

# TEST REPORT

Report No..... : ZHT-240529024E

Product..... : Stepper motor

Trademark..... : **XINJE**

Model(s)..... : MP3-110H120  
MP3-110H160, MP3-110H200, MP3-130H280, MP3-130H350,  
MP3-130H500

Model Difference..... MP3-110H120 is the test model, while other models are derivative models. These models are the same on the circuit, with only different model names. Therefore, the test data of MP3-110H120 can represent the remaining models.

Applicant..... : Wuxi Xinje Electric Co., Ltd.

Address..... : No.816, Jianzhu West Road, Binhu District, Wuxi City, Jiangsu Province, China

Manufacturer..... : Wuxi Xinje Electric Co., Ltd.

Address..... : No.816, Jianzhu West Road, Binhu District, Wuxi City, Jiangsu Province, China

Prepared by..... : Guangdong Zhonghan Testing Technology Co., Ltd.

Address..... : Room 104, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Date of Receipt..... : May 29, 2024

Date of Test(s)..... : May 29, 2024 - June 12, 2024

Date of Issue..... : June 12, 2024

Test Standard(s)..... : EN IEC 61800-3:2018  
EN 61000-3-12:2011  
EN IEC 61000-3-11:2019

In the configuration tested, the EUT complied with the standards specified above.

Tested by:

*Kimi Lu*

Kimi Lu/ Engineer

Reviewed by:

*Baret Wu*

Baret Wu/ Director



**Note:** The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report shall not be reproduced except in full, without prior written approval of ZHT. This document may be altered or revised by ZHT, personnel only, and shall be noted in the revision of the document.



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1. Revision History

| Report No.     | Issue Date    | Description | Approved |
|----------------|---------------|-------------|----------|
| ZHT-240529024E | June 12, 2024 | Original    | Valid    |
|                |               |             |          |

## 2. Test Summary

| Emission                               |                       |                      |        |
|----------------------------------------|-----------------------|----------------------|--------|
| Requirement - Test                     | Test Method           | Limit                | Result |
| Conducted Emission                     | EN IEC 61800-3:2018   | Class A              | PASS   |
| Radiated Emission                      | EN IEC 61800-3:2018   | Class A              | PASS   |
| Immunity                               |                       |                      |        |
| Requirement - Test                     | Test Method           | Performance criteria | Result |
| Electrostatic discharges               | EN 61000-4-2:2009     | B                    | PASS   |
| Radio-frequency electromagnetic fields | EN 61000-4-3:2020     | A                    | PASS   |
| Fast transients                        | EN 61000-4-4:2012     | B                    | PASS   |
| Surges                                 | EN 61000-4-5:2014     | B                    | PASS   |
| Injected currents                      | EN IEC 61000-4-6:2023 | A                    | PASS   |
| Power frequency magnetic fields        | EN 61000-4-8:2010     | A                    | N/A    |
| Voltage dips and short interruptions   | EN 61000-4-11:2020    | A & C & C & C & C    | PASS   |

| Requirement - Test                                | Test Method            | Limit    | Result |
|---------------------------------------------------|------------------------|----------|--------|
| Harmonic current emissions                        | EN 61000-3-12:2011     | Class A  | PASS   |
| Voltage changes, voltage fluctuations and flicker | EN IEC 61000-3-11:2019 | Clause 5 | PASS   |

Remark: N/A is abbreviation for Not Applicable.

### 3. General Information

#### 3.1. Description of EUT

|                             |                                        |
|-----------------------------|----------------------------------------|
| Product                     | Stepper motor                          |
| Model Name                  | MP3-110H120                            |
| Rated Power Supply          | Input: AC 176 - 253 V, 50 / 60 Hz, 3 A |
| Normal Testing Voltage      | AC 230 V / 50 Hz                       |
| DC Line                     | /                                      |
| I/O Ports                   | Refer to User Manual                   |
| Highest Frequency Generated | Below 108 MHz                          |

Note:

1) Other Accessory Device List and Details

| Description    | Manufacturer                  | Model        | Note |
|----------------|-------------------------------|--------------|------|
| Stepper driver | Wuxi Xinje Electric Co., Ltd. | DP3L-11022A3 | AE   |
|                |                               |              |      |

2) The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

### 3.2. Block diagram of EUT configuration



### 3.3. Test Mode

|                 |                                                   |             |        |
|-----------------|---------------------------------------------------|-------------|--------|
| Pretest mode    | Mode 1: Working mode                              |             |        |
| Final Test mode | Conducted Emission                                |             | Mode 1 |
|                 | Radiated Emission                                 | Below 1 GHz | Mode 1 |
|                 |                                                   | Above 1 GHz | N/A    |
|                 | Harmonic current emissions                        |             | Mode 1 |
|                 | Voltage changes, voltage fluctuations and flicker |             | Mode 1 |
|                 | Electrostatic discharges                          |             | Mode 1 |
|                 | Radio-frequency electromagnetic fields            |             | Mode 1 |
|                 | Electrical fast transients/burst (EFT/B)          |             | Mode 1 |
|                 | Surges                                            |             | Mode 1 |
|                 | Continuous induced RF disturbances                |             | Mode 1 |
|                 | Voltage dips and short interruptions              |             | Mode 1 |

\* Only the final test mode is shown in the report.



### 3.4. Test Site Environment

| Test Item                                         | Required                   |          | Actual |
|---------------------------------------------------|----------------------------|----------|--------|
| Conducted Emission                                | Temperature (°C)           | 15-35    | 24.0   |
|                                                   | Humidity (%RH)             | 25-75    | 53.3   |
|                                                   | Barometric pressure (mbar) | 860-1060 | 1014   |
| Radiated Emission                                 | Temperature (°C)           | 15-35    | 24.2   |
|                                                   | Humidity (%RH)             | 25-75    | 54.2   |
|                                                   | Barometric pressure (mbar) | 860-1060 | 1014   |
| Electrostatic discharges                          | Temperature (°C)           | --       | 24.2   |
|                                                   | Humidity (%RH)             | --       | 53.6   |
|                                                   | Barometric pressure (mbar) | --       | 1014   |
| Radio-frequency electromagnetic fields            | Temperature (°C)           | --       | 24.1   |
|                                                   | Humidity (%RH)             | --       | 52.3   |
|                                                   | Barometric pressure (mbar) | --       | 1014   |
| Fast transients                                   | Temperature (°C)           | 15-35    | 23.6   |
|                                                   | Humidity (%RH)             | 25-75    | 52.6   |
|                                                   | Barometric pressure (mbar) | 860-1060 | 1014   |
| Surges                                            | Temperature (°C)           | 15-35    | 23.6   |
|                                                   | Humidity (%RH)             | 25-75    | 52.6   |
|                                                   | Barometric pressure (mbar) | 860-1060 | 1014   |
| Injected currents                                 | Temperature (°C)           | 15-35    | 23.6   |
|                                                   | Humidity (%RH)             | 25-75    | 52.6   |
|                                                   | Barometric pressure (mbar) | 860-1060 | 1014   |
| Voltage dips and short interruptions              | Temperature (°C)           | 15-35    | 23.6   |
|                                                   | Humidity (%RH)             | 25-75    | 52.6   |
|                                                   | Barometric pressure (mbar) | 860-1060 | 1014   |
| Harmonic current emissions                        | Temperature (°C)           | 15-35    | 24.3   |
|                                                   | Humidity (%RH)             | 25-75    | 52.3   |
|                                                   | Barometric pressure (mbar) | 860-1060 | 1014   |
| Voltage changes, voltage fluctuations and flicker | Temperature (°C)           | 15-35    | 24.3   |
|                                                   | Humidity (%RH)             | 25-75    | 52.3   |
|                                                   | Barometric pressure (mbar) | 860-1060 | 1014   |

## 4. Facilities

### 4.1. Test Facility

Test address 1: Guangdong Zhonghan Testing Technology Co., Ltd.

Room 104, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Test site 2: Shenzhen Haiyun Testing Co., Ltd.

