



# CE EMC Test Report

Issued date: Jun. 03, 2025

Project No.: 24Q122702

**Product :** AI Computing System

**Model :** MIG-3000

**Series Model :** MIG-3XXXXXXXXXX ("X" can be 0-9, A-Z or blank)

**Applicant :** Vecow Co., Ltd

**Address :** 3F, No. 10, Jiankang Rd., Zhonghe Dist., New Taipei City 23586,  
Taiwan

**Report No: WD-EE-R-250171-B0**

## According to

EN 50121-1: 2017

EN 50121-3-2: 2016 + A1: 2019

EN 50155:2021, Clause 13.4.9

EN 61000-3-2: 2014, Class A

EN IEC 61000-3-2: 2019 + A2: 2024, Class A

EN 61000-3-3: 2013 + A2: 2021 + AC: 2022

EN 61000-4-2: 2009

EN IEC 61000-4-3: 2020

EN 61000-4-4: 2012

EN 61000-4-5: 2014 + A1: 2017

EN IEC 61000-4-6: 2023

Authorized Signatory :  / Ken Huang

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Wendell EMC & RF Laboratory

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### History of this test report

Report No.	Issue date	Description
WD-EE-R-250171-B0	Jun. 03, 2025	Initial Issue

#### Declaration

This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us.



### History of supplementary report

Report No.	Issue date	Description
WD-EE-R-250171-B0	Jun. 03, 2025	Original report

**Declaration**

This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us.



# 1 Certification

**Product:** AI Computing System  
**Brand Name:** Vecow  
**Model:** MIG-3000  
**Series Model:** MIG-3XXXXXXXXXX ("X" can be 0-9, A-Z or blank)  
**Applicant:** Vecow Co., Ltd  
**Tested:** May 12 ~ May 27, 2025  
**Standard:** EN 50121-1: 2017  
EN 50121-3-2: 2016 + A1: 2019  
EN 50155:2021, Clause 13.4.9  
EN 61000-3-2: 2014, Class A  
EN IEC 61000-3-2: 2019 + A2: 2024, Class A  
EN 61000-3-3: 2013 + A2: 2021 + AC: 2022  
EN 61000-4-2: 2009  
EN IEC 61000-4-3: 2020  
EN 61000-4-4: 2012  
EN 61000-4-5: 2014 + A1: 2017  
EN IEC 61000-4-6: 2023

The above equipment (Model: MIG-3000) has been tested by **Wendell EMC & RF Laboratory**, and found compliance with the requirement of the above standards. The test record, data evaluation and Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Please note that the measurement uncertainty are provided for informational purpose only and are not used in determining the Pass/Fail results.

## 1.1 Summary of Result

The EUT has been tested according to the following specifications:

Emission			
Basic Standard	Test Item	Result	Remark
EN 55016-2-1	Conducted disturbance at mains power ports	Pass	Meets the requirements
EN IEC 61000-6-4	Radiated disturbance	Pass	Meets the requirements
EN 61000-3-2	Harmonic current emissions	Pass	Meets the requirements
EN 61000-3-3	Voltage fluctuations and flicker	Pass	Meets the requirements

Immunity			
Basic Standard	Test Item	Result	Remark
EN 61000-4-2	Electrostatic discharge	Pass	Meets the requirements of Performance Criterion B
EN IEC 61000-4-3	Radiated, radio-frequency electromagnetic field	Pass	Meets the requirements of Performance Criterion A
EN 61000-4-4	Electrical fast transient / burst	Pass	Meets the requirements of Performance Criterion A
EN 61000-4-5	Surge	Pass	Meets the requirements of Performance Criterion A
EN IEC 61000-4-6	Conducted disturbances	Pass	Meets the requirements of Performance Criterion A

**Note:** Test record contained in the referenced test report relate only to the EUT sample and test item.

## **2 Laboratory Information**

### **2.1 Measurement / Test Facility**

**Conducted disturbance at main power port, Conducted disturbance at telecommunication port, Harmonics, Flicker, ESD, EFT, Surge, CS, PFMF, DIP and Close Proximity Radiated fields test**

W01: 5F-1, No.188, Baoqiao Rd., Xindian Dist., New Taipei City 23145, Taiwan (R.O.C)

**RS, ESD and Surge test**

W05: 1F-7, No.188, Baoqiao Rd., Xindian Dist., New Taipei City 23145, Taiwan (R.O.C)

**Conducted disturbance at main power port, Conducted disturbance at telecommunication port, Radiated disturbance (9\*6\*6 Chamber) and ESD test**

W08: No.119, Wugong 3rd Rd., Wugu Dist., New Taipei City 248, Taiwan (R.O.C)

#### **ACCREDITATIONS**

The laboratories are accredited and approved by the TAF according to ISO/IEC 17025.



## 2.2 Measurement Uncertainty

The measurement instrumentation uncertainty is evaluated according to CISPR 16-4-2.

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

Wendell EMC & RF Laboratory  $U_{lab}$  is less than  $U_{cispr}$ , therefore compliance or non-compliance with a disturbance limit shall be determined in the following manner.

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

Please note that the measurement uncertainty ( $U_{lab}$ ) is provided for informational purpose only and is not used in determining the Pass/Fail results.

### 2.2.1 Conducted Emission Measurement

Test Site	Frequency Range	dB ( $U_{lab}$ )	Note
W01-CE	150 kHz ~ 30 MHz	2.84	LISN
W08-CE	150 kHz ~ 30 MHz	2.72	LISN

### 2.2.2 Radiated Emission Measurement

Test Site	Frequency Range	Ant	dB ( $U_{lab}$ )	Note
W08-966-1	30 MHz ~ 200 MHz	V	3.50	N/A
	30 MHz ~ 200 MHz	H	2.96	N/A
	200 MHz ~ 1000 MHz	V	5.09	N/A
	200 MHz ~ 1000 MHz	H	3.41	N/A
	1 GHz ~ 6 GHz	V	4.37	N/A
	1 GHz ~ 6 GHz	H	4.30	N/A



### 3 General Information

#### 3.1 Description of Equipment Under Test

<b>Product</b>	AI Computing System
<b>Brand</b>	Vecow
<b>Model</b>	MIG-3000
<b>Series Model</b>	MIG-3XXXXXXXXXX ("X" can be 0-9, A-Z or blank)
<b>Applicant</b>	Vecow Co., Ltd
<b>Received Date</b>	Jan. 03, 2025
<b>EUT Power Rating</b>	24Vdc (from adapter)
<b>Model Differences</b>	The models are electrically identical, different models no. are for marketing purpose. The series model information is provided by client.
<b>Operating System</b>	Windows 11 Professional version: 24H2
<b>Data Cable Supplied</b>	N/A
<b>Accessory Device</b>	N/A
<b>I/O Port</b>	Please refer to the User's Manual

**Note:**

- The EUT uses the follow adapter:

Adapter (support unit only)	
<b>Brand</b>	LITEON
<b>Model</b>	PA-1181-28E
<b>Input Power</b>	100-240Vac, 2.34A, 50-60Hz
<b>Output Power</b>	24Vdc, 7.5A
<b>Power line</b>	Input: 1.8m non-shielded cable Output: 1m non-shielded cable with 2 cores

- The EUT contains following components.

Item	Brand	Model	Spec.	Qty.
CPU	Intel	13th Gen Intel® Core™ i7-13700E	1.80 GHz	1
RAM	innodisk	M5D0-BGS2Q5VP-H03	32GB DDR5 4800 W/T ECC SODIMM	2
M.2 SSD	innodisk	DEM24-C12DD1KCCQF-H03	M.2(P42) 3TE6 512GB	1

- The EUT's highest operating frequency is 1800MHz. Therefore the radiated emission is tested up to 6GHz.

### 3.2 Description of Measurement / Test Modes

Test results are presented in the report as below.

Test Mode	Measurement / Test Condition
<b>Conducted Emission Measurement</b>	
-	AC-DC Adapter mode
<b>Radiated Emission 30MHz ~ 1GHz Measurement</b>	
-	AC-DC Adapter mode
<b>Radiated Emission above 1GHz Measurement</b>	
-	AC-DC Adapter mode
<b>Harmonic &amp; Flicker Measurement</b>	
-	AC-DC Adapter mode
<b>Immunity Test</b>	
-	AC-DC Adapter mode

### 3.3 Description of Operating Condition

- a. The EUT placed on test table.
- b. Prepare PC to act as a communication partner and placed it outside of testing area.
- c. The EUT was connected to the PC with LAN cable.
- d. The communication partner sent data to EUT by command "ping" via LAN.
- e. The EUT read / write data with Internal SSD & External SSD.
- f. The EUT run test program BurnIN.exe to enable all functions.
- g. The EUT sent Color Bar ITU-R.BT471-1 signal to monitor and displayed on screen.
- h. The microphone sent voice signal to EUT.
- i. The EUT sent voice signal to earphone.



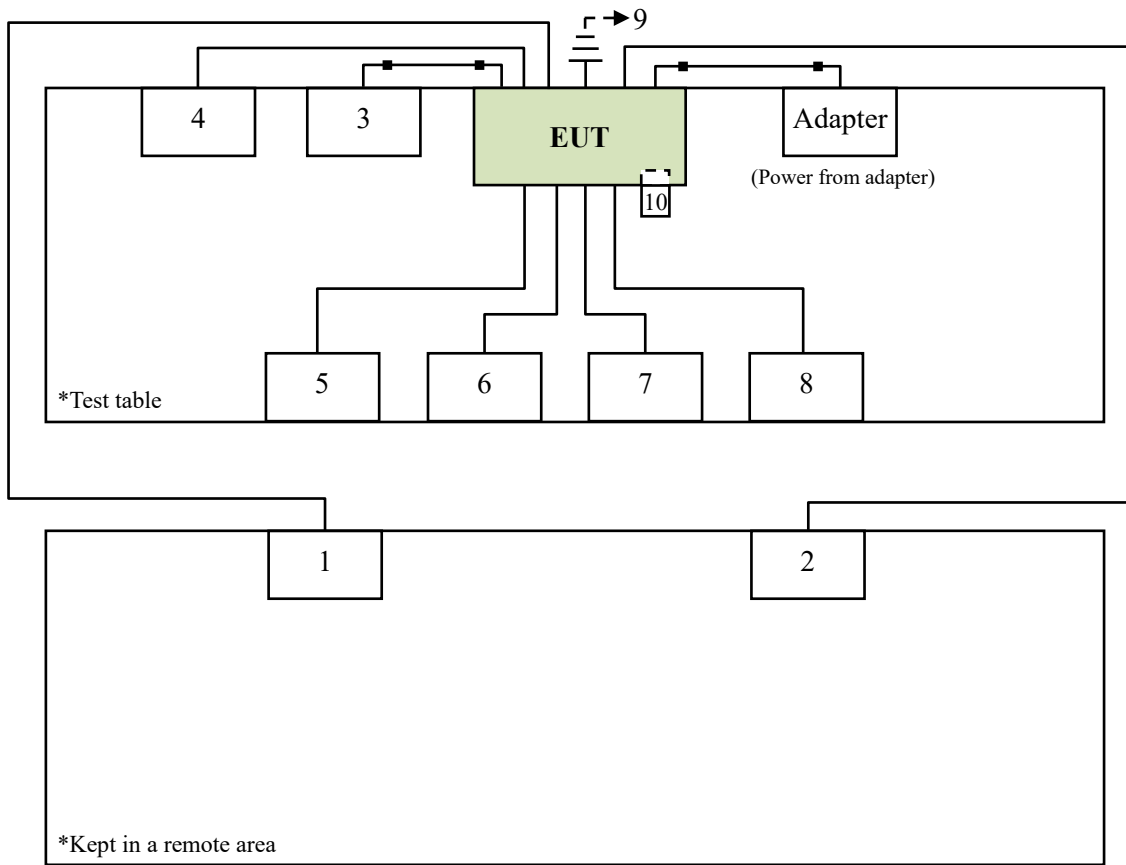
### 3.4 Description of Associated Equipment

The EUT has been conducted testing with other necessary accessories or support units.

Item	Equipment	Brand	Model No.	Serial No.	FCC ID	Data Cable	Power Cable	Remark
1	Desktop PC	DELL	D19M	N/A	PPD-QCNF A335	15m CAT.6A shielded LAN cable	AC: 1.8m non-shielded cable	-
2	Desktop PC	DELL	D24M	N/A	PD93165NG	15m CAT.6A shielded LAN cable	AC: 1.8m non-shielded cable	-
3	4K Monitor	ASUS	XG27UCS	S5LMTF2007 65	FCC SDoC Approved	1.5m shielded HDMI cable with 2 cores	AC: 1.8m non-shielded cable	-
4	4K Monitor	ASUS	XG27UCS	S7LMT011954	FCC SDoC Approved	1.7m shielded DP cable	AC: 1.8m non-shielded cable	-
5	Keyboard	DELL	KB216t	CN-0W33XP- L0300 -7C1-15UP	FCC SDoC Approved	1.5m non-shielded USB cable	N/A	-
6	Mouse	DELL	MS116	CN-0DV0RH- L0300 -7C1-15UP	FCC SDoC Approved	1.5m non-shielded USB cable	N/A	-
7	Earphone & Microphone	Avier	AEP-MM	N/A	N/A	1.2m non-shielded audio cable	N/A	-
8	External Portable SSD (x2)	Transcend	TS120GES D240C	F96474-0001	FCC SDoC Approved	1m shielded USB cable	N/A	-
9	Grounding wire	N/A	N/A	N/A	N/A	1m non-shielded cable	N/A	-
10	RS232 terminator (x2)	N/A	N/A	N/A	N/A	N/A	N/A	Supplied by client

**Note:** 1. The core(s) is(are) originally attached to the cable(s).  
2. Item 1-2 acted as communication partners to transfer data.

### 3.5 Configuration of Equipment Under Test





## 4 Emission Measurement

### 4.1 Conducted Emission Measurement

#### 4.1.1 Limit of Conducted Emission Measurement

Frequency (MHz)	Quasi-peak dB(μV)
0.15 to 0.5	99
0.5 to 30	93

- Note:**
- The lower limit shall apply at the transition frequencies.
  - Detector function in the form: QP = Quasi Peak, AVG = Average
  - The result calculated as following:  
 Measurement Value = Reading Level + Correct Factor  
 Correct Factor = LISN Factor + Cable Loss + Transient Limiter (If use)  
 Margin Level = Measurement Value – Limit Value

#### 4.1.2 Measurement Instrument

Test Site: W01-CE					
Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	TWO-LINE V-NETWORK	R&S	ENV216	CT-1-025-1	Apr. 26, 2025
2	Pulse limiter	R&S	ESH3-Z2	CT-2-015	Apr. 23, 2025
3	EMI Test Receiver	R&S	ESCI	CT-1-024	Apr. 18, 2025
4	Artificial Mains Network (AMN)	SCHWARZBECK	NSLK 8127	CT-1-104-1	Apr. 26, 2025
5	RF Cable	MVE	200200.400LL .500A	CT-9-101	Apr. 23, 2025
6	50ohm Termination	N/A	N/A	CT-1-065-1	Apr. 26, 2025
7	Measurement Software	EZ-EMC	Ver: EMC-CON 3A1	CT-3-012	No calibration request

- Note:** 1. The calibration interval of the above test instruments is 12 months.



Test Site: W08-CE					
Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	TWO-LINE V-NETWORK	R&S	ENV216	CT-1-025-2	Jun. 20, 2024
2	RF Cable	EMCI	EMCCFD300-BM-BM-5000	CT-1-107-2	Jun. 24, 2024
3	EMI Test Receiver	R&S	ESR3	CT-1-103	Jun. 20, 2024
4	Artificial Mains Network (AMN)	SCHWARZBECK	NSLK 8127 RC	CT-1-104-1R C	Jun. 20, 2024
5	Transient Limiter	Electro-Metrics	EM-7600	CT-1-026	Jun. 24, 2024
6	50ohm Termination	N/A	N/A	CT-1-109-1	Jun. 20, 2024
7	Measurement Software	EZ-EMC	Ver: EMC-CON 3A1	CT-3-012	No calibration request

**Note:** 1. The calibration interval of the above test instruments is 12 months.

### 4.1.3 Measurement Procedure

- a. The table-top equipment under test was placed 0.8 meter height wooden table from the horizontal ground plane with EUT being connected to power source through a line impedance stabilization network (LISN). The floor-standing equipment under test was placed insulation support unit from the horizontal ground plane. The LISN at least be 0.8 meter from nearest chassis of equipment under test.
- b. The line impedance stabilization network (LISN) provides 50 ohm/50uH of coupling impedance for the measuring instrument. All associated equipment powered from additional LISN(s).
- c. Interrelating cables that hang closer than 0.4 meter to the ground plane shall be folded back and forth in the center forming a bundle. All I/O cables were positioned to simulate typical usage.
- d. The loads and/or devices simulating typical operating conditions shall be connected to at least one of each type of interface port of the equipment under test. If loading (or terminating) with a device of actual usage is not feasible, the port should be loaded with a simulator. Where these options are not practical the port shall be loaded by the application of a typical impedance considering both the common and differential modes.
- e. The EMI test receiver connected to the line impedance stabilization network (LISN) powering the equipment. The measurements shall be limited to the operating ranges of voltage and frequency as specified for the equipment under test, having regard to the supply voltage and frequency for the intended market of the equipment under test.
- f. The EMI test receiver scanned from 150kHz to 30MHz for emissions in each of modes. A scan was taken on both power lines, Line and Neutral, recording at least six highest emission amplitude.
- g. The equipment under test and cable configuration of the above highest emission amplitude were recorded.

