



BUREAU  
VERITAS

Test Report No.: W7L-P23010004-2EM01



Certificate #6613.01

## EMC TEST REPORT

|            |   |
|------------|---|
| Applicant: | HMD Global Oy                               |
| Address:   | Bertel Jungin aukio 9, 02600 Espoo, Finland |

|                           |   |
|---------------------------|---|
| Manufacturer or Supplier: | HMD Global Oy                               |
| Address:                  | Bertel Jungin aukio 9, 02600 Espoo, Finland |
| Product:                  | Mobile Phone                                |
| Brand Name:               | NOKIA                                       |
| Model Name:               | TA-1541                                     |
| FCC ID:                   | 2AJOTTA-1541                                |
| Date of tests:            | Jan. 16, 2023 ~ Feb. 23, 2023               |

The submitted sample of the above equipment has been tested for according to the requirements of the following standards:

- FCC Part 15, Subpart B, Class A
- FCC Part 15, Subpart B, Class B
- ANSI C63.4:2014

**CONCLUSION: The submitted sample was found to COMPLY with the test requirement**

Prepared by Chao Wu  
Engineer / Mobile Department

Approved by Peibo Sun  
Manager / Mobile Department

Date: Feb. 23, 2023

Date: Feb. 23, 2023

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# TABLE OF CONTENTS

|   |           |
|---|-----------|
| <b>RELEASE CONTROL RECORD .....</b>   | <b>3</b>  |
| <b>1 GENERAL INFORMATION .....</b>  | <b>4</b>  |
| 1.1 GENERAL DESCRIPTION OF EUT .....  | 4         |
| 1.2 SUMMARY OF TEST RESULTS .....   | 8         |
| 1.3 MEASUREMENT UNCERTAINTY .....   | 9         |
| 1.4 DESCRIPTION OF TEST MODES .....   | 10        |
| 1.5 DESCRIPTION OF SUPPORT UNITS .....  | 12        |
| <b>2 EMISSION TEST .....</b>  | <b>13</b> |
| 2.1 CONDUCTED EMISSION MEASUREMENT .....  | 13        |
| 2.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT .....  | 13        |
| 2.1.2 TEST INSTRUMENTS .....  | 13        |
| 2.1.3 TEST PROCEDURES .....   | 14        |
| 2.1.4 DEVIATION FROM TEST STANDARD .....  | 14        |
| 2.1.5 TEST SETUP .....  | 15        |
| 2.1.6 EUT OPERATING CONDITIONS .....  | 15        |
| 2.1.7 TEST RESULTS .....  | 16        |
| 2.2 RADIATED EMISSION MEASUREMENT .....   | 18        |
| 2.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT .....   | 18        |
| 2.2.2 TEST INSTRUMENTS .....  | 19        |
| 2.2.3 TEST PROCEDURE .....  | 20        |
| 2.2.4 DEVIATION FROM TEST STANDARD .....  | 21        |
| 2.2.5 TEST SETUP .....  | 22        |
| 2.2.6 EUT OPERATING CONDITIONS .....  | 23        |
| 2.2.7 TEST RESULTS .....  | 24        |
| <b>3 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB .....</b> | <b>28</b> |



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Test Report No.: W7L-P23010004-2EM01

## RELEASE CONTROL RECORD

| ISSUE NO.           | REASON FOR CHANGE | DATE ISSUED   |
|---------------------|-------------------|---------------|
| W7L-P23010004-2EM01 | Original release  | Feb. 23, 2023 |



# 1 GENERAL INFORMATION

## 1.1 GENERAL DESCRIPTION OF EUT

|                            |  |  |
|----------------------------|--|--|
| <b>PRODUCT</b>             | Mobile Phone                                 |  |
| <b>BRAND NAME</b>          | NOKIA  |  |
| <b>MODEL NAME</b>          | TA-1541                                      |  |
| <b>NOMINAL VOLTAGE</b>     | 5.0Vdc(adapter)<br>3.85Vdc (Li-ion, battery) |  |
| <b>MODULATION TYPE</b>     | <b>BT_LE</b>                                 | GFSK   |
|                            | <b>Bluetooth</b>                             | GFSK, $\pi/4$ -DQPSK, 8DPSK  |
|                            | <b>FM</b>                                    | FM   |
|                            | <b>WLAN</b>                                  | DSSS, OFDM   |
|                            | <b>GPS/GALILEO/GLONASS/GPS/SBAS</b>          | BPSK   |
|                            | <b>GSM/GPRS/EDGE</b>                         | GMSK, 8PSK   |
|                            | <b>WCDMA</b>                                 | HSDPA/HSUPA/DC-HSDPA/HSPA+   |
|                            | <b>LTE</b>                                   | QPSK/16QAM/64QAM   |
| <b>OPERATING FREQUENCY</b> | <b>Bluetooth/BT_LE</b>                       | 2402MHz ~ 2480MHz  |
|                            | <b>FM</b>                                    | 87.5MHz ~ 108MHz   |
|                            | <b>WLAN</b>                                  | 2412 ~ 2462MHz for 11b/g/n(HT20)   |
|                            | <b>GPS/GALILEO/GLONASS/GPS/SBAS</b>          | 1559MHz ~ 1610MHz  |
|                            | <b>GSM</b>                                   | 824.2MHz ~ 848.8MHz (FOR GSM 850)<br>1850.2MHz ~ 1909.8MHz (FOR GSM 1900)  |
|                            | <b>WCDMA</b>                                 | 1922.6MHz~ 1977.4MHz(FOR WCDMA Band 1)<br>1852.4MHz ~ 1907.6MHz(FOR WCDMA Band 2)<br>1712.4MHz ~ 1752.6MHz(FOR WCDMA Band 4)<br>826.4MHz ~ 846.6MHz (FOR WCDMA Band 5)<br>882.4MHz ~ 912.6MHz (FOR WCDMA Band 8)   |
|                            | <b>LTE</b>                                   | 1922.5MHz~ 1977.5MHz (FOR LTE Band1)<br>1850.7MHz ~ 1909.3MHz (FOR LTE Band2)<br>1710.7MHz ~ 1784.3MHz (FOR LTE Band3)<br>1710.7MHz ~ 1754.3MHz (FOR LTE Band4)<br>824.7MHz ~ 848.3MHz (FOR LTE Band5)<br>2502.5MHz ~ 2567.5MHz (FOR LTE Band7)<br>880.7MHz ~ 914.3MHz (FOR LTE Band8)<br>699.7MHz ~ 715.3MHz (FOR LTE Band12)<br>779.5MHz ~ 784.5MHz (FOR LTE Band13)<br>706.5MHz ~ 713.5MHz (FOR LTE Band17) |



|                   |   |   |
|-------------------|---|---|
|                   |   | 704.5MHz ~ 746.5MHz (FOR LTEBand28)<br>1710.7MHz ~ 1779.3MHz (FOR LTE Band66) |
| HIGHEST FREQUENCY | 2567.5MHz   |   |
| HW VERSION        | SPR_S63Q0   |   |
| SW VERSION        | 00WW_0_090  |   |
| I/O PORTS         | Refer to user's manual  |   |
| CABLE SUPPLIED    | USB cable: non-shielded cable, with w/o ferrite core, 1 meter<br>USB cable: non-shielded cable, with w/o ferrite core, 1 meter<br>USB cable: non-shielded cable, with w/o ferrite core, 1 meter<br>Earphone: non-shielded cable, with w/o ferrite core, 1.2 meter |   |
| ACCESSORY DEVICES | Refer to note as below  |   |

NOTE:

