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# Taiwan RedEye Biomedical Inc.

# TEST REPORT

**REPORT NUMBER**
191200338TWN-001

**ISSUE DATE**
Jun. 01, 2020

**PAGES**
24

# Radio Spectrum
## TEST REPORT

| | |
|---|---|
| **Applicant:** | **Taiwan RedEye Biomedical Inc.**<br>**Hsinchu Science Park Room A2-A6 1F., No. 1, Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan** |
| **Product:** | **Wireless Charger** |
| **Model No.:** | **redeye-S** |
| **FCC ID:** | **2AWA7-REDEYE-S** |
| **Brand Name:** | **RedEye** |
| **Test Method/ Standard:** | **47 CFR FCC Part 15.209** |
| **Test By:** | **Intertek Testing Services Taiwan Ltd.,**<br>**Hsinchu Laboratory**<br>**No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,**<br>**Shiang-Shan District, Hsinchu City, Taiwan** |

Testing Laboratory
0597

Prepared and Checked by:

Durant Wei

Durant Wei
Engineer

Approved by:

Rico Deng

Rico Deng
Supervisor

# Revision History

| Report No. | Issue Date | Revision Summary |
|---|---|---|
| 191200338TWN-001 | Jun. 01, 2020 | Original report |

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## Summary of Test Data

| Test Requirement | Applicable Rule | Result |
|---|---|---|
| Radiated Emission test | 15.209 | Pass |
| Conducted Emission test | 15.207 | Pass |
| Antenna Requirement | 15.203 | Pass |

Note: Please note that the test results with statement of conformity, the decision rules which are based on: Safety Testing: the specification, standard or IEC Guide 115.
Other Testing: the specification, standard and not taking into account the measurement uncertainty.

## 1. General Information

### 1.1 Identification of the EUT

| | |
|---|---|
| **Product:** | Wireless Charger |
| **Model No.:** | redeye-S |
| **Operating Frequency:** | 120-225kHz |
| **Rated Power:** | DC 5V |
| **Power Cord:** | N/A |
| **Sample receiving date:** | Dec. 25, 2019 |
| **Sample condition:** | Workable |
| **Test Date(s):** | Dec. 25, 2019 ~ Mar. 09, 2020 |

### 1.2 Antenna description

**Antenna Type** : Coil Antenna
**Connector Type** : Fixed

## 2. Test specifications

### 2.1 Test standard

The EUT was performed according to the requirement in FCC Part 15 Subpart C Section 15.209.

### 2.2 Operation mode

TX mode: The EUT transmit continuously while we put on the peripheral and power on the EUT.

### 2.3 Peripherals equipment

| Peripherals | Brand | Model No. | Serial No. | Data cable |
|---|---|---|---|---|
| Notebook PC | HP | HP ProBook 440 G3 | 5CD8021S9H | N/A |
| Bio Sensor | Redeye | Redeye2 | N/A | N/A |

