



## EMC TEST REPORT

For

Mid Ocean Brands B.V.

Wireless charger

Test Model: MO6399

Additional Model No.: Please Refer to Page 6

|                                |                                                                                                                                                               |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Prepared for                   | : Mid Ocean Brands B.V.                                                                                                                                       |
| Address                        | : 7/F., Kings Tower, 111 King Lam Street, Cheung Sha Wan,<br>Kowloon, Hong Kong                                                                               |
| Prepared by                    | : Shenzhen LCS Compliance Testing Laboratory Ltd.                                                                                                             |
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| Date of receipt of test sample | : November 10, 2021                                                                                                                                           |
| Number of tested samples       | : 2                                                                                                                                                           |
| Serial number                  | : Prototype                                                                                                                                                   |
| Date of Test                   | : November 10, 2021 ~ November 16, 2021                                                                                                                       |
| Date of Report                 | : November 17, 2021                                                                                                                                           |





|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>EMC TEST REPORT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| <b>ETSI EN 301 489-1 V2.2.3 (2019-11) &amp; ETSI EN 301 489-3 V2.1.1 (2019-03) &amp; Draft ETSI EN 301 489-3 V2.1.2 (2021-03)</b>                                                                                                                                                                                                                                                                                                                                                                                             |  |
| <b>Report Reference No. .... : LCS211108127AEA</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Date Of Issue..... : November 17, 2021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| <b>Testing Laboratory Name..... : Shenzhen LCS Compliance Testing Laboratory Ltd.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |
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| Testing Location/ Procedure..... : Full application of Harmonised standards <input checked="" type="checkbox"/><br>Partial application of Harmonised standards <input type="checkbox"/><br>Other standard testing method <input type="checkbox"/>                                                                                                                                                                                                                                                                             |  |
| <b>Applicant's Name..... : Mid Ocean Brands B.V.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| Address..... : 7/F., Kings Tower, 111 King Lam Street, Cheung Sha Wan, Kowloon, Hong Kong                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
| <b>Test Specification</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
| Standard..... : ETSI EN 301 489-1 V2.2.3 (2019-11)<br>ETSI EN 301 489-3 V2.1.1 (2019-03)<br>Draft ETSI EN 301 489-3 V2.1.2 (2021-03)<br>EN 55032: 2015/A11: 2020<br>EN 55035: 2017+A11: 2020                                                                                                                                                                                                                                                                                                                                  |  |
| Test Report Form No. .... : LCSEMC-1.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| TRF Originator..... : Shenzhen LCS Compliance Testing Laboratory Ltd.                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |
| Master TRF..... : Dated 2017-06                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |
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| <b>Test Item Description..... : Wireless charger</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| Trade Mark..... : N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |
| Test Model..... : MO6399                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |
| Ratings..... : Input: 5V=2A, 9V=2A<br>Output: 5V=1A, 7.5V=1A, 9V=1.1A<br>Wireless Output power: 10W                                                                                                                                                                                                                                                                                                                                                                                                                           |  |
| <b>Result ..... : Positive</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |

Compiled by:

Kevin Huang

Kevin Huang/ Administrator

Supervised by:

Jin Wang

Jin Wang/ Technique principal

Approved by:

Gavin Liang

Gavin Liang/ Manager

**EMC -- TEST REPORT**

|                                                 |                                           |
|-------------------------------------------------|-------------------------------------------|
| <b>Test Report No. :</b> <b>LCS211108127AEA</b> | <u>November 17, 2021</u><br>Date of issue |
|-------------------------------------------------|-------------------------------------------|

|                          |                                                                                 |
|--------------------------|---------------------------------------------------------------------------------|
| Test Model.....          | : MO6399                                                                        |
| EUT.....                 | : Wireless charger                                                              |
| <b>Applicant.....</b>    | <b>: Mid Ocean Brands B.V.</b>                                                  |
| Address.....             | : 7/F., Kings Tower, 111 King Lam Street, Cheung Sha Wan,<br>Kowloon, Hong Kong |
| Telephone.....           | : /                                                                             |
| Fax.....                 | : /                                                                             |
| <b>Manufacturer.....</b> | <b>: 114628</b>                                                                 |
| Address.....             | : /                                                                             |
| Telephone.....           | : /                                                                             |
| Fax.....                 | : /                                                                             |
| <b>Factory.....</b>      | <b>: 114628</b>                                                                 |
| Address.....             | : /                                                                             |
| Telephone.....           | : /                                                                             |
| Fax.....                 | : /                                                                             |

|                    |                 |
|--------------------|-----------------|
| <b>Test Result</b> | <b>Positive</b> |
|--------------------|-----------------|

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.



## Revision History

| Report Version | Issue Date        | Revisions     | Revised By  |
|----------------|-------------------|---------------|-------------|
| 000            | November 17, 2021 | Initial Issue | Gavin Liang |
|                |                   |               |             |
|                |                   |               |             |



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## 1. GENERAL INFORMATION

### 1.1. Product Description for Equipment Under Test (EUT)

|                     |                                                                                                                                                              |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EUT                 | : Wireless charger                                                                                                                                           |
| Test Model          | : MO6399                                                                                                                                                     |
| Additional Model    | : MO6392, MO6453                                                                                                                                             |
| Model Declaration   | : PCB board, structure and internal of these model(s) are the same, So no additional models were tested                                                      |
| Power Supply        | : Input: 5V $\Rightarrow$ 2A, 9V $\Rightarrow$ 2A<br>Output: 5V $\Rightarrow$ 1A, 7.5V $\Rightarrow$ 1A, 9V $\Rightarrow$ 1.1A<br>Wireless Output power: 10W |
| Hardware Version    | : WD_Q5_10W V2.1                                                                                                                                             |
| Software Version    | : QX:4IDA                                                                                                                                                    |
| Wireless Charging   | :                                                                                                                                                            |
| Operating Frequency | : 110.0~205.0KHz                                                                                                                                             |
| Modulation Type     | : ASK                                                                                                                                                        |
| Antenna Type        | : Coil Antenna                                                                                                                                               |



## 1.2. Objective

|                   |                                                                                                                                                                                                                                                                                                |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ETSI EN 301 489-1 | ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility                                                                                                                    |
| ETSI EN 301 489-3 | ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU |
| EN 55032          | Electromagnetic compatibility of multimedia equipment — Emission Requirements                                                                                                                                                                                                                  |
| EN 55035          | Electromagnetic compatibility of multimedia equipment – Immunity requirements                                                                                                                                                                                                                  |

The objective is to determine compliance with ETSI EN 301 489-1 V2.2.3 (2019-11), ETSI EN 301 489-3 V2.1.1 (2019-03), Draft ETSI EN 301 489-3 V2.1.2 (2021-03), EN 55032: 2015/A11: 2020 and EN 55035: 2017+A11: 2020.





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

No Related Submittals.

### 1.4. Test Methodology

All measurements contained in this report were conducted with ETSI EN 301 489-1 V2.2.3 (2019-11), ETSI EN 301 489-3 V2.1.1 (2019-03), Draft ETSI EN 301 489-3 V2.1.2 (2021-03), EN 55032: 2015/A11: 2020 and EN 55035: 2017+A11: 2020.

### 1.5. Description of Test Facility

NVLAP Accreditation Code is 600167-0.

FCC Designation Number is CN5024.

CAB identifier is CN0071.

CNAS Registration Number is L4595.

### 1.6. Support Equipment List

| Manufacturer | Description  | Model    | Serial Number | Certificate |
|--------------|--------------|----------|---------------|-------------|
| HONOR        | Mobile phone | V30Pro   | ---           | CE          |
| OPPO         | Adapter      | OP52KAUH | --            | CE          |

Note: Phone equipment is provided by the laboratory.