No. 2 Danzi North Road, Kengzi Street, Pingshan District, Shenzhen, Guangdong, China

### 4.2. Test Instruments

#### Conducted emissions Test

| Equipment                 | Manufacturer | Model      | Last Cal.     | Next Cal.     |
|---------------------------|--------------|------------|---------------|---------------|
| Receiver                  | R&S          | ESCI       | May 10, 2024  | May 09, 2025  |
| LISN                      | R&S          | ENV216     | May 10, 2024  | May 09, 2025  |
| ISN CAT 6                 | Schwarzbeck  | NTFM 8158  | May 10, 2024  | May 09, 2025  |
| ISN CAT 5                 | Schwarzbeck  | CAT5 8158  | May 10, 2024  | May 09, 2025  |
| Capacitive Voltage Probe  | Schwarzbeck  | CVP 9222 C | May 10, 2024  | May 09, 2025  |
| Current Transformer Clamp | Schwarzbeck  | SW 9605    | May 10, 2024  | May 09, 2025  |
| CE Shielding Room         | EMToni       | 9m4m3m     | Nov. 25, 2021 | Nov. 24, 2024 |

#### Radiated emissions Test (966 chamber)

| Equipment            | Manufacturer | Model             | Last Cal.     | Next Cal.     |
|----------------------|--------------|-------------------|---------------|---------------|
| Receiver             | R&S          | ESCI              | May 10, 2024  | May 09, 2025  |
| Amplifier            | Schwarzbeck  | BBV 9743 B        | May 10, 2024  | May 09, 2025  |
| Amplifier            | Schwarzbeck  | BBV 9718 B        | May 10, 2024  | May 09, 2025  |
| Bilog Antenna        | Schwarzbeck  | VULB9168          | Aug. 04, 2023 | Aug. 03, 2024 |
| Horn Antenna         | Schwarzbeck  | BBHA9120D         | May 16, 2024  | May 15, 2025  |
| CDNE                 | Schwarzbeck  | CDNE M2 + CDNE M3 | May 10, 2024  | May 09, 2025  |
| 966 Anechoic Chamber | EMToni       | 9m6m6m            | Nov. 25, 2021 | Nov. 24, 2024 |

**Harmonic / Flicker Test**

| Equipment      | Manufacturer | Model   | Last Cal.    | Next Cal.    |
|----------------|--------------|---------|--------------|--------------|
| Power Analyzer | Li           | AC2000A | May 10, 2024 | May 09, 2025 |

**Electrostatic discharge immunity Test**

| Equipment          | Manufacturer | Model  | Last Cal.    | Next Cal.    |
|--------------------|--------------|--------|--------------|--------------|
| ESD TEST Generator | HTEC         | HESD16 | May 10, 2024 | May 09, 2025 |

**Fast transients and Surges and Voltage dips and short interruptions Test**

| Equipment       | Manufacturer | Model            | Last Cal.    | Next Cal.    |
|-----------------|--------------|------------------|--------------|--------------|
| Surge Generator | HTEC         | HCOMPACT5/HV1P6T | May 10, 2024 | May 09, 2025 |
| DIPS Generator  | HTEC         | HCOMPACT5/HV1P6T | May 10, 2024 | May 09, 2025 |
| EFT/B Generator | HTEC         | HCOMPACT5/HV1P6T | May 10, 2024 | May 09, 2025 |
| EFT/B Clamp     | HTEC         | H3C              | May 10, 2024 | May 09, 2025 |

**Continuous induced RF disturbances**

| Equipment        | Manufacturer | Model         | Last Cal.    | Next Cal.    |
|------------------|--------------|---------------|--------------|--------------|
| Signal Generator | Schwarzbeck  | CDG 7000-25   | May 10, 2024 | May 09, 2025 |
| Attenuator       | Schwarzbeck  | 6db           | May 10, 2024 | May 09, 2025 |
| CDN              | Schwarzbeck  | CDN M2+M3-16A | May 10, 2024 | May 09, 2025 |

**Continuous RF electromagnetic field disturbances(Site 2)**

| Equipment             | Manufacturer | Model              | Last Cal.     | Next Cal.     |
|-----------------------|--------------|--------------------|---------------|---------------|
| Signal Generator      | R&S          | SMB100A            | Oct. 15, 2023 | Oct. 14, 2024 |
| Signal Generator      | R&S          | SMR40              | Oct. 15, 2023 | Oct. 14, 2024 |
| Power Amplifier       | A&R          | 250W1000A          | Oct. 15, 2023 | Oct. 14, 2024 |
| Power Amplifier       | A&R          | 1150A100B          | Oct. 15, 2023 | Oct. 14, 2024 |
| Power Amplifier       | A&R          | 60S1G4             | Oct. 15, 2023 | Oct. 14, 2024 |
| Communication antenna | Schwarzbeck  | FPA3-0.8-6.0R/1329 | Oct. 15, 2023 | Oct. 14, 2024 |



#### 4.3. Testing software

| Project                    | Software name    | Edition        |
|----------------------------|------------------|----------------|
| Conducted Emission         | EZ-EMC           | EMC-CON 3A1.1+ |
| Radiated Emission          | EZ-EMC           | FA-03A2 RE+    |
| Conducted Susceptibility   | EN IEC 61000-4-6 | 1.4.1          |
| Harmonic current emissions | Harmonic         | 121            |

#### 4.4. Measurement uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

| Test item                         | Value (dB) |
|-----------------------------------|------------|
| Conducted Emission (150kHz-30MHz) | 2.60       |
| Radiated Emission(30MHz~1GHz)     | 4.60       |
| Radiated Emission(1GHz~6GHz)      | 4.30       |

##### Decision Rule

- ☒ Uncertainty is not included  
☐ Uncertainty is included

## 5. Emission

### 5.1. Conducted Emission

#### 5.1.1. Limit

##### A.C. Mains Conducted Interference Limit

| Frequency<br>(MHz) | Class A (dBuV) |         | Class B (dBuV) |         |
|--------------------|----------------|---------|----------------|---------|
|                    | Quasi-peak     | Average | Quasi-peak     | Average |
| 0.15 - 0.5         | 79             | 66      | 66 - 56        | 56 - 46 |
| 0.50 - 5.0         | 73             | 60      | 56             | 46      |
| 5.0 - 30.0         | 73             | 60      | 60             | 50      |

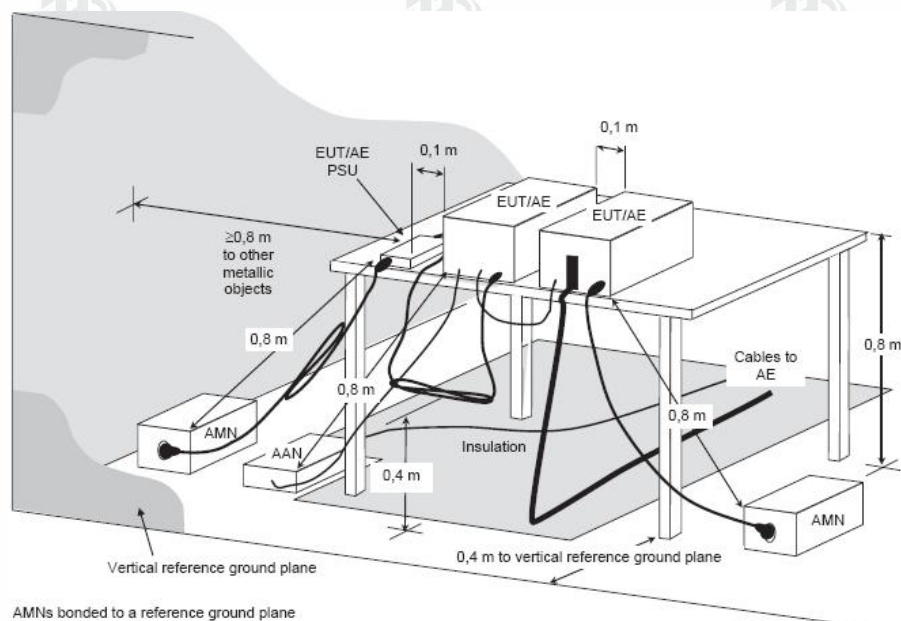
Note:

- (1) The lower limit shall apply at the transition frequencies.
- (2) The limit decreases in line with the logarithm of the frequency in the range 0.15 to 0.50 MHz.
- (3) All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