### 4.1.4 Deviation from Standard

No deviation

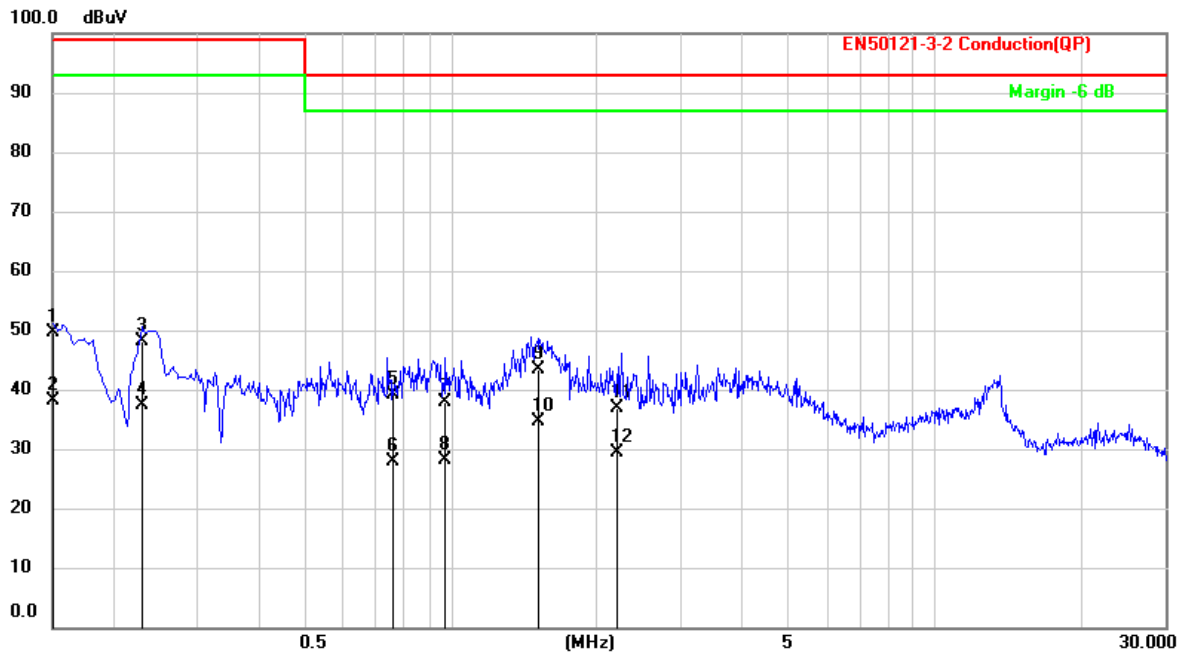






### 4.1.6 Measurement Result

Test Voltage	230Vac, 50Hz	Frequency Range	0.15 ~ 30 MHz
Environmental Conditions	21°C, 50% RH	6dB Bandwidth	9 kHz
Test Date	2025/05/23	Phase	L
Tested by	Guanwei Liao	Test Site	W01-CE

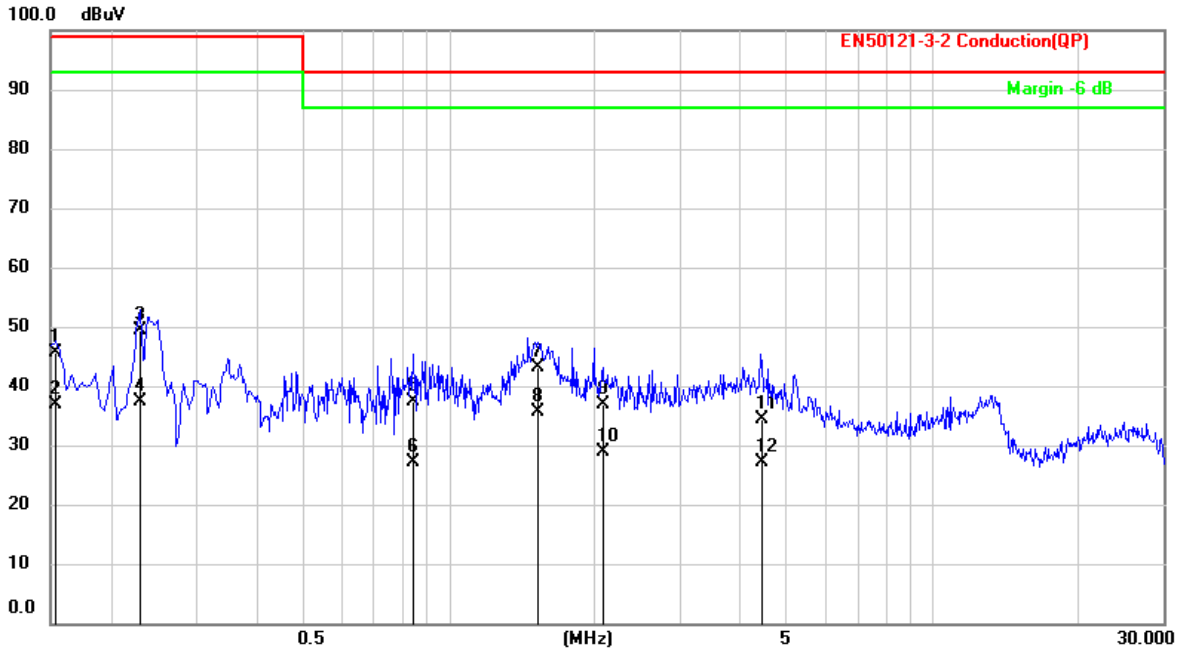


No.	Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.1515	39.60	9.91	49.51	99.00	-49.49	QP
2	0.1515	28.17	9.91	38.08	99.00	-60.92	AVG
3	0.2309	38.31	9.91	48.22	99.00	-50.78	QP
4	0.2309	27.45	9.91	37.36	99.00	-61.64	AVG
5	0.7568	29.16	9.94	39.10	93.00	-53.90	QP
6	0.7568	18.02	9.94	27.96	93.00	-65.04	AVG
7	0.9740	28.00	9.94	37.94	93.00	-55.06	QP
8	0.9740	18.07	9.94	28.01	93.00	-64.99	AVG
9	1.5043	33.41	9.95	43.36	93.00	-49.64	QP
10	1.5043	24.74	9.95	34.69	93.00	-58.31	AVG
11	2.2052	26.79	9.97	36.76	93.00	-56.24	QP
12	2.2052	19.37	9.97	29.34	93.00	-63.66	AVG

**Remark:** 1. QP = Quasi Peak, AVG = Average  
 2. Correct Factor = LISN Factor + Cable Loss + Transient Limiter (If use)  
 3. Measurement Value = Reading Level + Correct Factor  
 4. Margin Level = Measurement Value – Limit Value



Test Voltage	230Vac, 50Hz	Frequency Range	0.15 ~ 30 MHz
Environmental Conditions	21°C, 50% RH	6dB Bandwidth	9 kHz
Test Date	2025/05/23	Phase	N
Tested by	Guanwei Liao	Test Site	W01-CE



No.	Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.1545	35.64	9.91	45.55	99.00	-53.45	QP
2	0.1545	26.85	9.91	36.76	99.00	-62.24	AVG
3	0.2292	39.58	9.90	49.48	99.00	-49.52	QP
4	0.2292	27.41	9.90	37.31	99.00	-61.69	AVG
5	0.8427	27.48	9.94	37.42	93.00	-55.58	QP
6	0.8427	17.26	9.94	27.20	93.00	-65.80	AVG
7	1.5248	33.17	9.96	43.13	93.00	-49.87	QP
8	1.5248	25.59	9.96	35.55	93.00	-57.45	AVG
9	2.0854	26.96	9.98	36.94	93.00	-56.06	QP
10	2.0854	19.00	9.98	28.98	93.00	-64.02	AVG
11	4.4351	24.38	10.07	34.45	93.00	-58.55	QP
12	4.4351	17.12	10.07	27.19	93.00	-65.81	AVG

**Remark:** 1. QP = Quasi Peak, AVG = Average  
 2. Correct Factor = LISN Factor + Cable Loss + Transient Limiter (If use)  
 3. Measurement Value = Reading Level + Correct Factor  
 4. Margin Level = Measurement Value - Limit Value

### 4.1.7 Photographs of Measurement Configuration



## 4.2 Radiated Emission Measurement

### 4.2.1 Limit of Radiated Emission Measurement

According to EN IEC 61000-6-4 table2 - Required highest frequency for radiated measurement:

Highest internal frequency ( $F_x$ )	Highest measured frequency
$F_x \leq 108$ MHz	1 GHz
$108$ MHz $< F_x \leq 500$ MHz	2 GHz
$500$ MHz $< F_x \leq 1$ GHz	5 GHz
$F_x > 1$ GHz	$5 \times F_x$ up to a maximum of 6 GHz

Remark:

1.  $F_x$  : highest fundamental frequency generated or used within the EUT or highest frequency at which it operates.
2. Where  $F_x$  is unknown, the radiated emission measurements shall be performed up to 6 GHz.

Radiated Frequency range 30 MHz to 1000 MHz

Frequency (MHz)	Quasi-peak dB( $\mu$ V/m) at 3m
30 to 230	50
230 to 1000	57

Radiated Frequency range above 1 GHz

Frequency (GHz)	Average dB( $\mu$ V/m) at 3m	Peak dB( $\mu$ V/m) at 3m
1 to 3	56	76
3 to 6	60	80

- Note:**
1. The lower limit shall apply at the transition frequency.
  2. Detector function in the form: PK = Peak, QP = Quasi Peak, AVG = Average
  3. The result calculated as following:  
 Measurement Value = Reading Level + Correct Factor  
 Correct Factor = Antenna Factor + Cable Loss (Antenna to Pre-Amplifier) -  
 Pre-Amplifier Gain + Cable Loss (Pre-Amplifier to Receiver)  
 Margin Level = Measurement Value - Limit Value



#### 4.2.2 Measurement Instrument

Test Site: W08-966-1					
Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	Horn Antenna	Schwarzbeck	BBHA 9120D	CT-9-031	Jul. 29, 2024
2	Horn Antenna	Schwarzbeck	BBHA 9170	CT-9-032	Aug. 15, 2024
3	TRILOG Broadband Antenna with 6 dB Attenuator	Schwarzbeck & MVE	VULB 9168 & MVE2251-06	CT-1-096-1	Apr. 29, 2025
4	Spectrum Analyzer	Agilent	E4407B	CT-1-003(1)	May 06, 2025
5	EXA Signal Analyzer	Keysight	N9010A	CT-1-093	Aug. 18, 2024
6	EMI Test Receiver	Keysight	N9038A	CT-9-007	May 06, 2025
7	Preamplifier	EM	EMC330	CT-9-024	May 06, 2025
8	Preamplifier	SGH & MCL	SGH118 & BW-S15W2+	CT-9-071	May 06, 2025
9	Preamplifier	EMCI	EMC184045SE	CT-9-013	Aug. 16, 2024
10	Test Cable	EMCI	EMCCFD400-NM-NM-1000	CT-1-132	May 07, 2025
11	Test Cable	PEWC	CFD400NL-LW-NM-NM-3000	CT-1-141	May 07, 2025
12	Test Cable	EMCI	EMCCFD400-NM-NM-15000	CT-1-133	May 07, 2025
13	Test Cable	EMCI	EMC104-SM-35M-600	CT-1-134	May 07, 2025
14	Test Cable	MVE	280280.LL266.1400	CT-9-106	May 07, 2025
15	Test Cable	EMCI	EMC102-KM-KM-600	CT-1-136	Aug. 21, 2024
16	Test Cable	MVE	140140.LL404.700	CT-9-100	May 07, 2025
17	Measurement Software	EZ-EMC	Ver :WD-03A1-1	CT-3-012	No calibration request

**Note:** 1. The calibration interval of the above test instruments is 12 months.

### 4.2.3 Measurement Procedure

- a. The table-top equipment under test was placed on the top of a turntable 0.8 meter above the ground at 3 m 966 chamber. The floor-standing equipment under test was placed insulation support unit from the horizontal ground plane. The turntable was rotated 360 degrees to determine the position of the highest radiation emissions.
- b. The height of the antenna shall vary between 1 m to 4 m. Both vertical and horizontal polarizations of the antenna were set to make the measurement.
- c. The loads and/or devices simulating typical operating conditions shall be connected to at least one of each type of interface port of the equipment under test. If loading (or terminating) with a device of actual usage is not feasible, the port should be loaded with a simulator. Where these options are not practical the port shall be loaded by the application of a typical impedance considering both the common and differential modes.
- d. The initial step in collecting radiated emission data is a spectrum mode scanning the measurement frequency range.

Below 1GHz:

Reading in which marked as QP means measurements by using receiver mode with detector setting in RBW = 120 kHz.

If the spectrum mode measured peak value compliance with and lower than QP Limit, the equipment under test shall be deemed to meet QP Limits.

Above 1GHz:

Reading in which marked as Peak & AVG means measurements by using spectrum mode with setting in RBW = 1 MHz.

If the spectrum mode measured value compliance with the Peak Limits and lower than AVG Limits, the equipment under test shall be deemed to meet both Peak and AVG Limits.

- e. Emission frequency and amplitude were recorded, recording at least six highest emissions. The equipment under test and cable configuration of the above highest emission amplitude were recorded.

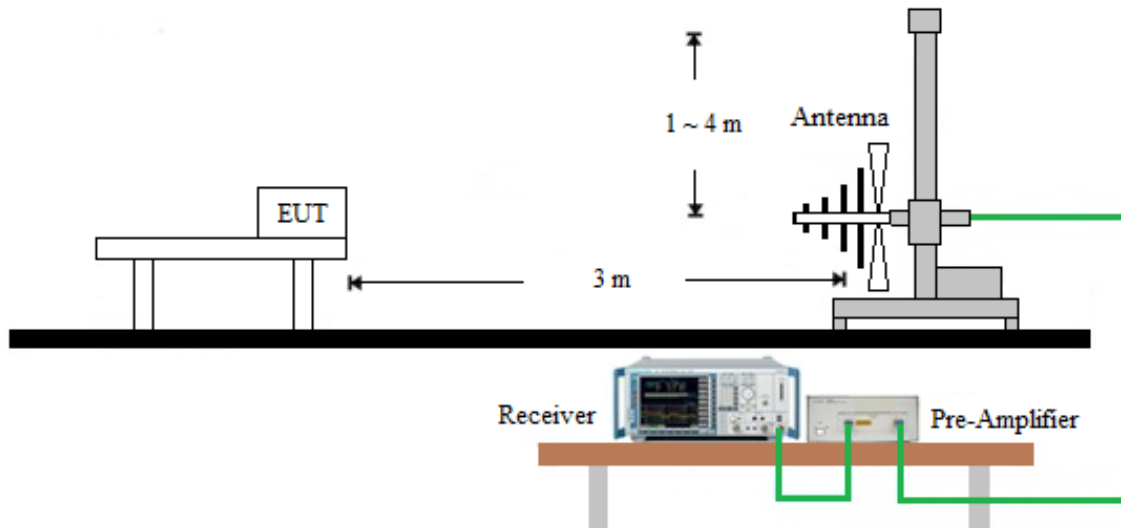
### 4.2.4 Deviation from Standard

No deviation

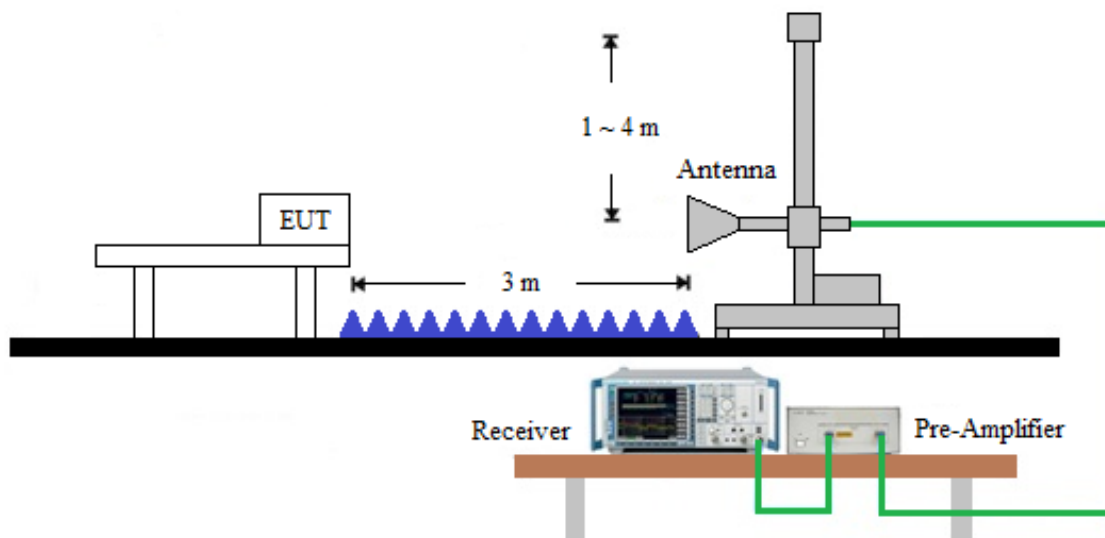


## 4.2.5 Measurement Configuration

< Radiated Emissions Frequency: 30 MHz to 1000 MHz >



< Radiated Emissions Frequency: above 1GHz >

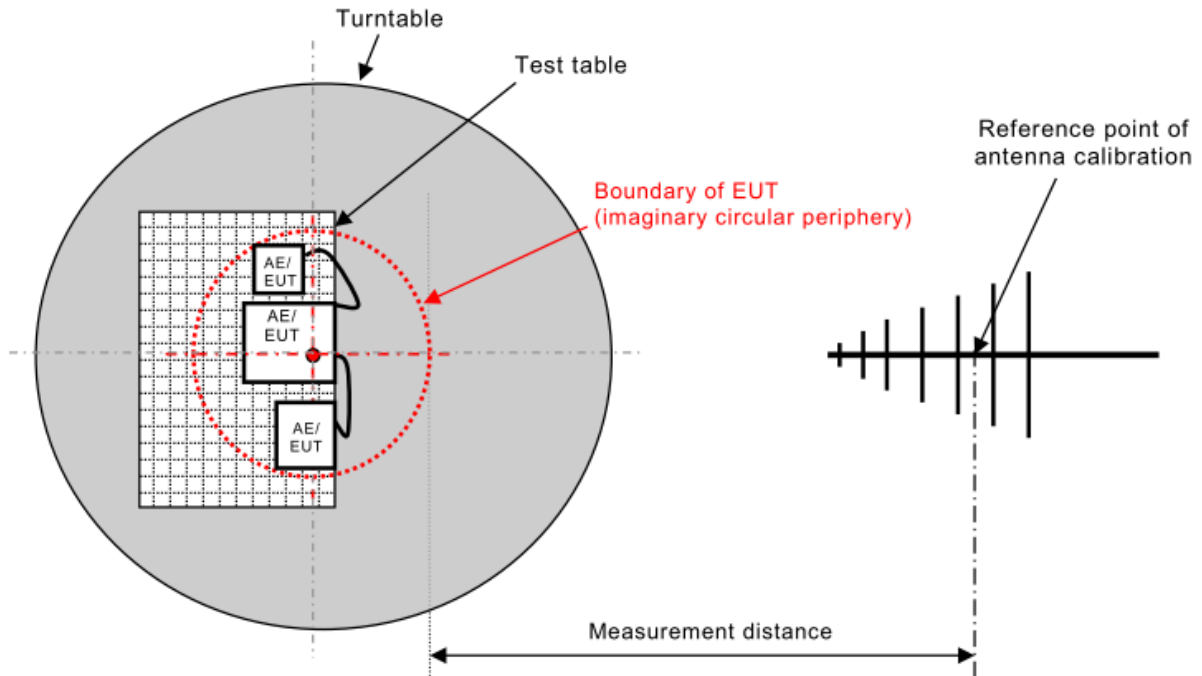


**Note:**

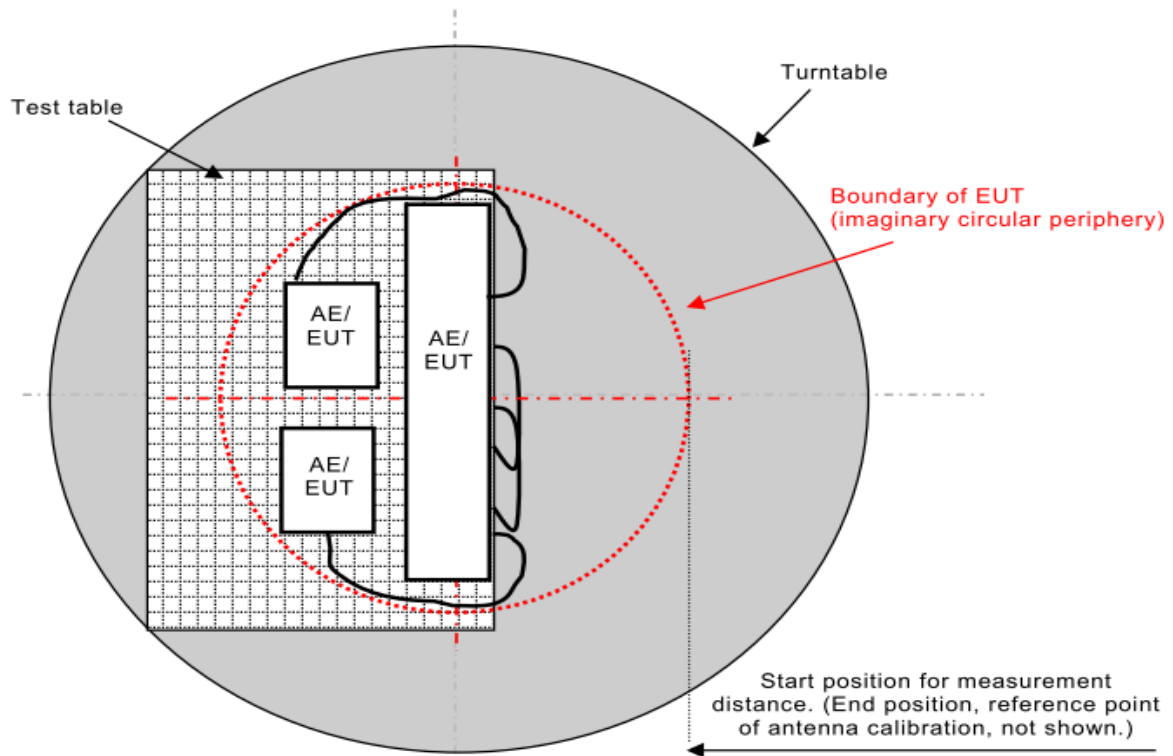
- (1) Please refer to the 4.3.7 for the actual test configuration.
- (2) Detector function in the form: PK = Peak, QP = Quasi Peak, AVG = Average
- (3) The test result calculated as following:
  - Measurement Value = Reading Level + Correct Factor
  - Correct Factor = Antenna Factor + Cable Loss – Pre-Amplifier Gain (if use)
  - Margin Level = Measurement Value - Limit Value



