



CE EMC Test Report

Issued date: Jun. 27, 2024

Project No.: 24Q030604

Product : Rugged Embedded System

Model : ECS-4700-PoE

Series Model : ECS-4700 Series, ECS-4XXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)

Applicant : Vecow Co., Ltd

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

Report No: WD-EE-R-240176-C0

According to

EN/IEC 60945: 2002, Clause 9, 10

EN 61000-3-2: 2014

EN 61000-3-3: 2013

IEC 61000-4-2: 2008

IEC 61000-4-3: 2020

IEC 61000-4-4: 2012

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

IEC 61000-4-6: 2013

IEC 61000-4-11: 2020

EN 61000-4-2: 2009

EN IEC 61000-4-3: 2020

EN 61000-4-4: 2012

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

EN 61000-4-6: 2014 + AC: 2015

EN IEC 61000-4-11: 2020

Authorized Signatory : _____



Wendell Industrial Co., Ltd
Wendell EMC & RF Laboratory

Add: 5F-1, No. 188, Baoqiao Road, Xindian District, New Taipei City 23145, Taiwan R.O.C.



Table of Contents

- 1 Certification 7**
- 1.1 Summary of Test Result..... 8**
- 2 Test Configuration of Equipment Under Test 9**
- 2.1 Test Facility..... 9**
- 2.2 Measurement Uncertainty 10**
 - 2.2.1 Conducted Emission test..... 10
 - 2.2.2 Radiated Emission test..... 10
- 3 General Information..... 11**
- 3.1 Description of EUT..... 11**
- 3.2 Description of Test Modes..... 12**
- 3.3 EUT Operating Condition 12**
- 3.4 Description of Support Unit 13**
- 3.5 Configuration of System Under Test..... 14**
- 4 Emission Test..... 15**
- 4.1 Conducted Emission Measurement 15**
 - 4.1.1 Limit of Conducted Emission Measurement 15
 - 4.1.2 Test Instrument 16
 - 4.1.3 Test Procedure..... 17
 - 4.1.4 Deviation from Test Standard 17
 - 4.1.5 Test Setup..... 18
 - 4.1.6 Test Result 19
 - 4.1.7 Photographs of Test Configuration 21
- 4.2 Radiated Emission Measurement 22**
 - 4.2.1 Limits of Radiated Emission Measurement 22
 - 4.2.2 Test Instrument 23
 - 4.2.3 Test Procedure..... 24
 - 4.2.4 Deviation from Test Standard 24
 - 4.2.5 Test Setup..... 25
 - 4.2.6 Test Result 27
 - 4.2.7 Photographs of Test Configuration 33
- 4.3 Harmonics Current Measurement..... 35**
 - 4.3.1 Limits of Harmonics Current Measurement 35
 - 4.3.2 Test Instrument 35
 - 4.3.3 Test Procedure..... 36
 - 4.3.4 Deviation from Test Standard 37
 - 4.3.5 Test Setup..... 37
 - 4.3.6 Test Result 38
 - 4.3.7 Photographs of Test Configuration 39
- 4.4 Voltage Fluctuation and Flicker Measurement 40**
 - 4.4.1 Limit for Voltage Function and Flicker Measurement..... 40
 - 4.4.2 Test Instrument 40
 - 4.4.3 Test Procedure..... 40
 - 4.4.4 Deviation from Test Standard 40
 - 4.4.5 Test Setup..... 41
 - 4.4.6 Test Result 42
 - 4.4.7 Photographs of Test Configuration 43



5 Immunity Test 44

5.1 Standard Description 44

5.2 Performance Criteria 44

5.3 Electrostatic Discharge (ESD) 45

5.3.1 Test Specification..... 45

5.3.2 Test Instrument 45

5.3.3 Test Procedure..... 46

5.3.4 Deviation from Test Standard 47

5.3.5 Test Setup..... 47

5.3.6 Test Result 48

5.3.7 Photographs of Test Configuration 53

5.4 Radiated, Radio-frequency, Electromagnetic Field Immunity Test (RS)..... 54

5.4.1 Test Specification..... 54

5.4.2 Test Instrument 54

5.4.3 Test Procedure..... 55

5.4.4 Deviation from Test Standard 55

5.4.5 Test Setup..... 56

5.4.6 Test Result 57

5.4.7 Photographs of Test Configuration 58

5.5 Electrical Fast Transient /Burst Immunity Test (EFT) 59

5.5.1 Test Specification..... 59

5.5.2 Test Instrument 59

5.5.3 Test Procedure..... 60

5.5.4 Deviation from Test Standard 60

5.5.5 Test Setup..... 61

5.5.6 Test Result 62

5.5.7 Photographs of Test Configuration 63

5.6 Surge Immunity Test..... 65

5.6.1 Test Specification..... 65

5.6.2 Test Instrument 65

5.6.3 Test Procedure..... 66

5.6.4 Deviation from Test Standard 66

5.6.5 Test Setup..... 66

5.6.6 Test Result 67

5.6.7 Photographs of Test Configuration 68

5.7 Continuous Conducted Disturbances (CS) 69

5.7.1 Test Specification..... 69

5.7.2 Test Instrument 69

5.7.3 Test Procedure..... 70

5.7.4 Deviation from Test Standard 70

5.7.5 Test Setup..... 71

5.7.6 Test Result 72

5.7.7 Photographs of Test Configuration 73

5.8 Power Supply Short-Term Variation 75

5.8.1 Test Specification..... 75

5.8.2 Test Instrument 75

5.8.3 Test Procedure..... 76

5.8.4 Deviation from Test Standard 76

5.8.5 Test Setup..... 76

5.8.6 Test Result 77



5.8.7 Photographs of Test Configuration 78

5.9 Power Supply Failure..... 79

5.9.1 Test Specification..... 79

5.9.2 Test Instrument 79

5.9.3 Test Procedure..... 79

5.9.4 Deviation from Test Standard 79

5.9.5 Test Setup..... 80

5.9.6 Test Result 81

5.9.7 Photographs of Test Configuration 82



History of this test report

Report No.	Issue date	Description
WD-EE-R-240176-C0	Jun. 27, 2024	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-240176-C0	Jun. 27, 2024	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: Rugged Embedded System

Model: ECS-4700-PoE

Series Model: ECS-4700 Series, ECS-4XXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)

Applicant: Vecow Co., Ltd

Tested: Mar. 16 ~ Jun. 21, 2024

Standard: **EN/IEC 60945: 2002, Clause 9, 10**
EN 61000-3-2: 2014
EN 61000-3-3: 2013
IEC 61000-4-2: 2008
IEC 61000-4-3: 2020
IEC 61000-4-4: 2012
IEC 61000-4-5: 2014 + A1: 2017
IEC 61000-4-6: 2013
IEC 61000-4-11: 2020
EN 61000-4-2: 2009
EN IEC 61000-4-3: 2020
EN 61000-4-4: 2012
EN 61000-4-5: 2014 + A1: 2017
EN 61000-4-6: 2014 + AC: 2015
EN IEC 61000-4-11: 2020

The above equipment (Model: ECS-4700-PoE) 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 Test Result

The EUT has been tested according to the following specifications:

Emission			
Standard	Test Item	Result	Remark
EN/IEC 60945	Conducted disturbance at mains terminals	Pass	Meets the requirements
	Radiated disturbance	Pass	Meets the requirements
EN 61000-3-2	Harmonic current emissions	Pass	The power consumption of EUT is less than 75W and no limits apply
EN 61000-3-3	Voltage fluctuations and flicker	Pass	Meets the requirements

Immunity			
Standard	Test Item	Result	Remark
IEC 61000-4-2	Electrostatic discharges (ESD)	Pass	Meets the requirements of Performance Criterion B
IEC 61000-4-3	Continuous radiated disturbances (RS)	Pass	Meets the requirements of Performance Criterion A
IEC 61000-4-4	Electrical fast transients (EFT)	Pass	Meets the requirements of Performance Criterion A
IEC 61000-4-5	Surges	Pass	Meets the requirements of Performance Criterion A
IEC 61000-4-6	Continuous conducted disturbances (CS)	Pass	Meets the requirements of Performance Criterion A
EN/IEC 60945 Clause 10.7 IEC 61000-4-11	Power supply short-term variation	Pass	Meets the requirements of Performance Criterion A
EN/IEC 60945 Clause 10.8 IEC 61000-4-11	Power supply failure	Pass	Meets the requirements of Performance Criterion C

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

2 Test Configuration of Equipment Under Test

2.1 Test Facility

Conducted disturbance at mains terminals, Conducted disturbance at telecommunication ports, Harmonics, Flicker, ESD, EFT, Surge, CS, PFMF and DIP Tests

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

RS Test

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

Conducted disturbance at mains terminals and Radiated emission (9*6*6 Chamber) Tests

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 $k=2$.

As required by IEC 60945, the measurement uncertainty shall be considered in determining the Pass/Fail test results.

2.2.1 Conducted Emission test

Test Site	Measurement Freq. Range	dB (U_{lab})	Note
W01-CE	10 kHz ~ 30 MHz	2.75	N/A
W08-CE	10 kHz ~ 30 MHz	2.76	N/A

2.2.2 Radiated Emission test

Test Site	Measurement Freq. Range	Ant	dB (U_{lab})	Note
W08-966-1	150 kHz ~ 30 MHz	V	2.50	N/A
	150 kHz ~ 30 MHz	H	2.50	N/A
	30 MHz ~ 200 MHz	V	3.78	N/A
	30 MHz ~ 200 MHz	H	2.69	N/A
	200 MHz ~ 1000 MHz	V	4.91	N/A
	200 MHz ~ 1000 MHz	H	3.40	N/A
	1 GHz ~ 6 GHz	V	4.48	N/A
	1 GHz ~ 6 GHz	H	4.33	N/A



3 General Information

3.1 Description of EUT

Product	Rugged Embedded System
Model	ECS-4700-PoE
Series Model	ECS-4700 Series, ECS-4XXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)
Applicant	Vecow Co., Ltd
Received Date	Mar. 07, 2024
EUT Power Rating	24Vdc (from adapter)
Model Differences	The models are electrically identical, different models no. are for marketing purpose. The series model information is provided by client.
Operating System	WIN 11, Burnintest
Data Cable Supplied	N/A
Accessory Device	N/A
I/O Port	Please refer to the User's Manual

Note:

- The EUT uses the follow adapter:

Adapter (support unit only)	
Brand	FSP
Model	FSP120-AAAN2
Input Power	100-240Vac, 1.8A, 50-60Hz
Output Power	24Vdc, 5A
Power line	Input: 1.8m non-shielded cable Output: 1.6m non-shielded cable with 1 core

- The EUT contains following components.

