

EMC TEST REPORT



| | |
|------------|---|
| Applicant: | Lenovo(Shanghai) Electronics Technology Co., Ltd. |
| Address: | NO.68 BUILDING, 199 FENJU RD, China (Shanghai) Pilot Free Trade Zone, 200131, CHINA |

| | |
|---------------------------|--|
| Manufacturer or Supplier: | Lenovo PC HK Limited |
| Address: | 23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong Kong |
| Product: | Portable Tablet Computer |
| Brand Name: | Lenovo |
| Model Name: | Lenovo TB-X605F |
| FCC ID: | O57TBX605F |
| Date of tests: | Oct. 23, 2018 ~ Nov. 03, 2018 |

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 B**
- ☒ **ANSI C63.4:2014**

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

| | |
|---|---|
| Issued by Alex Chen Engineer / Mobile Department | Approved by Sam Tung Manager / Mobile Department |
|  |  |
| Date: Nov. 07, 2018 | Date: Nov. 07, 2018 |

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Test Report No.: FV181022W002

RELEASE CONTROL RECORD

| ISSUE NO. | REASON FOR CHANGE | DATE ISSUED |
|--------------|--|---------------|
| FC180626C04 | Original release | Aug. 01, 2018 |
| FV181022W002 | Based on the original report FC180626C04 add a battery / two speakers & Lenovo Smart Dock and its adapter. | Nov. 05, 2018 |

1 GENERAL INFORMATION

1.1 GENERAL DESCRIPTION OF EUT

| | | |
|----------------------------|---|---|
| PRODUCT | Portable Tablet Computer | |
| BRAND NAME | Lenovo | |
| MODEL NAME | Lenovo TB-X605F | |
| NOMINAL VOLTAGE | 5.0Vdc (adapter or host equipment) 3.85Vdc (Li-ion) DC 5V (HA200) | |
| MODULATION TYPE | WLAN | CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM |
| | BT_LE | BT-LE(GFSK) for DTS |
| | Bluetooth | GFSK, $\pi/4$ -DQPSK, 8DPSK |
| OPERATING FREQUENCY | WLAN | 2412 ~ 2462MHz for 11b/g/n(HT20) 5150 ~ 5250MHz, 5250 ~ 5350MHz, 5470 ~ 5725MHz, 5725 ~ 5825MHz for 11a/n(HT20)/n(HT40)/ac(HT80) |
| | Bluetooth/BT_LE | 2402MHz ~ 2480MHz |
| HW VERSION | Lenovo Tablet TB-X605F | |
| FW VERSION | TB-X605F_RF01_20180615 | |
| I/O PORTS | Refer to user's manual | |
| CABLE | USB cable: shielded, detachable, 1.0meter | |
| 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.

3. There were Sample A, B, C, D, E and F for this project, the difference is as below:

| SAMPLE | EUT CONFIGURATION INFORMATION |
|----------|--|
| A | LCD Panel 2+Photo Camera 1+Photo Camera 3+CPU 1+EMMC1+DDR1+speaker 1+speaker 2+ motor2 + Main Broad 1+BT/WLAN Module+ Battery |
| B | LCD Panel 2+Photo Camera 2+Photo Camera 4+CPU 1+EMMC2+DDR2+speaker 1+speaker 2+motor1 + Main Broad 2 +BT/WLAN Module+ Battery |
| C | LCD Panel 2+Photo Camera 1+Photo Camera 3+CPU 1+EMMC3+DDR3+speaker 1+speaker 2 +motor2 + Main Broad 1+BT/WLAN Module+ Battery |
| D | LCD Panel 2+Photo Camera 2+Photo Camera 4+CPU 1+EMMC4+DDR4+speaker 1+speaker 2+motor1 + Main Broad 2+BT/WLAN Module+ Battery |
| E | LCD Panel 2+Photo Camera 1+Photo Camera 3+CPU 1+EMMC5+DDR5+speaker 1+speaker 2+motor2 + Main Broad 1+BT/WLAN Module+ Battery |
| F | LCD Panel 2+Photo Camera 2+Photo Camera 4+CPU 1+EMMC6+DDR6+speaker 1+speaker 2+motor1 + Main Broad 2+BT/WLAN Module+ Battery |

List of Accessories:

| ACCESSORIES | BRAND | MODEL | SPECIFICATION | Manufacturer |
|----------------------------|-----------|--------------------------|---|--------------|
| AC Adapter 1 | Salom | SC-42, SC-43 | I/P:100-240Vac, 300mA O/P: 5Vdc, 2000mA | - |
| AC Adapter 2 | AcBel | SC-42, SC-43 | I/P:100-240Vac, 30mA O/P: 5Vdc, 2000mA | - |
| AC Adapter 1 (For Dock) | XinSPower | A241-1202000U | I/P:100-240Vac, 800mA O/P: 12Vdc, 2000mA | - |
| AC Adapter 2 (For Dock) | N/A | CYSE20-120200U | I/P:100-240Vac, 600mA O/P: 12Vdc, 2000mA | - |
| Lenovo Smart Dock | Lenovo | Lenovo HA-200 | I/P: 12Vdc, 2000mA O/P: 5Vdc, 1500mA | |
| Battery 1 | Lenovo | L18D1P32 | Rating: 3.85Vdc, 4850mAh | Amperex |
| Battery 2 | Lenovo | L18D1P32 | Rating: 3.85Vdc, 4850mAh | Sunwoda |
| USB Cable 1(White) | LiQi | LQ-02300039 | 1.0m shielded cable w/o core | - |
| USB Cable 2(Black) | LiQi | LQ-02300040 | 1.0m shielded cable w/o core | - |
| LCD Panel1 (Black) | BOE | TV101WUM-LL2 | 10.1 " | - |
| LCD Panel2(White) | BOE | TV101WUM-LL3 | 10.1 " | - |
| EMMC1+DDR1 | SAMSUNG | KMQE60013M-B318(2+16) | 16G | - |
| EMMC2+DDR2 | HYNIX | H9TQ17ABJTCCUR-KUM(2+16) | 16G | - |
| EMMC3+DDR3 | SAMSUNG | KMGD6001BM-B421(3+32) | 32G | - |
| EMMC4+DDR4 | HYNIX | H9TQ27ADFTMCUR-KUM(3+32) | 32G | - |
| EMMC5+DDR5 | SAMSUNG | KMRH60014A-B614(4+64) | 64G | - |
| EMMC6+DDR6 | HYNIX | H9TQ52ACLTMCUR-KUM(4+64) | 64G | - |
| Speaker 1 | Keysound | QM171219AW84 | - | - |
| Speaker 2 | Keysound | QM171219AW85 | - | - |
| Speaker 3 | Honghua | SB9655B | - | - |
| Speaker 4 | Honghua | SB9655A | - | - |
| motor1 | AWA | YK2455R | - | - |
| Motor2 | Baolong | BLX-431320S | - | - |
| Photo Camera 1 | Lcetron | LE5143AM | 5M AF | - |
| Photo Camera 2 | Holitek | MF81Q | 5M AF | - |
| Photo Camera 3 | Lcetron | ZRT2509V-P102F | 2M FF | - |
| Photo Camera 4 | Holitech | HSU1005 | 2M FF | - |
| CPU | Qualcomm | SDA450 | 792nsp | - |
| Main Broad 1 | huashen | W93M71B2-3-03 | - | - |
| Main Broad 2 | yilianda | W93M71B2-3-05 | - | - |
| BT/WLAN Module | Qualcomm | WCN3680B | - | - |

Remark:

1. USB cabel 1 and USB cable 2 is identical, difference models are for color distinguished. Therefore, only USB cable 1 is as a representative for final test.
2. LCD Panel 1 and LCD Panel 2 is identical, difference models are for color distinguished. Therefore, only LCD Panel 2 is as a representative for final test.

1.2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

| APPLIED STANDARD: FCC Part 15, Subpart B | | | | |
|---|---------------------------------------|--------|--|-----------|
| Standard Section | Test Item | Result | Remark | Test Lab* |
| FCC Part 15, Subpart B, Class B ANSI C63.4:2014 | Conducted Test | PASS | Meets limits minimum passing margin is -27.46dB at 0.356000MHz. | A |
| | Radiated Emission Test (30MHz ~ 1GHz) | PASS | Meets Class B Limit Minimum passing margin is -3.38dB at 659.99MHz | B |
| | Radiated Emission Test (Above 1GHz) | PASS | Meets Class B Limit Minimum passing margin is -17.32dB at 2564MHz | A |

*Test Lab Information Reference

Lab A:

BV 7Layers Communications Technology (Shenzhen) Co. Ltd

Lab Address:

No.B102, Dazhu Chuangxin Mansion, North of Beihuan Avenue, North Area, Hi-Tech Industrial Park, Nanshan District, Shenzhen, Guangdong, China

Accredited Test Lab Cert 3939.01

Lab B:

Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

Lab Address:

No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan, R.O.C.

Accredited Test Lab Cert 4327.01

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 | +/-2.66dB |
| Radiated emissions | 30MHz ~ 1GHz | +/-3.26dB |
| | 1GHz ~ 18GHz | +/-4.48dB |

1.4 DESCRIPTION OF TEST MODES

| Test Mode | Test Condition |
|--------------------------------|--|
| Radiated emission test | |
| 1 | AC Adapter 1(For Dock)+ Sample A+ USB Cable+ Front Camera On+ Earphone+ BT Idle+ WIFI 2.4g Idle+ Battery 2+ GPS Rx+ Dock |
| 2 | AC Adapter 1(For Dock)+ Sample B+ USB Cable+ Back Camera On+ Earphone+ BT Idle+ WIFI 5g Idle+ Battery 2+ Glonass Rx+ Dock |
| 3 | AC Adapter 1(For Dock)+ Sample C+ USB Cable+ MPG4+ Earphone+ BT Idle+ WIFI 2.4g Idle+ Battery 2+ Glonass Rx+ Dock |
| 4 | AC Adapter 1(For Dock)+ Sample D+ USB Cable+ FM RX+ Earphone+ BT Idle+ WIFI 5g Idle++ Battery 2+ GPS Rx+ Dock |
| 5 | AC Adapter 1(For Dock)+ Sample E+ USB Cable+ Front Camera On+ Earphone+ BT Idle+ WIFI 2.4g Idle+ Battery 2+ GPS Rx+ Dock |
| 6 | AC Adapter 1(For Dock)+ Sample F+ USB Cable+ Back Camera On+ Earphone+ BT Idle+ WIFI 5g Idle++ Battery 2+ Glonass Rx+ Dock |
| 7 | AC Adapter 2 (For Dock)+ Worst case of (1-6) |
| 8 | Adapter 1+ Worst case of (1-6) |
| 9 | Adapter 2+ Worst case of (1-6) |
| 10 | Back Camera On+ Worst case of (1-9) |
| 11 | MPG4+ Worst case of (1-9) |
| 12 | FM RX+ Worst case of (1-9) |
| 13 | Sample E+ USB Link+ PC To EUT(Data Transmission)+ Earphone+ Battery 2+ BT Idle+ WIFI 2.4g Idle+ GPS Rx |
| 14 | Sample E+ USB Link+ EUT To PC(Data Transmission) + Earphone+ Battery 2+ BT Idle+ WIFI 5g Idle+ Glonass Rx |
| Conducted emission test | |
| 1 | AC Adapter 1(For Dock)+ Sample A+ USB Cable+ Front Camera On+ Earphone+ BT Idle+ WIFI 2.4g Idle+ Battery 2+ GPS Rx+ Dock |
| 2 | AC Adapter 1(For Dock)+ Sample B+ USB Cable+ Back Camera On+ Earphone+ BT Idle+ WIFI 5g Idle+ Battery 2+ Glonass Rx+ Dock |
| 3 | AC Adapter 1(For Dock)+ Sample C+ USB Cable+ MPG4+ Earphone+ BT Idle+ WIFI 2.4g Idle+ Battery 2+ Glonass Rx+ Dock |
| 4 | AC Adapter 1(For Dock)+ Sample D+ USB Cable+ FM RX+ Earphone+ BT Idle+ WIFI 5g Idle++ Battery 2+ GPS Rx+ Dock |
| 5 | AC Adapter 1(For Dock)+ Sample E+ USB Cable+ Front Camera On+ Earphone+ BT Idle+ WIFI 2.4g Idle+ Battery 2+ GPS Rx+ Dock |
| 6 | AC Adapter 1(For Dock)+ Sample F+ USB Cable+ Back Camera On+ Earphone+ BT Idle+ WIFI 5g Idle++ Battery 2+ Glonass Rx+ Dock |
| 7 | AC Adapter 2 (For Dock)+ Worst case of (1-6) |
| 8 | Adapter 1+ Worst case of (1-6) |
| 9 | Adapter 2+ Worst case of (1-6) |
| 10 | Back Camera On+ Worst case of (1-9) |