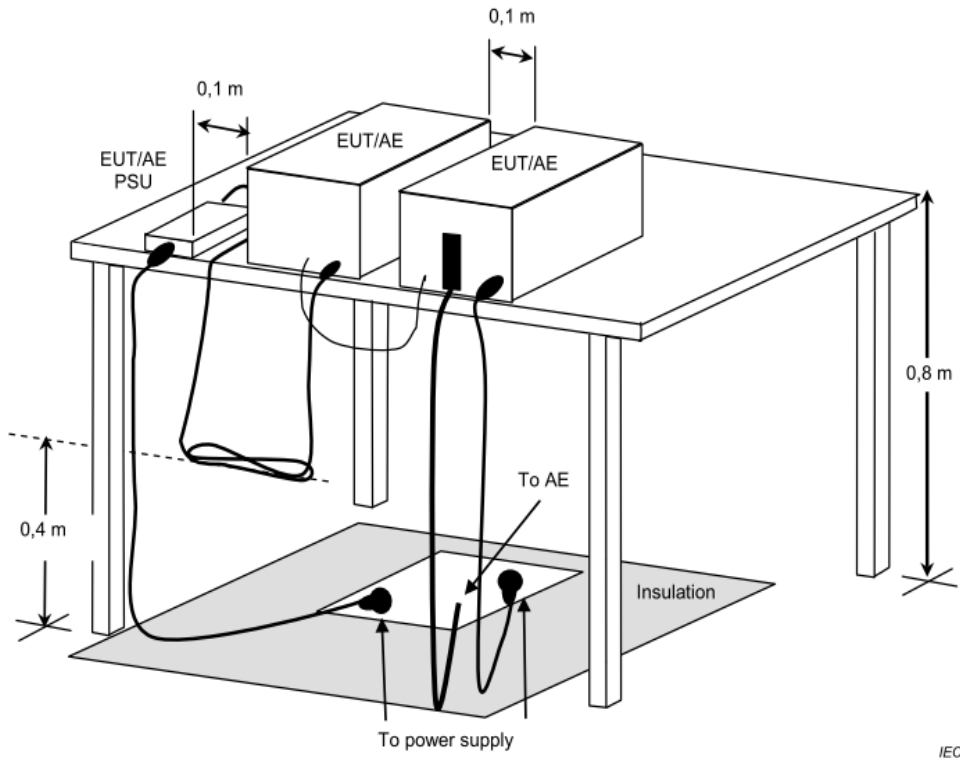
< EUT placement top view and measurement distance >



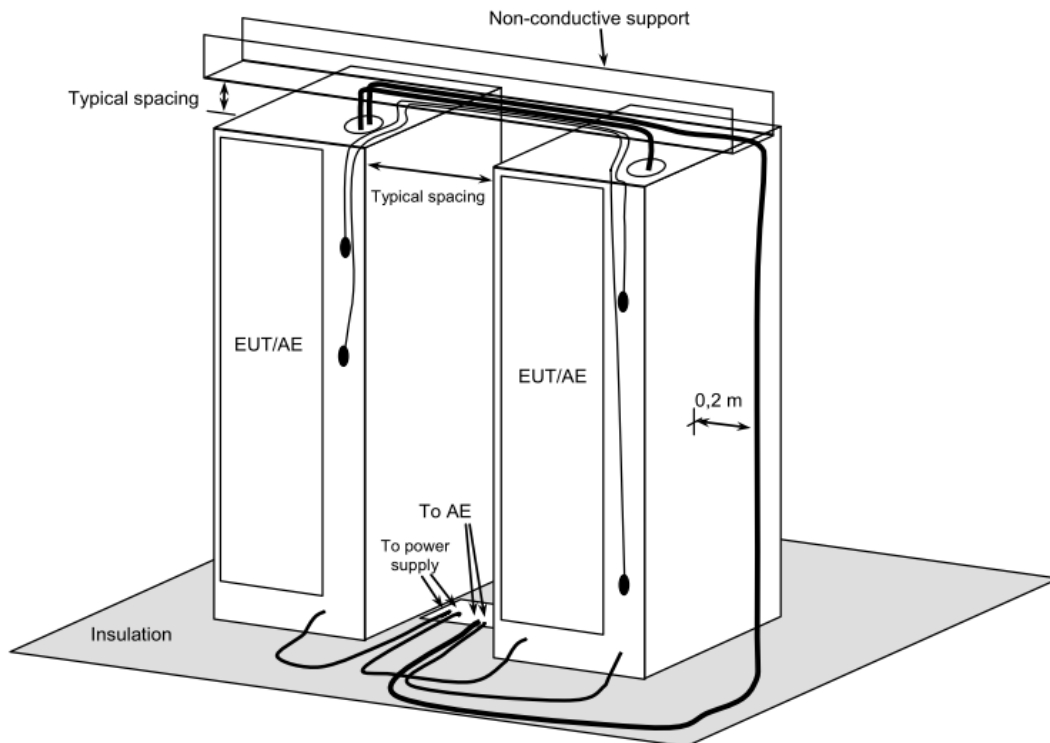
< Boundary of EUT, Local AE and associated cabling >



< Table-Top equipment under test >



< Floor-Standing equipment under test >

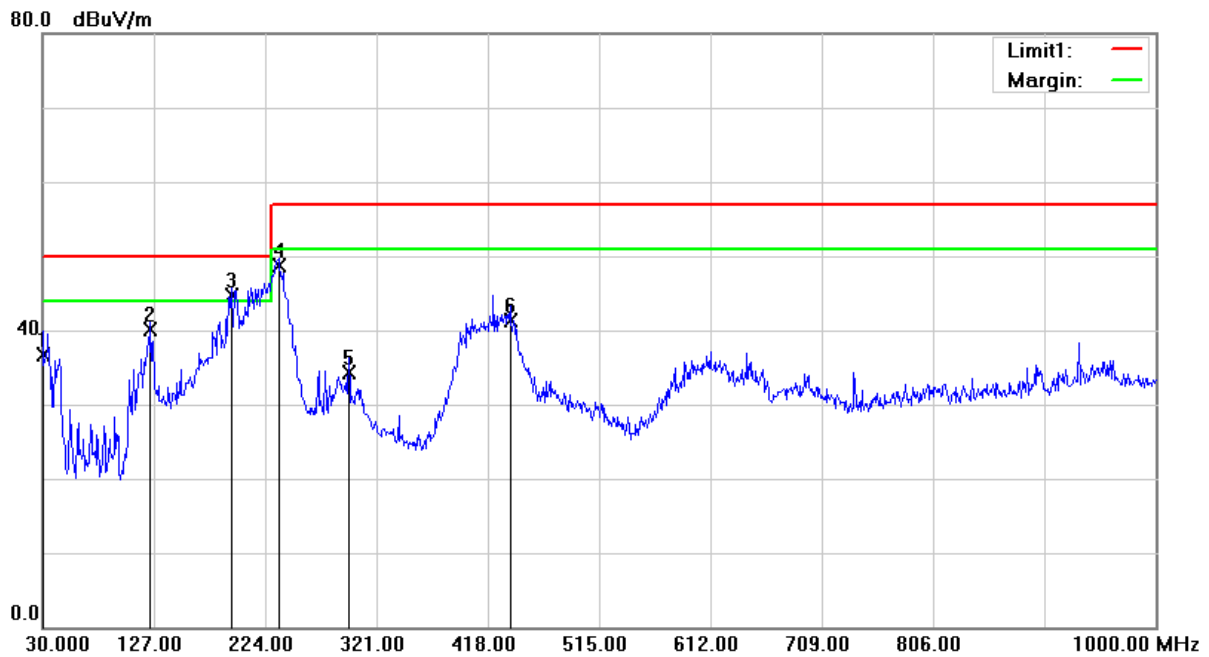


**Note:** Please refer to the 4.3.7 for the actual test configuration.



## 4.2.6 Measurement Result

Test Voltage	230Vac, 50Hz	Frequency Range	30 ~ 1000 MHz
Environmental Conditions	26°C, 44% RH	6dB Bandwidth	120 kHz
Test Date	2025/05/21	Test Distance	3m
Tested by	Karwin Kao	Polarization	Vertical
Test Site	W08-966-1		



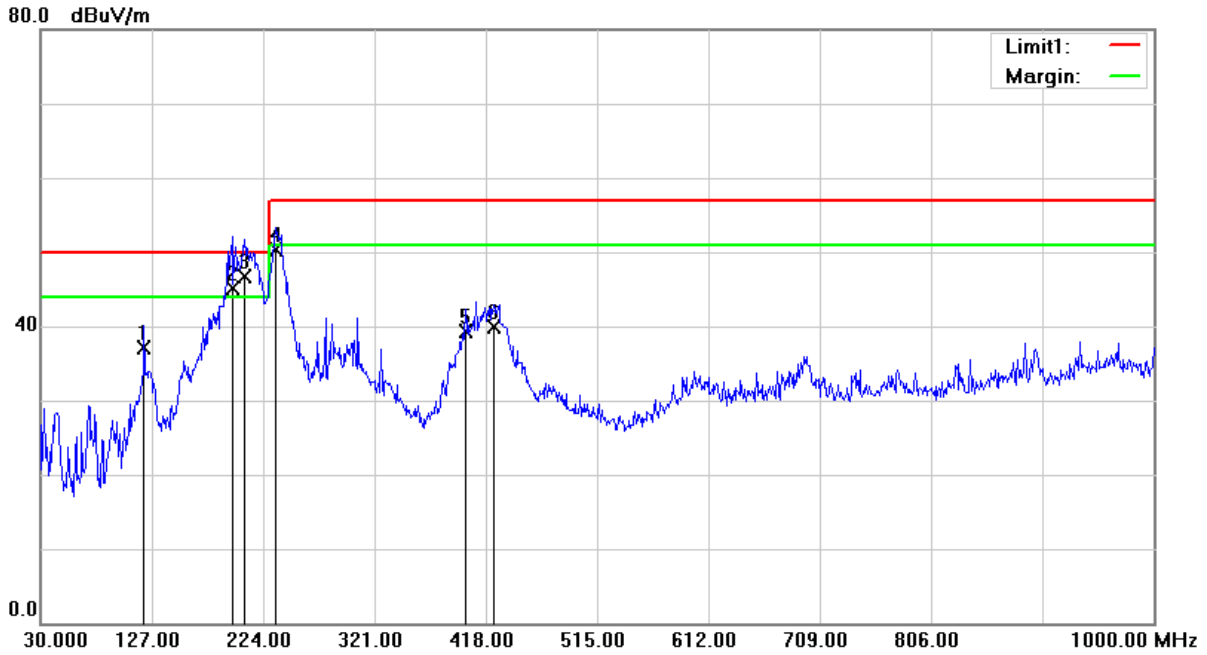
No.	Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB/m)	Measurement (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Table Degree (degree)	Antenna Height (cm)	Detector
1	30.0000	47.72	-10.92	36.80	50.00	-13.20	252	100	QP
2	124.0900	52.00	-11.92	40.08	50.00	-9.92	191	100	QP
3	194.9000	57.15	-12.37	44.78	50.00	-5.22	351	200	QP
4	235.6400	60.06	-11.35	48.71	57.00	-8.29	18	100	QP
5	296.7500	42.91	-8.56	34.35	57.00	-22.65	134	100	QP
6	437.4000	45.54	-4.18	41.36	57.00	-15.64	360	200	QP

**Remark:**

1. QP = Quasi Peak
2. Correct Factor = Antenna Factor + Cable Loss (Antenna to Pre-Amplifier) – Pre-Amplifier Gain + Cable Loss (Pre-Amplifier to Receiver)
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value – Limit Value



<b>Test Voltage</b>	230Vac, 50Hz	<b>Frequency Range</b>	30 ~ 1000 MHz
<b>Environmental Conditions</b>	26°C, 44% RH	<b>6dB Bandwidth</b>	120 kHz
<b>Test Date</b>	2025/05/21	<b>Test Distance</b>	3m
<b>Tested by</b>	Karwin Kao	<b>Polarization</b>	Horizontal
<b>Test Site</b>	W08-966-1		

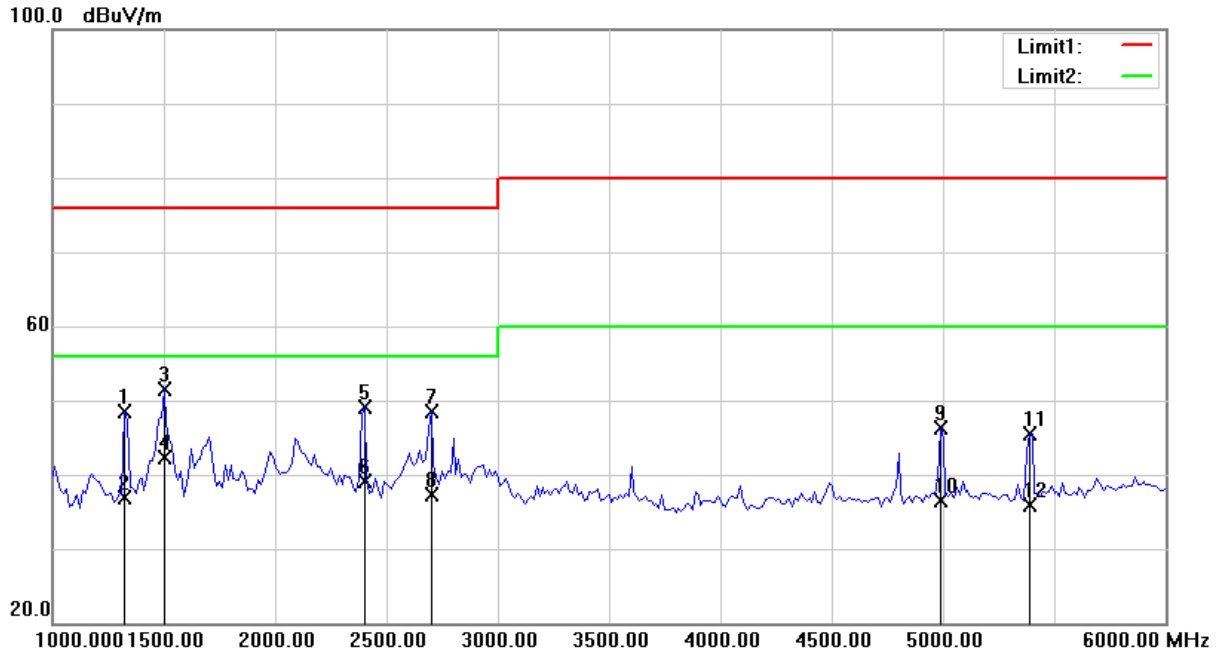


No.	Frequency (MHz)	Reading Level (dBµV)	Correct Factor (dB/m)	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Table Degree (degree)	Antenna Height (cm)	Detector
1	120.2100	49.20	-12.17	37.03	50.00	-12.97	226	200	QP
2	196.8400	57.56	-12.53	45.03	50.00	-4.97	87	200	QP
3	207.5100	59.25	-12.58	46.67	50.00	-3.33	87	200	QP
4	234.6700	61.79	-11.46	50.33	57.00	-6.67	53	100	QP
5	400.5400	45.00	-5.68	39.32	57.00	-17.68	39	100	QP
6	424.7900	44.80	-4.82	39.98	57.00	-17.02	43	100	QP

**Remark:** 1. QP = Quasi Peak  
 2. Correct Factor = Antenna Factor + Cable Loss (Antenna to Pre-Amplifier) – Pre-Amplifier Gain + Cable Loss (Pre-Amplifier to Receiver)  
 3. Measurement Value = Reading Level + Correct Factor  
 4. Margin Level = Measurement Value – Limit Value



<b>Test Voltage</b>	230Vac, 50Hz	<b>Frequency Range</b>	1 ~ 6 GHz
<b>Environmental Conditions</b>	26°C, 44% RH	<b>6dB Bandwidth</b>	1MHz
<b>Test Date</b>	2025/05/20	<b>Test Distance</b>	3m
<b>Tested by</b>	Karwin Kao	<b>Polarization</b>	Vertical
<b>Test Site</b>	W08-966-1		