- For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
- For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.
- The product of TA-1541(FCC ID: 2AJOTTA-1541) have version and components manufacturer from a second supplier. The first version is 090, the second one is 103, only the version changes, and the RF parameters do not change, components manufacturer with following changes as below:

| NO. | Change Description |           | specificatons                        | first supplier   | specificatons                              | second supplier |
|-----|--------------------|-----------|--------------------------------------|------------------|--|-----------------|
| 1   | PCBA               | 64GB EMMC | FEMDNN064G-A3 A56<br>BWCTARV11X64G   | Longsys          | FEMDNN064G-A3A56<br>BWCTARV11X64G          | Biwin           |
| 2   |                    | 2GB LPDDR | FLXC2002G-N2<br>BWMZEX32H2A-16G-X    | Longsys          | FLXC2002G-N2<br>BWMZEX32H2A-16G-X          | Biwin           |
| 3   |                    | 3GB LPDDR | FLXC4003G-50<br>BWMEXX32H2A-24Gb-X   | Longsys          | FLXC4003G-50<br>BWMEXX32H2A-24Gb-X         | Biwin           |
| 4   |                    | 4GB LPDDR | FLXC2004G-30<br>BWMZCX32H2A-32G-X    | Longsys          | FLXC2004G-30<br>BWMZCX32H2A-32G-X          | Biwin           |
| 5   |                    | PCB       | /                                    | KINGSHINE        | /  | WUZH U          |
| 6   | LCM                | LCD       | 6.517 HKC,<br>360min,400typ,<br>2.5D | TCL              | 6.517 BOE (B8) ,<br>360min,400typ,<br>2.5D | Lian Chuan g    |
| 7   | Front camera       | Camera    | 8M FF COM                            | Lian Heyingxiang | 8M FF COM                                  | Shijia          |



|    |             |        |                  |                  |                  |                   |
|----|-------------|--------|------------------|------------------|------------------|-------------------|
| 8  | Rear camera | Camera | 13M-AF COB       | Lian Heyingxiang | 13M-AF COB       | Ruiche ng         |
| 9  | Macro CAM   | Camera | 2M FF            | Shijia           | 2M FF            | Lian Heying xiang |
| 10 | fingerprint | module | Back fingerprint | Hedayuan         | Back fingerprint | Sanyin gxin       |
| 11 | Speaker     |        | 1712 1W          | Dong Sheng       | 1712 1W          | Xin Rongd a       |
| 12 | Vibrator    |        | 1027 FPC         | Kai Long         | 1027 FPC         | Chao Yin          |
| 13 | Receiver    |        | 0809             | Dong Sheng       | 0809             | Xin Rongd a       |
| 14 | FPC         |        | /                | Lante            | /                | Kaihon gxing      |
| 15 | Battery     |        | 5000MAH          | Gaoyuan          | 5000MAH          | Feng Hua          |
| 16 | Data cable  |        | 2A typeC         | Yuwei            | 2A typeC         | Juwei             |

## 4. List of Accessory:

| ACCESSORIES  | BRAND                      | MANUFACTURER                                      | MODEL         | SPECIFICATION                             |
|--------------|----------------------------|---|---------------|---|
| LCD Panel 1  | HKC                        | MianYang HKC Optoelectronics Technology Co., Ltd. | QM065HS03-1   | 6.517                                     |
| LCD Panel 2  | BOE                        | BOE   | BV065WBQ-L1B  | 6.517                                     |
| Battery 1    | Nokia                      | Guangdong Fenghua New Energy Co.,Ltd.             | WT510         | Capacity : 3.85 Vdc, 4900mAh              |
| Battery 2    | Nokia                      | GUANGDONG FENGHUA NEW ENERGY CO.,LTD.             | WT510         | Capacity : 3.85 Vdc, 4900mAh              |
| AC Adapter 1 | Nokia                      | SHENZHEN BAIJUNDA ELECTRONICS.,LTD                | AD-010U       | I/P: 100-240Vac, 0.35A, O/P: 5.0Vdc, 2.0A |
| Earphone     | Juwei Electronics Co., LTD | Juwei Electronics Co., LTD                        | JWEP1252-H21H | Signal Line, 1.2meter                     |
| USB Cable 1  | Juwei Electronics Co., LTD | Juwei Electronics Co., LTD                        | JWUB1536-H21H | Signal Line, 1.0meter                     |
| USB Cable 2  | Yu Wei                     | N/A   | CH2212TC      | Signal Line, 1.0meter                     |
| USB Cable 3  | Sai bao                    | Saibao (Jiangxi) Industrial Co., Ltd              | SHM1-A003A    | Signal Line, 1.0meter                     |



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**Test Report No.: W7L-P23010004-2EM01**

5. This report refers to the data of W7L-P23010004-1EM01(model:TA-1536, FCC ID: 2AJOTTA-1536), the difference of TA-1536 and TA-1541 is TA-1541 change model name, TA-1536 is dual card, TA-1541 is single card, and functions are realized through software. This report verify the test data of CE,RE worst case , So this report only replaces the test data of RE,CE worst case, other data is copied from the report W7L-P23010004-1EM01(model:TA-1536, FCC ID: 2AJOTTA-1536).

## 1.2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

| <b>APPLIED STANDARD: FCC Part 15, Subpart B</b>       |                                       |               |                  |
|---|---------------------------------------|---------------|------------------|
| <b>Standard Section</b>                               | <b>Test Item</b>                      | <b>Result</b> | <b>Test lab*</b> |
| FCC Part 15,<br>Subpart B, Class B<br>ANSI C63.4:2014 | Conducted Test                        | Compliance    | A                |
|   | Radiated Emission Test (30MHz ~ 1GHz) | Compliance    | A                |
|   | Radiated Emission Test (Above 1GHz)   | Compliance    | A                |

### \*Test Lab Information Reference

**Lab A:**

Huarui 7Layers High Technology (Suzhou) Co., Ltd.

**Lab Address:**

Tower N, Innovation Center, 88 Zhuyi Road, High-tech District, Suzhou City, Anhui Province

**Accredited Test Lab Cert 6613.01**

The FCC Site Registration No. is 434559; The Designation No. is CN1325.



### 1.3 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:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

| MEASUREMENT         | FREQUENCY      | UNCERTAINTY         |
|---------------------|----------------|---------------------|
| Conducted emissions | 150kHz ~ 30MHz | $\pm 2.70\text{dB}$ |
| Radiated emissions  | 30MHz~1GMHz    | $\pm 4.98\text{dB}$ |
|                     | 1GMHz ~6GMHz   | $\pm 4.70\text{dB}$ |
|                     | 6GMHz ~18GMHz  | $\pm 4.60\text{dB}$ |



