

## FCC Test Report (Co-Located)

**Report No.:** RF190919D02-5

**FCC ID:** P27NA503S

**Test Model:** NA503S-4G

**Series Model:** NA503S-4Gxxxxxxx (the 1st x should be "blank" or "-"; the rest x could be 0 to 9, A to Z, "blank" or " ", for marketing purpose)

**Received Date:** Sep. 19, 2019

**Test Date:** Oct. 22, 2019

**Issued Date:** Dec. 6, 2019

**Applicant:** Sercomm Corp.

**Address:** 8F, No. 3-1, YuanQu St., NanKang, Taipei 115, Taiwan, R.O.C. (NanKang Software Park)

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

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

**FCC Registration /**  
**Designation Number:** 198487 / TW2021



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### Release Control Record

| Issue No.     | Description       | Date Issued  |
|---------------|-------------------|--------------|
| RF190919D02-5 | Original release. | Dec. 6, 2019 |

## 1 Certificate of Conformity

**Product:** Multiple RF Home Gateway

**Brand:** Craftsman

**Test Model:** NA503S-4G

**Series Model:** NA503S-4Gxxxxxxx (the 1st x should be "blank" or "-"; the rest x could be 0 to 9, A to Z, "blank" or "- " , for marketing purpose)

**Sample Status:** Engineering sample

**Applicant:** Sercomm Corp.

**Test Date:** Oct. 22, 2019

**Standard:** 47 CFR FCC Part 15, Subpart C (Section 15.247)  
47 CFR FCC Part 15, Subpart E (Section 15.407)  
47 CFR FCC Part 15, Subpart C (Section 15.249)  
FCC Part 22, Subpart H  
FCC Part 24, Subpart E  
FCC Part 27, Subpart C, H, F, L  
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 :** Annie Chang , **Date:** Dec. 6, 2019  
Annie Chang / Senior Specialist

**Approved by :** Rex Lai , **Date:** Dec. 6, 2019  
Rex Lai / Associate Technical Manager

## 2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C (Section 15.247),<br>47 CFR FCC Part 15, Subpart C (Section 15.249)<br>47 CFR FCC Part 15, Subpart E (Section 15.407),<br>FCC Part 22, Subpart H<br>FCC Part 24, Subpart E<br>FCC Part 27, Subpart C, H, F, L |                                |        |                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------|------------------------------------------------------------------------------------|
| FCC Clause                                                                                                                                                                                                                                  | Test Item                      | Result | Remarks                                                                            |
| 15.205<br>15.209<br>15.247(d)<br>15.407(b)<br>(1/2/3/4(i/ii)/6)<br>2.1053<br>22.917<br>24.238<br>27.53(h)                                                                                                                                   | Radiated Emissions Measurement | Pass   | Meet the requirement of limit.<br>Minimum passing margin is -1.11dB at 2390.00MHz. |

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

### 2.1 Measurement Uncertainty

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

| Measurement                    | Frequency    | Expanded Uncertainty (k=2) (±) |
|--------------------------------|--------------|--------------------------------|
| Radiated Emissions up to 1 GHz | 9kHz ~ 30MHz | 2.38 dB                        |
|                                | 30MHz ~ 1GHz | 5.43 dB                        |
| Radiated Emissions above 1 GHz | Above 1GHz   | 5.42 dB                        |

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

|                       |                                                                                                                                    |                                                                                                                               |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Product               | Multiple RF Home Gateway                                                                                                           |                                                                                                                               |
| Brand                 | Craftsman                                                                                                                          |                                                                                                                               |
| Test Model            | NA503S-4G                                                                                                                          |                                                                                                                               |
| Series Model          | NA503S-4Gxxxxxxxx (the 1st x should be "blank" or "-"; the rest x could be 0 to 9, A to Z, "blank" or "- ", for marketing purpose) |                                                                                                                               |
| Model Difference      | For marking purpose                                                                                                                |                                                                                                                               |
| Status of EUT         | Engineering sample                                                                                                                 |                                                                                                                               |
| Power Supply Rating   | DC 12V from Adapter or DC 7.5V from battery                                                                                        |                                                                                                                               |
| Modulation Type       | WLAN                                                                                                                               | CCK, DQPSK, DBPSK for DSSS<br>64QAM, 16QAM, QPSK, BPSK for OFDM<br>256QAM for OFDM in 11ac mode only.                         |
|                       | Z-Wave                                                                                                                             | FSK                                                                                                                           |
|                       | Zigbee                                                                                                                             | OQPSK                                                                                                                         |
|                       | BT LE                                                                                                                              | GFSK                                                                                                                          |
|                       | WCDMA                                                                                                                              | QPSK                                                                                                                          |
|                       | LTE                                                                                                                                | QPSK, 16QAM                                                                                                                   |
| Modulation Technology | WLAN                                                                                                                               | DSSS, OFDM                                                                                                                    |
| Transfer Rate         | WLAN                                                                                                                               | 802.11a: up to 6Mbps<br>802.11b: up to 11Mbps<br>802.11g: up to 54Mbps<br>802.11n: up to 300Mbps<br>802.11ac: up to 866.7Mbps |
|                       | Zigbee                                                                                                                             | 250Kbps                                                                                                                       |
|                       | BT LE                                                                                                                              | 1Mbps                                                                                                                         |
| Operating Frequency   | WLAN                                                                                                                               | 2412~2462MHz, 5180~5240MHz, 5745~5825MHz                                                                                      |
|                       | Z-Wave                                                                                                                             | 908.4MHz, 916.0MHz                                                                                                            |
|                       | Zigbee                                                                                                                             | 2405 ~ 2480MHz                                                                                                                |
|                       | BT LE                                                                                                                              | 2402 ~ 2480MHz                                                                                                                |

