = Emission Level at 3m + $20\log(3/30)^2$

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| **Channel** | Channel 1 | **Frequency Range** | Below 1000 MHz |
| **Input Power** | 120 Vac, 60 Hz | **Detector Function** | Quasi-Peak |
| **Environmental Conditions** | 25 deg. C, 65 % RH | **Tested By** | Jisyong Wang |

Horizontal




Vertical



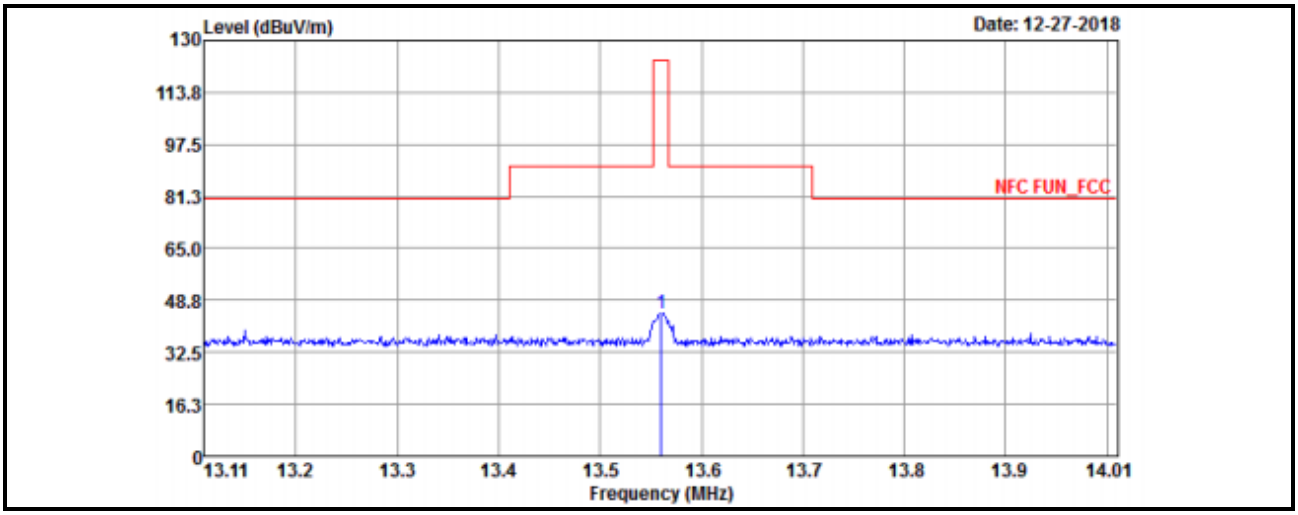
| Antenna Polarity & Test Distance: Horizontal at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Limit (dBuV/m) | Margin (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 114.39 | 28.22 | 48.82 | 43.5 | -15.28 | 10.46 | 0.81 | 31.87 | 152 | 254 | QP |
| 188.11 | 36.25 | 56.6 | 43.5 | -7.25 | 10.19 | 1.16 | 31.7 | 165 | 295 | QP |
| 213.33 | 31.97 | 52.37 | 43.5 | -11.53 | 9.93 | 1.3 | 31.63 | 147 | 152 | QP |
| 298.69 | 34.79 | 52.06 | 46 | -11.21 | 12.91 | 1.64 | 31.82 | 165 | 231 | QP |
| 312.27 | 32.89 | 49.88 | 46 | -13.11 | 13.24 | 1.71 | 31.94 | 195 | 284 | QP |
| 419.94 | 31.87 | 46.04 | 46 | -14.13 | 15.73 | 2.15 | 32.05 | 145 | 256 | QP |
| **Antenna Polarity & Test Distance: Vertical at 3 m** | | | | | | | | | | |
| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Limit (dBuV/m) | Margin (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 116.33 | 23.72 | 44.13 | 43.5 | -19.78 | 10.65 | 0.82 | 31.88 | 147 | 295 | QP |
| 189.08 | 28.66 | 49.06 | 43.5 | -14.84 | 10.12 | 1.17 | 31.69 | 165 | 321 | QP |
| 213.33 | 24.17 | 44.57 | 43.5 | -19.33 | 9.93 | 1.3 | 31.63 | 158 | 251 | QP |
| 431.58 | 32.92 | 46.77 | 46 | -13.08 | 15.96 | 2.2 | 32.01 | 165 | 295 | QP |
| 529.55 | 27.65 | 38.72 | 46 | -18.35 | 17.99 | 2.63 | 31.69 | 111 | 184 | QP |
| 907.85 | 29.1 | 33.53 | 46 | -16.9 | 23.55 | 4.06 | 32.04 | 102 | 251 | QP |

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp 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)

## Mode B

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| **Channel** | Channel 1 | **Frequency Range** | 13.553 ~ 13.567 MHz |
| **Input Power** | 120 Vac, 60 Hz | **Detector Function** | Quasi-Peak |
| **Environmental Conditions** | 25 deg. C, 65 % RH | **Tested By** | Jisyong Wang |




| Antenna Polarity & Test Distance: Loop Antenna Open at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Read Level (dBuV)** | **Limit (dBuV/m)** | **Margin (dB)** | **Antenna Factor (dB/m)** | **Cable Loss (dB)** | **Preamp Factor (dB)** | **Antenna Height (cm)** | **Table Angle (Degree)** | **Remark** |
| 13.56 | 44.79 | 65.34 | 124 | -79.21 | 20.5 | 0.31 | 41.36 | 100 | 360 | QP |

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. 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:

13.56 MHz = 15848 uV/m 30m

= 84 dBuV/m 30m

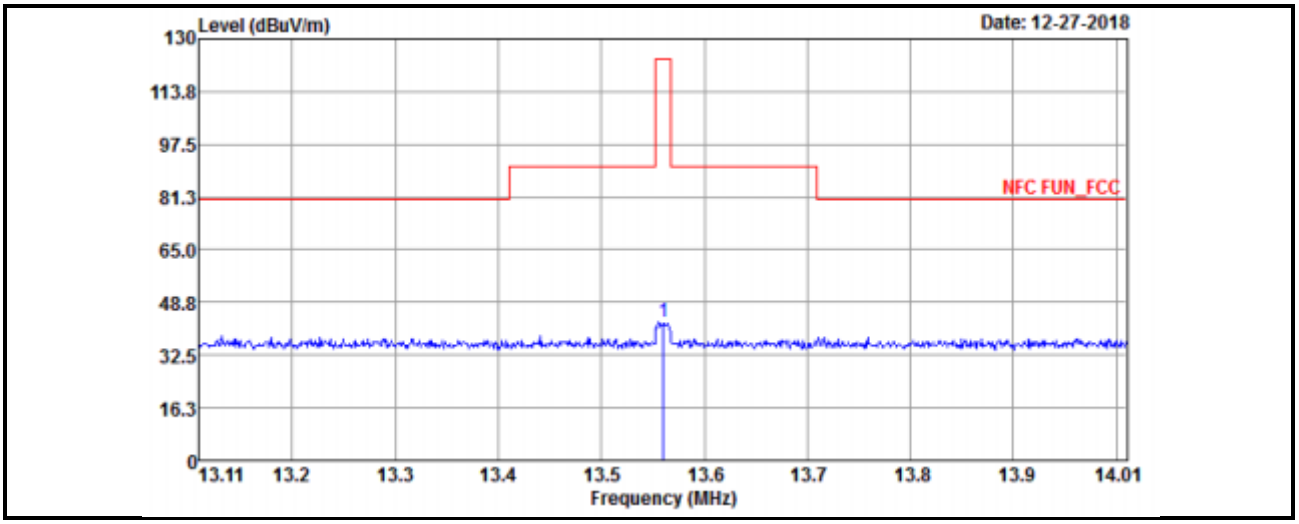
= $84+20\log(30/3)^2$ 3m

= 124 dBuV/m

| Antenna Polarity & Test Distance: Loop Antenna Open at 30 m | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Remark** |
| 13.56 | 4.79 | 84 | -79.21 | QP |