### 1.4 DESCRIPTION OF TEST MODES

| Test Mode                     | Test Condition  |
|-------------------------------|---|
| <b>Radiated emission test</b> |   |
| 1                             | GSM 850 Idle + earphone + USB Cable1 + adapter + BT Idle + wifi idle + GPS Rx + SIM1 + Front Camera On + SD + Battery 1 + Sample1               |
| 2                             | PCS 1900 Idle + earphone + USB Cable2 + adapter + BT Idle + wifi idle + GOLNASS Rx + SIM1 + Back Camera On + SD + Battery 1 + Sample1           |
| 3                             | WCDMA B2 idle + earphone + USB Cable3 + adapter + BT Idle + wifi idle + GALILEO Rx + SIM1 + FM RX + SD + Battery 1 + Sample1                    |
| 4                             | WCDMA B4 idle + earphone + USB Cable1 + adapter + BT Idle + wifi idle + BDS Rx + SIM1 + SD + Battery 1 + Sample1                                |
| 5                             | WCDMA B5 idle + earphone + USB Cable2 + adapter + BT Idle + wifi idle + SBAS Rx + SIM1 + SD + Battery 1 + Sample1                               |
| 6                             | LTE B2 idle + earphone + USB Cable3 + adapter + BT Idle + wifi idle + GPS Rx + SIM1 + MPG4 + SD + Battery 1 + Sample1                           |
| 7                             | LTE B4 idle + earphone + USB Cable1 + adapter + BT Idle + wifi idle + GOLNASS Rx + SIM1 + SD + Battery 1 + Sample1                              |
| 8                             | LTE B5 idle + earphone + USB Cable2 + adapter + BT Idle + wifi idle + GALILEO Rx + SIM1 + SD + Battery 1 + Sample1                              |
| 9                             | LTE B7 idle + earphone + USB Cable3 + adapter + BT Idle + wifi idle + BDS Rx + SIM1 + SD + Battery 1 + Sample1                                  |
| 10                            | LTE B12 idle + earphone + USB Cable1 + adapter + BT Idle + wifi idle + SBAS Rx + SIM1 + SD + Battery 1 + Sample1                                |
| 11                            | LTE B13 idle + earphone + USB Cable2 + adapter + BT Idle + wifi idle + GPS Rx + SIM1 + SD + Battery 1 + Sample1                                 |
| 12                            | LTE B17 idle + earphone + Powered by Battery + BT Idle + wifi idle + GOLNASS Rx + SIM2 + SD + Battery 1 + Sample1                               |
| 13                            | LTE B28 idle + earphone + USB Cable2 + Data Transmission + BT Idle + wifi idle + GALILEO Rx + SIM1 + EUT to Notebook + SD + Battery 1 + Sample1 |
| 14                            | LTE B66 idle + earphone + USB Cable3 + Data Transmission + BT Idle + wifi idle + BDS Rx + SIM1 + Notebook to EUT + SD + Battery 1 + Sample1     |
| 15                            | worst of 1-14 + Battery 2 + Sample2   |



| Test Mode                      | Test Condition  |
|--------------------------------|---|
| <b>Conducted emission test</b> |   |
| 1                              | GSM 850 Idle + earphone + USB Cable1 + adapter + BT Idle + wifi idle + GPS Rx + SIM1 + Front Camera On + SD + Battery 1 + Sample1     |
| 2                              | PCS 1900 Idle + earphone + USB Cable2 + adapter + BT Idle + wifi idle + GOLNASS Rx + SIM1 + Back Camera On + SD + Battery 1 + Sample1 |
| 3                              | WCDMA B2 idle + earphone + USB Cable3 + adapter + BT Idle + wifi idle + GALILEO Rx + SIM1 + FM RX + SD + Battery 1 + Sample1          |
| 4                              | WCDMA B4 idle + earphone + USB Cable1 + adapter + BT Idle + wifi idle + BDS Rx + SIM1 + SD + Battery 1 + Sample1                      |
| 5                              | WCDMA B5 idle + earphone + USB Cable2 + adapter + BT Idle + wifi idle + SBAS Rx + SIM1 + SD + Battery 1 + Sample1                     |
| 6                              | LTE B2 idle + earphone + USB Cable3 + adapter + BT Idle + wifi idle + GPS Rx + SIM1 + MPG4 + SD + Battery 1 + Sample1                 |
| 7                              | LTE B4 idle + earphone + USB Cable1 + adapter + BT Idle + wifi idle + GOLNASS Rx + SIM1 + SD + Battery 1 + Sample1                    |
| 8                              | LTE B5 idle + earphone + USB Cable2 + adapter + BT Idle + wifi idle + GALILEO Rx + SIM1 + SD + Battery 1 + Sample1                    |
| 9                              | LTE B7 idle + earphone + USB Cable3 + adapter + BT Idle + wifi idle + BDS Rx + SIM1 + SD + Battery 1 + Sample1                        |
| 10                             | LTE B12 idle + earphone + USB Cable1 + adapter + BT Idle + wifi idle + SBAS Rx + SIM1 + SD + Battery 1 + Sample1                      |
| 11                             | LTE B13 idle + earphone + USB Cable2 + adapter + BT Idle + wifi idle + GPS Rx + SIM1 + SD + Battery 1 + Sample1                       |
| 12                             | LTE B17 idle + earphone + USB Cable3 + adapter + BT Idle + wifi idle + GOLNASS Rx + SIM1 + SD + Battery 1 + Sample1                   |
| 13                             | LTE B28 idle + earphone + USB Cable1 + adapter + BT Idle + wifi idle + GALILEO Rx + SIM1 + SD + Battery 1 + Sample1                   |
| 14                             | LTE B66 idle + earphone + USB Cable2 + adapter + BT Idle + wifi idle + BDS Rx + SIM1 + SD + Battery 1 + Sample1                       |
| 15                             | worst of 1-14 + Sample2 + Battery 2   |

**NOTE:**

1. For radiated emission test, test mode 3 was the verification case and only this mode was presented in this report
2. For conducted emission test, test mode 3 was the verification case and only this mode was presented in this report



## 1.5 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.

### FOR ALL TESTS

| NO. | PRODUCT                              | BRAND         | MODEL NO.    | SERIAL NO. | FCC ID |
|-----|--------------------------------------|---------------|--------------|------------|--------|
| 1   | Laptop                               | Lenovo        | Thinkpad E14 | SL10W47313 | N/A    |
| 2   | Micro SD                             | SAM SUNG      | N/A          | N/A        | N/A    |
| 3   | Bluetooth                            | Rohde&Schwarz | SMBV100B     | 102176     | N/A    |
| 4   | FM signal generator                  | Rohde&Schwarz | SMB 100A     | 182185     | N/A    |
| 5   | GPS Simulator+Antenna                | Rohde&Schwarz | SMBV100A     | 261436     | N/A    |
| 6   | Universal radio communication tester | Rohde&Schwarz | CMW500       | 169399     | N/A    |
| 7   | WIFI Router                          | HUAWEI        | N/A          | N/A        | N/A    |

| NO. | SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS |
|-----|---|
| 1   | USB Line: 1m;                                       |

## 2 EMISSION TEST

### 2.1 CONDUCTED EMISSION MEASUREMENT

#### 2.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

TEST STANDARD: FCC Part 15, Subpart B (Section: 15.107 a CLASS B)

| FREQUENCY OF EMISSION (MHz) | CONDUCTED LIMIT (dB $\mu$ V) |          |
|-----------------------------|------------------------------|----------|
|                             | Quasi-peak                   | Average  |
| 0.15 ~ 0.5                  | 66 to 56                     | 56 to 46 |
| 0.5 ~ 5                     | 56                           | 46       |
| 5 ~ 30                      | 60                           | 50       |

TEST STANDARD: FCC Part 15, Subpart B (Section: 15.107 b CLASS A)

| FREQUENCY OF EMISSION (MHz) | CONDUCTED LIMIT (dB $\mu$ V) |         |
|-----------------------------|------------------------------|---------|
|                             | Quasi-peak                   | Average |
| 0.15 ~ 0.5                  | 79                           | 66      |
| 0.5 ~ 30                    | 73                           | 60      |

**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.

3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

#### 2.1.2 TEST INSTRUMENTS

| Equipment             | Manufacturer  | Model No. | Serial No. | Last Cal. | Next Cal. |
|-----------------------|---------------|-----------|------------|-----------|-----------|
| EMI Test Receiver     | Rohde&Schwarz | ESR3      | 102749     | Feb.25,22 | Feb.24,24 |
| ELEKTRA test software | Rohde&Schwarz | ELEKTRA   | NA         | N/A       | N/A       |
| LISN network          | Rohde&Schwarz | ENV216    | 102640     | Feb.17,22 | Feb.16,24 |
| CABLE                 | Rohde&Schwarz | W61.01    | N/A        | Oct.31,22 | Apr.29,23 |
| CABLE                 | Rohde&Schwarz | W601      | N/A        | Oct.31,22 | Apr.29,23 |