|                   |              |                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Frequency Range   | WCDMA Band 2 | 1852.4 ~ 1907.6 MHz                                                                                                                                                                                                                                                                                                                                                                       |
|                   | WCDMA Band 5 | 826.4 ~ 846.6MHz,                                                                                                                                                                                                                                                                                                                                                                         |
|                   | LTE Band 2   | Channel Bandwidth 1.4MHz: 1850.7 ~ 1909.3MHz<br>Channel Bandwidth 3MHz: 1851.5 ~ 1908.5MHz<br>Channel Bandwidth 5MHz: 1852.5 ~ 1907.5MHz<br>Channel Bandwidth 10MHz: 1855.0 ~ 1905.0MHz<br>Channel Bandwidth 15MHz: 1857.5 ~ 1902.5MHz<br>Channel Bandwidth 20MHz: 1860.0 ~ 1900.0MHz                                                                                                     |
|                   | LTE Band 4   | Channel Bandwidth 1.4MHz: 1710.7 ~ 1754.3MHz<br>Channel Bandwidth 3MHz: 1711.5 ~ 1753.5MHz<br>Channel Bandwidth 5MHz: 1712.5 ~ 1752.5MHz<br>Channel Bandwidth 10MHz: 1715.0 ~ 1750.0MHz<br>Channel Bandwidth 15MHz: 1717.5 ~ 1747.5MHz<br>Channel Bandwidth 20MHz: 1720.0 ~ 1745.0MHz                                                                                                     |
|                   | LTE Band 5   | Channel Bandwidth 1.4MHz: 824.7 ~ 848.3MHz<br>Channel Bandwidth 3MHz: 825.5 ~ 847.5MHz<br>Channel Bandwidth 5MHz: 826.5 ~ 846.5MHz<br>Channel Bandwidth 10MHz: 829.0 ~ 844.0MHz                                                                                                                                                                                                           |
|                   | LTE Band 12  | Channel Bandwidth 1.4MHz: 699.7 ~ 715.3MHz<br>Channel Bandwidth 3MHz: 700.5 ~ 714.5MHz<br>Channel Bandwidth 5MHz: 701.5 ~ 713.5MHz<br>Channel Bandwidth 10MHz: 704.0 ~ 711.0MHz                                                                                                                                                                                                           |
|                   | LTE Band 13  | Channel Bandwidth 3MHz: 779.5 ~ 784.5MHz<br>Channel Bandwidth 5MHz: 782.0MHz                                                                                                                                                                                                                                                                                                              |
| Number of Channel | WLAN         | <b>2412~2462MHz:</b><br>11 for 802.11b, 802.11g, 802.11n (20MHz)<br>7 for 802.11n (40MHz)<br><b>5180~5240MHz:</b><br>4 for 802.11a, 802.11n (20MHz), 802.11ac (20MHz)<br>2 for 802.11n (40MHz), 802.11ac (40MHz)<br>1 for 802.11ac (80MHz)<br><b>5745~5825MHz:</b><br>5 for 802.11a, 802.11n (20MHz) 802.11ac (20MHz)<br>2 for 802.11n (40MHz) 802.11ac (40MHz)<br>1 for 802.11ac (80MHz) |
|                   | Z-Wave       | 2                                                                                                                                                                                                                                                                                                                                                                                         |
|                   | Zigbee       | 16                                                                                                                                                                                                                                                                                                                                                                                        |
|                   | BT LE        | 40                                                                                                                                                                                                                                                                                                                                                                                        |
| Output Power      | WLAN         | <b>2412~2462MHz:</b> 599.834mW<br><b>5180~5240MHz:</b> 52.187mW<br><b>5745~5825MHz:</b> 72.533mW                                                                                                                                                                                                                                                                                          |
|                   | Zigbee       | 18.408mW                                                                                                                                                                                                                                                                                                                                                                                  |
|                   | BT LE        | 19.861mW                                                                                                                                                                                                                                                                                                                                                                                  |

