



## FCC PART 15C


## TEST REPORT

For

**Zens B.V.**

High Tech Campus 10, 5656 AE, Eindhoven, Netherlands

**FCC ID: 2AOGZ-ZESC05B**

|  |   |
|--|---|
| <b>Report Type:</b><br>Original Report | <b>Product Name:</b><br>Wireless Charger  |
| <b>Report Number:</b> RSC171127001     |   |
| <b>Report Date:</b> 2017-12-05         |   |
| Sula Huang                             |   |
| <b>Reviewed By:</b>                    | EMC Director   |
| <b>Test Laboratory:</b>                | Bay Area Compliance Laboratories Corp. (Chengdu)<br>No.5040, Huilongwan Plaza, No.1, Shawan Road,<br>Jinniu District, Chengdu, Sichuan, China<br>Tel: 028-65525123<br>Fax: 028-65525125<br>www.baclcorp.com |

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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

The **Zens B.V.**, model number: **ZESC05B (FCC ID: 2AOGZ-ZESC05B)** or the "EUT" as referred to in this report was the **Wireless Charger**.

### Mechanical Description of EUT

The EUT was measured approximately 62mm (D) x 12mm (H).

Rated input voltage: DC 5V from adapter.

*\*All measurement and test data in this report was gathered from final production sample, serial number: 171127001/01 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2017-11-27, and EUT conformed to test requirement.*

### Objective

This Type approval report is prepared on behalf of **Zens B.V.** in accordance with Part 2, Subpart J, and Part 15, Subparts A and C of the Federal Communications Commission's rules.

The objective is to determine the compliance of the EUT with FCC rules, sec 15.203, 15.205, 15.207 and 15.209.

### Related Submittal(s)/Grant(s)

No

### Measurement Uncertainty

| Item                              |              |   | Uncertainty |
|-----------------------------------|--------------|---|-------------|
| AC power line conducted emission  |              |   | 2.71dB      |
| Radiated Emission(Field Strength) | 9kHz-30MHz   |   | 6.1dB       |
|                                   | 30MHz-200MHz | H | 4.57dB      |
|                                   |              | V | 4.81dB      |
|                                   | 200MHz-1GHz  | H | 5.69dB      |
|                                   |              | V | 6.07dB      |

## **Test Methodology**

All measurements contained in this report were conducted with ANSI C63.10-2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Chengdu). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

## **Test Facility**

The test site used by BACL to collect test data is located No. 5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, Chengdu, Sichuan, China

BACL(Chengdu) is accredited by A2LA in accordance with the recognized international standard ISO/IEC 17025, A2LA cert No.: 4324.01. The Federal communications commission has on file and is listed under FCC Test Firm Registration No.: 910975.

BACL(Chengdu) has been fully described in reports on file and registered with the Innovation, Science and Economic Development Canada under Registration Numbers: 3062C-1.

## SYSTEM TEST CONFIGURATION

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### Justification

The system was configured for testing in a typical fashion (as normally used by a typical user)

### EUT Exercise Software

N/A

### Support Equipment List and Details

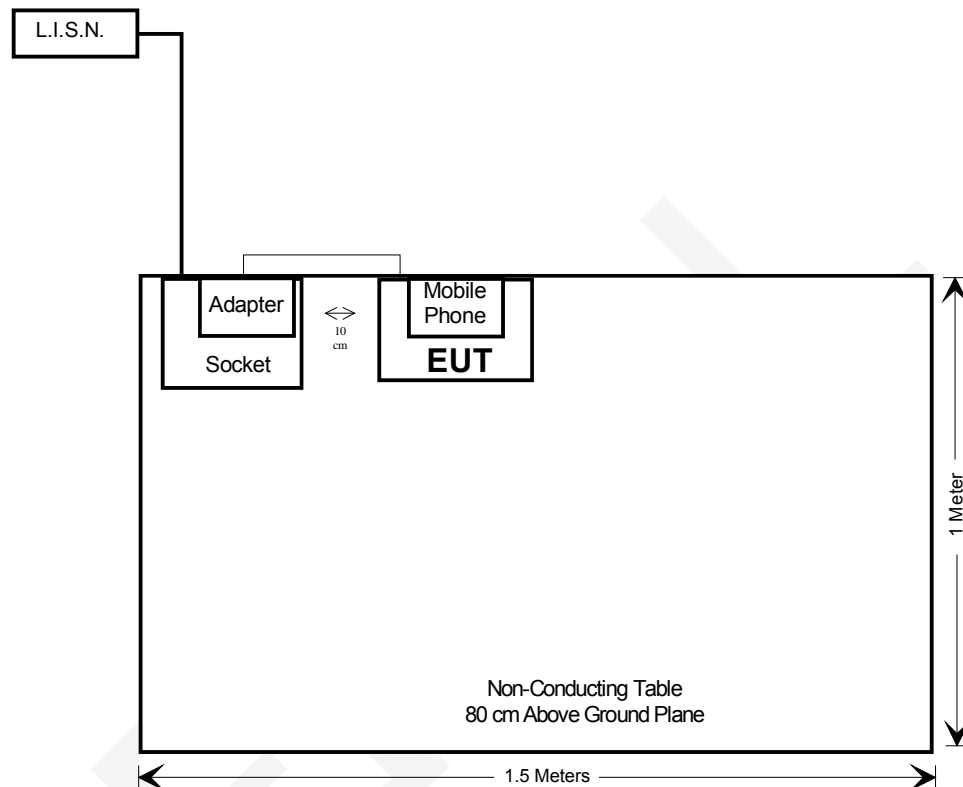
| Manufacturer | Description | Model     | Serial Number |
|--------------|-------------|-----------|---------------|
| Apple Inc.   | Iphone 8    | MQ6MZCH/A | C7CV95M4JC6F  |
| UGREEN       | Adapter     | CD122     | 303288        |