Remarks: Emission Level at 30m = Emission Level at 3m + $20\log(3/30)^2$

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| **Channel** | Channel 1 | **Frequency Range** | 13.553 ~ 13.567 MHz |
| **Input Power** | 120 Vac, 60 Hz | **Detector Function** | Quasi-Peak |
| **Environmental Conditions** | 25 deg. C, 65 % RH | **Tested By** | Jisyong Wang |




| Antenna Polarity & Test Distance: Loop Antenna Close at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Read Level (dBuV)** | **Limit (dBuV/m)** | **Margin (dB)** | **Antenna Factor (dB/m)** | **Cable Loss (dB)** | **Preamp Factor (dB)** | **Antenna Height (cm)** | **Table Angle (Degree)** | **Remark** |
| 13.56 | 42.6 | 63.15 | 124 | -81.4 | 20.5 | 0.31 | 41.36 | 100 | 0 | QP |

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. Above limits have been translated by the formula

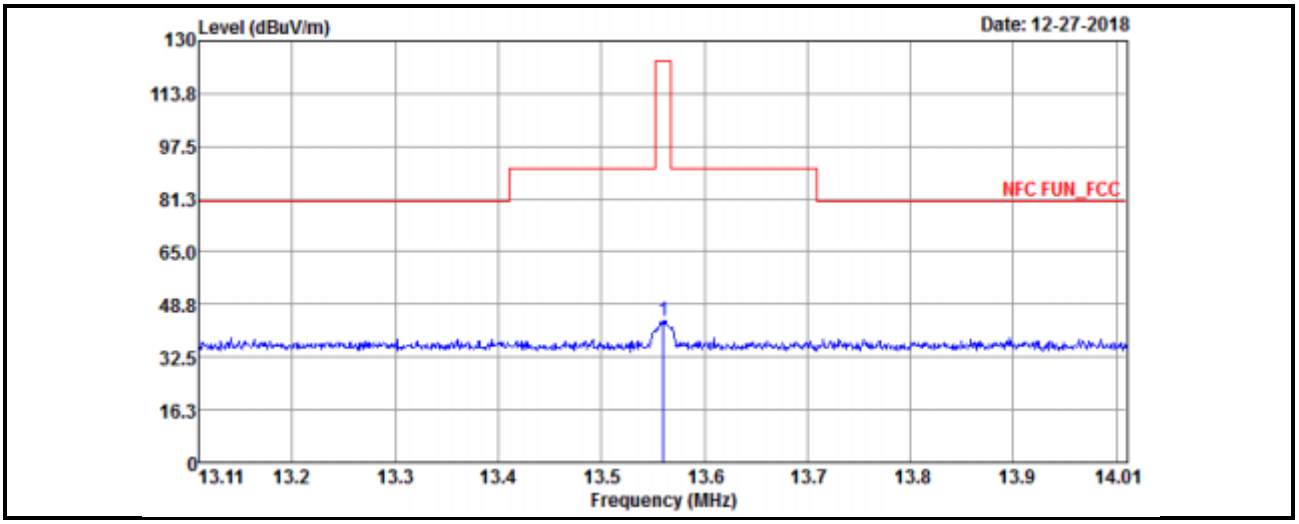
The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)
Example:

13.56 MHz = 15848 uV/m 30m
= 84 dBuV/m 30m
= $84+20\log(30/3)^2$ 3m
= 124 dBuV/m

| Antenna Polarity & Test Distance: Loop Antenna Close at 30 m | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Remark** |
| 13.56 | 2.6 | 84 | -81.4 | QP |

Remarks: Emission Level at 30m = Emission Level at 3m + $20\log(3/30)^2$

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| **Channel** | Channel 1 | **Frequency Range** | 13.553 ~ 13.567 MHz |
| **Input Power** | 120 Vac, 60 Hz | **Detector Function** | Quasi-Peak |
| **Environmental Conditions** | 25 deg. C, 65 % RH | **Tested By** | Jisyong Wang |




| Antenna Polarity & Test Distance: Loop Antenna Ground-parallel at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Read Level (dBuV)** | **Limit (dBuV/m)** | **Margin (dB)** | **Antenna Factor (dB/m)** | **Cable Loss (dB)** | **Preamp Factor (dB)** | **Antenna Height (cm)** | **Table Angle (Degree)** | **Remark** |
| 13.56 | 43.79 | 64.34 | 124 | -80.21 | 20.5 | 0.31 | 41.36 | 100 | 360 | QP |

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. 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)

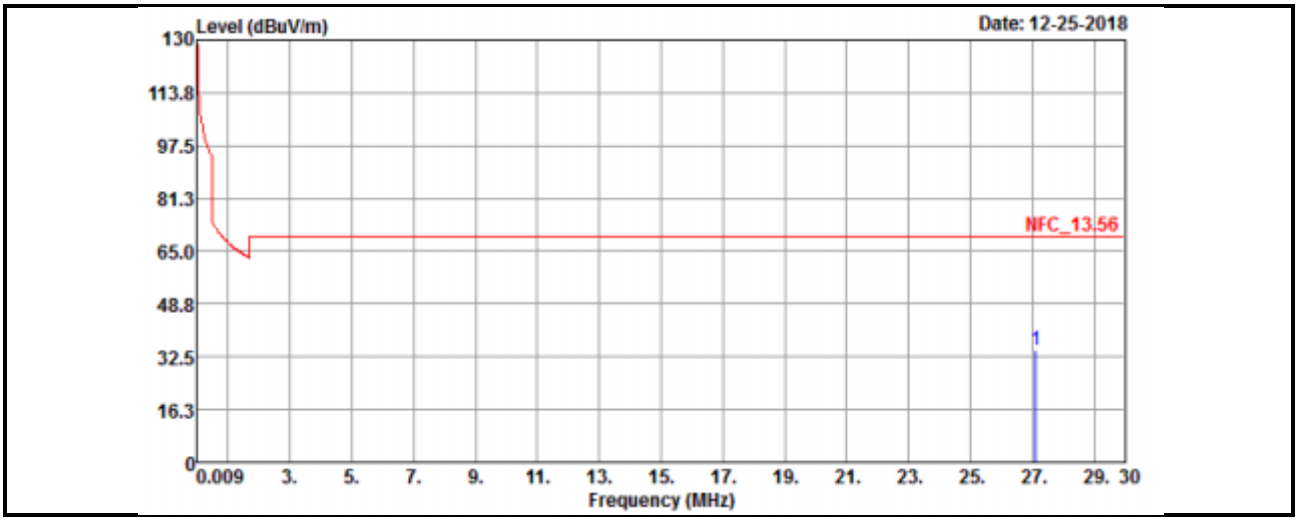
Example:

