EUROFINS PRODUCT TESTING SERVICE (SHANGHAI) CO., LTD.

# EMC TEST- REPORT

## TEST REPORT NUMBER: EFSH17010175-IE-01-E01

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## 1 Contents

# 2 General Information

## 2.1 Notes

The results of this test report relate exclusively to the item tested as specified in chapter "Description of test item" and are not transferable to any other test items.
Eurofins Product Testing Service (Shanghai) is not responsible for any generalisations and conclusions drawn from this report. Any modification of the test item can lead to invalidity of test results and this test report may therefore be not applicable to the modified test item.
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**Operator:**

| | | | |
|---|---|---|---|
| 2017-01-19 | | Perry Li / Testing Engineer | |
| Date | Eurofins-Lab. | Name / Title | Signature |

**Technical responsibility for area of testing:**

| | | | |
|---|---|---|---|
| 2017-01-19 | | Stefan Zhao / Project Engineer | |
| Date | Eurofins | Name / Title | Signature |

## 2.2 Testing laboratory

Eurofins Product Testing Service (Shanghai) Co., Ltd.
No.395 West Jiangchang Road, Jing'an District, Shanghai, 200436, P.R. China
Telephone : +86-21-61819181
Telefax : +86-21-61819180

**Test location, where different:**

Subcontractor

| | |
|---|---|
| Name | : BUREAU VERITAS ADT (SHANGHAI) CORPORATION. |
| Address | : 2F, Building C, No. 1618 Yishan Road SHANGHAI |
| Telephone | : + 86-21-6465 9091 |
| Fax | : + 86-21-6465 9092 |

Radiated emission and Radiated immunity tests were performed at BUREAU VERITAS ADT (SHANGHAI) CORPORATION.

## 2.3 Details of approval holder

| | | |
|---|---|---|
| Name | : | Xindao B. V |
| Address | : | P. O. Box 3082, 2280 GB, Rijswijk, The Netherlands |
| Telephone | : | ./. |
| Fax | : | ./. |

## 2.4 Application details

| | | |
|---|---|---|
| Date of receipt of application | : | 2017-01-04 |
| Date of receipt of test item | : | 2017-01-05 |
| Date of test | : | 2017-01-05 to 2017-01-19 |

## 2.5 EUT information

| | | |
|---|---|---|
| Product type | : | cloud hub |
| Model name | : | P308.30 |
| Brand name | : | ./. |
| Serial number | : | ./. |
| Ratings | : | 5Vdc input, 4x5Vdc output |
| Test voltage | : | 230V~, 50Hz for adapter |
| Additional information | : | The appliance is USB hub.<br>Adapter was used as test accessory.<br>Adapter model: A119<br>Input: 100-240V~ 50/60Hz 0.2A,<br>Output: DC 5V 1A |

## 2.6 Test standards

**EN 61000-6-1:2007**

**EN 61000-6-3:2007+A1:2011**

# 3 Technical test

## 3.1 Summary of test results

No deviations from the technical specification(s) were ascertained in the course of the tests performed. ☒

**or**

The deviations as specified were ascertained in the course of the tests performed. ☐

## 3.2 Test environment

**Eurofins Product Testing Service (Shanghai) Co., Ltd.**

| | | | |
|---|---|---|---|
| Temperature | : 20 | ... | 25°C |
| Relative humidity content | : 30 | ... | 60% |
| Air pressure | : 100 | ... | 103kPa |

**BUREAU VERITAS ADT (SHANGHAI) CORPORATION.**

| | |
|---|---|
| Temperature | : 24°C |
| Relative humidity content | : 41% |
| Air pressure | : 101kPa |

## 3.3 Test equipment utilized

| Measurement Equipment List | | | | |
|---|---|---|---|---|
| **No.** | **Name** | **Model** | **Manufacturer** | **Cal. due date** |
| 1 | EMI test receiver | ESCI | R&S | 2017-11-26 |
| 2 | Triple Loop Antenna | HXYZ 9170 | Schwarzbeck | 2017-11-26 |
| 3 | Single phase Harmonics & Flicker analyser | PACS-1 | California Instruments | 2017-11-26 |
| 4 | AC Power Source | 5001ix | California Instruments | 2017-11-26 |
| 5 | Coupling/Decoupling Network | L 801 M2/M3 | Luethi | 2017-11-26 |
| 6 | Ultra Compact Simulator | UCS 500N7 | EMTEST | 2017-11-26 |
| 7 | ESD Gun | NSG 437 | TESEQ | 2017-11-26 |
| 8 | Current transformer | MC2630 | EMTEST | 2017-11-26 |
| 9 | Motorized variac | MV2616 | EMTEST | 2017-11-26 |
| 10 | Continuous wave simulator | CWS500N1 | EMTEST | 2017-11-26 |
| 11 | Magnetic field coil | MS100 | EMTEST | 2017-11-26 |
| 12 | Current transformer | MC26100 | EMTEST | 2017-11-26 |
| 13 | Artificial mains | ENV216 | R&S | 2017-11-26 |
| 14 | EMI Test Spectrum | E4403B | Agilent | 2017-08-24 |
| 15 | EMI test receiver | ESCS30 | R&S | 2017-04-13 |
| 16 | Broadband Antenna | VULB9168 | Schwarzbeck | 2017-03-25 |
| 17 | Amplifier | 8447D | Agilent | 2017-11-05 |
| 18 | Signal Generator | MG3692B | Anritsu | 2017-04-13 |
| 19 | Logarithmic Periodic Antenna | STCP9128D | Schwarzbeck | 2017-11-21 |
| 20 | Power Amplifier | MT225 | AP32 | 2017-12-03 |
| 21 | Power meter | 4232A/01/02 | Boonton | 2017-04-13 |

## 3.4 Test results

☒ 1st test ☐ test after modification ☐ production test

| Test case | Subclause | Required | Test passed | Test failed |
|---|---|---|---|---|
| Radiated emission | Table 1 of EN 61000-6-3 & CISPR 16-2-3 | ☒ | ☒ | ☐ |
| Conducted emission | Table 2 of EN 61000-6-3 & CISPR 16-2-1 | ☒ | ☒ | ☐ |
| Harmonics current emission | Table 1 of EN 61000-6-3 & EN 61000-3-2 | ☒ | ☒ | ☐ |
| Voltage changes, voltage fluctuations and flicker | Table 1 of EN 61000-6-3 & EN 61000-3-3 | ☒ | ☒ | ☐ |
| Electrostatic discharge | Table 1 of EN 61000-6-1 & IEC 61000-4-2 | ☒ | ☒ | ☐ |
| Radio-frequency electromagnetic field | Table 1 of EN 61000-6-1 & IEC 61000-4-3 | ☒ | ☒ | ☐ |
| Electrical Fast Transients | Table 4 of EN 61000-6-1 & IEC 61000-4-4 | ☒ | ☒ | ☐ |
| Surge immunity | Table 4 of EN 61000-6-1 & IEC 61000-4-5 | ☒ | ☒ | ☐ |
| Injected currents (RF continues conducted) | Table 4 of EN 61000-6-1 & IEC 61000-4-6 | ☒ | ☒ | ☐ |
| Power-frequency Magnetic field | Table 1 of EN 61000-6-1 & IEC 61000-4-8 | ☒ | ☒ | ☐ |
| Voltage dips and interruptions | Table 4 of EN 61000-6-1 & IEC 61000-4-11 | ☒ | ☒ | ☐ |

# 4 Emission Test

## 4.1 Radiated emission

This clause lays down the general requirements for the measurement of Radiated disturbance produced at the space of apparatus.

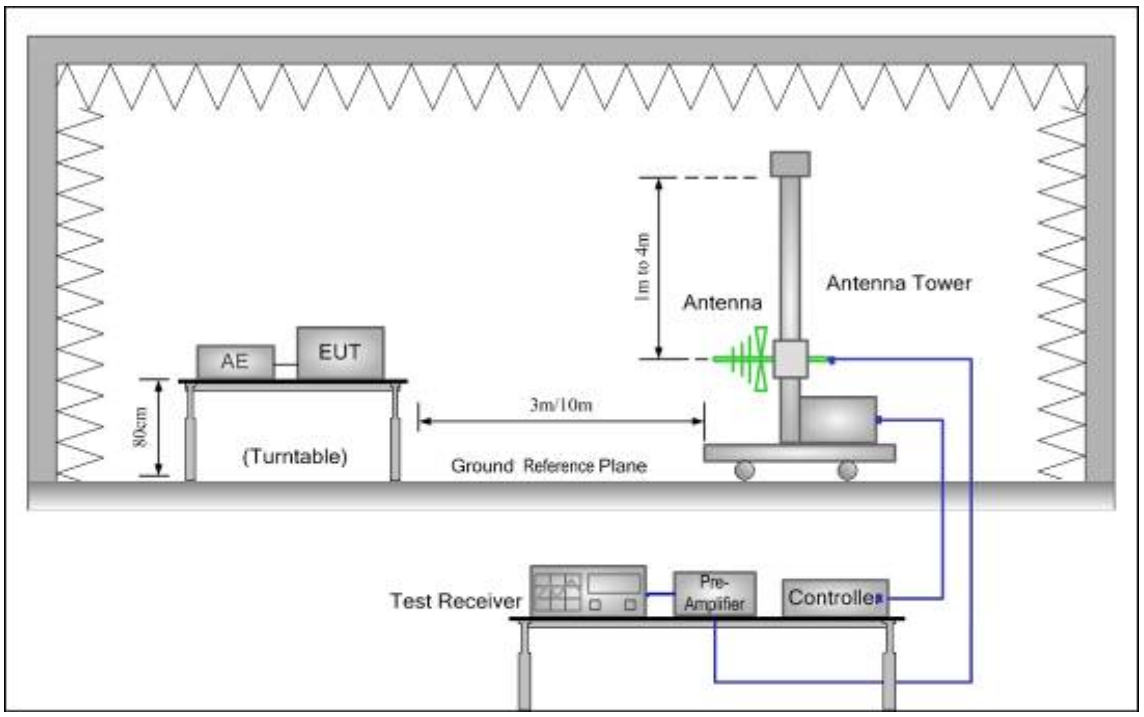
### 4.1.1 Limits

Below 1GHz

| Frequency range | Quasi-peak limits at 3m |
|---|---|
| MHz | dB (μV/m) |
| 30 to 230 | 40 |
| 230 to 1000 | 47 |
| At transitional frequencies the lower limit applies. | |

Above 1GHz is not considered for the highest internal source of the EUT is less than 108MHz.

### 4.1.2 Measurement procedure




1. The radiated emissions test was conducted in a semi-anechoic chamber. The EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.

2. Before get the final emission results with quasi-peak (QP) detector, a pre-scan was performed with the peak (PK) detector to find out the maximum emission data plots of the EUT.

3. The frequencies of maximum emission were determined in the final radiated emissions measurement, the physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance.