## 3. Radiated emission test FCC 15.209

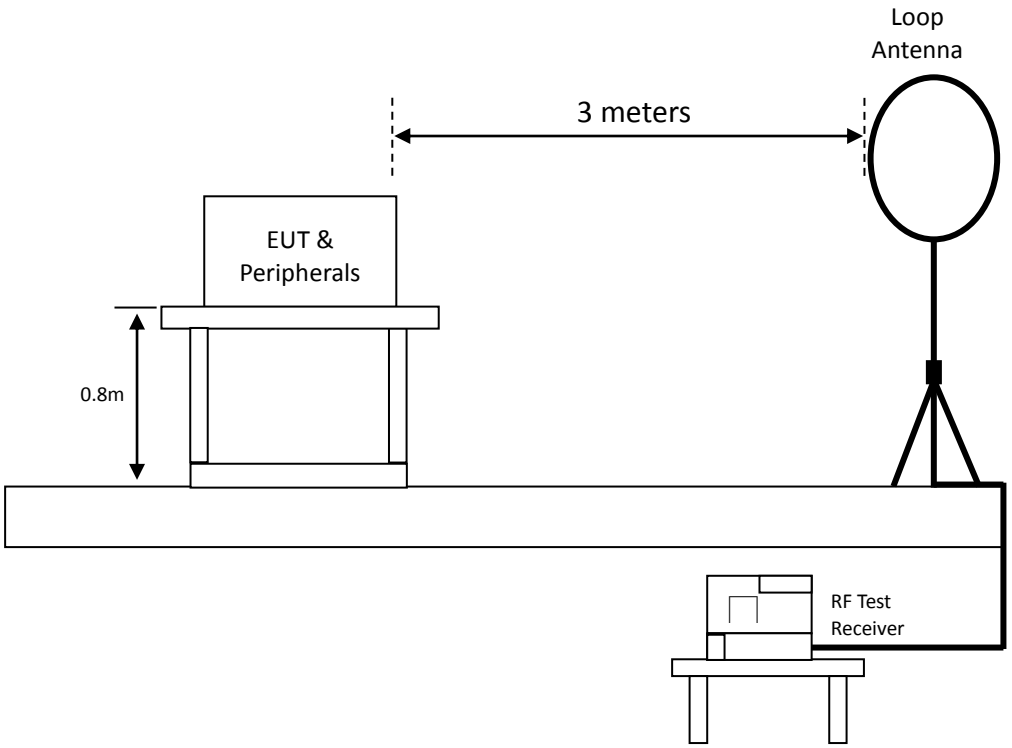
### 3.1 Operating environment

| | | |
|---|---|---|
| Temperature: | 23 | ℃ |
| Relative Humidity: | 56 | % |

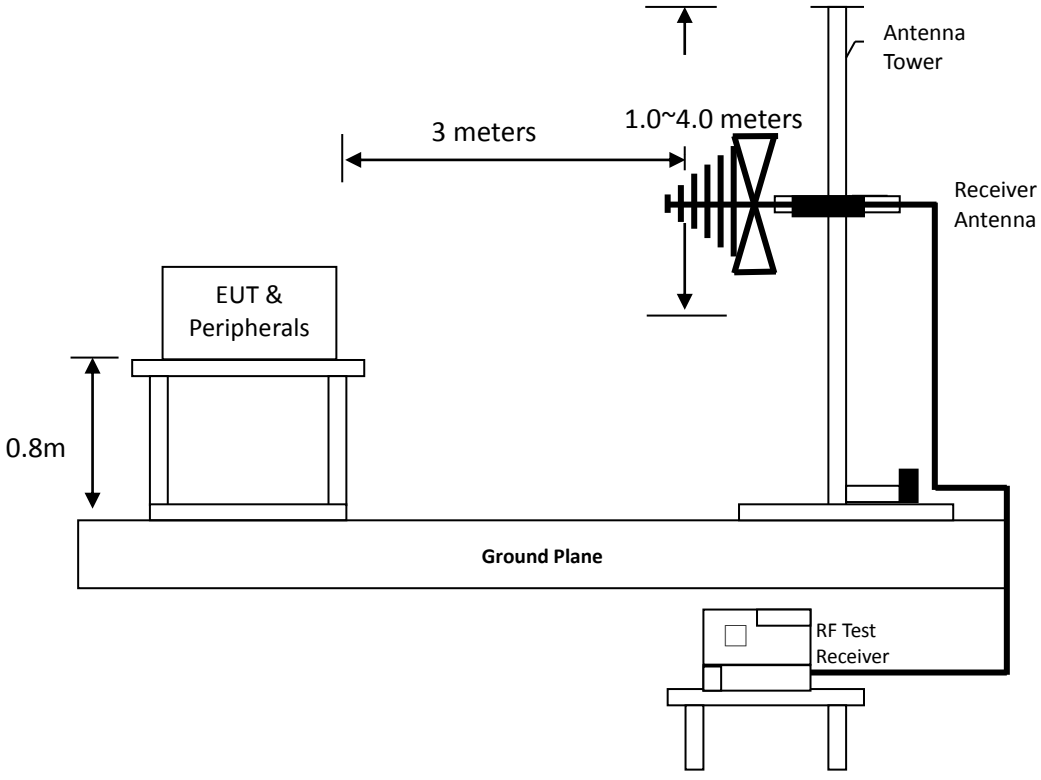
### 3.2 Test setup & procedure

| | |
|---|---|
| Step 1 | Configure the EUT according to ANSI C63.10:2013. The EUT was placed on the top of the turntable 0.8 meter (below 1GHz) and 1.5 meter (above 1GHz) above ground. The center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable. |
| Step 2 | Power on the EUT and all the companion devices. The turntable was rotated by 360 degree to find the position of the maximum emission level. |
| Step 3 | The height of the receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of the both horizontal and vertical polarization. |
| Step 4 | If find the frequencies above the limit or below within 3dB, the antenna tower was scan (from 1m to 4m) and then the turntable was rotated to find the maximum reading. |
| Step 5 | Set the test-receiver system to peak or CISPR quasi-peak detector with specified bandwidth under maximum hold mode. |
| Step 6 | If the emissions level of the EUT in peak mode was 3dB lower than the average limit specified then testing will be stopped and peak values of the EUT will be reported. Otherwise, the emissions which do not have 3dB margin will be measured using the quasi-peak method for below 1GHz. |
| Step 7 | In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be quasi-peak measured by receiver. |

### 3.2.1 Radiated emission from 9kHz to 30MHz uses Loop Antenna:




### 3.2.2 Radiated emission below 1GHz using Bilog Antenna



### 3.3 Radiated emission limit

#### 3.3.1 General radiated emission limit

The spurious Emission shall test through the 10th harmonic. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

| Frequency (MHz) | Field Strength (μV/m) | Field Strength (dBμV/m) | Measurement Distance |
|---|---|---|---|
| 0.009-0.490 | 2400/F(KHz) | 20 log (uV/m) | 300 |
| 0.490-1.705 | 2400/F(KHz) | 20 log (uV/m) | 30 |
| 1.705-30 | 30 | 29.5 | 30 |
| 30-88 | 100 | 40 | 3 |
| 88-216 | 150 | 43.5 | 3 |
| 216-960 | 200 | 46 | 3 |
| Above 960 | 500 | 54 | 3 |

Remark:
1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

### 3.4 Radiated emission test data FCC 15.209

#### 3.4.1 Measurement results: Fundamental emission

| Ant Polarization | Frequency (MHz) | Spectrum Analyzer Detector | Correction Factor (dB/m) | Reading (dBµV) | Corrected Reading (dBµV/m) | Limit @ 3 m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Perpendicular | 0.15 | AV | 18.34 | 54.90 | 73.24 | 104.08 | -30.84 |
| Parallel | 0.15 | AV | 18.34 | 50.21 | 68.55 | 104.08 | -35.53 |
| Ground-parallel | 0.15 | AV | 18.34 | 42.53 | 60.87 | 104.08 | -43.21 |