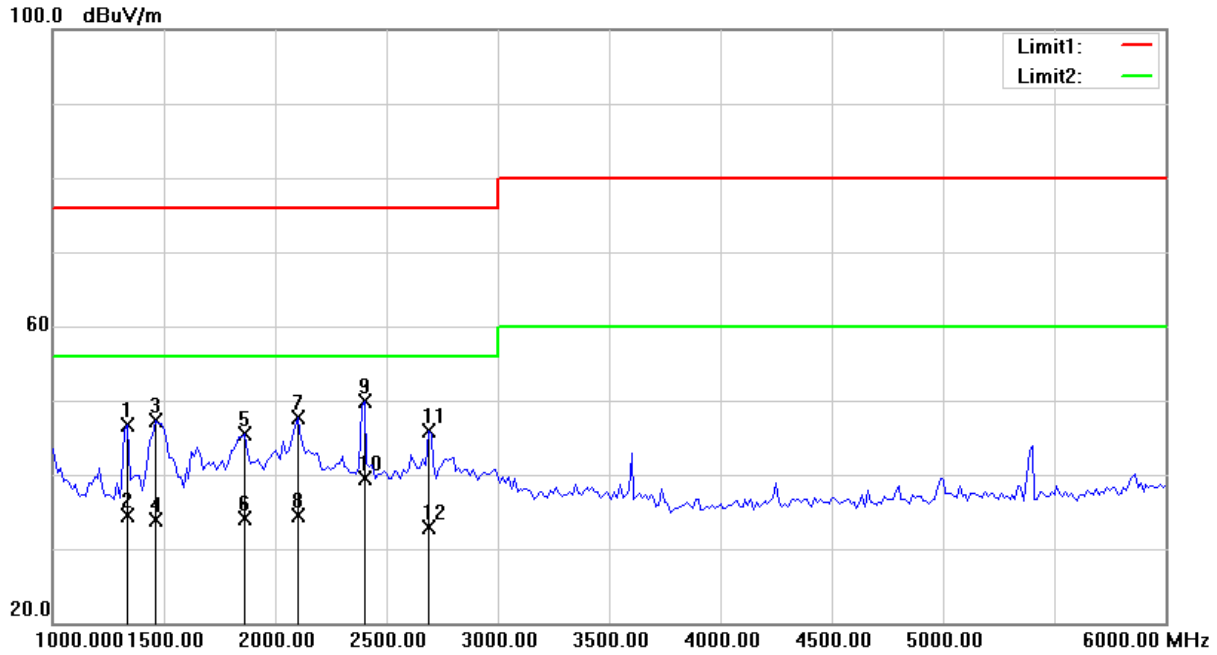


No.	Frequency (MHz)	Reading Level (dBµV)	Correct Factor (dB/m)	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Table Degree (degree)	Antenna Height (cm)	Detector
1	1325.000	66.72	-18.29	48.43	76.00	-27.57	301	100	peak
2	1325.000	55.17	-18.29	36.88	56.00	-19.12	301	100	AVG
3	1500.000	70.02	-18.47	51.55	76.00	-24.45	146	100	peak
4	1500.000	60.83	-18.47	42.36	56.00	-13.64	146	100	AVG
5	2400.000	63.97	-14.77	49.20	76.00	-26.80	206	100	peak
6	2400.000	53.88	-14.77	39.11	56.00	-16.89	206	100	AVG
7	2700.000	62.94	-14.34	48.60	76.00	-27.40	206	100	peak
8	2700.000	51.74	-14.34	37.40	56.00	-18.60	206	100	AVG
9	4987.500	54.61	-8.37	46.24	80.00	-33.76	165	100	peak
10	4987.500	44.86	-8.37	36.49	60.00	-23.51	165	100	AVG
11	5387.500	53.47	-7.95	45.52	80.00	-34.48	165	100	peak
12	5387.500	43.90	-7.95	35.95	60.00	-24.05	165	100	AVG

**Remark:** 1. peak = Peak, AVG = Average  
 2. Correct Factor = Antenna Factor + Cable Loss (Antenna to Pre-Amplifier) – Pre-Amplifier Gain + Cable Loss (Pre-Amplifier to Receiver)  
 3. Measurement Value = Reading Level + Correct Factor  
 4. Margin Level = Measurement Value – Limit Value



<b>Test Voltage</b>	230Vac, 50Hz	<b>Frequency Range</b>	1 ~ 6 GHz
<b>Environmental Conditions</b>	26°C, 44% RH	<b>6dB Bandwidth</b>	1MHz
<b>Test Date</b>	2025/05/21	<b>Test Distance</b>	3m
<b>Tested by</b>	Karwin Kao	<b>Polarization</b>	Horizontal
<b>Test Site</b>	W08-966-1		

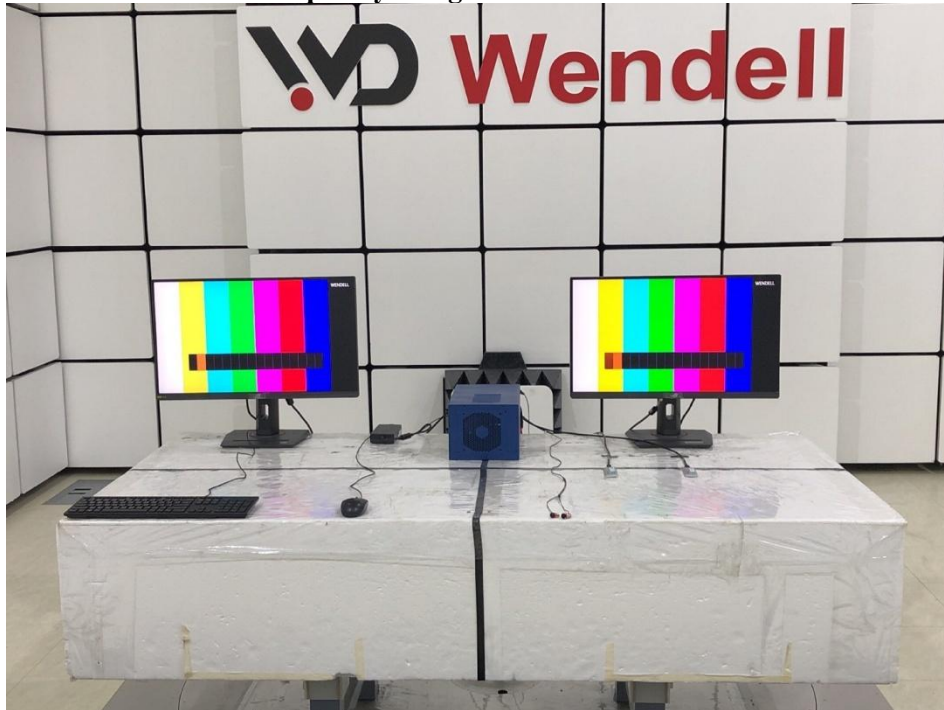


No.	Frequency (MHz)	Reading Level (dBµV)	Correct Factor (dB/m)	Measurement (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Table Degree (degree)	Antenna Height (cm)	Detector
1	1337.500	65.11	-18.32	46.79	76.00	-29.21	241	100	peak
2	1337.500	52.81	-18.32	34.49	56.00	-21.51	241	100	AVG
3	1462.500	65.39	-18.16	47.23	76.00	-28.77	257	100	peak
4	1462.500	52.09	-18.16	33.93	56.00	-22.07	257	100	AVG
5	1862.500	63.17	-17.59	45.58	76.00	-30.42	200	100	peak
6	1862.500	51.63	-17.59	34.04	56.00	-21.96	200	100	AVG
7	2100.000	63.68	-15.96	47.72	76.00	-28.28	146	100	peak
8	2100.000	50.47	-15.96	34.51	56.00	-21.49	146	100	AVG
9	2400.000	64.65	-14.77	49.88	76.00	-26.12	159	100	peak
10	2400.000	54.19	-14.77	39.42	56.00	-16.58	159	100	AVG
11	2687.500	60.33	-14.38	45.95	76.00	-30.05	194	100	peak
12	2687.500	47.28	-14.38	32.90	56.00	-23.10	194	100	AVG

**Remark:** 1. peak = Peak, AVG = Average  
 2. Correct Factor = Antenna Factor + Cable Loss (Antenna to Pre-Amplifier) – Pre-Amplifier Gain + Cable Loss (Pre-Amplifier to Receiver)  
 3. Measurement Value = Reading Level + Correct Factor  
 4. Margin Level = Measurement Value – Limit Value

### 4.2.7 Photographs of Measurement Configuration

Frequency Range: 30 MHz ~ 1 GHz





Frequency Range: Above 1 GHz





### 4.3 Harmonic Current Measurement

#### 4.3.1 Limit of Harmonic Current Measurement

Limit for Class A equipment	
Harmonic Order <i>n</i>	Max. permissible harmonics current A
Odd harmonic	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
$15 \leq n \leq 39$	$0.15*(15/n)$
Even harmonic	
2	1.08
4	0.43
6	0.30
$8 \leq n \leq 40$	$0.23*(8/n)$

Limit for Class D equipment		
Harmonic Order <i>n</i>	Max. permissible harmonics current per watt mA/W	Max. permissible harmonics current A
Odd Harmonic only		
3	3.4	2.30
5	1.9	1.14
7	1.0	0.77
9	0.5	0.40
11	0.35	0.33
13	0.30	0.21
$15 \leq n \leq 39$	$3.85/n$	$0.15*(15/n)$

- Note:** 1. Class A and Class D are classified according to item section 5 of EN IEC 61000-3-2.  
 2. According to section 7 of EN IEC 61000-3-2, the above limits for all equipment except for Class B or C equipment and no limits apply for equipment with a rated power of 75W or less.

#### 4.3.2 Measurement Instrument

Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	Harmonic & Flicker Analyzer	EMC PARTNER	HAR-1000-1P	CT-1-090(1)	Oct. 17, 2024
2	Power Source	APC	AFV-P-5000B	CT-1-210	Oct. 17, 2024

- Note:** 1. The calibration interval of the above test instruments is 12 months.

### 4.3.3 Measurement Procedure

The table-top equipment under test was placed on the top of a wooden table 0.8 meter above the ground and operated to produce the maximum harmonic under normal operating conditions for each successive harmonic component in turn. The floor-standing equipment under test was placed insulation support unit from the horizontal ground plane.

The classification of equipment is according to section 5 of EN IEC 61000-3-2.

The equipment is classified as follows:

Class A:

Equipment not specified as belonging to Class B, C or D shall be considered as Class A equipment.

Some example of Class A equipment are:

- Balanced three-phase equipment;
- Household appliances, excluding those specified as belonging to Class B, C or D;
- Vacuum cleaners;
- High pressure cleaners;
- Tools, excluding portable tools;
- Independent phase control dimmers;
- Audio equipment;
- Professional luminaires for stage lighting and studios.

Class B:

- Portable tools;
- Arc welding equipment which is not professional equipment.

Class C:

- Lighting equipment;
- Integrated lamps, integrated luminaires, non-integrated luminaires, separate lighting control gear;
- Lighting part of multi-function equipment where one the primary function of this is illumination;
- Ultraviolet (UV) and infrared (IR) radiation equipment;
- Illuminated advertising signs;
- Independent dimmers, other than phase control type, for lighting equipment;
- DLT control device.

Class D:

Equipment having a specified power less than or equal to 600W, of the following types:

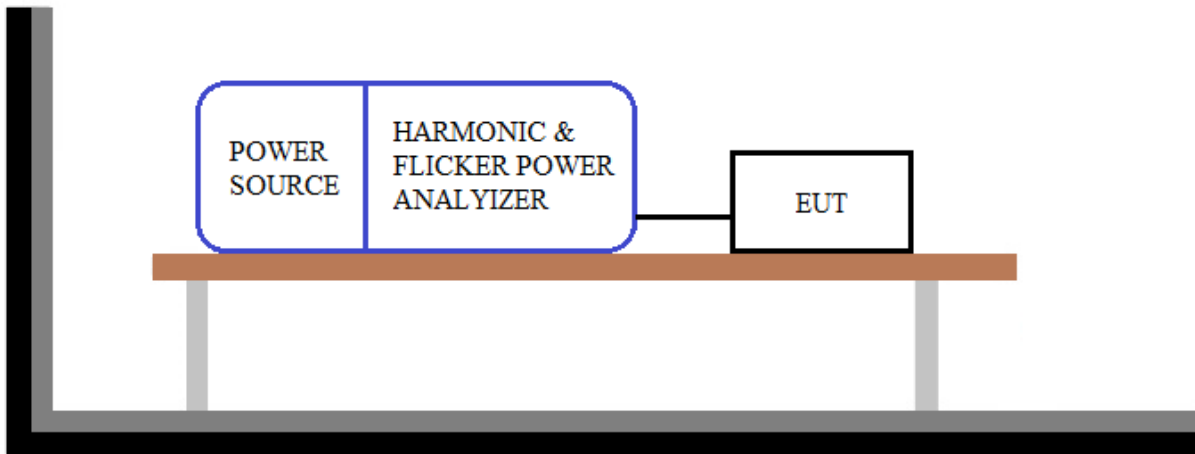
- Personal computers and personal computer monitors;
- Television receivers;
- Refrigerators and freezers having one or more variable-speed drives to control compressor motor(s).

#### 4.3.4 Deviation from Standard

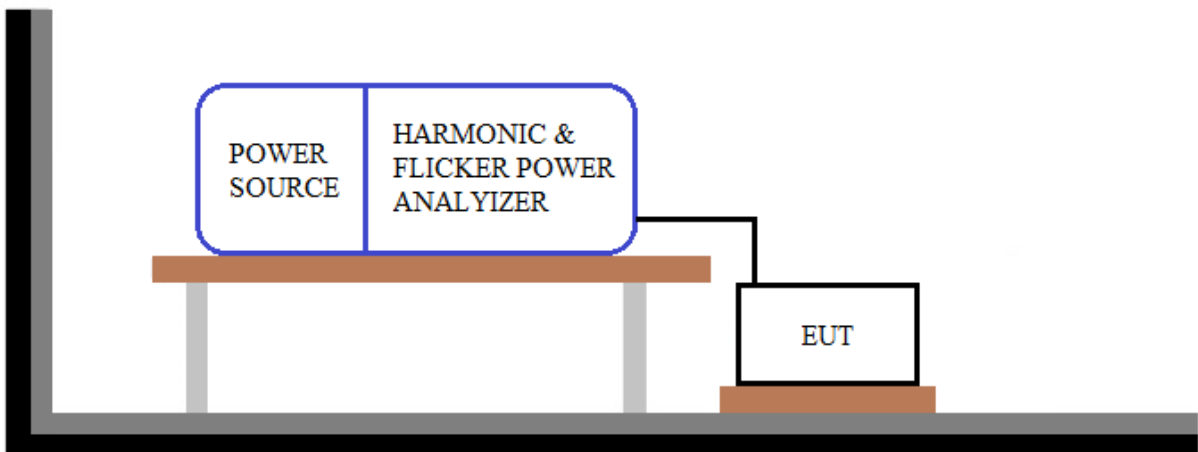
No deviation

#### 4.3.5 Measurement Configuration

< Table-Top equipment under test >



< Floor-Standing equipment under test >





### 4.3.6 Measurement Result

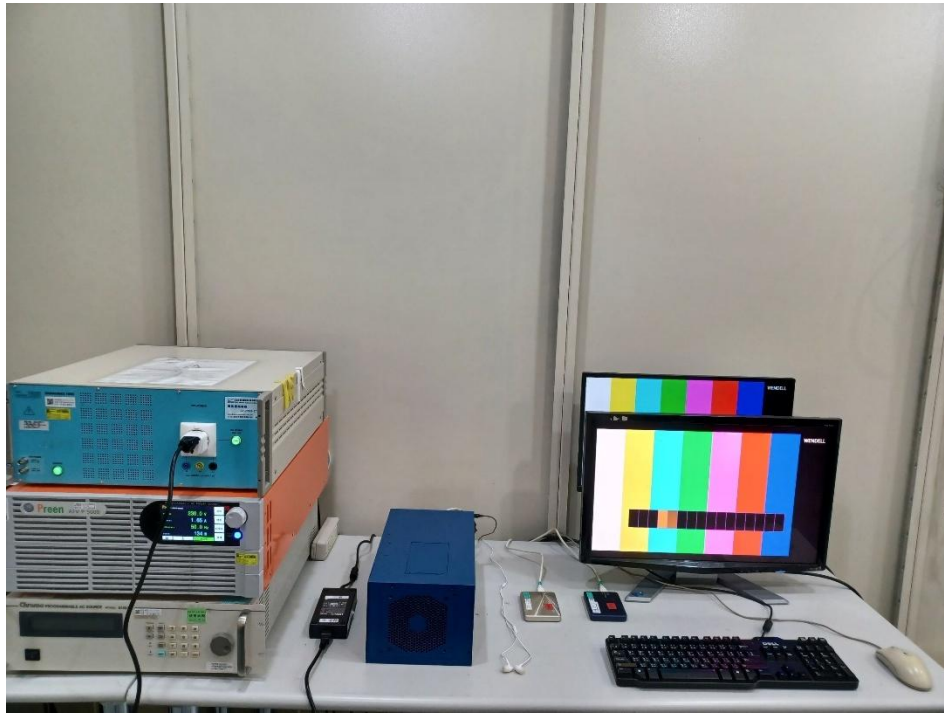
<b>Supply Voltage / Ampere</b>	230.5 Vrms / 0.538 Arms	<b>Test Date</b>	2025/05/20
<b>Test Duration</b>	5 min	<b>Power Consumption</b>	111.3W
<b>Power Frequency</b>	50.000Hz	<b>Power Factor</b>	0.898
<b>Environmental Conditions</b>	22°C, 51% RH	<b>Tested by</b>	Guanwei Liao

Order	Freq. [Hz]	Iavg [A]	Irms [A]	Irms% [%]	Irms%L [%]	Imax [A]	Limit [A]	Vrms [V]	Vrms% [%]
1	50	0.4993	0.4939	91.788	-	0.5728	-	230.45	99.979
2	100	0.0184	0.0161	2.9946	1.4920	0.0271	1.0800	0.1473	0.0639
3	150	0.1788	0.1768	32.849	7.6851	0.2053	2.3000	0.0736	0.0319
4	200	0.0073	0.0068	1.2704	1.5898	0.0099	0.4300	0.0982	0.0426
5	250	0.0520	0.0522	9.7096	4.5830	0.0571	1.1400	0.0736	0.0319
6	300	0.0000	0.0031	0.5672	1.0173	0.0045	0.3000	0.0736	0.0319
7	350	0.0237	0.0237	4.4011	3.0755	0.0269	0.7700	0.0982	0.0426
8	400	0.0000	0.0024	0.4537	1.0615	0.0043	0.2300	0.0491	0.0213
9	450	0.0073	0.0066	1.2250	1.6479	0.0121	0.4000	0.0736	0.0319
10	500	0.0000	0.0023	0.4310	1.2605	0.0039	0.1840	0.0736	0.0319
11	550	0.0110	0.0112	2.0871	3.4032	0.0120	0.3300	0.0491	0.0213
12	600	0.0000	0.0022	0.4083	1.4330	0.0029	0.1533	0.0736	0.0319
13	650	0.0093	0.0092	1.7015	4.3597	0.0106	0.2100	0.0736	0.0319
14	700	0.0000	0.0022	0.4083	1.6718	0.0024	0.1314	0.0491	0.0213
15	750	0.0065	0.0065	1.2024	4.3132	0.0070	0.1500	0.0736	0.0319
16	800	0.0000	0.0022	0.4083	1.9107	0.0026	0.1150	0.0736	0.0319
17	850	0.0061	0.0062	1.1570	4.7038	0.0067	0.1324	0.0736	0.0319
18	900	0.0000	0.0022	0.4083	2.1495	0.0026	0.1022	0.0491	0.0213
19	950	0.0063	0.0062	1.1570	5.2572	0.0073	0.1184	0.0491	0.0213
20	1000	0.0000	0.0021	0.3857	2.2556	0.0024	0.0920	0.0736	0.0319
21	1050	0.0006	0.0049	0.9074	4.5573	0.0055	0.1071	0.0736	0.0319
22	1100	0.0000	0.0021	0.3857	2.4812	0.0023	0.0836	0.0736	0.0319
23	1150	0.0008	0.0046	0.8621	4.7418	0.0054	0.0978	0.0736	0.0319
24	1200	0.0000	0.0022	0.4083	2.8660	0.0026	0.0767	0.0736	0.0319
25	1250	0.0021	0.0051	0.9528	5.6966	0.0055	0.0900	0.0736	0.0319
26	1300	0.0000	0.0024	0.4537	3.4498	0.0027	0.0708	0.0736	0.0319
27	1350	0.0003	0.0050	0.9301	6.0059	0.0052	0.0833	0.0736	0.0319
28	1400	0.0000	0.0023	0.4310	3.5294	0.0027	0.0657	0.0736	0.0319
29	1450	0.0004	0.0043	0.7940	5.5067	0.0054	0.0776	0.0736	0.0319
30	1500	0.0000	0.0023	0.4310	3.7815	0.0027	0.0613	0.0736	0.0319
31	1550	0.0000	0.0048	0.8848	6.5592	0.0050	0.0726	0.0736	0.0319
32	1600	0.0000	0.0026	0.4764	4.4582	0.0029	0.0575	0.0982	0.0426
33	1650	0.0000	0.0039	0.7260	5.7292	0.0048	0.0682	0.0982	0.0426
34	1700	0.0000	0.0029	0.5445	5.4136	0.0032	0.0541	0.0736	0.0319
35	1750	0.0005	0.0049	0.9074	7.5955	0.0054	0.0643	0.0982	0.0426
36	1800	0.0000	0.0029	0.5445	5.7320	0.0034	0.0511	0.0982	0.0426
37	1850	0.0008	0.0043	0.7940	7.0258	0.0056	0.0608	0.0982	0.0426
38	1900	0.0000	0.0028	0.5218	5.7983	0.0037	0.0484	0.0982	0.0426
39	1950	0.0002	0.0043	0.7940	7.4056	0.0055	0.0577	0.0982	0.0426
40	2000	0.0000	0.0027	0.4991	5.8381	0.0037	0.0460	0.0982	0.0426

**Note:**

1. Limits are not specified for equipment with a rated power of 75W or less.
2. According to EN IEC 61000-3-2 the manufacturer shall specify the power of the apparatus. This value shall be used for establishing limits. The specified power shall be within +/-10% of the measured power.