### 1.7. External I/O

| I/O Port Description | Quantity | Cable |
|----------------------|----------|-------|
| Micro USB Port       | 1        | N/A   |





## 1.8. Measurement Uncertainty

| Item                                                                     | MU      | Remark      |
|--------------------------------------------------------------------------|---------|-------------|
| Uncertainty for Power point Conducted Emissions Test                     | 2.42dB  |             |
| Uncertainty for Radiation Emission test in 3m chamber<br>(30MHz to 1GHz) | 3.54dB  | Polarize: V |
|                                                                          | 4.1dB   | Polarize: H |
| Uncertainty for Radiation Emission test in 3m chamber<br>(1GHz to 25GHz) | 2.08dB  | Polarize: H |
|                                                                          | 2.56dB  | Polarize: V |
| Uncertainty for radio frequency                                          | 0.01ppm |             |
| Uncertainty for conducted RF Power                                       | 0.65dB  |             |
| Uncertainty for temperature                                              | 0.2°C   |             |
| Uncertainty for humidity                                                 | 1%      |             |
| Uncertainty for DC and low frequency voltages                            | 0.06%   |             |

## 1.9. Description of Test Modes

There was 2 test Modes. TM1 to TM2 were shown below:

TM1 : Operate Wireless Charging Mode

TM2 : Idle Mode

\*\*\*Note:

1. All test modes were tested, but we only recorded the worst case in this report.



## 2. SUMMARY OF TEST RESULTS

| Rule | Description of Test Items                                                                                                                                             | Result    |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| §7.1 | Reference to clause 8.4 of ETSI EN 301 489-1<br>Conducted Emission (AC mains input/output port)                                                                       | Compliant |
| §7.1 | Reference to clause 8.3 of ETSI EN 301 489-1<br>Conducted Emission (DC power input/output port)                                                                       | N/A*      |
| §7.1 | Reference to clause 8.7 of ETSI EN 301 489-1<br>Conducted Emission (Wired network port)                                                                               | N/A*      |
| §7.1 | Reference to clause 8.2 of ETSI EN 301 489-1<br>Radiated Emission (Enclosure of ancillary equipment)                                                                  | Compliant |
| §7.1 | Reference to clause 8.5 of ETSI EN 301 489-1<br>Harmonic current emissions (AC mains input port)                                                                      | Compliant |
| §7.1 | Reference to clause 8.6 of ETSI EN 301 489-1<br>Voltage fluctuations and flicker (AC mains input port)                                                                | Compliant |
| §7.2 | Reference to clause 9.3 of ETSI EN 301 489-1<br>Electrostatic discharge (Enclosure port)<br>(EN 61000-4-2)                                                            | Compliant |
| §7.2 | Reference to clause 9.2 of ETSI EN 301 489-1<br>RF electromagnetic field (80MHz to 6000MHz) (Enclosure port)<br>(EN 61000-4-3)                                        | Compliant |
| §7.2 | Reference to clause 9.4 of ETSI EN 301 489-1<br>Fast transients common mode (signal, wired network and control ports, DC<br>and AC power ports)<br>(EN 61000-4-4)     | Compliant |
| §7.2 | Reference to clause 9.8 of ETSI EN 301 489-1<br>Surges, line to line and line to ground (AC mains power input ports, wired<br>network ports)<br>(EN 61000-4-5)        | Compliant |
| §7.2 | Reference to clause 9.5 of ETSI EN 301 489-1<br>RF common mode 0.15MHz to 80MHz (signal, wired network and control<br>ports, DC and AC power ports)<br>(EN 61000-4-6) | Compliant |
| §7.2 | Reference to clause 9.6 of ETSI EN 301 489-1<br>Transients and surges in the vehicular environment<br>(ISO 7637-2)                                                    | N/A*      |
| §7.2 | Reference to clause 9.7 of ETSI EN 301 489-1<br>Voltage dips and interruptions (AC mains power input ports)<br>(EN 61000-4-11)                                        | Compliant |



### 3. TEST RESULTS

#### 3.1. Line Conducted Emission

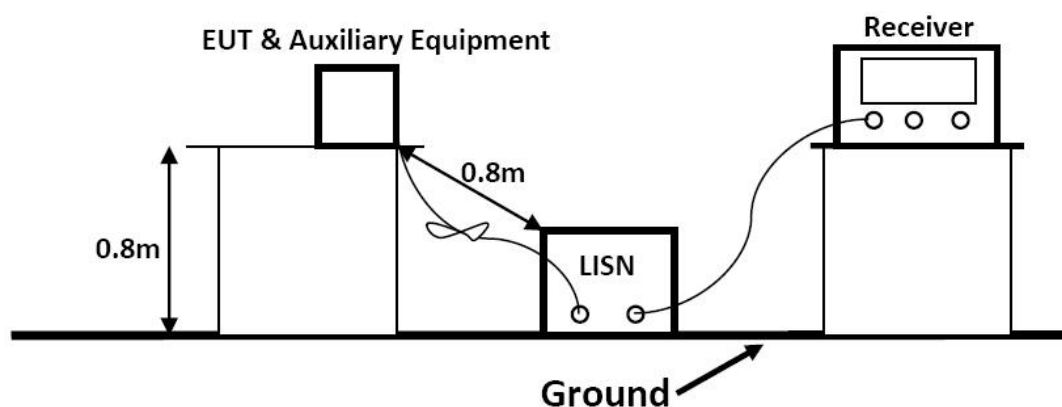
##### 3.1.1 Conducted Emission Limit

**Relevant Standard(s):** ETSI EN 301 489-1 V2.2.3 (2019-11) / EN 55032: 2015/A11: 2020 Class B

| Limits for Line Conducted Emission |                    |               |
|------------------------------------|--------------------|---------------|
| Frequency (MHz)                    | Limit (dB $\mu$ V) |               |
|                                    | Quasi-peak Level   | Average Level |
| 0.15 ~ 0.50                        | 66.0 ~ 56.0 *      | 56.0 ~ 46.0 * |
| 0.50 ~ 5.00                        | 56.0               | 46.0          |
| 5.00 ~ 30.00                       | 60.0               | 50.0          |

NOTE1-The lower limit shall apply at the transition frequencies.  
NOTE2-The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz.

##### 3.1.2 Test Configuration



The setup of EUT is according with per ETSI EN 301 489-1 measurement procedure. The specification used was with the ETSI EN 301 489-1 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 EUT received charging power from the charger which received power through a LISN supplying power of AC 230V/50Hz.



### 3.1.3 EMI Test Receiver Setup

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

| Receiver Parameter     | Setting        |
|------------------------|----------------|
| Attenuation            | Auto           |
| Start ~ Stop Frequency | 150KHz ~ 30MHz |
| (IF)RBW                | 9kHz           |

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

### 3.1.4 Test Procedure

Power on the EUT, the EUT begins to work. Make sure the EUT operates normally during the test.

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.

### 3.1.5 Test Results

PASS

Please refer to Appendix A.1 for Emission and Immunity test results.