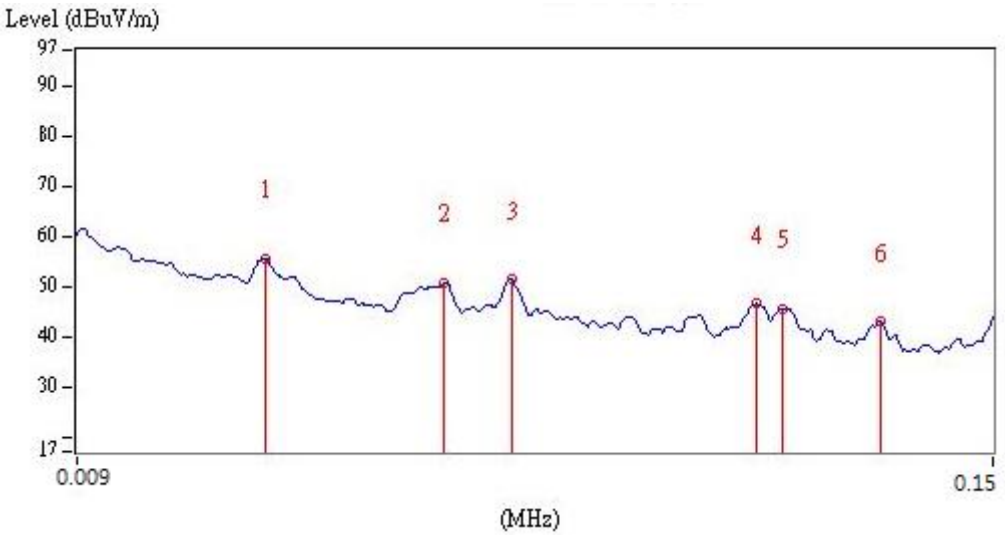
Remark: Corr. Factor = Antenna Factor + Cable Loss

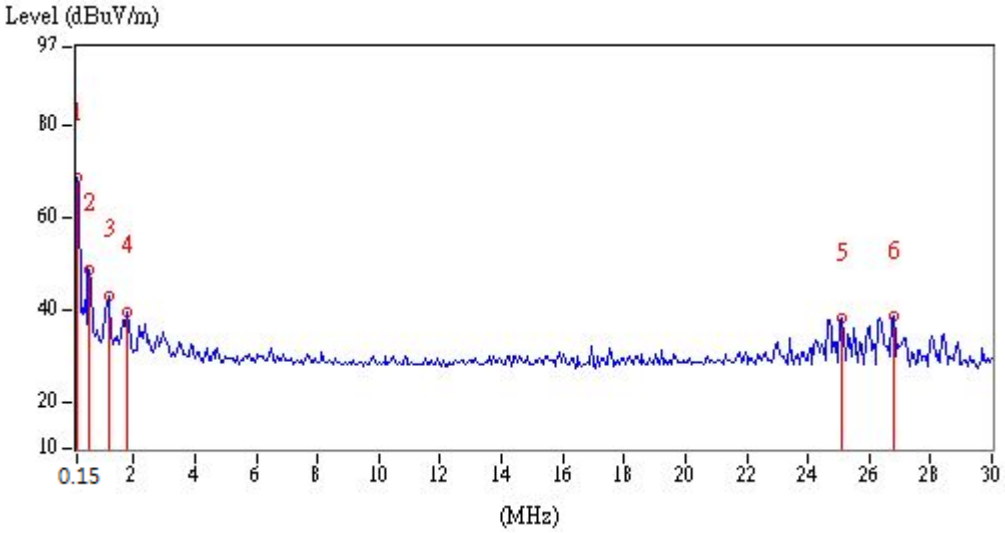
#### 3.4.2 Measurement results: frequencies equal to or less than 1 GHz

Test condition : Tx mode

| Ant Polarity | Frequency (MHz) | Detector | Factor (dB/m) | Reading (dBµV) | Corrected Reading (dBµV/m) | Limit @ 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Perpendicular | 0.04 | AV | 18.93 | 37.25 | 56.18 | 115.56 | -59.38 |
| Perpendicular | 0.06 | AV | 18.58 | 31.55 | 50.13 | 112.04 | -61.91 |
| Perpendicular | 0.08 | AV | 18.49 | 33.00 | 51.49 | 109.54 | -58.05 |
| Perpendicular | 0.10 | QP | 18.31 | 29.31 | 47.62 | 107.60 | -59.98 |
| Perpendicular | 0.12 | AV | 18.32 | 30.71 | 49.03 | 106.02 | -56.99 |
| Perpendicular | 0.13 | AV | 18.33 | 29.23 | 47.56 | 105.33 | -57.77 |
| Perpendicular | 0.15 | AV | 18.34 | 54.90 | 73.24 | 104.08 | -30.84 |
| Perpendicular | 0.57 | QP | 18.58 | 34.03 | 52.61 | 72.49 | -19.88 |
| Perpendicular | 1.16 | QP | 18.87 | 28.32 | 47.19 | 66.32 | -19.13 |
| Perpendicular | 1.76 | QP | 18.91 | 23.49 | 42.40 | 69.54 | -27.14 |
| Perpendicular | 2.36 | QP | 18.95 | 19.60 | 38.55 | 69.54 | -30.99 |
| Perpendicular | 2.96 | QP | 18.99 | 19.13 | 38.12 | 69.54 | -31.42 |

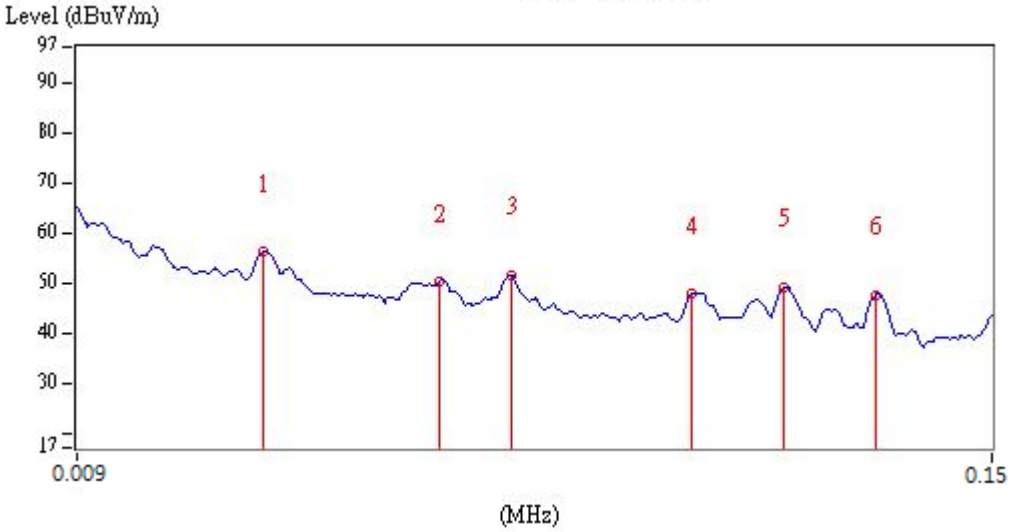
Remark: Corr. Factor = Antenna Factor + Cable Loss