### 4.3.7 Photographs of Measurement Configuration



## 4.4 Voltage Fluctuations and Flicker Measurement

### 4.4.1 Limit for Voltage Functions and Flicker Measurement

Tests Item	Limits	Remark
	IEC/EN 61000-3-3	
$P_{st}$	1.0, $T_p=10$ min.	$P_{st}$ means short-term flicker indicator.
$P_{lt}$	0.65, $T_p=2$ hr.	$P_{lt}$ means long-term flicker indicator.
$d_c$ (%)	3.3%	$d_c$ means relative steady-state voltage change.
$d_{max}$ (%)	4%	$d_{max}$ means maximum relative voltage change.
$T_{dt}$ (ms)	500 ms	$T_{dt}$ means maximum time that $d(t)$ exceeds 3.3 %.

### 4.4.2 Measurement Instrument

Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	Harmonic & Flicker Analyzer	EMC PARTNER	HAR-1000-1P	CT-1-090(1)	Oct. 17, 2024
2	Power Source	APC	AFV-P-5000B	CT-1-210	Oct. 17, 2024

**Note:** 1. The calibration interval of the above test instruments is 12 months.

### 4.4.3 Measurement Procedure

The table-top equipment under test was placed on the top of a wooden table 0.8 meter above the ground and operated to produce the most unfavorable sequence of voltage changes under normal operating condition. The floor-standing equipment under test was placed insulation support unit from the horizontal ground plane.

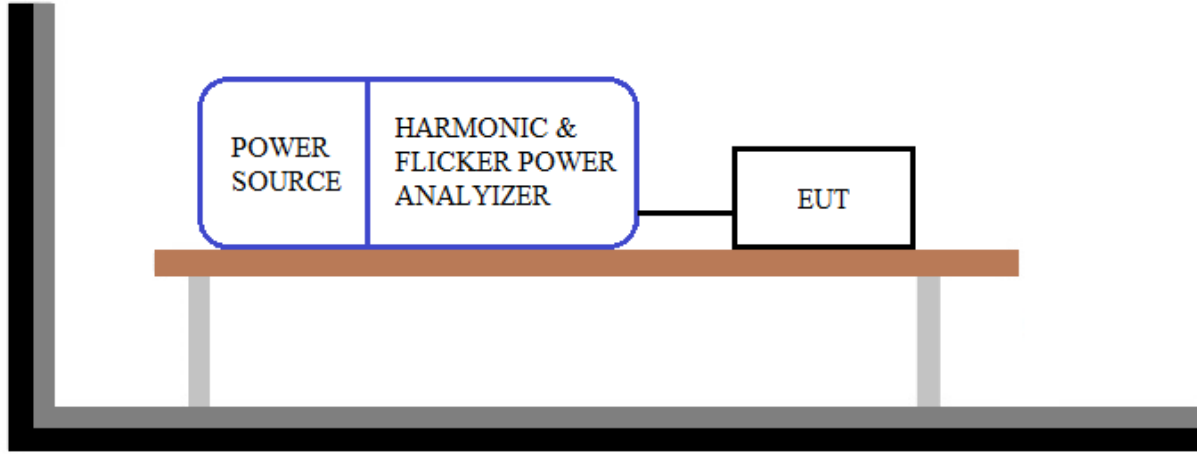
During the flick measurement, the measure time shall include that part of whole operation cycle in which the EUT produce the most unfavorable sequence of voltage changes. The observation period for short-term flicker indicator is 10 min and the observation period for long-term flicker indicator is 2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

### 4.4.4 Deviation from Standard

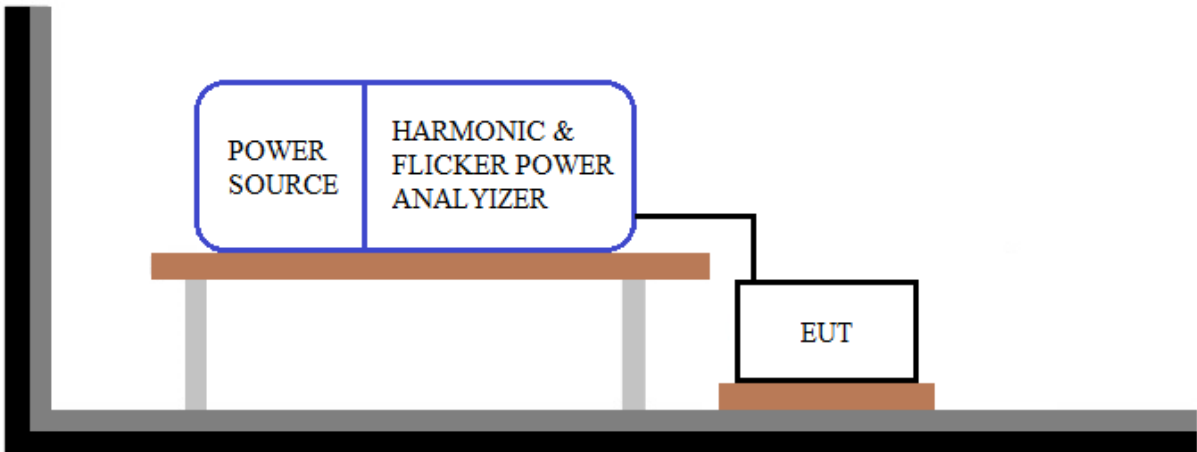
No deviation

### 4.4.5 Measurement Configuration

< Table-Top equipment under test >



< Floor-Standing equipment under test >





#### 4.4.6 Measurement Result

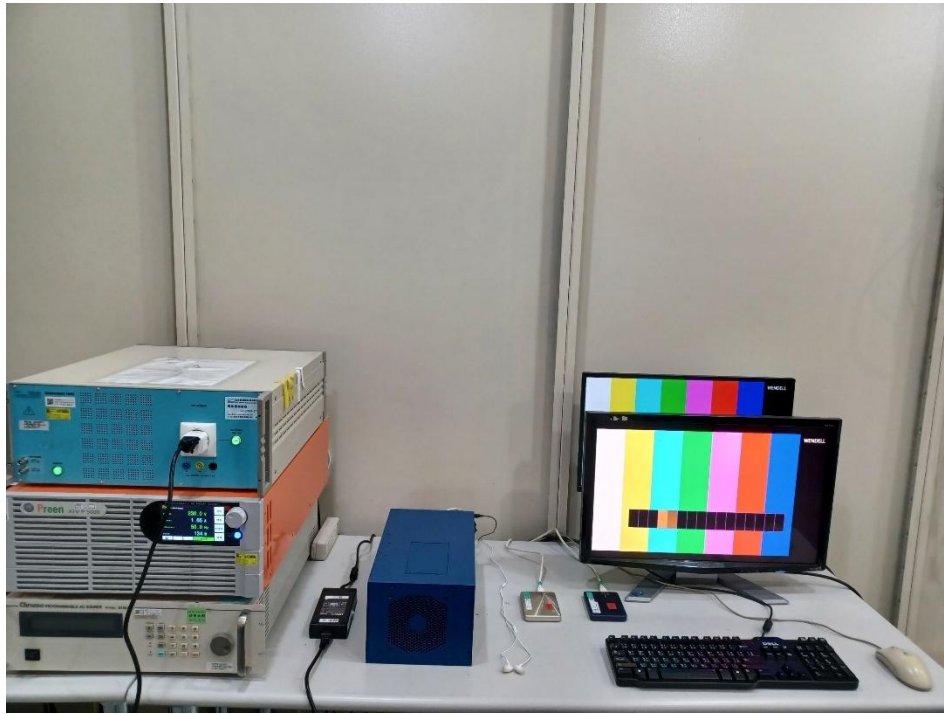
Supply Voltage / Ampere	230.3 V <sub>rms</sub> / 0.482 Arms	Test Date	2025/05/20
Observation (Tp)	30 min	Environmental Conditions	22°C, 51% RH
Power Frequency	50.013Hz	Tested by	Guanwei Liao

Test Parameter	Measurement Value	Test Limit	Remarks
$P_{st}$	0.08	1.00	Pass
$P_{lt}$	0.09	0.65	Pass
$T_{dt}$ (ms)	0.00	500	Pass
$d_{max}$ (%)	0.00	4%	Pass
$d_c$ (%)	0.12	3.3%	Pass

- Note:**
1.  $P_{st}$  means short-term flicker indicator.
  2.  $P_{lt}$  means long-term flicker indicator.
  3.  $T_{dt}$  means maximum time that dt exceeds 3.3 %.
  4.  $d_{max}$  means maximum relative voltage change.
  5.  $d_c$  means relative steady-state voltage change.



#### 4.4.7 Photographs of Measurement Configuration



## 5 Immunity Test

### 5.1 Standard Description

Product standard	EN 50121-3-2	
<b>Basic Standard and Performance Criterion required</b>	EN 61000-4-2 (ESD)	Contact discharge: $\pm 6$ kV, Air discharge: $\pm 8$ kV Performance Criterion B
	EN IEC 61000-4-3 (RS)	Field Strength: 20 V/m <sup>(Note1, 2)</sup> , 10 V/m, 5 V/m, 3 V/m Test Signal: 80% AM with 1 kHz sine wave Frequency Range: 80 M ~ 1000 MHz, 1400 MHz ~ 2000 MHz, 2000 MHz ~ 2700 MHz, 5100 MHz ~ 6000 MHz Performance Criterion A
	EN 61000-4-4 (EFT)	Power Port: $\pm 2$ kV Signal / Control Port (cable length > 3m): $\pm 2$ kV Performance Criterion A
	EN 61000-4-5 (Surge)	Power Port - Line to Line: $\pm 1$ kV, 42 $\Omega$ , 0.5 $\mu$ F Line to Ground: $\pm 2$ kV, 42 $\Omega$ , 0.5 $\mu$ F Performance Criteria B
	EN IEC 61000-4-6 (CS)	Voltage Level: 10V Test Signal: 80% AM with 1 kHz sine wave Frequency Range: 0.15 M ~ 80 MHz Applicable to port: Power Port, Signal / Control Port Performance Criterion A

Note 1: This limit applies to equipment mounted in the passenger compartments, drivers cab or external to the rolling stock (roof, underframe). For equipment mounted in all other areas a severity level of 10V/m may be used.

Note 2: For large apparatus (e.g. traction drives, auxiliary converters) it is often not practical to perform the immunity test to radiated electromagnetic fields on the complete unit. In such cases the manufacturer should test susceptible sub-systems (e.g. control electronics). The test report should justify the selection or not of sub-systems and any assumptions made (e.g. reduction of field due to case shielding).

## 5.2 Performance Criteria

According to EN 50121-1 standard, the general performance criteria as following:

<b>Criteria A</b>	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 from what the user may reasonably expect from the apparatus if used as intended.
<b>Criteria B</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 from what the user may reasonably expect from the apparatus if used as intended.
<b>Criteria C</b>	Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

## 5.3 Electrostatic Discharge Immunity Test

### 5.3.1 Test Specification

<b>Standard</b>	EN 61000-4-2
<b>Discharge Impedance</b>	330 ohm / 150 pF
<b>Discharge Voltage</b>	Air Discharge: $\pm 2$ kV, $\pm 4$ kV, $\pm 8$ kV (Direct) Contact Discharge: $\pm 6$ kV (Direct/Indirect)
<b>Number of Discharge</b>	Air: Minimum 10 times at each polarity Contact: Minimum 10 times at each polarity
<b>Discharge Mode</b>	Single Discharge
<b>Discharge Period</b>	1 second minimum

### 5.3.2 Test Instrument

Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	ESD Generator	TESEQ	NSG 437	CT-1-140	Jun. 15, 2024
2	ESD Generator	NoiseKen	ESS-B3011	CT-1-089	Jul. 23, 2024
3	Digital Thermo-Hygro Meter	N/A	HTC-8	CT-2-047	Jun. 06, 2023
4	Atmosphere pressure meter	TES	TES-1161	CT-5-094	Aug. 10, 2023

- Note:** 1. The calibration interval of the test instruments is 12 months.  
2. The calibration interval of thermo hygrometer/ Atmosphere pressure meter is 24 months.

### 5.3.3 Test Procedure

The test procedure was in accordance with IEC 61000-4-2.

The test generator necessary to perform direct and indirect application of discharge to the equipment under test in following methods:

a. Contact discharges to the conductive surface and coupling planes:

For table-top equipment under test one of the test points shall be the centre front edge of the horizontal coupling plane, which shall be subjected to at least 20 indirect discharges (10 of each polarity).

All other test points shall each receive at least 20 direct contact discharges (10 of each polarity).

All surfaces normally touched by the user should be tested. Test shall be performed at a maximum repetition rate of one discharge per second.

Vertical Coupling Plane (VCP):

The coupling plane, of dimensions 0.5 m × 0.5 m, is placed parallel to, and positioned at a distance 0.1 m from the equipment under test, with the discharge electrode touching the coupling plane. The four faces of the equipment under test will be performed with electrostatic discharge.

Horizontal Coupling Plane (HCP):

The coupling plane, of dimensions 1.6 m × 0.8 m, is placed under the equipment under test. The generator shall be positioned vertically a distance of 0.1 m from the equipment under test, with the discharge electrode touching the coupling plane. The four faces of the equipment under test will be performed with electrostatic discharge.

b. Air discharge at apertures and slots and insulating surface:

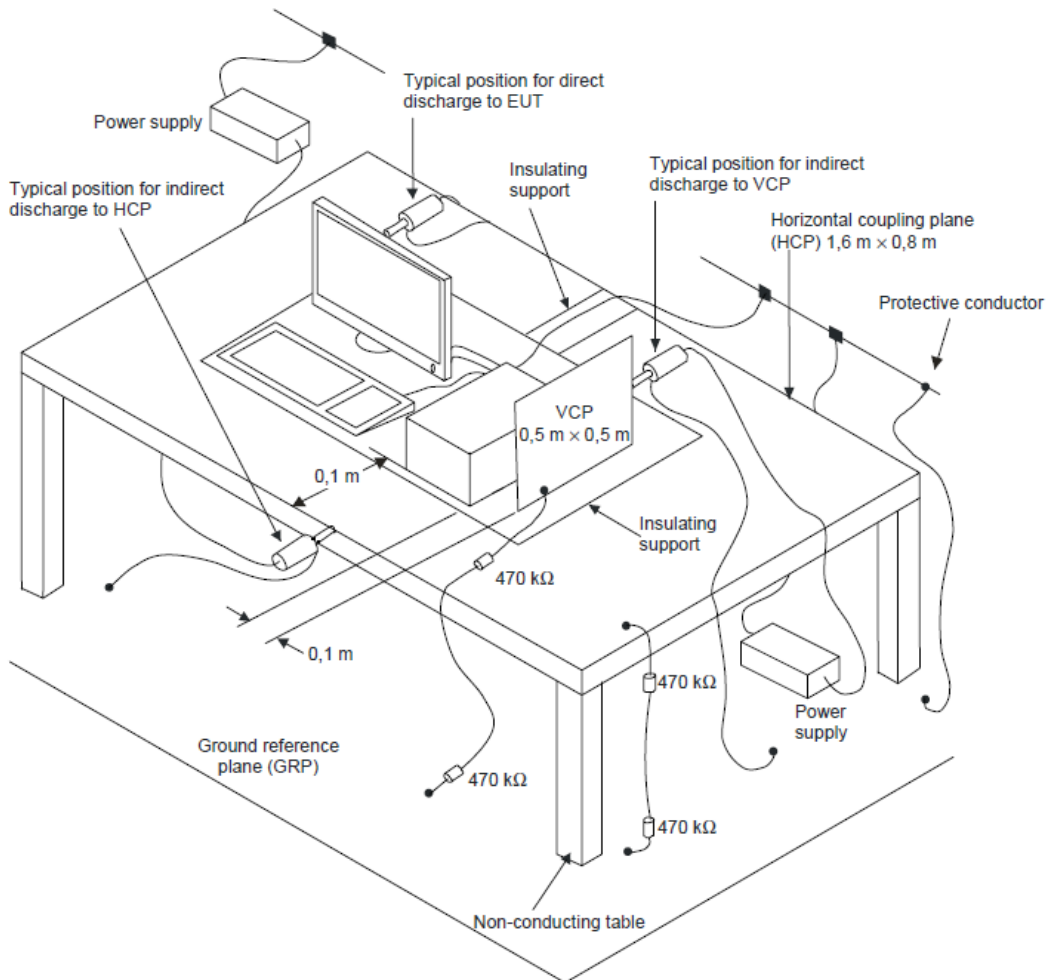
On those surfaces of the equipment under test where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air discharge method. This investigation should be restricted to those area normally handled by the user. A minimum 20 single air discharges (10 of each polarity) shall be applied to the selected test point for each such area.

