

## FCC Test Report

**Report No.:** RF160630D15

**FCC ID:** ARS-SMMTN28C01

**Model No.:** SM-MTN28-C01

**Received Date:** Jun. 30, 2016

**Test Date:** Jul. 19 ~ 21, 2016

**Issued Date:** Jul. 22, 2016

**Applicant:** TOP VICTORY ELECTRONICS (TAIWAN) CO., LTD.

**Address:** 10F., No 230, Liancheng Rd., Zhonghe Dist., New Taipei City 23553, Taiwan

**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



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### Release Control Record

| Issue No.   | Description       | Date Issued   |
|-------------|-------------------|---------------|
| RF160630D15 | Original release. | Jul. 22, 2016 |

## 1 Certificate of Conformity

**Product:** NFC Controller Module with Integrated Antenna

**Brand:** TPV

**Model No.:** SM-MTN28-C01

**Sample Status:** Engineering sample

**Applicant:** TOP VICTORY ELECTRONICS (TAIWAN) CO., LTD.

**Test Date:** Jul. 19 ~ 21, 2016

**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 EMC characteristics under the conditions specified in this report.

**Prepared by :** Annie Chang , **Date:** Jul. 22, 2016  
Annie Chang / Senior Specialist

**Approved by :** Rex Lai , **Date:** Jul. 22, 2016  
Rex Lai / Assistant Manager

## 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 -21.10dB at 0.40781MHz. |
| 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 -70.46dB 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. Minimum passing margin is -2.83dB at 40.68MHz.    |
| 15.225 (e)   | The frequency tolerance  | PASS   | Meet the requirement of limit.   |
| 15.215 (c)   | 20dB Bandwidth   | PASS   | Meet the requirement of limit.   |

### 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 | 150kHz ~ 30MHz  | 2.78 dB                        |
| Radiated Emissions up to 1 GHz     | 30MHz ~ 1000MHz | 4.00 dB                        |

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

|                     |   |
|---------------------|---|
| Product             | NFC Controller Module with Integrated Antenna |
| Brand               | TPV   |
| Model No.           | SM-MTN28-C01                                  |
| Status of EUT       | Engineering sample                            |
| Power Supply Rating | 5Vdc from host equipment                      |
| Modulation Type     | ASK   |
| Operating Frequency | 13.56MHz                                      |
| Number of Channel   | 1   |
| Antenna Type        | Loop antenna                                  |
| Antenna Connector   | N/A   |
| Accessory Device    | N/A   |
| Data Cable Supplied | N/A   |

Note:

1. The EUT could be used with the following platforms:

| Product                | Brand  | Model No.         | Color of Outer Appearance |
|------------------------|--------|-------------------|---------------------------|
| Interactive flat panel | Google | GA5A00001-A03-Z04 | Red                       |
|                        |        | GA5A00001-A03-Z11 | Blue                      |
|                        |        | GA5A00001-A03-Z37 | Dark grey                 |

Mode: **GA5A00001-A03-Z04** was selected for final test.

2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

#### 3.2 Description of Test Modes

One channel was provided to this EUT:

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

### 3.2.1 Test Mode Applicability and Tested Channel Detail

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

Where **RE:** Radiated Emission **PLC:** Power Line Conducted Emission  
**FS:** Frequency Stability **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:**

- This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

| EUT CONFIGURE MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE |
|--------------------|-------------------|----------------|-----------------|
| -                  | 1                 | 1              | ASK             |

#### **20dB 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 |
|--------------------|-------------------|----------------|-----------------|
| -                  | 1                 | 1              | ASK             |

**TEST CONDITION:**

| Applicable To | Environmental Conditions | Input Power           | Tested By |
|---------------|--------------------------|-----------------------|-----------|
| RE            | 25deg. C, 73%RH          | 120Vac, 60Hz (System) | Ian Chang |
| PLC           | 25deg. C, 73%RH          | 120Vac, 60Hz (System) | Ian Chang |
| APCM          | 25deg. C, 60%RH          | 120Vac, 60Hz (System) | Saxon Lee |