Item	Brand	Model	Spec.	Qty.
Main Board	-	ECS-4700	Rev. B	1
CPU	Intel	13th Gen Intel® Core™ i7-1365UE	1.70 GHz	1
RAM	innodisk	M5D0-BGS2Q5VP-H03	32GB DDR5 4800 W/T ECC SODIMM	2
SSD	innodisk	DGS25-C12M71EW3QF-H03	512GB 2.5" SATA SSD 3TG6-P	2
M.2 SSD	innodisk	DGM28-01TDP1KWAEF-H03	M.2(P80) 4TG2-P 1TB	1

3.2 Description of Test Modes

Test results are presented in the report as below.

Test Mode	Test Condition
Conducted emission test	
-	Adapter mode
Radiated emission 150kHz ~ 30MHz test	
-	Adapter mode
Radiated emission 30MHz ~ 1GHz test	
-	Adapter mode
Radiated emission 1GHz ~ 2GHz test	
-	Adapter mode
Harmonics, Flicker and Immunity test	
-	Adapter mode

3.3 EUT Operating Condition

- a. Placed the EUT on the 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 IPCAM sent signal to EUT through PoE supply LAN cable.
- f. The EUT read and write data with Internal HDD, External HDD & SSD.
- g. The EUT run test program "BurnIN.exe" to enable all functions.
- h. The EUT sent "Color Bar ITU-R.BT471-1" signal to monitor and displayed on screen.
- i. The microphone sent voice signal to EUT.
- j. The EUT sent voice signal to earphone.



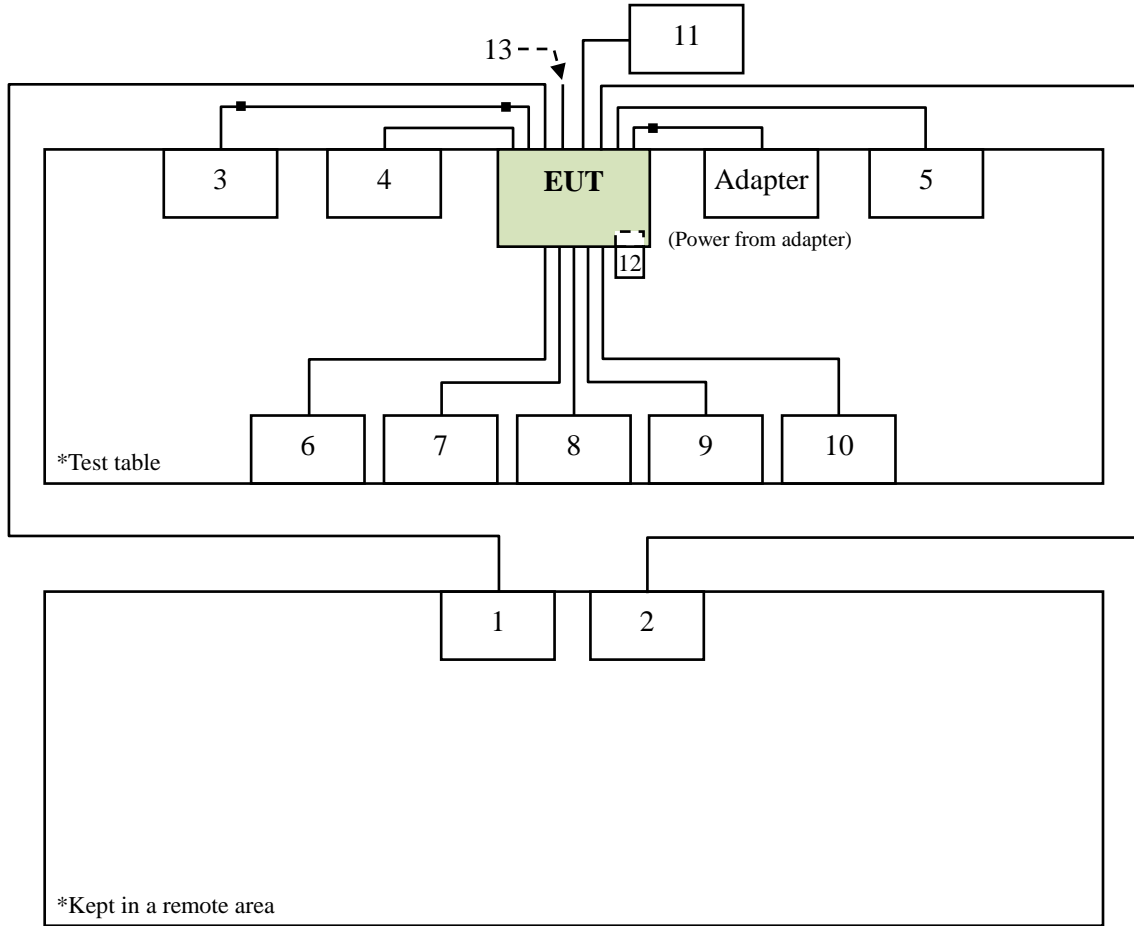
3.4 Description of Support Unit

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-QCN FA335	20m CAT.5E non-shielded RJ45 cable	1.8m non-shielded cable	-
2	Desktop PC	DELL	D13M	H6K10 A00	FCC DoC Approved	20m CAT.5E non-shielded RJ45 cable	1.8m non-shielded cable	-
3	4K monitor	PHILIPS	276E8V	UKC192600 0458	FCC DoC Approved	1.5m shielded HDMI cable with 2 cores	AC: 1.8m non-shielded cable DC: 1.4m non-shielded cable with 1 core	-
4	4K monitor	HP	HP 27f 4k Display	3CM01916T F	FCC DoC Approved	1.7m shielded DP cable	AC: 1.8m non-shielded cable DC: 1.4m non-shielded cable with 1 core	-
5	4K monitor	HP	HP 27f 4k Display	3CM01935T F	FCC DoC Approved	1.7m shielded DP cable	AC: 1.8m non-shielded cable DC: 1.4m non-shielded cable with 1 core	-
6	Keyboard	Logitech	Y-U0009	1710SC500L A8	FCC DoC Approved	1.5m non-shielded cable	N/A	
7	Mouse	Logitech	M-U0026	HS726HB	FCC DoC Approved	2m non-shielded cable	N/A	-
8	Earphone & microphone	E-books	E-EPA057	N/A	N/A	1.4m non-shielded cable	N/A	-
9	External hard drive (x2)	Transcend	TS1TSJ25C 3N	D62397-0399	FCC DoC Approved	1m shielded cable	N/A	-
10	External portable SSD	Transcend	TS120GES D240C	F96474-0001	FCC DoC Approved	1m shielded cable	N/A	-
11	IP CAM (x4)	N/A	MBL030A- ORZ0310	N/A	N/A	1m CAT.5E non-shielded RJ45 cable	N/A	Use shielded cable only for ESD, RS, Surge and CS Supplied by client
12	RS232 terminator (x4)	N/A	N/A	N/A	N/A	N/A	N/A	Supplied by client
13	Multi conductor cable	N/A	N/A	N/A	N/A	1.2m non-shielded cable	N/A	-

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 System Under Test



4 Emission Test

4.1 Conducted Emission Measurement

4.1.1 Limit of Conducted Emission Measurement

Conducted Emissions Limits Quasi-peak (dB μ V)				
Frequency range (MHz)	Portable	Protected	Exposed	Submerged
0.01 to 0.15	N/A	96 to 50*		
0.15 to 0.35		60 to 50*		
0.35 to 30		50		

* Decreases with the logarithm of the frequency.

- Note:**
1. The lower limit shall apply at the transition frequencies.
 2. Detector function in the form: PK = Peak, QP = Quasi Peak, AV = Average
 3. The test result calculated as following:
Measurement Value = Reading Level + Correct Factor + U_{lab}
Correction Factor = Insertion loss of LISN + Cable loss + Transient Limiter (If use)
Margin Level = Measurement Value – Limit Value



4.1.2 Test 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	Jun. 05, 2024
2	Pulse limiter	R&S	ESH3-Z2	CT-2-015	Jun. 06, 2024
3	EMI Test Receiver	R&S	ESCI	CT-1-024	Jun. 06, 2024
4	Artificial Mains Network (AMN)	SCHWARZBEC K	NSLK 8127	CT-1-104-1	Jun. 06, 2024
5	RF Cable	MVE	200200.400LL .500A	CT-9-101	Jun. 06, 2024
6	50ohm Termination	N/A	N/A	CT-1-065-1	May 30, 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.

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. 16, 2023
2	RF Cable	EMCI	EMCCFD300-BM-BM-5000	CT-1-107-2	Jun. 17, 2023
3	EMI Test Receiver	R&S	ESR3	CT-1-103	Jun. 19, 2023
4	Artificial Mains Network (AMN)	SCHWARZBEC K	NSLK 8127 RC	CT-1-104-1RC	Jun. 16, 2023
5	Transient Limiter	Electro-Metrics	EM-7600	CT-1-026	Jun. 17, 2023
6	50ohm Termination	N/A	N/A	CT-1-109-1	Jun. 16, 2023
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.