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| | |
|----|---|
| 11 | MPG4+ Worst case of (1-9) |
| 12 | FM RX+ Worst case of (1-9) |
| 13 | Sample E+ USB Link+ PC To EUT(Data Transmission)+ Earphone+ Battery 2+ BT Idle+ WIFI 2.4g Idle+ GPS Rx |
| 14 | Sample E+ USB Link+ EUT To PC(Data Transmission) + Earphone+ Battery 2+ BT Idle+ WIFI 5g Idle+ Glonass Rx |

NOTE:

1. For conducted emission test, test mode 10 was the worst case and only this mode was presented in this report.
2. For radiated emission test, test mode 13 was the worst 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 EMISSION TESTS

| NO. | PRODUCT | BRAND | MODEL NO. | SERIAL NO. | FCC ID |
|-----|---------------------|-----------------|------------------|------------|--------|
| 1 | Wireless AP | ABOCOM | WR224GR | 060500749P | N/A |
| 2 | Bluetooth Earphone | FAP00 | H6080 | 12098 | N/A |
| 3 | Laptop | Lenovo | Thnikpad L440 | R90FTFKP | N/A |
| 4 | GPS Simulator | Spetctracom/USA | GSG-5 | 200782 | N/A |
| 5 | Printer | HP | hp LaserJet 1300 | N/A | N/A |
| 6 | FM signal generator | Rohde&Schwarz | SMB100A | 109279 | N/A |
| 7 | Earphone | Nokia | WH-108 | N/A | N/A |

| NO. | SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS |
|-----|---|
| 1 | N/A |
| 2 | N/A |
| 3 | N/A |
| 4 | N/A |
| 5 | N/A |
| 6 | N/A |
| 7 | N/A |

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)

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

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.
 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 | 101900 | Mar. 15,18 | Mar. 14,19 |
| EMC32 test software | Rohde&Schwarz | EMC32 | NA | NA | NA |
| LISN network | Rohde&Schwarz | ENV216 | 101922 | Mar. 15,18 | Mar. 14,19 |

- NOTE:**
1. The test was performed in CE shielded room.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

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.

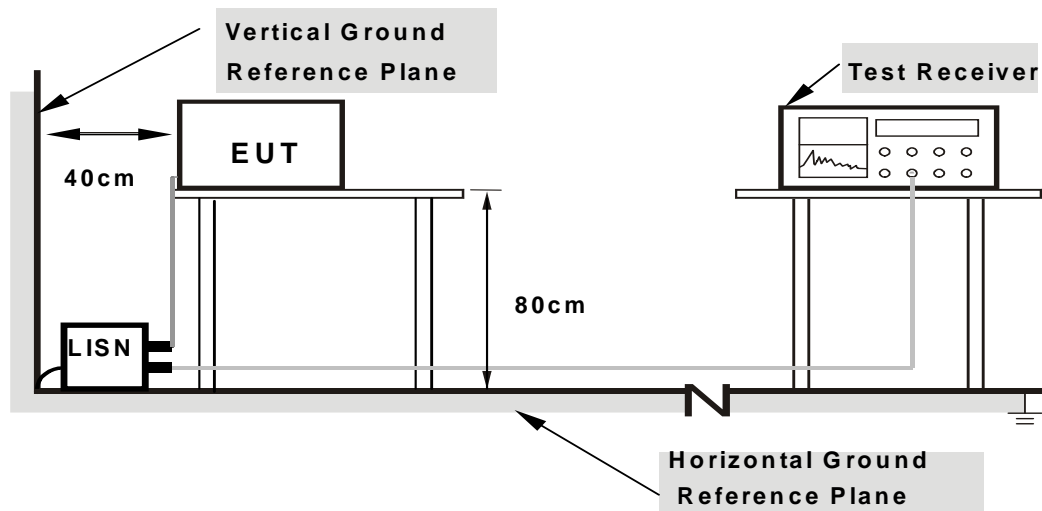
NOTE: All modes of operation were investigated and the worst-case emissions are reported.

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.