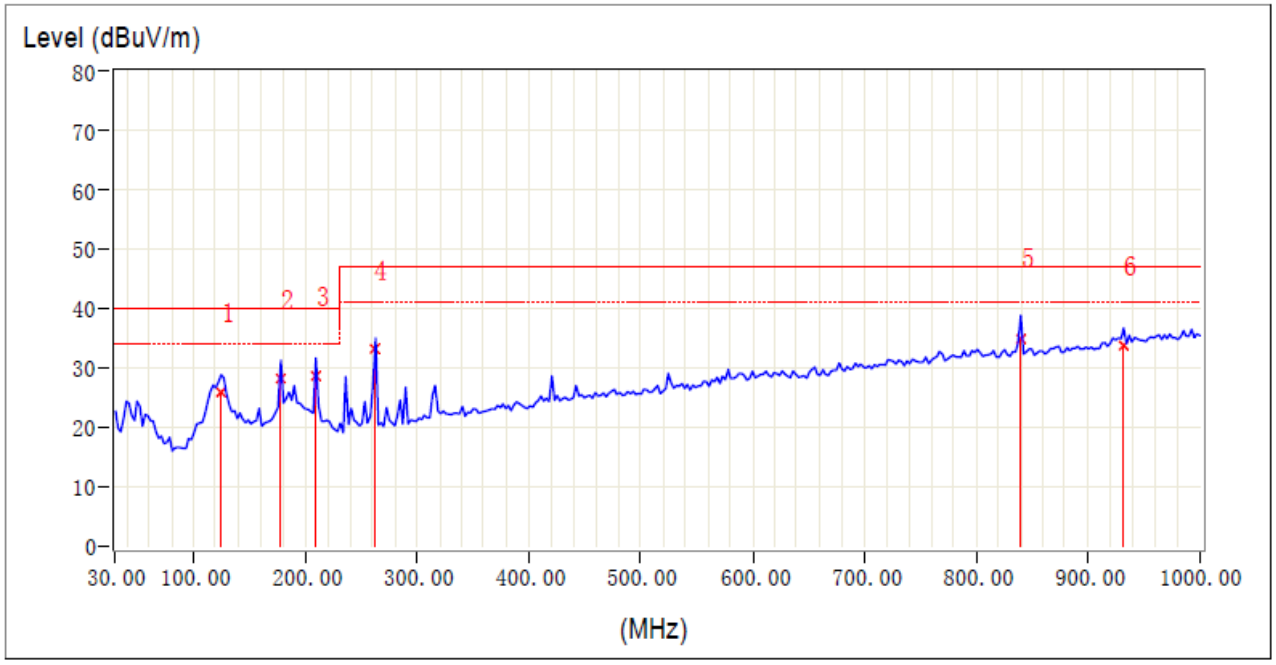
Measurements were performed for both horizontal and vertical antenna polarization. Test was performed on subcontractor.

### 4.1.3 Measurement uncertainty

Ulab(cond) = 3.22dB at 95% level of confidence, k=2

### 4.1.4 Results

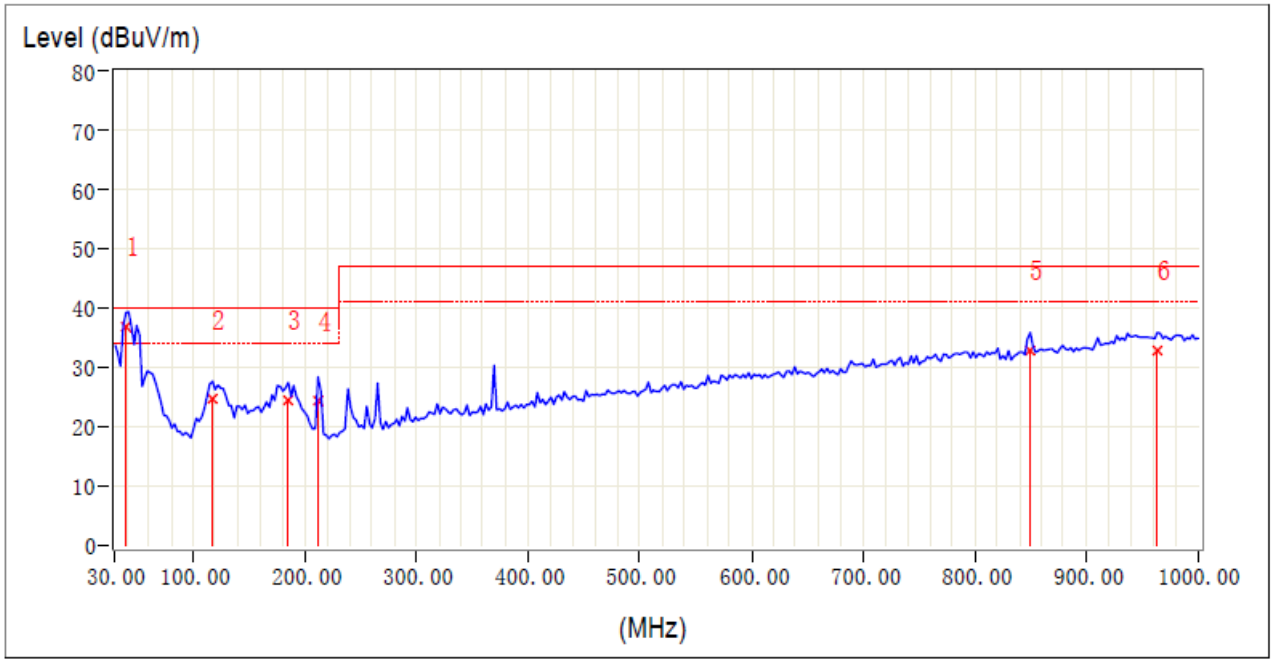
**Horizontal:**
**Level**




| No. | | Frequency | Factor | Reading | Emission | Limit | Over Limit | Tower / Table | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dB | dBuV/m | dBuV/m | dBuV/m | dB | cm | deg |
| | 1 | 124.58 | 12.51 | 13.35 | 25.86 | 40.00 | -14.14 | 200 | 205 |
| | 2 | 177.93 | 13.41 | 14.82 | 28.23 | 40.00 | -11.77 | 200 | 281 |
| * | 3 | 209.45 | 11.66 | 16.99 | 28.65 | 40.00 | -11.35 | 200 | 307 |
| | 4 | 261.90 | 13.16 | 20.04 | 33.20 | 47.00 | -13.80 | 200 | 134 |
| | 5 | 839.95 | 26.68 | 8.15 | 34.83 | 47.00 | -12.17 | 200 | 57 |
| | 6 | 932.10 | 28.24 | 5.48 | 33.72 | 47.00 | -13.28 | 200 | 155 |

Note:
1. All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
2. Emission Level = Reading Level + Factor.

**Vertical**
**Level**




| No. | | Frequency | Factor | Reading | Emission | Limit | Over Limit | Tower / Table | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dB | dBuV/m | dBuV/m | dBuV/m | dB | cm | deg |
| * | 1 | 39.75 | 14.07 | 22.79 | 36.85 | 40.00 | -3.15 | 100 | 89 |
| | 2 | 117.30 | 12.05 | 12.60 | 24.65 | 40.00 | -15.35 | 100 | 234 |
| | 3 | 185.20 | 12.47 | 11.96 | 24.43 | 40.00 | -15.57 | 100 | 57 |
| | 4 | 211.87 | 11.64 | 12.74 | 24.38 | 40.00 | -15.62 | 100 | 344 |
| | 5 | 849.65 | 26.60 | 6.24 | 32.84 | 47.00 | -14.16 | 100 | 345 |
| | 6 | 963.62 | 28.86 | 3.97 | 32.83 | 47.00 | -14.17 | 100 | 205 |

Note:
1. All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
2. Emission Level = Reading Level + Factor.

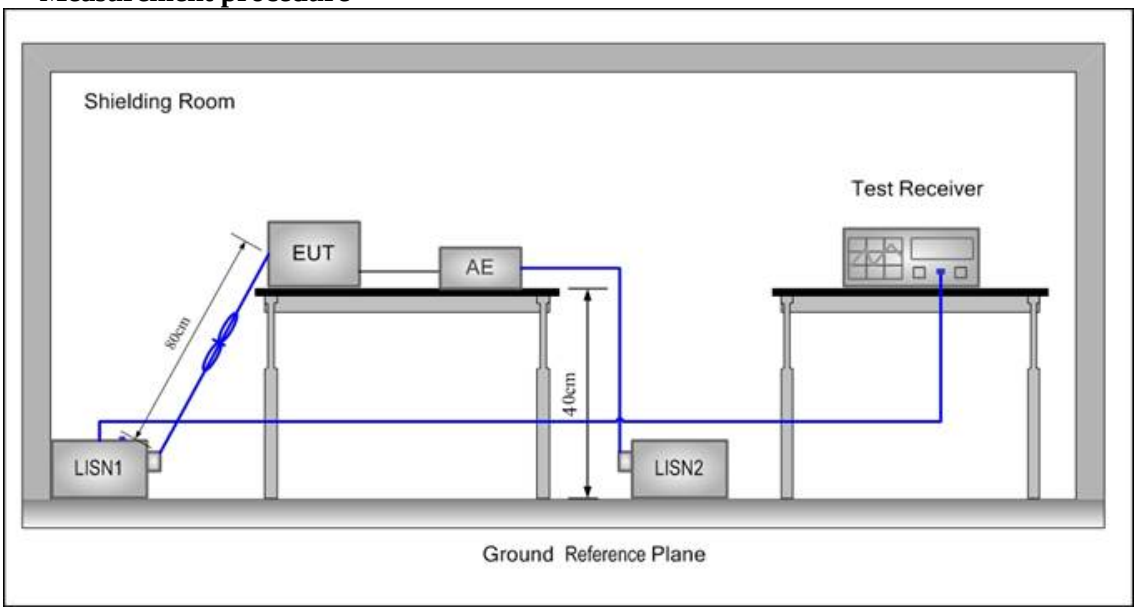
## 4.2 Conducted Emission

This clause lays down the general requirements for the measurement of disturbance voltage produced at the terminals of apparatus.

### 4.2.1 Limits

| Frequency range MHz | At mains terminals dB (μV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |
| Note1: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 30 MHz.<br>Note2: The lower limit is applicable at the transition frequency. | | |

### 4.2.2 Measurement procedure



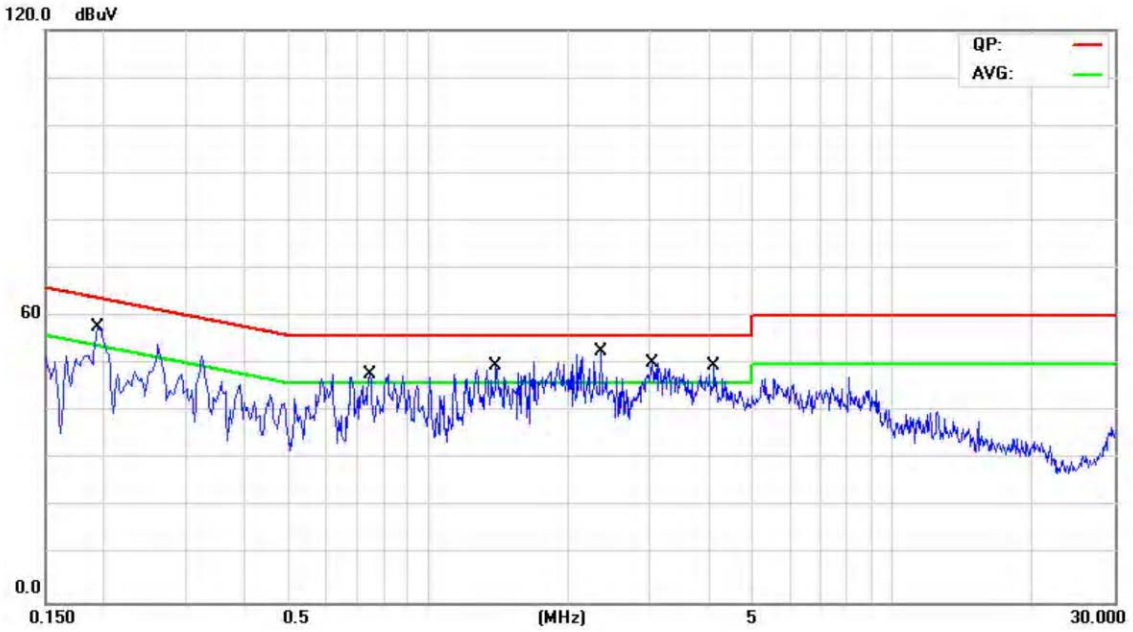

1. The mains terminal disturbance voltage was measured with the EUT in a shielded room.
2. The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a (50 $\mu$H + 5 $\Omega$) || 50 $\Omega$ linear impedance. The power cables of all other units of the EUT was connected to a second LISN, which was bonded to the ground reference plane in the same way as the LISN for the unit being measured.
3. The tabletop EUT was placed upon a non-metallic table 0.4m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.