13.56 MHz = 15848 uV/m 30m
= 84 dBuV/m 30m
= $84+20\log(30/3)^2$ 3m
= 124 dBuV/m

| Antenna Polarity & Test Distance: Loop Antenna Ground-parallel at 3 m | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Remark** |
| 13.56 | 3.79 | 84 | -80.21 | QP |

Remarks: Emission Level at 30m = Emission Level at 3m + $20\log(3/30)^2$

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| **Channel** | Channel 1 | **Frequency Range** | Below 30 MHz |
| **Input Power** | 120 Vac, 60 Hz | **Detector Function** | Quasi-Peak |
| **Environmental Conditions** | 25 deg. C, 65 % RH | **Tested By** | Jisyong Wang |




| Antenna Polarity & Test Distance: Loop Antenna Open at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Read Level (dBuV)** | **Limit (dBuV/m)** | **Margin (dB)** | **Antenna Factor (dB/m)** | **Cable Loss (dB)** | **Preamp Factor (dB)** | **Antenna Height (cm)** | **Table Angle (Degree)** | **Remark** |
| 27.12 | 34.62 | 40.02 | 69.54 | -34.92 | 35.55 | 0.38 | 41.33 | 100 | 0 | QP |

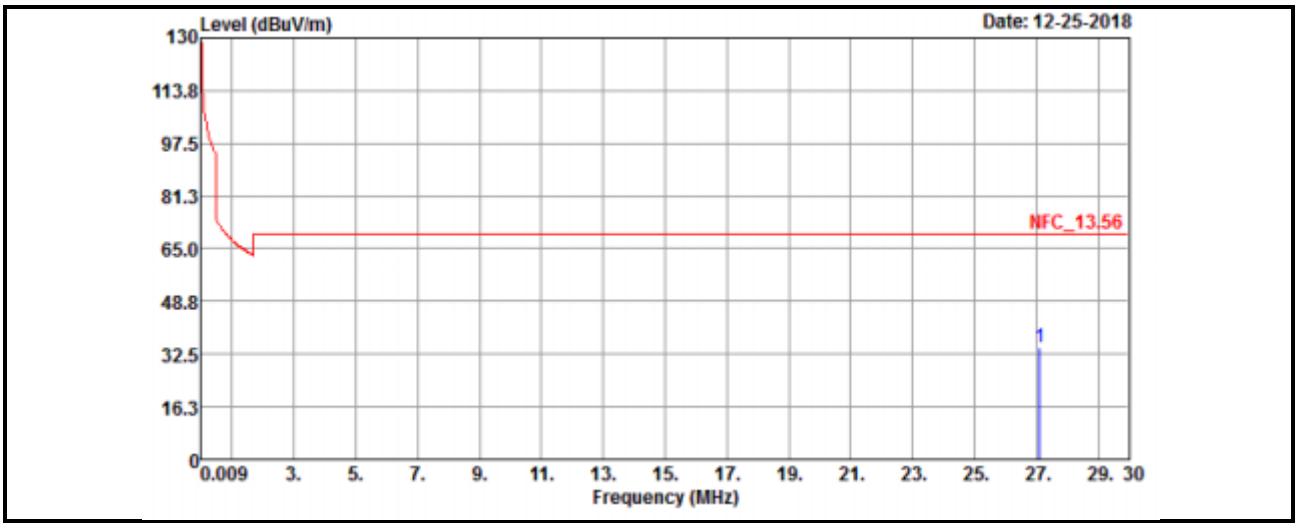
Remarks:

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.

| Antenna Polarity & Test Distance: Loop Antenna Open at 30 m | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Remark** |
| 27.12 | -5.38 | 29.54 | -34.92 | QP |

Remarks: Emission Level at 30m = Emission Level at 3m + $20\log(3/30)^2$

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| **Channel** | Channel 1 | **Frequency Range** | Below 30 MHz |
| **Input Power** | 120 Vac, 60 Hz | **Detector Function** | Quasi-Peak |
| **Environmental Conditions** | 25 deg. C, 65 % RH | **Tested By** | Jisyong Wang |




| Antenna Polarity & Test Distance: Loop Antenna Close at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Read Level (dBuV)** | **Limit (dBuV/m)** | **Margin (dB)** | **Antenna Factor (dB/m)** | **Cable Loss (dB)** | **Preamp Factor (dB)** | **Antenna Height (cm)** | **Table Angle (Degree)** | **Remark** |
| 27.12 | 34.58 | 39.98 | 69.54 | -34.96 | 35.55 | 0.38 | 41.33 | 100 | 360 | QP |

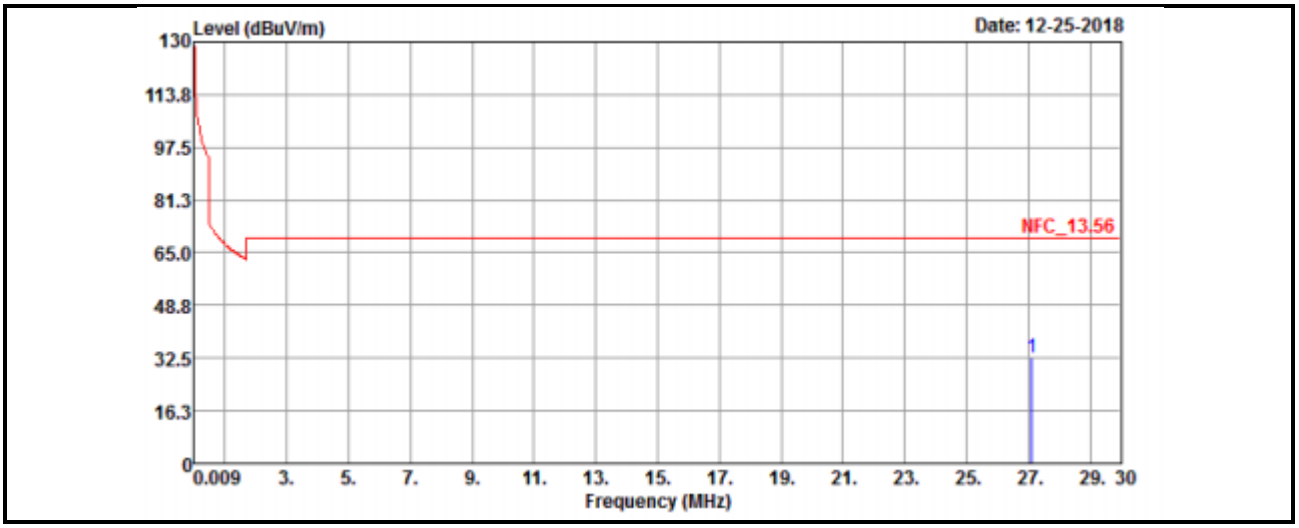
Remarks:

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.

| Antenna Polarity & Test Distance: Loop Antenna Close at 30 m | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Remark** |
| 27.12 | -5.42 | 29.54 | -34.96 | QP |