##### Telecommunication Port Asymmetric mode Conducted Interference Limit

| Requirement<br>(MHz) | Class A Equipment       |          |                         |          | Class B Equipment       |          |                         |          |
|----------------------|-------------------------|----------|-------------------------|----------|-------------------------|----------|-------------------------|----------|
|                      | Voltage Limit<br>(dBμV) |          | Current Limit<br>(dBμA) |          | Voltage Limit<br>(dBμV) |          | Current Limit<br>(dBμA) |          |
|                      | QP                      | Avg.     | QP                      | Avg.     | QP                      | Avg.     | QP                      | Avg.     |
| 0.15 to 0.50         | 97 to 87                | 84 to 74 | 53 to 43                | 40 to 30 | 84 to 74                | 74 to 64 | 40 to 30                | 30 to 20 |
| 0.50 to 30           | 87                      | 74       | 43                      | 30       | 74                      | 64       | 30                      | 20       |

### 5.1.2. Test setup



### 5.1.3. Test procedure

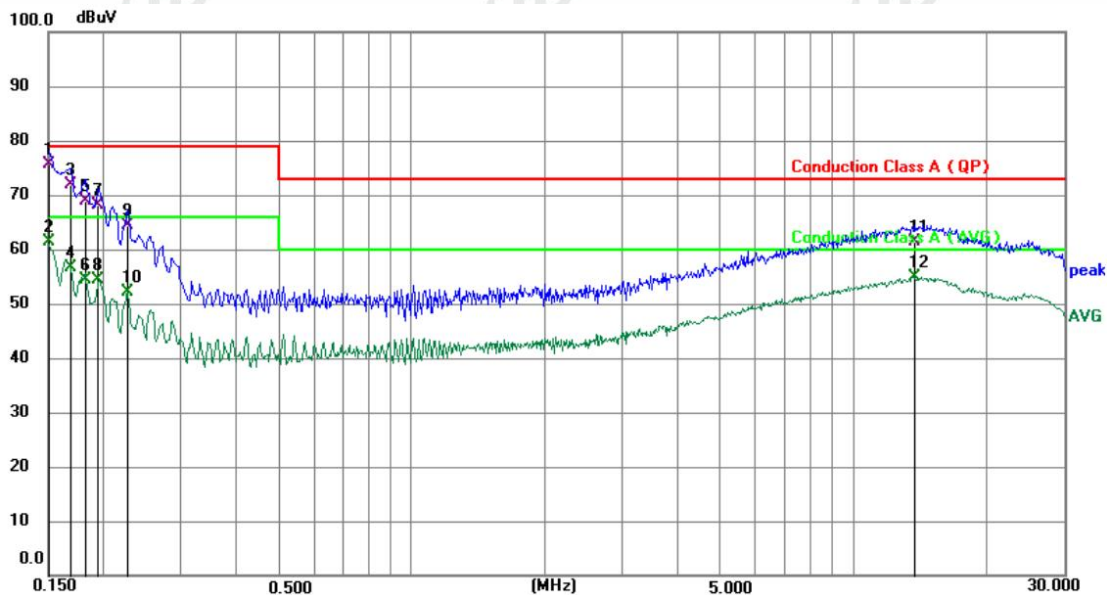
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
  - b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
  - c. The test results of conducted emissions at mains ports are recorded of six worst margins for quasi-peak(mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.
- Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

#### 5.1.4. Test results

**PASS**

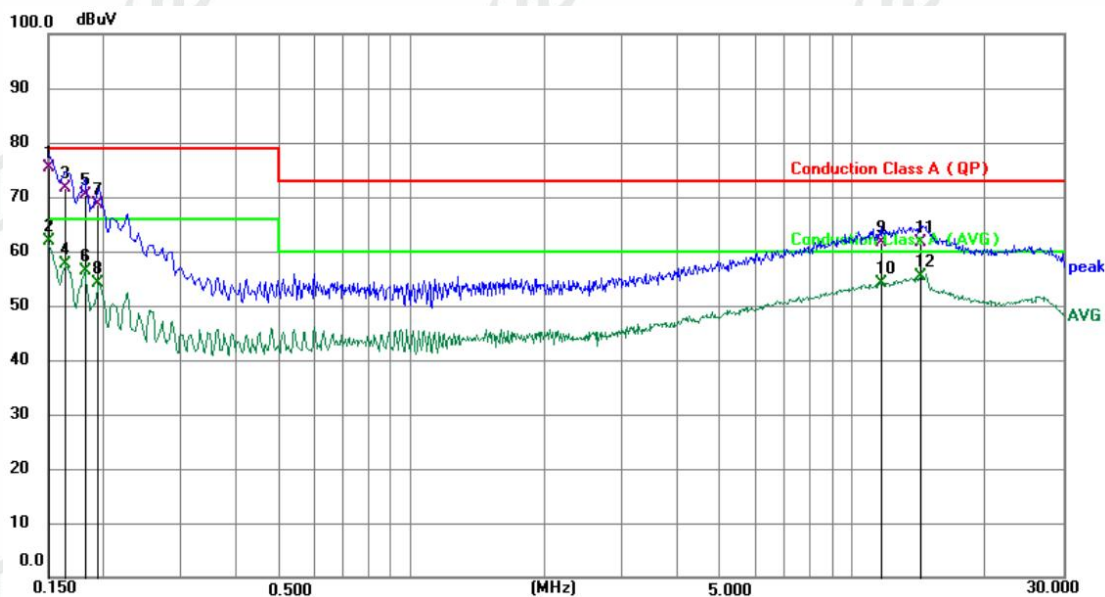
Please refer to pages 14 -15 for data.

Phase: Live



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F | Remark |
|-----|-----------------|----------------|-------------|--------------|--------------|-------------|----------|-----|--------|
| 1 * | 0.1500          | 66.17          | 9.52        | 75.69        | 79.00        | -3.31       | QP       | P   |        |
| 2   | 0.1500          | 51.76          | 9.52        | 61.28        | 66.00        | -4.72       | AVG      | P   |        |
| 3   | 0.1680          | 62.41          | 9.53        | 71.94        | 79.00        | -7.06       | QP       | P   |        |
| 4   | 0.1680          | 47.16          | 9.53        | 56.69        | 66.00        | -9.31       | AVG      | P   |        |
| 5   | 0.1824          | 59.37          | 9.53        | 68.90        | 79.00        | -10.10      | QP       | P   |        |
| 6   | 0.1824          | 44.83          | 9.53        | 54.36        | 66.00        | -11.64      | AVG      | P   |        |
| 7   | 0.1949          | 58.57          | 9.55        | 68.12        | 79.00        | -10.88      | QP       | P   |        |
| 8   | 0.1949          | 44.82          | 9.55        | 54.37        | 66.00        | -11.63      | AVG      | P   |        |
| 9   | 0.2265          | 54.81          | 9.56        | 64.37        | 79.00        | -14.63      | QP       | P   |        |
| 10  | 0.2265          | 42.47          | 9.56        | 52.03        | 66.00        | -13.97      | AVG      | P   |        |
| 11  | 13.8390         | 51.39          | 9.90        | 61.29        | 73.00        | -11.71      | QP       | P   |        |
| 12  | 13.8390         | 45.03          | 9.90        | 54.93        | 60.00        | -5.07       | AVG      | P   |        |