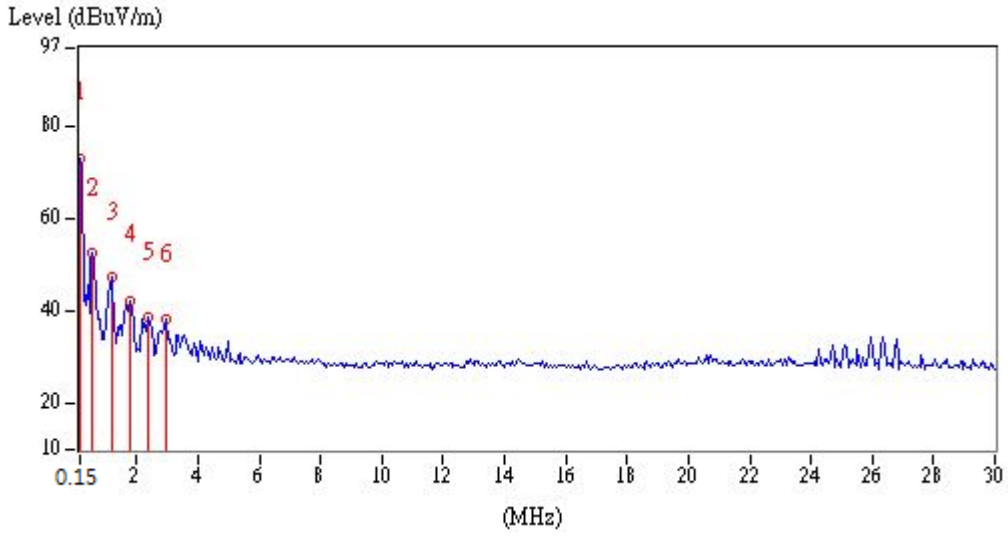

Level (dBuV/m)
97
90
80
70
60
50
40
30
17
1
2
3
4
5
6
0.009
0.15
(MHz)


Level (dBuV/m)
97
80
60
40
20
10
1
2
3
4
5
6
0.15
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
(MHz)

| Ant Polarity | Frequency (MHz) | Detector | Factor (dB/m) | Reading (dBµV) | Corrected Reading (dBµV/m) | Limit @ 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Parallel | 0.04 | AV | 18.93 | 36.57 | 55.50 | 115.56 | -60.06 |
| Parallel | 0.07 | AV | 18.57 | 32.07 | 50.64 | 110.70 | -60.06 |
| Parallel | 0.08 | AV | 18.49 | 32.80 | 51.29 | 109.54 | -58.25 |
| Parallel | 0.11 | AV | 18.32 | 28.11 | 46.43 | 106.78 | -60.35 |
| Parallel | 0.12 | AV | 18.32 | 27.20 | 45.52 | 106.02 | -60.50 |
| Parallel | 0.13 | AV | 18.33 | 24.62 | 42.95 | 105.33 | -62.38 |
| Parallel | 0.15 | AV | 18.34 | 50.21 | 68.55 | 104.08 | -35.53 |
| Parallel | 0.57 | QP | 18.58 | 30.23 | 48.81 | 72.49 | -23.68 |
| Parallel | 1.16 | QP | 18.87 | 24.39 | 43.26 | 66.32 | -23.06 |
| Parallel | 1.76 | QP | 18.91 | 20.85 | 39.76 | 69.54 | -29.78 |
| Parallel | 25.10 | QP | 21.53 | 16.53 | 38.06 | 69.54 | -31.48 |
| Parallel | 26.78 | QP | 21.59 | 17.05 | 38.64 | 69.54 | -30.90 |

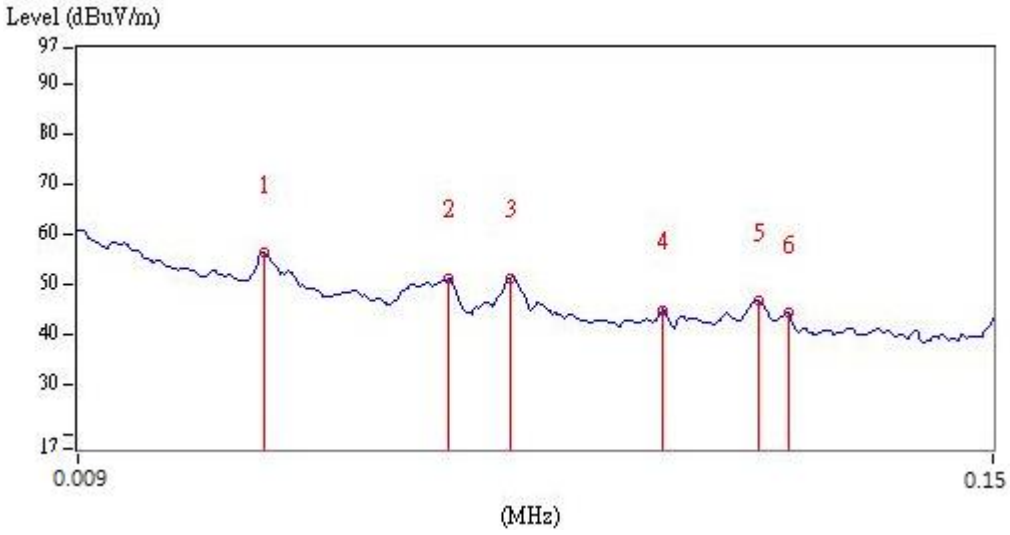
Remark: Corr. Factor = Antenna Factor + Cable Loss