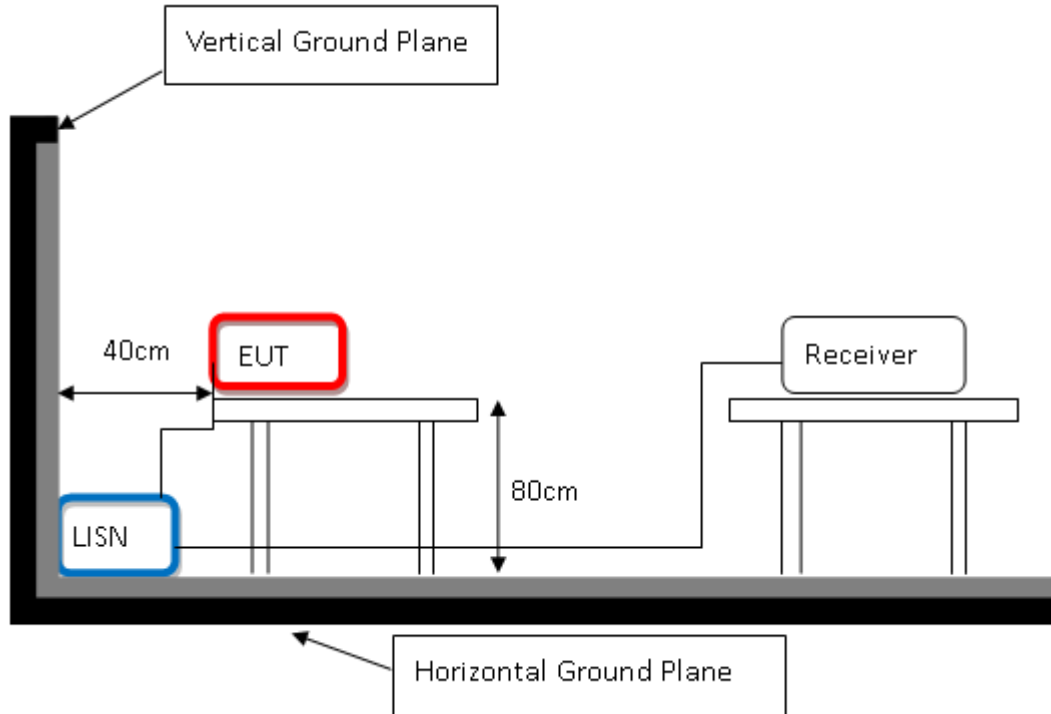
4.1.3 Test Procedure

- a. The table-top EUT 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 LISN at least be 80 cm from nearest chassis of EUT.
- b. The line impedance stabilization network (LISN) provides 50 ohm/50uH of coupling impedance for the measuring instrument. All other support equipments powered from additional LISN(s).
- c. Interrelating cables that hang closer than 40 cm 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. All I/O cables that are not connected to a peripheral shall be bundle in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- e. The EMI test receiver connected to LISN powering the EUT. The actual test configuration, please refer to EUT test photos.
- f. The receiver scanned from 10kHz to 30MHz for emissions in each of test modes. A scan was taken on both power lines, Line and Neutral, recording at least six highest emissions.
- g. The EUT and cable configuration of the above highest emission levels were recorded. The test data of the worst case was recorded.

4.1.4 Deviation from Test Standard

No deviation

4.1.5 Test Setup

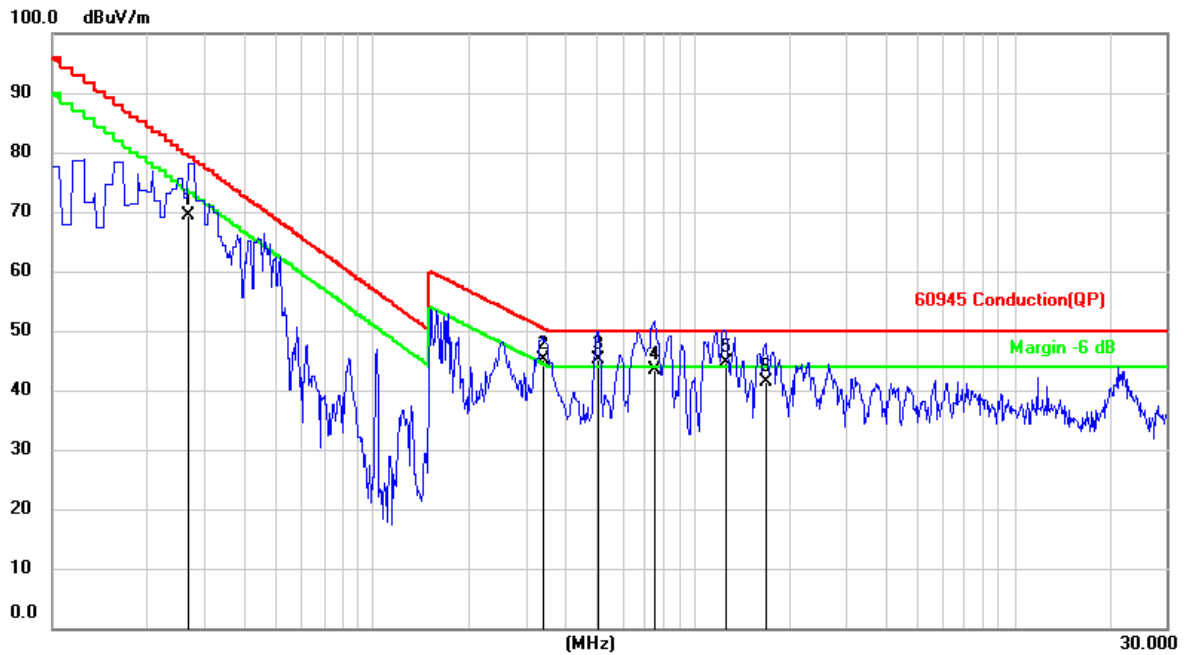


Note: Please refer to 4.1.7 for the actual test configuration.



4.1.6 Test Result

Test Voltage	230Vac, 50Hz	Frequency Range	10 k - 30 MHz
Environmental Conditions	21°C, 51% RH	6dB Bandwidth	200 & 9 kHz
Test Date	2024/03/22	Phase	L
Tested by	Andy Li	Test Site	W01-CE



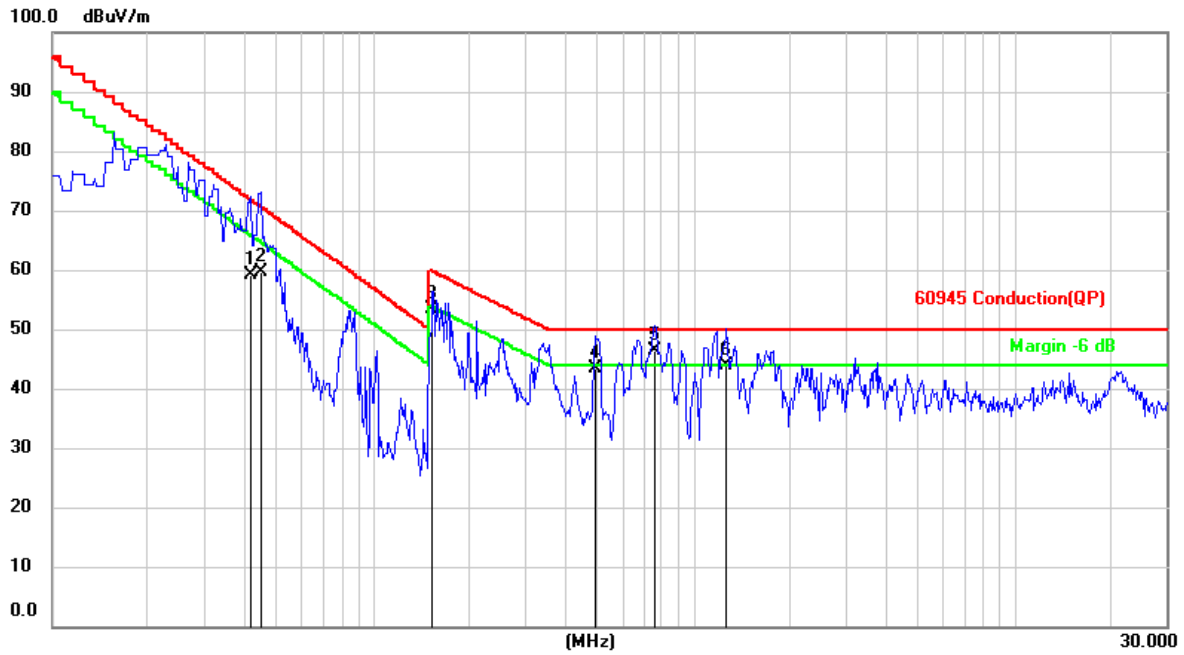
No.	Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	U_{lab} (dB)	Measurement (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.0269	59.15	10.28	2.75	72.18	79.19	-7.01	QP
2	0.3381	35.19	9.95	2.75	47.89	50.41	-2.52	QP
3	0.5078	35.27	9.95	2.75	47.97	50.00	-2.03	QP
4	0.7617	33.53	9.97	2.75	46.25	50.00	-3.75	QP
5	1.2702	34.58	9.98	2.75	47.31	50.00	-2.69	QP
6	1.6931	31.39	10.01	2.75	44.15	50.00	-5.85	QP

Remark:

1. QP = Quasi Peak, AVG = Average
2. Correction Factor = Insertion loss of LISN + Cable loss + Transient Limiter (If use)
3. Measurement Value = Reading Level + Correct Factor + U_{lab}
4. Margin Level = Measurement Value - Limit Value