### 4.2.3 Measurement uncertainty

Ulab(cond) = 2.5dB at 95% level of confidence, k=2

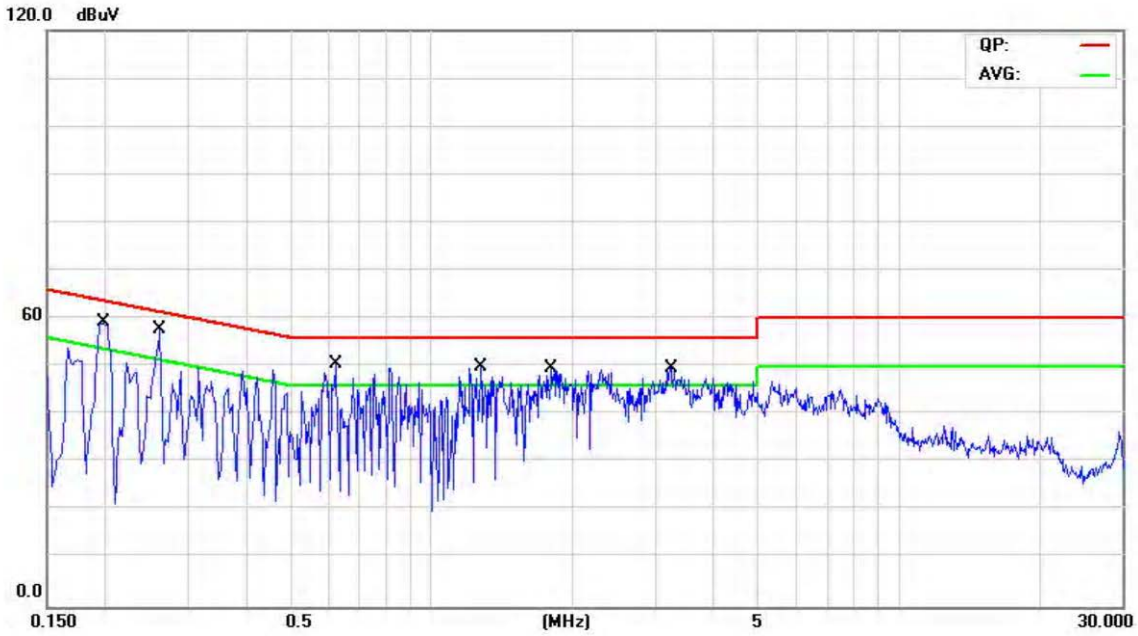
### 4.2.4 Results -Measurement Data

**Live Line:**
**Level**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector |
| 1 | | 0.1940 | 43.25 | 10.49 | 53.74 | 63.86 | -10.12 | QP |
| 2 | | 0.1940 | 31.65 | 10.49 | 42.14 | 53.86 | -11.72 | AVG |
| 3 | | 0.7500 | 34.59 | 10.37 | 44.96 | 56.00 | -11.04 | QP |
| 4 | | 0.7500 | 27.80 | 10.37 | 38.17 | 46.00 | -7.83 | AVG |
| 5 | | 1.4020 | 35.25 | 10.41 | 45.66 | 56.00 | -10.34 | QP |
| 6 | * | 1.4020 | 28.61 | 10.41 | 39.02 | 46.00 | -6.98 | AVG |
| 7 | | 2.3500 | 34.81 | 10.43 | 45.24 | 56.00 | -10.76 | QP |
| 8 | | 2.3500 | 26.85 | 10.43 | 37.28 | 46.00 | -8.72 | AVG |
| 9 | | 3.0380 | 37.15 | 10.45 | 47.60 | 56.00 | -8.40 | QP |
| 10 | | 3.0380 | 27.34 | 10.45 | 37.79 | 46.00 | -8.21 | AVG |
| 11 | | 4.1140 | 30.88 | 10.48 | 41.36 | 56.00 | -14.64 | QP |
| 12 | | 4.1140 | 20.56 | 10.48 | 31.04 | 46.00 | -14.96 | AVG |

**Neutral Line：**
**Level**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector |
| 1 | * | 0.1980 | 46.99 | 10.31 | 57.30 | 63.69 | -6.39 | QP |
| 2 | | 0.1980 | 33.02 | 10.31 | 43.33 | 53.69 | -10.36 | AVG |
| 3 | | 0.2620 | 43.80 | 10.33 | 54.13 | 61.37 | -7.24 | QP |
| 4 | | 0.2620 | 30.88 | 10.33 | 41.21 | 51.37 | -10.16 | AVG |
| 5 | | 0.6220 | 36.87 | 10.41 | 47.28 | 56.00 | -8.72 | QP |
| 6 | | 0.6220 | 25.69 | 10.41 | 36.10 | 46.00 | -9.90 | AVG |
| 7 | | 1.2740 | 37.94 | 10.32 | 48.26 | 56.00 | -7.74 | QP |
| 8 | | 1.2740 | 27.03 | 10.32 | 37.35 | 46.00 | -8.65 | AVG |
| 9 | | 1.8060 | 35.11 | 10.33 | 45.44 | 56.00 | -10.56 | QP |
| 10 | | 1.8060 | 23.98 | 10.33 | 34.31 | 46.00 | -11.69 | AVG |
| 11 | | 3.2540 | 32.48 | 10.34 | 42.82 | 56.00 | -13.18 | QP |
| 12 | | 3.2540 | 20.44 | 10.34 | 30.78 | 46.00 | -15.22 | AVG |

## 4.3 Harmonic Current Emissions

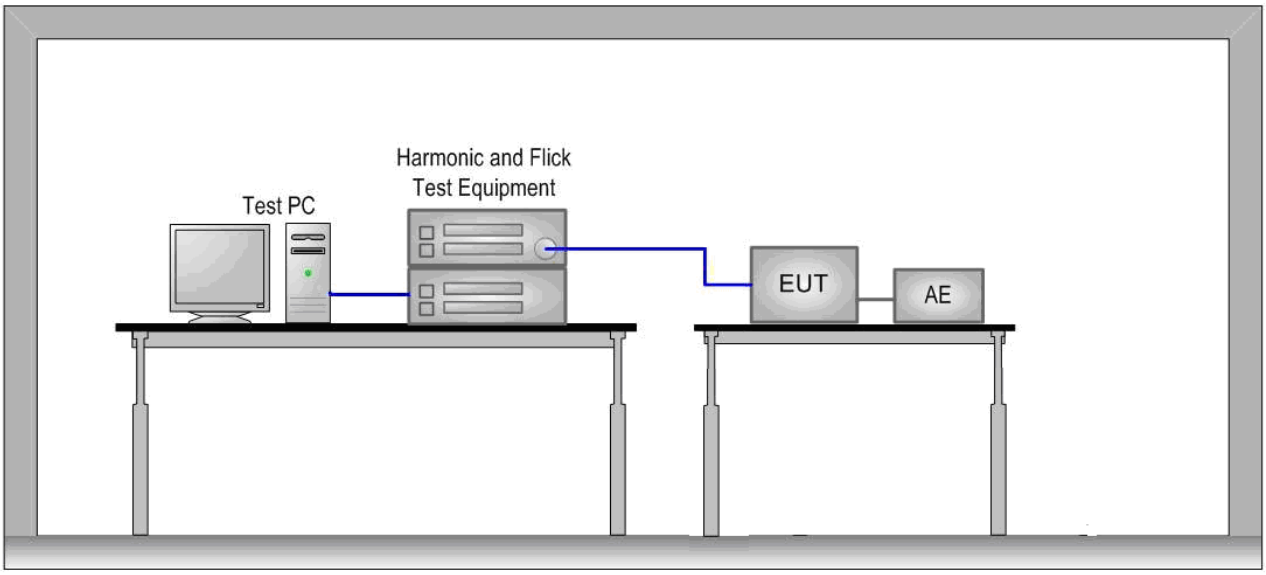
This part deals with the limitation of harmonic currents injected into the public supply system.

### 4.3.1 Limits

Limit for Class A equipment

| Harmonic order<br>n | Maximum permissible harmonic current<br>A |
|---|---|
| **Odd harmonics** | |
| 3 | 2,30 |
| 5 | 1,14 |
| 7 | 0,77 |
| 9 | 0,40 |
| 11 | 0,33 |
| 13 | 0,21 |
| $15 \le n \le 39$ | $0,15 \frac{15}{n}$ |
| **Even harmonics** | |
| 2 | 1,08 |
| 4 | 0,43 |
| 6 | 0,30 |
| $8 \le n \le 40$ | $0,23 \frac{8}{n}$ |

### 4.3.2 Measurement procedure



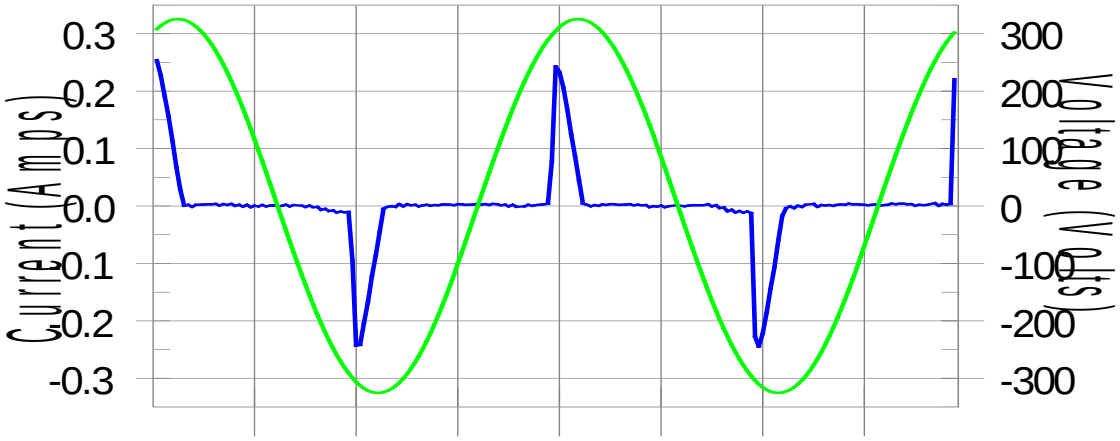

The equipment under test is placed on a wooden table with a height of 0,8 m in the EMC lab. For each harmonic order, measure the 1,5 s smoothed r.m.s. harmonic current in each DFT time window and calculate the arithmetic average of the measured values from the DFT time windows, over the entire observation period. Each harmonic order, all 1.5 s smoothed r.m.s. harmonic current values and the average values for the individual harmonic currents, taken over the entire test observation period shall be less than or equal to the applicable limits.