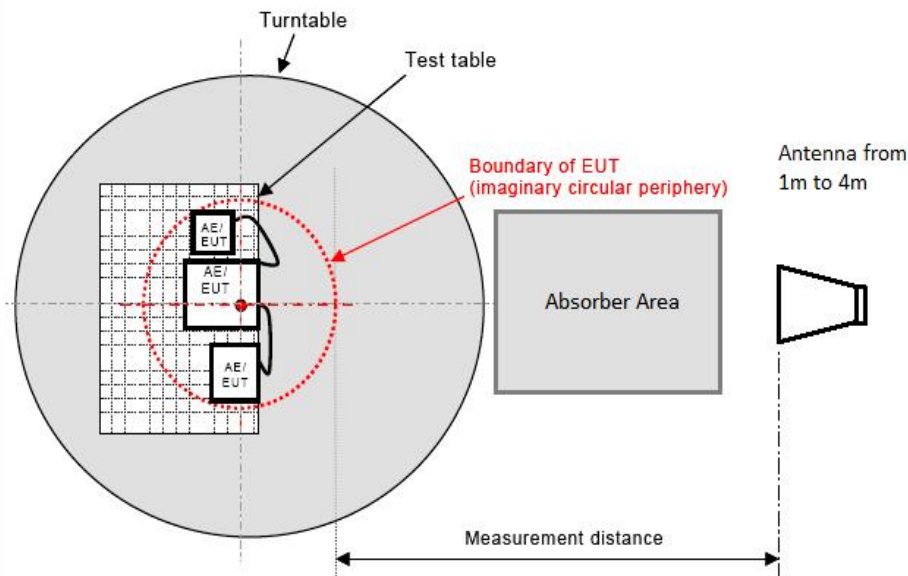
Phase: Neutral



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F | Remark |
|-----|-----------------|----------------|-------------|--------------|--------------|-------------|----------|-----|--------|
| 1 * | 0.1500          | 65.82          | 9.52        | 75.34        | 79.00        | -3.66       | QP       | P   |        |
| 2   | 0.1500          | 52.33          | 9.52        | 61.85        | 66.00        | -4.15       | AVG      | P   |        |
| 3   | 0.1635          | 62.08          | 9.53        | 71.61        | 79.00        | -7.39       | QP       | P   |        |
| 4   | 0.1635          | 48.13          | 9.53        | 57.66        | 66.00        | -8.34       | AVG      | P   |        |
| 5   | 0.1814          | 60.77          | 9.53        | 70.30        | 79.00        | -8.70       | QP       | P   |        |
| 6   | 0.1814          | 46.81          | 9.53        | 56.34        | 66.00        | -9.66       | AVG      | P   |        |
| 7   | 0.1949          | 59.01          | 9.54        | 68.55        | 79.00        | -10.45      | QP       | P   |        |
| 8   | 0.1949          | 44.52          | 9.54        | 54.06        | 66.00        | -11.94      | AVG      | P   |        |
| 9   | 11.5890         | 51.73          | 9.84        | 61.57        | 73.00        | -11.43      | QP       | P   |        |
| 10  | 11.5890         | 44.35          | 9.84        | 54.19        | 60.00        | -5.81       | AVG      | P   |        |
| 11  | 14.2440         | 51.87          | 9.86        | 61.73        | 73.00        | -11.27      | QP       | P   |        |
| 12  | 14.2440         | 45.48          | 9.86        | 55.34        | 60.00        | -4.66       | AVG      | P   |        |

Note: Level=Reading + Factor  
Margin=Level – Limit





### 5.2.3. Test procedure

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The height of antenna is varied from 1 meter to 4 meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1GHz.

### 5.2.4. Test results

**PASS**

Please refer to pages 18 -19 for data.



Polarization: Horizontal



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg.) | P/F | Remark |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|-------------|----------------|-----|--------|
| 1   | 73.8756         | 57.57          | -13.66        | 43.91          | 50.00          | -6.09       | QP       |             |                | P   |        |
| 2 ! | 77.3210         | 60.23          | -14.20        | 46.03          | 50.00          | -3.97       | QP       |             |                | P   |        |
| 3   | 82.3588         | 57.75          | -14.13        | 43.62          | 50.00          | -6.38       | QP       |             |                | P   |        |
| 4 * | 86.5027         | 60.13          | -13.26        | 46.87          | 50.00          | -3.13       | QP       |             |                | P   |        |
| 5 ! | 89.5899         | 56.88          | -12.62        | 44.26          | 50.00          | -5.74       | QP       |             |                | P   |        |
| 6   | 101.6443        | 52.49          | -11.10        | 41.39          | 50.00          | -8.61       | QP       |             |                | P   |        |



Polarization: Vertical



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg.) | P/F | Remark |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|-------------|----------------|-----|--------|
| 1 ! | 37.6796         | 58.50          | -10.10        | 48.40          | 50.00          | -1.60       | QP       |             |                | P   |        |
| 2 ! | 41.7129         | 57.69          | -9.52         | 48.17          | 50.00          | -1.83       | QP       |             |                | P   |        |
| 3 * | 44.7433         | 57.90          | -9.24         | 48.66          | 50.00          | -1.34       | QP       |             |                | P   |        |
| 4 ! | 80.3617         | 63.01          | -14.55        | 48.46          | 50.00          | -1.54       | QP       |             |                | P   |        |
| 5   | 123.6984        | 56.12          | -13.11        | 43.01          | 50.00          | -6.99       | QP       |             |                | P   |        |
| 6   | 143.3260        | 57.22          | -13.78        | 43.44          | 50.00          | -6.56       | QP       |             |                | P   |        |

Note: Level=Reading + Factor

Margin=Level – Limit



### 5.3. Harmonic current emissions

#### 5.3.1. Test Procedure

The EUT was placed on the top of a wooden table 0.8 meters above the ground and the EUT is supplied in series with power analyzer from a power source having the same normal voltage and frequency as the rated supply voltage and the equipment under test. And the rated voltage at the supply voltage of EUT of 0.94 times and 1.06 times shall be performed.

A definition of the normal load or of the conditions for adequate heat discharge can usually be found in the EN publication corresponding to the equipment under test.

Equipment may have several separately controlled circuits. Each circuit is considered as a single piece of equipment if it can be operated independently and separately from the other circuits.

#### 5.3.2. Limit

Current emission limits for equipment other than balanced three-phase equipment

| Minimum $R_{sce}$                                                                                                                                                                                                                                                                                                                 | Admissible individual harmonic current $I_h/I_{ref}$ <sup>a</sup> |       |       |       |          |          | Admissible harmonic parameters |                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-------|-------|-------|----------|----------|--------------------------------|----------------|
|                                                                                                                                                                                                                                                                                                                                   | $I_3$                                                             | $I_5$ | $I_7$ | $I_9$ | $I_{11}$ | $I_{13}$ | $THC/I_{ref}$                  | $PWHC/I_{ref}$ |
| 33                                                                                                                                                                                                                                                                                                                                | 21,6                                                              | 10,7  | 7,2   | 3,8   | 3,1      | 2        | 23                             | 23             |
| 66                                                                                                                                                                                                                                                                                                                                | 24                                                                | 13    | 8     | 5     | 4        | 3        | 26                             | 26             |
| 120                                                                                                                                                                                                                                                                                                                               | 27                                                                | 15    | 10    | 6     | 5        | 4        | 30                             | 30             |
| 250                                                                                                                                                                                                                                                                                                                               | 35                                                                | 20    | 13    | 9     | 8        | 6        | 40                             | 40             |
| ≥350                                                                                                                                                                                                                                                                                                                              | 41                                                                | 24    | 15    | 12    | 10       | 8        | 47                             | 47             |
| <p>The relative values of even harmonics up to order 12 shall not exceed <math>16/h</math> %. Even harmonics above order 12 are taken into account in <math>THC</math> and <math>PWHC</math> in the same way as odd order harmonics.</p> <p>Linear interpolation between successive <math>R_{sce}</math> values is permitted.</p> |                                                                   |       |       |       |          |          |                                |                |
| <p><sup>a</sup> <math>I_{ref}</math> = reference current; <math>I_h</math> = harmonic current component.</p>                                                                                                                                                                                                                      |                                                                   |       |       |       |          |          |                                |                |

#### 5.3.3. Test Result

**PASS**

#### 5.4. Voltage changes, voltage fluctuations and flicker

##### 5.4.1. Test Procedure

The EUT is supplied in series with power analyzer from a power source having the same normal voltage and frequency as the rated supply voltage and the equipment under test. And the rated voltage at the supply voltage of EUT of 0.94 times and 1.06 times shall be performed.

The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under normal operating conditions.

During the flick measurement, the measure time shall include that part of whole operation cycle in which the EUT produce the most unfavorable sequence of voltage changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours.

##### 5.4.2. Limit

| Test Item                                        | Limit |
|--------------------------------------------------|-------|
| Pst (Short-term flicker indicator.)              | 1.0   |
| Plt (Long-term flicker indicator.)               | 0.65  |
| Td(t)(ms) ( Maximum time that d(t) exceeds 3.3%) | 500   |
| dmax(%) (Maximum relative voltage change.)       | 4     |
| dc(%) (Relative steady-state voltage change)     | 3.3   |

##### 5.4.3. Test Result

**PASS**

## 6. Immunity

### Performance criteria

#### Performance criterion A

The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss function is allowed below a performance level specified by the manufacturer, when the equipment 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, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

#### Performance criterion B

The equipment shall continue to operate as intended after the test. No degradation of performance or loss function is allowed below a performance level specified by the manufacturer, when the equipment is used as intended. 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 specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from equipment if used as intended.

#### Performance criterion C

Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by operation of the controls.



