



## EMC TEST REPORT

For

Shenzhen Sonoff Technologies Co., Ltd.

SONOFF Smart Stackable Power Meter (Main Unit+4-Relays)

Test Model: SPM-Main

Additional Model No.: SPM-4Relay

Prepared for : Shenzhen Sonoff Technologies Co., Ltd.  
Address : 1001, BLDG8, Lianhua Industrial Park, Shenzhen, GD, China

Prepared by : Shenzhen LCS Compliance Testing Laboratory Ltd.  
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Date of receipt of test sample : July 12, 2021  
Number of tested samples : 1  
Serial number : Prototype  
Date of Test : July 12, 2021 ~ January 21, 2022  
Date of Report : January 22, 2022



Scan code to check authenticity



**EMC TEST REPORT**

**ETSI EN 301 489-1 V2.2.3 (2019-11) & ETSI EN 301 489-17 V3.2.4 (2020-09)**

**Report Reference No. .... : LCS210706070AEA**

**Date Of Issue..... : January 22, 2022**

**Testing Laboratory Name ..... : Shenzhen LCS Compliance Testing Laboratory Ltd.**

**Address..... : Room 101, 201, Building A and Room 301, Building C, Juji Industrial Park, Yabianxueziwei, Shajing Street, Bao'an District, Shenzhen, Guangdong, China**

**Testing Location/ Procedure ..... : Full application of Harmonised standards   
Partial application of Harmonised standards   
Other standard testing method**

**Applicant's Name ..... : Shenzhen Sonoff Technologies Co., Ltd.**

**Address..... : 1001, BLDG8, Lianhua Industrial Park, Shenzhen, GD, China**

**Test Specification**

**Standard..... : ETSI EN 301 489-1 V2.2.3 (2019-11)  
ETSI EN 301 489-17 V3.2.4 (2020-09)  
EN 55032:2015/A11:2020  
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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**Test Item Description..... : SONOFF Smart Stackable Power Meter (Main Unit+4-Relays)**

**Trade Mark..... : SONOFF**

**Test Model ..... : SPM-Main**

**Ratings ..... : Input: AC 100-240V, 50/60Hz  
Output: AC 100-240V, 50/60Hz**

**Result ..... : Positive**

**Compiled by:**

**Supervised by:**

**Approved by:**

Jin Wang/ Administrator

Cary Luo/ Technique principal

Gavin Liang/ Manager



# EMC -- TEST REPORT

<b>Test Report No. :</b> <b>LCS210706070AEA</b>	<u>January 22, 2022</u> Date of issue
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Test Model.....	: SPM-Main
EUT.....	: SONOFF Smart Stackable Power Meter (Main Unit+4-Relays)
<b>Applicant.....</b>	<b>: Shenzhen Sonoff Technologies Co., Ltd.</b>
Address.....	: 1001, BLDG8, Lianhua Industrial Park, Shenzhen, GD, China
Telephone.....	: /
Fax.....	: /
<b>Manufacturer.....</b>	<b>: Shenzhen Sonoff Technologies Co., Ltd.</b>
Address.....	: 1001, BLDG8, Lianhua Industrial Park, Shenzhen, GD, China
Telephone.....	: /
Fax.....	: /
<b>Factory.....</b>	<b>: Shenzhen Yindao Micro-electronics.</b>
Address.....	: 5th floor, 7th floor, building 5, Jingsheng Industrial Zone, huawang Road, Tongsheng community, Dalang street, Longhua New District, Shenzhen, China
Telephone.....	: /
Fax.....	: /

<b>Test Result</b>	<b>Positive</b>
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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	Revision Content	Revised By
000	January 22, 2022	Initial Issue	---





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## 1. GENERAL INFORMATION

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

EUT	: SONOFF Smart Stackable Power Meter (Main Unit+4-Relays)
Test Model	: SPM-Main
Additional Model	: SPM-4Relay
Model Declaration	: PCB board, structure and internal of these model(s) are the same, So no additional models were tested
Power Supply	: Input: AC 100-240V, 50/60Hz Output: AC 100-240V, 50/60Hz
Hardware Version	: VER.1.0
Software Version	: VER.1.0
Bluetooth	:
Frequency Range	: 2402MHz ~ 2480MHz
Channel Number	: 40 channels for Bluetooth V5.0 (BT LE)
Channel Spacing	: 2MHz for Bluetooth V5.0 (BT LE)
Modulation Type	: GFSK for Bluetooth V5.0 (BT LE)
Bluetooth Version	: V5.0
Antenna Description	: PCB Antenna, 0.5dBi(Max.)
WIFI(2.4G Band)	:
Frequency Range	: 2412MHz ~ 2472MHz
Channel Spacing	: 5MHz
Channel Number	: 13 Channel for 20MHz bandwidth(2412~2472MHz)
Modulation Type	: 802.11b: DSSS; 802.11g/n: OFDM
Antenna Description	: PCB Antenna, 0.5dBi(Max.)