|                     |                        |                                                                                                                                                                                                                                                                                                   |
|---------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Max. ERP Power      | WCDMA Band 5           | 218.776mW (23.40dBm)                                                                                                                                                                                                                                                                              |
|                     | LTE Band 5             | Channel Bandwidth 1.4MHz: 204.174mW (23.10dBm)<br>Channel Bandwidth 3MHz: 204.174mW (23.10dBm)<br>Channel Bandwidth 5MHz: 208.890mW (23.20dBm)<br>Channel Bandwidth 10MHz: 194.984mW (22.90dBm)                                                                                                   |
|                     | LTE Band 12            | Channel Bandwidth 1.4MHz: 158.489mW (22.00dBm)<br>Channel Bandwidth 3MHz: 147.911mW (21.70dBm)<br>Channel Bandwidth 5MHz: 147.911mW (21.70dBm)<br>Channel Bandwidth 10MHz: 120.226mW (20.80dBm)                                                                                                   |
|                     | LTE Band 13            | Channel Bandwidth 3MHz: 120.226mW (20.80dBm)<br>Channel Bandwidth 5MHz: 128.825mW (21.10dBm)                                                                                                                                                                                                      |
| Max. EIRP Power     | WCDMA Band 2           | 245.471mW (23.90dBm)                                                                                                                                                                                                                                                                              |
|                     | LTE Band 2             | Channel Bandwidth 1.4MHz: 331.131mW (25.20dBm)<br>Channel Bandwidth 3MHz: 323.594mW (25.10dBm)<br>Channel Bandwidth 5MHz: 331.131mW (25.20dBm)<br>Channel Bandwidth 10MHz: 331.131mW (25.20dBm)<br>Channel Bandwidth 15MHz: 331.131mW (25.20dBm)<br>Channel Bandwidth 20MHz: 338.844mW (25.30dBm) |
|                     | LTE Band 4             | Channel Bandwidth 1.4MHz: 263.027mW (24.20dBm)<br>Channel Bandwidth 3MHz: 275.423mW (24.40dBm)<br>Channel Bandwidth 5MHz: 263.027mW (24.20dBm)<br>Channel Bandwidth 10MHz: 269.153mW (24.30dBm)<br>Channel Bandwidth 15MHz: 269.153mW (24.30dBm)<br>Channel Bandwidth 20MHz: 281.838mW (24.50dBm) |
| Antenna Type        | Refer to note as below |                                                                                                                                                                                                                                                                                                   |
| Antenna Connector   | Refer to note as below |                                                                                                                                                                                                                                                                                                   |
| Accessory Device    | Refer to note as below |                                                                                                                                                                                                                                                                                                   |
| Data Cable Supplied | N/A                    |                                                                                                                                                                                                                                                                                                   |



Note:

1. The EUT provides 2 completed transmitter and 2 receiver.

| Modulation Mode  | TX Function |
|------------------|-------------|
| 802.11a          | 2TX         |
| 802.11b          | 2TX         |
| 802.11g          | 2TX         |
| 802.11n (20MHz)  | 2TX         |
| 802.11n (40MHz)  | 2TX         |
| 802.11ac (20MHz) | 2TX         |
| 802.11ac (40MHz) | 2TX         |
| 802.11ac (80MHz) | 2TX         |

2. The EUT uses following adapter or battery.

| Item          | Adapter                                | Battery             |
|---------------|----------------------------------------|---------------------|
| Brand         | APD                                    | Simplo              |
| Model         | WB-24J12FU                             | NA50X               |
| AC I/P Rating | 100-240V, 50-60Hz, 0.7A                | -                   |
| DC O/P Rating | 12V, 2A                                | 7.5V, 2500mAh, 18Wh |
| Power cord    | AC 2 Pin, Non-shielded DC cable (1.5m) | -                   |

3. The EUT used antennas listed as below:

| Function     | Ant. No.   | Frequency Band (MHz) | Antenna Type | Antenna Connector | Gain (dBi) |         |
|--------------|------------|----------------------|--------------|-------------------|------------|---------|
|              |            |                      |              |                   | Chian 0    | Chian 1 |
| WCDMA Band 2 | Ant. 1 & 2 | 826.4-846.6          | PIFA         | I-PEX             | 3.00       | 2.49    |
| WCDMA Band 5 |            | 1852.4-1907.6        | PIFA         | I-PEX             | -0.66      | 0.03    |
| LTE Band 2   |            | 1850.7-1909.3        | PIFA         | I-PEX             | 3.00       | 2.49    |
| LTE Band 4   |            | 1710.7-1754.3        | PIFA         | I-PEX             | 1.87       | 2.58    |
| LTE Band 5   |            | 824.7-848.3          | PIFA         | I-PEX             | -0.66      | 0.03    |
| LTE Band 12  |            | 699.7-715.3          | PIFA         | I-PEX             | -0.45      | -0.63   |
| LTE Band 13  |            | 779.5-784.5          | PIFA         | I-PEX             | -0.14      | 0.76    |
| WLAN         | Ant. 3 & 4 | 2412-2462            | Dipole       | I-PEX             | 2.65       | 2.94    |
| WLAN         |            | 5180-5240            | Dipole       | I-PEX             | 2.56       | 2.82    |
| WLAN         |            | 5745-5825            | Dipole       | I-PEX             | 3.20       | 2.85    |
| BT LE        | Ant. 5     | 2402-2480            | Dipole       | I-PEX             | 3.74       | -       |
| Zigbee       | Ant. 6     | 2405-2480            | Dipole       | I-PEX             | 3.95       | -       |
| Z-Wave       | Ant. 7     | 908.4, 916.0         | PIFA         | N/A               | 1.26       | -       |

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

### 3.2 Test Mode Applicability and Tested Channel Detail

| EUT Configure Mode | Applicable To |       | Description |
|--------------------|---------------|-------|-------------|
|                    | RE $\geq$ 1G  | RE<1G |             |
| -                  | √             | √     | -           |

Where **RE $\geq$ 1G**: Radiated Emission above 1GHz **RE<1G**: Radiated Emission below 1GHz