## 6.1. Electrostatic discharges

### 6.1.1. Test Specification

|                     |   |                                   |
|---------------------|---|-----------------------------------|
| Test Port           | : | Enclosure port                    |
| Discharge Impedance | : | 330 ohm / 150 pF                  |
| Discharge Mode      | : | Single Discharge                  |
| Discharge Period    | : | one second between each discharge |

### 6.1.2. Test Levels and Performance Criterion

Test Standard

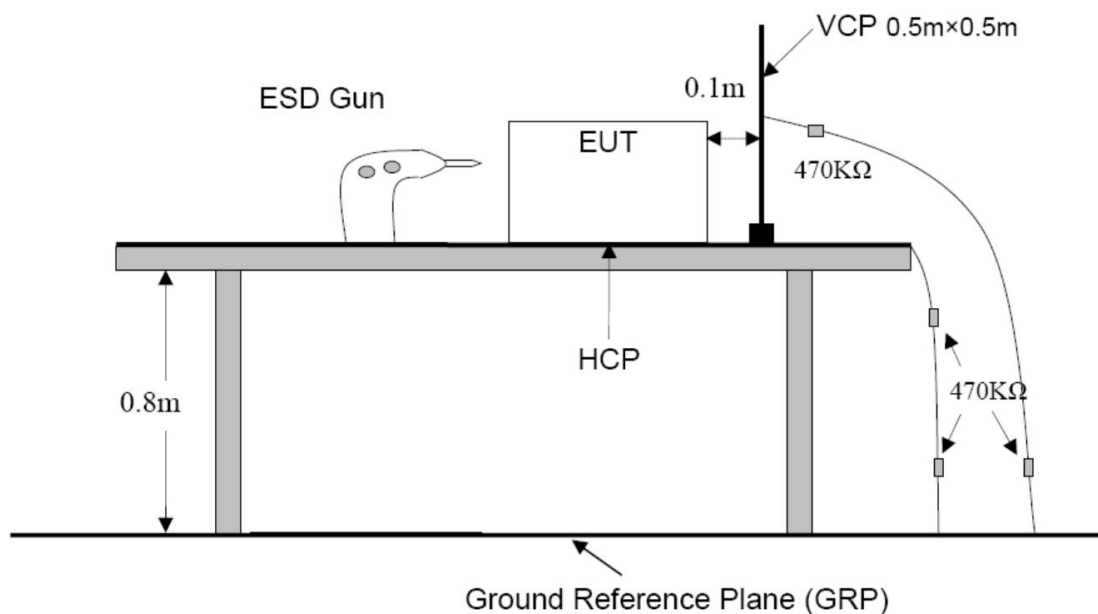
EN 55035:2017+A11:2020

(EN 61000-4-2: 2009)

| Level | Test Voltage<br>Contact Discharge (KV) | Test Voltage<br>Air Discharge (KV) |
|-------|----------------------------------------|------------------------------------|
| 1.    | ±2                                     | ±2                                 |
| 2.    | ±4                                     | ±4                                 |
| 3.    | ±6                                     | ±8                                 |
| 4.    | ±8                                     | ±15                                |
| X     | Special                                | Special                            |

Performance criterion: **B**

### 6.1.3. Test setup



#### 6.1.4. Test Procedure

##### **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 of each polarity) for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

##### **Contact Discharge:**

All the procedure shall be same as Section Air Discharge except that the tip of the discharge electrode shall touch the EUT.

##### **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.

##### **Indirect discharge for vertical coupling plane:**

At least 10 single discharge (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.

#### 6.1.5. Test Result

**PASS**

| Test Point                                | Contact (C) Air (A) | Voltage (kV) | Performance Criterion                                            | Result (Performance Criterion) |
|-------------------------------------------|---------------------|--------------|------------------------------------------------------------------|--------------------------------|
| Indirect Discharge (HCP)                  | C                   | $\pm 4$      | <input type="checkbox"/> A <input checked="" type="checkbox"/> B | A                              |
| Indirect Discharge (VCP)                  | C                   | $\pm 4$      | <input type="checkbox"/> A <input checked="" type="checkbox"/> B | A                              |
| Conductive Surfaces                       | C                   | $\pm 4$      | <input type="checkbox"/> A <input checked="" type="checkbox"/> B | A                              |
| Slots, Apertures, and Insulating Surfaces | A                   | $\pm 8$      | <input type="checkbox"/> A <input checked="" type="checkbox"/> B | A                              |

## 6.2. Radio-frequency electromagnetic fields

### 6.2.1. Test Specification

|              |   |                       |
|--------------|---|-----------------------|
| Test Port    | : | Enclosure port        |
| Step Size    | : | 1%                    |
| Modulation   | : | 1kHz, 80% AM          |
| Dwell Time   | : | 1 second              |
| Polarization | : | Horizontal & Vertical |

### 6.2.2. Test Levels and Performance Criterion

Test Standard

EN 55035:2017+A11:2020

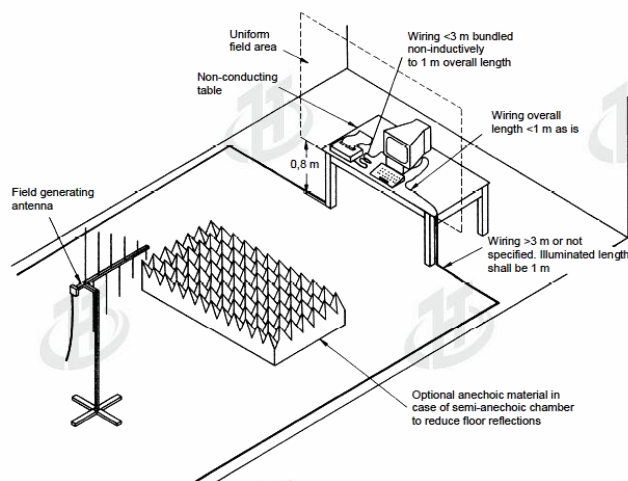
(EN 61000-4-3:2020)

| Characteristics | Test levels                                     |                           |
|-----------------|-------------------------------------------------|---------------------------|
| Frequency range | 80 MHz to 1 000 MHz,<br>1 400 MHz to 2 000 MHz, | 2 000 MHz to 2 700 MHz    |
| Test level      | 3 V/m (unmodulated)                             | 1 V/m (unmodulated)       |
| Modulation      | 1 kHz, 80 % AM, sine wave                       | 1 kHz, 80 % AM, sine wave |

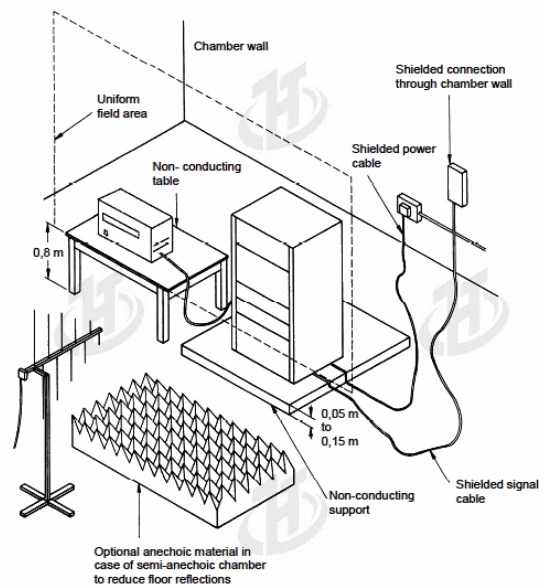
Performance criterion: **A**

### 6.2.3. Test setup

#### For table-top equipment



#### For floor standing equipment



## 6.2.4. Test Procedure

Measurement was performed in full-anechoic chamber.

Measurement procedure was applied according to EN 61000-4-3 clause 8.

The test method and equipment was specified by EN 61000-4-3.