### 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.

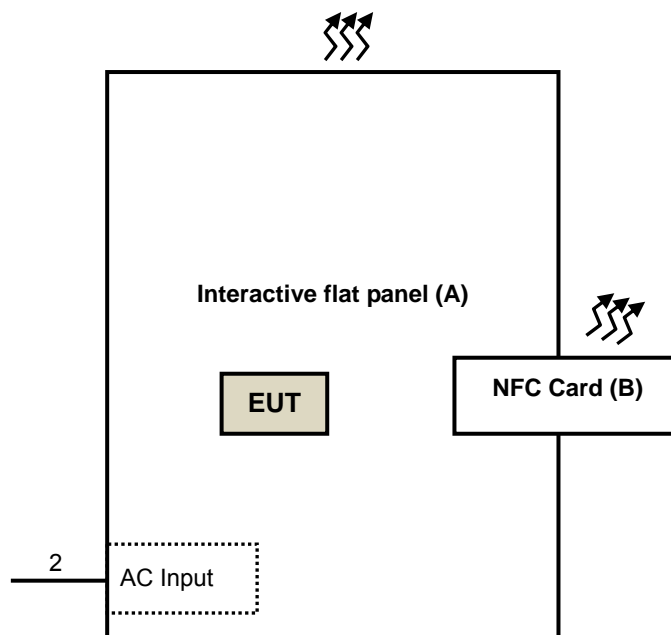
| ID | Product                | Brand  | Model No.         | Serial No. | FCC ID | Remarks            |
|----|------------------------|--------|-------------------|------------|--------|--------------------|
| A. | Interactive flat panel | Google | GA5A00001-A03-Z04 | N/A        | N/A    | Provided by Lab    |
| B. | NFC Card               | N/A    | N/A               | N/A        | N/A    | Supplied by client |

Note: 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. | AC Power Cord | 1    | 1.8        | N                  | 0            | Supplied by client |

Note: The core(s) is(are) originally attached to the cable(s).

#### 3.3.1 Configuration of System under Test



### 3.4 General Description of Applied Standards

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

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

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

**KDB 174176 D01 Line Conducted FAQ v01**

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

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 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.     | CALIBRATED DATE | CALIBRATED UNTIL |
|---|----------------------|----------------|-----------------|------------------|
| HP Preamplifier                         | 8447D                | 2432A03504     | Feb. 26, 2016   | Feb. 25, 2017    |
| HP Preamplifier                         | 8449B                | 3008A01201     | Feb. 26, 2016   | Feb. 25, 2017    |
| MITEQ Preamplifier                      | AMF-6F-260400-33-8P  | 892164         | Mar. 01, 2016   | Feb. 28, 2017    |
| Agilent TEST RECEIVER                   | N9038A               | MY51210129     | Feb. 02, 2016   | Feb. 01, 2017    |
| Schwarzbeck Antenna                     | VULB 9168            | 139            | Jan. 04, 2016   | Jan. 03, 2017    |
| Schwarzbeck Antenna                     | VHBA 9123            | 480            | May 29, 2015    | May 28, 2017     |
| Schwarzbeck Horn Antenna                | BBHA-9170            | 212            | Jan. 08, 2016   | Jan. 07, 2017    |
| Schwarzbeck Horn Antenna                | BBHA 9120-D1         | D130           | Jan. 21, 2016   | Jan. 20, 2017    |
| ADT. Turn Table                         | TT100                | 0306           | NA              | NA               |
| ADT. Tower                              | AT100                | 0306           | NA              | NA               |
| Software                                | Radiated_V7.6.15.9.4 | NA             | NA              | NA               |
| SUHNER RF cable With 4dB PAD            | SF104                | CABLE-CH6      | Aug. 15, 2015   | Aug. 14, 2016    |
| SUHNER RF cable With 3dB PAD            | SF102                | Cable-CH8-3.6m | Aug. 15, 2015   | Aug. 14, 2016    |
| KEYSIGHT MIMO Powermeasurement Test set | U2021XA              | U2021XA-001    | May 25, 2016    | May 24, 2017     |
| Loop Antenna EMCI                       | LPA600               | 270            | Aug. 20, 2015   | Aug. 19, 2017    |
| ROHDE & SCHWARZ Spectrum Analyzer       | FSV40                | 101042         | Sep. 23, 2015   | Sep. 22, 2016    |
| Temperature & Humidity Chamber          | MHU-225AU            | 920409         | May 25, 2016    | May 24, 2017     |
| Programable DC Source IDRC              | DSP-030-025HD        | 500156         | Jul. 15, 2016   | Jul. 14, 2017    |

- NOTE:**
1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.
  2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
  3. The test was performed in Chamber No. 6.
  4. The Industry Canada Reference No. IC 7450E-6.
  5. The FCC Site Registration No. is 447212.

#### 4.1.3 Test Procedures

##### **For Frequency range 9kHz~30MHz**

- a. The EUT was placed on the horizontal metal ground plane at an accredited test facility at a 3 meter Semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation. Then the Loop antenna was rotated 360 degrees to determine the position of the highest radiation.
- b. The antenna is a broadband loop antenna, which is fixed of a 1m height above the ground, and set away from 3m to the EUT to find the disturbance reading on each frequency.
- c. The test-receiver system was set to Quasi-peak Detect Function and Specified Bandwidth.