#### Radiated Emission Test (Above 1GHz):

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

| EUT Configure Mode | Mode                                                        |
|--------------------|-------------------------------------------------------------|
| -                  | LTE B12 + WiFi 2.4GHz + WiFi 5GHz + Zigbee + Z-Wave + BT LE |

#### Radiated Emission Test (Below 1GHz):

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

| EUT Configure Mode | Mode                                                        |
|--------------------|-------------------------------------------------------------|
| -                  | LTE B12 + WiFi 2.4GHz + WiFi 5GHz + Zigbee + Z-Wave + BT LE |

#### Test Condition:

| Applicable To | Environmental Conditions | Input Power  | Tested By |
|---------------|--------------------------|--------------|-----------|
| RE $\geq$ 1G  | 25deg. C, 77%RH          | 120Vac, 60Hz | Ian Chang |
| RE<1G         | 25deg. C, 77%RH          | 120Vac, 60Hz | Ian Chang |

### 3.3 Description of Support Units

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

| ID | Product     | Brand | Model No. | Serial No. | FCC ID | Remarks         |
|----|-------------|-------|-----------|------------|--------|-----------------|
| A. | Notebook PC | DELL  | E6530     | 9331GV1    | N/A    | Provided by Lab |

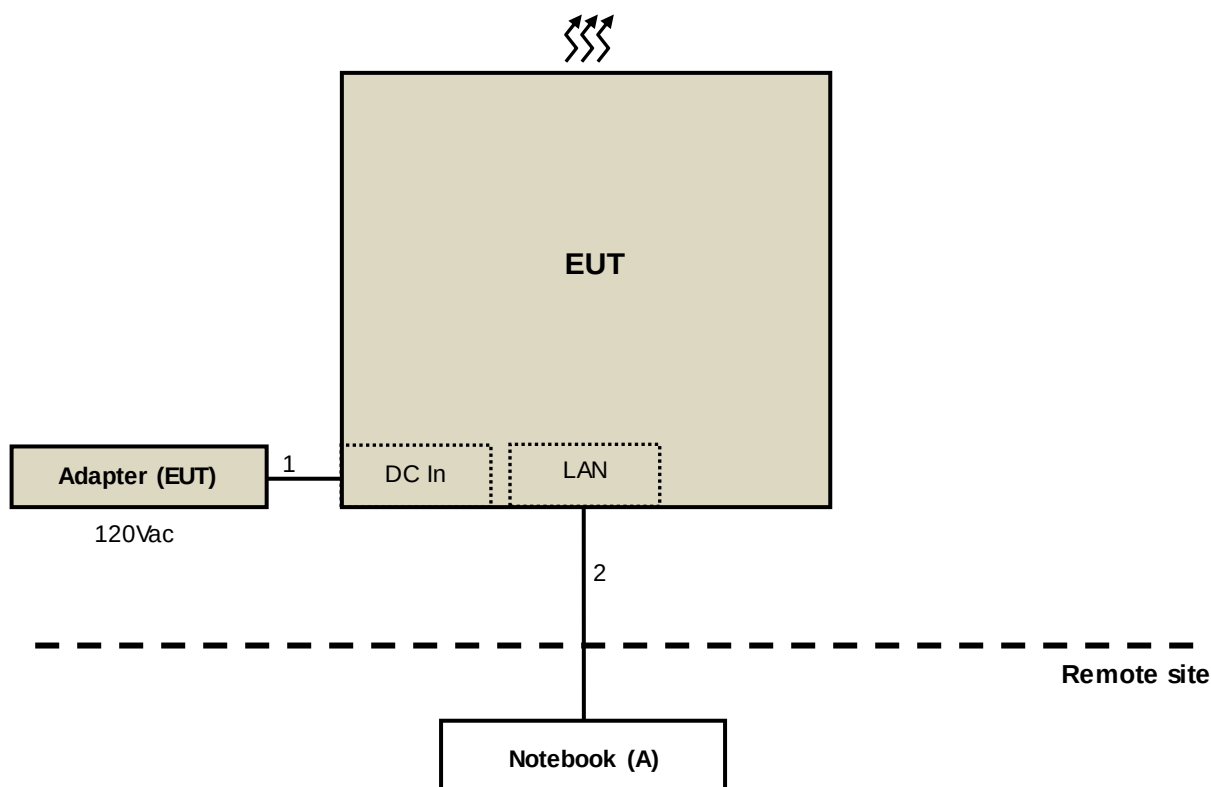
Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as communication partners to transfer data.

| ID | Cable Descriptions | Qty. | Length (m) | Shielding (Yes/ No) | Cores (Qty.) | Remarks                        |
|----|--------------------|------|------------|---------------------|--------------|--------------------------------|
| 1. | DC cable           | 1    | 1.5        | N                   | 0            | Supplied by client             |
| 2. | LAN cable          | 1    | 10         | N                   | 0            | Provided by Lab (RJ45, Cat.5e) |