### 4.3.3 Results

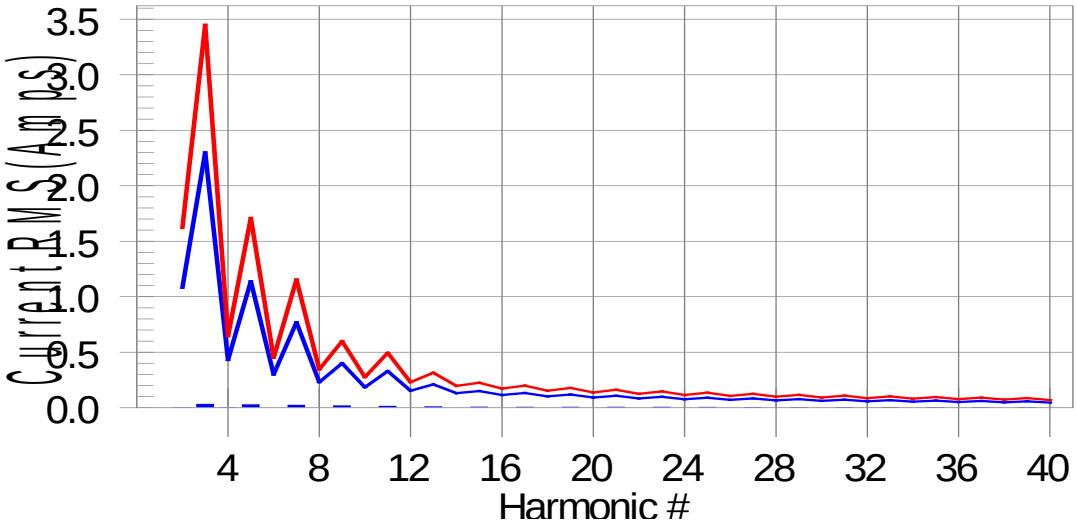
**Harmonic**

**Test Result: Pass** **Source qualification: Normal**

**Current & voltage waveforms**




**Harmonics and Class A limit line** **European Limits**




**Test result: Pass** **Worst harmonic was #3 with 0.00% of the limit.**

**Test Result: Pass** **Source qualification: Normal**
**THC(A): 0.00** **I-THD(%): 0.00** **POHC(A): 0.000** **POHC Limit(A): 0.251**
**Highest parameter values during test:**

| | | | |
|---|---|---|---|
| V_RMS (Volts): | 230.25 | Frequency(Hz): | 50.00 |
| I_Peak (Amps): | 0.259 | I_RMS (Amps): | 0.067 |
| I_Fund (Amps): | 0.035 | Crest Factor: | 4.002 |
| Power (Watts): | 7.8 | Power Factor: | 0.523 |

| Harm# | Harms(avg) | 100%Limit | %of Limit | Harms(max) | 150%Limit | %of Limit | Status |
|---|---|---|---|---|---|---|---|
| 2 | 0.001 | 1.080 | 0.0 | 0.001 | 1.620 | 0.09 | Pass |
| 3 | 0.030 | 2.300 | 1.3 | 0.032 | 3.450 | 0.92 | Pass |
| 4 | 0.001 | 0.430 | 0.0 | 0.001 | 0.645 | 0.17 | Pass |
| 5 | 0.027 | 1.140 | 2.4 | 0.028 | 1.710 | 1.65 | Pass |
| 6 | 0.001 | 0.300 | 0.0 | 0.001 | 0.450 | 0.18 | Pass |
| 7 | 0.023 | 0.770 | 3.0 | 0.023 | 1.155 | 2.02 | Pass |
| 8 | 0.001 | 0.230 | 0.0 | 0.001 | 0.345 | 0.24 | Pass |
| 9 | 0.018 | 0.400 | 4.6 | 0.019 | 0.600 | 3.10 | Pass |
| 10 | 0.001 | 0.184 | 0.0 | 0.001 | 0.276 | 0.28 | Pass |
| 11 | 0.014 | 0.330 | 4.2 | 0.014 | 0.495 | 2.84 | Pass |
| 12 | 0.001 | 0.153 | 0.0 | 0.001 | 0.230 | 0.29 | Pass |
| 13 | 0.010 | 0.210 | 4.7 | 0.010 | 0.315 | 3.17 | Pass |
| 14 | 0.001 | 0.131 | 0.0 | 0.001 | 0.197 | 0.33 | Pass |
| 15 | 0.007 | 0.150 | 4.7 | 0.007 | 0.225 | 3.21 | Pass |
| 16 | 0.001 | 0.115 | 0.0 | 0.001 | 0.173 | 0.37 | Pass |
| 17 | 0.006 | 0.132 | 4.5 | 0.006 | 0.199 | 3.02 | Pass |
| 18 | 0.001 | 0.102 | 0.0 | 0.001 | 0.153 | 0.41 | Pass |
| 19 | 0.006 | 0.118 | 4.8 | 0.006 | 0.178 | 3.25 | Pass |
| 20 | 0.001 | 0.092 | 0.0 | 0.001 | 0.138 | 0.45 | Pass |
| 21 | 0.006 | 0.107 | 5.2 | 0.006 | 0.161 | 3.52 | Pass |
| 22 | 0.001 | 0.084 | 0.0 | 0.001 | 0.125 | 0.50 | Pass |
| 23 | 0.005 | 0.098 | 5.2 | 0.005 | 0.147 | 3.55 | Pass |
| 24 | 0.001 | 0.077 | 0.0 | 0.001 | 0.115 | 0.51 | Pass |
| 25 | 0.004 | 0.090 | 0.0 | 0.004 | 0.135 | 3.31 | Pass |
| 26 | 0.000 | 0.071 | 0.0 | 0.001 | 0.106 | 0.51 | Pass |
| 27 | 0.003 | 0.083 | 0.0 | 0.004 | 0.125 | 2.91 | Pass |
| 28 | 0.000 | 0.066 | 0.0 | 0.000 | 0.099 | 0.50 | Pass |
| 29 | 0.003 | 0.078 | 0.0 | 0.003 | 0.116 | 2.62 | Pass |
| 30 | 0.000 | 0.061 | 0.0 | 0.000 | 0.092 | 0.51 | Pass |
| 31 | 0.003 | 0.073 | 0.0 | 0.003 | 0.109 | 2.60 | Pass |
| 32 | 0.000 | 0.058 | 0.0 | 0.000 | 0.086 | 0.57 | Pass |
| 33 | 0.003 | 0.068 | 0.0 | 0.003 | 0.102 | 2.77 | Pass |
| 34 | 0.000 | 0.054 | 0.0 | 0.000 | 0.081 | 0.61 | Pass |
| 35 | 0.003 | 0.064 | 0.0 | 0.003 | 0.096 | 2.88 | Pass |
| 36 | 0.000 | 0.051 | 0.0 | 0.000 | 0.077 | 0.64 | Pass |
| 37 | 0.002 | 0.061 | 0.0 | 0.003 | 0.091 | 2.79 | Pass |
| 38 | 0.000 | 0.048 | 0.0 | 0.000 | 0.073 | 0.64 | Pass |
| 39 | 0.002 | 0.058 | 0.0 | 0.002 | 0.087 | 2.53 | Pass |
| 40 | 0.000 | 0.046 | 0.0 | 0.000 | 0.069 | 0.63 | Pass |

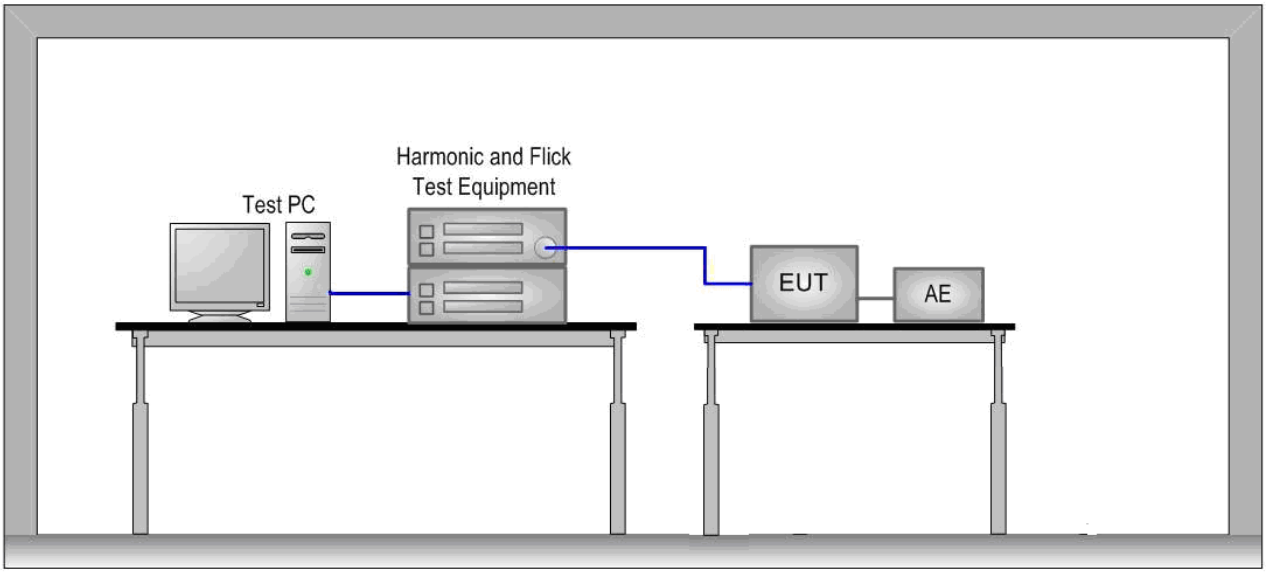
## 4.4 Voltage Changes, Voltage Fluctuations and Flicker

This part is concerned with the limitation of voltage fluctuations and flicker impressed on the public low-voltage system.

### 4.4.1 Limits

| Value | Limit |
|---|---|
| Pst | 1,0 |
| Plt | 0,65 |
| dt | 3,3% |
| dc | 3,3% |
| dmax | 4,0% |

### 4.4.2 Measurementest procedure




The equipment under test is placed on a wooden table with a height of 0,8 m in the EMC lab. The voltage fluctuations and flicker were measured at the supply terminals of the EUT. Test was performed on AC port.

### 4.4.3 Results

**Test Result: Pass** **Status: Test Completed**

**Parameter values recorded during the test:**

| | | | | |
|---|---|---|---|---|
| **Vrms at the end of test (Volt):** | **229.97** | | | |
| **Highest dt (%):** | **0.00** | **Test limit (%):** | **3.30** | **Pass** |
| **Time(mS) > dt:** | **0.0** | **Test limit (mS):** | **500.0** | **Pass** |
| **Highest dc (%):** | **0.00** | **Test limit (%):** | **3.30** | **Pass** |
| **Highest dmax (%):** | **0.00** | **Test limit (%):** | **4.00** | **Pass** |
| **Highest Pst (10 min. period):** | **0.000** | **Test limit:** | **1.000** | **Pass** |