## 6.2.5. Test Result

**PASS**

| Frequency<br>(MHz)   | Polarization | Test level<br>(V/m) | Modulation                      | Exposed<br>location | Result<br>(Performance<br>Criterion) |
|----------------------|--------------|---------------------|---------------------------------|---------------------|--------------------------------------|
| 80-1 000, 1 400-2000 | H & V        | 3                   | 1 kHz, 80% AM,<br>1 % increment | All sides           | A                                    |
| 2 000 - 2 700        | H & V        | 1                   | 1 kHz, 80% AM,<br>1 % increment | All sides           | A                                    |

### 6.3. Fast transients

#### 6.3.1. Test Specification

|                    |   |                        |
|--------------------|---|------------------------|
| Test Port          | : | input a.c. power port  |
| Impulse Frequency  | : | 5 kHz                  |
| Impulse Wave-shape | : | 5/50 ns                |
| Burst Duration     | : | 15 ms                  |
| Burst Period       | : | 300 ms                 |
| Test Duration      | : | 2 minutes per polarity |

#### 6.3.2. Test Levels and Performance Criterion

Test Standard

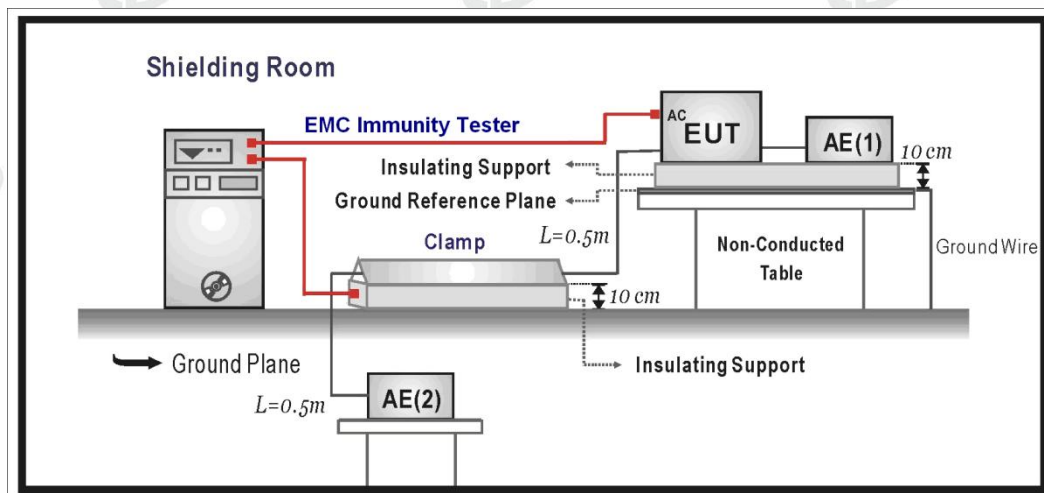
EN 55035:2017+A11:2020

(EN 61000-4-4: 2012)

| Open circuit output test voltage and repetition rate of the impulses                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                        |                                                     |                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------------------------|-----------------------------------------------------|------------------------|
| Level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | On power port, PE  |                        | On I/O (Input/Output) Signal data and control ports |                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Voltage peak<br>KV | Repetition rate<br>KHz | Voltage peak<br>KV                                  | Repetition rate<br>KHz |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.5                | 5 or 100               | 0.25                                                | 5 or 100               |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1.0                | 5 or 100               | 0.5                                                 | 5 or 100               |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2.0                | 5 or 100               | 1.0                                                 | 5 or 100               |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 4.0                | 5 or 100               | 2.0                                                 | 5 or 100               |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Special            | Special                | Special                                             | Special                |
| <p>Note 1 Use of 5 KHz repetition rates is traditional; however, 100 KHz is closer to reality. Product committees should determine which frequencies are relevant for specific products or product types.</p> <p>Note 2 With some products, there may be no clear distinction, between power ports and I/O ports, in which case it is up to product committees to make this determination for test purposes.</p> <p>Note 3 "X" is an open level. The level has to be specified in the dedicated equipment specification.</p> |                    |                        |                                                     |                        |

Performance criterion: **B**

### 6.3.3. Test setup



### 6.3.4. 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.

#### 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 minus.

#### For signal lines ports:

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

#### For DC ports:

It's unnecessary to test.

### 6.3.5. Test Result

| Test Point | Polarity | Test Level (kV) | Inject Time (Second) | Inject Method | Performance Criterion                                            | Result (Performance Criterion) |
|------------|----------|-----------------|----------------------|---------------|------------------------------------------------------------------|--------------------------------|
| L          | ±        | 1               | 60                   | Direct        | <input type="checkbox"/> A <input checked="" type="checkbox"/> B | A                              |
| N          | ±        | 1               | 60                   | Direct        | <input type="checkbox"/> A <input checked="" type="checkbox"/> B | A                              |
| PE         | ±        | 1               | 60                   | Direct        | <input type="checkbox"/> A <input checked="" type="checkbox"/> B | A                              |
| L+N        | ±        | 1               | 60                   | Direct        | <input type="checkbox"/> A <input checked="" type="checkbox"/> B | A                              |
| L+PE       | ±        | 1               | 60                   | Direct        | <input type="checkbox"/> A <input checked="" type="checkbox"/> B | A                              |
| N+PE       | ±        | 1               | 60                   | Direct        | <input type="checkbox"/> A <input checked="" type="checkbox"/> B | A                              |
| L+N+PE     | ±        | 1               | 60                   | Direct        | <input type="checkbox"/> A <input checked="" type="checkbox"/> B | A                              |

Note 1: The testing performed is from lowest level up to the highest level as required by standard, but only highest level is shown on the report.

Criterion A: Operate as intended during and after the test

Criterion B: Operate as intended after the test

Criterion C: Loss/Error of function



## 6.4. Surges

### 6.4.1. Test Specification

|                       |   |                                                                         |
|-----------------------|---|-------------------------------------------------------------------------|
| Test Port             | : | input a.c. power port                                                   |
| Wave-Shape            | : | Open Circuit Voltage - 1.2 / 50 us<br>Short Circuit Current - 8 / 20 us |
| Pulse Repetition Rate | : | 1 pulse / min.                                                          |
| Phase Angle           | : | 90° / 270°                                                              |
| Test Events           | : | 5 pulses (positive & negative) for each polarity                        |

### 6.4.2. Test Levels and Performance Criterion

Test Standard

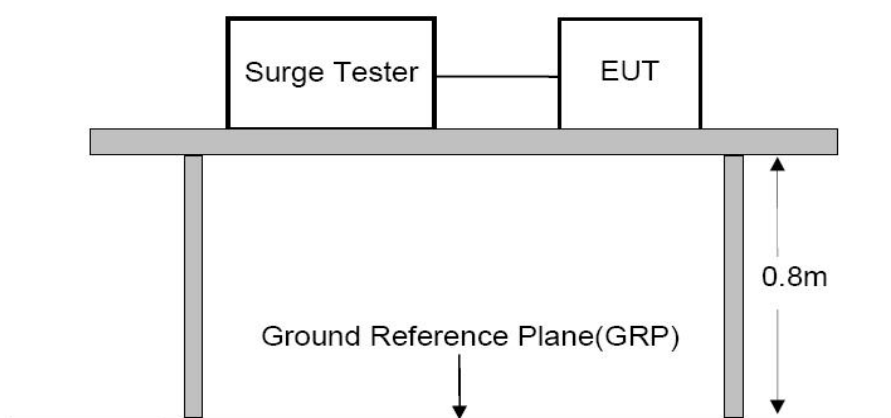
EN 55035:2017+A11:2020

(EN 61000-4-5: 2014)

| Severity Level | Open-Circuit Test Voltage KV |
|----------------|------------------------------|
| 1              | 0.5                          |
| 2              | 1.0                          |
| 3              | 2.0                          |
| 4              | 4.0                          |
| *              | Special                      |

Performance criterion: **B**

### 6.4.3. Test setup



#### 6.4.4. Test Procedure

1. Set up the EUT and test generator as shown on Section 12.1.
2. For line to line coupling mode, provide a 1.0KV 1.2/50us voltage surge (at open-circuit condition) and 8/20us current surge to EUT selected points.
3. Five positive pulses Line-to-neutral at 90°phase, Five negative pulses Line-to-neutral at 270°phase. with a maximum 1/min repetition rate are conducted during test.
4. Different phase angles are done individually.
5. Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.

#### 6.4.5. Test Result

| Angle: Positive pulses at 90° phase, Negative pulses at 270° phase |          |              |                        |               |                                                                  |                                |
|--------------------------------------------------------------------|----------|--------------|------------------------|---------------|------------------------------------------------------------------|--------------------------------|
| Inject Line                                                        | Polarity | Voltage (kV) | Time Interval (Second) | Inject Method | Performance Criterion                                            | Result (Performance Criterion) |
| L-N                                                                | ±        | 1            | 60                     | Direct        | <input type="checkbox"/> A <input checked="" type="checkbox"/> B | A                              |
| L-PE                                                               | ±        | 2            | 60                     | Direct        | <input type="checkbox"/> A <input checked="" type="checkbox"/> B | A                              |
| N-PE                                                               | ±        | 2            | 60                     | Direct        | <input type="checkbox"/> A <input checked="" type="checkbox"/> B | A                              |

Note 1: The testing performed is from lowest level up to the highest level as required by standard, but only highest level is shown on the report.