### External I/O Cable

| Cable Description    | Length (m) | From    | To  |
|----------------------|------------|---------|-----|
| Unshielded USB Cable | 1.0        | Adapter | EUT |

## Block Diagram of Test Setup

### Conducted Emission Test



## Test Equipments List

| Manufacturer                    | Description           | Model Number | Serial Number | Calibration Date | Calibration Due Date |
|---------------------------------|-----------------------|--------------|---------------|------------------|----------------------|
| <b>Conducted Emissions Test</b> |                       |              |               |                  |                      |
| Rohde & Schwarz                 | EMI Test Receiver     | ESCS 30      | 836858/0016   | 2016-12-02       | 2017-12-01           |
| Rohde & Schwarz                 | L.I.S.N.              | ENV216       | 100018        | 2017-05-20       | 2018-05-19           |
| Rohde & Schwarz                 | RF Limiter            | ESH3Z2       | DE14781       | 2017-11-10       | 2018-11-09           |
| N/A                             | Conducted Cable       | NO.5         | N/A           | 2017-11-10       | 2018-11-09           |
| Rohde & Schwarz                 | EMC32                 | N/A          | V 8.52.0      | N/A              | N/A                  |
| <b>Radiated Emissions Test</b>  |                       |              |               |                  |                      |
| Rohde & Schwarz                 | EMI Test Receiver     | ESCI         | 100028        | 2017-05-20       | 2018-05-19           |
| ETS LINGREN                     | Passive Loop Antenna  | 6512         | 0040501       | 2017-05-19       | 2020-05-18           |
| Sunol Sciences                  | Broadband Antenna     | JB3          | A121808       | 2017-05-18       | 2020-05-17           |
| INMET                           | Attenuator            | N-6dB        | /             | 2017-11-10       | 2018-11-09           |
| Sonoma                          | Pre-Amplifier         | 310N         | 186684        | 2017-07-18       | 2018-07-17           |
| EMCT                            | Semi-Anechoic Chamber | 966          | N/A           | 2015-04-24       | 2018-04-23           |
| N/A                             | RF Cable (Below 1GHz) | NO.1         | N/A           | 2017-11-10       | 2018-11-09           |
| N/A                             | RF Cable (Below 1GHz) | NO.4         | N/A           | 2017-11-10       | 2018-11-09           |
| Rohde & Schwarz                 | EMC32                 | N/A          | V 8.52.0      | N/A              | N/A                  |
| <b>RF Exposure</b>              |                       |              |               |                  |                      |
| NARDA                           | Magnetic field meter  | ELT-400      | 423314        | 2017-04-24       | 2018-04-23           |
| NARDA                           | E-field Probe         | EF-0391      | D-0607        | 2017-04-24       | 2018-04-23           |
| NARDA                           | Magnetic Probe        | HF-3061      | D-0228        | 2017-04-24       | 2018-04-23           |

\* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## SUMMARY OF TEST RESULTS

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| FCC Rules        | Description of Test | Result    |
|------------------|---------------------|-----------|
| §15.203          | Antenna Requirement | Compliant |
| §1.1307, §1.1310 | RF Exposure         | Compliant |
| §15.207          | Conducted Emissions | Compliant |
| §15.209, §15.205 | Radiated Emissions  | Compliant |



## **FCC§15.203 - ANTENNA REQUIREMENT**

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### **Applicable Standard**

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

### **Antenna Connected Construction**

The EUT has one integrated loop inductive antenna arrangement, which was permanently attached and fulfill the requirement of this section. Please refer to the EUT photos.