### 5.3.4 Deviation from Standard

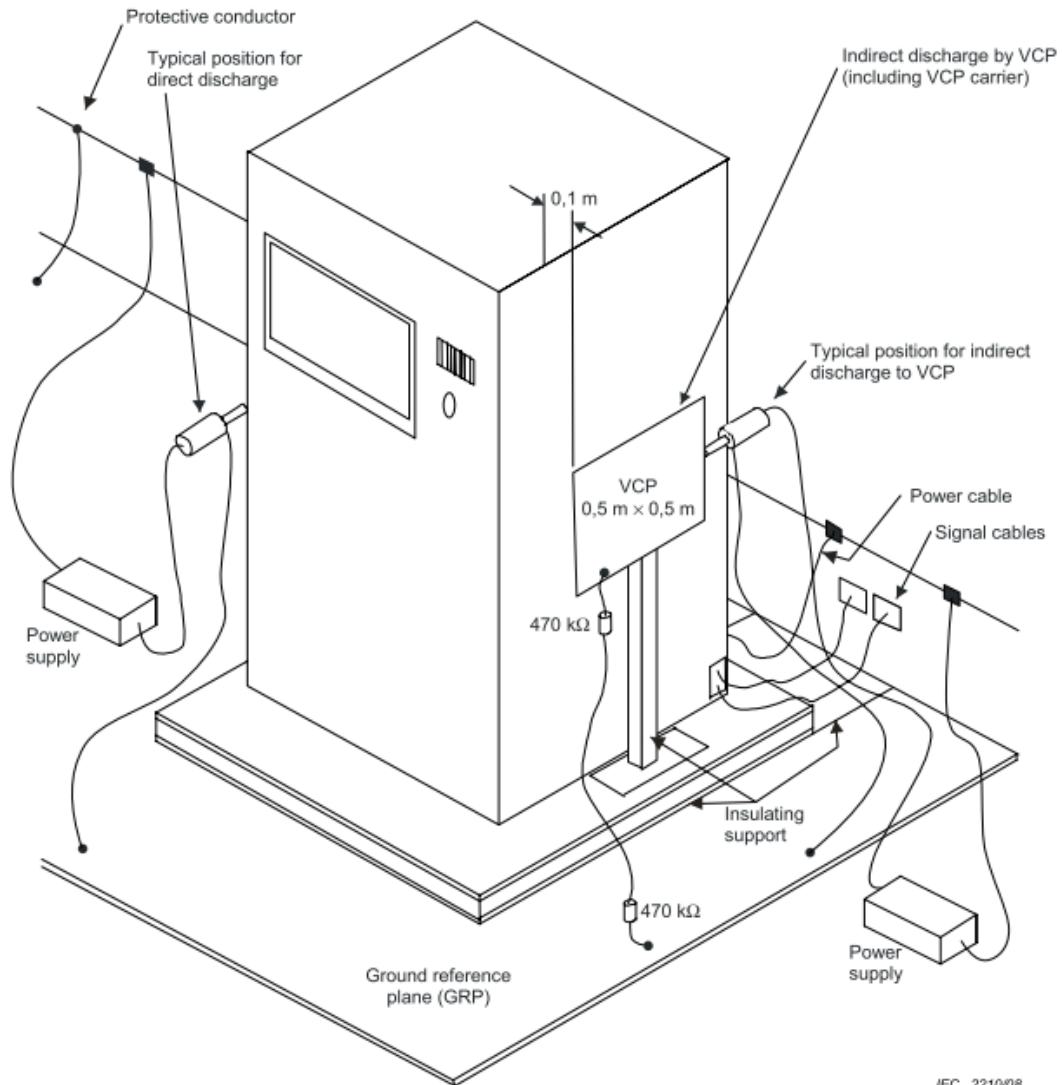
No deviation

### 5.3.5 Test Configuration

< Table-Top equipment under test >



< Floor-Standing equipment under test >





### 5.3.6 Test Result

<b>Test Voltage</b>	230Vac, 50Hz	<b>Test Date</b>	2025/05/26
<b>Environmental Conditions</b>	22°C, 42% RH	<b>Pressure</b>	1009 mbar
<b>Tested by</b>	Guanwei Liao	<b>Test Site</b>	W01

#### Test Results of Direct Application

Air Discharge				
Test Point	Discharge Level (kV)			Result
	±2	±4	±8	
Front	NA	NA	NA	NA
Back	A (#1)	A (#1)	A (#1)	A
Left	NA	NA	NA	NA
Right	NA	NA	NA	NA
Top	NA	NA	NA	NA
Bottom	NA	NA	NA	NA
Other	NA	NA	NA	NA

\* Test location(s) in which discharge to be applied illustrated by photos shown in next page(s).

Contact Discharge			
Test Point	Discharge Level (kV)		Result
	±6		
Front	A		A
Back	B (#1)		B
Left	A		A
Right	A		A
Top	A		A
Bottom	A		A
Other	NA		NA

\* Test location(s) in which discharge to be applied illustrated by photos shown in next page(s).



**Test Results of Indirect Application**

HCP Discharge		
Test Point	Discharge Level (kV)	Result
	±6	
Front	A	A
Back	A	A
Left	A	A
Right	A	A

VCP Discharge		
Test Point	Discharge Level (kV)	Result
	±6	
Front	A	A
Back	A	A
Left	A	A
Right	A	A

**Note:**

Criteria A: The EUT function was correct during the test.

Criteria A: (#1) No occur arcing.

Criteria B: (#1) The EUT was interrupted during the test, but could self-recover to the normal mode after the test.

### Description of Test Points

Front

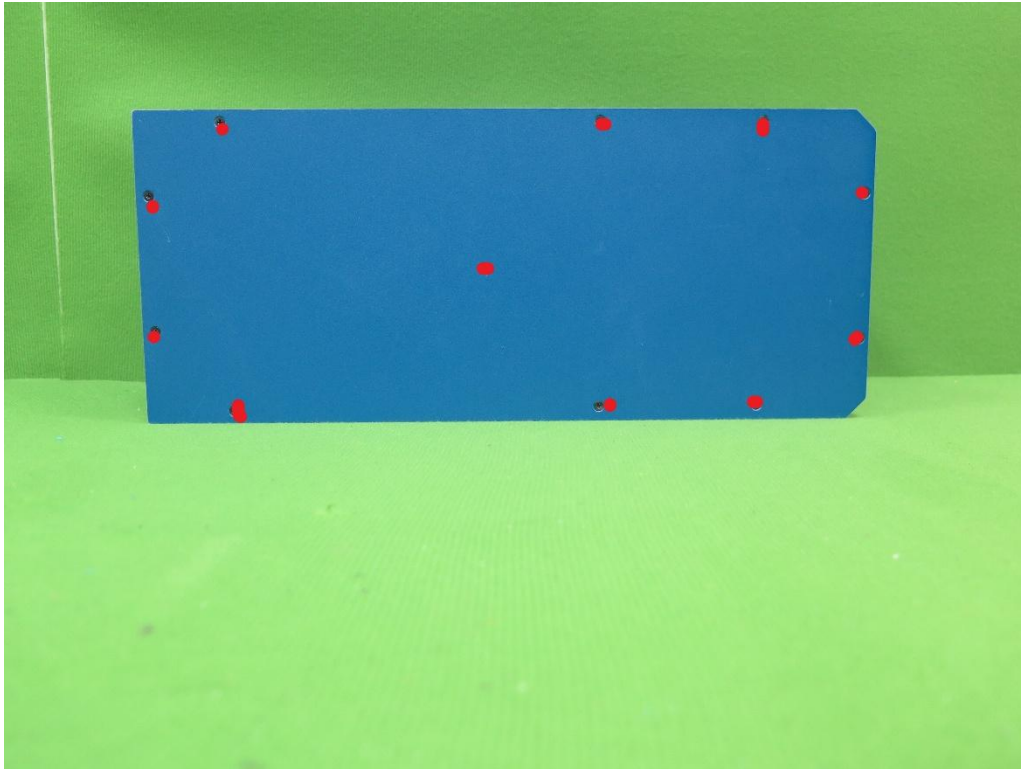


Back

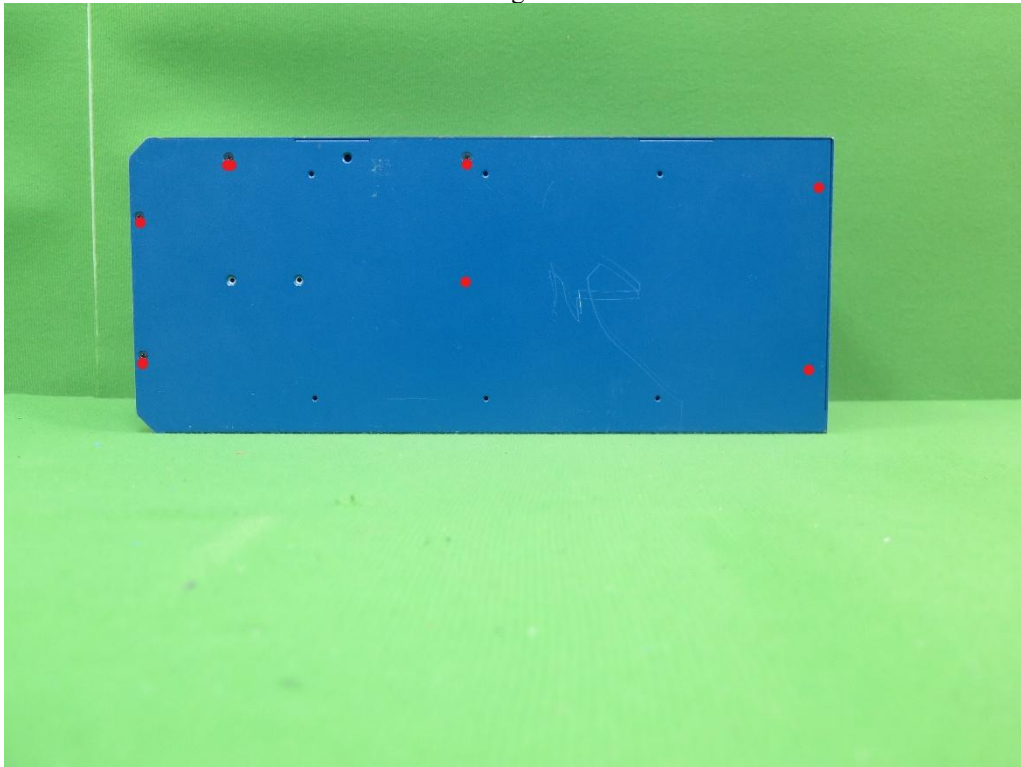


\*Red Dot - Contact Discharged  
Blue Dot - Air Discharged

Left

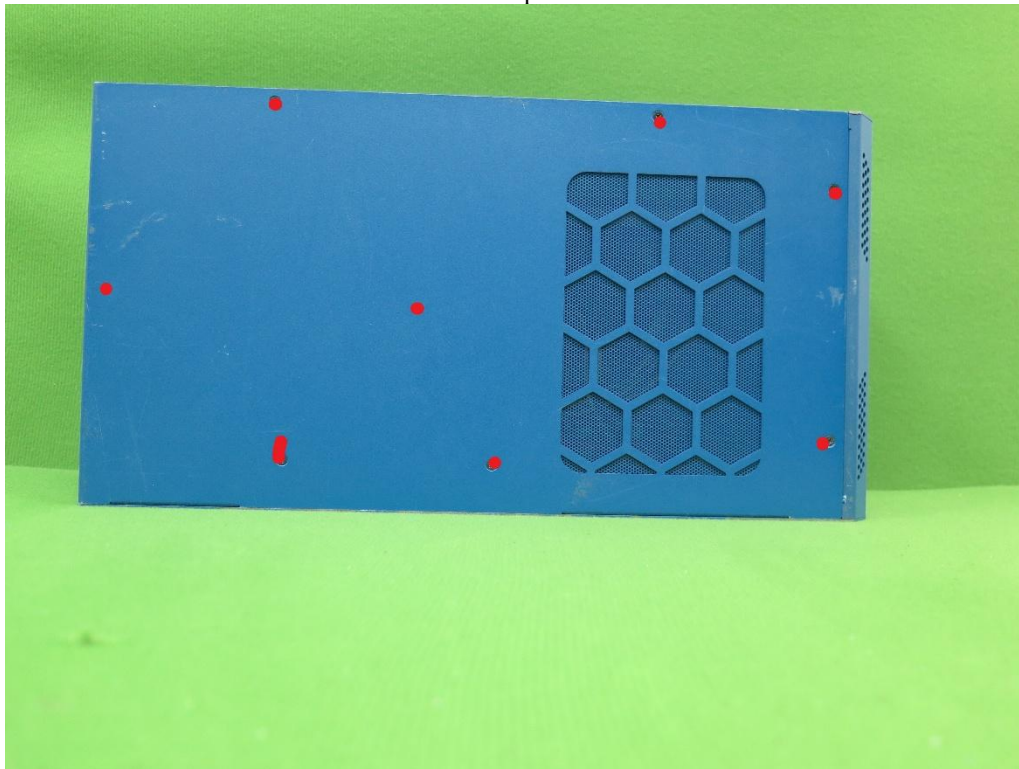


Right

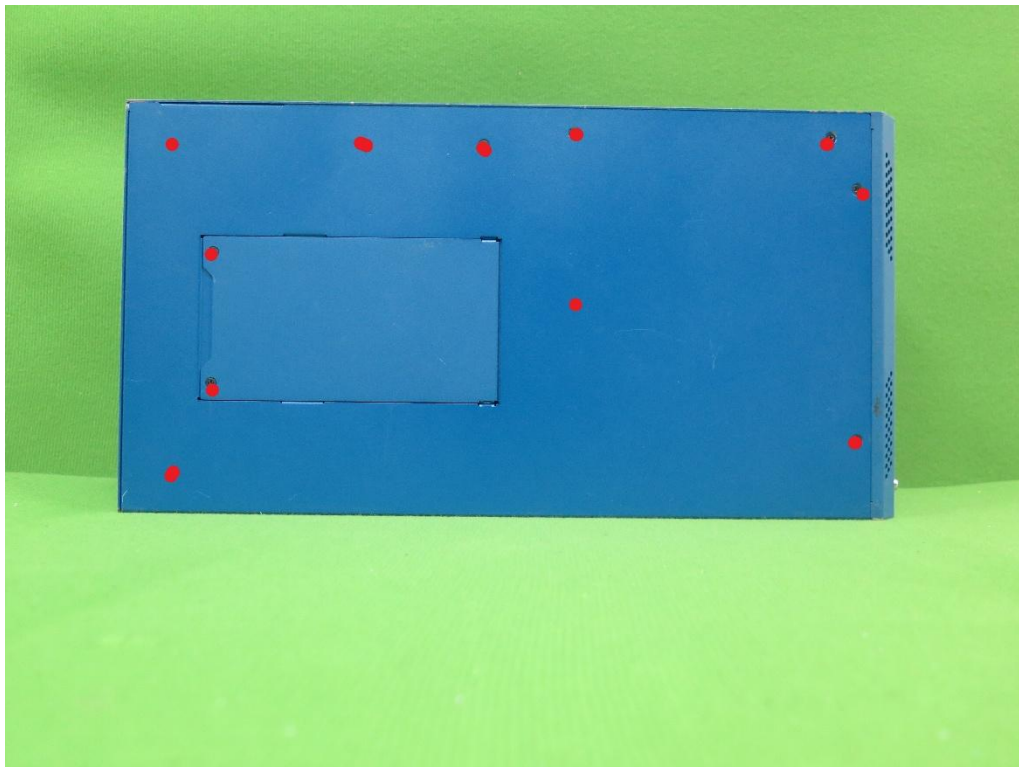


\*Red Dot - Contact Discharged  
Blue Dot - Air Discharged

Top



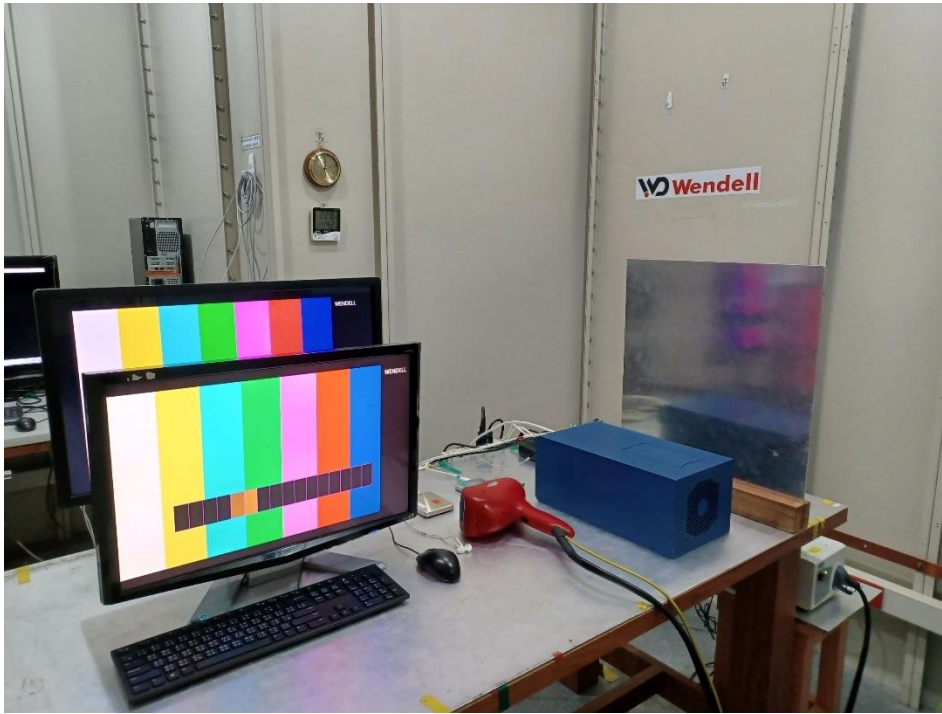
Bottom



\*Red Dot - Contact Discharged  
Blue Dot - Air Discharged



### 5.3.7 Photographs of Test Configuration



## 5.4 Radiated, Radio-frequency Electromagnetic Field Immunity Test

### 5.4.1 Test Specification

<b>Standard</b>	EN IEC 61000-4-3
<b>Frequency Range / Field Strength</b>	80 MHz ~ 800 MHz: 20 V/m <sup>(Note1)</sup> 800 MHz ~ 1000 MHz: 20 V/m 1400 MHz ~ 2000 MHz: 10 V/m 2000 MHz ~ 2700 MHz: 5 V/m 5100 MHz ~ 6000 MHz: 3 V/m
<b>Modulation</b>	80% AM Modulation with 1 kHz Sine Wave
<b>Frequency Step</b>	1%
<b>Polarity of Antenna</b>	Horizontal and Vertical
<b>Test Distance</b>	2.15 m (80 MHz ~ 1000 MHz) 1 m (1 GHz ~ 6 GHz)
<b>Antenna Height</b>	1.55 m (80 MHz ~ 1000 MHz) 1.05 m (1 GHz ~ 6 GHz)
<b>Dwell Time</b>	3 seconds

Note 1: This limit applies to equipment mounted in the passenger compartments, drivers cab or external to the rolling stock (roof, underframe). For equipment mounted in all other areas a severity level of 10 V/m may be used.