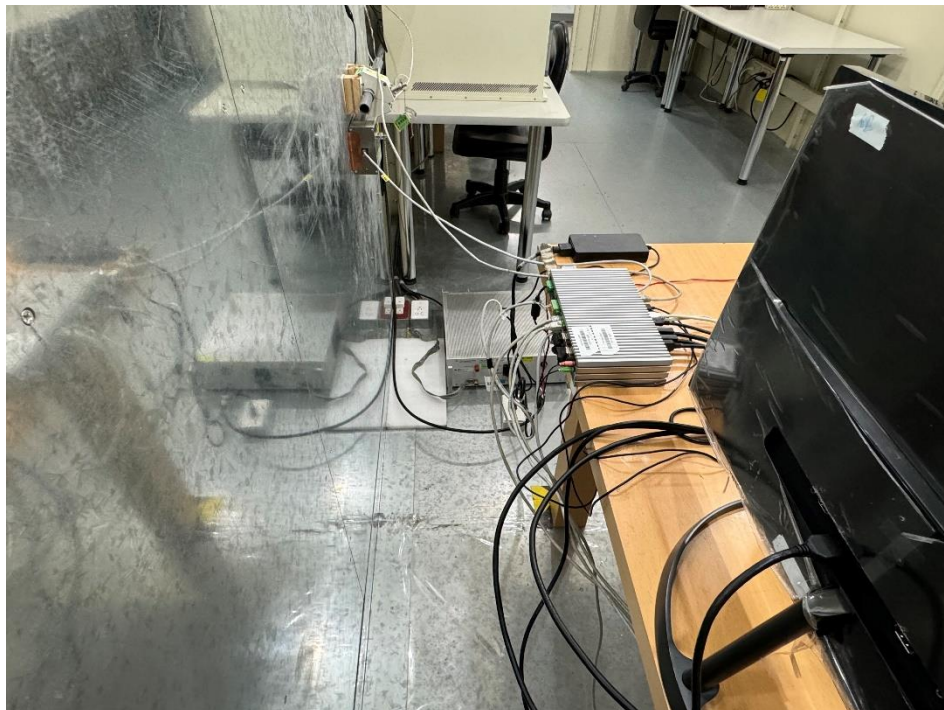
Test Voltage	230Vac, 50Hz	Frequency Range	10 k - 30 MHz
Environmental Conditions	21°C, 51% RH	6dB Bandwidth	200 & 9 kHz
Test Date	2024/03/22	Phase	N
Tested by	Andy Li	Test Site	W01-CE



No.	Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	U_{lab} (dB)	Measurement (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.0413	49.12	10.13	2.75	62.00	71.91	-9.91	QP
2	0.0441	49.48	10.10	2.75	62.33	70.79	-8.46	QP
3	0.1531	43.46	9.97	2.75	56.18	59.76	-3.58	QP
4	0.4945	33.31	9.97	2.75	46.03	50.00	-3.97	QP
5	0.7553	36.31	9.99	2.75	49.05	50.00	-0.95	QP
6	1.2723	33.87	10.00	2.75	46.62	50.00	-3.38	QP

Remark: 1. QP = Quasi Peak, AVG = Average
 2. Correction Factor = Insertion loss of LISN + Cable loss + Transient Limiter (If use)
 3. Measurement Value = Reading Level + Correct Factor + U_{lab}
 4. Margin Level = Measurement Value - Limit Value

4.1.7 Photographs of Test Configuration



4.2 Radiated Emission Measurement

4.2.1 Limits of Radiated Emission Measurement

Radiated Emissions Limits Quasi-peak (dB μ V/m) at 3m				
Frequency range (MHz)	Portable	Protected	Exposed	Submerged
0.15 to 0.3	80 to 52*			N/A
0.3 to 30	52 to 34*			
30 to 2000	54			
156 to 165	Peak (dBμV/m) at 3m			
	30			
	Quasi-peak (dBμV/m) at 3m			
	24			

* Decreases with the logarithm of the frequency.

Note: 1. The lower limit shall apply at the transition frequency.

2. Detector function in the form: PK = Peak, QP = Quasi Peak, AV = Average

3. The test result calculated as following:

Measurement Value = Reading Level + Correct Factor + U_{lab}

Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain
+ Cable loss (preamplifier to receiver)

Margin Level = Measurement Value - Limit Value

dB μ V/m = dB μ A/m + 51.5



4.2.2 Test Instrument

Test Site: W08-966-1					
Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	Horn Antenna	Schwarzbeck	BBHA 9120D	CT-9-031	Jul. 31, 2023
2	Horn Antenna	Schwarzbeck	BBHA 9170	CT-9-032	Aug. 21, 2023
3	TRILOG Broadband Antenna with 6 dB Attenuator	Schwarzbeck & MVE	VULB 9168 & MVE2251-06	CT-1-096-1	May 06, 2024
4	Spectrum Analyzer	Agilent	E4407B	CT-1-003(1)	Aug. 02, 2023
5	EXA Signal Analyzer	Keysight	N9010A	CT-1-093	Aug. 18, 2023
6	EMI Test Receiver	Keysight	N9038A	CT-9-007	Aug. 02, 2023
7	Preamplifier	EM	EM 330	CT-9-024	Aug. 03, 2023
8	Preamplifier	SGH & MCL	SGH118 & BW-S15W2+	CT-9-071	Aug. 03, 2023
9	Preamplifier	EMCI	EMC184045SE	CT-9-013	Aug. 22, 2023
10	Test Cable	EMCI	EMCCFD400-NM-NM-1000	CT-1-132	Aug. 03, 2023
11	Test Cable	PEWC	CFD400NL-LW-NM-NM-3000	CT-1-141	Aug. 03, 2023
12	Test Cable	EMCI	EMCCFD400-NM-NM-15000	CT-1-133	Aug. 03, 2023
13	Test Cable	EMCI	EMC104-SM-35M-600	CT-1-134	Aug. 03, 2023
14	Test Cable	MVE	280280.LL266.1400	CT-9-072	Aug. 03, 2023
15	Test Cable	EMCI	EMC102-KM-KM-600	CT-1-136	Aug. 22, 2023
16	Measurement Software	EZ-EMC	Ver :WD-03A1-1	CT-3-012	No calibration request
17	Loop Antenna	Schwarzbeck	FMZB 1513-60 B	CT-9-111	May 8, 2023

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

4.2.3 Test Procedure

- a. The EUT was placed on the top of a turntable 0.8 meters above the ground at a 3 m 966 chamber. The table was rotated 360 degrees to determine the position of the high radiation emissions.
- b. The height of the test 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 EUT was set up as per the test configuration to simulate typical usage per the user's manual. All I/O cables were positioned to simulate typical usage. The actual test configuration, please refer to EUT test photos.
- d. The initial step in collecting radiated emission data is a Spectrum Mode scanning the measurement frequency range.

150kHz~30MHz:

Reading in which marked as Quasi Peak or Peak means measurements by using Spectrum Mode with detector RBW=9kHz.

30M~2GHz:

Reading in which marked as Quasi Peak or Peak means measurements by using Spectrum Mode with detector RBW=120kHz.

If the Spectrum Mode measured peak value compliance with and lower than Quasi Peak Limit, the EUT shall be deemed to meet Quasi Peak Limits.

156M~165MHz:

Reading in which marked as Peak & Quasi Peak means measurements by using Spectrum Mode with setting in RBW=9kHz.

Reading in which marked as must be either Quasi Peak or Peak.

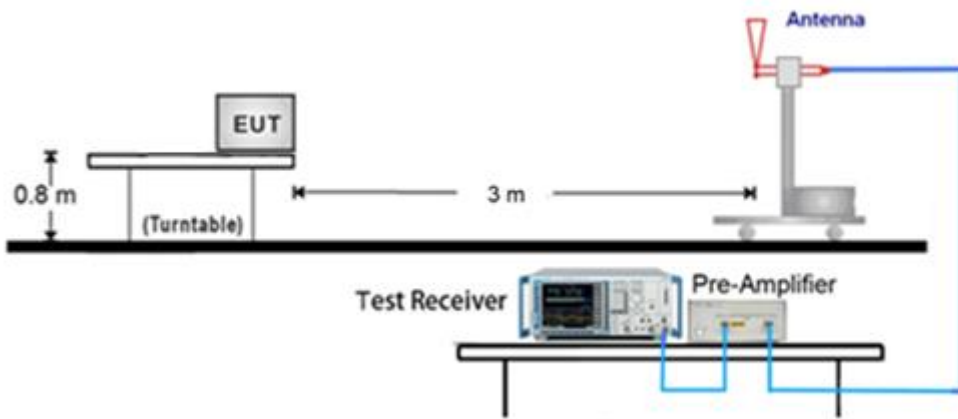
- e. Emission frequency and amplitude were recorded, recording at least six highest emissions. The EUT and cable configuration of the above highest emission levels were recorded. The test data of the worst case was recorded.