**Result:** Compliance.

## FCC §1.1307 & 1.1310 – RF EXPOSURE

### Applicable Standard

FCC §1.1307 & 1.1310

According to the item 5.2 of KDB 680106 D01 RF Exposure Wireless Charging Apps v02: Inductive wireless power transfer applications that meet all of the following requirements are excluded from submitting an RF evaluation.

- Power transfer frequency is less than 1 MHz.
- Output power from each primary coil is less than 5 watts.
- The transfer system includes only single primary and secondary coils. This includes charging systems that may have multiple primary coils and clients that are able to detect and allow coupling only between individual pairs of coils.
- Client device is inserted in or placed directly in contact with the transmitter.
- The maximum coupling surface area of the transmit (charging) device is between 60 cm<sup>2</sup> and 400 cm<sup>2</sup>.
- Aggregate leakage fields at 10 cm surrounding the device from all simultaneous transmitting coils are demonstrated to be less than 30% of the MPE limit.

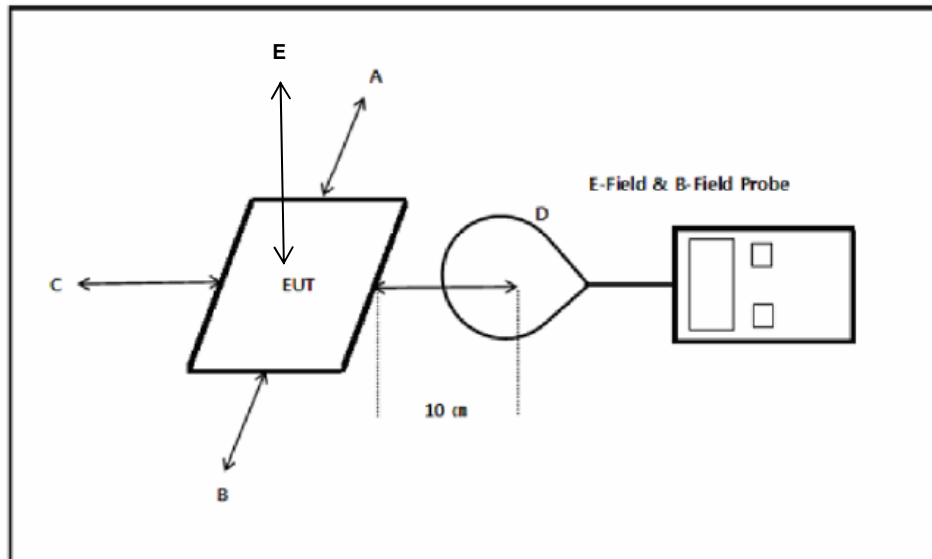
Limits for Maximum Permissible Exposure (MPE)

| Frequency range (MHz)  | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|--|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(A) Limits for Occupational/Controlled Exposure</b>         |                               |                               |                                     |                          |
| 0.3-3.0  | 614                           | 1.63                          | *100                                | 6                        |
| 3.0-30   | 1842/f                        | 4.89/f                        | *900/f <sup>2</sup>                 | 6                        |
| 30-300   | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300-1,500  |                               |                               | f/300                               | 6                        |
| 1,500-100,000  |                               |                               | 5                                   | 6                        |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3-1.34   | 614                           | 1.63                          | *100                                | 30                       |
| 1.34-30  | 824/f                         | 2.19/f                        | *180/f <sup>2</sup>                 | 30                       |
| 30-300   | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300-1,500  |                               |                               | f/1500                              | 30                       |
| 1,500-100,000  |                               |                               | 1.0                                 | 30                       |

f = frequency in MHz

\*= Plane-wave equivalent power density

## EUT Setup



## Result

- a) Power transfer frequency is less than 1 MHz.  
The device operates in the frequency 110kHz-148kHz.
- b) Output power from each primary coil is less than 5 watts.  
The maximum output power of the primary coil is 4.82W<5W.
- c) The transfer system includes only single primary and secondary coils. This includes charging systems that may have multiple primary coils and clients that are able to detect and allow coupling only between individual pairs of coils.  
  
The transfer system including a charging system with only single primary coils is to detect and allow only between individual of coils.
- d) Client device is inserted in or placed directly in contact with the transmitter.  
Client device is placed directly in contact with the transmitter.
- e) The maximum coupling surface area of the transmit(charging) device is between 60 cm<sup>2</sup> and 400 cm<sup>2</sup>.  
  
The EUT Coupling surface area (Type: Circle)  
$$\pi * R^2 = 3.14 * 5^2 = 78.50 \text{ cm}^2 > 60 \text{ cm}^2$$
- f) Aggregate leakage fields at 10 cm surrounding the device from all simultaneous transmitting coils are demonstrated to be less than 30% of the MPE limit.  
The EUT E-field Strength at 10cm & The EUT H-field Strength levels at 10cm are less than 30% the MPE limit.