**NOTE:** 1. The test was performed in CE shielded room.

### 2.1.3 TEST PROCEDURES

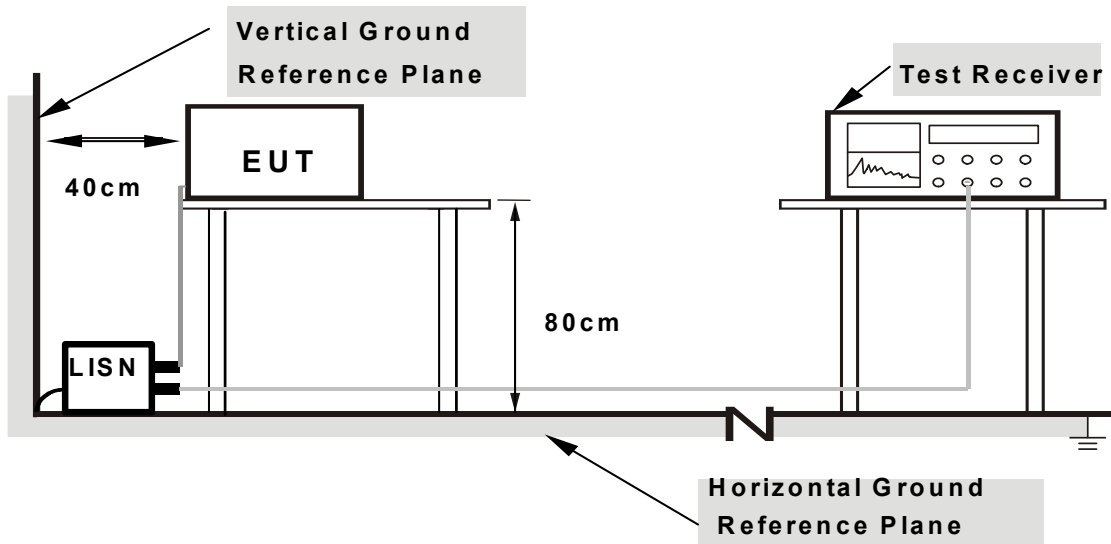
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling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

**NOTE:** All modes of operation were investigated and the worst-case emissions are reported.

### 2.1.4 DEVIATION FROM TEST STANDARD

No deviation.

## 2.1.5 TEST SETUP



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

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

## 2.1.6 EUT OPERATING CONDITIONS

- a. Turned on the power and connected of all equipment.
- b. EUT was operated according to the use type described in the manufacturer's specifications or the user's manual.



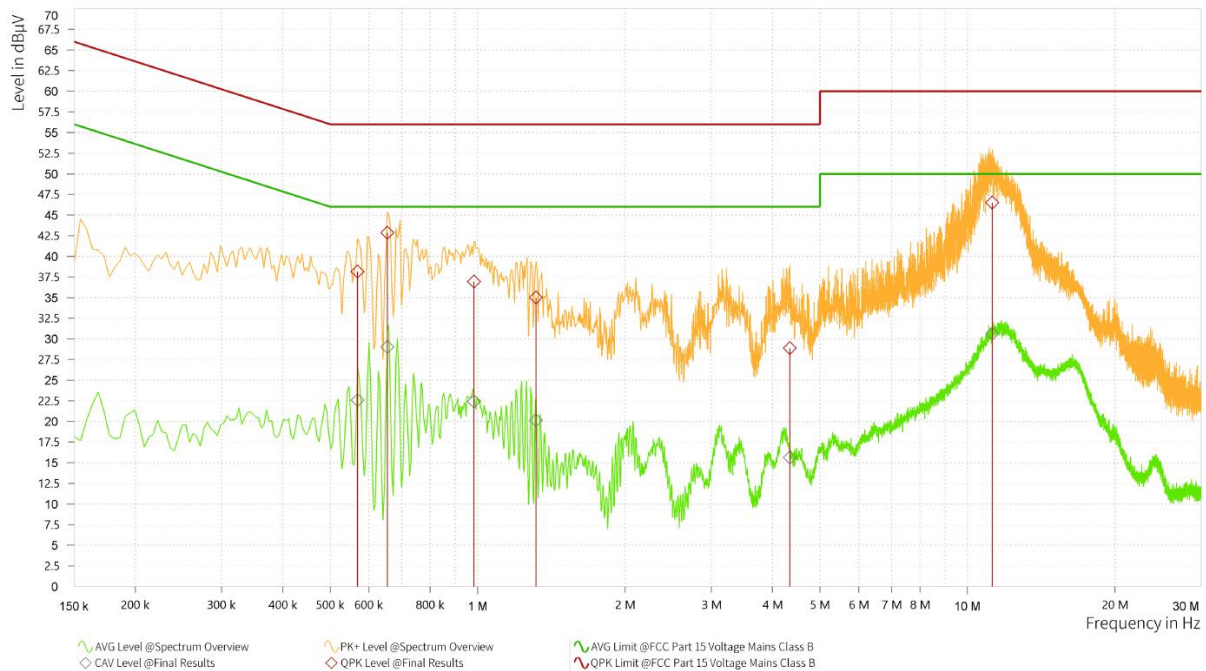
## 2.1.7 TEST RESULTS

Worst case data:

|                                 |                      |   |                                       |
|---------------------------------|----------------------|---|---------------------------------------|
| <b>TEST VOLTAGE</b>             | Input 120 Vac, 60 Hz | <b>Detector Function &amp; Resolution Bandwidth</b> | Quasi-Peak (QP) / Average (AV), 9 kHz |
| <b>ENVIRONMENTAL CONDITIONS</b> | 26deg. C, 51%RH      | <b>TESTED BY</b>                                    | Chao Wu                               |

| Rg | Frequency [MHz] | QPK Level [dBμV] | QPK Limit [dBμV] | QPK Margin [dB] | CAV Level [dBμV] | CAV: AVG Limit [dBμV] | CAV Margin [dB] | Correction [dB] | Line | Meas. BW [kHz] |
|----|-----------------|------------------|------------------|-----------------|------------------|-----------------------|-----------------|-----------------|------|----------------|
| 1  | 0.569           | 38.14            | 56.00            | 17.86           | 22.58            | 46.00                 | 23.42           | 10.04           | L1   | 9.000          |
| 1  | 0.654           | 42.87            | 56.00            | 13.13           | 29.03            | 46.00                 | 16.97           | 10.00           | L1   | 9.000          |
| 1  | 0.983           | 36.95            | 56.00            | 19.05           | 22.42            | 46.00                 | 23.58           | 9.87            | L1   | 9.000          |
| 1  | 1.316           | 35.03            | 56.00            | 20.97           | 20.12            | 46.00                 | 25.88           | 9.82            | L1   | 9.000          |
| 1  | 4.340           | 28.89            | 56.00            | 27.11           | 15.65            | 46.00                 | 30.35           | 9.81            | L1   | 9.000          |
| 1  | 11.238          | 46.52            | 60.00            | 13.48           | 30.63            | 50.00                 | 19.37           | 9.97            | L1   | 9.000          |

- 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 = Limit value- Emission level
  4. Correction factor = Insertion loss + Cable loss + Attenuate
  5. Emission Level = Correction Factor + Reading Value.