##### **For Frequency range 30 ~ 1000MHz**

- a. The EUT was placed on the horizontal metal ground plane at an accredited test facility
- 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:**

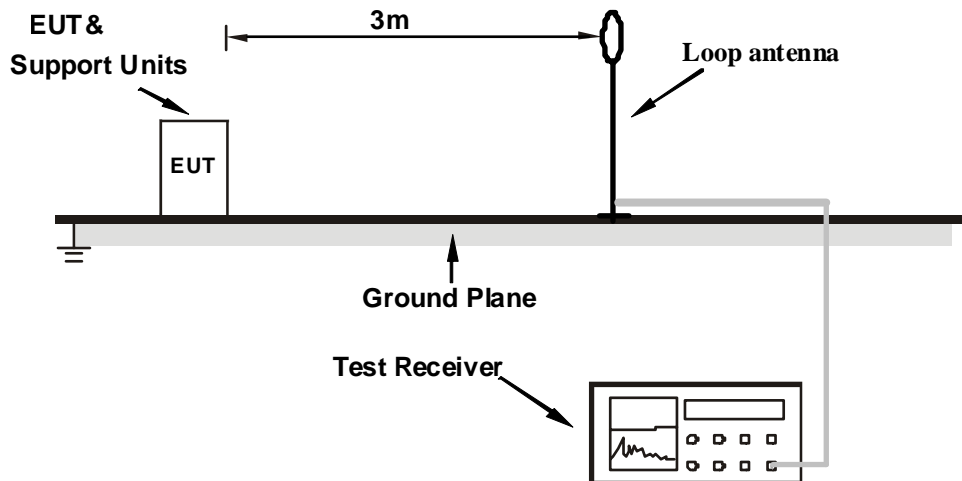
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 Deviation from Test Standard

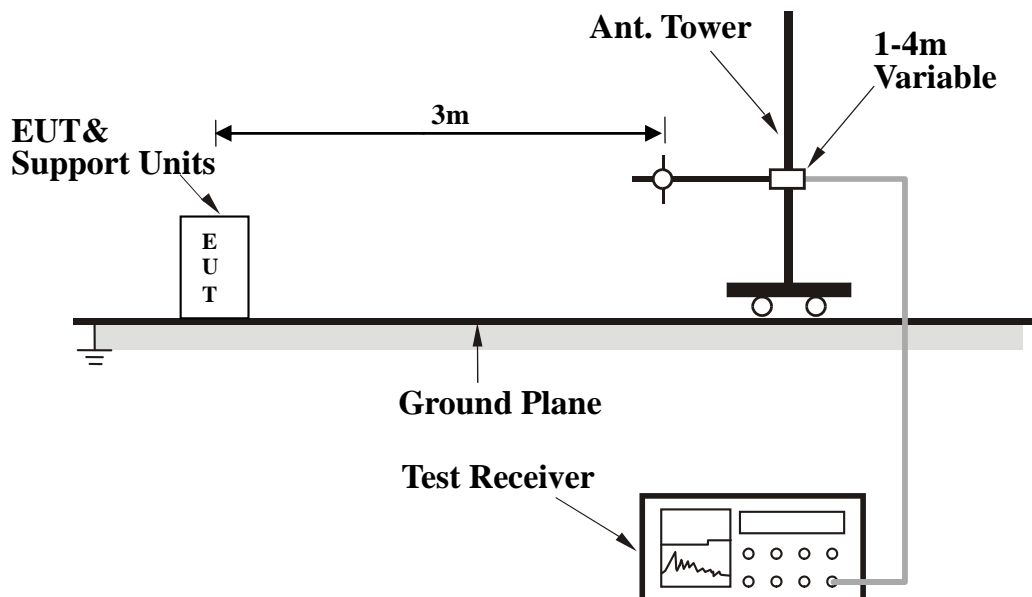
No deviation.

#### 4.1.5 Test Set Up

For Frequency range 9kHz~30MHz



For Frequency range 30 ~ 1000MHz



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

#### 4.1.6 EUT Operating Conditions

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

4.1.7 Test Results

|                        |                    |                          |            |
|------------------------|--------------------|--------------------------|------------|
| <b>Channel</b>         | Channel 1          | <b>Detector Function</b> | Quasi-Peak |
| <b>Frequency Range</b> | 13.553 ~ 13.567MHz |                          |            |

**Antenna Polarity & Test Distance: Loop Antenna Open At 3m**

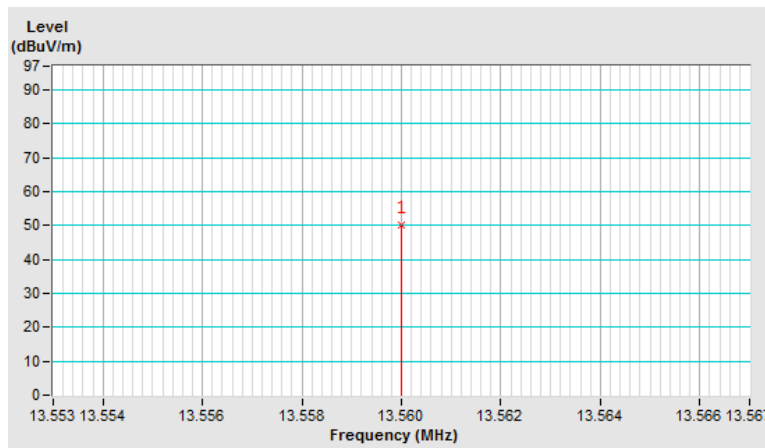
| No. | Freq. (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
|-----|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| 1   | 13.56       | 50.11 QP                | 124.00         | -73.89      | 1.00               | 217                  | 53.92            | -3.81                    |