## Test Data

### Environmental Conditions

|                    |          |
|--------------------|----------|
| Temperature:       | 19 °C    |
| Relative Humidity: | 63 %     |
| ATM Pressure:      | 96.4 kPa |

*The testing was performed by Lorin Bian on 2017-11-28.*

Please refer the results below.

#### E-Filed Strength(10 cm)

| Frequency Range (kHz) | Position A (V/m) | Position B (V/m) | Position C (V/m) | Position D (V/m) | Position E (V/m) | Limit Test (V/m) |
|-----------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| 110-148               | 1.82             | 1.88             | 2.14             | 1.72             | 6.52             | 614              |

#### H-Filed Strength(10 cm)

| Frequency Range (kHz) | Position A (A/m) | Position B (A/m) | Position C (A/m) | Position D (A/m) | Position E (A/m) | Limit Test (A/m) |
|-----------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| 110-148               | 0.269            | 0.266            | 0.301            | 0.267            | 0.394            | 1.63             |

### Note:

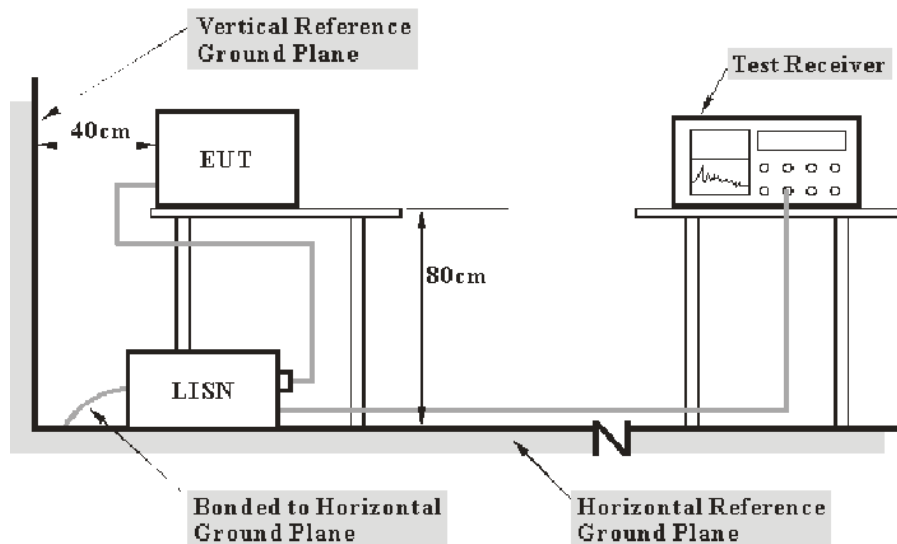
According with KDB 680106 D01 RF Exposure Wireless Charging Apps v02, Emissions between 100 kHz to 300 kHz should be assessed versus the limits at 300 kHz in Table 1 of Section 1.1310: 614V/m and 1.63 A/m.

## FCC §15.207 – AC LINE CONDUCTED EMISSION

### Applicable Standard

FCC §15.207

### EUT Setup



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

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

The adapter was connected to a 120 VAC/60 Hz power source.

## EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

| Frequency Range  | IF B/W |
|------------------|--------|
| 150 kHz – 30 MHz | 9 kHz  |

## Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

According FCC publication number 174176, for a device with a permanent antenna operating at or below 30 MHz, the measurements done with a suitable dummy load, in lieu of the permanent antenna under the following conditions: (1) perform the AC line conducted tests with the permanent antenna to determine compliance with the Section 15.207 limits outside the transmitter's fundamental emission band; (2) retest with a dummy load in lieu of the permanent antenna to determine compliance with the Section 15.207 limits within the transmitter's fundamental emission band.

## Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

Herein,

$V_C$ : corrected voltage amplitude

$V_R$ : reading voltage amplitude

$A_C$ : attenuation caused by cable loss

$VDF$ : voltage division factor of AMN or ISN

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit.