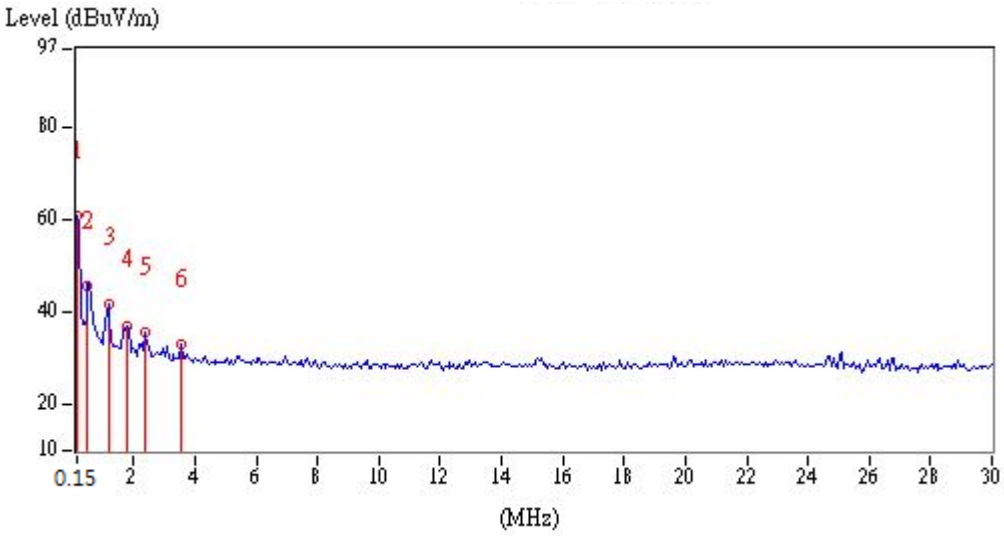

Level (dBuV/m)
97
90
80
70
60
50
40
30
17
1
2
3
4
5
6
0.009
0.15
(MHz)


Level (dBuV/m)
97
80
60
40
20
10
1
2
3
4
5
6
0.15
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
(MHz)

| Ant Polarity | Frequency (MHz) | Detector | Factor (dB/m) | Reading (dBµV) | Corrected Reading (dBµV/m) | Limit @ 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Ground-parallel | 0.04 | AV | 18.93 | 37.11 | 56.04 | 115.56 | -59.52 |
| Ground-parallel | 0.07 | AV | 18.57 | 32.44 | 51.01 | 110.70 | -59.69 |
| Ground-parallel | 0.08 | AV | 18.50 | 32.56 | 51.06 | 109.54 | -58.48 |
| Ground-parallel | 0.10 | QP | 18.32 | 26.46 | 44.78 | 107.60 | -62.82 |
| Ground-parallel | 0.11 | AV | 18.32 | 28.14 | 46.46 | 106.78 | -60.32 |
| Ground-parallel | 0.12 | AV | 18.32 | 25.79 | 44.11 | 106.02 | -61.91 |
| Ground-parallel | 0.15 | AV | 18.34 | 42.53 | 60.87 | 104.08 | -43.21 |
| Ground-parallel | 0.51 | QP | 18.54 | 27.03 | 45.57 | 73.45 | -27.88 |
| Ground-parallel | 1.16 | QP | 18.87 | 23.03 | 41.90 | 66.32 | -24.42 |
| Ground-parallel | 1.76 | QP | 18.91 | 18.15 | 37.06 | 69.54 | -32.48 |
| Ground-parallel | 2.36 | QP | 18.95 | 16.62 | 35.57 | 69.54 | -33.97 |
| Ground-parallel | 3.55 | QP | 19.11 | 13.79 | 32.90 | 69.54 | -36.64 |

Remark: Corr. Factor = Antenna Factor + Cable Loss

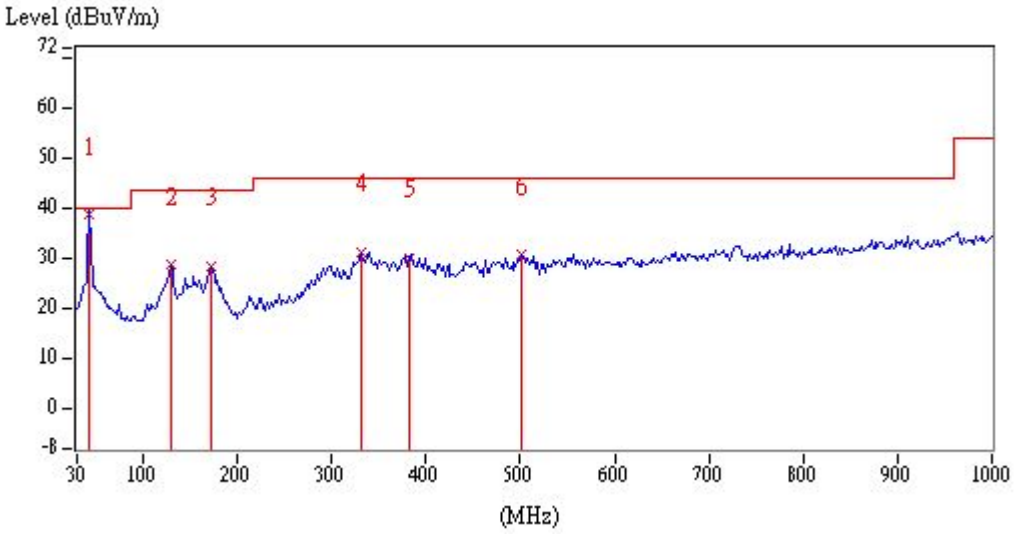

Level (dBuV/m)
97
90
80
70
60
50
40
30
17
1
2
3
4
5
6
0.009
0.15
(MHz)