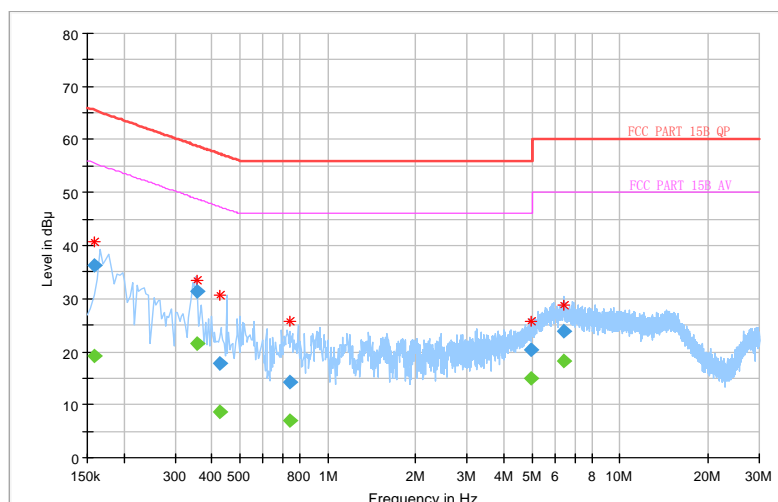
2.1.7 TEST RESULTS

| | | | |
|---------------------------------|----------------------|---|---------------------------------------|
| TEST VOLTAGE | Input 120 Vac, 60 Hz | Detector Function & Resolution Bandwidth | Quasi-Peak (QP) / Average (AV), 9 kHz |
| ENVIRONMENTAL CONDITIONS | 24deg. C, 43RH | TESTED BY | John Wen |

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|---------------|-----------|-----------|------------|
| 0.158000 | --- | 19.27 | 55.57 | -36.30 | L1 | ON | 9.6 |
| 0.158000 | 36.37 | --- | 65.57 | -29.20 | L1 | ON | 9.6 |
| 0.356000 | --- | 21.54 | 48.82 | -27.28 | L1 | ON | 9.7 |
| 0.356000 | 31.36 | --- | 58.82 | -27.46 | L1 | ON | 9.7 |
| 0.428000 | --- | 8.71 | 47.29 | -38.58 | L1 | ON | 9.7 |
| 0.428000 | 17.82 | --- | 57.29 | -39.47 | L1 | ON | 9.7 |
| 0.740000 | --- | 7.05 | 46.00 | -38.95 | L1 | ON | 9.7 |
| 0.740000 | 14.36 | --- | 56.00 | -41.64 | L1 | ON | 9.7 |
| 4.952000 | --- | 14.92 | 46.00 | -31.08 | L1 | ON | 9.7 |
| 4.952000 | 20.37 | --- | 56.00 | -35.63 | L1 | ON | 9.7 |
| 6.412000 | --- | 18.14 | 50.00 | -31.86 | L1 | ON | 9.8 |
| 6.412000 | 23.96 | --- | 60.00 | -36.04 | L1 | ON | 9.8 |

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
 3. The emission levels of other frequencies were very low against the limit.
 4. Margin value = Emission level - Limit value
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.

Full Spectrum

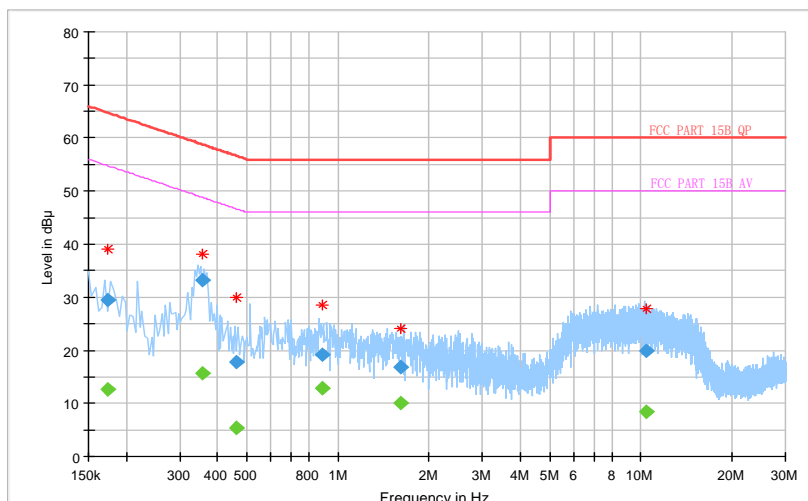


| | | | |
|---------------------------------|----------------------|---|---------------------------------------|
| TEST VOLTAGE | Input 120 Vac, 60 Hz | Detector Function & Resolution Bandwidth | Quasi-Peak (QP) / Average (AV), 9 kHz |
| ENVIRONMENTAL CONDITIONS | 24deg. C, 43RH | TESTED BY | John Wen |

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.174000 | --- | 12.63 | 54.77 | -42.14 | N | ON | 10.2 |
| 0.174000 | 29.39 | --- | 64.77 | -35.37 | N | ON | 10.2 |
| 0.356000 | --- | 15.62 | 48.82 | -33.20 | N | ON | 10.0 |
| 0.356000 | 33.23 | --- | 58.82 | -25.60 | N | ON | 10.0 |
| 0.464000 | --- | 5.37 | 46.62 | -41.25 | N | ON | 10.1 |
| 0.464000 | 17.82 | --- | 56.62 | -38.80 | N | ON | 10.1 |
| 0.888000 | --- | 12.80 | 46.00 | -33.20 | N | ON | 9.9 |
| 0.888000 | 19.13 | --- | 56.00 | -36.87 | N | ON | 9.9 |
| 1.604000 | --- | 9.99 | 46.00 | -36.01 | N | ON | 9.9 |
| 1.604000 | 16.96 | --- | 56.00 | -39.04 | N | ON | 9.9 |
| 10.384000 | --- | 8.47 | 50.00 | -41.53 | N | ON | 9.9 |
| 10.384000 | 19.83 | --- | 60.00 | -40.17 | N | ON | 9.9 |

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
 3. The emission levels of other frequencies were very low against the limit.
 4. Margin value = Emission level - Limit value
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.