## 3.2. Conducted Emission (Wired Network Port)

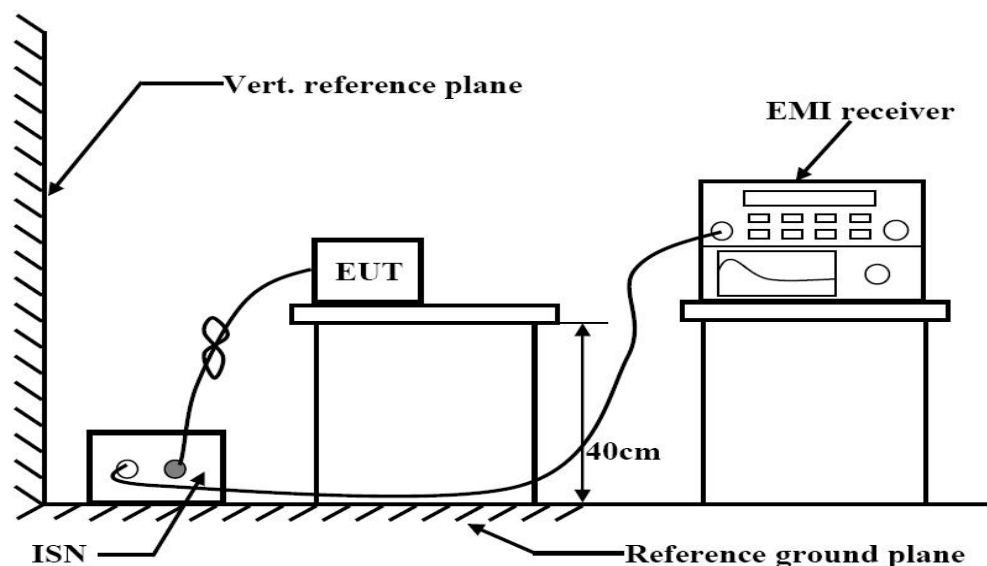
### 3.2.1 Conducted Emission Limit(Wired Network Port)

| Limits for asymmetric mode conducted emissions |                               |               |                               |               |
|------------------------------------------------|-------------------------------|---------------|-------------------------------|---------------|
| Frequency (MHz)                                | Class B voltage limits (dBμV) |               | Class B current limits (dBμA) |               |
|                                                | Quasi-peak Level              | Average Level | Quasi-peak Level              | Average Level |
| 0.15 ~ 0.50                                    | 84.0~74.0                     | 74.0~64.0     | 40.0~30.0                     | 30.0~20.0     |
| 0.50 ~ 30.00                                   | 74.0                          | 64.0          | 30.0                          | 20.0          |

NOTE 1-The limits decrease linearly with the logarithm of the frequency in the range 0,15 MHz to 0,5 MHz.

NOTE 2-The current and voltage disturbance limits are derived for use with an impedance stabilization network (ISN) which presents a common mode (asymmetric mode) impedance of 150Ω to the telecommunication port under test (conversion factor is  $20 \log_{10} 150 / 1 = 44 \text{ dB}$ ).

### 3.2.2 Test Configuration



### 3.2.3 EMI Test Receiver Setup

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

| Receiver Parameter     | Setting        |
|------------------------|----------------|
| Attenuation            | Auto           |
| Start ~ Stop Frequency | 150KHz ~ 30MHz |
| (IF)RBW                | 9kHz           |

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

### 3.2.4 Test Procedure

Please refer to ETSI EN 301 489-1 Clause 8.7.2 and EN 55032 Clause 6 for the measurement methods.

### 3.2.5 Test Results

Not applicable.



### 3.3. Radiated Disturbance

#### 3.3.1 Radiated Emission Limit

**Relevant Standard(s):** ETSI EN 301 489-1 V2.2.3 (2019-11) / EN 55032: 2015/A11: 2020 Class B

| Limits for Radiated Disturbance Below 1GHz                                                                                                                                                                                                 |                   |                           |                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------------|--------------------------------------|
| Frequency (MHz)                                                                                                                                                                                                                            | Facility          | Distance (Meters)         | Field Strengths Limit (dB $\mu$ V/m) |
| 30 ~ 230                                                                                                                                                                                                                                   | FAR               | 3                         | 42-35                                |
| 230 ~ 1000                                                                                                                                                                                                                                 | FAR               | 3                         | 42                                   |
| ***Note:<br>(1) The smaller limit shall apply at the combination point between two frequency bands.<br>(2) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the EUT. |                   |                           |                                      |
| Limits for Radiated Disturbance Above 1GHz                                                                                                                                                                                                 |                   |                           |                                      |
| Frequency (MHz)                                                                                                                                                                                                                            | Distance (Meters) | Peak Limit (dB $\mu$ V/m) | Average Limit (dB $\mu$ V/m)         |
| 1000 ~ 3000                                                                                                                                                                                                                                | 3                 | 70                        | 50                                   |
| 3000 ~ 6000                                                                                                                                                                                                                                | 3                 | 74                        | 54                                   |
| ***Note: The lower limit applies at the transition frequency.                                                                                                                                                                              |                   |                           |                                      |

| Limits for Radiated Disturbance Below 1GHz (For FM Receivers)                                                                                                                                             |                      |                              |           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------------------|-----------|
| Frequency<br>(MHz)                                                                                                                                                                                        | Distance<br>(Meters) | Class B Limit (dB $\mu$ V/m) |           |
|                                                                                                                                                                                                           |                      | Fundamental                  | Harmonics |
| 30 ~ 230                                                                                                                                                                                                  | 3                    | 60                           | 52        |
| 230 ~ 300                                                                                                                                                                                                 | 3                    |                              | 52        |
| 300 ~ 1000                                                                                                                                                                                                | 3                    |                              | 56        |
| ***Note: These relaxed limits apply only to emissions at the fundamental and harmonic frequencies of the LO.<br>Signals at all other frequencies shall be compliant with the limits given in above Table. |                      |                              |           |
|                                                                                                                                                                                                           |                      |                              |           |
| Limits for Radiated Disturbance Above 1GHz (For FM Receivers)                                                                                                                                             |                      |                              |           |
| 1000 ~ 3000                                                                                                                                                                                               | 3                    | 70                           | 50        |
| 3000 ~ 6000                                                                                                                                                                                               | 3                    | 74                           | 54        |
| ***Note: The lower limit applies at the transition frequency.                                                                                                                                             |                      |                              |           |