- REMARKS:**
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
  2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor(dB)
  3. 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:

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



|                        |                    |                          |            |
|------------------------|--------------------|--------------------------|------------|
| <b>Channel</b>         | Channel 1          | <b>Detector Function</b> | Quasi-Peak |
| <b>Frequency Range</b> | 13.553 ~ 13.567MHz |                          |            |

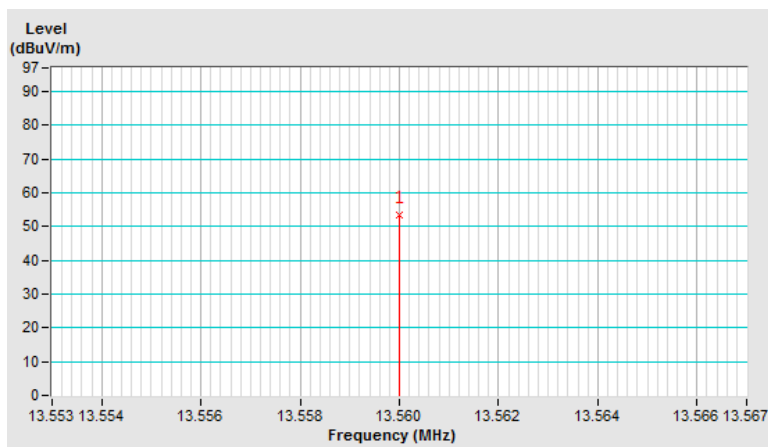
| Antenna Polarity & Test Distance: Loop Antenna Close At 3m |             |                         |                |             |                    |                      |                  |                          |
|--|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No.  | Freq. (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1  | 13.56       | 53.54 QP                | 124.00         | -70.46      | 1.00               | 162                  | 57.35            | -3.81                    |

- REMARKS:**
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
  2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor(dB)
  3. 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:

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



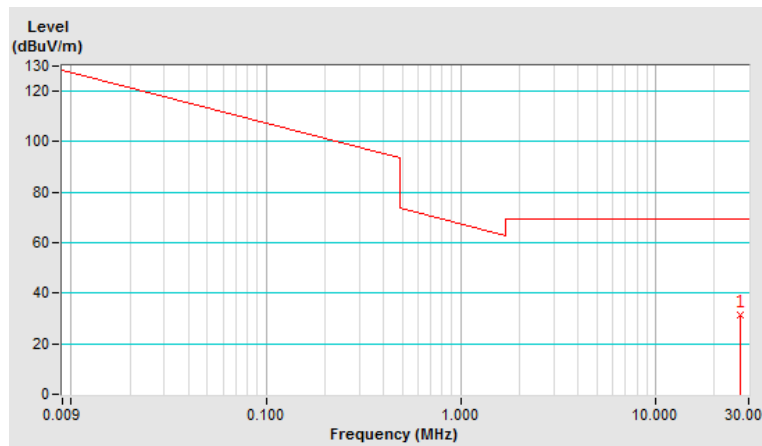


|                        |             |                          |            |
|------------------------|-------------|--------------------------|------------|
| <b>CHANNEL</b>         | Channel 1   | <b>DETECTOR FUNCTION</b> | Quasi-Peak |
| <b>FREQUENCY RANGE</b> | Below 30MHz |                          |            |

| Antenna Polarity & Test Distance: Loop Antenna Open At 3m |             |                         |                |             |                    |                      |                  |                          |
|---|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No.   | Freq. (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1   | 27.12       | 31.31 QP                | 69.54          | -38.23      | 1.00 H             | 100                  | 36.23            | -4.92                    |

**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

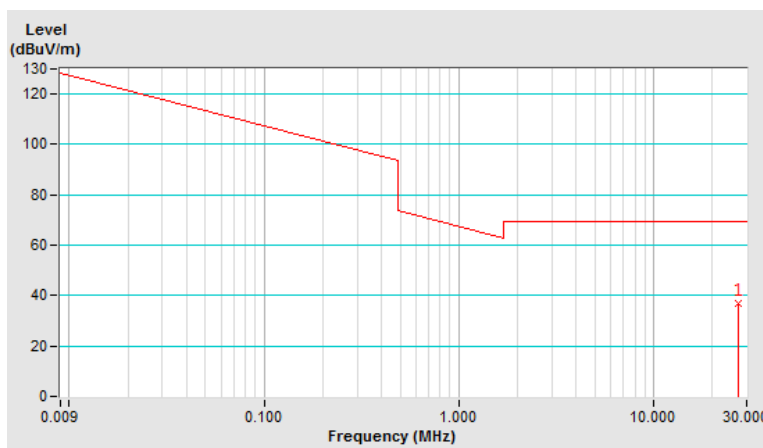


|                        |             |                          |            |
|------------------------|-------------|--------------------------|------------|
| <b>CHANNEL</b>         | Channel 1   | <b>DETECTOR FUNCTION</b> | Quasi-Peak |
| <b>FREQUENCY RANGE</b> | Below 30MHz |                          |            |