Full Spectrum



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 10 meters (dBμV/m) | | | | |
|---|----------------------------|-----------------------------|-------------------|-------------------|
| Frequencies (MHz) | FCC 15B/ ICES-003, Class A | FCC 15B / ICES-003, Class B | CISPR 22, Class A | CISPR 22, Class B |
| 30-88 | 39 | 29.5 | 40 | 30 |
| 88-216 | 43.5 | 33.1 | | |
| 216-230 | 46.4 | 35.6 | | |
| 230-960 | | | 47 | 37 |
| 960-1000 | 49.5 | 43.5 | | |
| 1000-3000 | Avg: 49.5 | Avg: 43.5 | Not defined | Not defined |
| 3000+ | Peak: 69.5 | Peak: 63.5 | Not defined | Not defined |

| Radiated Emissions Limits at 3 meters (dBμV/m) | | | | |
|--|-----------------------------|-----------------------------|---------------------|---------------------|
| Frequencies (MHz) | FCC 15B / ICES-003, Class A | FCC 15B / ICES-003, Class B | CISPR 22, Class A | CISPR 22, Class B |
| 30-88 | 49.5 | 40 | 50.5 | 40.5 |
| 88-216 | 54 | 43.5 | | |
| 216-230 | 56.9 | 46 | | |
| 230-960 | | | 57.5 | 47.5 |
| 960-1000 | 60 | 54 | | |
| 1000-3000 | Avg: 60 Peak: 80 | Avg: 54 Peak: 74 | Avg: 56 Peak: 76 | Avg: 50 Peak: 70 |
| 3000+ | | | Avg: 60 Peak: 80 | Avg: 54 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 th harmonic of the highest frequency or 40GHz, whichever is lower |

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
 2. Emission level (dBuV/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

| Equipment& Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|--|----------------------------------|------------------------|---------------|---------------|
| Test Receiver ROHDE & SCHWARZ (V) | ESR | 101240 | Oct. 30, 2018 | Oct. 29, 2019 |
| Test Receiver ROHDE & SCHWARZ (H) | ESR | 101264 | Dec. 25, 2017 | Dec. 24, 2018 |
| BILOG Antenna SCHWARZBECK (V) | VULB9168 | 9168-160 | Nov. 29, 2017 | Nov. 28, 2018 |
| BILOG Antenna SCHWARZBECK (H) | VULB9168 | 9168-156 | Nov. 29, 2017 | Nov. 28, 201 |
| Preamplifier Sonoma (V) | 310N | 352924 | Jul. 12, 2018 | Jul. 11, 2019 |
| Preamplifier Sonoma (H) | 310N | 352923 | Jul. 12, 2018 | Jul. 11, 2019 |
| RF signal cable (with 5dB PAD) Times (V) | LMR-600 (18M) +LMR-400 (7M) | CABLE-CH1 (VER) -01 | Oct. 03, 2018 | Oct. 02, 2019 |
| RF signal cable (with 5dB PAD) Times (H) | LMR-600 (11.8M) +LMR-400 (7M) | CABLE-CH1 (HOR) -01 | Oct. 03, 2018 | Oct. 02, 2019 |
| Software BV ADT | BV ADT_Radiated_ V8.7.08 | NA | NA | NA |
| Antenna Tower (V) | MFA-440 | 9707 | NA | NA |
| Antenna Tower (H) | MFA-440 | 970705 | NA | NA |
| Turn Table | DS430 | 50303 | NA | NA |
| Controller (V) | MF7802 | 074 | NA | NA |
| Controller (H) | MF7802 | 08093 | NA | NA |

- NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 1.
3. The IC Site Registration No. is IC 7450F-1.
4. The VCCI Site Registration No. is R-1893.

Frequency range above 1GHz

| Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|-----------------------------|--------------|----------------|---------------------------------|------------|------------|
| 3m Semi-anechoic Chamber | ETS-LINDGREN | 9m*6m*6m | Euroshieldpn- CT0001143-1216 | Apr. 21,18 | Apr. 20,19 |
| Horn Antenna | ETS-LINDGREN | 3117 | 00168728 | Nov. 10,16 | Nov. 09,18 |
| MXE EMI Receiver | KEYSIGHT | N9038A-544 | MY54450026 | Mar. 16,18 | Mar. 15,19 |
| Signal Pre-Amplifier | EMSI | EMC 012645B | 980257 | Jul. 09,18 | Jul. 08,19 |

- NOTE: 1. The test was performed in 3m chamber.
2. The calibration interval of the above test instruments is 12 months or 24 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
3. The FCC Site Registration No. is 525120.

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 10 meter semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 10 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. $\text{Emission level(dBuV/m)} = \text{Raw Value(dBuV)} + \text{Correction Factor(dB/m)}$
3. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)}$ (if the raw value not contains the amplifier);
4. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)} - \text{Amplifier Gain(dB)}$ (if the raw value contains the amplifier).
5. $\text{Margin value} = \text{Emission level} - \text{Limit value}$.