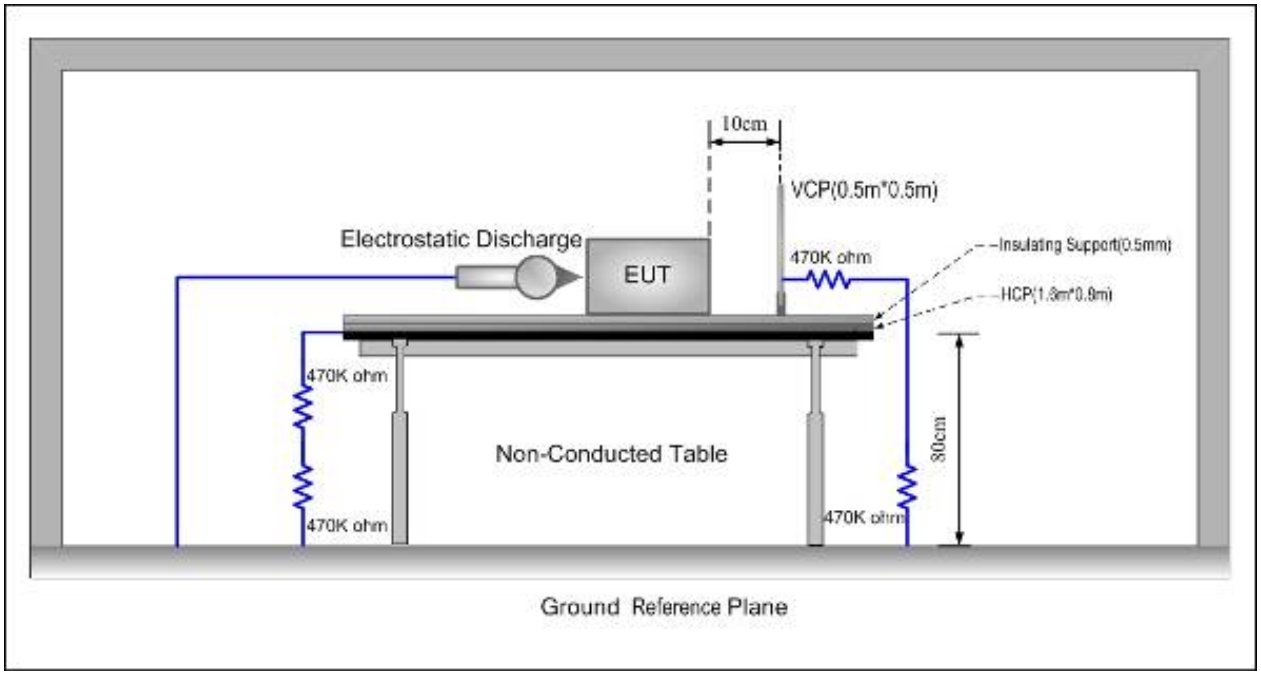
# 5 Immunity Test

## 5.1 Performance Criteria Description in Clause 4 of EN 61000-6-1

| | |
|---|---|
| **Criterion A:** | The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended. |
| **Criterion B:** | The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended. |
| **Criterion C:** | Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls. |

## 5.2 ESD

### 5.2.1 Test Procedures




1. Contact discharge was applied only to conductive surfaces of the EUT. Air discharge was applied only to non-conducted surfaces of the EUT.
2. The EUT was put on a 0.8m high wooden table for table-top equipment or 0.1m high for floor standing equipment standing on the ground reference plane (GRP).
3. A horizontal coupling plane(HCP) 1.6m by 0.8m in size was placed on the table, and the EUT with its cables were isolated from the HCP by an insulating support thick than 0.5mm. The VCP 0.5m by 0.5m in size while HCP were constructed from the same material type and thickness as that of the GRP, and connected to the GRP via a 470kΩ resistor at each end. The distance between EUT and any of the other metallic surface excepted the GRP, HCP and VCP was greater than 1m.
4. During the contact discharges, the tip of the discharge electrode was touch the EUT before the discharge switch is operated. During the air discharges, the round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT. After each discharge, the ESD generator was removed from the EUT, the generator is then retriggered for a new single discharge. For ungrounded product, a discharge cable with two resistances were used after each discharge to remove remnant electrostatic voltage. 10 times of each polarity single discharge were applied to HCP and VCP.

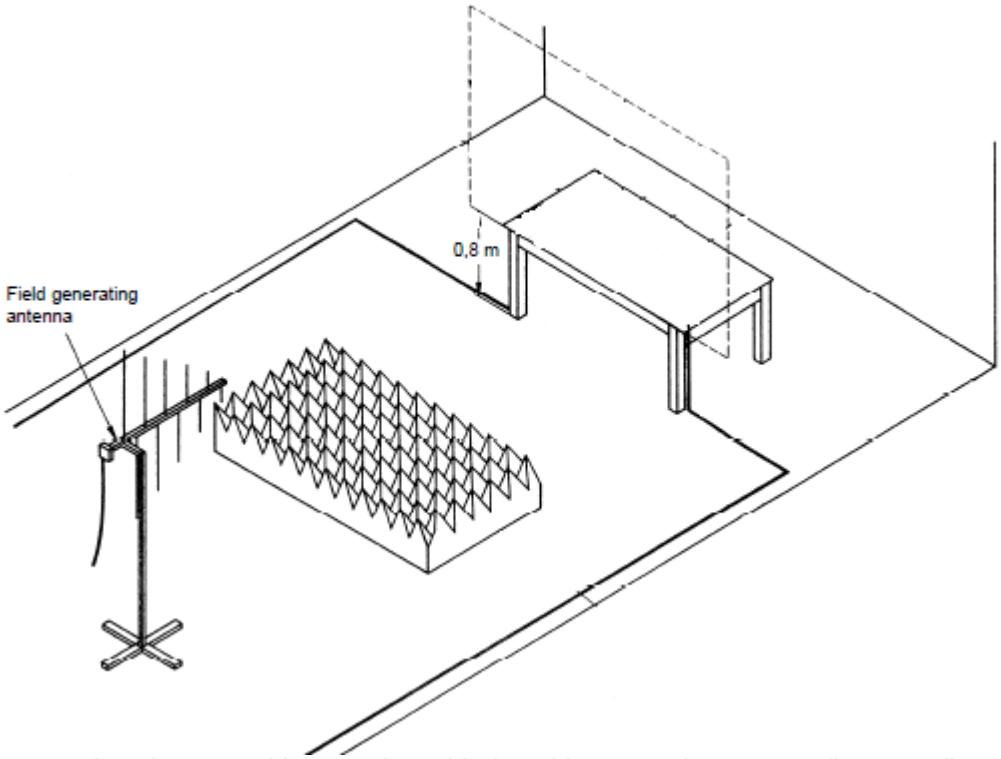
### 5.2.2 Results

| Test point | Table (T) Floor (F) | Contact (C) Air (A) | Voltage (kV) | Number of discharge | Polarity (+ / -) | Opinion |
|---|---|---|---|---|---|---|
| Air discharge | T | A | 8 | 20 | + / - | A |
| Contact discharge | T | C | 4 | 20 | + / - | A |
| HCP | T | C | 4 | 20 | + / - | A |
| VCP | T | C | 4 | 20 | + / - | A |

A: no loss of function.

## 5.3 Radio frequency electromagnetic fields

### 5.3.1 Measurement procedure




1. The EUT was placed on 0.8m high wooden table for table-top equipment. For floor standing equipment, the EUT was placed on a 0.1m high wooden support above the GRP. The tests normally shall be performed with the generating antenna facing each of four sides of the EUT. When equipment can be used in different orientations (e.g. vertical or horizontal) the test shall be performed on all possible sides of the EUT.

2. The tests are carried out with a field strength by 3 V/m (measured in the unmodulated field) with amplitude modulated signal by a depth of 80 % by a sinusoidal audio signal of 1 kHz. The logarithmic step was 1% and the dwell time was 3s dependent of the EUT cycle time. Test was performed on subcontractor.

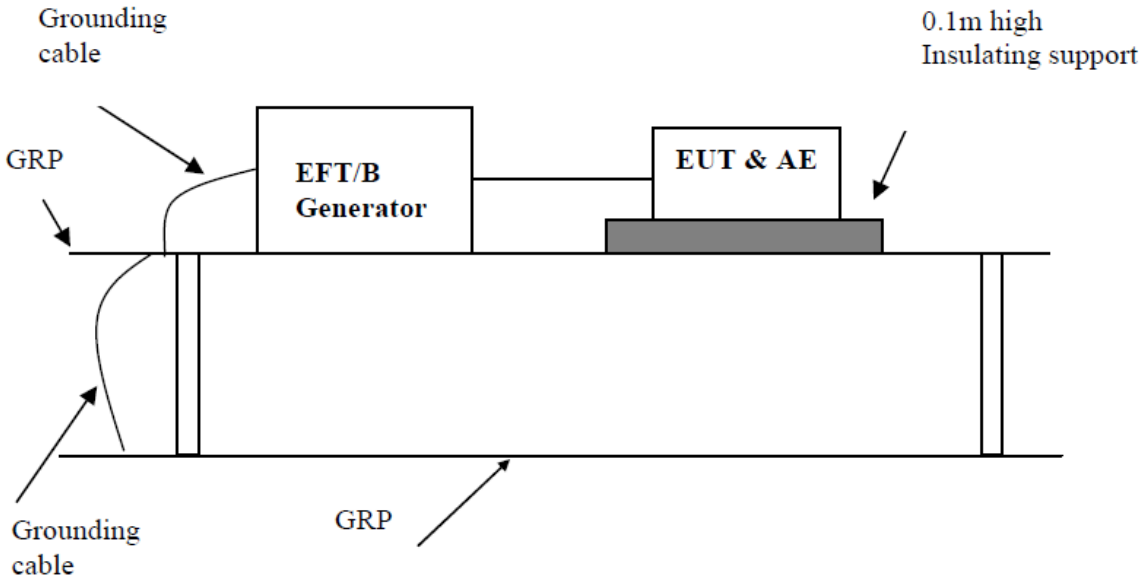
### 5.3.2 Results

| Frequency Range | Field Strength | Modulation | Opinion |
|---|---|---|---|
| 80MHz to 1GHz | 3V/m | 80% AM 1kHz | A |
| 1.4GHz to 2GHz | 3V/m | 80% AM 1kHz | A |
| 2GHz to 2.7GHz | 1V/m | 80% AM 1kHz | A |

A: no loss of function.

## 5.4 Electrical Fast Transients

### 5.4.1 Measurement procedure




1. The EUT was placed on a ground reference plane(GRP) insulated by an insulating support 0,1 m thick and the GRP was placed on a 0.8m high wooden table for table-top equipment. For floor standing equipment, the EUT was placed on a 0.1m high wooden support above the GRP.
2. The GRP shall project beyond the EUT and the clamp by at least 0.1m on all sides. The distance between the EUT and any other of the metallic surface except the GRP was greater than 0.5m. All cables to the EUT was placed on the insulation support 0.1m above GRP. Cables not subject to EFT was routed as far as possible from cable under test to minimize the coupling between the cables.
3. The length of signal and power cable between the EUT and EFT generator was 0.5m. If the cable is a non-detachable supply cable more than 0.5m, the excess length of this cable shall be folded to avoid a flat coil and situated at a distance of 0.1m above the GRP.

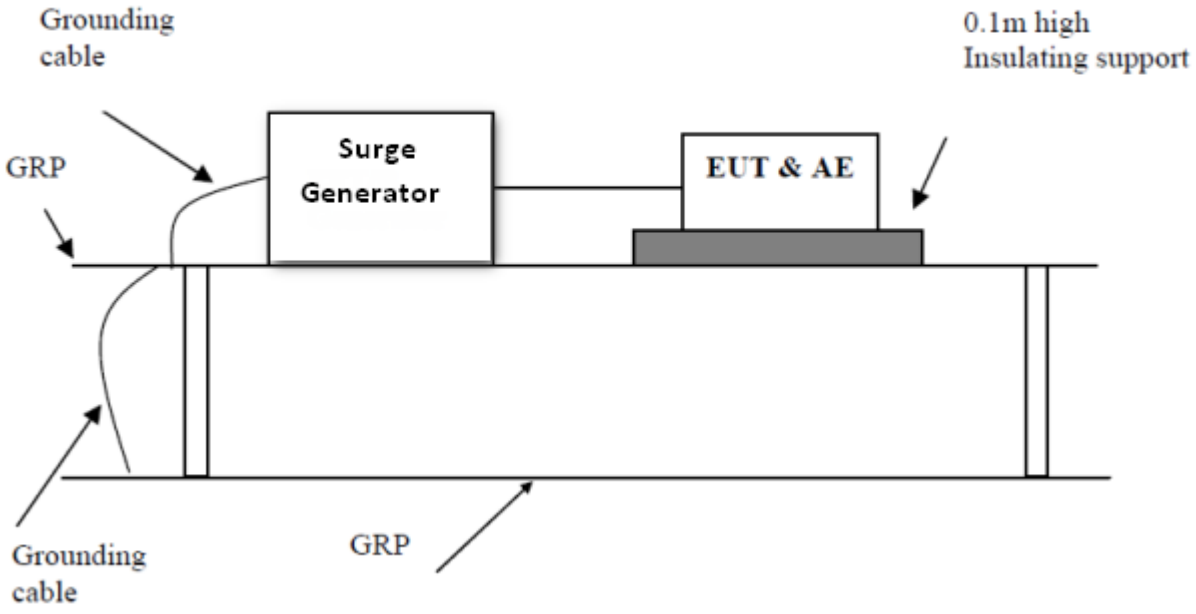
### 5.4.2 Results

| Test port | Voltage (kV) | Polarity (+ / -) | Duration (s or min) | Waveform Tr / Th | Repetition Frequency (kHz) | Opinion |
|---|---|---|---|---|---|---|
| AC power line | 1 | + / - | 2 min | 5/50 ns | 5 | A |

A: no loss of function.