Remarks: Emission Level at 30m = Emission Level at 3m + $20\log(3/30)^2$

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| **Channel** | Channel 1 | **Frequency Range** | Below 30 MHz |
| **Input Power** | 120 Vac, 60 Hz | **Detector Function** | Quasi-Peak |
| **Environmental Conditions** | 25 deg. C, 65 % RH | **Tested By** | Jisyong Wang |




| Antenna Polarity & Test Distance: Loop Antenna Ground-parallel at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Read Level (dBuV)** | **Limit (dBuV/m)** | **Margin (dB)** | **Antenna Factor (dB/m)** | **Cable Loss (dB)** | **Preamp Factor (dB)** | **Antenna Height (cm)** | **Table Angle (Degree)** | **Remark** |
| 27.12 | 32.56 | 37.96 | 69.54 | -36.98 | 35.55 | 0.38 | 41.33 | 100 | 0 | QP |

Remarks:

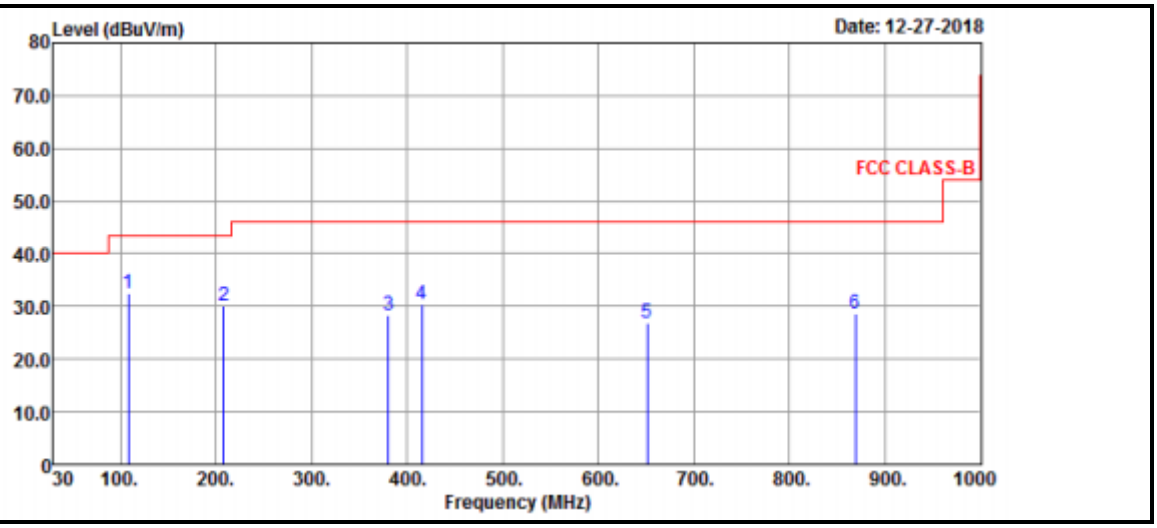
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

| Antenna Polarity & Test Distance: Loop Antenna Ground-parallel at 30 m | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Remark** |
| 27.12 | -7.44 | 29.54 | -36.98 | QP |

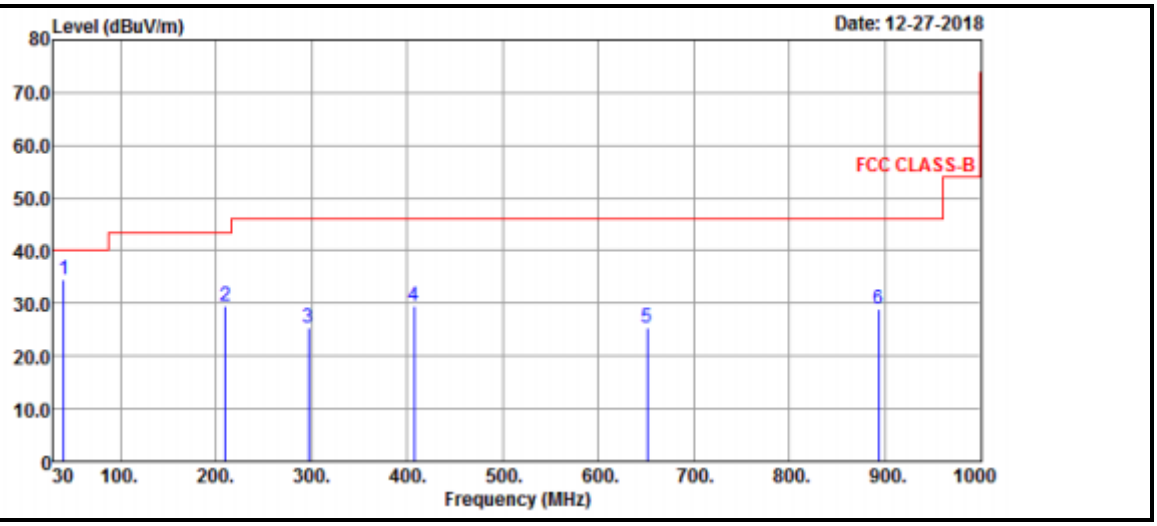
Remarks: Emission Level at 30m = Emission Level at 3m + $20\log(3/30)^2$

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| **Channel** | Channel 1 | **Frequency Range** | Below 1000 MHz |
| **Input Power** | 120 Vac, 60 Hz | **Detector Function** | Quasi-Peak |
| **Environmental Conditions** | 25 deg. C, 65 % RH | **Tested By** | Jisyong Wang |

Horizontal




Vertical



| Antenna Polarity & Test Distance: Horizontal at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Limit (dBuV/m) | Margin (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 108.57 | 32.55 | 53.72 | 43.5 | -10.95 | 9.9 | 0.78 | 31.85 | 145 | 251 | QP |
| 208.48 | 29.97 | 50.59 | 43.5 | -13.53 | 9.73 | 1.27 | 31.62 | 165 | 295 | QP |
| 380.17 | 28.34 | 43.42 | 46 | -17.66 | 14.87 | 2 | 31.95 | 111 | 148 | QP |
| 415.09 | 30.36 | 44.61 | 46 | -15.64 | 15.64 | 2.13 | 32.02 | 132 | 251 | QP |
| 650.8 | 26.77 | 35.44 | 46 | -19.23 | 20.22 | 3.12 | 32.01 | 165 | 295 | QP |
| 869.05 | 28.6 | 33.56 | 46 | -17.4 | 23.11 | 3.93 | 32 | 147 | 152 | QP |
| **Antenna Polarity & Test Distance: Vertical at 3 m** | | | | | | | | | | |
| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Limit (dBuV/m) | Margin (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
| **40.67** | **34.49** | **51.47** | **40** | **-5.51** | **13.55** | **0.49** | **31.02** | **145** | **251** | **QP** |
| 209.45 | 29.58 | 50.14 | 43.5 | -13.92 | 9.77 | 1.28 | 31.61 | 165 | 295 | QP |
| 296.75 | 25.43 | 42.73 | 46 | -20.57 | 12.85 | 1.64 | 31.79 | 111 | 152 | QP |
| 407.33 | 29.44 | 43.88 | 46 | -16.56 | 15.48 | 2.11 | 32.03 | 165 | 231 | QP |
| 650.8 | 25.24 | 33.91 | 46 | -20.76 | 20.22 | 3.12 | 32.01 | 147 | 185 | QP |
| 893.3 | 29.04 | 33.62 | 46 | -16.96 | 23.42 | 4 | 32 | 165 | 295 | QP |

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp 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 0.50 MHz.
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

### 4.2.2 Test Instruments

| Description & Manufacturer | Model No. | Serial No. | Date of Calibration | Due Date of Calibration |
|---|---|---|---|---|
| Test Receiver ROHDE & SCHWARZ | ESCI | 100613 | Dec. 10, 2018 | Dec. 09, 2019 |
| RF signal cable Woken | 5D-FB | Cable-cond1-01 | Sep. 05, 2018 | Sep. 04, 2019 |
| LISN ROHDE & SCHWARZ (EUT) | ENV216 | 101826 | Feb. 26, 2018 | Feb. 25, 2019 |
| LISN ROHDE & SCHWARZ (Peripheral) | ESH3-Z5 | 100311 | Aug. 19, 2018 | Aug. 18, 2019 |
| Software ADT | BV ADT_Cond_ 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 1.
3. The VCCI Site Registration No. is C-2040.