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 Standard and references

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

**Test standard:**

**FCC Part 15, Subpart C (15.247)**

**ANSI C63.10-2013**

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

**References Test Guidance:**

**KDB 558074 D01 15.247 Meas Guidance v05r02**

**KDB 662911 D01 Multiple Transmitter Output v02r01**

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

**Test standard:**

**FCC Part 15, Subpart E (15.407)**

**ANSI C63.10-2013**

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

**References Test Guidance:**

**KDB 789033 D02 General UNII Test Procedure New Rules v02r01**

**KDB 662911 D01 Multiple Transmitter Output v02r01**

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

**Test standard:**

**FCC Part 15, Subpart C (15.249)**

**ANSI C63.10-2013**

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

**Test standard:**

**FCC 47 CFR Part 2**

**FCC 47 CFR Part 22**

**ANSI/TIA/EIA-603-E 2016**

**ANSI 63.26-2015**

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

**References Test Guidance:**

**KDB 971168 D01 Power Meas License Digital Systems v03r01**

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

**Test standard:**

**FCC 47 CFR Part 2**

**FCC 47 CFR Part 24**

**ANSI/TIA/EIA-603-E 2016**

**ANSI 63.26-2015**

**ANSI 63.2-1996**

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

**References Test Guidance:**

**KDB 971168 D01 Power Meas License Digital Systems v03r01**

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

**Test standard:**

**FCC 47 CFR Part 2**

**FCC 47 CFR Part 27**

**ANSI/TIA/EIA-603-E 2016**

**ANSI 63.26-2015**

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

**References Test Guidance:**

**KDB 971168 D01 Power Meas License Digital Systems v03r01**

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

## 4 Test Types and Results

### 4.1 Radiated Emission and Bandedge Measurement

#### 4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified 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 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. 20, 2019   | Feb. 19, 2020    |
| HP Preamplifier                         | 8449B                | 3008A01201     | Feb. 21, 2019   | Feb. 20, 2020    |
| MITEQ Preamplifier                      | AMF-6F-260400-33-8P  | 892164         | Feb. 20, 2019   | Feb. 19, 2020    |
| Agilent TEST RECEIVER                   | N9038A               | MY51210129     | Mar. 05, 2019   | Mar. 04, 2020    |
| Schwarzbeck Antenna                     | VULB 9168            | 139            | Nov. 26, 2018   | Nov. 25, 2019    |
| Schwarzbeck Antenna                     | VHBA 9123            | 480            | Jun. 3, 2019    | Jun. 2, 2021     |
| Schwarzbeck Horn Antenna                | BBHA-9170            | 212            | Nov. 25, 2018   | Nov. 24, 2019    |
| Schwarzbeck Horn Antenna                | BBHA 9120-D1         | D130           | Nov. 25, 2018   | Nov. 24, 2019    |
| ADT. Turn Table                         | TT100                | 0306           | NA              | NA               |
| ADT. Tower                              | AT100                | 0306           | NA              | NA               |
| Software                                | Radiated_V7.6.15.9.5 | NA             | NA              | NA               |
| SUHNER RF cable With 4dB PAD            | SF102                | Cable-CH6-01   | Jul. 10, 2019   | Jul. 9, 2020     |
| SUHNER RF cable With 3/4dB PAD          | SF102                | Cable-CH8-3.6m | Jul. 10, 2019   | Jul. 9, 2020     |
| KEYSIGHT MIMO Powermeasurement Test set | U2021XA              | U2021XA-001    | Jun. 11, 2019   | Jun. 10, 2020    |
| KEYSIGHT Spectrum Analyzer              | N9030A               | MY54490260     | Jul. 30, 2019   | Jul. 29, 2020    |
| Loop Antenna EMCI                       | LPA600               | 270            | Aug. 23, 2019   | Aug. 22, 2021    |
| EMCO Horn Antenna                       | 3115                 | 00028257       | Nov. 25, 2018   | Nov. 24, 2019    |
| Highpass filter Wainwright Instruments  | WHK 3.1/18G-10SS     | SN 8           | NA              | NA               |
| ROHDE & SCHWARZ Spectrum Analyzer       | FSV40                | 101042         | Sep. 23, 2019   | Sep. 22, 2020    |
| Anritsu Power Sensor                    | MA2411B              | 0738404        | Apr. 16, 2019   | Apr. 15, 2020    |
| Anritsu Power Meter                     | ML2495A              | 0842014        | Apr. 16, 2019   | Apr. 15, 2020    |

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

#### 4.1.3 Test Procedure

##### **For Radiated emission below 30MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, Perpendicular and Ground-parallel of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