### 3.3.2 Test Configuration

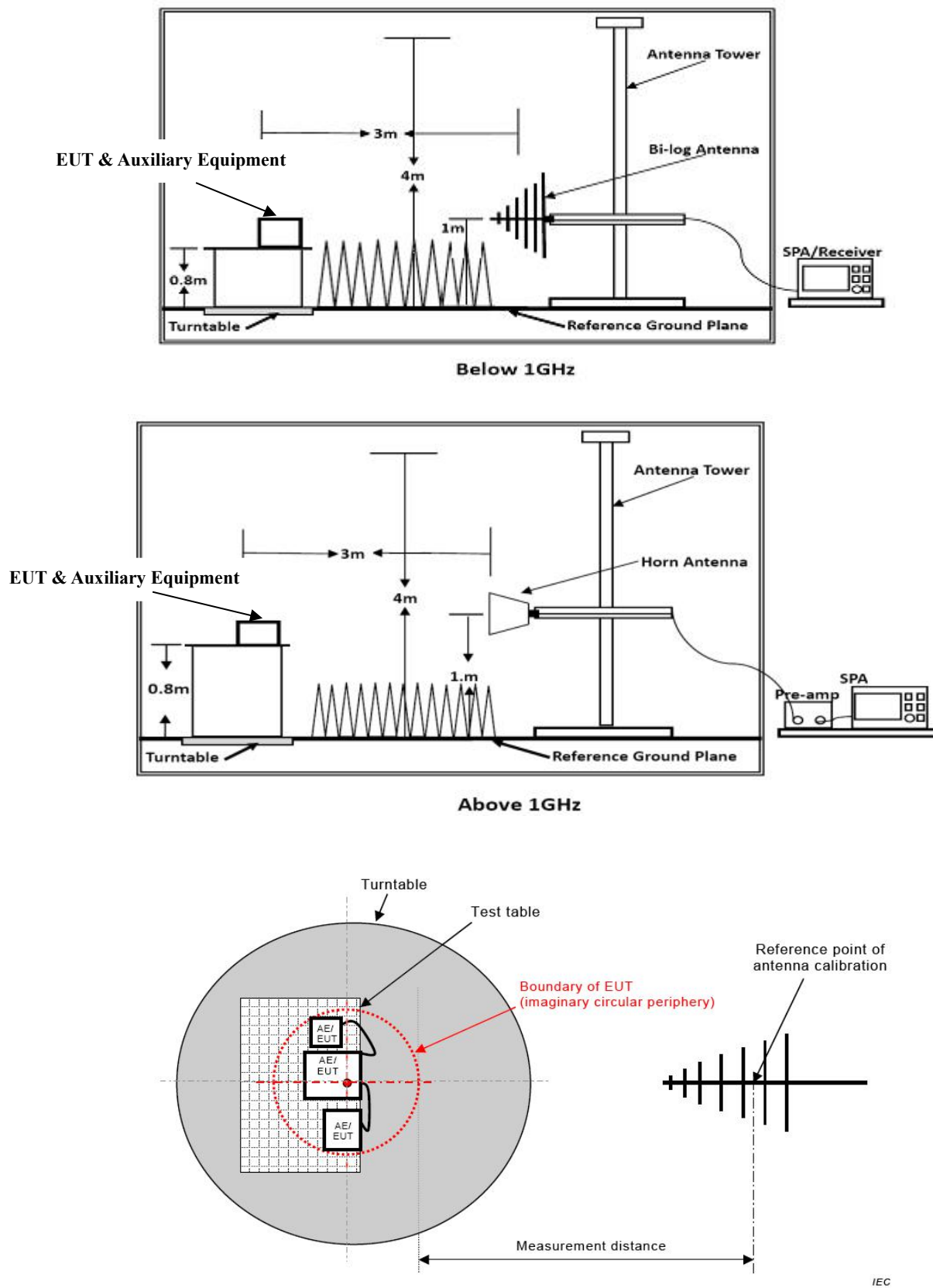
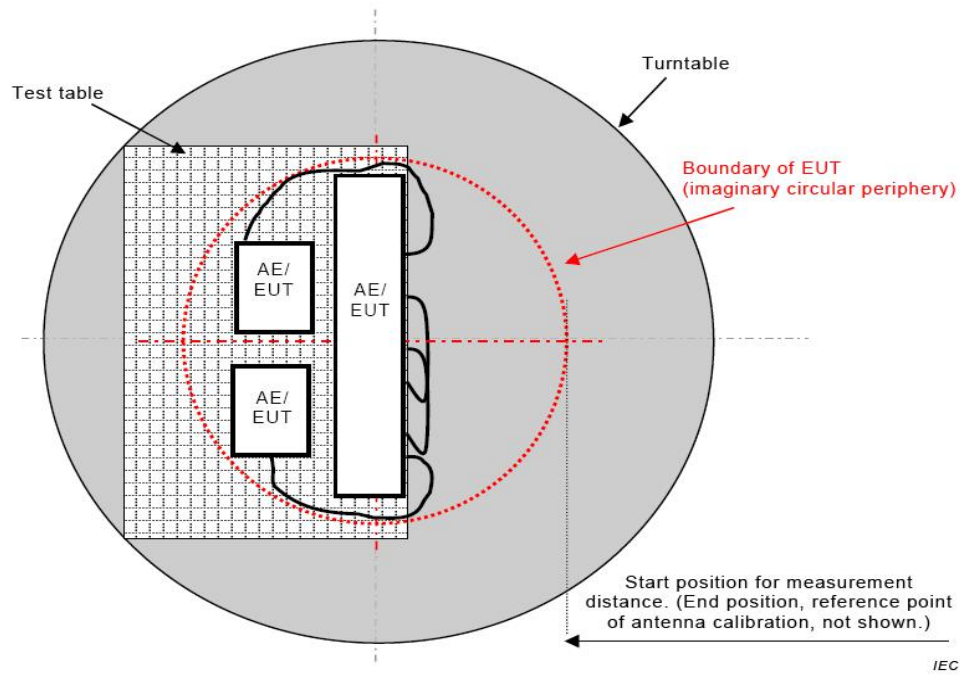


Figure C.1 – Measurement distance

### Test Setup for FM Receiver



**Figure C.2 – Boundary of EUT, Local AE and associated cabling**

### Test Setup for FM Receiver

#### 3.3.3 Test Procedure

The test method shall be in accordance with CENELEC EN 55032 [1], annex A.3.

#### 3.3.4 Test Results

PASS

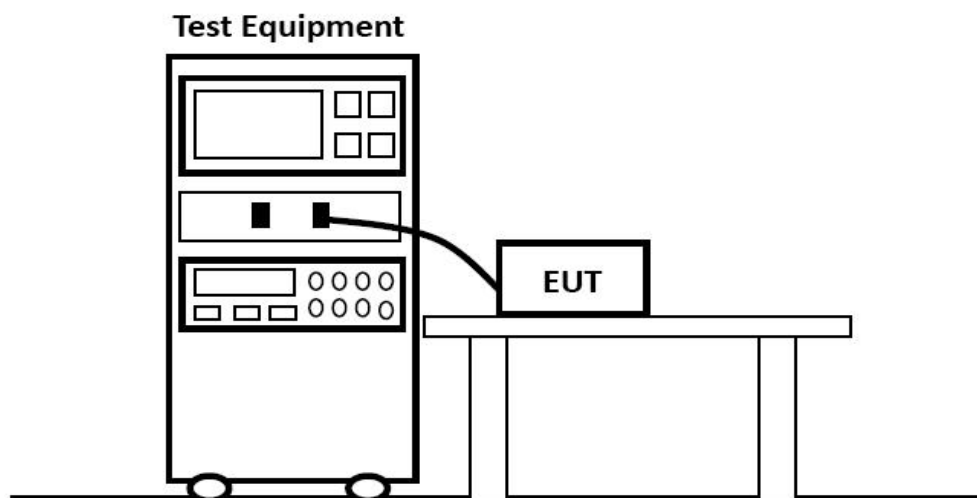
The worst test mode of the EUT was TM1, and its test data please refer to Appendix A.3 for Emission and Immunity test results.





### 3.4. Harmonic Current Emissions

#### 3.4.1 Test Configuration



#### 3.4.2 Test Standard

According to ETSI EN 301 489-1 V2.2.3 (2019-11) & EN 61000-3-2: 2014

#### 3.4.3 Test Results

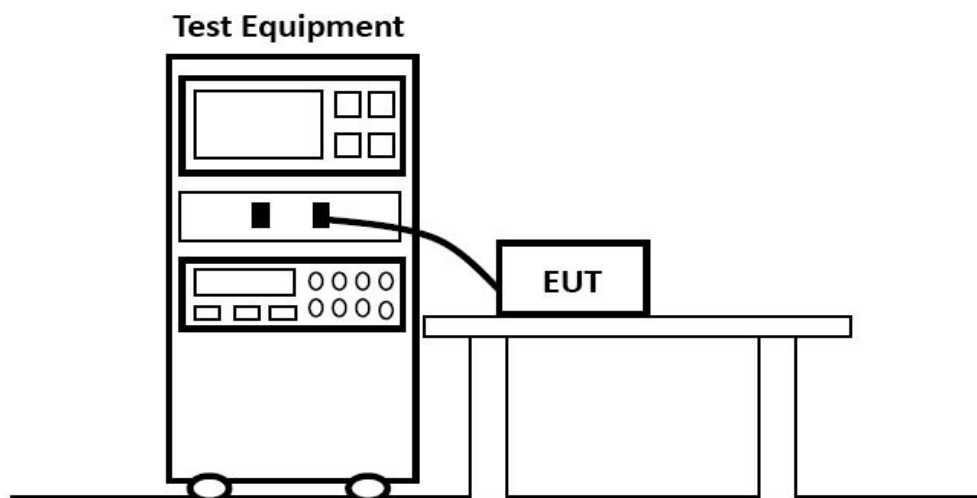
PASS

Please refer to Appendix A.4 for Emission and Immunity test results.