| Antenna Polarity & Test Distance: Loop Antenna Close At 3m |             |                         |                |             |                    |                      |                  |                          |
|--|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No.  | Freq. (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1  | 27.12       | 37.08 QP                | 69.54          | -32.46      | 1.00 V             | 159                  | 42.00            | -4.92                    |

**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



|                        |               |                          |            |
|------------------------|---------------|--------------------------|------------|
| <b>CHANNEL</b>         | Channel 1     | <b>DETECTOR FUNCTION</b> | Quasi-Peak |
| <b>FREQUENCY RANGE</b> | Below 1000MHz |                          |            |

| Antenna Polarity & Test Distance: Horizontal At 3m |             |                         |                |             |                    |                      |                  |                          |
|--|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No.  | Freq. (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1  | 40.67       | 31.35 QP                | 40.00          | -8.65       | 3.62 H             | 360                  | 41.77            | -10.42                   |
| 2  | 122.05      | 31.17 QP                | 43.50          | -12.33      | 2.85 H             | 223                  | 42.84            | -11.67                   |
| 3  | 233.22      | 33.73 QP                | 46.00          | -12.27      | 1.34 H             | 128                  | 44.97            | -11.24                   |
| 4  | 339.04      | 27.49 QP                | 46.00          | -18.51      | 1.19 H             | 123                  | 34.61            | -7.12                    |
| 5  | 399.76      | 30.88 QP                | 46.00          | -15.12      | 1.50 H             | 101                  | 36.34            | -5.46                    |
| 6  | 417.56      | 29.13 QP                | 46.00          | -16.87      | 1.87 H             | 141                  | 34.48            | -5.35                    |

| Antenna Polarity & Test Distance: Vertical At 3m |              |                         |                |              |                    |                      |                  |                          |
|--|--------------|-------------------------|----------------|--------------|--------------------|----------------------|------------------|--------------------------|
| No.  | Freq. (MHz)  | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB)  | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| <b>1</b>   | <b>40.68</b> | <b>37.17 QP</b>         | <b>40.00</b>   | <b>-2.83</b> | <b>1.00 V</b>      | <b>112</b>           | <b>47.59</b>     | <b>-10.42</b>            |
| 2  | 116.43       | 32.77 QP                | 43.50          | -10.73       | 1.03 V             | 143                  | 45.00            | -12.23                   |
| 3  | 135.49       | 33.31 QP                | 43.50          | -10.19       | 1.62 V             | 119                  | 43.74            | -10.43                   |
| 4  | 230.01       | 30.36 QP                | 46.00          | -15.64       | 1.80 V             | 87                   | 42.15            | -11.79                   |
| 5  | 347.82       | 26.27 QP                | 46.00          | -19.73       | 2.35 V             | 12                   | 33.39            | -7.12                    |
| 6  | 417.51       | 32.08 QP                | 46.00          | -13.92       | 1.69 V             | 143                  | 37.43            | -5.35                    |
| 7  | 600.02       | 32.92 QP                | 46.00          | -13.08       | 1.41 V             | 222                  | 34.53            | -1.61                    |

**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

## 4.2 Conducted Emission Measurement

### 4.2.1 Limits of Conducted Emission Measurement

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

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

### 4.2.2 Test Instruments

| Description & Manufacturer                                       | Model No.   | Serial No.   | Cal. Date     | Cal. Due      |
|--|-------------|--------------|---------------|---------------|
| ROHDE & SCHWARZ<br>TEST RECEIVER                                 | ESCS 30     | 100276       | Apr. 12, 2016 | Apr. 11, 2017 |
| ROHDE & SCHWARZ<br>Artificial Mains Network<br>(for EUT)         | ENV216      | 101197       | May 04, 2016  | May 03, 2017  |
| LISN With Adapter<br>(for EUT)                                   | AD10        | C10Ada-002   | May 04, 2016  | May 03, 2017  |
| ROHDE & SCHWARZ<br>Artificial Mains Network<br>(for peripherals) | ESH3-Z5     | 100218       | Nov. 25, 2015 | Nov. 24, 2016 |
| SCHWARZBECK<br>Artificial Mains Network (For<br>EUT)             | NNLK8129    | 8129229      | May 04, 2016  | May 03, 2017  |
| Software   | Cond_V7.3.7 | NA           | NA            | NA            |
| RF cable (JYEBAO)<br>With 10dB PAD                               | 5D-FB       | Cable-C10.01 | Feb. 15, 2016 | Feb. 14, 2017 |
| SUHNER Terminator<br>(For ROHDE & SCHWARZ<br>LISN)               | 65BNC-5001  | E1-011484    | May 12, 2016  | May 11, 2017  |
| ROHDE & SCHWARZ<br>Artificial Mains Network (For<br>TV EUT)      | ESH3-Z5     | 100220       | Nov. 13, 2015 | Nov. 12, 2016 |
| LISN With Adapter<br>(for TV EUT)                                | 100220      | N/A          | Nov. 13, 2015 | Nov. 12, 2016 |