4.2.3 Test Procedures

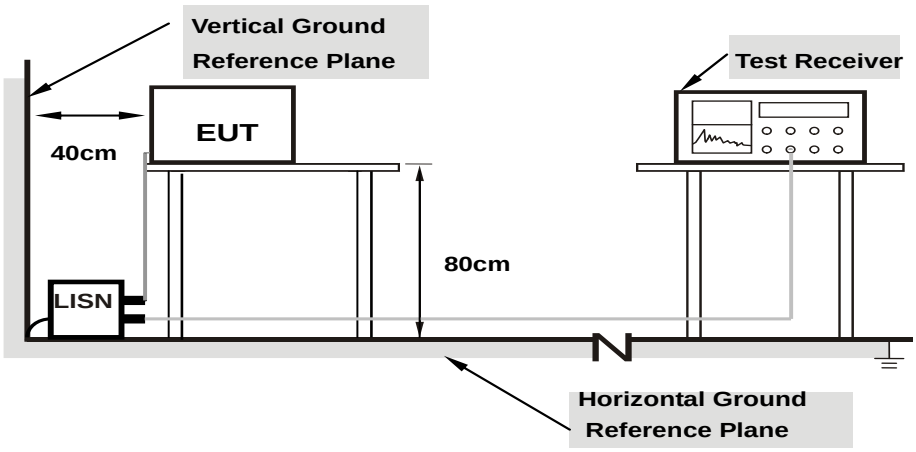
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling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

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup




**Note: 1.Support units were connected to second LISN.**
**2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes**

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

4.2.6 EUT Operating Conditions

a. Placed the EUT on the testing table.
b. Set the EUT under transmission condition continuously at specific channel frequency.

4.2.7 Test Results

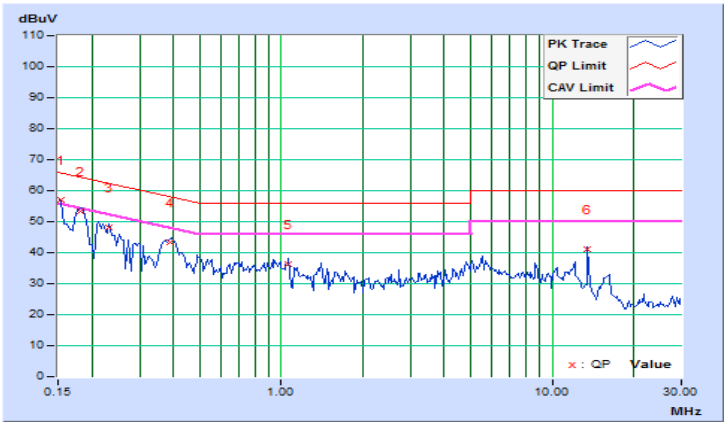
**Mode A**

| | | | |
|---|---|---|---|
| Frequency Range | 150kHz ~ 30MHz | Detector Function & Resolution Bandwidth | Quasi-Peak (QP) / Average (AV), 9kHz |
| Input Power | 120Vac, 60Hz | Environmental Conditions | 25℃, 65%RH |
| Tested by | Thomas Wei | Test Date | 2019/1/2 |

| Phase Of Power : Line (L) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No | Frequency (MHz) | Correction Factor (dB) | Reading Value (dBuV) | | Emission Level (dBuV) | | Limit (dBuV) | | Margin (dB) | |
| | | | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.15391 | 9.67 | 47.40 | 33.25 | 57.07 | 42.92 | 65.79 | 55.79 | -8.72 | -12.87 |
| 2 | 0.18125 | 9.67 | 43.48 | 25.51 | 53.15 | 35.18 | 64.43 | 54.43 | -11.28 | -19.25 |
| 3 | 0.23203 | 9.67 | 38.32 | 20.77 | 47.99 | 30.44 | 62.38 | 52.38 | -14.39 | -21.94 |
| 4 | 0.38828 | 9.66 | 33.78 | 20.19 | 43.44 | 29.85 | 58.10 | 48.10 | -14.66 | -18.25 |
| 5 | 1.06641 | 9.65 | 26.54 | 12.14 | 36.19 | 21.79 | 56.00 | 46.00 | -19.81 | -24.21 |
| 6 | 13.55859 | 9.87 | 31.29 | 17.40 | 41.16 | 27.27 | 60.00 | 50.00 | -18.84 | -22.73 |

Remarks:

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

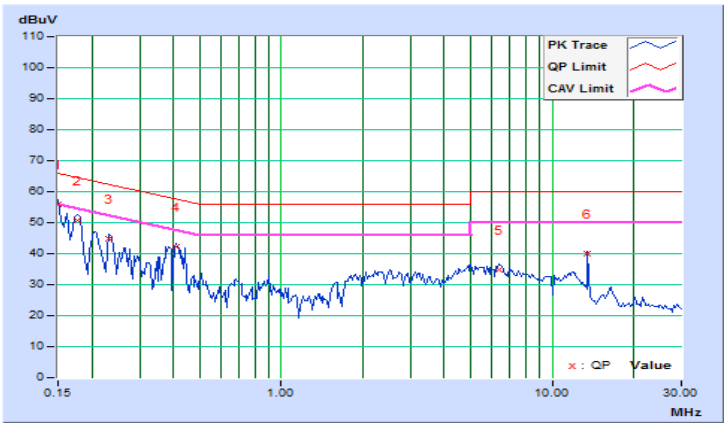


| | | | |
|---|---|---|---|
| Frequency Range | 150kHz ~ 30MHz | Detector Function & Resolution Bandwidth | Quasi-Peak (QP) / Average (AV), 9kHz |
| Input Power | 120Vac, 60Hz | Environmental Conditions | 25℃, 65%RH |
| Tested by | Thomas Wei | Test Date | 2019/1/2 |

| Phase Of Power : Neutral (N) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No | Frequency (MHz) | Correction Factor (dB) | Reading Value (dBuV) | | Emission Level (dBuV) | | Limit (dBuV) | | Margin (dB) | |
| | | | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.15000 | 9.68 | 46.24 | 31.51 | 55.92 | 41.19 | 66.00 | 56.00 | -10.08 | -14.81 |
| 2 | 0.17734 | 9.67 | 40.97 | 23.41 | 50.64 | 33.08 | 64.61 | 54.61 | -13.97 | -21.53 |
| 3 | 0.23203 | 9.67 | 35.18 | 20.10 | 44.85 | 29.77 | 62.38 | 52.38 | -17.53 | -22.61 |
| 4 | 0.41172 | 9.67 | 32.70 | 18.23 | 42.37 | 27.90 | 57.61 | 47.61 | -15.24 | -19.71 |
| 5 | 6.38281 | 9.78 | 25.22 | 11.08 | 35.00 | 20.86 | 60.00 | 50.00 | -25.00 | -29.14 |
| 6 | 13.55859 | 9.92 | 29.96 | 15.34 | 39.88 | 25.26 | 60.00 | 50.00 | -20.12 | -24.74 |