Level (dBuV/m)
97
80
60
40
20
10
1
2
3
4
5
6
0.15
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
(MHz)

Test condition : Tx mode

| Ant Polarity | Frequency (MHz) | Detector | Factor (dB/m) | Reading (dBµV) | Corrected Reading (dBµV/m) | Limit @ 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Vertical | 43.58 | QP | 20.15 | 18.51 | 38.66 | 40.00 | -1.34 |
| Vertical | 128.94 | QP | 18.73 | 9.98 | 28.71 | 43.50 | -14.79 |
| Vertical | 171.62 | QP | 20.04 | 8.53 | 28.57 | 43.50 | -14.93 |
| Vertical | 330.70 | QP | 22.46 | 8.77 | 31.23 | 46.00 | -14.77 |
| Vertical | 383.08 | QP | 23.79 | 6.28 | 30.07 | 46.00 | -15.93 |
| Vertical | 501.42 | QP | 26.37 | 4.40 | 30.77 | 46.00 | -15.23 |

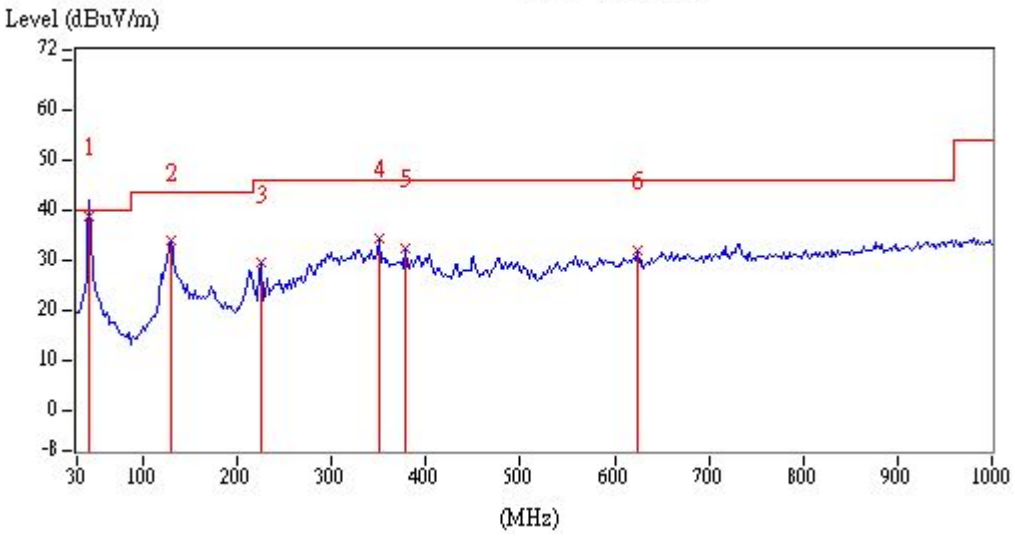
Remark: Corr. Factor = Antenna Factor + Cable Loss



Test condition : Tx mode

| Ant Polarity | Frequency (MHz) | Detector | Factor (dB/m) | Reading (dBµV) | Corrected Reading (dBµV/m) | Limit @ 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Horizontal | 43.58 | QP | 20.15 | 18.84 | 38.99 | 40.00 | -1.01 |
| Horizontal | 128.94 | QP | 18.73 | 15.09 | 33.82 | 43.50 | -9.68 |
| Horizontal | 225.94 | QP | 19.47 | 9.99 | 29.46 | 46.00 | -16.54 |
| Horizontal | 350.10 | QP | 22.93 | 11.66 | 34.59 | 46.00 | -11.41 |
| Horizontal | 377.26 | QP | 23.64 | 8.93 | 32.57 | 46.00 | -13.43 |
| Horizontal | 623.64 | QP | 28.94 | 3.16 | 32.10 | 46.00 | -13.90 |

Remark: Corr. Factor = Antenna Factor + Cable Loss



## 4. Conducted emission FCC 15.207

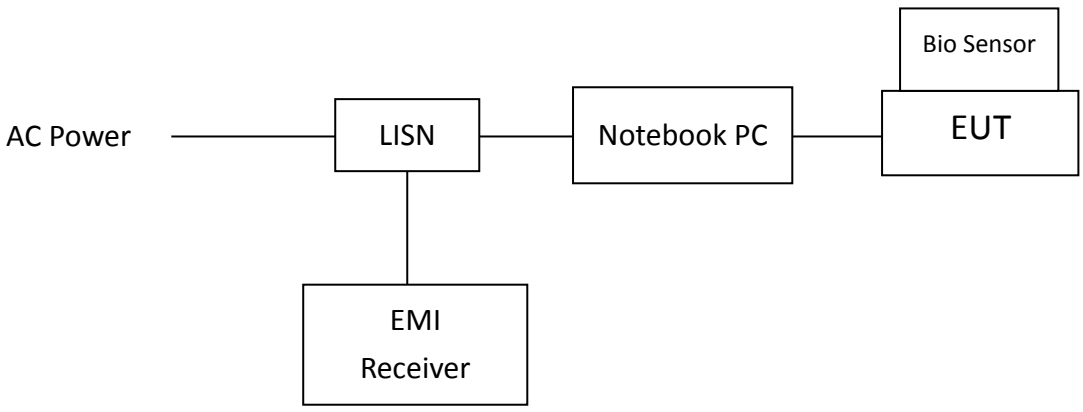
### 4.1 Measuring instrument setting

| Receiver Function | Setting |
|---|---|
| Detector | QP |
| Start frequency | 0.15MHz |
| Stop frequency | 30MHz |
| IF bandwidth | 9 kHz |
| Attenuation | 10dB |