4.2.4 Deviation from Test Standard

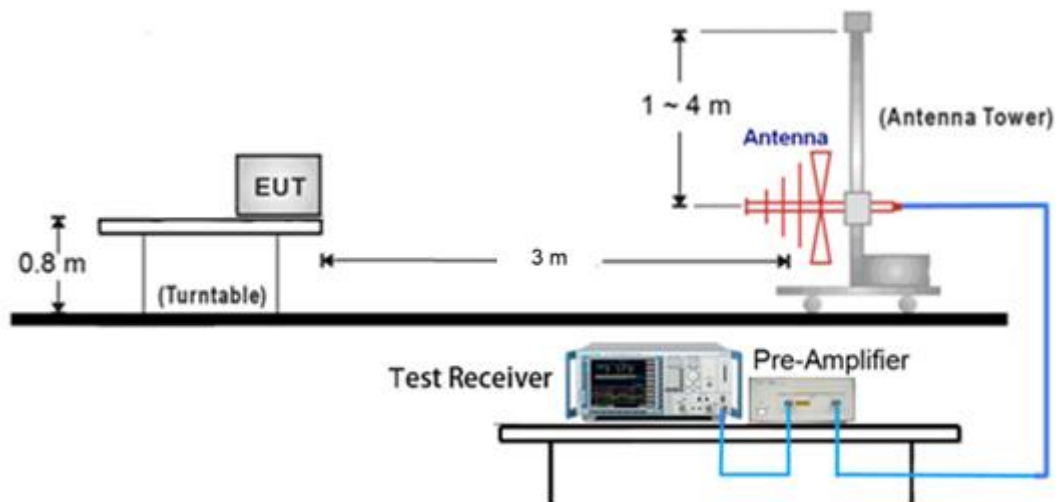
No deviation

4.2.5 Test Setup

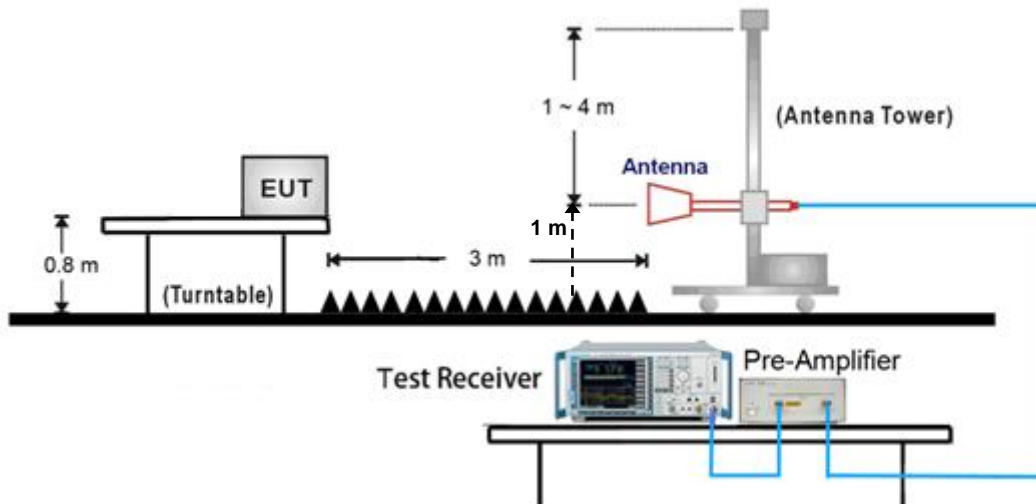
< Radiated Emissions Frequency: 150 kHz to 30 MHz >



< 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) The formula of measured value as: Test Result = Reading + Correction Factor
- (3) Detector function in the form: PK = Peak, QP = Quasi Peak, AV = Average
- (4) The test result calculated as following:

Measurement Value = Reading Level + Correct Factor + U_{lab}

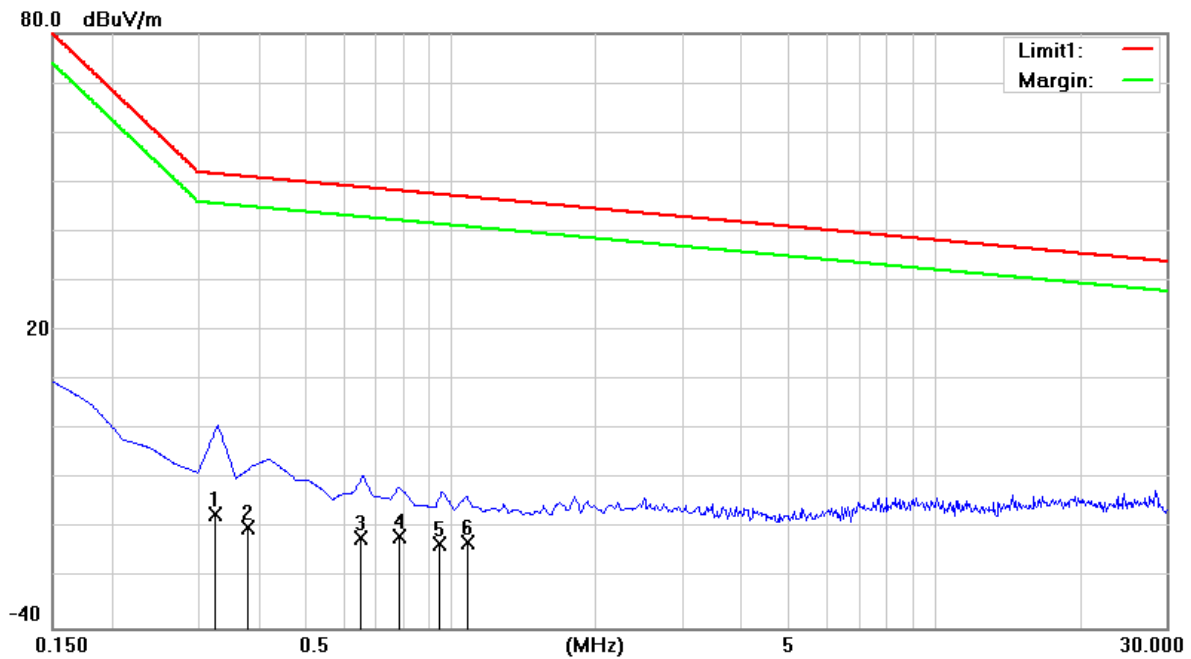
Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain (if use)

Margin Level = Measurement Value - Limit Value



4.2.6 Test Result

Test Voltage	230Vac, 50Hz	Frequency Range	150 k - 30 MHz
Environmental Conditions	26°C, 46% RH	6dB Bandwidth	9 kHz
Test Date	2024/03/21	Test Distance	3m
Tested by	Rod Yu	Polarization	Vertical
Test Site	W08-966-1		



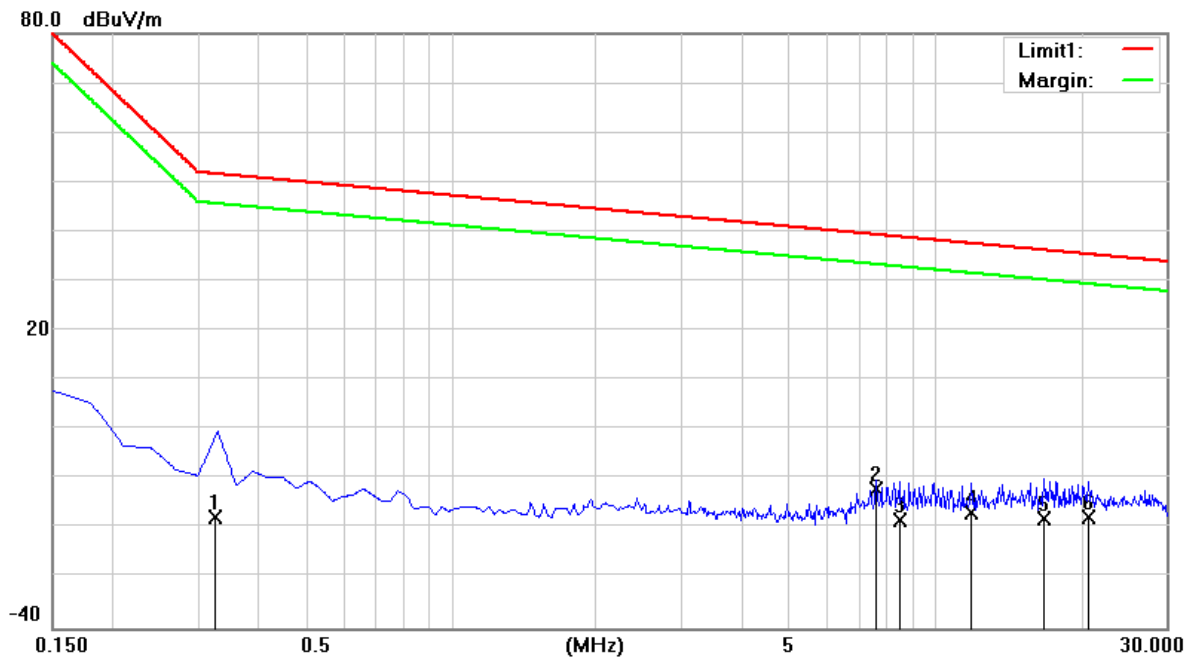
No.	Frequency (MHz)	Reading Level (dB μ V)	Correct Factor (dB/m)	U_{lab} (dB/m)	Measurement (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Table Degree (degree)	Antenna Height (cm)	Detector
1	0.3240	-36.36	19.25	2.50	-14.61	51.70	-66.31	136	150	QP
2	0.3772	-38.96	19.25	2.50	-17.21	51.10	-68.31	0	150	QP
3	0.6445	-41.23	19.28	2.50	-19.45	49.01	-68.46	133	150	QP
4	0.7811	-40.92	19.37	2.50	-19.05	48.26	-67.31	321	150	QP
5	0.9420	-42.26	19.31	2.50	-20.45	47.53	-67.98	89	150	QP
6	1.0814	-42.06	19.31	2.50	-20.25	46.99	-67.24	109	150	QP

Remark:

1. QP = Quasi Peak
2. Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain + Cable loss (preamplifier to receiver)
3. Measurement Value = Reading Level + Correct Factor + U_{lab}
4. Margin Level = Measurement Value - Limit Value
5. dBuV/m = dBuA/m + 51.5



Test Voltage	230Vac, 50Hz	Frequency Range	150 k - 30 MHz
Environmental Conditions	26°C, 46% RH	6dB Bandwidth	9 kHz
Test Date	2024/03/21	Test Distance	3m
Tested by	Rod Yu	Polarization	Horizontal
Test Site	W08-966-1		