Remarks:

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



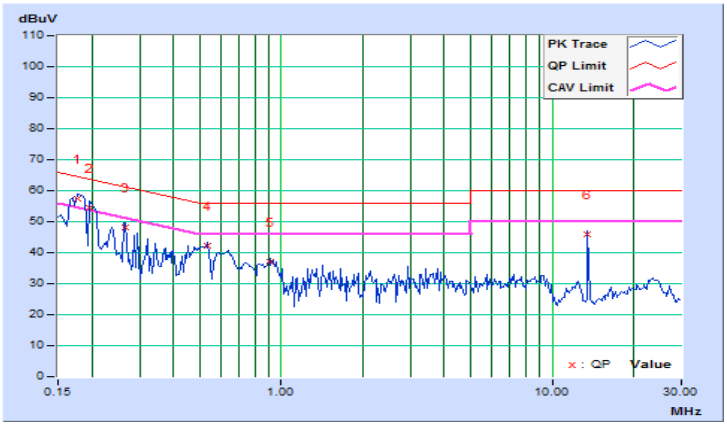
## Mode B

| | | | |
|---|---|---|---|
| Frequency Range | 150kHz ~ 30MHz | Detector Function & Resolution Bandwidth | Quasi-Peak (QP) / Average (AV), 9kHz |
| Input Power | 120Vac, 60Hz | Environmental Conditions | 25℃, 65%RH |
| Tested by | Thomas Wei | Test Date | 2019/1/3 |

| Phase Of Power : Line (L) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No | Frequency (MHz) | Correction Factor (dB) | Reading Value (dBuV) | | Emission Level (dBuV) | | Limit (dBuV) | | Margin (dB) | |
| | | | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| **1** | **0.17734** | **9.67** | **47.61** | **31.38** | **57.28** | **41.05** | **64.61** | **54.61** | **-7.33** | **-13.56** |
| 2 | 0.19687 | 9.67 | 44.94 | 28.90 | 54.61 | 38.57 | 63.74 | 53.74 | -9.13 | -15.17 |
| 3 | 0.26719 | 9.67 | 38.35 | 23.42 | 48.02 | 33.09 | 61.20 | 51.20 | -13.18 | -18.11 |
| 4 | 0.53281 | 9.66 | 32.61 | 17.75 | 42.27 | 27.41 | 56.00 | 46.00 | -13.73 | -18.59 |
| 5 | 0.91563 | 9.65 | 27.40 | 12.41 | 37.05 | 22.06 | 56.00 | 46.00 | -18.95 | -23.94 |
| 6 | 13.55859 | 9.87 | 36.09 | 20.81 | 45.96 | 30.68 | 60.00 | 50.00 | -14.04 | -19.32 |

Remarks:

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

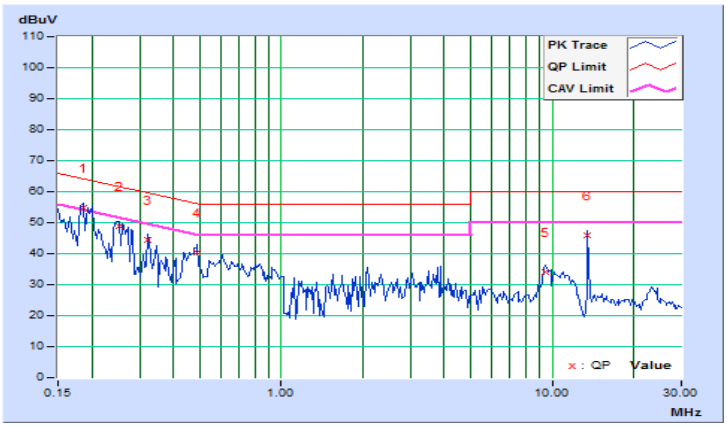


| | | | |
|---|---|---|---|
| Frequency Range | 150kHz ~ 30MHz | Detector Function & Resolution Bandwidth | Quasi-Peak (QP) / Average (AV), 9kHz |
| Input Power | 120Vac, 60Hz | Environmental Conditions | 25℃, 65%RH |
| Tested by | Thomas Wei | Test Date | 2019/1/3 |

| Phase Of Power : Neutral (N) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No | Frequency (MHz) | Correction Factor (dB) | Reading Value (dBuV) | | Emission Level (dBuV) | | Limit (dBuV) | | Margin (dB) | |
| | | | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.18516 | 9.67 | 45.04 | 28.94 | 54.71 | 38.61 | 64.25 | 54.25 | -9.54 | -15.64 |
| 2 | 0.25156 | 9.67 | 39.15 | 24.41 | 48.82 | 34.08 | 61.71 | 51.71 | -12.89 | -17.63 |
| 3 | 0.32188 | 9.67 | 34.83 | 19.03 | 44.50 | 28.70 | 59.66 | 49.66 | -15.16 | -20.96 |
| 4 | 0.48984 | 9.67 | 30.62 | 15.65 | 40.29 | 25.32 | 56.17 | 46.17 | -15.88 | -20.85 |
| 5 | 9.48047 | 9.85 | 24.24 | 11.03 | 34.09 | 20.88 | 60.00 | 50.00 | -25.91 | -29.12 |
| 6 | 13.55859 | 9.92 | 35.83 | 21.57 | 45.75 | 31.49 | 60.00 | 50.00 | -14.25 | -18.51 |

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

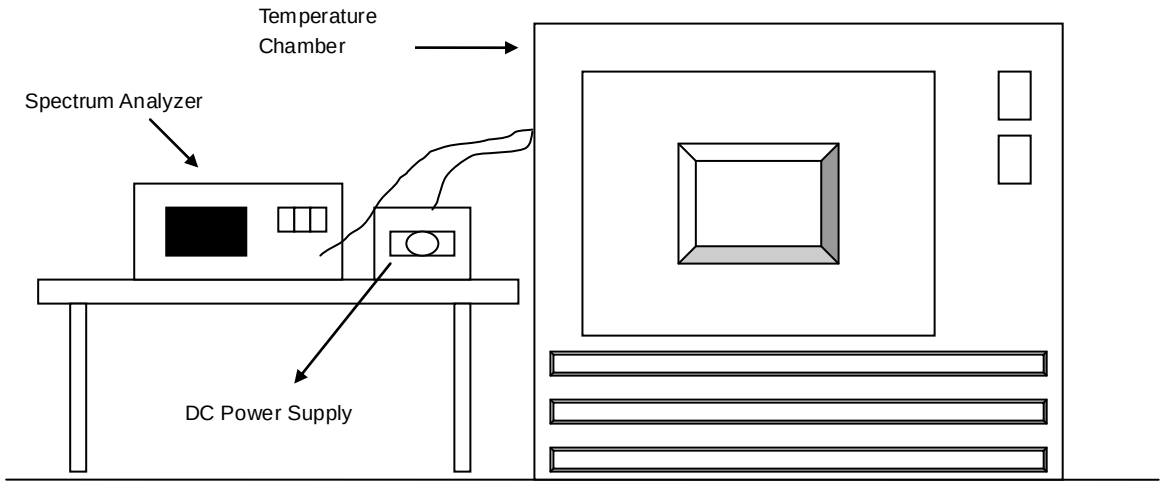


## 4.3 Frequency Stability

### 4.3.1 Limits of Frequency Stability Measurement

The frequency tolerance of the carrier signal shall be maintained within +/- 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

Refer to section 4.1.2 to get information of above instrument.