## 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 301 489-17	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard for ElectroMagnetic Compatibility
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 301 489-17 V3.2.4 (2020-09), 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 301 489-17 V3.2.4 (2020-09), 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
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## 1.7. External I/O

I/O Port Description	Quantity	Cable
LAN Port	1	NA
SD Card Port	1	NA
RS-485 Port	1	NA



### 1.8. Measurement Uncertainty

Item	MU	Remark
Uncertainty for Power point Conducted Emissions Test	2.42dB	
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.54dB	Polarize: V
	4.1dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (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 were 4 test Modes. TM1 to TM4 were shown below:

- TM1 : Operate in Bluetooth Mode
- TM2 : Operate in 2.4G WIFI mode
- TM3 : Operate in LAN mode
- TM4 : 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 Conducted Emission (AC mains input/output port)	Compliant
§7.1	Reference to clause 8.3 of ETSI EN 301 489-1 Conducted Emission (DC power input/output port)	N/A*
§7.1	Reference to clause 8.7 of ETSI EN 301 489-1 Conducted Emission (Wired network port)	Compliant
§7.1	Reference to clause 8.2 of ETSI EN 301 489-1 Radiated Emission (Enclosure of ancillary equipment)	Compliant
§7.1	Reference to clause 8.5 of ETSI EN 301 489-1 Harmonic current emissions (AC mains input port)	Compliant
§7.1	Reference to clause 8.6 of ETSI EN 301 489-1 Voltage fluctuations and flicker (AC mains input port)	Compliant
§7.2	Reference to clause 9.3 of ETSI EN 301 489-1 Electrostatic discharge (Enclosure port) (EN 61000-4-2)	Compliant
§7.2	Reference to clause 9.2 of ETSI EN 301 489-1 RF electromagnetic field (80MHz to 6000MHz) (Enclosure port) (EN 61000-4-3)	Compliant
§7.2	Reference to clause 9.4 of ETSI EN 301 489-1 Fast transients common mode (signal, wired network and control ports, DC and AC power ports) (EN 61000-4-4)	Compliant
§7.2	Reference to clause 9.8 of ETSI EN 301 489-1 Surges, line to line and line to ground (AC mains power input ports, wired network ports) (EN 61000-4-5)	Compliant
§7.2	Reference to clause 9.5 of ETSI EN 301 489-1 RF common mode 0.15MHz to 80MHz (signal, wired network and control ports, DC and AC power ports) (EN 61000-4-6)	Compliant
§7.2	Reference to clause 9.6 of ETSI EN 301 489-1 Transients and surges in the vehicular environment (ISO 7637-2)	N/A*
§7.2	Reference to clause 9.7 of ETSI EN 301 489-1 Voltage dips and interruptions (AC mains power input ports) (EN 61000-4-11)	Compliant