The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

## Test Data

### Environmental Conditions

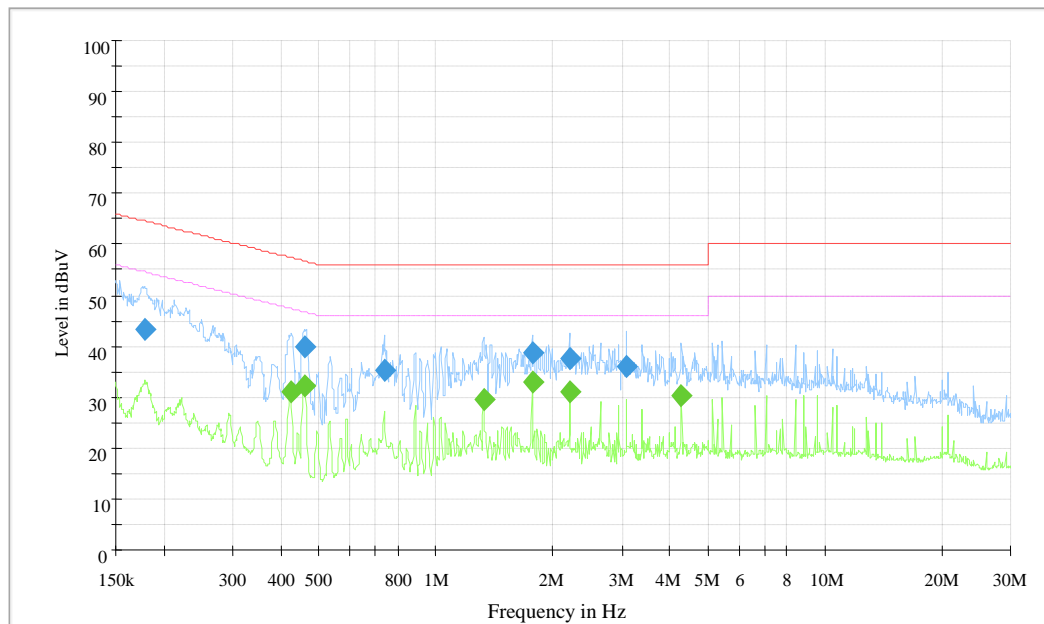
|                           |          |
|---------------------------|----------|
| <b>Temperature:</b>       | 19 °C    |
| <b>Relative Humidity:</b> | 63 %     |
| <b>ATM Pressure:</b>      | 96.4 kPa |

*The testing was performed by Lorin Bian on 2017-11-28.*

*Test mode: Charging and communication*

FINAL

**AC120V/60Hz, Line:**

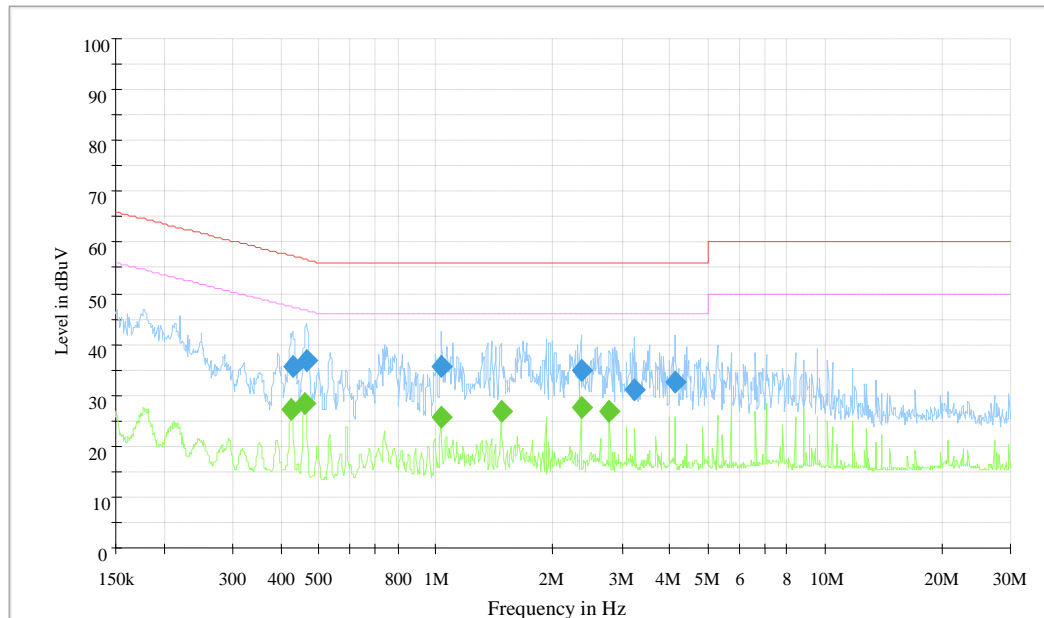


| Frequency (MHz) | QuasiPeak (dB $\mu$ V) | Line | Corr. (dB) | Margin (dB) | Limit (dB $\mu$ V) |
|-----------------|------------------------|------|------------|-------------|--------------------|
| 0.178091        | 43.4                   | L1   | 19.6       | 21.2        | 64.6               |
| 0.458703        | 39.8                   | L1   | 19.8       | 16.9        | 56.7               |
| 0.734699        | 35.4                   | L1   | 19.8       | 20.6        | 56.0               |
| 1.768178        | 38.7                   | L1   | 19.8       | 17.3        | 56.0               |
| 2.211128        | 37.7                   | L1   | 19.8       | 18.3        | 56.0               |
| 3.092045        | 36.2                   | L1   | 19.9       | 19.8        | 56.0               |