### 5.4.2 Test Instrument

Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	RadiCentre ® Modular EMC Test Systems	DARE	CTR1004B	CT-1-080	No calibration request
2	RF Signal Generator	DARE	RGN6000B	CT-1-080	Aug. 06, 2024
3	LINEAR POWER RF AMPLIFIER	TESEQ	CBA1G-300 D	CT-1-163	Aug. 06, 2024
4	LINEAR POWER RF AMPLIFIER	OPHIR	5193	CT-1-083	Aug. 06, 2024
5	LINEAR POWER RF AMPLIFIER	FRANKONIA	FLG-30C	CT-1-061	Aug. 06, 2024
6	Periodic Test-Antenna	Schwarzbeck Mess - Elektronik	STLP 9128 E	CT-1-085	No calibration request
7	Stacked Microwave Log.-Per. Antenna	Schwarzbeck Mess - Elektronik	STLP 9149	CT-1-086	No calibration request
8	E-Field Probe	Narda	EP-601	CT-1-212	Sep. 26, 2024
9	Measurement Software	EMC-RS	Ver: 2.0.1.3	N/A	No calibration request

**Note:** 1. The calibration interval of the above test instruments is 12 months.

### 5.4.3 Test Procedure

The test procedure was in accordance with IEC 61000-4-3.

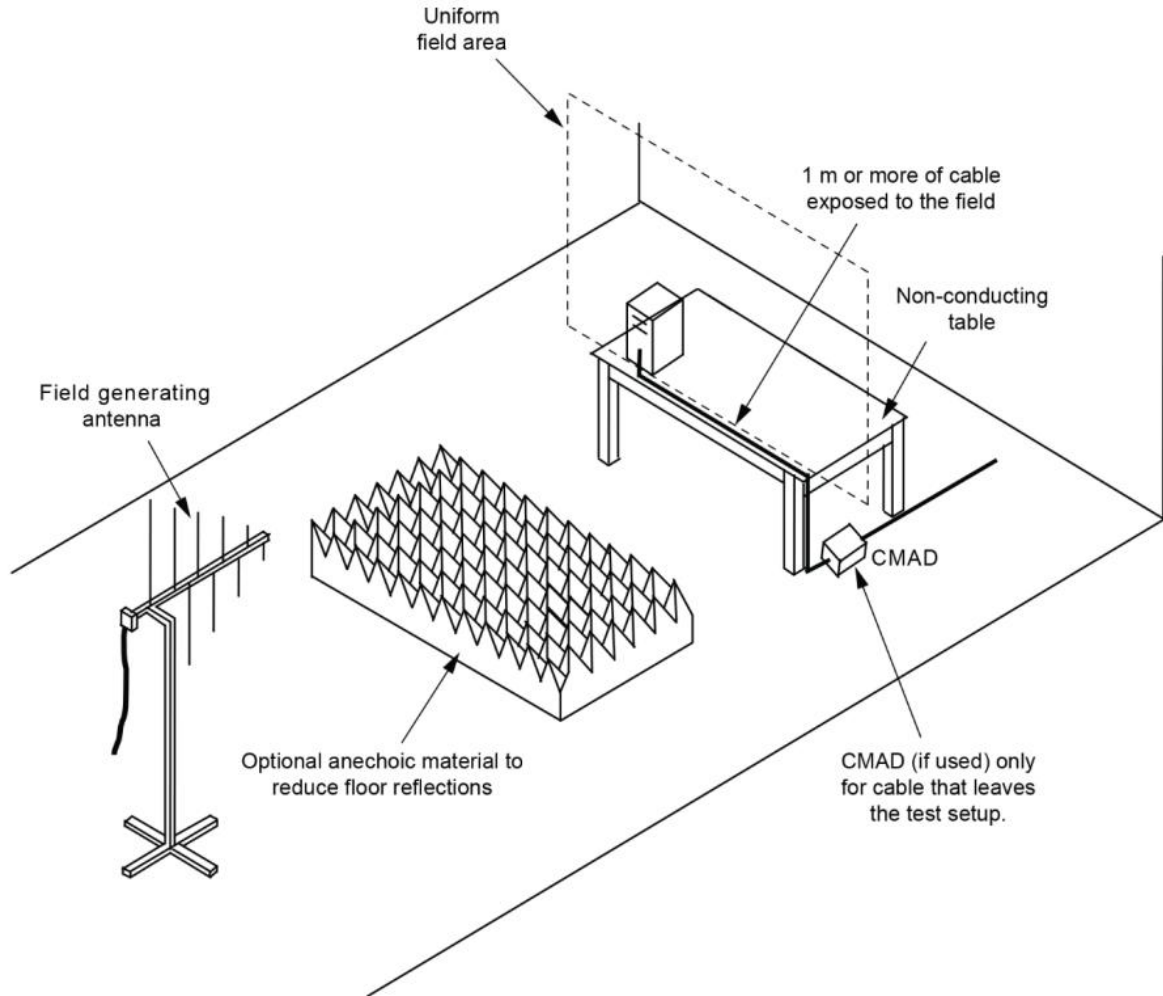
- a. The table-top equipment under test and load, which are placed on a table that is 0.8 meter above ground, are placed with one coincident with the Uniform Field Area (UFA) such that the distance from antenna to the EUT was 2.15 meter at test frequency 80M ~ 1GHz & 1 meter at test frequency 1G ~ 6GHz. Both horizontal and vertical polarization of the antenna and four sides of the equipment under test are set on measurement. All cables shall be connected to the equipment under test and arranged on the test site in accordance with the installation instructions and shall replicate typical installations and use as much as possible.
- b. The specified wiring types and connectors shall be used. If the wiring to and from the equipment under test is not specified, unshielded parallel conductors shall be used. If the product specification require a wiring length of less than or equal to 1 m, then the specified length shall be used. If the length specified is greater than 1 m, or is not specified, then the length of cable used shall be chosen in accordance with typical installation practices. Unless otherwise specified above, a minimum of 1 m of cable shall be exposed to the electromagnetic field in one orientation, either vertical or horizontal.
- c. Each cable does not need to be exposed to the field during the exposure of each face of the equipment under test. But each cable shall, at least during one of the equipment under test orientations, be positioned within the Uniform Field Area (UFA), and thus exposed to the field.
- d. If a product committee determines excess cable length needs to be decoupled (for cables leaving the test area), then the decoupling method used shall not impair the operation of the equipment under test. If cable decoupling is performed, CMADs may be used. The CMAD shall always be placed flat on the floor. Each cable to be decoupled should be treated with a separate CMAD.
- e. If the equipment under test is too large such that it cannot be fully illuminated by the radiating antenna, or exceeds the size of the Uniform Field Area (UFA) then partial illumination shall be used. The equipment under test can be repositioned so that the front surface remains within the Uniform Field Area (UFA) in order to illuminate those sections of the equipment under test that were previously outside the Uniform Field Area (UFA).
- f. The frequency range shall be swept, with the signal 80% amplitude modulated with a 1kHz sine wave. If multiple test signals were used during testing, care should be taken to ensure that any recorded performance degradation was caused by a single test signal and was not caused by the combination of multiple test signals.



### 5.4.4 Deviation from Standard

No deviation

### 5.4.5 Test Configuration





### 5.4.6 Test Result

<b>Test Voltage</b>	230Vac, 50Hz	<b>Environmental Conditions</b>	22°C, 50% RH
<b>Tested by</b>	Eric Hsieh	<b>Test Date</b>	2025/05/13

Frequency Range (MHz)	Azimuth	Polarity	Field Strength (V/m)	Modulation	Result
80 ~ 1000	0	H/V	20	80% AM (1kHz)	A
80 ~ 1000	90	H/V	20	80% AM (1kHz)	A
80 ~ 1000	180	H/V	20	80% AM (1kHz)	A
80 ~ 1000	270	H/V	20	80% AM (1kHz)	A

Frequency Range (MHz)	Azimuth	Polarity	Field Strength (V/m)	Modulation	Result
1400 ~ 2000	0	H/V	10	80% AM (1kHz)	A
1400 ~ 2000	90	H/V	10	80% AM (1kHz)	A
1400 ~ 2000	180	H/V	10	80% AM (1kHz)	A
1400 ~ 2000	270	H/V	10	80% AM (1kHz)	A

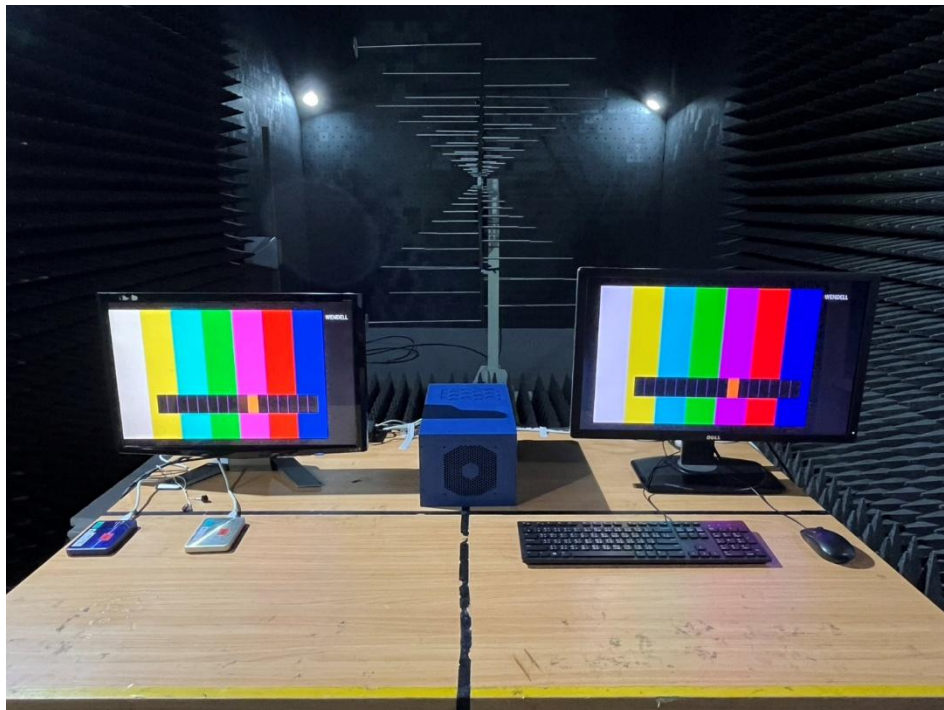
Frequency Range (MHz)	Azimuth	Polarity	Field Strength (V/m)	Modulation	Result
2000 ~ 2700	0	H/V	5	80% AM (1kHz)	A
2000 ~ 2700	90	H/V	5	80% AM (1kHz)	A
2000 ~ 2700	180	H/V	5	80% AM (1kHz)	A
2000 ~ 2700	270	H/V	5	80% AM (1kHz)	A

Frequency Range (MHz)	Azimuth	Polarity	Field Strength (V/m)	Modulation	Result
5100 ~ 6000	0	H/V	3	80% AM (1kHz)	A
5100 ~ 6000	90	H/V	3	80% AM (1kHz)	A
5100 ~ 6000	180	H/V	3	80% AM (1kHz)	A
5100 ~ 6000	270	H/V	3	80% AM (1kHz)	A

**Note:**

Criteria A: The EUT function was correct during the test.

### 5.4.7 Photographs of Test Configuration



## 5.5 Electrical Fast Transient /Burst Immunity Test

### 5.5.1 Test Specification

<b>Standard</b>	EN 61000-4-4
<b>Test Voltage</b>	Power Port: $\pm 2$ kV Signal / Control Port (cable length > 3m): $\pm 2$ kV
<b>Polarity</b>	Positive & Negative
<b>Impulse Frequency</b>	5 kHz
<b>Impulse Wave</b>	5/50 ns
<b>Burst Duration</b>	15 ms
<b>Burst Period</b>	300 ms
<b>Test Duration</b>	Not less than 1 min.

### 5.5.2 Test Instrument

Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	EFT Generator	3ctest	EFT500S	CT-1-165	Sep. 27, 2024
2	Clamp	3ctest	CCC100	CT-1-166	Sep. 27, 2024

**Note:** 1. The calibration interval of the above test instruments is 12 months.

### 5.5.3 Test Procedure

The test procedure was in accordance with IEC 61000-4-4.

- a. The table-top equipment under test was placed on a table that is 0.8 meter height. A ground reference plane is placed on the table, and uses 0.1 m insulation between the equipment under test and ground reference plane. The floor-standing equipment under test was placed on 0.1 m insulation support unit between the equipment under test and ground reference plane.
- b. The minimum area of the ground reference plane is 1 m × 1 m, and 0.65 mm thick min, and projected beyond the equipment under test by at least 0.1 m on all sides. The equipment under test shall be arranged and connected to satisfy its functional requirements, according to the equipment installation specifications.

For input power ports:

The equipment under test is connected to the power ports through a coupling device that directly couples the EFT/B interference signal. Each of the line conductors is impressed with burst noise for 1 minute. The distance between the coupling device and the table-top equipment under test is 0.5 m.

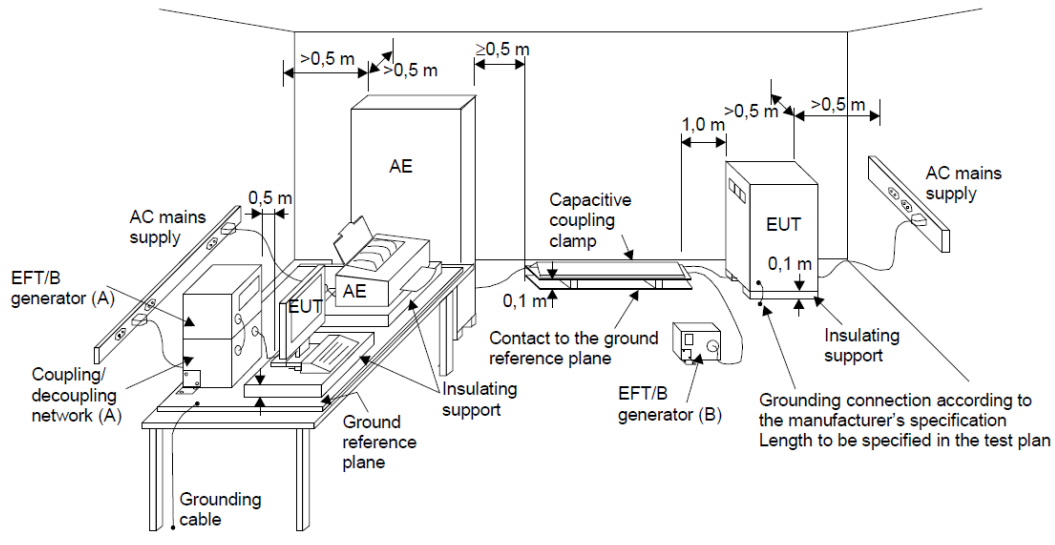
For signal / data ports:

The capacitive coupling clamp shall be used for the application of the test voltages. The test voltages shall be coupled to all of the equipment under test ports in turn including those between two units of equipment involved in the test, unless the length of the interconnecting cable makes it impossible to test.

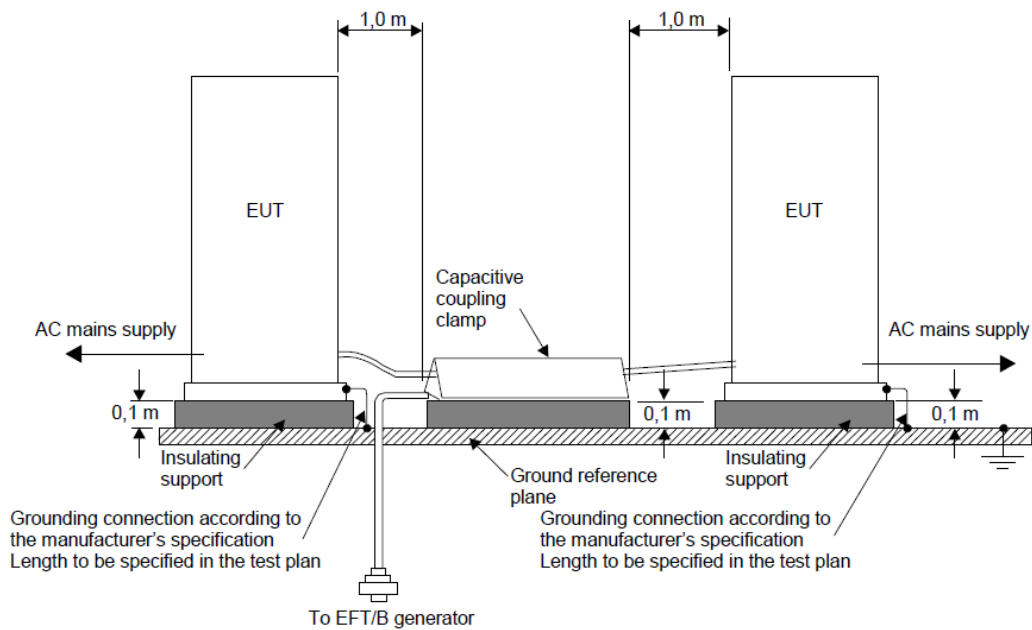
### 5.5.4 Deviation from Standard

No deviation

### 5.5.5 Test Configuration



- (A) location for supply line coupling
- (B) location for signal lines coupling





### 5.5.6 Test Result

<b>Test Voltage</b>	230Vac, 50Hz	<b>Environmental Conditions</b>	23°C, 49% RH
<b>Tested by</b>	Tim Chao	<b>Test Date</b>	2025/05/12

Test Point		Test Level (kV)	Polarity (+/-)	Result
AC Power Port	L	2	+/-	A
	N	2	+/-	A
	PE	2	+/-	A
	L + N	2	+/-	A
	L + PE	2	+/-	A
	N + PE	2	+/-	A
	L + N + PE	2	+/-	A
Signal and communication, process measurement and control ports	LAN_1G	2	+/-	A
	LAN_2.5G	2	+/-	A

**Note:**

Criteria A: The EUT function was correct during the test.



### 5.5.7 Photographs of Test Configuration

Power



LAN (1G)





LAN (2.5G)



## 5.6 Surge Immunity Test

### 5.6.1 Test Specification

<b>Standard</b>	EN 61000-4-5
<b>Wave- Shape</b>	Combination Wave 1.2/50 $\mu$ s Open Circuit Voltage, 8/20 $\mu$ s Short Circuit Current
<b>Test Voltage</b>	Power Port - Line to Line: $\pm 1$ kV, 42 $\Omega$ , 0.5 $\mu$ F Line to Ground: $\pm 2$ kV, 42 $\Omega$ , 0.5 $\mu$ F
<b>Polarity</b>	Positive/Negative
<b>Phase Angle</b>	0°/90°/180°/270° (For AC Main Power Port)
<b>Pulse Repetition Rate</b>	1 time / min. (maximum)
<b>Times</b>	5 Positive and 5 Negative at selected points

### 5.6.2 Test Instrument

<b>Item</b>	<b>Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Meter No.</b>	<b>Calibration Date</b>
1	Surge Generator	3ctest	SG5020H	CT-1-119	Aug. 13, 2024
2	CDN	3ctest	SGN2232S20	CT-1-120	Aug. 13, 2024
3	Surge CDN	3ctest	CDN-405T8A1	CT-1-074(5)	May 15, 2025

**Note:** 1. The calibration interval of the above test instruments is 12 months.

### 5.6.3 Test Procedure

The test procedure was in accordance with IEC 61000-4-5.

- a. The table-top equipment under test was placed on a table that is 0.8 meter height. A ground reference plane is placed on the table, and uses 0.1m insulation between the equipment under test and ground reference plane.
- b. If not otherwise specified the power cord between the EUT and the coupling network shall not exceed 2 m in length.