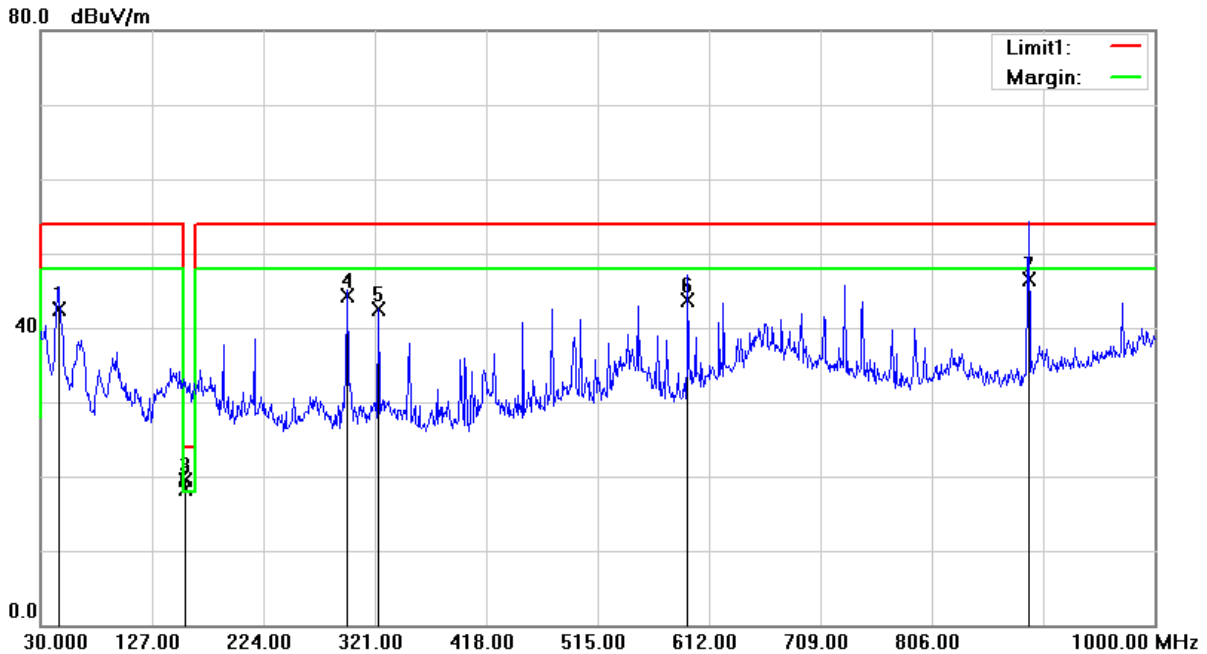


No.	Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB/m)	U_{lab} (dB/m)	Measurement (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Table Degree (degree)	Antenna Height (cm)	Detector
1	0.3236	-36.96	19.25	2.50	-15.21	51.70	-66.91	130	150	QP
2	7.5522	-32.56	20.76	2.50	-9.30	39.39	-48.69	63	150	QP
3	8.4135	-39.03	20.74	2.50	-15.79	38.97	-54.76	275	150	QP
4	11.8693	-38.23	21.49	2.50	-14.24	37.62	-51.86	248	150	QP
5	16.8320	-39.94	22.02	2.50	-15.42	36.26	-51.68	244	150	QP
6	20.7134	-40.02	22.24	2.50	-15.28	35.45	-50.73	258	150	QP

Remark: 1. QP = Quasi Peak
 2. Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain + Cable loss (preamplifier to receiver)
 3. Measurement Value = Reading Level + Correct Factor + U_{lab}
 4. Margin Level = Measurement Value - Limit Value
 5. dBuV/m = dBuA/m + 51.5



Test Voltage	230Vac, 50Hz	Frequency Range	30 - 1000 MHz
Environmental Conditions	26°C, 46% RH	6dB Bandwidth	9k (For 156M~165M) & 120 kHz
Test Date	2024/03/21	Test Distance	3m
Tested by	Rod Yu	Polarization	Vertical
Test Site	W08-966-1		



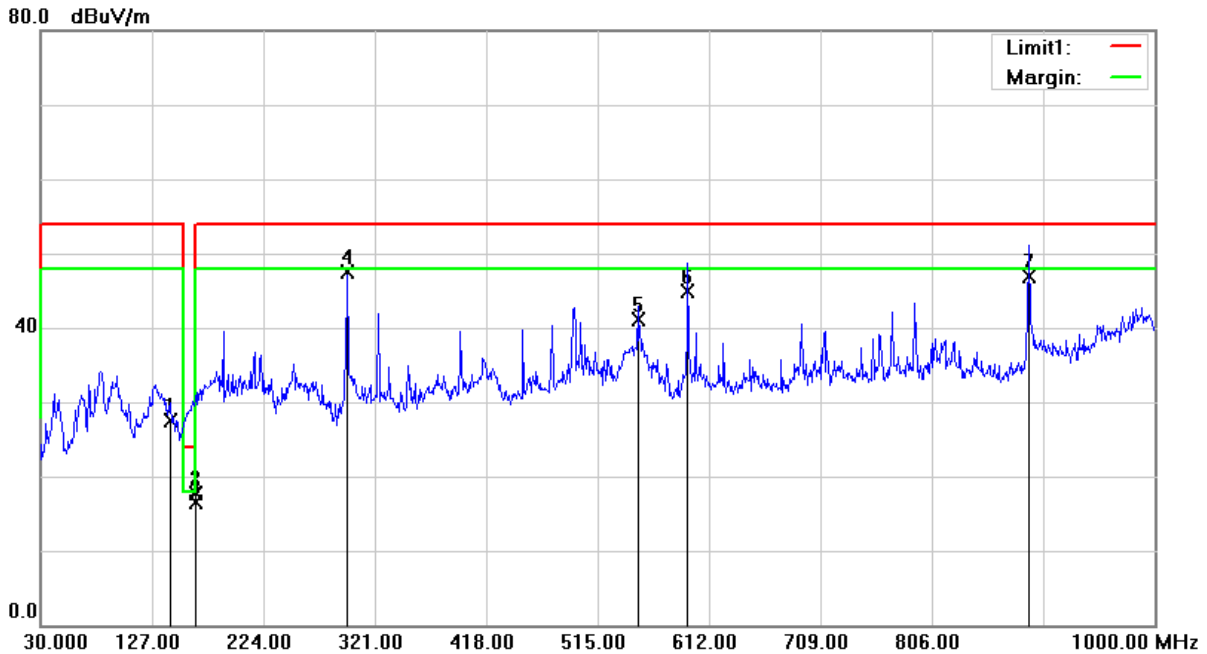
No.	Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB/m)	U_{lab} (dB/m)	Measurement (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Table Degree (degree)	Antenna Height (cm)	Detector
1	45.5480	52.20	-9.64	3.78	46.34	54.00	-7.66	269	100	QP
2	156.4325	27.80	-9.42	3.78	22.16	30.00	-7.84	286	100	peak
3	156.4325	28.90	-9.42	3.78	23.26	24.00	-0.74	286	100	QP
4	296.7040	52.96	-8.68	4.91	49.19	54.00	-4.81	300	100	QP
5	323.9980	50.17	-7.76	4.91	47.32	54.00	-6.68	144	100	QP
6	593.4160	44.36	-0.74	4.91	48.53	54.00	-5.47	171	100	QP
7	890.1400	42.17	4.33	4.91	51.41	54.00	-2.59	219	100	QP

Remark:

1. QP = Quasi Peak
2. Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain + Cable loss (preamplifier to receiver)
3. Measurement Value = Reading Level + Correct Factor + U_{lab}
4. Margin Level = Measurement Value - Limit Value



Test Voltage	230Vac, 50Hz	Frequency Range	30 - 1000 MHz
Environmental Conditions	26°C, 46% RH	6dB Bandwidth	9k (For 156M~165M) & 120 kHz
Test Date	2024/03/21	Test Distance	3m
Tested by	Rod Yu	Polarization	Horizontal
Test Site	W08-966-1		

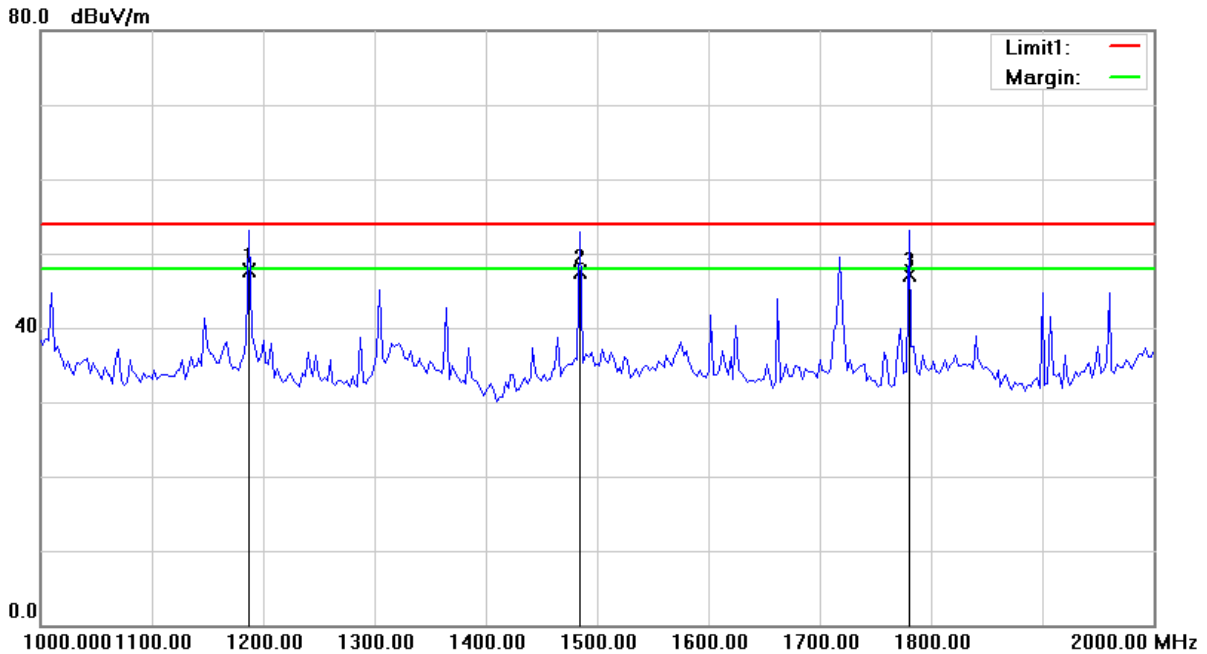


No.	Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB/m)	U_{lab} (dB/m)	Measurement (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Table Degree (degree)	Antenna Height (cm)	Detector
1	143.2400	37.27	-9.82	2.69	30.14	54.00	-23.86	282	200	QP
2	164.5540	27.37	-9.74	2.69	20.32	30.00	-9.68	0	175	peak
3	164.5540	26.26	-9.74	2.69	19.21	24.00	-4.79	0	175	QP
4	296.7140	56.20	-8.68	3.40	50.92	54.00	-3.08	181	100	QP
5	550.0020	43.19	-2.09	3.40	44.50	54.00	-9.50	201	200	QP
6	593.4420	45.70	-0.74	3.40	48.36	54.00	-5.64	215	100	QP
7	890.3900	42.57	4.34	3.40	50.31	54.00	3.69	256	100	QP