### 4.3.4 Test Procedure

a. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
b. Turned the EUT on and coupled its output to a spectrum analyzer.
c. Turned the EUT off and set the chamber to the highest temperature specified.
d. 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.
e. Repeated step 2 and 3 with the temperature chamber set to the lowest temperature.
f. 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

a. Placed the EUT on the testing table.
b. Set the EUT under transmission condition continuously at specific channel frequency.

4.3.7 Test Results

**Mode A**

| Frequency Stability Versus Temperature | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Temp. (℃) | Power Supply (Vac) | 0 Minute | | 2 Minute | | 5 Minute | | 10 Minute | |
| | | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift |
| | | (MHz) | % | (MHz) | % | (MHz) | % | (MHz) | % |
| 50 | 120 | 13.55993 | -0.00052 | 13.55993 | -0.00052 | 13.55993 | -0.00052 | 13.55993 | -0.00052 |
| 40 | 120 | 13.56005 | 0.00037 | 13.56005 | 0.00037 | 13.56006 | 0.00044 | 13.56006 | 0.00044 |
| 30 | 120 | 13.55997 | -0.00022 | 13.55996 | -0.00029 | 13.55997 | -0.00022 | 13.55997 | -0.00022 |
| 20 | 120 | 13.56003 | 0.00022 | 13.56003 | 0.00022 | 13.56003 | 0.00022 | 13.56003 | 0.00022 |
| 10 | 120 | 13.55999 | -0.00007 | 13.56 | 0.00000 | 13.55999 | -0.00007 | 13.56 | 0.00000 |
| 0 | 120 | 13.55994 | -0.00044 | 13.55995 | -0.00037 | 13.55994 | -0.00044 | 13.55993 | -0.00052 |
| -10 | 120 | 13.56 | 0.00000 | 13.56 | 0.00000 | 13.56 | 0.00000 | 13.56 | 0.00000 |
| -20 | 120 | 13.56003 | 0.00022 | 13.56004 | 0.00029 | 13.56003 | 0.00022 | 13.56003 | 0.00022 |

| Frequency Stability Versus Voltage | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Temp. (℃) | Power Supply (Vac) | 0 Minute | | 2 Minute | | 5 Minute | | 10 Minute | |
| | | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift |
| | | (MHz) | % | (MHz) | % | (MHz) | % | (MHz) | % |
| 20 | 138 | 13.56003 | 0.00022 | 13.56003 | 0.00022 | 13.56003 | 0.00022 | 13.56003 | 0.00022 |
| | 120 | 13.56003 | 0.00022 | 13.56003 | 0.00022 | 13.56003 | 0.00022 | 13.56003 | 0.00022 |
| | 102 | 13.56003 | 0.00022 | 13.56003 | 0.00022 | 13.56003 | 0.00022 | 13.56003 | 0.00022 |

## Mode B

| Frequency Stability Versus Temperature | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Temp. (℃) | Power Supply (Vac) | 0 Minute | | 2 Minute | | 5 Minute | | 10 Minute | |
| | | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift |
| | | (MHz) | % | (MHz) | % | (MHz) | % | (MHz) | % |
| 50 | 120 | 13.55994 | -0.00044 | 13.55994 | -0.00044 | 13.55993 | -0.00052 | 13.55994 | -0.00044 |
| 40 | 120 | 13.55993 | -0.00052 | 13.55993 | -0.00052 | 13.55993 | -0.00052 | 13.55993 | -0.00052 |
| 30 | 120 | 13.56004 | 0.00029 | 13.56004 | 0.00029 | 13.56004 | 0.00029 | 13.56004 | 0.00029 |
| 20 | 120 | 13.56004 | 0.00029 | 13.56004 | 0.00029 | 13.56005 | 0.00037 | 13.56004 | 0.00029 |
| 10 | 120 | 13.56003 | 0.00022 | 13.56004 | 0.00029 | 13.56004 | 0.00029 | 13.56003 | 0.00022 |
| 0 | 120 | 13.55999 | -0.00007 | 13.55999 | -0.00007 | 13.55999 | -0.00007 | 13.56 | 0.00000 |
| -10 | 120 | 13.56 | 0.00000 | 13.56001 | 0.00007 | 13.56 | 0.00000 | 13.56 | 0.00000 |
| -20 | 120 | 13.55996 | -0.00029 | 13.55996 | -0.00029 | 13.55997 | -0.00022 | 13.55996 | -0.00029 |

| Frequency Stability Versus Voltage | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Temp. (℃) | Power Supply (Vac) | 0 Minute | | 2 Minute | | 5 Minute | | 10 Minute | |
| | | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift |
| | | (MHz) | % | (MHz) | % | (MHz) | % | (MHz) | % |
| 20 | 138 | 13.56004 | 0.00029 | 13.56004 | 0.00029 | 13.56005 | 0.00037 | 13.56004 | 0.00029 |
| | 120 | 13.56004 | 0.00029 | 13.56004 | 0.00029 | 13.56005 | 0.00037 | 13.56004 | 0.00029 |
| | 102 | 13.56004 | 0.00029 | 13.56004 | 0.00029 | 13.56005 | 0.00037 | 13.56004 | 0.00029 |

## 4.4 20 dB Bandwidth

### 4.4.1 Limits of 20 dB Bandwidth Measurement

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

### 4.4.2 Test Setup

Refer to section 4.1.5.

### 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 1 kHz RBW and 3 kHz VBW. The 20 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20 dB.

### 4.4.5 Deviation from Test Standard

No deviation.