### 3. TEST RESULTS

#### 3.1. Line Conducted Emission

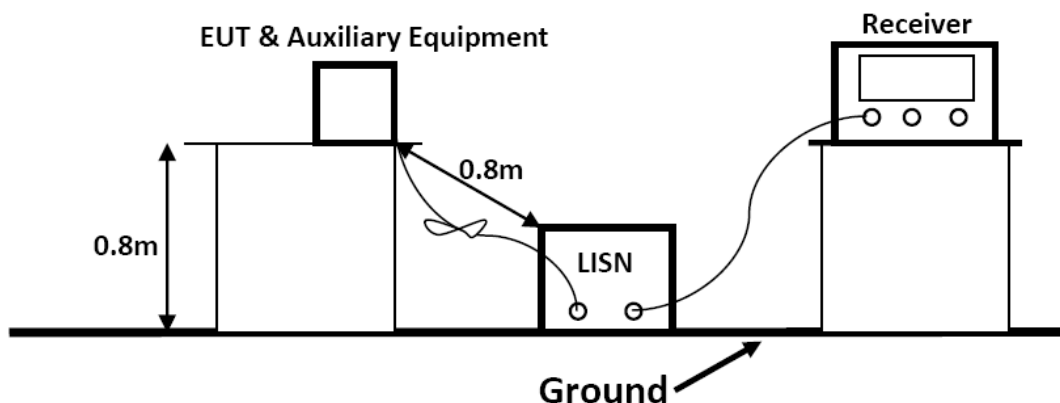
##### 3.1.1 Conducted Emission Limit

**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.



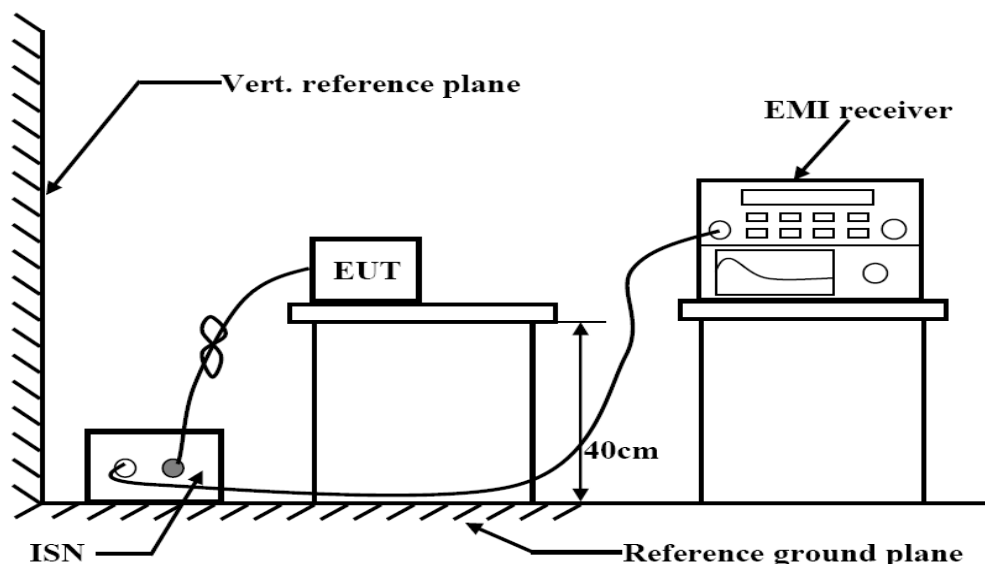
### 3.2. Conducted Emission (Wired Network Port)

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

Limits for asymmetric mode conducted emissions				
Frequency (MHz)	Class B voltage limits (dB $\mu$ V)		Class B current limits (dB $\mu$ A)	
	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 150 $\Omega$  to the telecommunication port under test (conversion factor is 20 log<sub>10</sub> 150 / 1 = 44 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

PASS

Please refer to Appendix A.2 for Emission and Immunity test results.



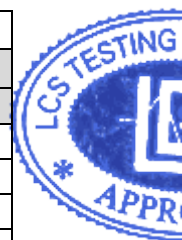
### 3.3. Radiated Disturbance

#### 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

<b>Limits for Radiated Disturbance Below 1GHz</b>			
Frequency (MHz)	Facility	Distance (Meters)	Field Strengths Limit (dB $\mu$ V/m)
30 ~ 230	OATS/SAC	3	40
230 ~ 1000	OATS/SAC	3	47
***Note: (1) The smaller limit shall apply at the combination point between two frequency bands. (2) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the EUT.			
<b>Limits for Radiated Disturbance Above 1GHz</b>			
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.			

<b>Limits for Radiated Disturbance Below 1GHz (For FM Receivers)</b>			
Frequency (MHz)	Distance (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. Signals at all other frequencies shall be compliant with the limits given in above Table.			
<b>Limits for Radiated Disturbance Above 1GHz (For FM Receivers)</b>			
1000 ~ 3000	3	70	50
3000 ~ 6000	3	74	54
***Note: The lower limit applies at the transition frequency.			