Remark: 1. QP = Quasi Peak
 2. Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain + Cable loss (preamplifier to receiver)
 3. Measurement Value = Reading Level + Correct Factor + U_{lab}
 4. Margin Level = Measurement Value - Limit Value



Test Voltage	230Vac, 50Hz	Frequency Range	1 - 2 GHz
Environmental Conditions	26°C, 46% RH	6dB Bandwidth	120 kHz
Test Date	2024/03/21	Test Distance	3m
Tested by	Rod Yu	Polarization	Vertical
Test Site	W08-966-1		

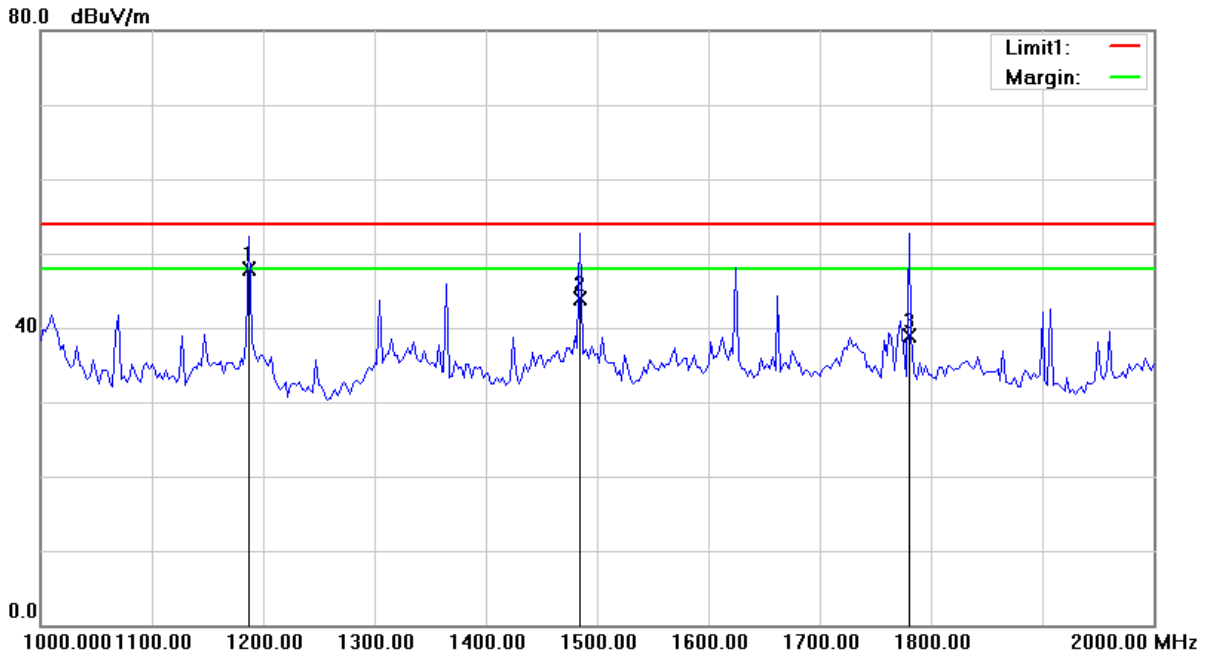


No.	Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB/m)	U_{lab} (dB/m)	Measurement (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Table Degree (degree)	Antenna Height (cm)	Detector
1	1187.500	66.79	-19.12	4.48	52.15	54.00	-1.85	226	100	QP
2	1485.000	65.90	-18.33	4.48	52.05	54.00	-1.95	216	100	QP
3	1780.000	65.30	-18.18	4.48	51.60	54.00	-2.40	286	100	QP

Remark: 1. peak = Peak, AVG = Average
 2. Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain + Cable loss (preamplifier to receiver)
 3. Measurement Value = Reading Level + Correct Factor + U_{lab}
 4. Margin Level = Measurement Value - Limit Value



Test Voltage	230Vac, 50Hz	Frequency Range	1 - 2 GHz
Environmental Conditions	26°C, 46% RH	6dB Bandwidth	120 kHz
Test Date	2024/03/21	Test Distance	3m
Tested by	Rod Yu	Polarization	Horizontal
Test Site	W08-966-1		



No.	Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB/m)	U_{lab} (dB/m)	Measurement (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Table Degree (degree)	Antenna Height (cm)	Detector
1	1187.500	66.96	-19.12	4.33	52.17	54.00	-1.83	186	100	QP
2	1485.000	62.14	-18.33	4.33	48.14	54.00	-5.86	151	100	QP
3	1780.000	56.99	-18.18	4.33	43.14	54.00	-10.86	174	100	QP

Remark: 1. peak = Peak, AVG = Average
 2. Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain + Cable loss (preamplifier to receiver)
 3. Measurement Value = Reading Level + Correct Factor + U_{lab}
 4. Margin Level = Measurement Value - Limit Value

4.2.7 Photographs of Test Configuration

Radiated Emission Test (150kHz~1GHz)



Radiated Emission Test (1GHz~2GHz)



4.3 Harmonics Current Measurement

4.3.1 Limits of Harmonics Current Measurement

The limits ensure that harmonic disturbance levels do not exceed the compatibility levels defined in IEC 61000-3-2.

Limits for Class A equipment	
Harmonics Order n	Max. permissible harmonics current A
Odd harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
15<=n<=39	0.15x15/n
Even harmonics	
2	1.08
4	0.43
6	0.30
8<=n<=40	0.23x8/n

Limits for Class D equipment		
Harmonics Order n	Max. permissible harmonics current per watt mA/W	Max. permissible harmonics current A
Odd Harmonics 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<=n<=39	3.85/n	0.15x15/n

- Note:** 1. Class A and Class D are classified according to item section 5 of EN 61000-3-2.
 2. According to section 7 of EN 61000-3-2, the above limits for all equipment except for lighting equipment having an active input power > 75 W and no limits apply for equipment with an active input power up to and including 75 W.

4.3.2 Test Instrument

Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	Harmonics & Flicker Analyser	EMC PARTNER	HAR-1000-1P	CT-1-090(1)	Oct. 19, 2023
2	Power Source	EMC PARTNER	PS3-1	CT-1-090a1	Oct. 19, 2023

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

4.3.3 Test Procedure

The table-top EUT 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 EUT was placed insulation support unit from the horizontal ground plane.

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

The EUT classified as follows:

Class A:

- Balanced three-phase equipment;
- Household appliances excluding equipment identified as Class D;
- Tools excluding portable tools;
- Dimmers for incandescent lamps;
- Audio equipment.

Equipment not specified in one of the three other classes should be considered as Class A equipment.

Note 1: Equipment that can be shown to have a significant effect on the supply system may be reclassified in a future edition of the standard. Factors to be taken into account include:

- Number in use;
- Duration of use;
- Simultaneity of use;
- Power consumption;
- Harmonic spectrum, including phase.

Class B:

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

Class C:

- Lighting equipment;

Class D:

Equipment having a specified power according to 6.2.2 less than or equal to 600W, of the following types:

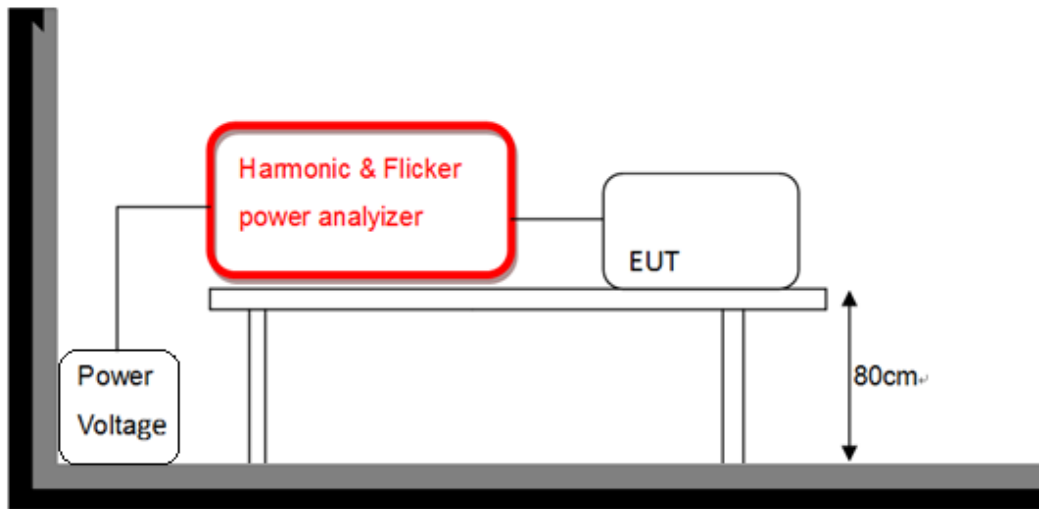
- Personal computers and personal computer monitors;
- Television receivers.
- Refrigerators and freezers having one or more variable-speed drives to control compressor motor(s).