### 3.5. Voltage Fluctuation and Flicker

#### 3.5.1 Test Configuration



#### 3.5.2 Test Standard

According to ETSI EN 301 489-1 V2.2.3 (2019-11) & EN 61000-3-3: 2013

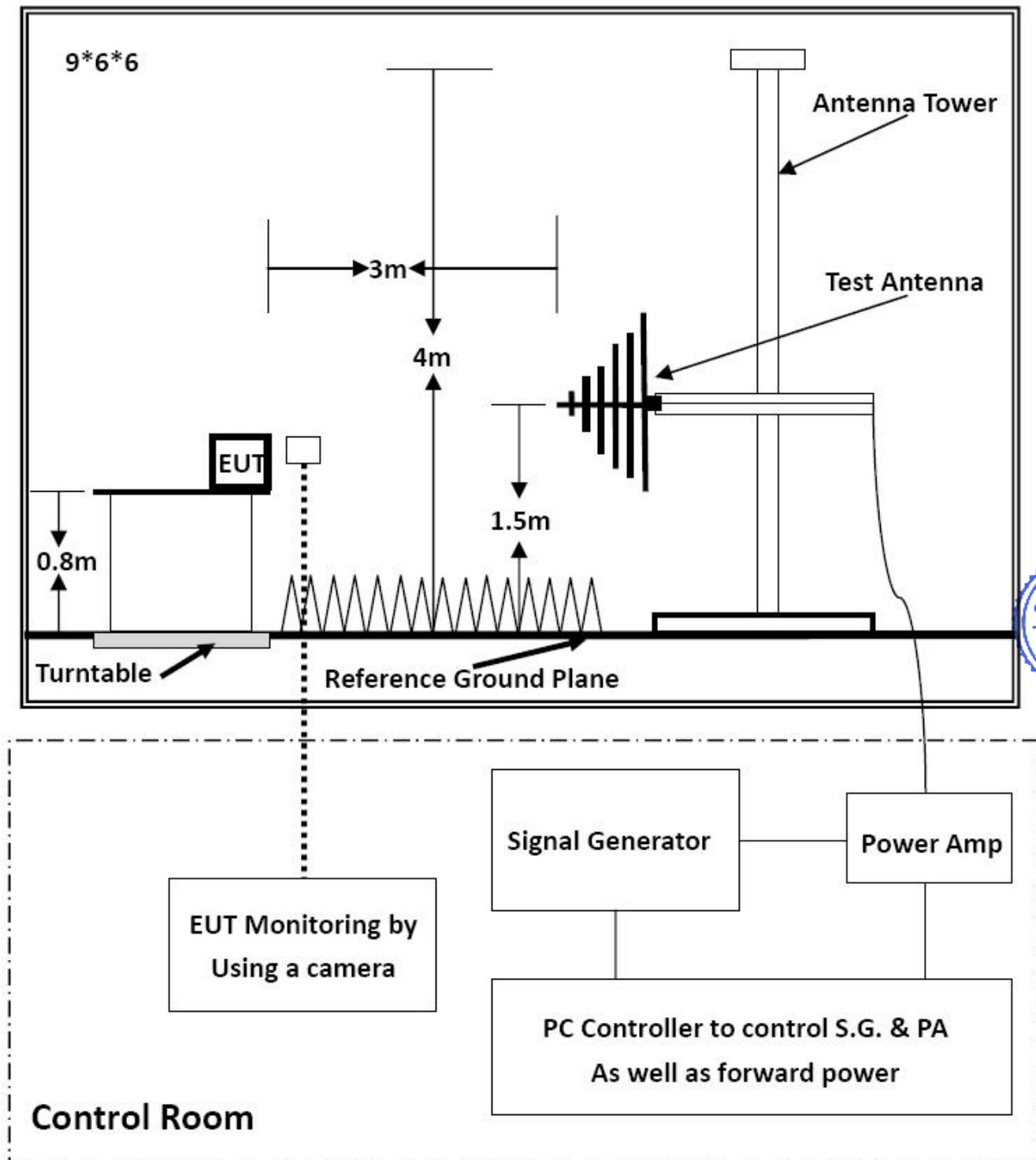
#### 3.5.3 Test Results

PASS

Please refer to Appendix A.5 for Emission and Immunity test results.

### 3.6. RF Electromagnetic Field (80 MHz - 6000 MHz)

#### 3.6.1 Test Configuration





### 3.6.2 Test Standard

ETSI EN 301 489-1, ETSI EN 301 489-3(EN 61000-4-3: 2006+A2: 2010)

Test level 2 at 3V/m.

### 3.6.3 Severity Level

| Level                    | Field Strength<br>(V/m) |
|--------------------------|-------------------------|
| 1                        | 1                       |
| 2                        | 3                       |
| 3                        | 10                      |
| X                        | Special                 |
| Performance Criterion: A |                         |

### 3.6.4 Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. EUT is set 3 meter away from the transmitting antenna which is mounted on an antenna tower. Both horizontal and vertical polarization of the antenna are set on test. Each of the four sides of EUT must be faced this transmitting antenna and measured individually. In order to judge the EUT performance, a CCD camera is used to monitor EUT screen. All the scanning conditions are as follows:

| Condition of Test      | Remark                   |
|------------------------|--------------------------|
| Fielded Strength       | 3 V/m (Severity Level 2) |
| Radiated Signal        | Unmodulated              |
| Scanning Frequency     | 80-6000MHz               |
| Dwell time of radiated | 0.0015 decade/s          |
| Waiting Time           | 3 Sec.                   |

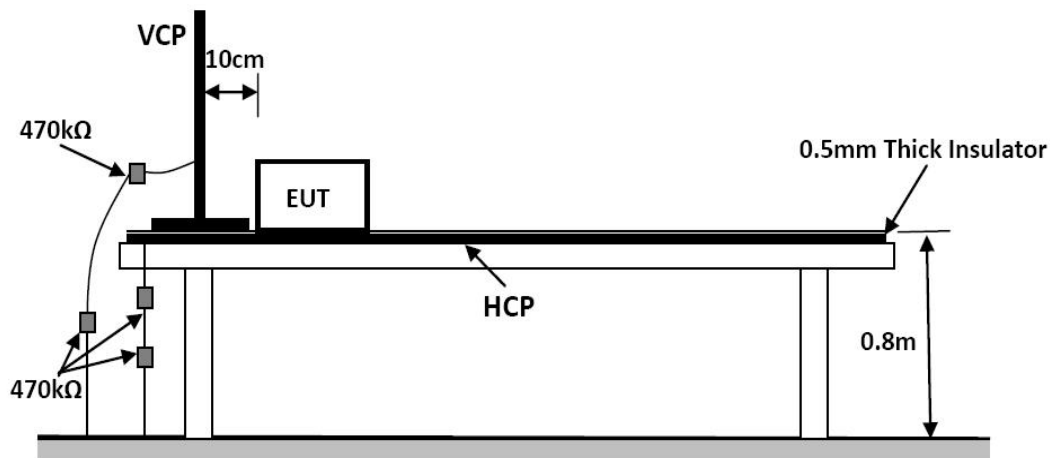
### 3.6.5 Test Results

PASS

Please refer to Appendix A.6 for Emission and Immunity test results.