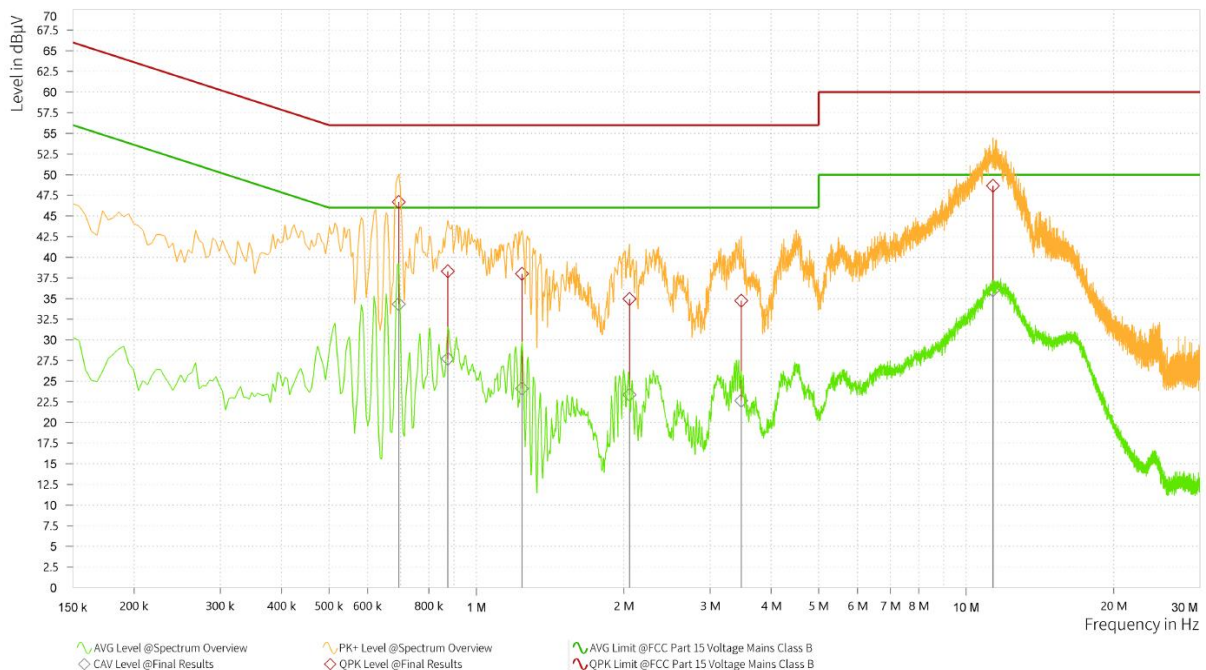
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**Test Report No.: W7L-P23010004-2EM01**

|                                 |                      |   |                                       |
|---------------------------------|----------------------|---|---------------------------------------|
| <b>TEST VOLTAGE</b>             | Input 120 Vac, 60 Hz | <b>Detector Function &amp; Resolution Bandwidth</b> | Quasi-Peak (QP) / Average (AV), 9 kHz |
| <b>ENVIRONMENTAL CONDITIONS</b> | 26deg. C, 51%RH      | <b>TESTED BY</b>                                    | Chao Wu                               |

| Rg | Frequency [MHz] | QPK Level [dBμV] | QPK Limit [dBμV] | QPK Margin [dB] | CAV Level [dBμV] | CAV: AVG Limit [dBμV] | CAV Margin [dB] | Correction [dB] | Line | Meas. BW [kHz] |
|----|-----------------|------------------|------------------|-----------------|------------------|-----------------------|-----------------|-----------------|------|----------------|
| 1  | 0.695           | 46.70            | 56.00            | 9.30            | 34.31            | 46.00                 | 11.69           | 9.99            | N    | 9.000          |
| 1  | 0.875           | 38.29            | 56.00            | 17.71           | 27.71            | 46.00                 | 18.29           | 9.91            | N    | 9.000          |
| 1  | 1.239           | 38.01            | 56.00            | 17.99           | 24.13            | 46.00                 | 21.87           | 9.83            | N    | 9.000          |
| 1  | 2.054           | 34.94            | 56.00            | 21.06           | 23.35            | 46.00                 | 22.65           | 9.78            | N    | 9.000          |
| 1  | 3.476           | 34.76            | 56.00            | 21.24           | 22.63            | 46.00                 | 23.37           | 9.80            | N    | 9.000          |
| 1  | 11.346          | 48.65            | 60.00            | 11.35           | 36.02            | 50.00                 | 13.98           | 9.99            | N    | 9.000          |

- 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 = Limit value- Emission level
  4. Correction factor = Insertion loss + Cable loss + Attenuate
  5. Emission Level = Correction Factor + Reading Value.



## 2.2 RADIATED EMISSION MEASUREMENT

### 2.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

**TEST STANDARD: FCC Part 15, Subpart B (Section: 15.109)**

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

| Radiated Emissions Limits at 3 meters (dB $\mu$ V/m) |                         |                     |
|--|-------------------------|---------------------|
| Frequencies (MHz)                                    | FCC 15B Class A         | FCC 15B Class B     |
| 30-88  | 49                      | 40                  |
| 88-216   | 53.5                    | 43.5                |
| 216-960  | 56                      | 46                  |
| 960-1000   | 59.5                    | 54                  |
| Above 1000   | Avg: 59.5<br>Peak: 79.5 | Avg: 54<br>Peak: 74 |

#### Frequency Range (For unintentional radiators)

| Highest frequency generated or used in the device or on which the device operates or tunes (MHz) | Upper frequency of measurement range (MHz)                                     |
|--|--|
| Below 1.705  | 30   |
| 1.705-108  | 1000   |
| 108-500  | 2000   |
| 500-1000   | 5000   |
| Above 1000   | 5 <sup>th</sup> harmonic of the highest frequency or 40GHz, whichever is lower |

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
  2. Emission level (dB $\mu$ V/m) = 20 log Emission level (uV/m).
  3. As shown in 15.35(b), 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. QP detector shall be applied if not specified.

## 2.2.2 TEST INSTRUMENTS

### Frequency range below 1GHz

| Instrument               | Manufacturer    | Model No. | Serial No.            | Calibration Date | Due Date  |
|--------------------------|-----------------|-----------|-----------------------|------------------|-----------|
| 3m Semi-anechoic Chamber | TDK             | 9m*6m*6m  | HRSW-SZ-EMC-02Chamber | Nov.24,22        | Nov.23,25 |
| Bilog Antenna            | SCHWARZBEC<br>K | VULB 9163 | 1264                  | Feb.28,22        | Feb.27,24 |
| EMI Test Receiver        | R&S             | ESW44     | 101973                | Feb.25,22        | Feb.24,24 |
| Measurement Software     | R&S             | ELEKTRA   | N/A                   | N/A              | N/A       |
| Pre-Amplifier            | R&S             | SCU08F1   | 101028                | Sep.16,22        | Sep.15,24 |
| CABLE                    | R&S             | W13.01    | N/A                   | Oct.31,22        | Apr.29,23 |
| CABLE                    | R&S             | W13.02    | N/A                   | Oct.31,22        | Apr.29,23 |
| CABLE                    | R&S             | W12.14    | N/A                   | Oct.31,22        | Apr.29,23 |

### Frequency range above 1GHz

| Instrument                | Manufacturer | Model No. | Serial No.            | Calibration Date | Due Date  |
|---------------------------|--------------|-----------|-----------------------|------------------|-----------|
| 3m Fully-anechoic Chamber | TDK          | 9m*6m*6m  | HRSW-SZ-EMC-01Chamber | Nov.24,22        | Nov.23,25 |
| Horn Antenna              | ETS-LINDGREN | 3117      | 227836                | Aug.22,22        | Aug.21,24 |
| EMI Test Receiver         | R&S          | ESW44     | 101973                | Feb.25,22        | Feb.24,24 |
| Pre-Amplifier             | R&S          | SCU08F1   | 101028                | Sep.16,22        | Sep.15,24 |
| Measurement Software      | R&S          | ELEKTRA   | N/A                   | N/A              | N/A       |
| CABLE                     | R&S          | W13.01    | N/A                   | Oct.31,22        | Apr.29,23 |
| CABLE                     | R&S          | W13.02    | N/A                   | Oct.31,22        | Apr.29,23 |
| CABLE                     | R&S          | W12.14    | N/A                   | Oct.31,22        | Apr.29,23 |

#### NOTE:

1. The calibration interval of the above test instruments is 6 months or 24 months or 36 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in 3m Chamber.