### 3.3.2 Test Configuration

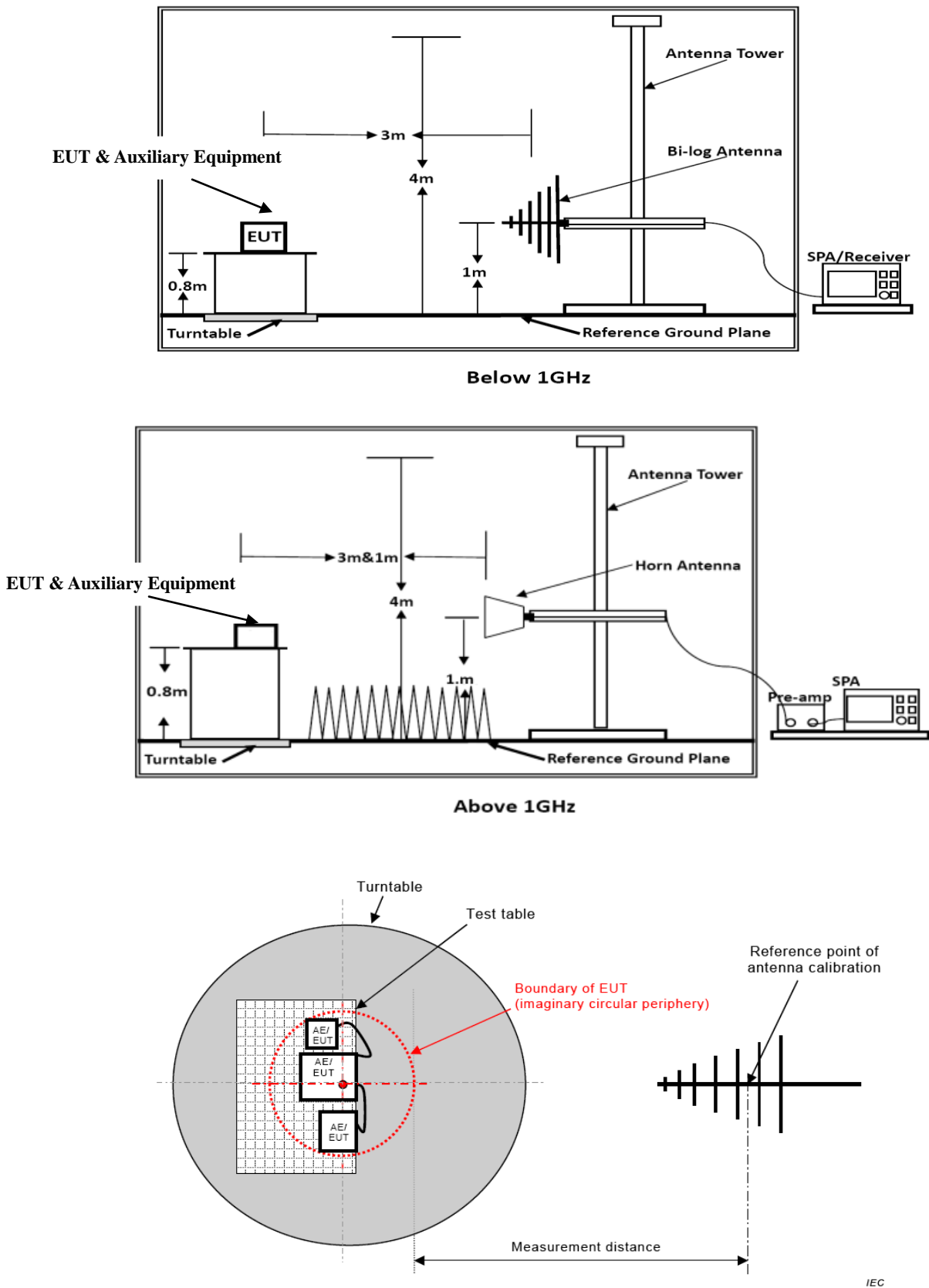


Figure C.1 – Measurement distance

### Test Setup for FM Receiver

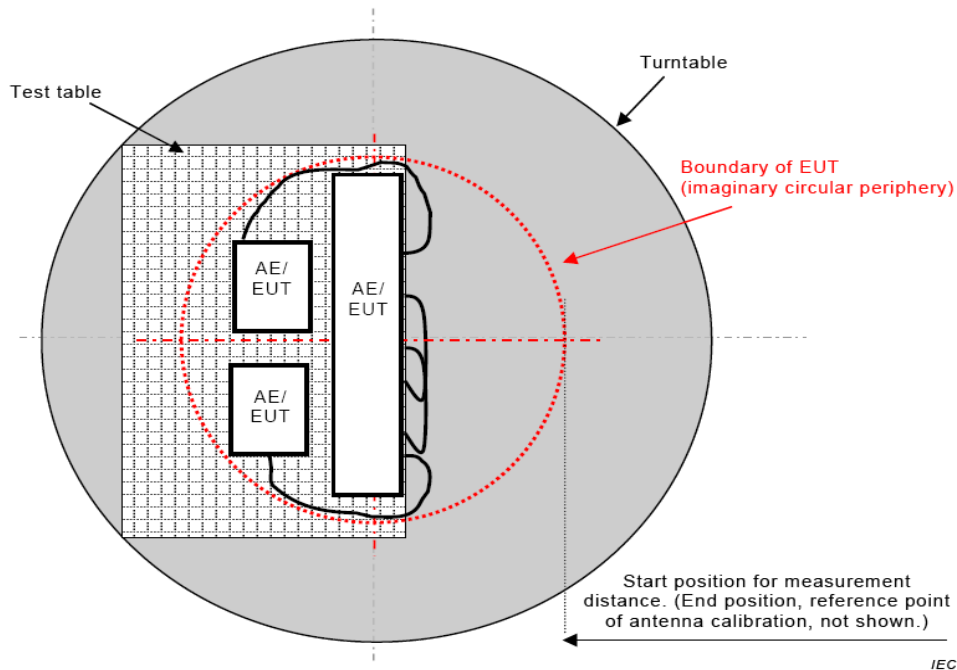


Figure C.2 – Boundary of EUT, Local AE and associated cabling

### Test Setup for FM Receiver

#### 3.3.3 Test Procedure

##### 1) Sequence of testing 30 MHz to 1 GHz

###### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

###### Pre-measurement:

- The turntable rotates from 0 ° to 315 ° using 45 ° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 to 4 meter.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

###### Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ( $\pm 45^\circ$ ) and antenna movement between 1 and 4 meter.
- The final measurement will be done with QP detector with an EMI receiver.
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre-measurement with marked maximum final measurements and the limit will be stored.

##### 2) Sequence of testing 1 GHz to 6 GHz



**Setup:**

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

**Pre-measurement:**

- The turntable rotates from 0 ° to 315 ° using 45 ° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height scan range is 1 meter to 4 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

**Final measurement:**

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of pre-measurement the software maximize the peaks by changing turntable position ( $\pm 45^\circ$ ) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre-measurement with marked maximum final measurements and the limit will be stored.

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	30MHz~1000MHz / RBW 100kHz for QP

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	6000 MHz
RBW / VBW	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average