### 3.7. Electrostatic Discharge

#### 3.7.1 Test Configuration



EN 61000-4-2 specifies that a tabletop EUT shall be placed on a non-conducting table which is 80 centimeters above a ground reference plane and that floor mounted equipment shall be placed on a insulating support approximately 10 centimeters above a ground plane. During the tests, the EUT is positioned over a ground reference plane in conformance with this requirement.

For tabletop equipment, a 1.5 by 1.0-meter metal sheet (HCP) is placed on the table and connected to the ground plane via a metal strap with two 470 k Ohms resistors in series. The EUT and attached cables are isolated from this metal sheet by 0.5-millimeter thick insulating material. A Vertical Coupling Plane (VCP) grounded on the ground plane through the same configuration as in the HCP is used.

#### 3.7.2 Test Procedure

ETSI EN 301 489-1 V2.2.3 (2019-11) / EN 61000-4-2: 2009

Test level 3 for Air Discharge at  $\pm 8$  kV

Test level 2 for Contact Discharge at  $\pm 4$  kV

##### 3.7.2.1 Air Discharge

This test is done on a non-conductive surface. The round discharge tip of the discharge electrode shall be approached as fast as possible to touch the EUT. After each discharge, the discharge electrode shall be removed from the EUT. The generator is then re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

##### 3.7.2.2 Contact Discharge

All the procedure shall be same as Section 3.7.2.1. except that the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

##### 3.7.2.3 Indirect Discharge For Horizontal Coupling Plane

At least 10 single discharges (in the most sensitive polarity) shall be applied at the front edge of each HCP opposite the center point of each unit (if applicable) of the EUT and 0.1m from the front of the EUT. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge.



#### 3.7.2.4 Indirect Discharge For Vertical Coupling Plane

At least 10 single discharges (in the most sensitive polarity) shall be applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, is placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges shall be applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.

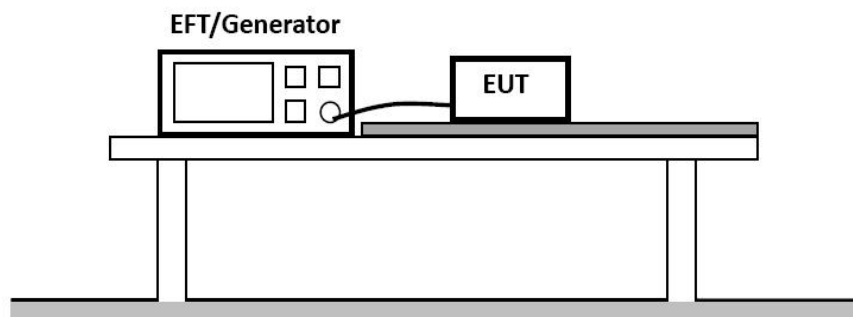
#### 3.7.3 Test Results

PASS

Please refer to Appendix A.7 for Emission and Immunity test results.

### 3.8. Electrical Fast Transient Immunity

### 3.8.1 Test Configuration



### 3.8.2 Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11)/ EN61000-4-4: 2012

Test level 2 at 1 kV

| Test Level                                  |                       |                                                        |
|---------------------------------------------|-----------------------|--------------------------------------------------------|
| Open Circuit Output Test Voltage $\pm 10\%$ |                       |                                                        |
| Level                                       | On Power Supply Lines | On I/O (Input/Output)<br>Signal data and control lines |
| 1                                           | 0.5 kV                | 0.25 kV                                                |
| 2                                           | 1 kV                  | 0.5 kV                                                 |
| 3                                           | 2 kV                  | 1 kV                                                   |
| 4                                           | 4 kV                  | 2 kV                                                   |
| X                                           | Special               | Special                                                |
| Performance Criterion: B                    |                       |                                                        |

### 3.8.3 Test Procedure

The EUT is put on the table, which is 0.8 meter high above the ground. This reference ground plane shall project beyond the EUT by at least 0.1m on all sides and the minimum distance between EUT and all other conductive structure, except the ground plane beneath the EUT, shall be more than 0.5m.

#### 3.8.3.1 For input and output AC power ports:

The EUT is connected to the power mains by using a coupling device, which couples the EFT interference signal to AC power lines. Both polarities of the test voltage should be applied during compliance test and the duration of the test is 2 minutes.

### 3.8.3.2 For signal lines and control lines ports: No I/O ports. It's unnecessary to test.

### 3.8.3.3 For DC output line ports: It's unnecessary to test.

### 3.8.4 Test Results

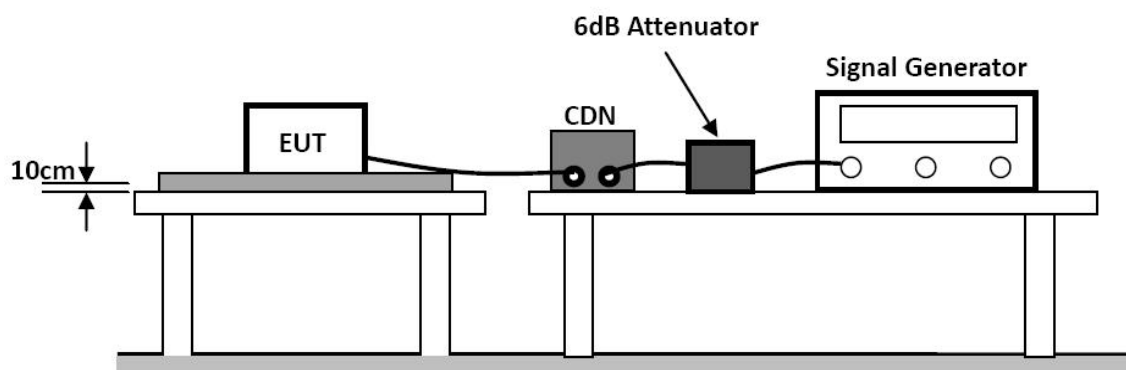
PASS

Please refer to Appendix A.8 for Emission and Immunity test results.



### 3.9. RF Common Mode

#### 3.9.1 Test Configuration



#### 3.9.2 Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11)/ EN 61000-4-6: 2014

Test level: 3V (r.m.s.) for 0.15MHz ~ 10MHz; 3V (r.m.s.) to 1V (r.m.s.) for 10MHz ~ 30MHz;

1V (r.m.s.) for 30MHz ~ 80MHz

Modulation type: AM

Modulation depth: 80%

Modulation signal: 1 kHz

| Test Level               |                            |
|--------------------------|----------------------------|
| Level                    | Voltage Level (r.m.s.) (V) |
| 1                        | 1                          |
| 2                        | 3                          |
| 3                        | 10                         |
| X                        | Special                    |
| Performance Criterion: A |                            |





### 3.9.3 Test Procedure

3.9.3.1 Let the EUT work in test mode and test it.

3.9.3.2 The EUT are placed on an insulating support 0.1m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50mm (where possible).

3.9.3.3 The disturbance signal described below is injected to EUT through CDN.

3.9.3.4 The EUT operates within its operational mode(s) under intended climatic conditions after power on.

3.9.3.5 The frequency range is swept from 150kHz to 10MHz using 3V signal level, 10MHz to 30MHz using 3V to 1V signal level, 30MHz to 80MHz using 1V signal level, and with the disturbance signal 80% amplitude modulated with a 1kHz sine wave.

3.9.3.6 The rate of sweep shall not exceed  $1.5 \times 10^{-3}$  decades/s. Where the frequency is swept incrementally, the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value.

3.9.3.7 Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.