## 2.2.3 TEST PROCEDURE

### <Frequency Range below 1GHz>

The basic test procedure was in accordance with ANSI C63.4:2014 (section 12).

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic 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. The height of antenna is varied from 1 meter to 4 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 1GHz.

#### NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
3. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) (if the raw value not contains the amplifier);
4. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Amplifier Gain(dB) (if the raw value contains the amplifier).
5. Margin value = Limit value -Emission level.

### <Frequency Range above 1GHz>

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter fully-anechoic 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. 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. The bore sight should be used during the test above 1GHz.
- 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 peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz

#### NOTE:

- 1.The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 2.The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth of test receiver/spectrum analyzer is 1Hz for Average detection (AV) at frequency above 1GHz.
- 3.For measurement of frequency above 1000 MHz, the EUT was set 3 meters away from the receiver antenna.
- 4.Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
- 5.Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) (if the raw value not contains the amplifier);
- 6.Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Amplifier Gain(dB) (if the raw value contains the amplifier)
- 7.Margin value = Limit value- Emission level.

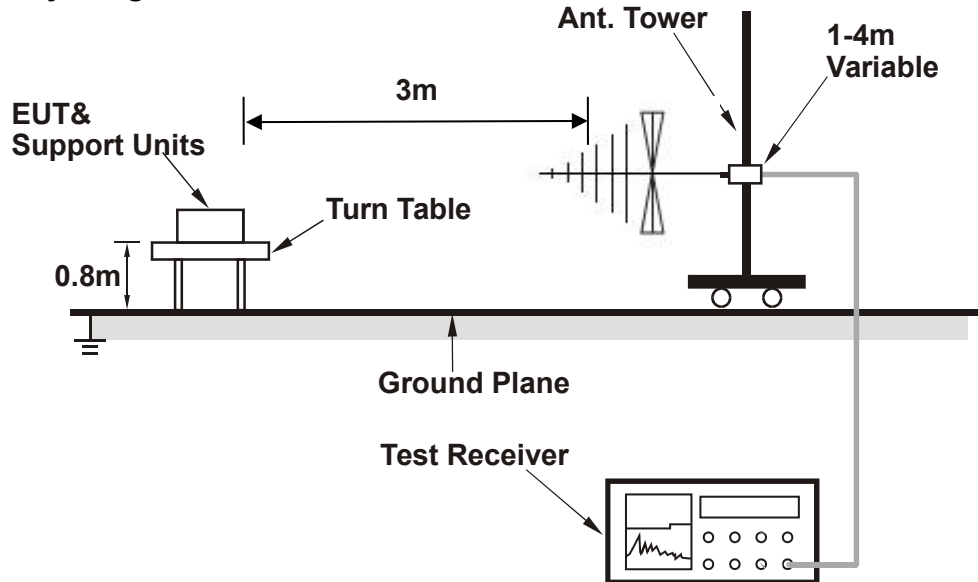
## 2.2.4 DEVIATION FROM TEST STANDARD

No deviation.

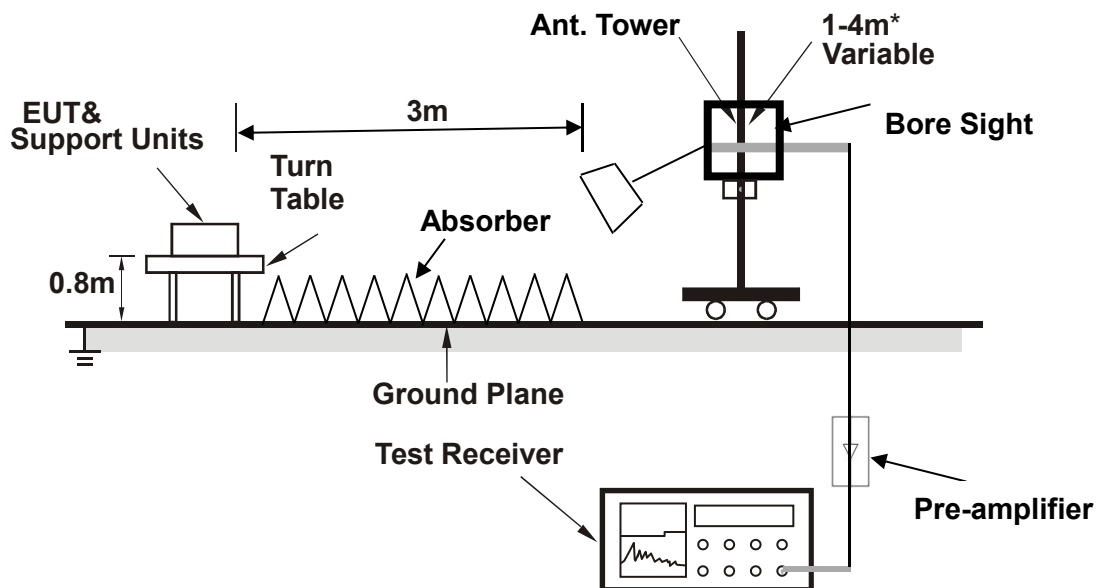


## 2.2.5 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



**Note:** Above 1G is a directional antenna

depends on the EUT height and the antenna 3dB bandwidth both, refer to section 7.3 of CISPR 16-2-3.



Test Report No.: W7L-P23010004-2EM01

## 2.2.6 EUT OPERATING CONDITIONS

Same as item 2.1.6.



## 2.2.7 TEST RESULTS

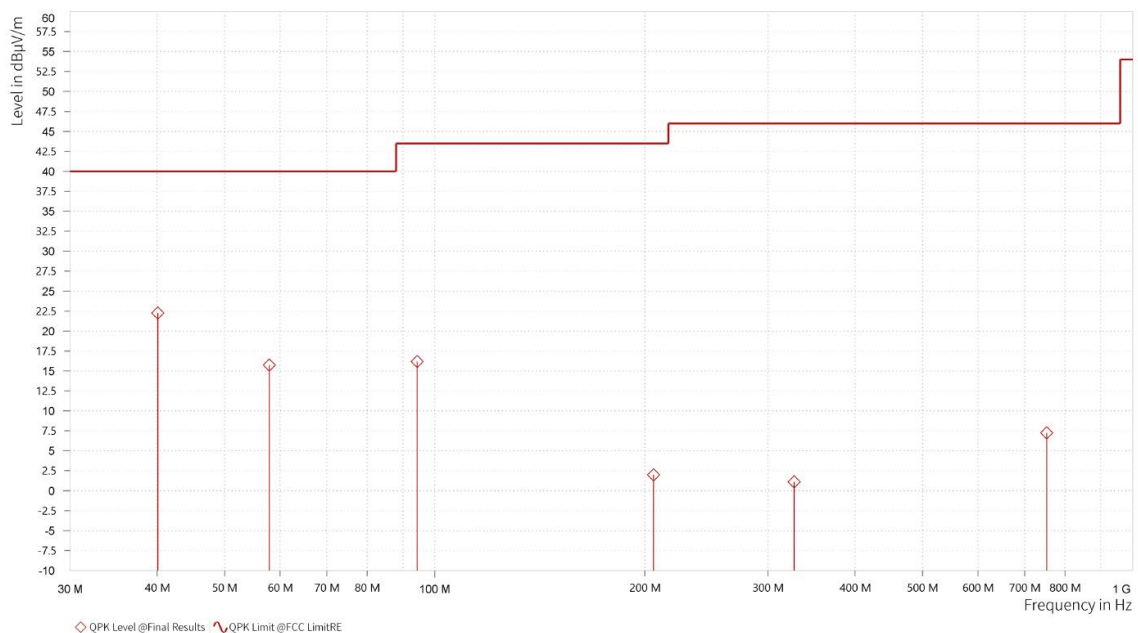
Worst case:

|                                 |                      |   |                     |
|---------------------------------|----------------------|---|---------------------|
| <b>TEST VOLTAGE</b>             | Input 120 Vac, 60 Hz | <b>FREQUENCY RANGE</b>                              | 30-1000 MHz         |
| <b>ENVIRONMENTAL CONDITIONS</b> | 23deg. C, 70%RH      | <b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b> | Quasi-Peak, 120 kHz |
| <b>TESTED BY</b>                | Chao Wu              |   |                     |

### ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

| Rg | Frequency [MHz] | QPK Level [dBμV/m] | QPK Limit [dBμV/m] | QPK Margin [dB] | Correction [dB] | Polarization | Azimuth [deg] | Antenna Height [m] | Meas. BW [kHz] |
|----|-----------------|--------------------|--------------------|-----------------|-----------------|--------------|---------------|--------------------|----------------|
| 1  | 40.088          | 22.24              | 40.00              | 17.76           | -18.35          | H            | 1             | 1                  | 120.000        |
| 1  | 57.888          | 15.73              | 40.00              | 24.27           | -19.69          | H            | 50            | 2                  | 120.000        |
| 1  | 94.360          | 16.18              | 43.50              | 27.32           | -22.53          | H            | 154           | 2                  | 120.000        |
| 1  | 205.813         | 1.99               | 43.50              | 41.51           | -23.23          | H            | 154           | 2                  | 120.000        |
| 1  | 327.354         | 1.11               | 46.00              | 44.89           | -21.57          | H            | 257           | 2                  | 120.000        |
| 1  | 753.426         | 7.24               | 46.00              | 38.76           | -14.35          | H            | 103.8         | 1                  | 120.000        |

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 30MHz to 1000MHz.
  4. Only emissions significantly above equipment noise floor are reported.







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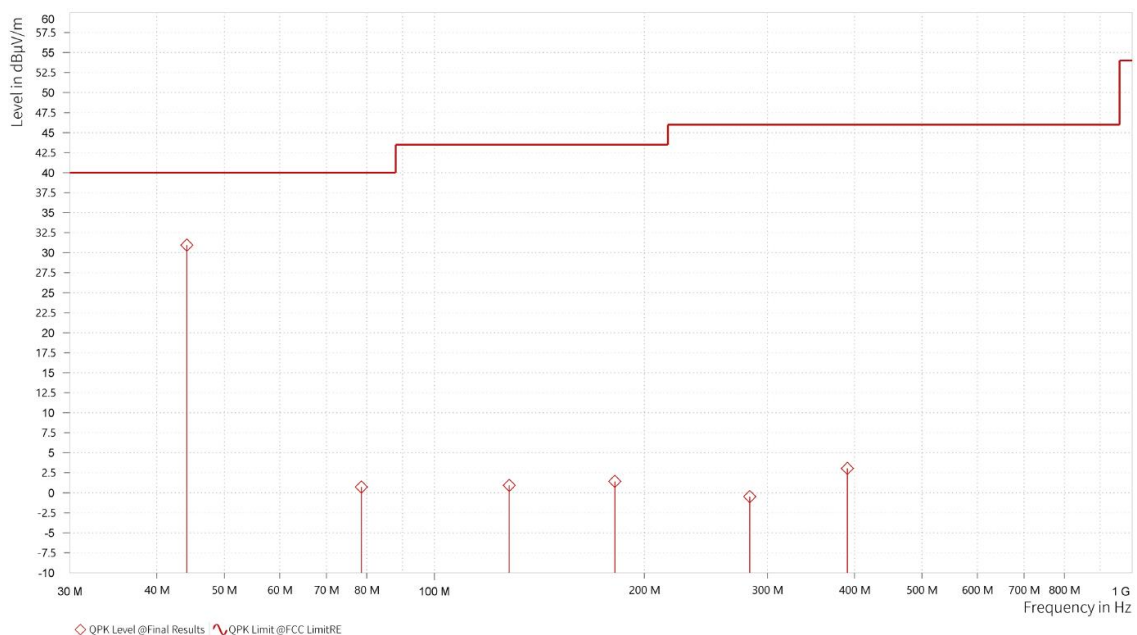
**Test Report No.: W7L-P23010004-2EM01**

|                                 |                      |   |                     |
|---------------------------------|----------------------|---|---------------------|
| <b>TEST VOLTAGE</b>             | Input 120 Vac, 60 Hz | <b>FREQUENCY RANGE</b>                              | 30-1000 MHz         |
| <b>ENVIRONMENTAL CONDITIONS</b> | 23deg. C, 70 %RH     | <b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b> | Quasi-Peak, 120 kHz |
| <b>TESTED BY</b>                | Chao Wu              |   |                     |

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

| Rg | Frequency [MHz] | QPK Level [dBμV/m] | QPK Limit [dBμV/m] | QPK Margin [dB] | Correction [dB] | Polarization | Azimuth [deg] | Antenna Height [m] | Meas. BW [kHz] |
|----|-----------------|--------------------|--------------------|-----------------|-----------------|--------------|---------------|--------------------|----------------|
| 1  | 44.162          | 30.96              | 40.00              | 9.04            | -17.01          | V            | 4.4           | 1                  | 120.000        |
| 1  | 78.549          | 0.72               | 40.00              | 39.28           | -24.81          | V            | 355           | 2                  | 120.000        |
| 1  | 127.970         | 0.94               | 43.50              | 42.56           | -25.74          | V            | 309           | 1                  | 120.000        |
| 1  | 181.369         | 1.44               | 43.50              | 42.06           | -25.51          | V            | 309           | 1                  | 120.000        |
| 1  | 283.122         | -0.49              | 46.00              | 46.49           | -22.32          | V            | 206           | 1                  | 120.000        |
| 1  | 390.889         | 3.05               | 46.00              | 42.95           | -20.17          | V            | 4.4           | 1                  | 120.000        |

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 30MHz to 1000MHz.
  4. Only emissions significantly above equipment noise floor are reported.