## 5.5 Surge Immunity

### 5.5.1 Measurement procedure




1. The EUT was placed on a ground reference plane(GRP) insulated by an insulating support 0,1 m thick and the GRP was placed on a 0.8m high wooden table for table-top equipment. For floor standing equipment, the EUT was placed on a 0.1m high wooden support above the GRP.
2. The 1,2/50 μs surge was to be applied to the EUT power supply terminals via the capacitive coupling network .Decoupling networks were required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines and to provide sufficient decoupling impedance to the surge wave so that the specified wave may be applied on the lines under test.
3. Test was performed on AC port. Five positive and five negative pulses each at 0º, 90º, 180º and at 270º. Time between successive pulses: 1 min.

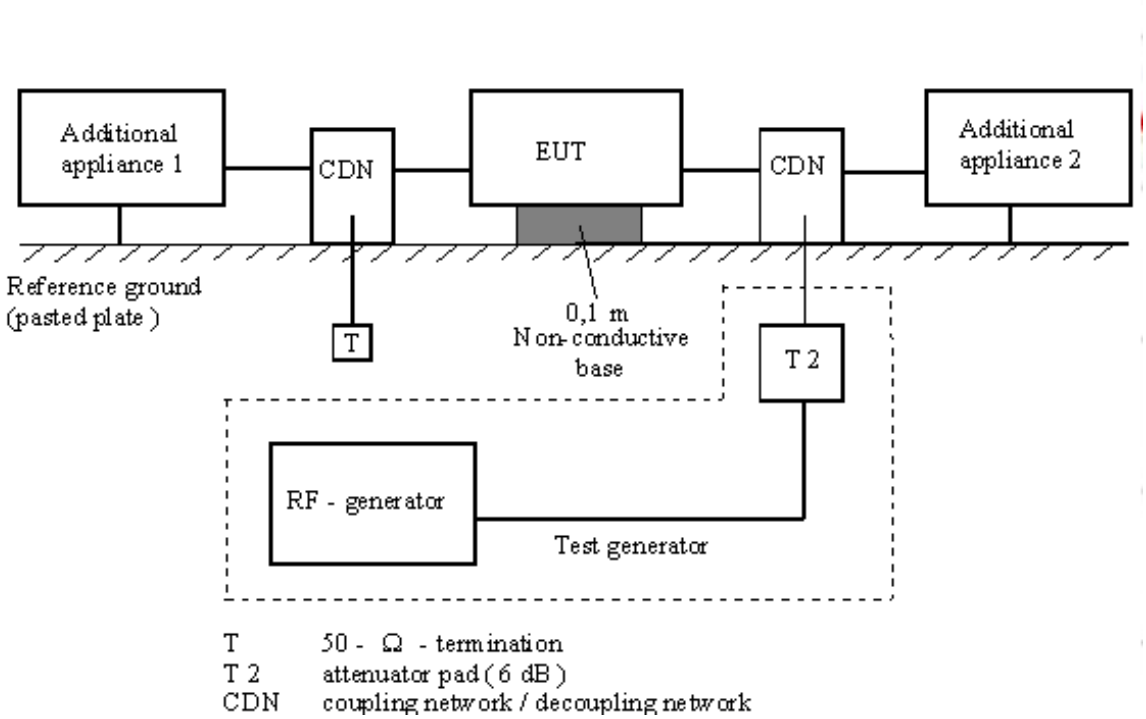
### 5.5.2 Results

| Test mode | Voltage ( kV ) | Waveform Tr / Th | Number of pulses | Opinion |
|---|---|---|---|---|
| L-N | +1 / -1 | 1.2/50 μs | 5 | A |

A: no loss of function.

## 5.6 Injected currents

### 5.6.1 Measurement procedure




1. The EUT was placed on an insulating support of 0.1m height above a ground reference Plane, arranged and connected to satisfy its functional requirement. All cables exiting the EUT was supported at a height of at least 30 mm above the ground reference plane.
2. The coupling and decoupling devices were required, they were located between 0,1 m and 0,3 m from the EUT. This distance was to be measured horizontally from the projection of the EUT on to the ground reference plane to the coupling and decoupling device.
3. The frequency range was swept from 150 kHz to 80 MHz, using the signal levels established during the setting process, and with the disturbance signal 80 % amplitude modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or to change coupling devices as necessary. Where the frequency was swept incrementally, the step size do not exceed 1 % of the preceding frequency value. The dwell time of the amplitude modulated carrier at each frequency was not less than the time necessary for the EUT to be exercised and to respond, and was not less than 1.0 s.

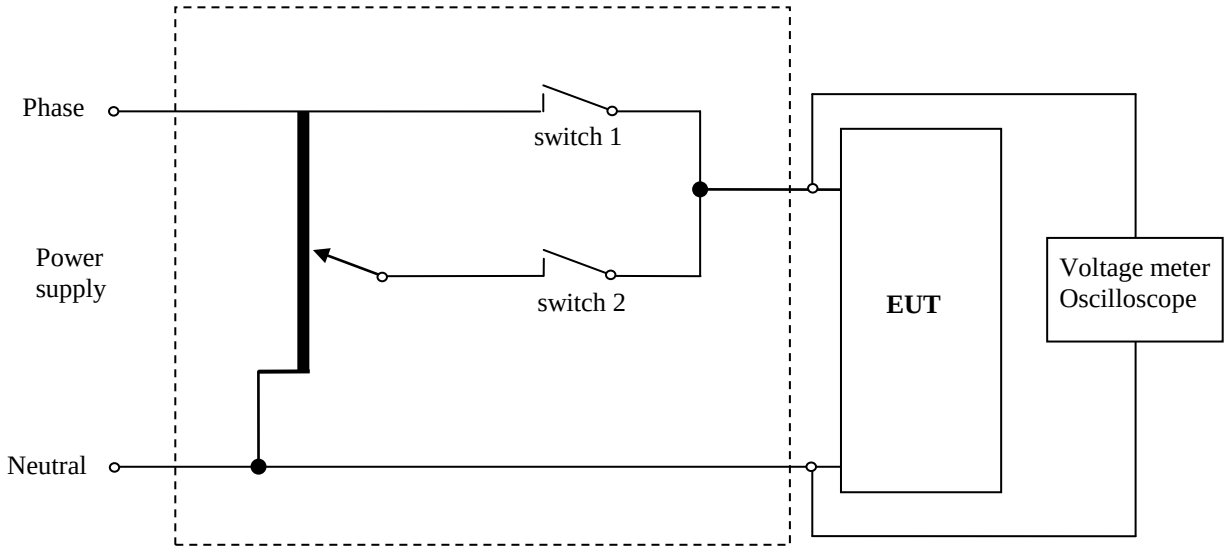
### 5.6.2 Results

| Test port | Voltage (e.m.f.) | Modulation | Frequency Range | Opinion |
|---|---|---|---|---|
| AC power line | 3V | 80% AM 1 kHz | 150 kHz - 80 MHz | A |

A: no loss of function.

## 5.7 Voltage dips and Interruption

### 5.7.1 Measurement procedure




1. The EUT was placed on a ground reference plane(GRP) insulated by an insulating support 0,1 m thick and the GRP was placed on a 0.8m high wooden table for table-top equipment. For floor standing equipment, the EUT was placed on a 0.1m high wooden support above the GRP.
2. The test was performed with the EUT connected to the test generator with the shortest power supply cable as specified by the EUT manufacturer. Voltage change shall occur at zero crossing
3. The EUT was tested for each selected combination of test level and duration with a sequence of three dips /interruptions with intervals of 10 s minimum. Each representative mode of operation was tested.

### 5.7.2 Results

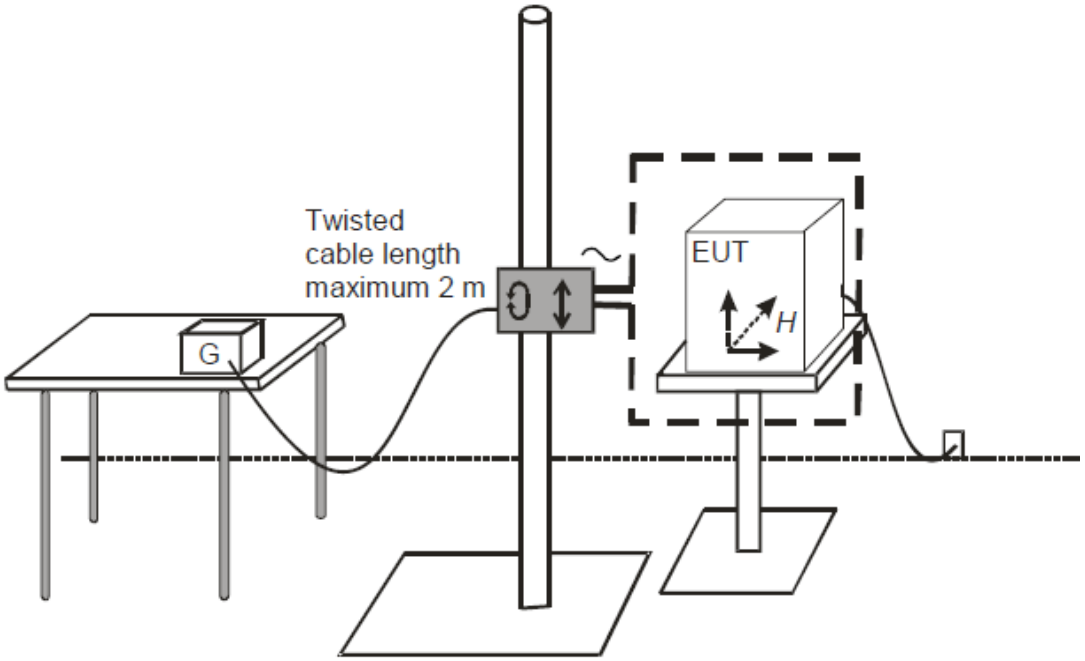
| Reduction of supply voltage of | Voltage in % (in V) | Duration in parts of period (in ms) | Opinion |
|---|---|---|---|
| 100% | 0 % (0V) | 0,5 (10 ms) | A |
| 100% | 0 % (0V) | 1 (20 ms) | A |
| 30 % | 70 % (161V) | 25 (500 ms) | B |
| 100% | 0 % (0V) | 250(5000ms) | B |

A: no loss of function.
B: the appliance could not work during test, but after test, it would recover its function.

## 5.8 Frequency magnetic field

The magnetic fields to which equipment is subjected may influence the reliable operation of equipment and systems.

### 5.8.1 Measurement procedure




The electromagnetic conditions of the laboratory shall be such as to guarantee the correct operation of the EUT in order not to influence the test results; otherwise, the tests shall be carried out in a Faraday cage. The plane of the inductive coil shall then be rotated by 90° in order to expose the EUT to the test field with different orientations.