### 4.2 Test Procedure

| | |
|---|---|
| Step 1 | Configure the EUT according to ANSI C63.10:2013. The EUT or host of EHT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface. |
| Step 2 | Connect EUT or host of EUT to the power mains through a line impedance stabilization network. |
| Step 3 | All the companion devices are connected to the other LISN. The LISN should provide 50Uh/50ohms coupling impedance. |
| Step 4 | The frequency range from 150 kHz to 30MHz was searched. |
| Step 5 | Set the test-receiver system to peak detector and specified bandwidth with maximum hold mode. |
| Step 6 | The measurement has to be done between each power line and ground at the power terminal. |

### 4.3 Test Diagram



### 4.4 Limit

| Frequency (MHz) | Conducted Limit (dBuV) | |
|---|---|---|
| | Q.P. | Ave. |
| 0.15~0.50 | 66 – 56 | 56 – 46 |
| 0.50~5.00 | 56 | 46 |
| 5.00~30.0 | 60 | 50 |

### 4.5 Operating Environment Condition

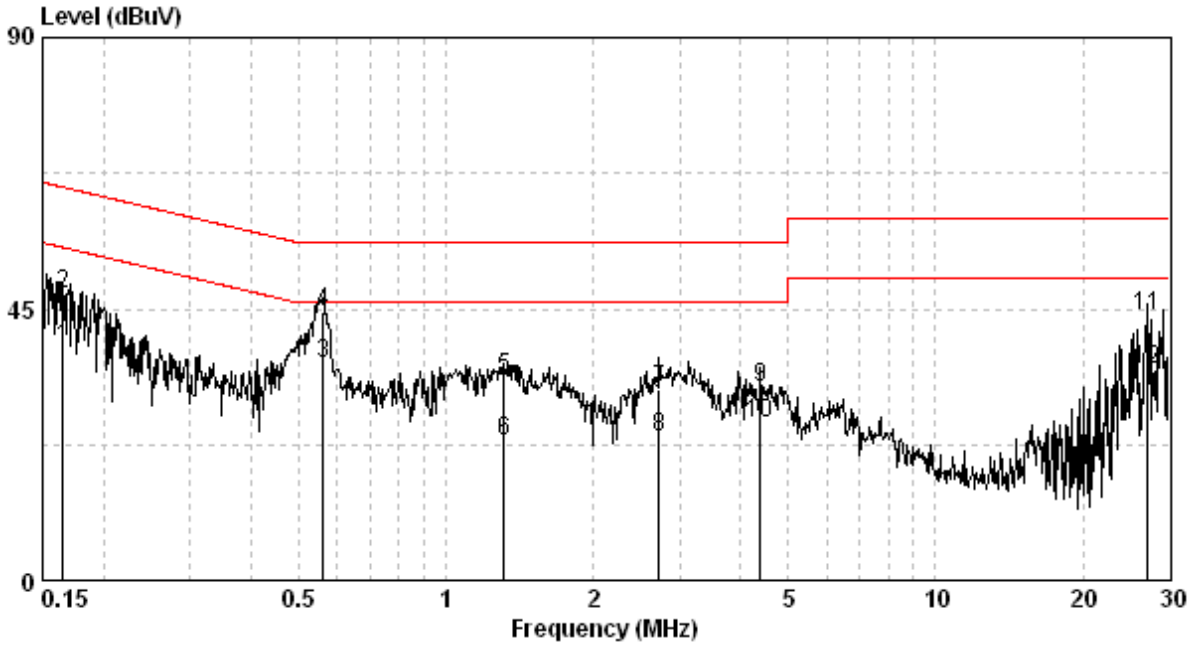
| | |
|---|---|
| Temperature (℃) : | 24 |
| Relative Humidity (%) : | 59 |
| Atmospheric Pressure (hPa) : | 1003 |
| Test date : | Dec. 25, 2019 |

## 4.6 Test Results

Phase: Live Line
Test Condition: Tx mode

| Frequency (MHz) | Corr. Factor (dB) | Reading QP (dBuV) | Level QP (dBuV) | Limit QP (dBuV) | Reading AV (dBuV) | Level AV (dBuV) | Limit AV (dBuV) | Margin (dB) QP | Margin (dB) AV |
|---|---|---|---|---|---|---|---|---|---|
| 0.165 | 0.04 | 47.40 | 47.44 | 65.21 | 38.67 | 38.71 | 55.21 | -17.77 | -16.50 |
| 0.561 | 0.07 | 44.34 | 44.41 | 56.00 | 35.72 | 35.79 | 46.00 | -11.59 | -10.21 |
| 1.317 | 0.10 | 33.60 | 33.70 | 56.00 | 22.97 | 23.07 | 46.00 | -22.30 | -22.93 |
| 2.721 | 0.15 | 31.59 | 31.74 | 56.00 | 23.62 | 23.77 | 46.00 | -24.26 | -22.23 |
| 4.384 | 0.20 | 31.64 | 31.84 | 56.00 | 25.84 | 26.04 | 46.00 | -24.16 | -19.96 |
| 27.127 | 1.09 | 42.88 | 43.97 | 60.00 | 33.82 | 34.91 | 50.00 | -16.03 | -15.09 |