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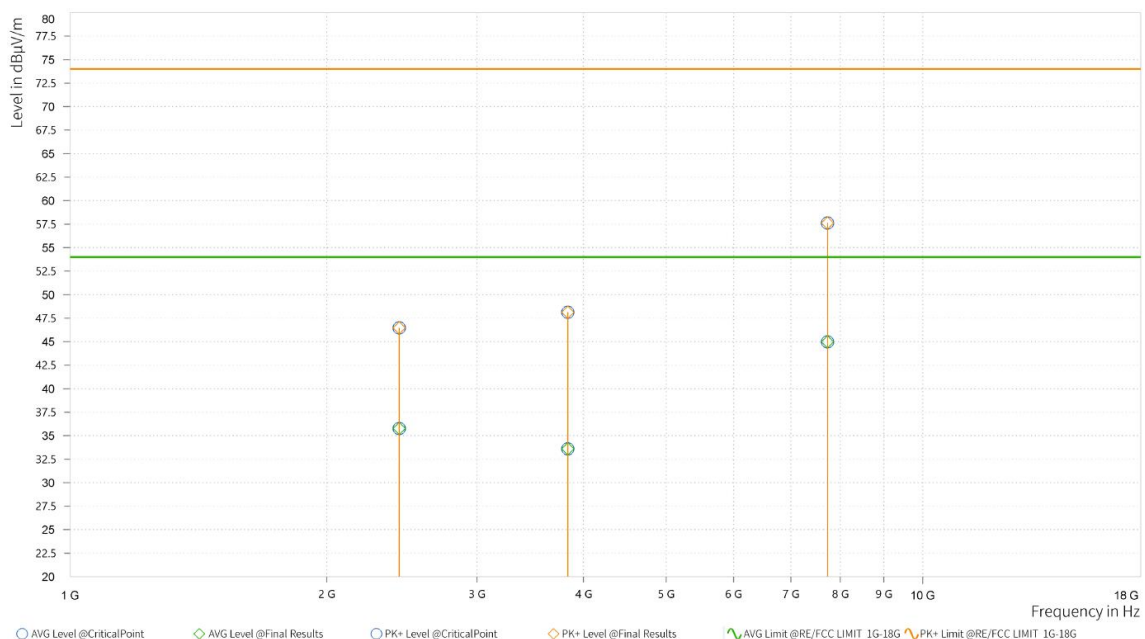
**Test Report No.: W7L-P23010004-2EM01**

|                                 |                      |   |                     |
|---------------------------------|----------------------|---|---------------------|
| <b>TEST VOLTAGE</b>             | Input 120 Vac, 60 Hz | <b>FREQUENCY RANGE</b>                              | 1-18 GHz            |
| <b>ENVIRONMENTAL CONDITIONS</b> | 23deg. C, 70 %RH     | <b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b> | Peak/Average, 1 MHz |
| <b>TESTED BY</b>                | Chao Wu              |   |                     |

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

| Rg | Frequency [MHz] | PK+ Level [dBμV/m] | PK+ Limit [dBμV/m] | PK+ Margin [dB] | AVG Level [dBμV/m] | AVG Limit [dBμV/m] | AVG Margin [dB] | Correction [dB] | Polarization | Azimuth [deg] | Antenna Height [m] | Meas. BW [kHz] |
|----|-----------------|--------------------|--------------------|-----------------|--------------------|--------------------|-----------------|-----------------|--------------|---------------|--------------------|----------------|
| 3  | 2,432.727       | 46.47              | 74.00              | 27.53           | 35.77              | 54.00              | 18.23           | 11.36           | H            | 359           | 2                  | 1,000.000      |
| 4  | 3,835.000       | 48.12              | 74.00              | 25.88           | 33.60              | 54.00              | 20.40           | 14.59           | H            | 359           | 2                  | 1,000.000      |
| 5  | 7,730.125       | 57.62              | 74.00              | 16.38           | 44.97              | 54.00              | 9.03            | 24.23           | H            | 0.9           | 2                  | 1,000.000      |

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 1GHz to 5th harmonic of the highest frequency or 40GHz, whichever is lower. For frequency above 18GHz, the emission was tested 20db below the limit so the data not recorded in the sheet.
  4. Only emissions significantly above equipment noise floor are reported.





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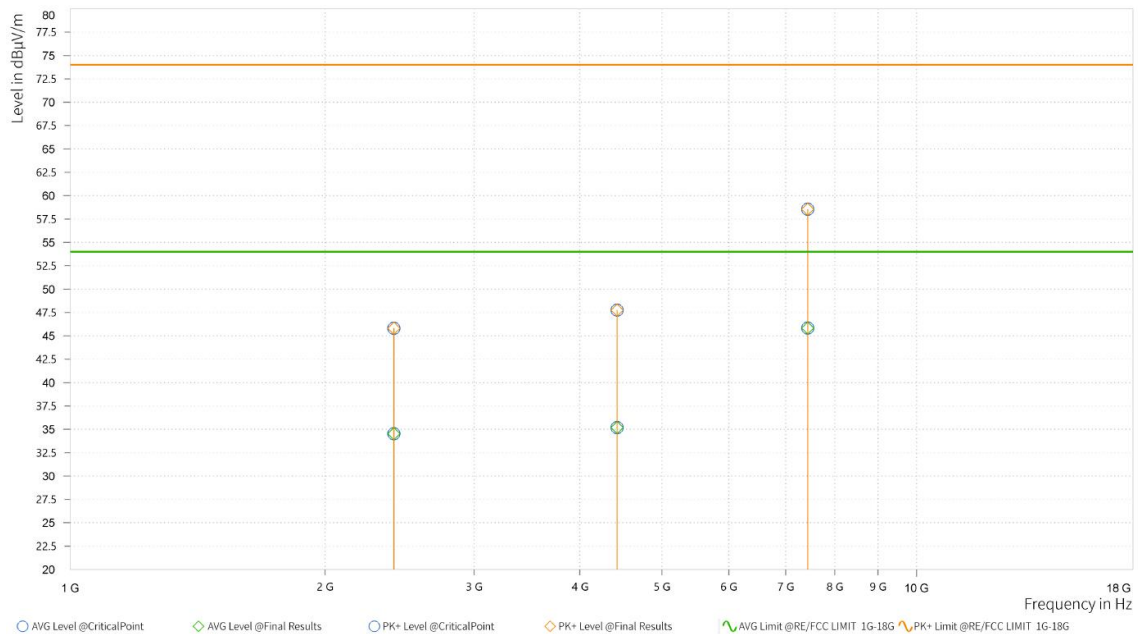
**Test Report No.: W7L-P23010004-2EM01**

|                                 |                      |   |                     |
|---------------------------------|----------------------|---|---------------------|
| <b>TEST VOLTAGE</b>             | Input 120 Vac, 60 Hz | <b>FREQUENCY RANGE</b>                              | 1-18 GHz            |
| <b>ENVIRONMENTAL CONDITIONS</b> | 23deg. C, 70 %RH     | <b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b> | Peak/Average, 1 MHz |
| <b>TESTED BY</b>                | Chao Wu              |   |                     |

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

| Rg | Frequency [MHz] | PK+ Level [dBμV/m] | PK+ Limit [dBμV/m] | PK+ Margin [dB] | AVG Level [dBμV/m] | AVG Limit [dBμV/m] | AVG Margin [dB] | Correction [dB] | Polarization | Azimuth [deg] | Antenna Height [m] | Meas. BW [kHz] |
|----|-----------------|--------------------|--------------------|-----------------|--------------------|--------------------|-----------------|-----------------|--------------|---------------|--------------------|----------------|
| 3  | 2,411.273       | 45.80              | 74.00              | 28.20           | 34.53              | 54.00              | 19.47           | 11.38           | V            | 359           | 1                  | 1,000.000      |
| 4  | 4,426.000       | 47.76              | 74.00              | 26.24           | 35.18              | 54.00              | 18.82           | 15.85           | V            | 359           | 2                  | 1,000.000      |
| 5  | 7,432.625       | 58.56              | 74.00              | 15.44           | 45.83              | 54.00              | 8.17            | 23.94           | V            | 359           | 1                  | 1,000.000      |

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 1GHz to 5th harmonic of the highest frequency or 40GHz, whichever is lower. For frequency above 18GHz, the emission was tested 20db below the limit so the data not recorded in the sheet.
  4. Only emissions significantly above equipment noise floor are reported.





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VERITAS**

Test Report No.: W7L-P23010004-2EM01

### **3 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB**

No any modifications were made to the EUT by the lab during the test.

**---END---**