##### **NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

##### **For Radiated emission above 30MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

##### **Note:**

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

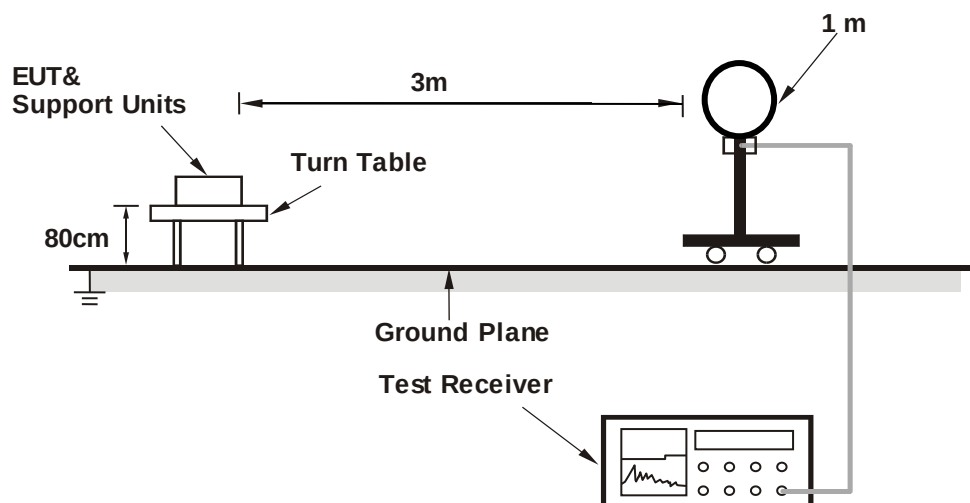
#### 4.1.4 Deviation from Test Standard

No deviation.

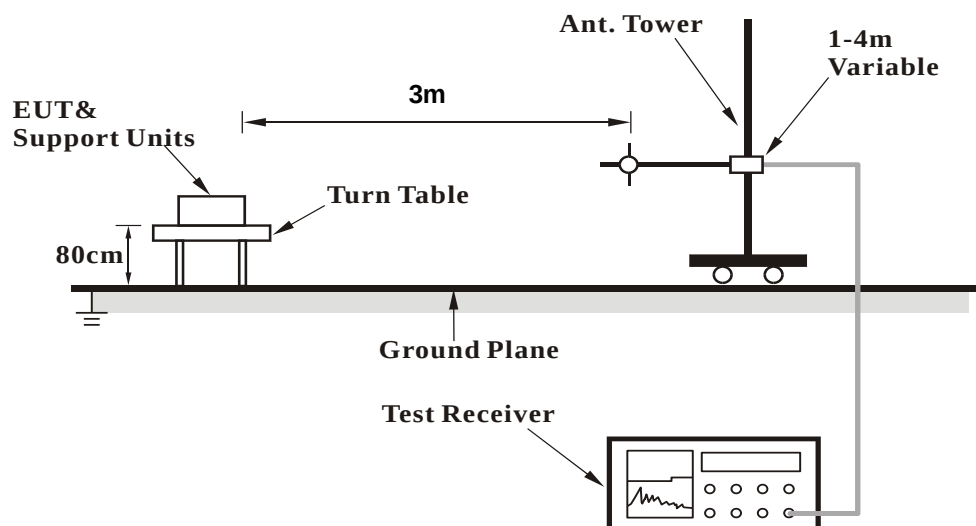


#### 4.1.5 Test Setup

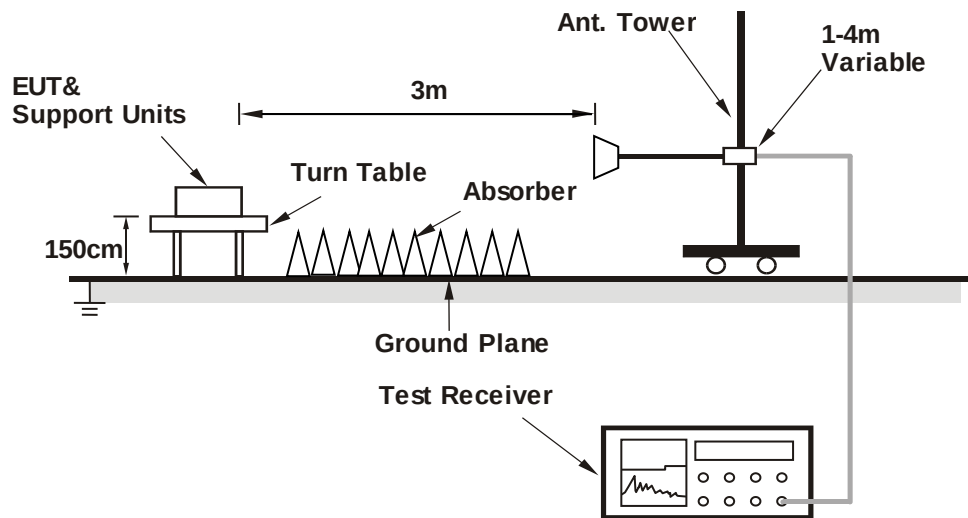
##### For Radiated emission below 30MHz



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



### For Radiated emission above 1GHz



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

#### 4.1.6 EUT Operating Condition

- Placed the EUT on the testing table.
- Prepared notebooks to act as communication partner and placed it outside of testing area.
- The communication partner connected with EUT via a RJ45 cable and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
- The necessary accessories enable the system in full functions.