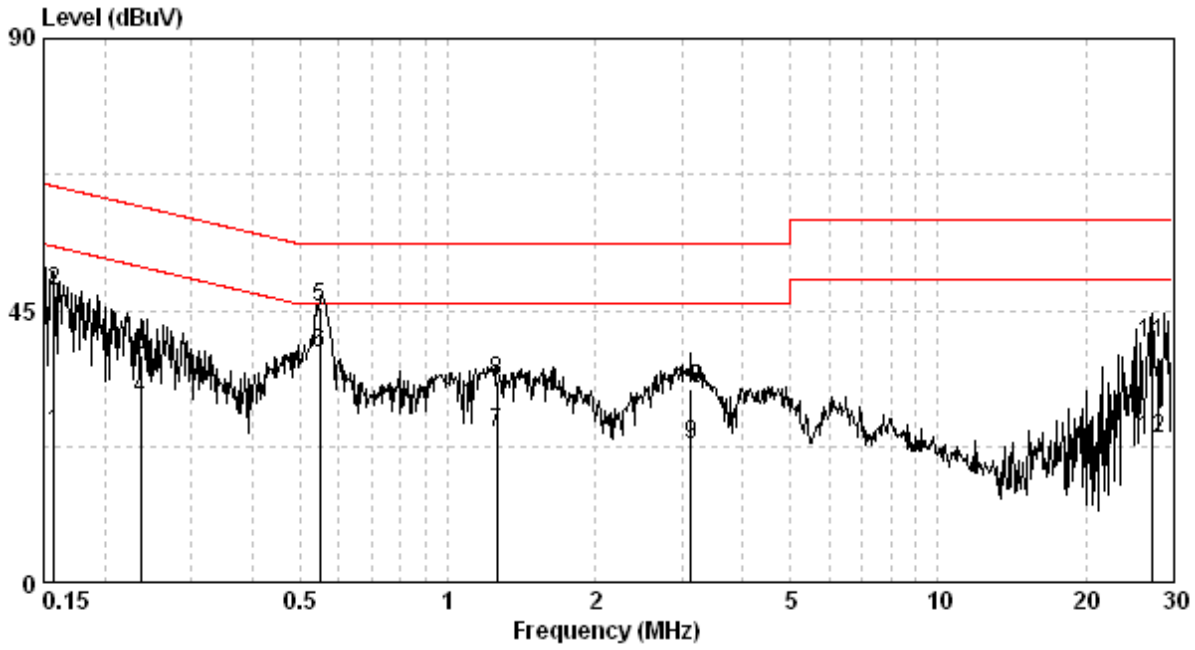
Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Level (dBuV) = Corr. Factor (dB) + Reading (dBuV)
3. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase: Neutral Line
Test Condition: Tx mode

| Frequency (MHz) | Corr. Factor (dB) | Reading QP (dBuV) | Level QP (dBuV) | Limit QP (dBuV) | Reading AV (dBuV) | Level AV (dBuV) | Limit AV (dBuV) | Margin (dB) QP | Margin (dB) AV |
|---|---|---|---|---|---|---|---|---|---|
| 0.157 | 0.06 | 48.22 | 48.28 | 65.60 | 24.52 | 24.58 | 55.60 | -17.33 | -31.02 |
| 0.237 | 0.04 | 37.62 | 37.67 | 62.22 | 30.16 | 30.20 | 52.22 | -24.55 | -22.01 |
| 0.550 | 0.07 | 45.33 | 45.40 | 56.00 | 37.95 | 38.01 | 46.00 | -10.60 | -7.99 |
| 1.262 | 0.10 | 33.22 | 33.32 | 56.00 | 24.53 | 24.63 | 46.00 | -22.68 | -21.37 |
| 3.140 | 0.16 | 31.95 | 32.10 | 56.00 | 22.42 | 22.58 | 46.00 | -23.90 | -23.42 |
| 27.271 | 1.09 | 38.52 | 39.61 | 60.00 | 22.74 | 23.83 | 50.00 | -20.39 | -26.17 |

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Level (dBuV) = Corr. Factor (dB) + Reading (dBuV)
3. Margin (dB) = Level (dBuV) – Limit (dBuV)



**Appendix A: Test equipment list**

| Test Equipment/ Test site | Brand | Model No. | Serial No. | Calibration Date | Next Calibration Date |
|---|---|---|---|---|---|
| EMI Test Receiver | Rohde & Schwarz | ESR-7 | 101232 | 2020/01/18 | 2021/01/16 |
| Signal Analyzer | Agilent | N9030A | MY51380492 | 2019/08/21 | 2020/08/19 |
| Active Loop Antenna | SCHWARZBECK MESS-ELEKTRONIC | FMZB1519 | 1519-067 | 2019/04/19 | 2020/04/17 |
| Broadband Antenna | SHWARZBECK | VULB 9168 | 9168-172 | 2019/06/05 | 2020/06/03 |
| 966-2(A) Cable | SUHNER | SMA / EX 100 | N/A | 2019/08/19 | 2020/08/17 |
| 966-2(B) Cable | SUHNER | SUCOFLEX 104P | CB0005 | 2019/08/19 | 2020/08/17 |
| 966-2_3m Semi-Anechoic Chamber | 966_2 | CEM-966_2 | N/A | 2020/02/23 | 2021/02/22 |

Note: No Calibration Required (NCR)

| Test Equipment/ Test site | Brand | Model No. | Serial No. | Calibration Date | Next Calibration Date |
|---|---|---|---|---|---|
| EMI Test Receiver | R&S | ESCI | 100059 | 2019/11/05 | 2020/11/03 |
| Two-Line V-Network | R&S | ENV216 | 101160 | 2019/07/17 | 2020/07/15 |
| Two-Line -V-Network | R&S | ESH3-Z5 | 825562/003 | 2019/08/27 | 2020/08/25 |
| CON-3 Shielded Room | N/A | N/A | N/A | NCR | NCR |
| CON-3 Cable | SUHNER | SUCOFLEX 106 | 27222 /6 | 2019/01/17 | 2020/01/16 |
| Test software | Audix | e3 | 4.20040112L | NCR | NCR |

Note: No Calibration Required (NCR).

## Appendix B: Measurement Uncertainty

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

| Item | Uncertainty |
|---|---|
| Timing requirement of manually operated transmitter | 1.15 dB |
| 20dB Bandwidth | 7.69 % |
| Radiated disturbances from 9kHz~30MHz in a semi-anechoic chamber at a distance of 3m | 2.99 dB |
| Vertically polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m | 4.90 dB |
| Horizontally polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m | 4.89 dB |
| Vertically polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m | 4.29 dB |
| Horizontally polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m | 4.29 dB |
| AC Power Line Conducted Emission | 2.52 dB |