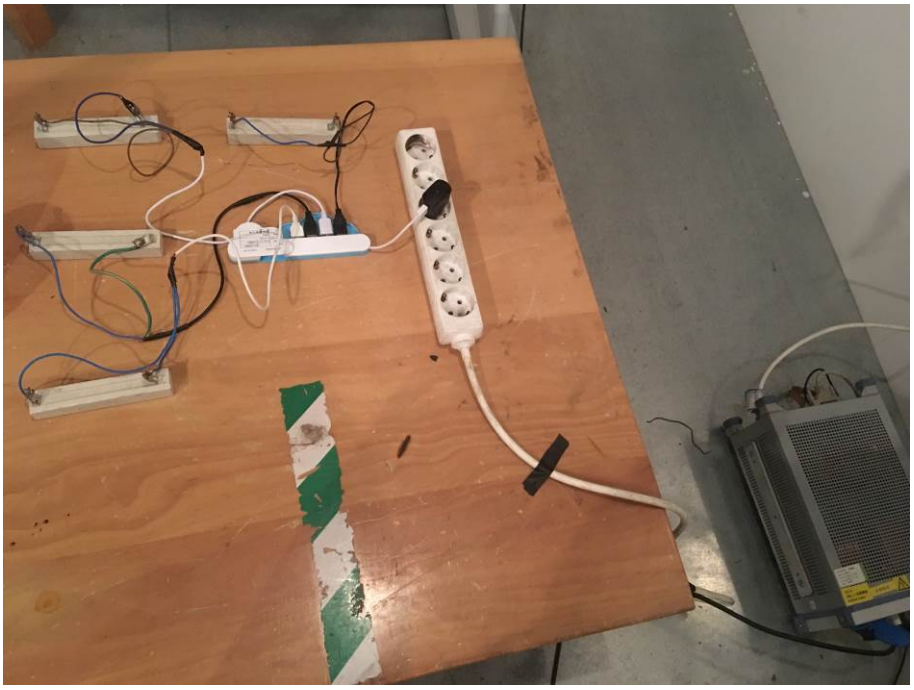
### 5.8.2 Results

| Test Frequency | Field Level (A/m) | Duration (Second) | Axis of Orientation | Opinion |
|---|---|---|---|---|
| 50/60Hz | 3 | 60 | X | A |
| 50/60Hz | 3 | 60 | Y | A |
| 50/60Hz | 3 | 60 | Z | A |

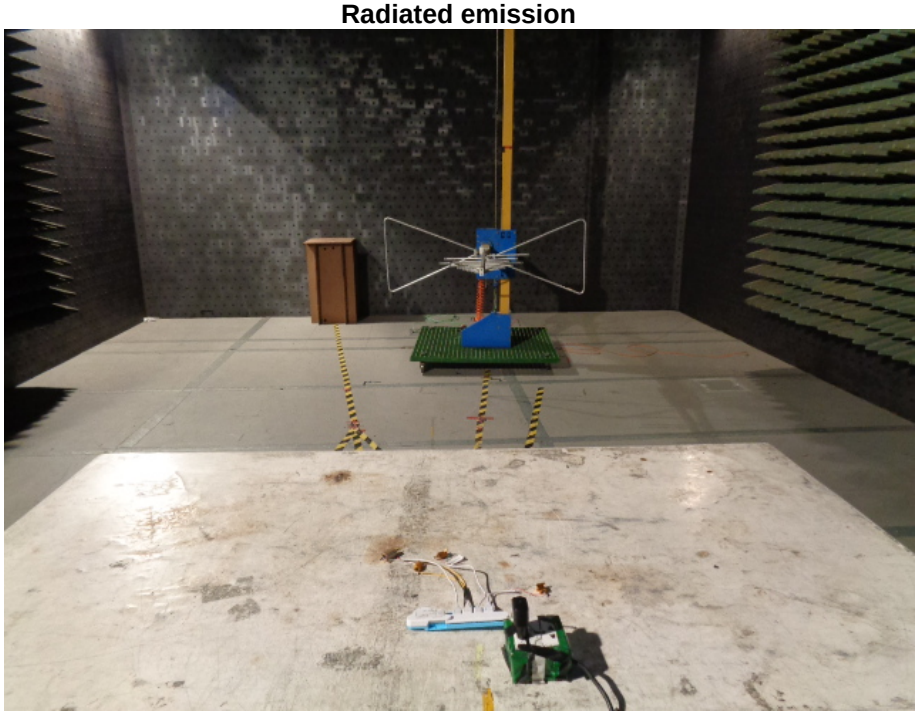
A: no loss of function.