<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:

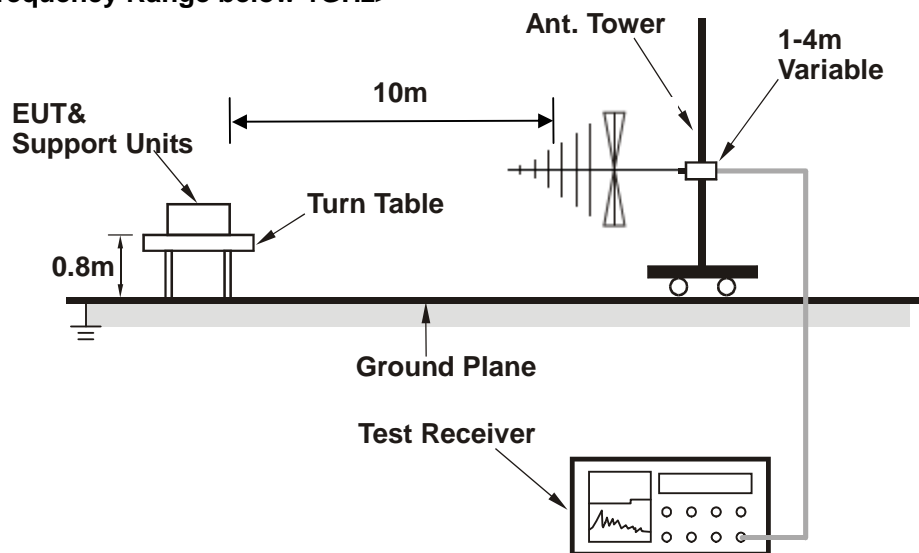
1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth of test receiver/spectrum analyzer is 10Hz 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. $\text{Emission level(dBuV/m)} = \text{Raw Value(dBuV)} + \text{Correction Factor(dB/m)}$
5. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)}$ (if the raw value not contains the amplifier);
6. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)} - \text{Amplifier Gain(dB)}$ (if the raw value contains the amplifier)
7. $\text{Margin value} = \text{Emission level} - \text{Limit value}$.

2.2.4 DEVIATION FROM TEST STANDARD

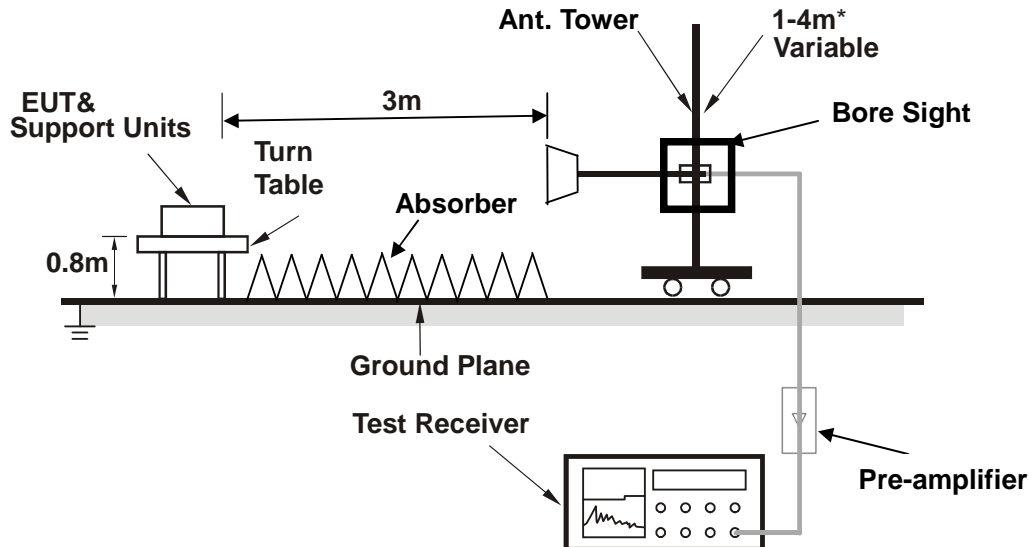
No deviation.

2.2.5 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

2.2.6 EUT OPERATING CONDITIONS

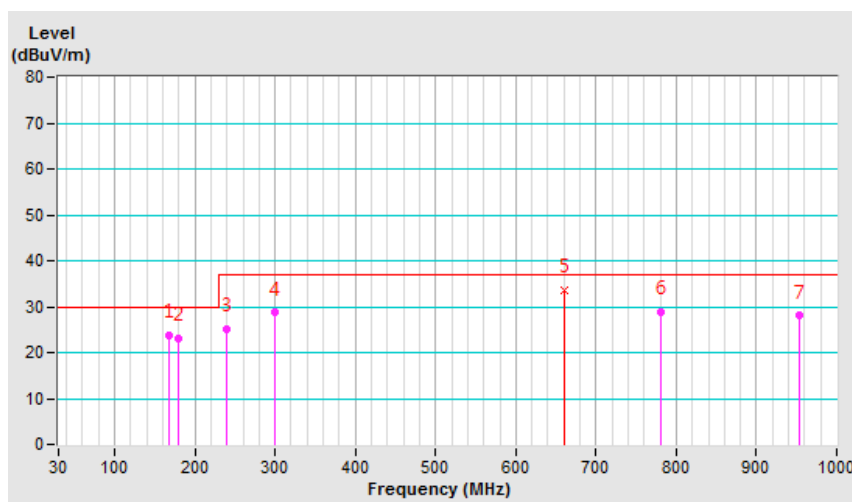
Same as 2.1.6

2.2.7 TEST RESULTS

| | | | |
|---------------------------------|----------------------|---|---------------------|
| TEST VOLTAGE | Input 120 Vac, 60 Hz | FREQUENCY RANGE | 30-1000 MHz |
| ENVIRONMENTAL CONDITIONS | 23deg. C, 70 %RH | DETECTOR FUNCTION & RESOLUTION BANDWIDTH | Quasi-Peak, 120 kHz |
| TESTED BY | Felix | | |