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

2. The test was performed in Shielded Room No. 10.

3. The VCCI Site Registration No. C-1852.

#### 4.2.3 Test Procedures

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

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

**Per Q5 of KDB 174176 D01 Line Conducted FAQ v01,**

#### Devices Operating Below 30 MHz

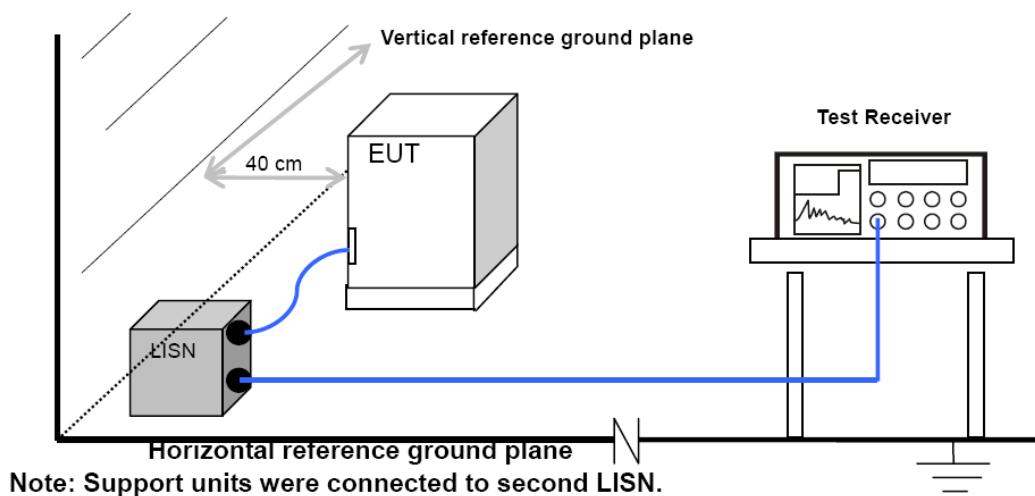
For a device with a permanent or detachable antenna operating at or below 30 MHz, the FCC will accept measurements done with a suitable dummy load in lieu of the antenna under the following conditions: (1) perform the AC line conducted tests with the antenna connected to determine compliance with Section 15.207 limits outside the transmitter's fundamental emission band; (2) retest with a dummy load in lieu of the antenna to determine compliance with Section 15.207 limits within the transmitter's fundamental emission band. For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network which simulates the antenna in the fundamental frequency band.

All measurements must be performed as specified in clause 6.2 of ANSI C63.10-2013.

#### 4.2.4 Deviation from Test Standard

No deviation.

#### 4.2.5 Test Setup



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

#### 4.2.6 EUT Operating Conditions

Same as item 4.1.6.

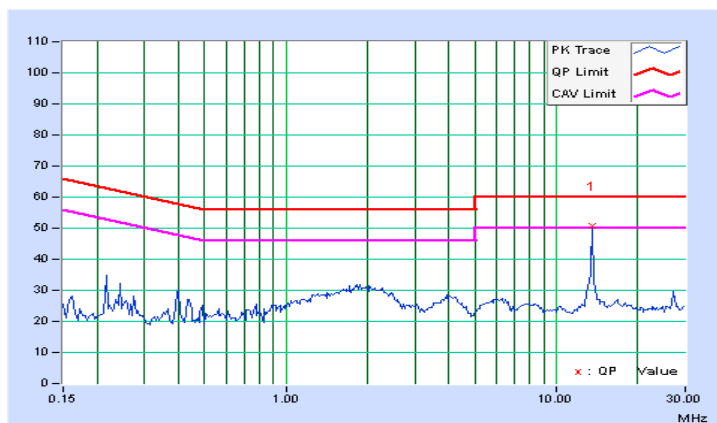
#### 4.2.7 Test Results

|                        |          |                      |      |
|------------------------|----------|----------------------|------|
| <b>Phase</b>           | Line 1   | <b>6dB Bandwidth</b> | 9kHz |
| <b>Frequency Range</b> | 13.56MHz |                      |      |

| 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  | *13.55987       | 9.93                   | 40.87                | 40.65 | 50.80                 | 50.58 | 60.00        | 50.00 | -9.20       | 0.58 |