| Frequency (MHz) | Average (dB $\mu$ V) | Line | Corr. (dB) | Margin (dB) | Limit (dB $\mu$ V) |
|-----------------|----------------------|------|------------|-------------|--------------------|
| 0.421816        | 31.1                 | L1   | 19.8       | 16.3        | 47.4               |
| 0.458703        | 32.1                 | L1   | 19.8       | 14.6        | 46.7               |
| 1.326474        | 29.5                 | L1   | 19.8       | 16.5        | 46.0               |
| 1.768178        | 32.9                 | L1   | 19.8       | 13.1        | 46.0               |
| 2.211128        | 30.9                 | L1   | 19.8       | 15.1        | 46.0               |
| 4.272446        | 30.1                 | L1   | 19.9       | 15.9        | 46.0               |



**AC120V/60Hz, Neutral:**



| Frequency (MHz) | QuasiPeak (dB $\mu$ V) | Line | Corr. (dB) | Margin (dB) | Limit (dB $\mu$ V) |
|-----------------|------------------------|------|------------|-------------|--------------------|
| 0.426898        | 35.8                   | N    | 19.5       | 21.5        | 57.3               |
| 0.462379        | 36.6                   | N    | 19.5       | 20.0        | 56.6               |
| 1.031513        | 35.6                   | N    | 19.5       | 20.4        | 56.0               |
| 2.356966        | 34.9                   | N    | 19.6       | 21.1        | 56.0               |
| 3.243773        | 31.0                   | N    | 19.6       | 25.0        | 56.0               |
| 4.121670        | 32.4                   | N    | 19.7       | 23.6        | 56.0               |

| Frequency (MHz) | Average (dB $\mu$ V) | Line | Corr. (dB) | Margin (dB) | Limit (dB $\mu$ V) |
|-----------------|----------------------|------|------------|-------------|--------------------|
| 0.423503        | 27.3                 | N    | 19.5       | 20.1        | 47.4               |
| 0.460537        | 28.2                 | N    | 19.5       | 18.5        | 46.7               |
| 1.031513        | 25.7                 | N    | 19.5       | 20.3        | 46.0               |
| 1.471551        | 26.9                 | N    | 19.5       | 19.1        | 46.0               |
| 2.356966        | 27.5                 | N    | 19.6       | 18.5        | 46.0               |
| 2.798356        | 27.0                 | N    | 19.6       | 19.0        | 46.0               |

Note:

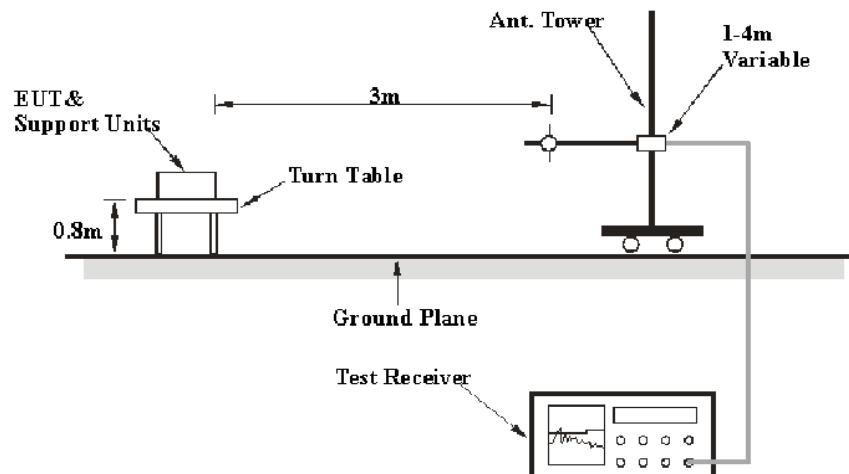
- 1) Corrected Amplitude = Reading + Correction Factor
- 2) Correction Factor = LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter
- 3) Margin = Limit – Corrected Amplitude

## FCC §15.205 & §15.209 - FIELD STRENGTH AND RADIATED EMISSIONS

### Applicable Standard

FCC§15.205, §15.209

### EUT Setup



The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209 and FCC 15.205 limits.

The spacing between the peripherals was 10 cm.

The adapter was connected to 120VAC/60Hz power source.

### EMI Test Receiver Setup

The system was investigated from 9 kHz to 1 GHz.