For input power ports:

The table-top equipment under test was connected to the power ports through a coupling device that directly couples the surge interference signal. The surge noise shall be applied synchronized to the peak value of the voltage wave (Positive and negative). Each of Line to Earth and Line to Line is impressed with a sequence of five surge voltages with interval of 1 minute.

For signal / data ports:

The table-top equipment under test was connected to the signal ports of associated equipment through a Coupling / De-coupling Network (CDN). The surge noise shall be applied synchronized to the peak value of the voltage wave (Positive and negative). Each of Line to Earth is impressed with a sequence of five surge voltages with interval of 1 minute.

For shielded lines:

The table-top equipment under test is isolated from ground and the surge is applied to its metallic enclosure; the termination (or auxiliary equipment) at the port under test is grounded. The length of the cable between the port under test and the device attached to the other end of the cable shall be 20 m (preferred length) or, the shortest length over 10 m, where the manufacturer provides pre-assembled cables used in actual installations. For EUTs which do not have metallic enclosures, the surge is applied directly to the shielded cable at the EUT side.

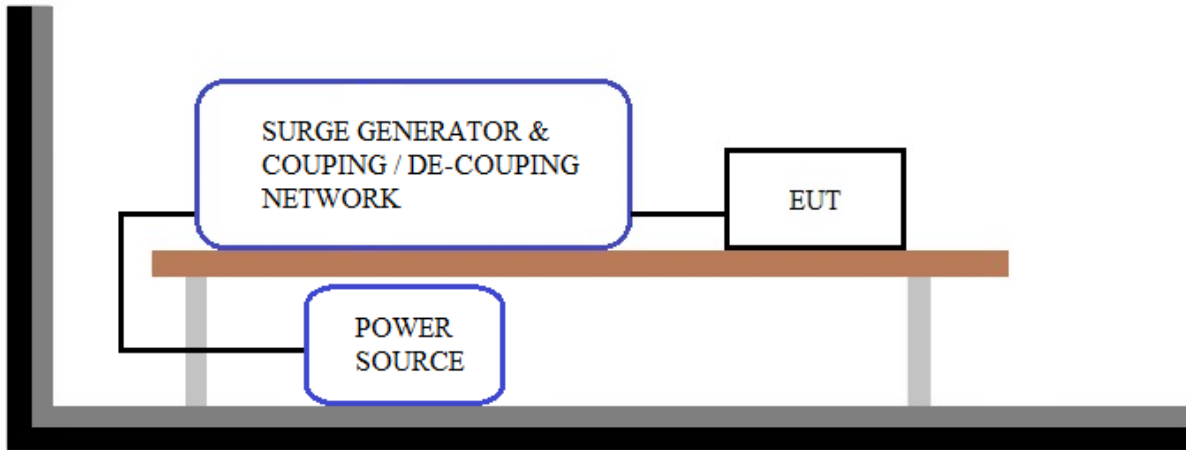
No test shall be required for cables which according to the manufacturer's specification are  $\leq 10$  m.

### 5.6.4 Deviation from Standard

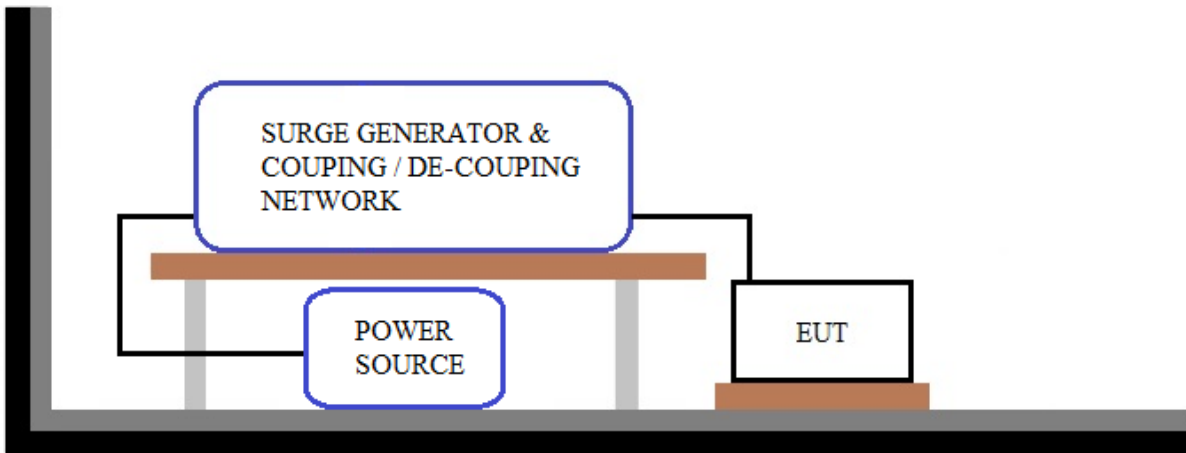
No deviation

### 5.6.5 Test Configuration

< Table-Top equipment under test >



< Floor-Standing equipment under test >





### 5.6.6 Test Result

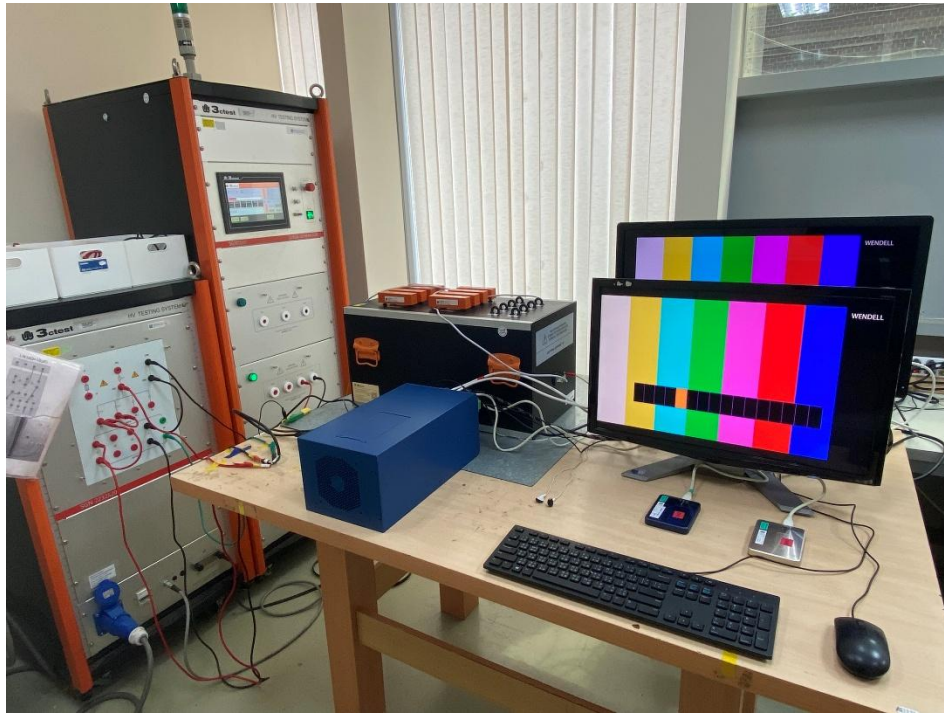
<b>Test Voltage</b>	230Vac, 50Hz	<b>Environmental Conditions</b>	20°C, 51% RH
<b>Tested by</b>	Dennis Chen	<b>Test Date</b>	2025/05/27
<b>Test Site</b>	W05		

AC Power Port						
Test Point	Phase	Polarity (+/-)	Test Voltage (kV)			Result
			0.5	1	2	
L to N	0°	+/-	A	A	-	A
	90°	+/-	A	A	-	
	180°	+/-	A	A	-	
	270°	+/-	A	A	-	
L to PE	0°	+/-	A	A	A	A
	90°	+/-	A	A	A	
	180°	+/-	A	A	A	
	270°	+/-	A	A	A	
N to PE	0°	+/-	A	A	A	A
	90°	+/-	A	A	A	
	180°	+/-	A	A	A	
	270°	+/-	A	A	A	

**Note:**

Criteria A: The EUT function was correct during the test.

### 5.6.7 Photographs of Test Configuration



## 5.7 Conducted Disturbances Immunity Test

### 5.7.1 Test Specification

<b>Standard</b>	EN IEC 61000-4-6
<b>Frequency Range</b>	0.15 MHz ~ 80 MHz
<b>Voltage Level</b>	10 V
<b>Modulation</b>	80% AM Modulation with 1 kHz Sine Wave
<b>Frequency Step</b>	1%
<b>Dwell Time</b>	3 seconds

### 5.7.2 Test Instrument

Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	Coupling clamp according to IEC 6100-4-6	FRANKONIA	EMCL-20	CT-1-049	May 30, 2024
2	CDN for power supply lines	FRANKONIA	CDN M2+M3	CT-1-054	May 30, 2024
3	6 dB Attenuator	BIRD	75-A-FFN-06	CT-1-056	May 30, 2024
4	Compact Immunity Test System acc	FRANKONIA	CIT-10/75	CT-1-057	May 30, 2024
5	CDN for screened lines	FRANKONIA	RJ45S	CT-1-052 (1)	May 30, 2024
6	50ohm Termination	N/A	N/A	CT-1-065-2	Apr. 26, 2025
7	CDN Four Balanced Pairs-unscreened	Com-Power	CDN-T8E	CT-1-130	May 30, 2024
8	Measurement Software	HUBERT	Ver: 1.1.2	N/A	No calibration request

**Note:** 1. The calibration interval of the above test instruments is 12 months.

### 5.7.3 Test Procedure

The test procedure was in accordance with IEC 61000-4-6.

- a. The table-top equipment under test was placed on an insulating support of 0.1 m height above a reference ground plane. If the equipment is designed to be mounted in a panel, rack or cabinet, then it shall be tested in this configuration. Grounding of the equipment shall be consistent with the EUT's installation instructions. The Coupling/De-coupling Network (CDN) shall be located between 0.1 m and 0.3 m from the equipment under test.
- b. The frequency range shall be swept, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal is modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. Where the frequency is swept incrementally, the step size shall not exceed 1 % of the preceding frequency value.

For input power ports:

The table-top equipment under test was connected to the power ports through a Coupling/De-coupling Network (CDN) for power supply lines. And directly couples the disturbances signal into equipment under test.

For signal / data ports:

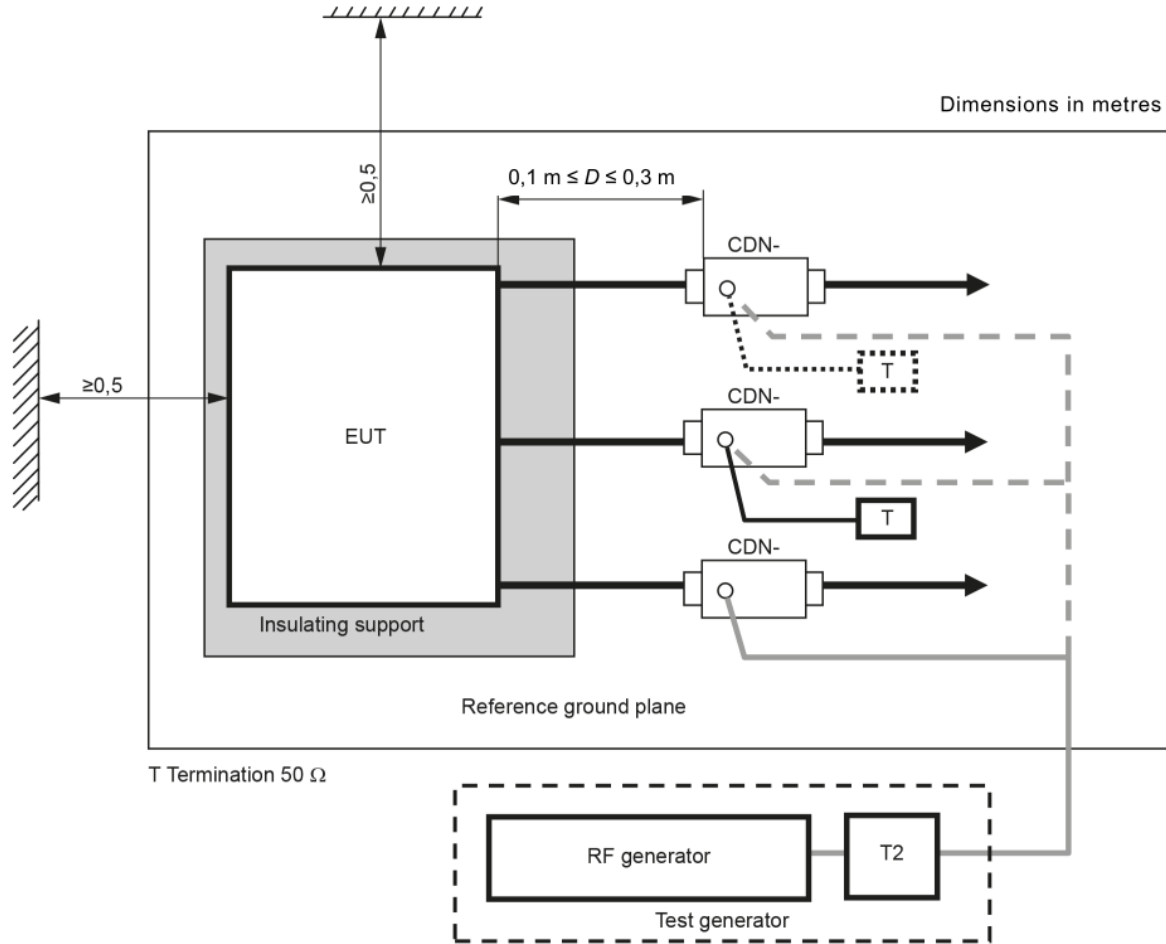
The table-top equipment under test was connected to the signal ports of associated equipment through a Coupling/De-coupling Network (CDN). And directly couples the disturbances signal into equipment under test.

### 5.7.4 Deviation from Standard

No deviation



### 5.7.5 Test Configuration



**Note:**

1. The EUT clearance from any metallic objects other than test equipment shall be at least 0,5 m.
2. Only one of the CDNs not used for injection shall be terminated with 50  $\Omega$ , providing only a single return path.  
All other CDNs shall be configured as decoupling networks.



### 5.7.6 Test Result

<b>Test Voltage</b>	230Vac, 50Hz	<b>Environmental Conditions</b>	22°C, 50% RH
<b>Tested by</b>	Guanwei Liao	<b>Test Date</b>	2025/05/19

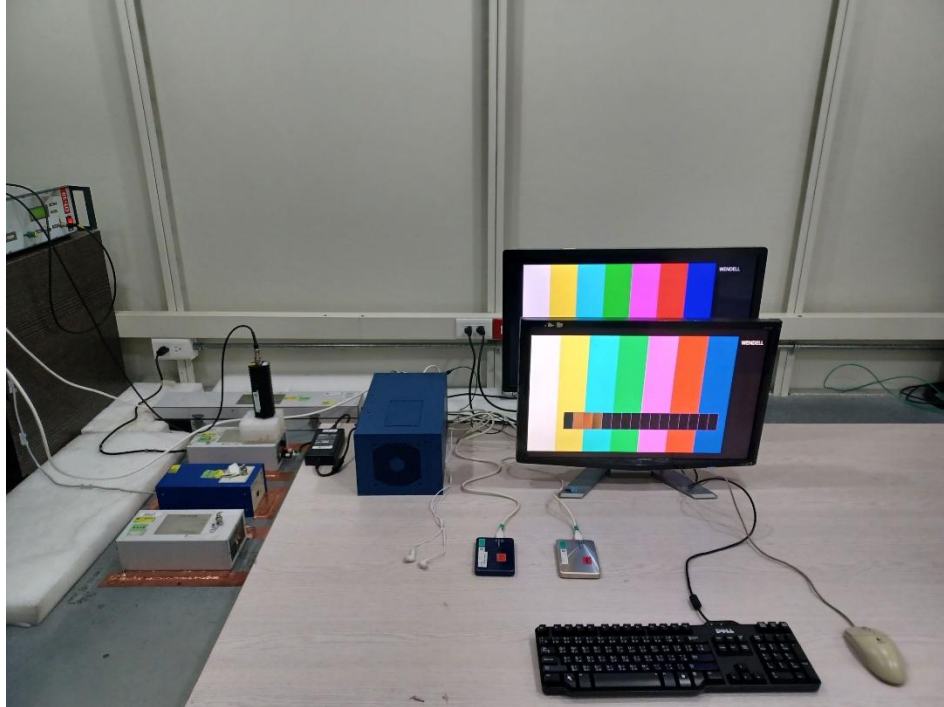
<b>Frequency Range (MHz)</b>	<b>Tested Port</b>	<b>Injection Method</b>	<b>Test Level (V<sub>r.m.s.</sub>)</b>	<b>Modulation</b>	<b>Result</b>
0.15 ~ 80	AC Power	CDN-M2 +M3 (M3)	10	80% AM, 1kHz	A
0.15 ~ 80	LAN_1G	CLAMP	10	80% AM, 1kHz	A
0.15 ~ 80	LAN_2.5G	CLAMP	10	80% AM, 1kHz	A

**Note:**

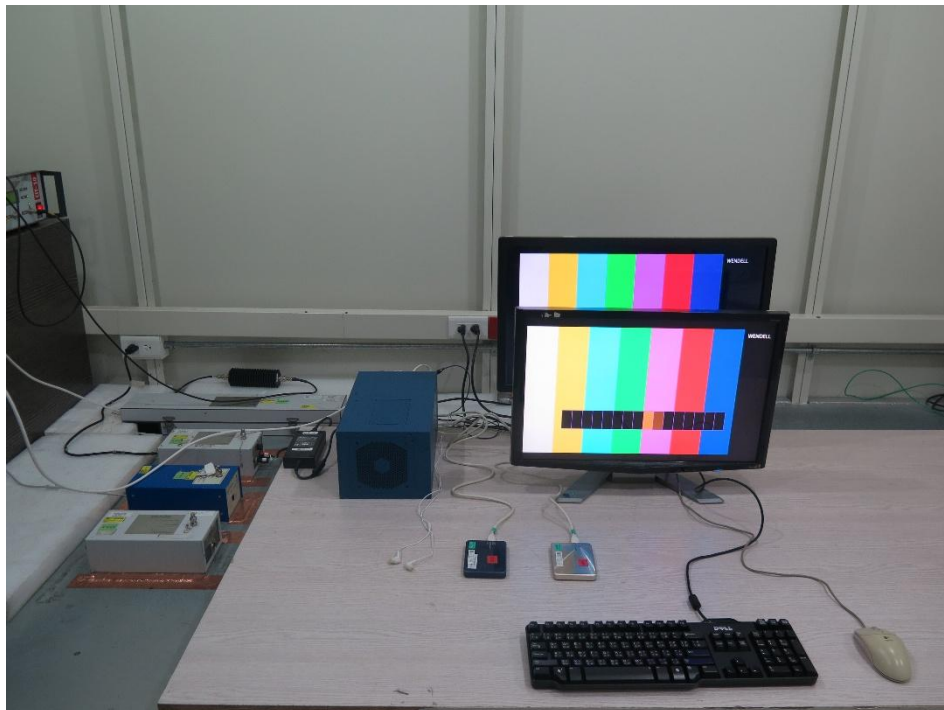
Criteria A: The EUT function was correct during the test.

### 5.7.7 Photographs of Test Configuration

Power



LAN (1G)



LAN (2.5G)



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