### 3.9.4 Test Results

PASS

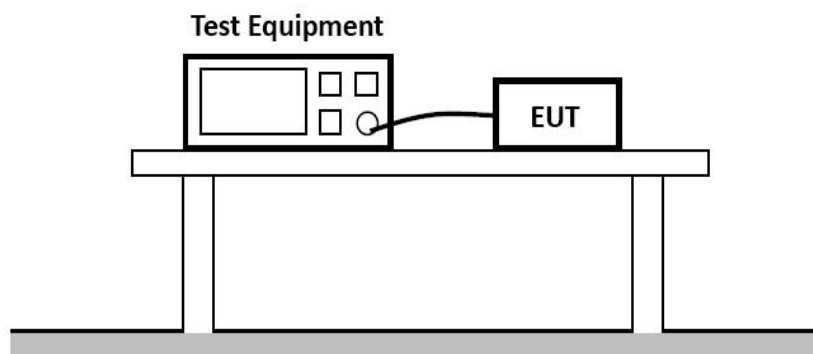
Please refer to Appendix A.9 for Emission and Immunity test results.





### 3.10. Surges, Line to Line and Line to Ground

#### 3.10.1 Test Configuration



#### 3.10.2 Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11) / EN 61000-4-5: 2014

L-N: Test level 2 at 1 kV

L-PE, N-PE Test Level 3 at 2kV

| Test Level                                  |                       |                                                        |
|---------------------------------------------|-----------------------|--------------------------------------------------------|
| Open Circuit Output Test Voltage $\pm 10\%$ |                       |                                                        |
| Level                                       | On Power Supply Lines | On I/O (Input/Output)<br>Signal data and control lines |
| 1                                           | 0.5 kV                | 0.25 kV                                                |
| 2                                           | 1 kV                  | 0.5 kV                                                 |
| 3                                           | 2 kV                  | 1 kV                                                   |
| 4                                           | 4 kV                  | 2 kV                                                   |
| X                                           | Special               | Special                                                |
| Performance Criterion: B                    |                       |                                                        |

#### 3.10.3 Test Procedure

3.10.3.1 For line to line coupling mode, provide a 0.5 kV 1.2/50us voltage surge (at open-circuit condition).

3.10.3.2 At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are conducted during test.

3.10.3.3 Different phase angles are done individually.

3.10.3.4 Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.

#### 3.10.4 Test Results

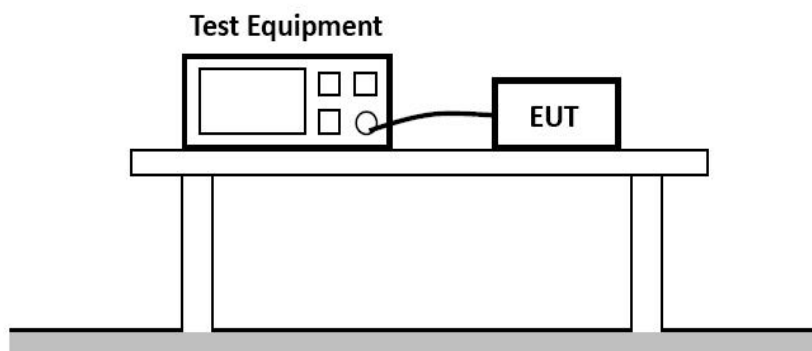
PASS

Please refer to Appendix A.10 for Emission and Immunity test results.



### 3.11. Voltage Dips/Interruptions Immunity Test

#### 3.11.1 Test Configuration



#### 3.11.2 Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11)/ EN 61000-4-11: 2004+A1:2017

Test levels and Performance Criterion

| Test Level                   |                         |                         |
|------------------------------|-------------------------|-------------------------|
| Voltage Reduction<br>$\%U_T$ | Voltage Dips<br>$\%U_T$ | Duration<br>(in Period) |
| 100                          | 0                       | 0.5                     |
| 100                          | 0                       | 1                       |
| 30                           | 70                      | 5                       |
| Voltage Reduction<br>$\%U_T$ | Voltage Dips<br>$\%U_T$ | Duration<br>(in Period) |
| 100                          | 0                       | 250                     |
| Performance Criterion: B&C   |                         |                         |

#### 3.11.3 Test Procedure

3.11.3.1 The interruption is introduced at selected phase angles with specified duration.

3.11.3.2 Record any degradation of performance.

#### 3.11.4 Test Results

PASS

Please refer to Appendix A.11 for Emission and Immunity test results.



## **4. GENERAL PERFORMANCE CRITERIA FOR IMMUNITY TEST**

### **4.1. Performance criteria for Continuous phenomena applied to Transmitter (CT)**

For equipment of type II or type III that requires a communication link that is maintained during the test, it shall be verified by appropriate means supplied by the manufacturer that the communication link is maintained during each individual exposure in the test sequence.

Where the EUT is a transmitter, tests shall be repeated with the EUT in standby mode to ensure that any unintentional transmission does not occur.

### **4.2. Performance criteria for Transient phenomena applied to Transmitter (TT)**

For equipment of type II or type III that requires a communication link that is maintained during the test, this shall be verified by appropriate means supplied by the manufacturer during each individual exposure in the test sequence. Where the EUT is a transmitter, tests shall be repeated with the EUT in standby mode to ensure that any unintentional transmission does not occur.

### **4.3. Performance criteria for Continuous phenomena applied to Receiver (CR)**

For equipment of type II or III that requires a communication link that is maintained during the test, it shall be verified by appropriate means supplied by the manufacturer that the communication link is maintained during each individual exposure in the test sequence. Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.

### **4.4. Performance criteria for Transient phenomena applied to Receiver (TR)**

For equipment of type II or type III that requires a communication link that is maintained during the test, this shall be verified by appropriate means supplied by the manufacturer during each individual exposure in the test sequence. Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.



## Performance criteria for Draft ETSI EN 301 489-3 V2.1.2 (2021-03)

### 1) Introduction

The performance criteria are used to make an assessment whether a radio equipment passes or fails immunity tests. Only the performance criteria specified in the present document or in ETSI EN 301 489-1 [1] where referenced shall apply. The provisions of ETSI EN 301 489-1 [1], clause 6, shall apply together with the following.

### 2) Continuous and non-continuous operation

Latency is the time delay between the initiation and the completion of operation of the EUT. Correct functioning requires completing the relevant operation within the maximum latency time. Where the maximum latency is specified in the applicable harmonised radio standard (in the wanted performance criterion, or an acknowledge requirement), that value shall be used. Where this is not the case, then the maximum latency is that required by the intended use of the EUT.

### 3) Operating modes

Where the EUT has more than one mode of operation (see clause 4.4.1), an unplanned transition from one mode to another is considered as an unintentional response. The EUT shall be tested in all modes to confirm there are no such unintentional responses.





## 5. LIST OF MEASURING EQUIPMENT

### LINE CONDUCTED EMISSION

| Item | Equipment                           | Manufacturer | Model No.   | Serial No.      | Cal Date   | Due Date   |
|------|-------------------------------------|--------------|-------------|-----------------|------------|------------|
| 1    | EMI Test Software                   | Farad        | EZ          | /               | N/A        | N/A        |
| 2    | EMI Test Receiver                   | R&S          | ESR3        | 102311          | 2021-03-16 | 2022-03-15 |
| 3    | Artificial Mains                    | R&S          | ENV216      | 101288          | 2021-06-21 | 2022-06-20 |
| 4    | 10dB Attenuator                     | SCHWARZBECK  | MTS-IMP-136 | 261115-001-0032 | 2021-06-21 | 2022-06-20 |
| 5    | Impedance Stabilization Network     | TESEQ        | ISN T800    | 45130           | 2020-12-02 | 2021-12-01 |
| 6    | WIDEBAND RADIO COMMUNICATION TESTER | R&S          | CMW 500     | 103818          | 2021-06-21 | 2022-06-20 |