#### 4.1.7 Test Results

##### ABOVE 1GHz DATA

|                 |              |                   |                           |
|-----------------|--------------|-------------------|---------------------------|
| Frequency Range | 1GHz ~ 40GHz | Detector Function | Peak (PK)<br>Average (AV) |
|-----------------|--------------|-------------------|---------------------------|

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |             |                         |                |             |                    |                      |                  |                          |
|-----------------------------------------------------|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| NO.                                                 | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1                                                   | 1399.40     | 47.31 PK                | 74.00          | -26.69      | 2.06 H             | 102                  | 51.83            | -4.52                    |
| 2                                                   | 1399.40     | 36.82 AV                | 54.00          | -17.18      | 2.06 H             | 102                  | 41.34            | -4.52                    |
| 3                                                   | #1816.80    | 62.59 PK                | 68.20          | -5.61       | 2.45 H             | 168                  | 64.52            | -1.93                    |
| 4                                                   | #1816.80    | 45.12 AV                | 54.00          | -8.88       | 2.45 H             | 168                  | 47.05            | -1.93                    |
| 5                                                   | 2390.00     | 58.67 PK                | 68.20          | -9.53       | 1.97 H             | 215                  | 58.23            | 0.44                     |
| 6                                                   | 2390.00     | 51.47 AV                | 54.00          | -2.53       | 1.97 H             | 215                  | 51.03            | 0.44                     |
| 7                                                   | 2483.50     | 57.73 PK                | 74.00          | -16.27      | 1.97 H             | 44                   | 57.11            | 0.62                     |
| 8                                                   | 2483.50     | 45.78 AV                | 54.00          | -8.22       | 1.97 H             | 44                   | 45.16            | 0.62                     |
| 9                                                   | 4874.00     | 53.14 PK                | 74.00          | -20.86      | 1.84 H             | 257                  | 44.75            | 8.39                     |
| 10                                                  | 4874.00     | 44.58 AV                | 54.00          | -9.42       | 1.84 H             | 257                  | 36.19            | 8.39                     |
| 11                                                  | 4880.00     | 50.22 PK                | 74.00          | -23.78      | 1.69 H             | 238                  | 41.81            | 8.41                     |
| 12                                                  | 4880.00     | 37.30 AV                | 54.00          | -16.70      | 1.69 H             | 238                  | 28.89            | 8.41                     |
| 13                                                  | #5580.48    | 62.01 PK                | 68.20          | -6.19       | 2.25 H             | 36                   | 51.84            | 10.17                    |
| 14                                                  | #5994.63    | 63.41 PK                | 68.20          | -4.79       | 2.25 H             | 36                   | 53.51            | 9.90                     |
| 15                                                  | 11490.00    | 58.68 PK                | 74.00          | -15.32      | 2.36 H             | 351                  | 40.97            | 17.71                    |
| 16                                                  | 11490.00    | 46.74 AV                | 54.00          | -7.26       | 2.36 H             | 351                  | 29.03            | 17.71                    |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |             |                         |                |             |                    |                      |                  |                          |
|-----------------------------------------------------|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| NO.                                                 | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1                                                   | 1399.40     | 45.42 PK                | 74.00          | -28.58      | 2.55 V             | 149                  | 49.94            | -4.52                    |
| 2                                                   | 1399.40     | 35.35 AV                | 54.00          | -18.65      | 2.55 V             | 149                  | 39.87            | -4.52                    |
| 3                                                   | #1816.80    | 60.18 PK                | 68.20          | -8.02       | 1.07 V             | 148                  | 62.11            | -1.93                    |
| 4                                                   | #1816.80    | 42.12 AV                | 54.00          | -11.88      | 1.07 V             | 148                  | 44.05            | -1.93                    |
| 5                                                   | 2390.00     | 60.21 PK                | 68.20          | -7.99       | 1.78 V             | 49                   | 59.77            | 0.44                     |
| 6                                                   | 2390.00     | 52.89 AV                | 54.00          | -1.11       | 1.78 V             | 49                   | 52.45            | 0.44                     |
| 7                                                   | 2483.50     | 58.44 PK                | 74.00          | -15.56      | 1.81 V             | 58                   | 57.82            | 0.62                     |
| 8                                                   | 2483.50     | 47.48 AV                | 54.00          | -6.52       | 1.81 V             | 58                   | 46.86            | 0.62                     |
| 9                                                   | 4874.00     | 53.75 PK                | 74.00          | -20.25      | 1.55 V             | 254                  | 45.36            | 8.39                     |
| 10                                                  | 4874.00     | 48.28 AV                | 54.00          | -5.72       | 1.55 V             | 254                  | 39.89            | 8.39                     |
| 11                                                  | 4880.00     | 49.54 PK                | 74.00          | -24.46      | 2.36 V             | 192                  | 41.13            | 8.41                     |
| 12                                                  | 4880.00     | 36.31 AV                | 54.00          | -17.69      | 2.36 V             | 192                  | 27.90            | 8.41                     |
| 13                                                  | #5602.36    | 61.91 PK                | 68.20          | -6.29       | 1.87 V             | 271                  | 51.85            | 10.06                    |
| 14                                                  | #5964.89    | 62.67 PK                | 68.20          | -5.53       | 1.87 V             | 271                  | 52.83            | 9.84                     |
| 15                                                  | 11490.00    | 59.74 PK                | 74.00          | -14.26      | 2.71 V             | 146                  | 42.03            | 17.71                    |
| 16                                                  | 11490.00    | 47.78 AV                | 54.00          | -6.22       | 2.71 V             | 146                  | 30.07            | 17.71                    |