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 10 M

| No. | Frequency MHz | Factor dB/m | Reading dBuV | Emission dBuV/m | Limit dBuV/m | Margin dB | Tower cm | Table deg |
|-----|------------------|----------------|-----------------|--------------------|-----------------|--------------|-------------|--------------|
| 1 | 167.75 | -12.80 | 36.55 | 23.75 | 30.00 | -6.25 | 250 | 163 |
| 2 | 179.97 | -13.75 | 36.80 | 23.05 | 30.00 | -6.95 | 400 | 152 |
| 3 | 239.97 | -14.34 | 39.42 | 25.08 | 37.00 | -11.92 | 300 | 191 |
| 4 | 299.96 | -12.60 | 41.29 | 28.69 | 37.00 | -8.31 | 400 | 198 |
| * 5 | 659.99 | -4.51 | 38.13 | 33.62 | 37.00 | -3.38 | 100 | 31 |
| 6 | 780.04 | -1.60 | 30.55 | 28.95 | 37.00 | -8.05 | 100 | 129 |
| 7 | 953.58 | 1.41 | 26.61 | 28.02 | 37.00 | -8.98 | 250 | 181 |

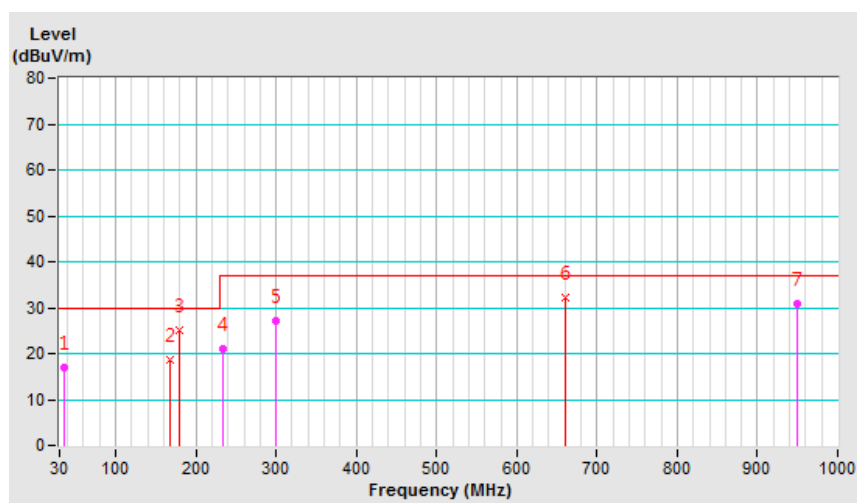


- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
 2. Negative sign (-) in the margin column signify levels below the limit.
 3. Frequency range scanned: 30MHz to 1000MHz.
 4.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

| | | | |
|--------------------------|----------------------|--|---------------------|
| TEST VOLTAGE | Input 120 Vac, 60 Hz | FREQUENCY RANGE | 30-1000 MHz |
| ENVIRONMENTAL CONDITIONS | 23deg. C, 70 %RH | DETECTOR FUNCTION & RESOLUTION BANDWIDTH | Quasi-Peak, 120 kHz |
| TESTED BY | Felix | | |

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 10 M

| No. | Frequency MHz | Factor dB/m | Reading dBuV | Emission dBuV/m | Limit dBuV/m | Margin dB | Tower cm | Table deg |
|-----|------------------|----------------|-----------------|--------------------|-----------------|--------------|-------------|--------------|
| 1 | 36.60 | -14.53 | 31.61 | 17.08 | 30.00 | -12.92 | 200 | 156 |
| 2 | 167.98 | -13.43 | 32.21 | 18.78 | 30.00 | -11.22 | 250 | 1 |
| 3 | 179.99 | -14.25 | 39.29 | 25.04 | 30.00 | -4.96 | 100 | 43 |
| 4 | 233.23 | -15.84 | 37.02 | 21.18 | 37.00 | -15.82 | 100 | 160 |
| 5 | 300.01 | -13.16 | 40.39 | 27.23 | 37.00 | -9.77 | 100 | 194 |
| * | 660.01 | -5.11 | 37.36 | 32.25 | 37.00 | -4.75 | 250 | 171 |
| 7 | 949.46 | 0.81 | 30.09 | 30.90 | 37.00 | -6.10 | 150 | 233 |



- 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.

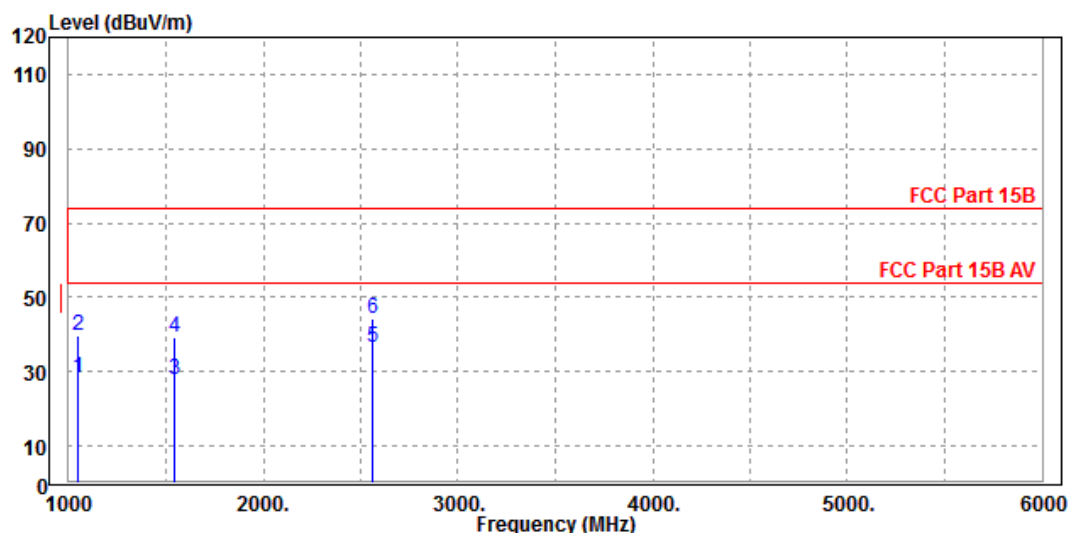
Note: Radiated Emission below 1GHz Test was performed in **Lab B**.