Criterion A: Operate as intended during and after the test

Criterion B: Operate as intended after the test

Criterion C: Loss/Error of function

## 6.5. Injected currents

### 6.5.1. Test Specification

|            |   |                       |
|------------|---|-----------------------|
| Test Port  | : | input a.c. power port |
| Step Size  | : | 1%                    |
| Modulation | : | 1kHz, 80% AM          |
| Dwell Time | : | 1 second              |

### 6.5.2. Test Levels and Performance Criterion

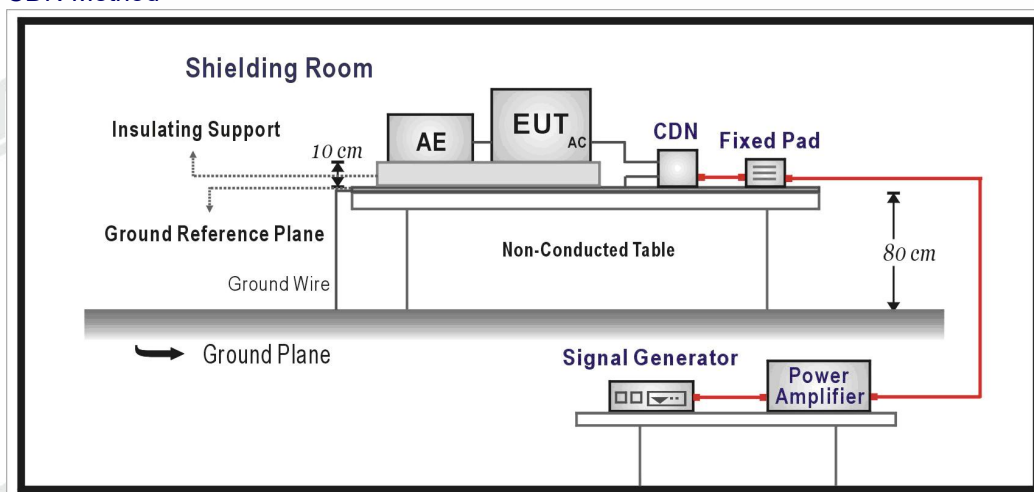
Test Standard  
EN 55035:2017+A11:2020  
(EN IEC 61000-4-6: 2023)

| Frequency ranges<br>MHz | Test level<br>V | Modulation    | Performance criterion |
|-------------------------|-----------------|---------------|-----------------------|
| 0,15 to 80              | 3               | 80% AM (1kHz) | A                     |

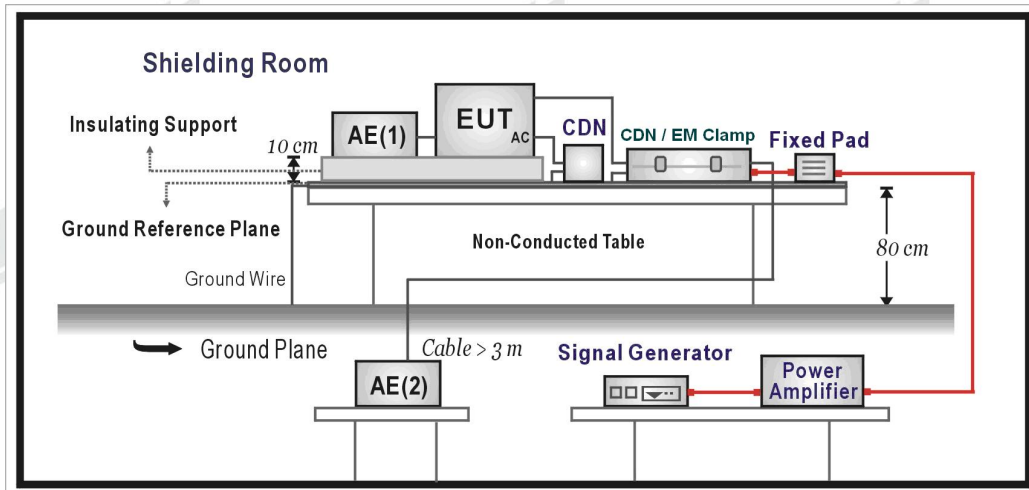
Performance criterion: **A**

### 6.5.3. Test setup

#### CDN Method



#### EM Clamp Method



#### 6.5.4. Test Procedure

1. Set up the EUT, CDN and test generators as shown on Section 5.6.1.
2. Let the EUT work in test mode and measure it.
3. 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 50 mm (where possible).
4. The disturbance signal described below is injected to EUT through CDN.
5. The EUT operates within its operational mode(s) under intended climatic conditions after power on.
6. The frequency range is swept from 150 KHz to 80 MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 1KHz sine wave.
7. 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.
8. Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.

#### 6.5.5. Test Result

| Frequency Band (MHz) | Field Strength (Vrms) | Inject Port | Inject Method | Performance Criterion                                            | Result (Performance Criterion) |
|----------------------|-----------------------|-------------|---------------|------------------------------------------------------------------|--------------------------------|
| 0.15 ~ 80            | 3                     | AC Mains    | CDN           | <input checked="" type="checkbox"/> A <input type="checkbox"/> B | A                              |

Note 1: The testing performed is from lowest level up to the highest level as required by standard, but only highest level is shown on the report.

Criterion A: Operate as intended during and after the test

Criterion B: Operate as intended after the test

Criterion C: Loss/Error of function

Note 2: The display quality of a display output was evaluated by using a subjective by direct observation.



## 6.6. Power frequency magnetic fields.

### 6.6.1. Test Levels and Performance Criterion

Test Standard

EN 55035:2017+A11:2020

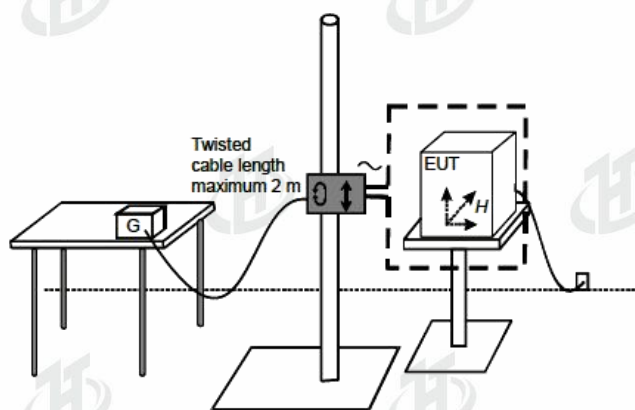
(EN 61000-4-8:2010)

| Characteristics | Test levels |
|-----------------|-------------|
| Field frequency | 50/60 Hz    |
| Test level      | 1 A/m       |

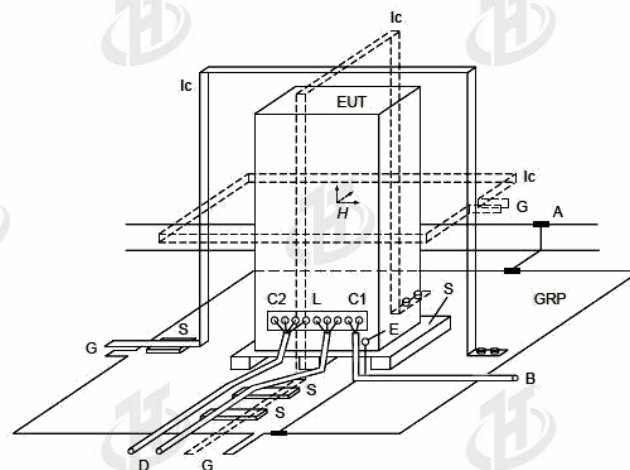
Performance criterion: **A**

### 6.6.2. Test setup

For table-top equipment



For floor standing equipment



### 6.6.3. Test Procedure

Measurement was performed in shielded room.

Measurement procedure was applied according to EN 61000-4-8 clause 8.