3.3.4 Test Results

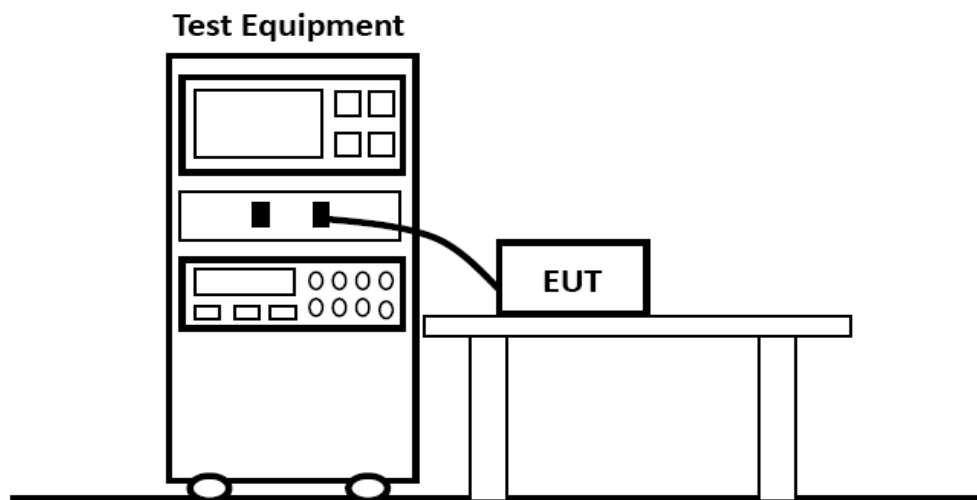
PASS

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

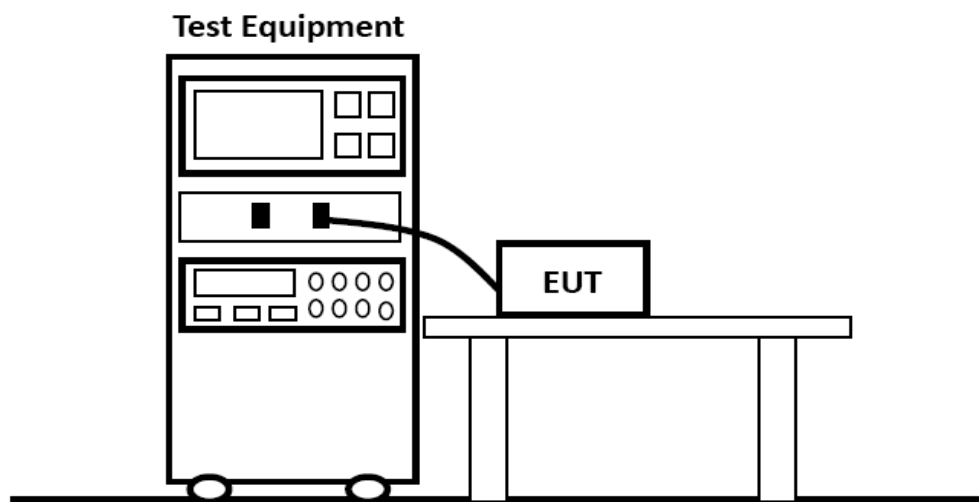
PASS

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

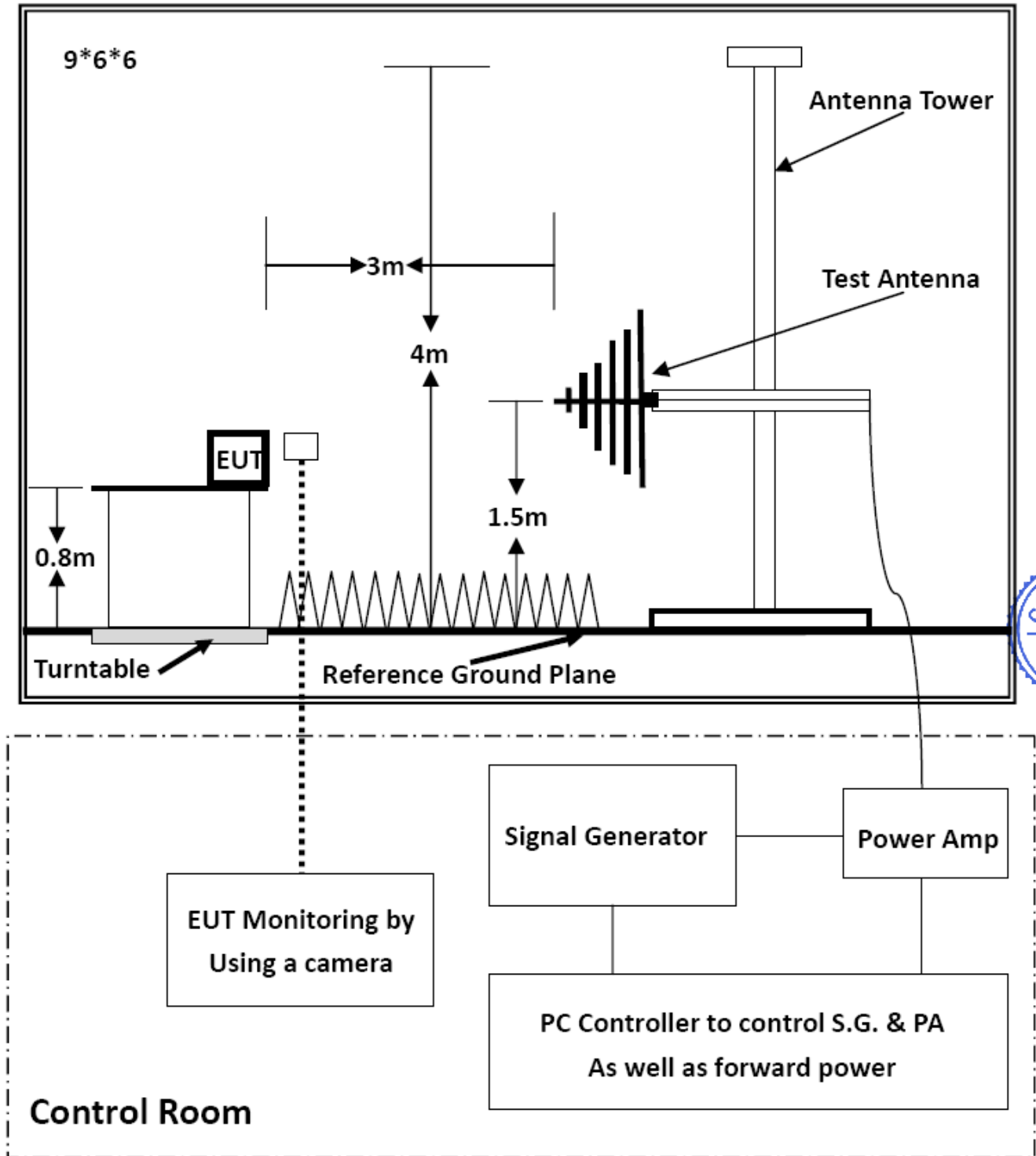
PASS

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 301 489-17 (EN 61000-4-3: 2006+A2: 2010)

Test level 2 at 3V/m.