| | | | |
|---------------------------------|----------------------|---|---------------------|
| TEST VOLTAGE | Input 120 Vac, 60 Hz | FREQUENCY RANGE | 1-18 GHz |
| ENVIRONMENTAL CONDITIONS | 23deg. C, 70 %RH | DETECTOR FUNCTION & RESOLUTION BANDWIDTH | Peak/Average, 1 MHz |
| TESTED BY | Rose Ma | | |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | |
|---|-------------------------------|-------------------------|-------------------|----------------|------------------------------|-----------------------|--------------------------|---------------------------|----------------------------|----------------|
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 1045 | 28.33 | 42.35 | 54 | -25.67 | 29.16 | 3.08 | 46.26 | 145 | 138 | Average |
| 1045 | 39.63 | 53.65 | 74 | -34.37 | 29.16 | 3.08 | 46.26 | 145 | 138 | Peak |
| 1540 | 27.77 | 41.22 | 54 | -26.23 | 28.96 | 3.74 | 46.15 | 102 | 133 | Average |
| 1540 | 39.18 | 52.63 | 74 | -34.82 | 28.96 | 3.74 | 46.15 | 102 | 133 | Peak |
| 2564 | 36.68 | 45.03 | 54 | -17.32 | 32.46 | 5.07 | 45.88 | 156 | 188 | Average |
| 2564 | 44.12 | 52.47 | 74 | -29.88 | 32.46 | 5.07 | 45.88 | 156 | 188 | Peak |

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 18GHz.
4. Only emissions significantly above equipment noise floor are reported.

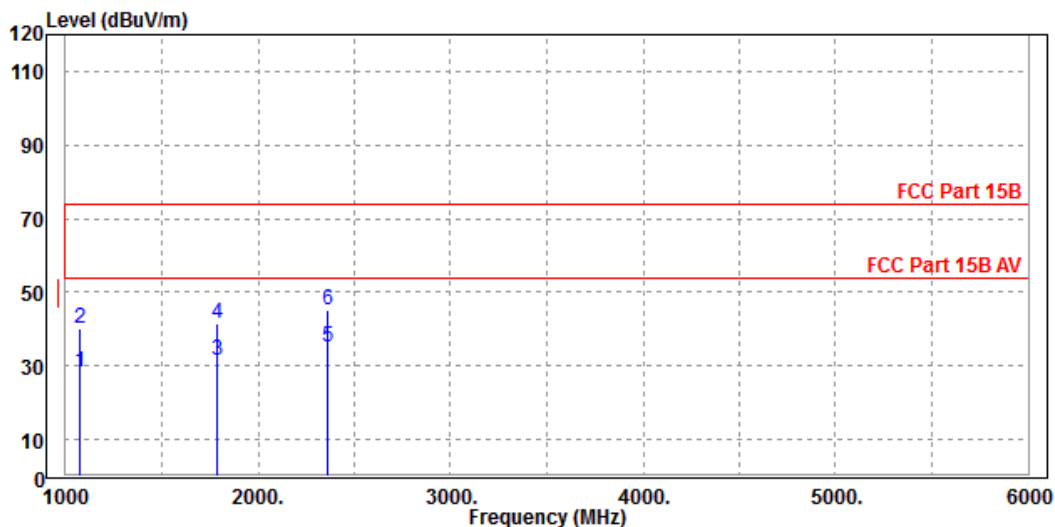


| | | | |
|---------------------------------|----------------------|---|---------------------|
| TEST VOLTAGE | Input 120 Vac, 60 Hz | FREQUENCY RANGE | 1-18 GHz |
| ENVIRONMENTAL CONDITIONS | 23deg. C, 70 %RH | DETECTOR FUNCTION & RESOLUTION BANDWIDTH | Peak/Average, 1 MHz |
| TESTED BY | Rose Ma | | |

| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | | | |
|---|-------------------------------|-------------------------|-------------------|----------------|------------------------------|-----------------------|--------------------------|---------------------------|----------------------------|---------|
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 1078 | 28.37 | 42.38 | 54 | -25.63 | 29.12 | 3.12 | 46.25 | 155 | 264 | Average |
| 1078 | 40.02 | 54.03 | 74 | -33.98 | 29.12 | 3.12 | 46.25 | 155 | 264 | Peak |
| 1789 | 31.32 | 42.72 | 54 | -22.68 | 30.55 | 4.13 | 46.08 | 149 | 257 | Average |
| 1789 | 41.71 | 53.11 | 74 | -32.29 | 30.55 | 4.13 | 46.08 | 149 | 257 | Peak |
| 2360 | 35.06 | 43.88 | 54 | -18.94 | 32.26 | 4.85 | 45.93 | 124 | 277 | Average |
| 2360 | 45.28 | 54.1 | 74 | -28.72 | 32.26 | 4.85 | 45.93 | 124 | 277 | Peak |

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 18GHz.
4. Only emissions significantly above equipment noise floor are reported.





Test Report No.: FV181022W002

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---