During the radiated emission test, the EMI test Receiver was set with the following configurations:

| Frequency Range   | RBW     | Video B/W | Detector |
|-------------------|---------|-----------|----------|
| 9 kHz – 150 kHz   | 200 Hz  | 1 kHz     | QP       |
| 150 kHz – 30 MHz  | 9 kHz   | 30 kHz    | QP       |
| 30 MHz – 1000 MHz | 120 kHz | 300 kHz   | QP       |

Note: The frequency bands 9-90 kHz and 110-490 kHz, the testing is based on average detector.

## Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Loss and Cable Loss, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude.}$$

## Test Results Summary

According to the data in the following table, the EUT complied with the FCC Part 15.209.

## Test Data

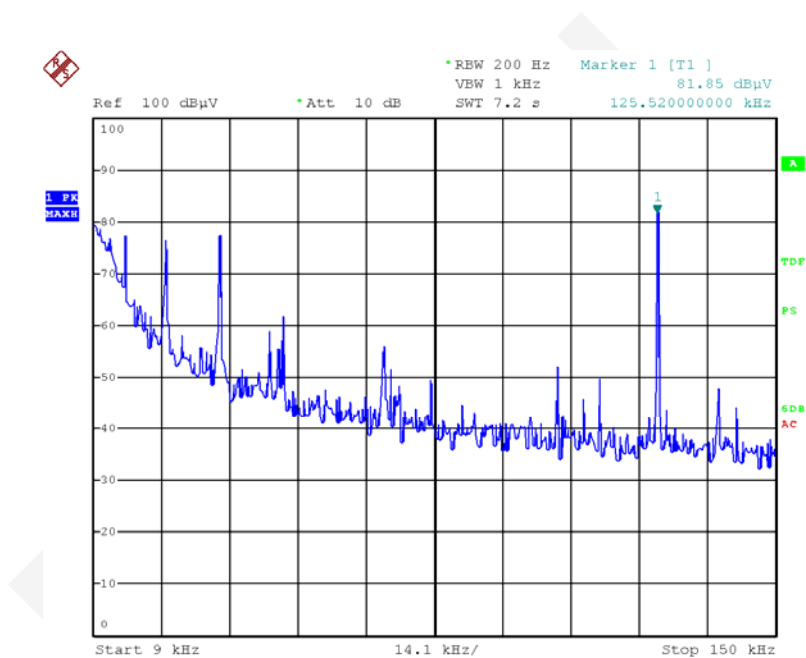
### Environmental Conditions

|                    |          |
|--------------------|----------|
| Temperature:       | 21°C     |
| Relative Humidity: | 58 %     |
| ATM Pressure:      | 96.2 kPa |

\* The testing was performed by Lorin Bian on 2017-12-01.