### 3.6.3 Severity Level

Level	Field Strength (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.

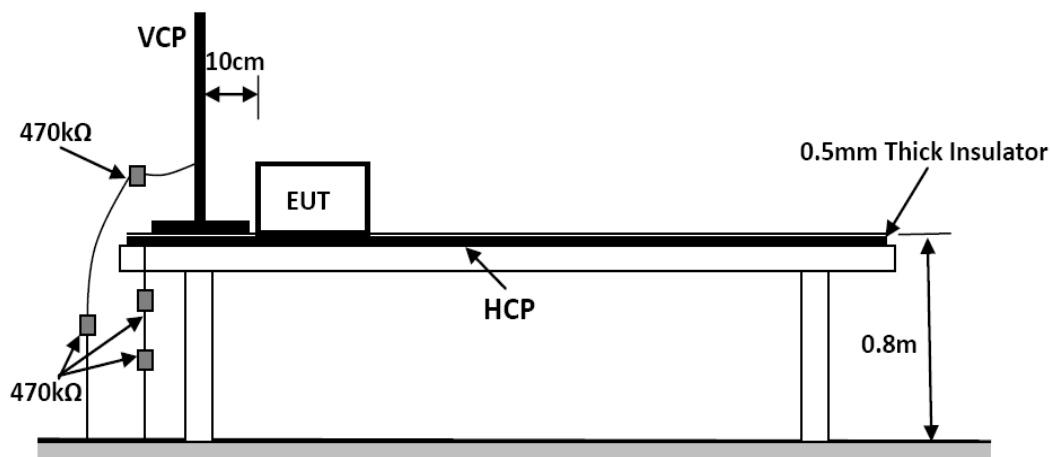
### 3.6.5 Test Results

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

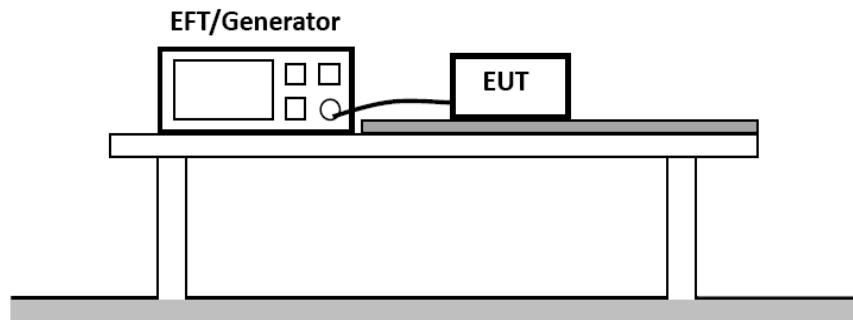
PASS

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) 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.