### 4.4.6 EUT Operating Conditions

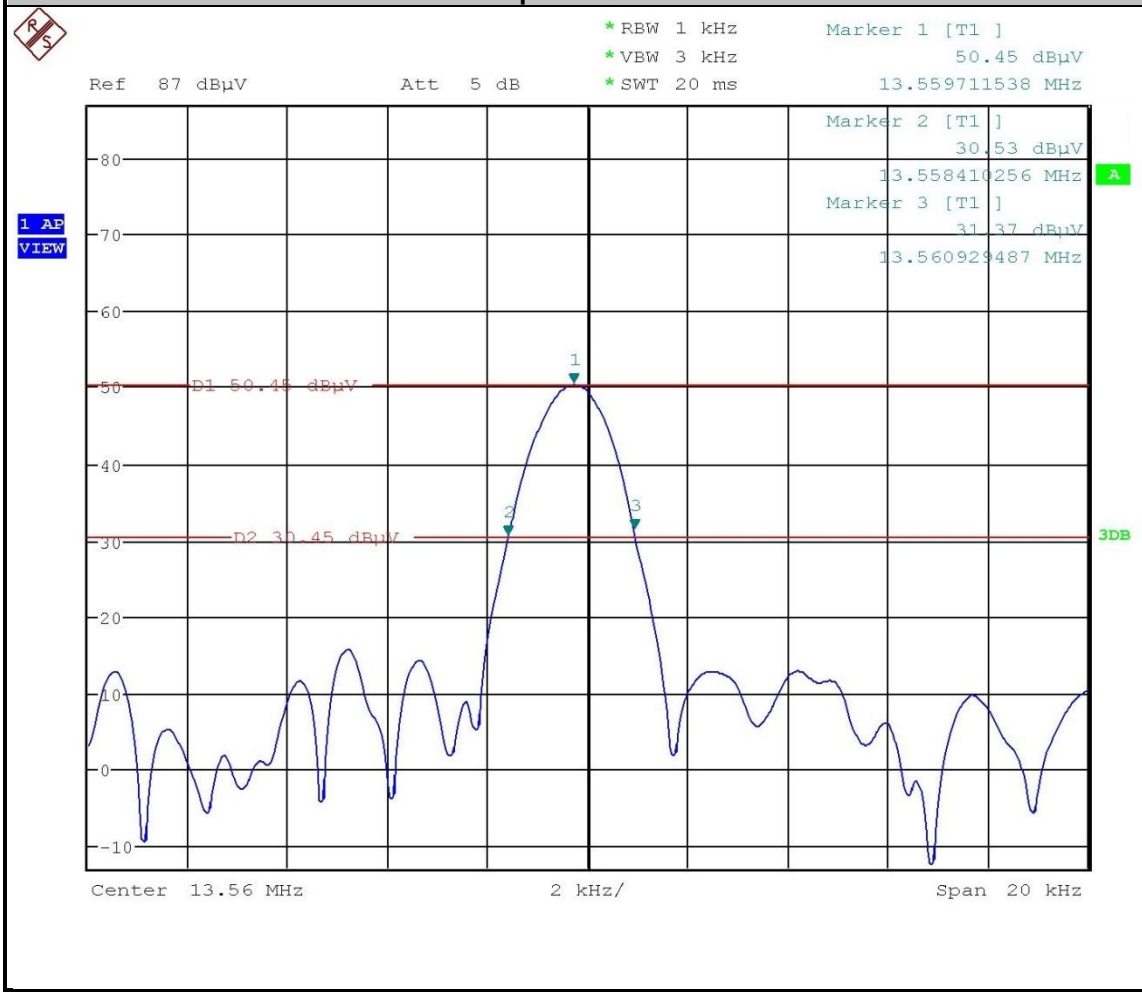
a. Placed the EUT on the testing table.
b. Set the EUT under transmission condition continuously at specific channel frequency.

4.4.7 Test Results

**Mode A**

| 20 dBc Point (Low) | 20 dBc Point (High) | Operating Frequency Band (MHz) | Pass / Fail |
|---|---|---|---|
| 13.558410256 MHz | 13.560929487 MHz | 13.553~13.567 | Pass |

**Spectrum Plot Of Value**

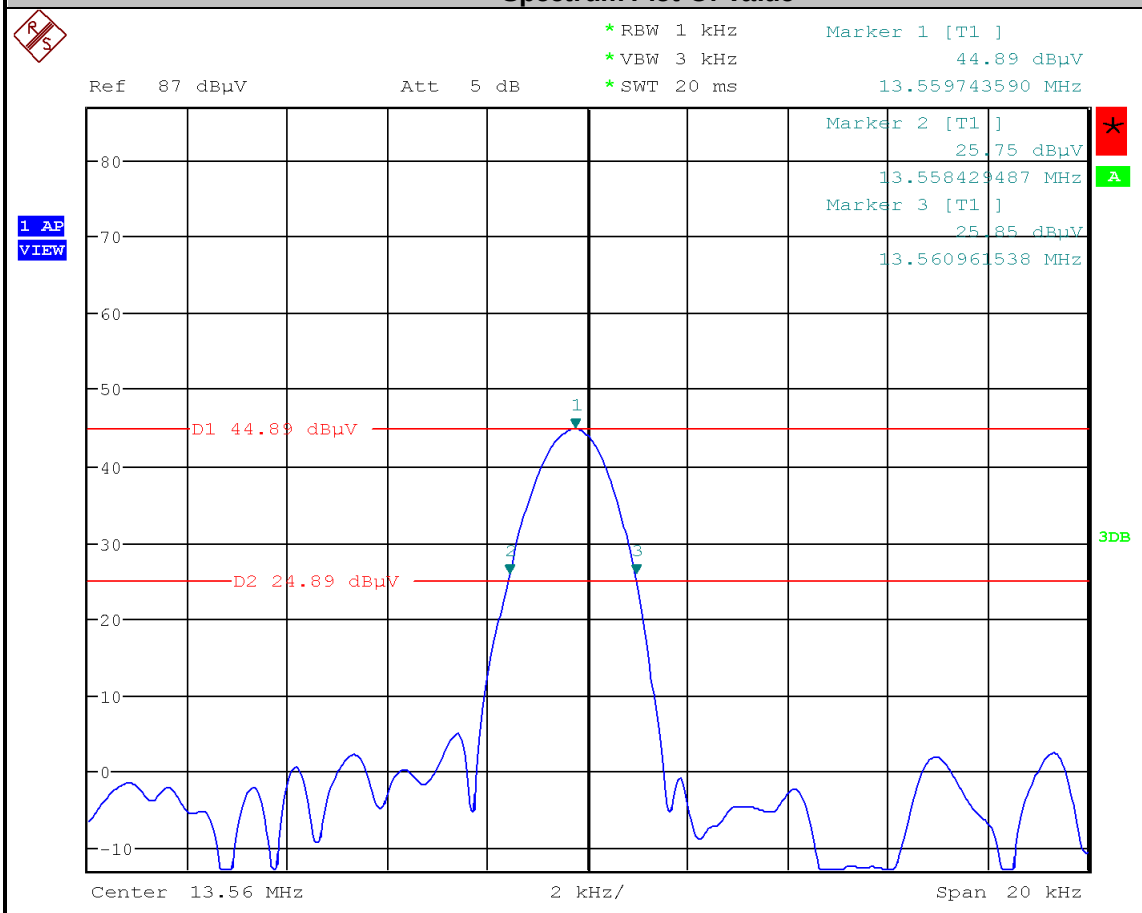



Note: The signal look like CW signal, so RBW can't be match 1~5 % OBW.

## Mode B

| 20 dBc Point (Low) | 20 dBc Point (High) | Operating Frequency Band (MHz) | Pass / Fail |
|---|---|---|---|
| 13.558429487 MHz | 13.560961538 MHz | 13.553~13.567 | Pass |

**Spectrum Plot Of Value**




Note: The signal look like CW signal, so RBW can't be match 1~5 % OBW.

## 5 Pictures of Test Arrangements

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

**Appendix – Information of the Testing Laboratories**

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

If you have any comments, please feel free to contact us at the following: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Tel: 886-3-6668565
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Tel: 886-3-3183232
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**Email:** service.adt@tw.bureauveritas.com
**Web Site:** www.bureauveritas-adt.com


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

**--- END ---**