**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
6. " \* ": Fundamental frequency.

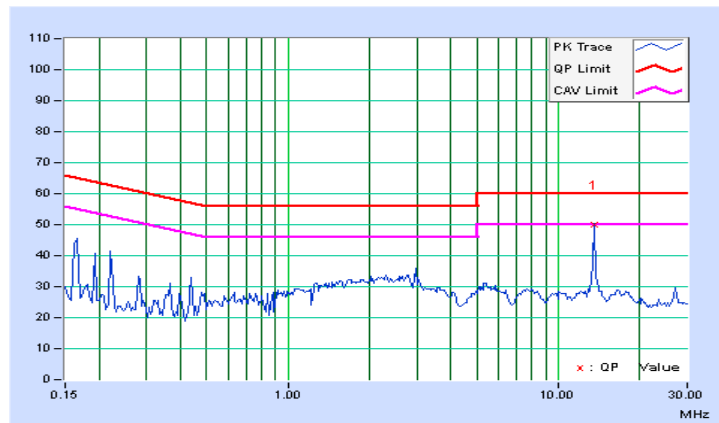


|                        |          |                      |      |
|------------------------|----------|----------------------|------|
| <b>Phase</b>           | Line 2   | <b>6dB Bandwidth</b> | 9kHz |
| <b>Frequency Range</b> | 13.56MHz |                      |      |

| 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  | *13.55987       | 9.92                   | 40.05                | 40.04 | 49.97                 | 49.96 | 60.00        | 50.00 | -10.03      | -0.04 |

**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
6. " \* ": Fundamental frequency.

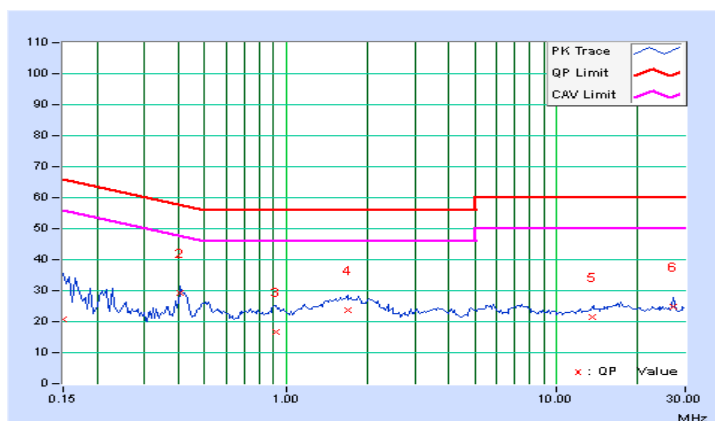


|                        |  |                      |      |
|------------------------|--|----------------------|------|
| <b>Phase</b>           | Line 1   | <b>6dB Bandwidth</b> | 9kHz |
| <b>Frequency Range</b> | 150kHz ~ 30MHz<br>(Remove the antenna and terminate the RF output with a dummy load) |                      |      |

| 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         | 9.70                   | 10.89                | 3.13         | 20.59                 | 12.83        | 66.00        | 56.00        | -45.41        | -43.17        |
| <b>2</b> | <b>0.40781</b>  | <b>9.69</b>            | <b>19.40</b>         | <b>16.90</b> | <b>29.09</b>          | <b>26.59</b> | <b>57.69</b> | <b>47.69</b> | <b>-28.60</b> | <b>-21.10</b> |
| 3        | 0.91953         | 9.73                   | 6.96                 | 2.88         | 16.69                 | 12.61        | 56.00        | 46.00        | -39.31        | -33.39        |
| 4        | 1.68750         | 9.77                   | 13.95                | 10.24        | 23.72                 | 20.01        | 56.00        | 46.00        | -32.28        | -25.99        |
| 5        | 13.56000        | 9.93                   | 11.43                | 8.05         | 21.36                 | 17.98        | 60.00        | 50.00        | -38.64        | -32.02        |
| 6        | 27.12109        | 9.98                   | 14.98                | 14.42        | 24.96                 | 24.40        | 60.00        | 50.00        | -35.04        | -25.60        |

**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



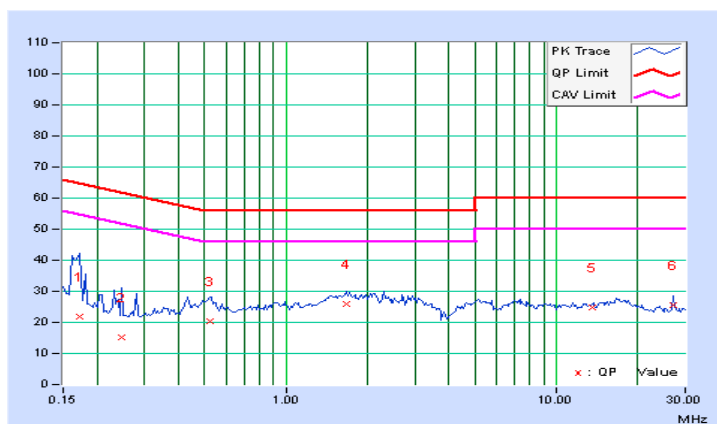


|                        |  |                      |      |
|------------------------|--|----------------------|------|
| <b>Phase</b>           | Line 2   | <b>6dB Bandwidth</b> | 9kHz |
| <b>Frequency Range</b> | 150kHz ~ 30MHz<br>(Remove the antenna and terminate the RF output with a dummy load) |                      |      |