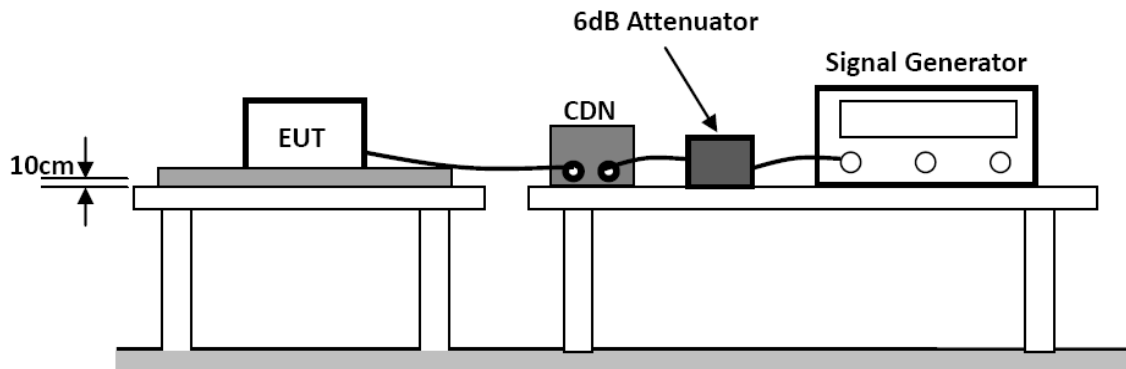
#### 3.8.4 Test Results

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

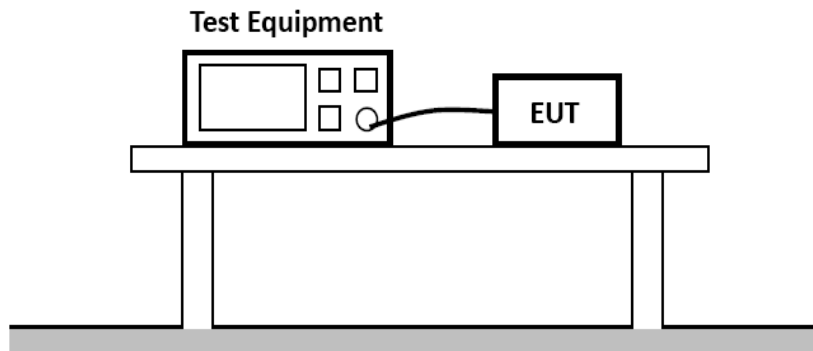
PASS

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) 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.

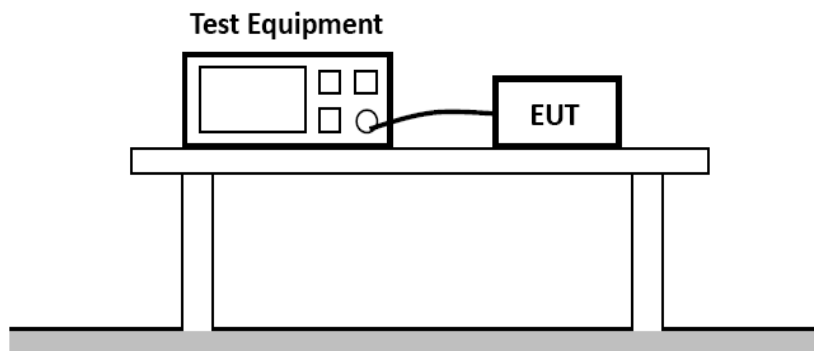
#### 3.10.4 Test Results

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 %U <sub>T</sub>	Voltage Dips %U <sub>T</sub>	Duration (in Period)
100	0	0.5
100	0	1
30	70	5
Voltage Reduction %U <sub>T</sub>	Voltage Dips %U <sub>T</sub>	Duration (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 ETSI EN 301 489-17 V3.2.4 (2020-09)**

<b>Criteria</b>	<b>During test</b>	<b>After test (i.e. as a result of the application of the test)</b>
A	Shall operate as intended. (See note). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance. Shall be no loss of function. Shall be no loss of critical stored data.
B	May be loss of function.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no loss of critical stored data.
C	May be loss of function.	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no loss of critical stored data.

NOTE: Operate as intended during the test allows a level of degradation in accordance with clause 6.2.2.





## 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	ESPI	101840	2021-06-21	2022-06-20
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	2021-12-01	2022-11-30
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-50 W	/	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	1146.2003K02-101 721-UW	2021-11-16	2022-11-15
12	Mouse Simulation	Bruel & Kjaer	4227	A0304216	2021-06-21	2022-06-20
13	Ear Simulation and supply	Bruel & Kjaer	2669.4182.5935	A0305284	2021-06-21	2022-06-20
14	Acoustical Calibrators	Bruel & Kjaer	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

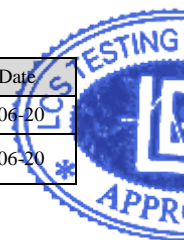
**SURGES, LINE TO LINE AND LINE TO GROUND**

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\_EMG

## 7. PHOTOGRAPHS OF THE EUT

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

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