#### REMARKS:

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

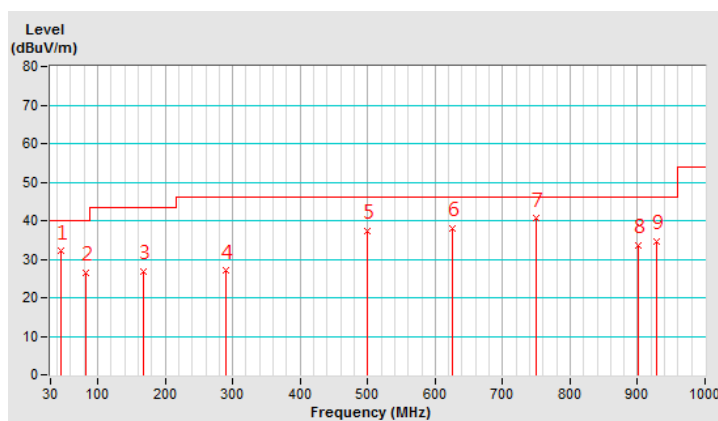
# Below 1GHz DATA

|                 |             |                   |                 |
|-----------------|-------------|-------------------|-----------------|
| Frequency Range | 9kHz ~ 1GHz | Detector Function | Quasi-Peak (QP) |
|-----------------|-------------|-------------------|-----------------|

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |             |                         |                |             |                    |                      |                  |                          |
|-----------------------------------------------------|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| NO.                                                 | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1                                                   | 46.15       | 32.06 QP                | 40.00          | -7.94       | 1.06 H             | 346                  | 39.31            | -7.25                    |
| 2                                                   | 82.43       | 26.50 QP                | 40.00          | -13.50      | 1.37 H             | 286                  | 38.50            | -12.00                   |
| 3                                                   | 166.92      | 26.94 QP                | 43.50          | -16.56      | 2.06 H             | 267                  | 33.76            | -6.82                    |
| 4                                                   | 289.67      | 27.01 QP                | 46.00          | -18.99      | 1.00 H             | 77                   | 32.20            | -5.19                    |
| 5                                                   | 500.01      | 37.29 QP                | 46.00          | -8.71       | 1.94 H             | 155                  | 37.96            | -0.67                    |
| 6                                                   | 625.00      | 38.13 QP                | 46.00          | -7.87       | 1.72 H             | 282                  | 35.78            | 2.35                     |
| 7                                                   | 749.98      | 40.58 QP                | 46.00          | -5.42       | 1.37 H             | 98                   | 36.04            | 4.54                     |
| 8                                                   | 902.00      | 33.69 QP                | 46.00          | -12.31      | 2.45 H             | 78                   | 26.68            | 7.01                     |
| 9                                                   | 928.00      | 34.68 QP                | 46.00          | -11.32      | 2.45 H             | 78                   | 27.19            | 7.49                     |

## REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

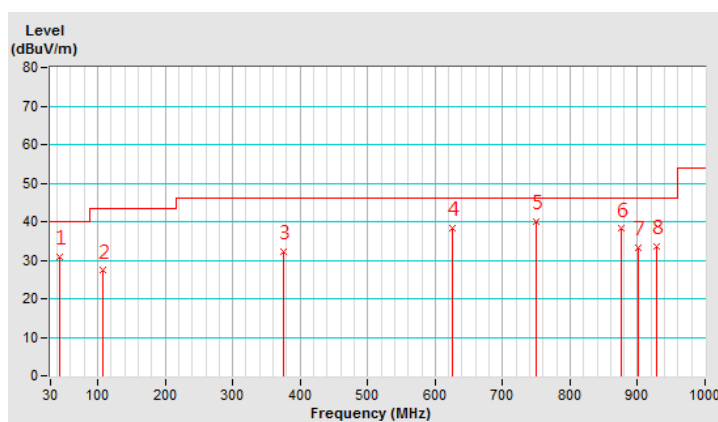


|                 |             |                   |                 |
|-----------------|-------------|-------------------|-----------------|
| Frequency Range | 9kHz ~ 1GHz | Detector Function | Quasi-Peak (QP) |
|-----------------|-------------|-------------------|-----------------|

| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M |             |                         |                |             |                    |                      |                  |                          |
|---------------------------------------------------|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| NO.                                               | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1                                                 | 42.95       | 30.91 QP                | 40.00          | -9.09       | 1.08 V             | 157                  | 38.40            | -7.49                    |
| 2                                                 | 106.68      | 27.35 QP                | 43.50          | -16.15      | 1.34 V             | 355                  | 37.75            | -10.40                   |
| 3                                                 | 375.03      | 32.36 QP                | 46.00          | -13.64      | 1.87 V             | 208                  | 35.87            | -3.51                    |
| 4                                                 | 625.00      | 38.40 QP                | 46.00          | -7.60       | 2.26 V             | 125                  | 36.05            | 2.35                     |
| 5                                                 | 750.01      | 40.03 QP                | 46.00          | -5.97       | 2.78 V             | 287                  | 35.49            | 4.54                     |
| 6                                                 | 875.02      | 38.14 QP                | 46.00          | -7.86       | 1.00 V             | 315                  | 31.74            | 6.40                     |
| 7                                                 | 902.00      | 33.28 QP                | 46.00          | -12.72      | 1.03 V             | 25                   | 26.27            | 7.01                     |
| 8                                                 | 928.00      | 33.67 QP                | 46.00          | -12.33      | 1.03 V             | 25                   | 26.18            | 7.49                     |

#### REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



## 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 accredited and approved according to ISO/IEC 17025.

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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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