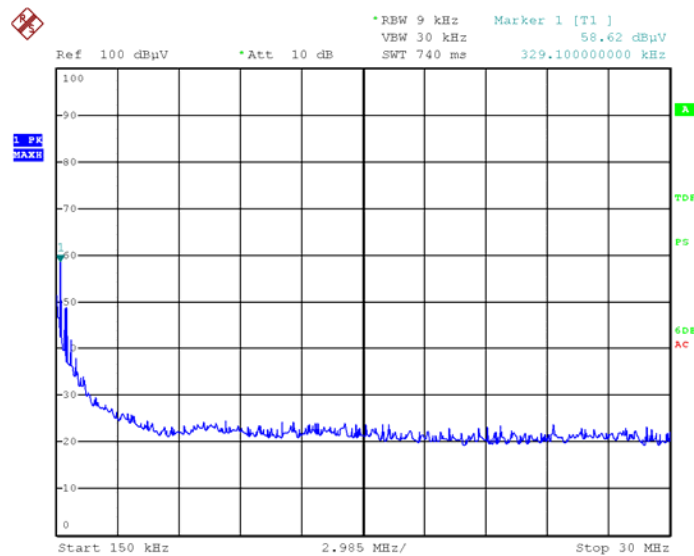
Test mode: Charging and communication

### 9 kHz-150 kHz



Date: 1.DEC.2017 16:24:57

### 150 kHz-30 MHz



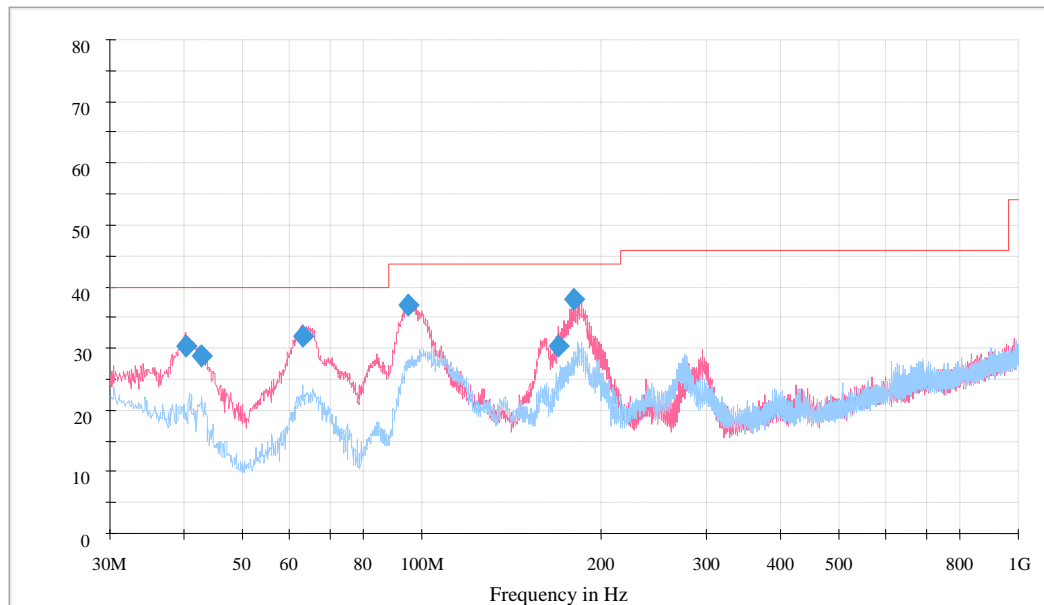
Date: 1.DEC.2017 16:27:39

| Frequency | Receiver |          | Rx Antenna | Cable loss | Amplifier Gain | Corrected Amplitude | Limit  | Margin |
|-----------|----------|----------|------------|------------|----------------|---------------------|--------|--------|
|           | Reading  | Detector | Factor     |            |                |                     |        |        |
| MHz       | dBμV     | PK/QP/AV | dB(1/m)    | dB         | dB             | dBμV/m              | dBμV/m | dB     |
| 0.009     | 21.24    | AV       | 88.2       | 0.02       | 31.22          | 78.14               | 128.52 | 50.38  |
| 0.035     | 28.57    | AV       | 79.21      | 0.03       | 31.29          | 76.52               | 116.72 | 40.20  |
| 0.105     | 23.04    | QP       | 65.84      | 0.05       | 31.40          | 57.53               | 107.18 | 49.65  |
| 0.125*    | 48.19    | AV       | 64.79      | 0.06       | 31.39          | 81.65               | 105.67 | 24.02  |
| 0.15      | 21.18    | AV       | 63.53      | 0.06       | 31.36          | 53.41               | 104.08 | 50.67  |
| 0.329     | 16.66    | AV       | 63.33      | 0.06       | 31.24          | 48.81               | 97.26  | 48.45  |

**Note:**

1. "\*" Means Fundamental frequency.
2. Corrected Amplitude (dBμV/m) = Reading (dBμV) + Ant. Factor (dB/m) + Cable Loss (dB)-Amplifier Gain(dB)
3. Margin [dB] = Limit (dBμV/m) - Corrected Amplitude
4. Limit calculation: Limit at specified distance +  $40\log(300/3)$  = Limit + 80 dB for up to 0.49 MHz;  
Limit at specified distance +  $40\log(30/3)$  = Limit + 40 dB for above 0.49 MHz up to 30 MHz;
5. According to §15.209 (d), the measurements were tested by using Quasi peak detector except for the frequency bands 9 – 90 kHz, 110 – 490 kHz and above 1 GHz in these three bands on measurements employing an average detector.

**30 MHz-1GHz:**



| Frequency (MHz) | QuasiPeak (dBμV/m) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) |
|-----------------|--------------------|-------------|--------------|---------------|------------|-------------|----------------|
| 40.185000       | 30.4               | 107.0       | V            | 249.0         | -11.3      | 9.6         | 40.0           |
| 42.610000       | 28.9               | 100.0       | V            | 183.0         | -12.9      | 11.1        | 40.0           |
| 62.980000       | 31.8               | 129.0       | V            | 240.0         | -17.4      | 8.2         | 40.0           |
| 94.990000       | 36.9               | 114.0       | V            | 115.0         | -16.6      | 6.6         | 43.5           |
| 169.195000      | 30.4               | 100.0       | V            | 208.0         | -12.1      | 13.1        | 43.5           |
| 180.107500      | 37.8               | 113.0       | V            | 175.0         | -13.2      | 6.7         | 43.5           |

Note:

Corrected Amplitude = Corrected Factor + Reading

Corrected Factor=Antenna factor (RX) + Cable Loss – Amplifier Factor

Margin = Limit- Corr. Amplitude

Emissions more than 20dB below the limit are not recorded.

**\*\*\*\*\*END OF REPORT\*\*\*\*\***