# 6 Test Setup Photos

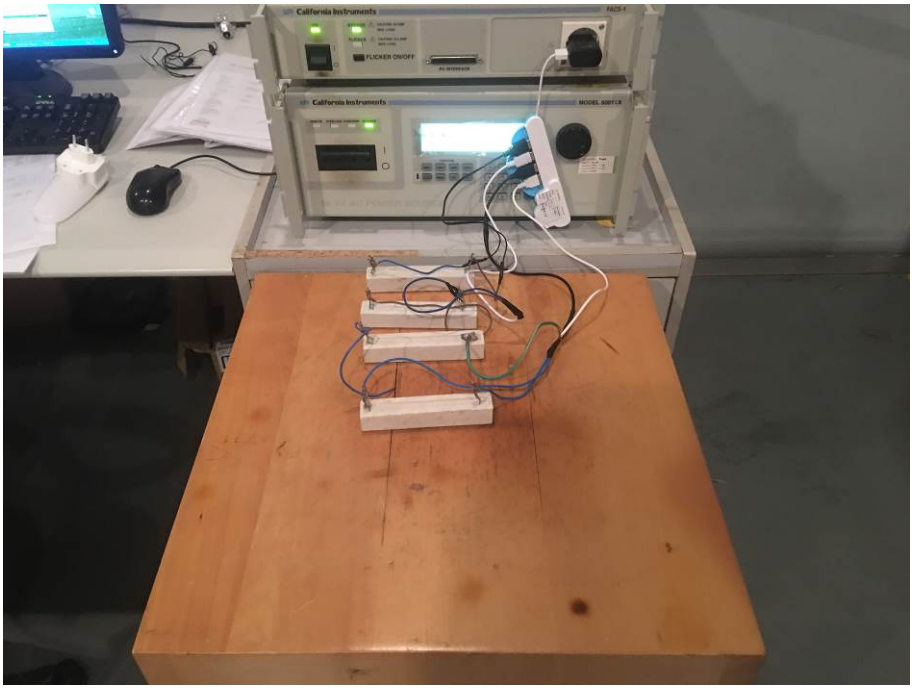
**Conducted disturbance**



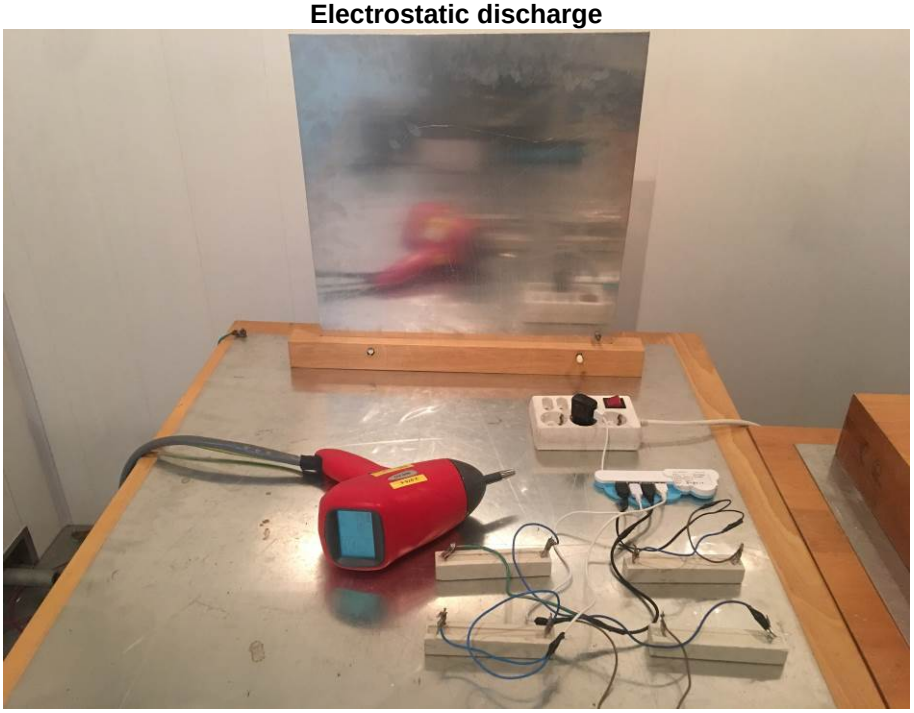
**Radiated emission**



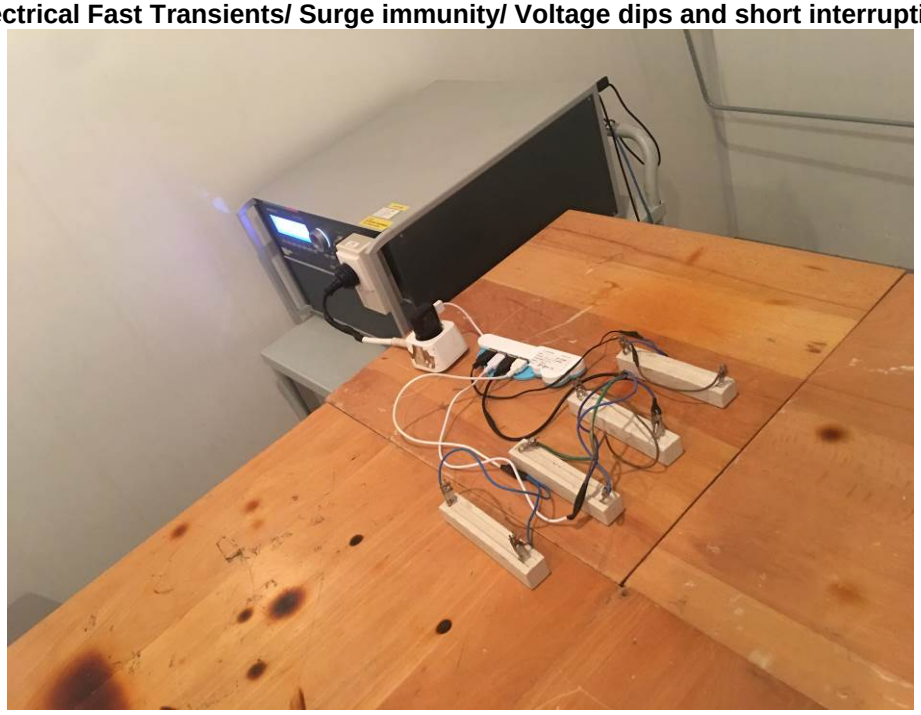
**Harmonic/Flicker**



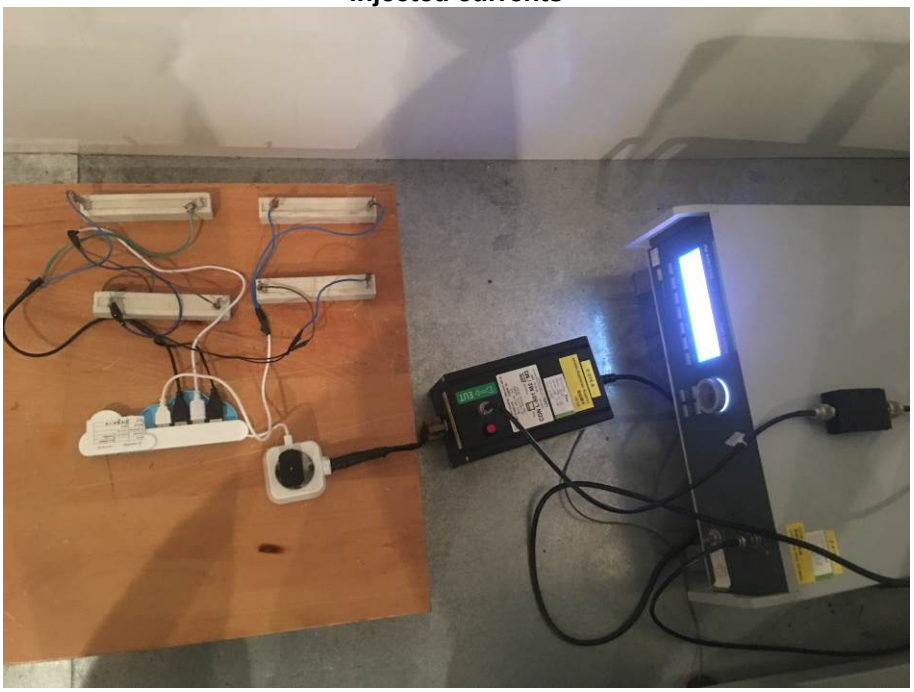

**Electrostatic discharge**



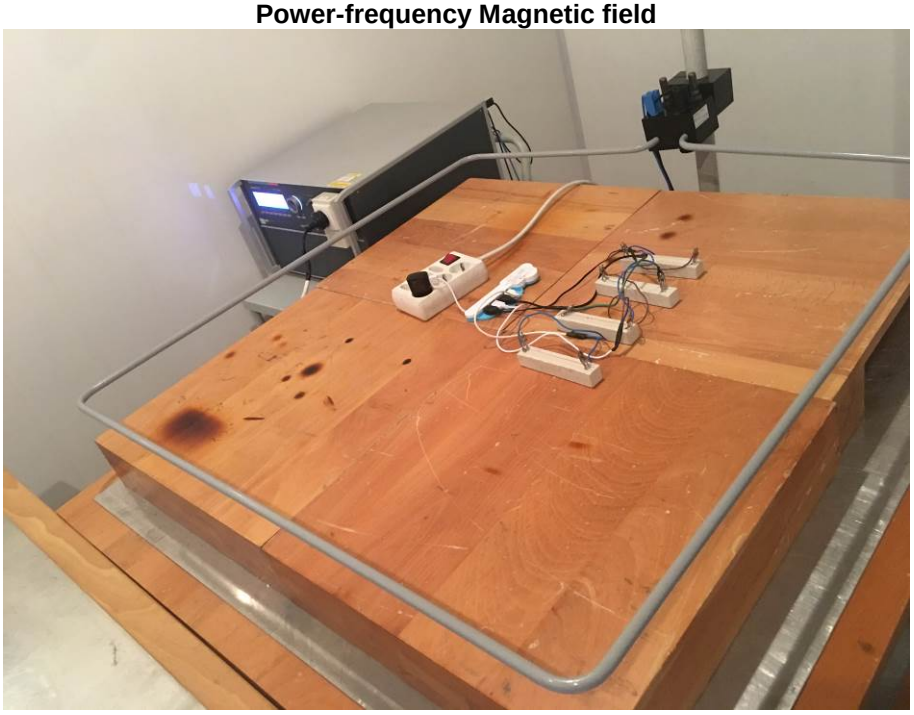
**Electrical Fast Transients/ Surge immunity/ Voltage dips and short interruption**



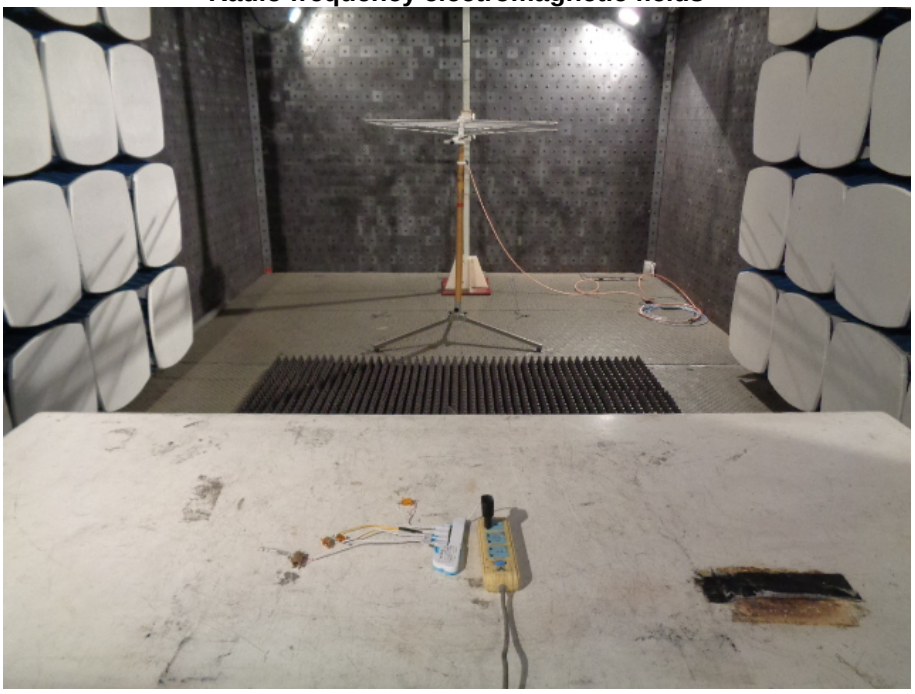
**Injected currents**



**Power-frequency Magnetic field**



**Radio frequency electromagnetic fields**



# 7 EUT Photos

Photo 1
Overall view

Photo 2
Overall view

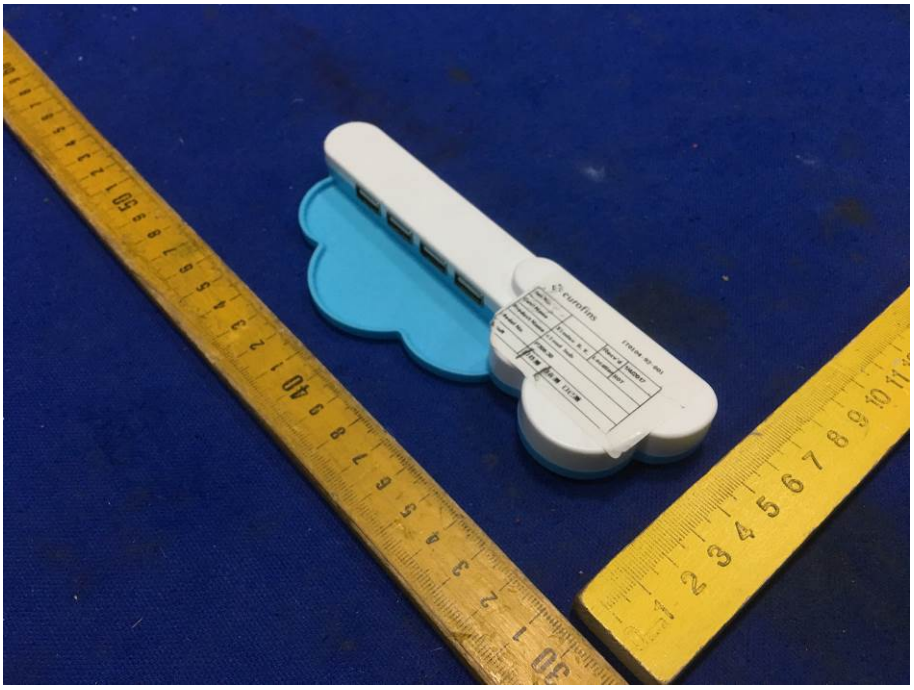


Photo 3
Internal view

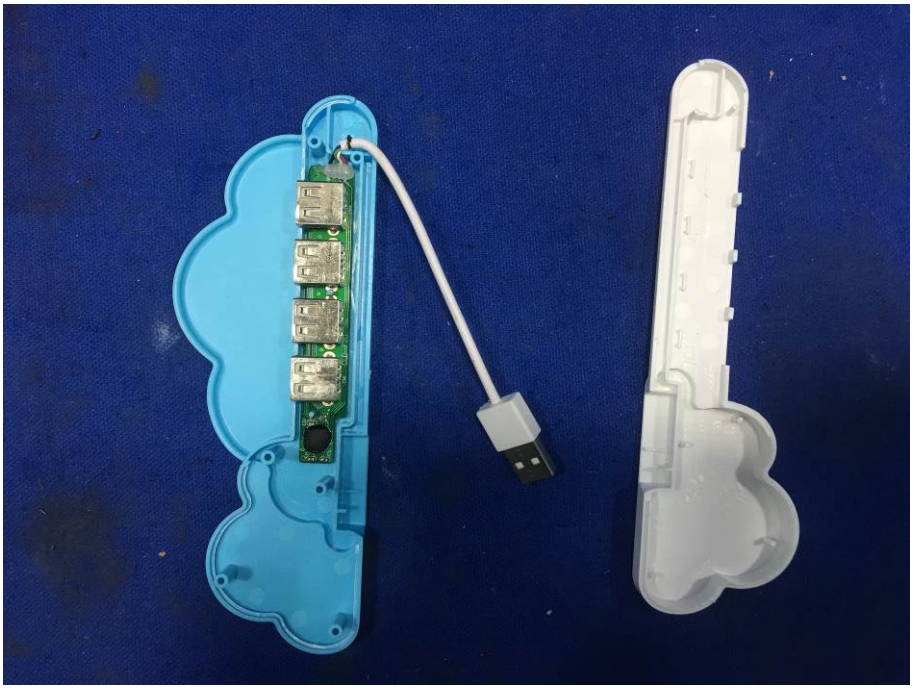


Photo 4
PCB view

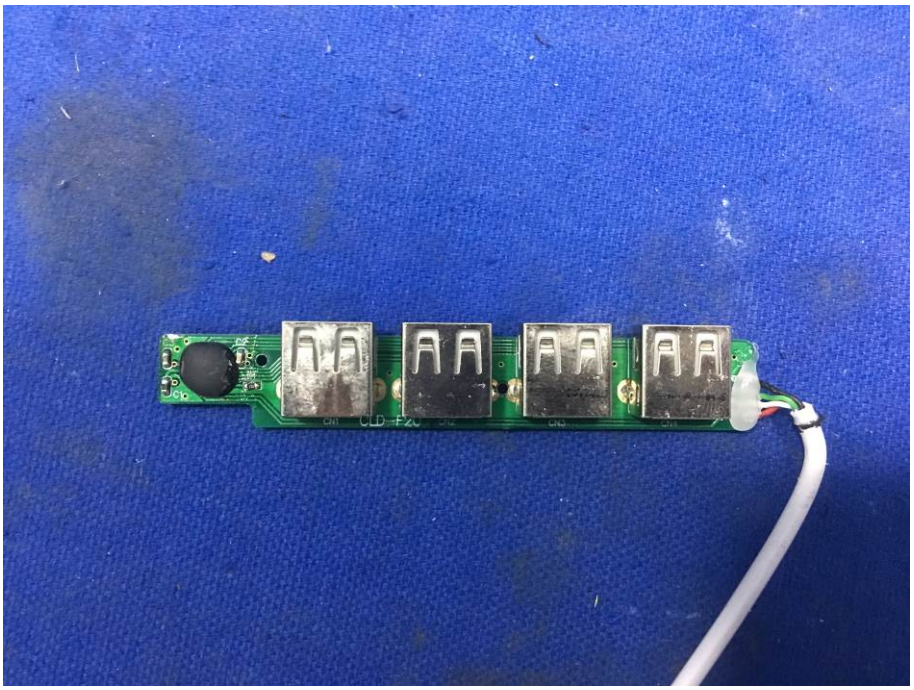


Photo 5
PCB view