### RADIATED DISTURBANCE

| Item | Equipment                           | Manufacturer | Model No.  | Serial No. | Cal Date   | Due Date   |
|------|-------------------------------------|--------------|------------|------------|------------|------------|
| 1    | EMI Test Software                   | Farad        | EZ         | /          | N/A        | N/A        |
| 2    | 3m Full Anechoic Chamber            | MRDIANZI     | FAC-3M     | MR009      | 2021-09-25 | 2022-09-24 |
| 3    | Positioning Controller              | MF           | MF7082     | MF78020803 | 2021-06-21 | 2022-06-20 |
| 4    | By-log Antenna                      | SCHWARZBECK  | VULB9163   | 9163-470   | 2021-07-25 | 2024-07-24 |
| 5    | Horn Antenna                        | SCHWARZBECK  | BBHA 9120D | 9120D-1925 | 2021-07-01 | 2024-06-30 |
| 6    | EMI Test Receiver                   | R&S          | ESR3       | 102312     | 2021-06-21 | 2022-06-20 |
| 7    | RS SPECTRUM ANALYZER                | R&S          | FSP40      | 100503     | 2021-11-16 | 2022-11-15 |
| 8    | Broadband Preamplifier              | /            | BP-01M18G  | P190501    | 2021-06-21 | 2022-06-20 |
| 9    | WIDEBAND RADIO COMMUNICATION TESTER | R&S          | CMW 500    | 103818     | 2021-06-21 | 2022-06-20 |

### VOLTAGE FLUCTUATION AND FLICKER/HARMONIC CURRENT EMISSIONS

| Item | Equipment                           | Manufacturer | Model No. | Serial No.   | Cal Date   | Due Date   |
|------|-------------------------------------|--------------|-----------|--------------|------------|------------|
| 1    | Power Analyzer Test System          | Voltech      | PM6000    | 200006700523 | 2021-06-21 | 2022-06-20 |
| 2    | WIDEBAND RADIO COMMUNICATION TESTER | R&S          | CMW 500   | 103818       | 2021-06-21 | 2022-06-20 |

### RF ELECTROMAGNETIC FIELD

| Item | Equipment                              | Manufacturer    | Model No.      | Serial No.             | Cal Date   | Due Date   |
|------|----------------------------------------|-----------------|----------------|------------------------|------------|------------|
| 1    | RS Test Software                       | Tonscend        | /              | /                      | N/A        | N/A        |
| 2    | ESG Vector Signal Generator            | Agilent         | E4438C         | MY42081396             | 2021-11-16 | 2022-11-15 |
| 3    | 3m Full Anechoic Chamber               | MRDIANZI        | FAC-3M         | MR009                  | 2021-09-25 | 2022-09-24 |
| 4    | RF POWER AMPLIFIER                     | OPHIR           | 5225R          | 1052                   | NCR        | NCR        |
| 5    | RF POWER AMPLIFIER                     | OPHIR           | 5273F          | 1019                   | NCR        | NCR        |
| 6    | RF POWER AMPLIFIER                     | SKET            | HAP_0306G-50W  | /                      | NCR        | NCR        |
| 7    | Stacked Broadband Log Periodic Antenna | SCHWARZBECK     | STLP 9128      | 9128ES-145             | NCR        | NCR        |
| 8    | Stacked Mikrowellen Log.-Per Antenna   | SCHWARZBECK     | STLP 9149      | 9149-484               | NCR        | NCR        |
| 9    | Electric field probe                   | Narda S.TS./PMM | EP601          | 611WX80208             | 2021-03-25 | 2022-03-24 |
| 10   | Sound Level meter                      | BK Precision    | 735            | 7350087310010020       | 2021-06-21 | 2022-06-20 |
| 11   | Audio Analyzer                         | R&S             | UPV            | 1146.2003K02-101721-UW | 2021-11-16 | 2022-11-15 |
| 12   | Mouse Simulation                       | Brüel & Kjær    | 4227           | A0304216               | 2021-06-21 | 2022-06-20 |
| 13   | Ear Simulation and supply              | Brüel & Kjær    | 2669.4182.5935 | A0305284               | 2021-06-21 | 2022-06-20 |
| 14   | Acoustical Calibrators                 | Brüel & Kjær    | 4231           | A0304215               | 2021-06-21 | 2022-06-20 |
| 15   | WIDEBAND RADIO COMMUNICATION TESTER    | R&S             | CMW 500        | 103818                 | 2021-06-21 | 2022-06-20 |



## ELECTROSTATIC DISCHARGE

| Item | Equipment                           | Manufacturer | Model No. | Serial No. | Cal Date   | Due Date   |
|------|-------------------------------------|--------------|-----------|------------|------------|------------|
| 1    | ESD Simulator                       | SCHLODER     | SESD 230  | 604035     | 2021-07-20 | 2022-07-19 |
| 2    | WIDEBAND RADIO COMMUNICATION TESTER | R&S          | CMW 500   | 103818     | 2021-06-21 | 2022-06-20 |

## ELECTRICAL FAST TRANSIENT IMMUNITY

| Item | Equipment                           | Manufacturer | Model No. | Serial No. | Cal Date   | Due Date   |
|------|-------------------------------------|--------------|-----------|------------|------------|------------|
| 1    | Immunity Simulative Generator       | EM TEST      | UCS500-M4 | 0101-34    | 2021-06-22 | 2022-06-21 |
| 2    | WIDEBAND RADIO COMMUNICATION TESTER | R&S          | CMW 500   | 103818     | 2021-06-21 | 2022-06-20 |

## RF COMMON MODE

| Item | Equipment                           | Manufacturer | Model No. | Serial No. | Cal Date   | Due Date   |
|------|-------------------------------------|--------------|-----------|------------|------------|------------|
| 1    | Simulator                           | FRANKONIA    | CIT-10/75 | A126A1195  | 2021-06-21 | 2022-06-20 |
| 2    | CDN                                 | FRANKONIA    | CDN-M2+M3 | A2210177   | 2021-06-21 | 2022-06-20 |
| 3    | 6dB Attenuator                      | FRANKONIA    | DAM25W    | 1172040    | 2021-06-21 | 2022-06-20 |
| 4    | WIDEBAND RADIO COMMUNICATION TESTER | R&S          | CMW 500   | 103818     | 2021-06-21 | 2022-06-20 |

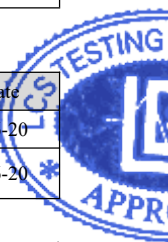
## SURGES, LINE TO LINE AND LINE TO GROUND

| Item | Equipment                           | Manufacturer | Model No. | Serial No. | Cal Date   | Due Date   |
|------|-------------------------------------|--------------|-----------|------------|------------|------------|
| 1    | Immunity Simulative Generator       | EM TEST      | UCS500-M4 | 0101-34    | 2021-06-22 | 2022-06-21 |
| 2    | WIDEBAND RADIO COMMUNICATION TESTER | R&S          | CMW 500   | 103818     | 2021-06-21 | 2022-06-20 |

## VOLTAGE DIPS/INTERRUPTIONS IMMUNITY TEST

| Item | Equipment                           | Manufacturer | Model No. | Serial No. | Cal Date   | Due Date   |
|------|-------------------------------------|--------------|-----------|------------|------------|------------|
| 1    | Voltage dips and up generator       | 3CTEST       | VDG-1105G | EC0171014  | 2021-06-21 | 2022-06-20 |
| 2    | WIDEBAND RADIO COMMUNICATION TESTER | R&S          | CMW 500   | 103818     | 2021-06-21 | 2022-06-20 |

Note: NCR --- No calibration requirement.





## 6. PHOTOGRAPHS OF TEST SETUP

Please refer to separated files Appendix B for Photographs of Test Setup\_EMC

## 7. PHOTOGRAPHS OF THE EUT

Please refer to separated files Appendix C for Photographs of The EUT.



-----THE END OF REPORT-----