| 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  | 0.17344         | 9.70                   | 12.23                | 6.18  | 21.93                 | 15.88 | 64.79        | 54.79 | -42.87      | -38.92 |
| 2  | 0.24766         | 9.69                   | 5.58                 | 1.35  | 15.27                 | 11.04 | 61.84        | 51.84 | -46.57      | -40.80 |
| 3  | 0.52109         | 9.70                   | 10.80                | 4.91  | 20.50                 | 14.61 | 56.00        | 46.00 | -35.50      | -31.39 |
| 4  | 1.67578         | 9.76                   | 16.29                | 13.83 | 26.05                 | 23.59 | 56.00        | 46.00 | -29.95      | -22.41 |
| 5  | 13.56000        | 9.92                   | 14.85                | 12.12 | 24.77                 | 22.04 | 60.00        | 50.00 | -35.23      | -27.96 |
| 6  | 27.11975        | 9.93                   | 15.72                | 15.41 | 25.65                 | 25.34 | 60.00        | 50.00 | -34.35      | -24.66 |

**Remarks:**

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

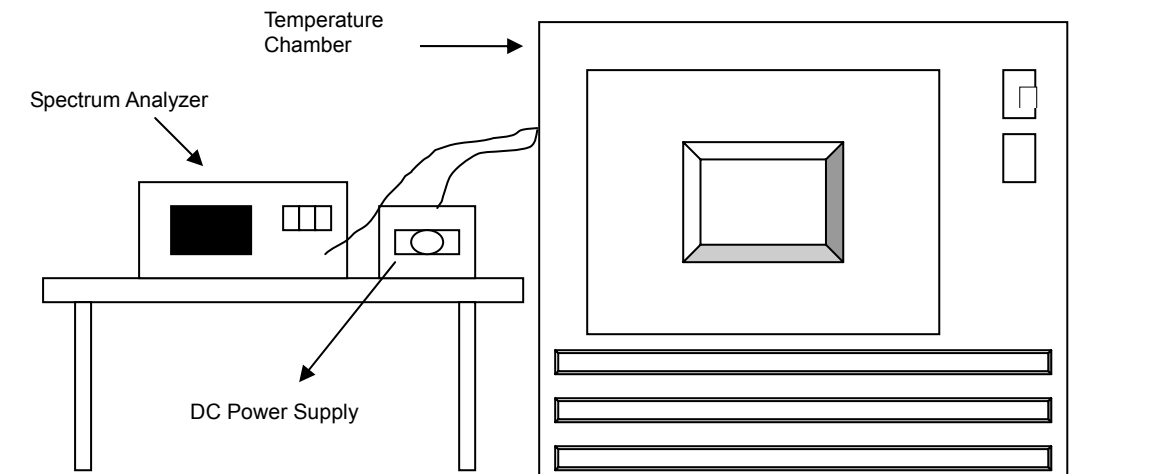


### 4.3 Frequency Stability

#### 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

- 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.
- Repeated step 2 and 3 with the temperature chamber set to the lowest temperature.
- 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

| OPERATING FREQUENCY: 13.56MHz |                       | LIMIT: $\pm 0.01\%$ |             |
|-------------------------------|-----------------------|---------------------|-------------|
| TEMP.<br>(°C)                 | POWER SUPPLY<br>(Vdc) | (MHz)               | (%)         |
| 20                            | 5                     | 13.5590             | -0.00737463 |
|                               | 5.75                  | 13.5601             | 0.00076746  |
|                               | 4.25                  | 13.5604             | 0.00294985  |
| -20                           | 5                     | 13.5608             | 0.00589970  |
| 55                            | 5                     | 13.5596             | -0.00294985 |

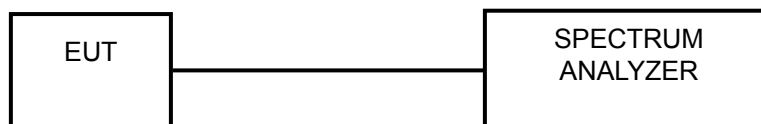
**Note:** Operating temperature of EUT is -20 degrees C to 50 degrees C.

#### 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

| Channel | Frequency (MHz) | 20dB Bandwidth (kHz) | Pass/Fail |
|---------|-----------------|----------------------|-----------|
| 1       | 13.56           | 25.40                | Pass      |



## 5 Pictures of Test Arrangements

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

## Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are 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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The address and road map of all our labs can be found in our web site also.

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