The test method and equipment was specified by EN 61000-4-8.

### 6.6.4. Test Result

**N/A**

The product is not a magnetically sensitive device.

## 6.7. Voltage dips and interruptions

### 6.7.1. Test Specification

|             |   |                       |
|-------------|---|-----------------------|
| Test Port   | : | input a.c. power port |
| Phase Angle | : | 0°, 180°              |
| Test cycle  | : | 3 times               |

### 6.7.2. Test Levels and Performance Criterion

Test Standard

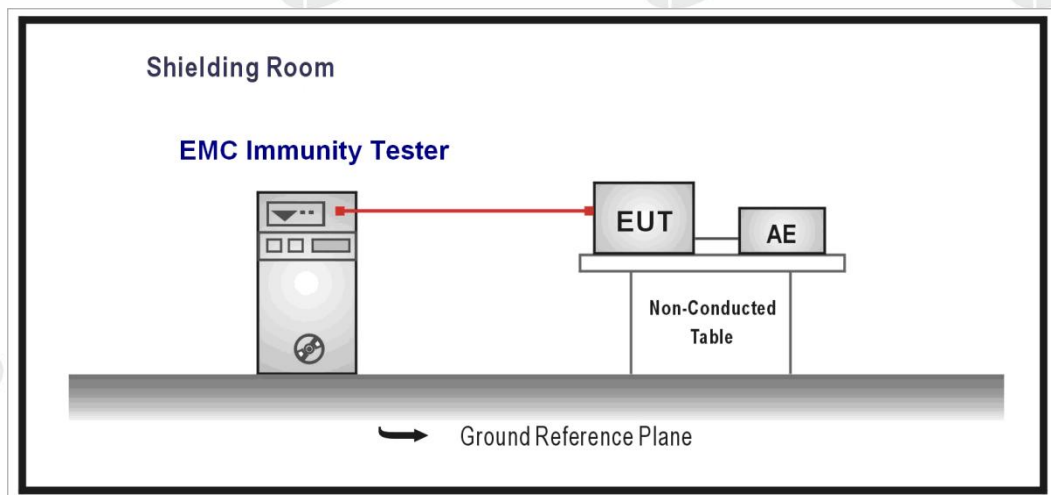
EN 55035:2017+A11:2020

(EN 61000-4-11: 2020)

| Test Level<br>%UT | Voltage dip and short<br>interruptions<br>%UT | Duration<br>(in period) |
|-------------------|-----------------------------------------------|-------------------------|
| 0                 | 100                                           | 1                       |
| 40                | 60                                            | 10                      |
| 70                | 30                                            | 25                      |
| 80                | 20                                            | 250                     |
| 0                 | 100                                           | 250                     |

Performance criterion: **A, C, C, C, C**

### 6.7.3. Test setup



#### 6.7.4. Test Procedure

1. Set up the EUT and test generator as shown on Section 5.7.1.
2. The interruptions is introduced at selected phase angles with specified duration. Record any degradation of performance.

#### 6.7.5. Test Result

| Test Voltage (Vac) | Voltage Residual (%) | Test Duration (Periods) | Performance Criterion                                                                       | Result (Performance Criterion) |
|--------------------|----------------------|-------------------------|---------------------------------------------------------------------------------------------|--------------------------------|
| 230                | 0                    | 1                       | <input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C | A                              |
|                    | 40                   | 10                      | <input type="checkbox"/> A <input type="checkbox"/> B <input checked="" type="checkbox"/> C | B                              |
|                    | 70                   | 25                      | <input type="checkbox"/> A <input type="checkbox"/> B <input checked="" type="checkbox"/> C | B                              |
|                    | 80                   | 250                     | <input type="checkbox"/> A <input type="checkbox"/> B <input checked="" type="checkbox"/> C | B                              |
|                    | 0                    | 250                     | <input type="checkbox"/> A <input type="checkbox"/> B <input checked="" type="checkbox"/> C | B                              |

Note 1: The testing performed is from lowest level up to the highest level as required by standard, but only highest level is shown on the report.

Criterion A: Operate as intended during and after the test

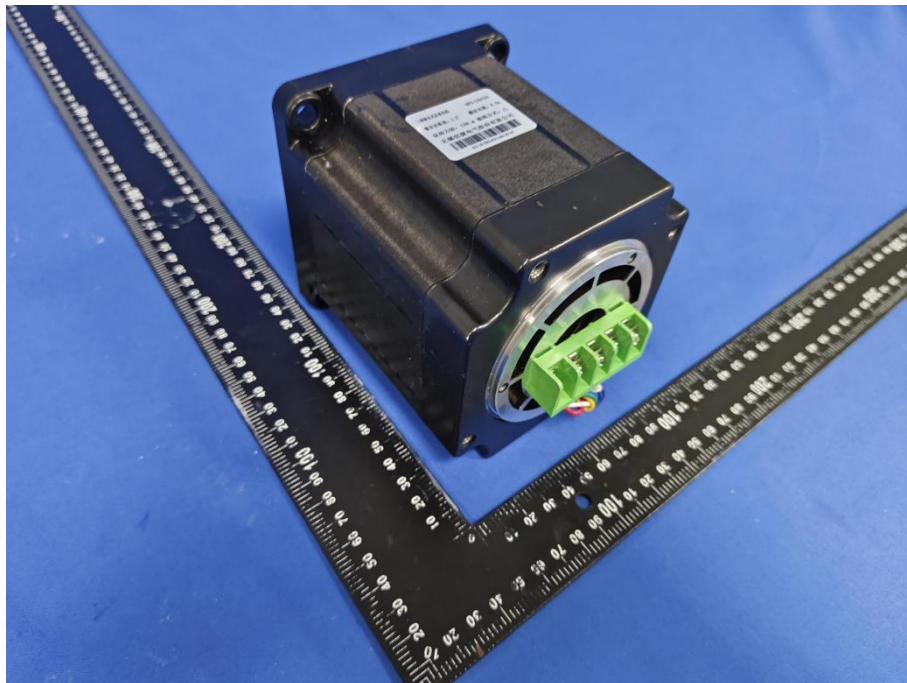
Criterion B: Operate as intended after the test

Criterion C: Loss/Error of function

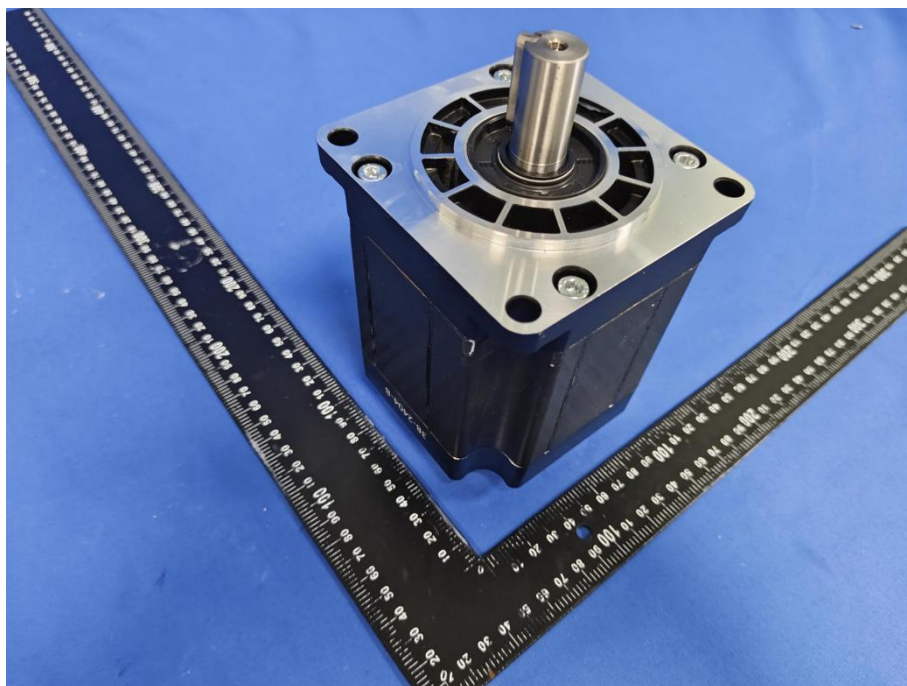
Note2: The power is temporary off and can be reset by the operator.

## 7. Photographs of EUT

EUT Photo 1



EUT Photo 2



\*\*\*End of report\*\*\*