4.3.4 Deviation from Test Standard

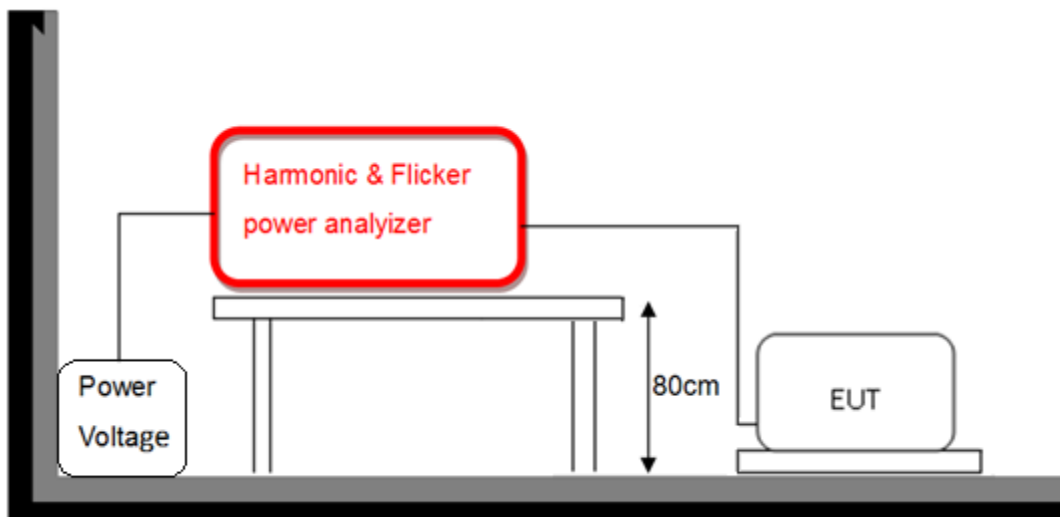
No deviation

4.3.5 Test Setup

< Table-Top equipment >



< Floor-Standing equipment >





4.3.6 Test Result

Supply Voltage / Ampere	229.7 V _{rms} / 0.352 A _{rms}	Test Date	2024/03/16
Test Duration	5 min	Power Consumption	72.62W
Power Frequency	49.922Hz	Power Factor	0.898
Environmental Conditions	21°C, 49% RH	Tested by	Guanwei Liao

Note:

1. Limits are not specified for equipment with a rated power of 75W or less (other than lighting equipment).
2. According to EN 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 Test Configuration



4.4 Voltage Fluctuation and Flicker Measurement

4.4.1 Limit for Voltage Function 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
P _{lt}	0.65, T _p =2 hr.	P _{lt} means long-term flicker
dc (%)	3.3%	dc means relative steady-state voltage change
d _{max} (%)	4%	d _{max} means maximum relative voltage change.
T _{dt}	3.3% / 500 ms	T _{dt} means maximum time that dt exceeds 3.3 %.

4.4.2 Test Instrument

Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	Harmonics & Flicker Analyser	EMC PARTNER	HAR-1000-1P	CT-1-090(1)	Oct. 19, 2023
2	Power Source	EMC PARTNER	PS3-1	CT-1-090a1	Oct. 19, 2023

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

4.4.3 Test Procedure

The table-top EUT 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 EUT was placed insulation support unit from the horizontal ground plane.

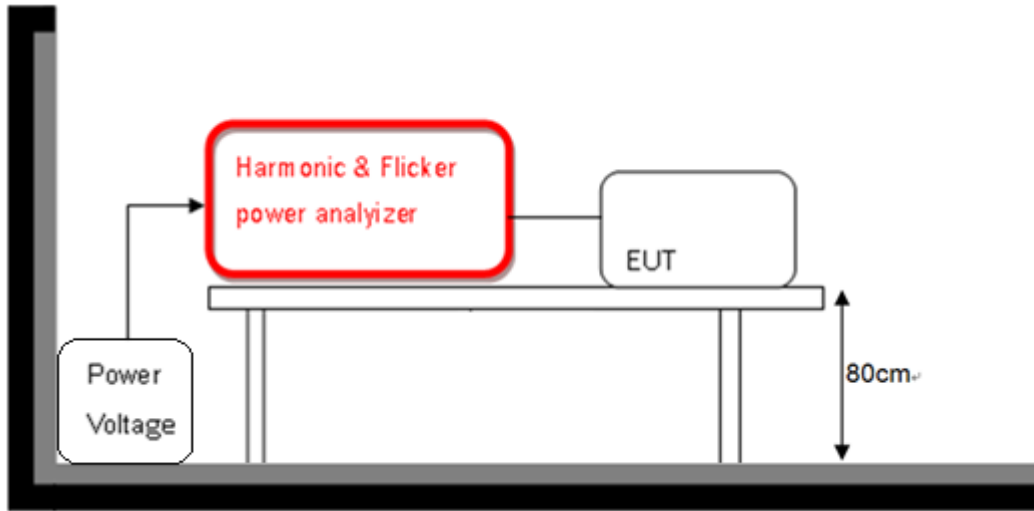
During the flick measurement, the measure time shall include that part of whole operation cycle in which the EUT produce the most unfavorable sequence of voltage changes. The observation period for short-term flicker indicator is 10 min and the observation period for long-term flicker indicator is 2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

4.4.4 Deviation from Test Standard

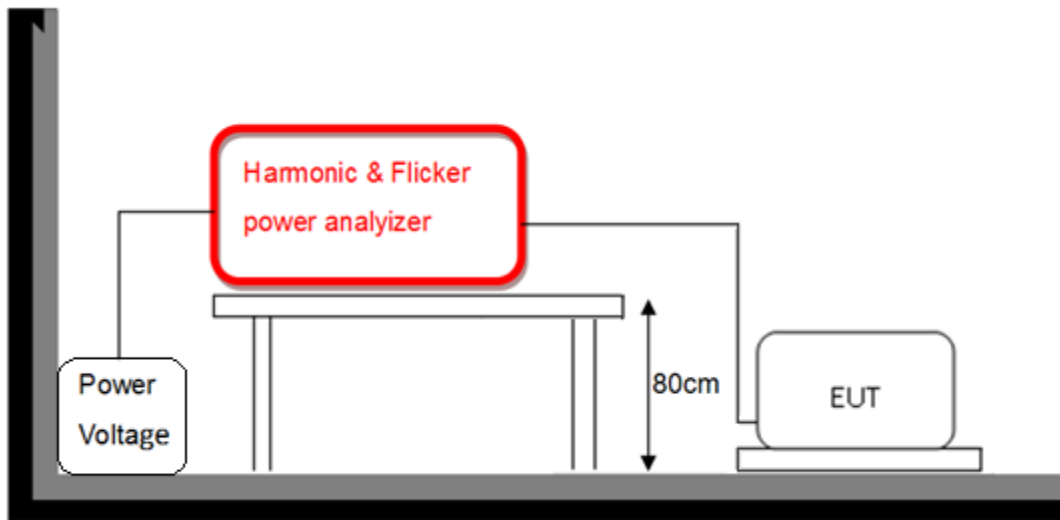
No deviation

4.4.5 Test Setup

< Table-Top equipment >



< Floor-Standing equipment >





4.4.6 Test Result

Supply Voltage / Ampere	229.5 Vrms / 0.345 Arms	Test Date	2024/03/16
Observation (Tp)	30 min	Environmental Conditions	21°C, 49% RH
Power Frequency	49.922Hz	Tested by	Guanwei Liao

Test Parameter	Measurement Value	Test Limit	Remarks
P _{st}	0.07	1.00	Pass
P _{lt}	0.07	0.65	Pass
T _{dt} (ms)	0.00	500	Pass
d _{max} (%)	0.00	4%	Pass
dc (%)	0.01	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. dc means relative steady-state voltage change.

4.4.7 Photographs of Test Configuration



5 Immunity Test

5.1 Standard Description

Product standard	EN/IEC 60945	
Basic Standard and Performance Criterion required	IEC 61000-4-2 (ESD)	±8kV Air discharge, ±6kV Contact discharge Performance Criterion B
	IEC 61000-4-3 (RS)	80 M ~ 2000 MHz, 10V/m(rms), 80% AM 400Hz, Performance Criterion A
	IEC 61000-4-4 (EFT)	AC Power Port: ±2kV Signal Ports and Control Ports: 1kV Performance Criterion B
	IEC 61000-4-5 (Surge)	AC Power Port: Line to Line: ±0.5kV, Line to Earth: ±1kV Performance Criteria B
	IEC 61000-4-6 (CS)	AC and DC Power Port, Signal and Control Ports, Common Mode: 0.15 ~ 80 MHz, 3Vrms, 80% AM 400Hz, 10V(rms), 80% AM 400Hz at specified spot frequencies Performance Criterion A
	Power supply short-term variation	±20 % voltage for 1.5s, ±10 % frequency for 5s AC Power Port Performance Criterion B
	Power supply failure	60s interruption AC and DC power ports Performance Criterion C

5.2 Performance Criteria

According to Clause 10.1 of EN/IEC 60945 standard, the general performance criteria as following:

Criteria A	The EUT shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed as defined in the relevant equipment standard and in the technical specification published by the manufacturer.
Criteria B	The EUT shall continue to operate as intended after the tests. No degradation of performance or loss of function is allowed as defined in the technical specification published by the manufacturer. During the test, degradation or loss of function or performance which is self-recoverable is, however, allowed but no change of actual operating state or stored data is allowed.
Criteria C	Temporary degradation or loss of function or performance is allowed during and after the test, provided the function is self-recoverable, or can be restored by the operation of the controls as defined in the relevant equipment standard and in the technical specification published by the manufacturer.

5.3 Electrostatic Discharge (ESD)

5.3.1 Test Specification

Standard	IEC/EN 61000-4-2
Discharge Impedance	330 ohm / 150 pF
Discharge Voltage	Air Discharge: $\pm 2, \pm 4, \pm 8$ kV (Direct) Contact Discharge: ± 6 kV (Direct/Indirect)
Number of Discharge	Air: Minimum 10 times at each polarity Contact: Minimum 10 times at each polarity
Discharge Mode	Single Discharge
Discharge Period	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	Aug. 04, 2023
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 generator necessary to perform direct and indirect application of discharge to the EUT in following methods:

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

For table-top equipment 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 areas 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 EUT, with the discharge electrode touching the coupling plane. The four faces of the EUT 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 EUT. The generator shall be positioned vertically a distance of 0.1 m from the EUT, with the discharge electrode touching the coupling plane. The four faces of the EUT will be performed with electrostatic discharge.

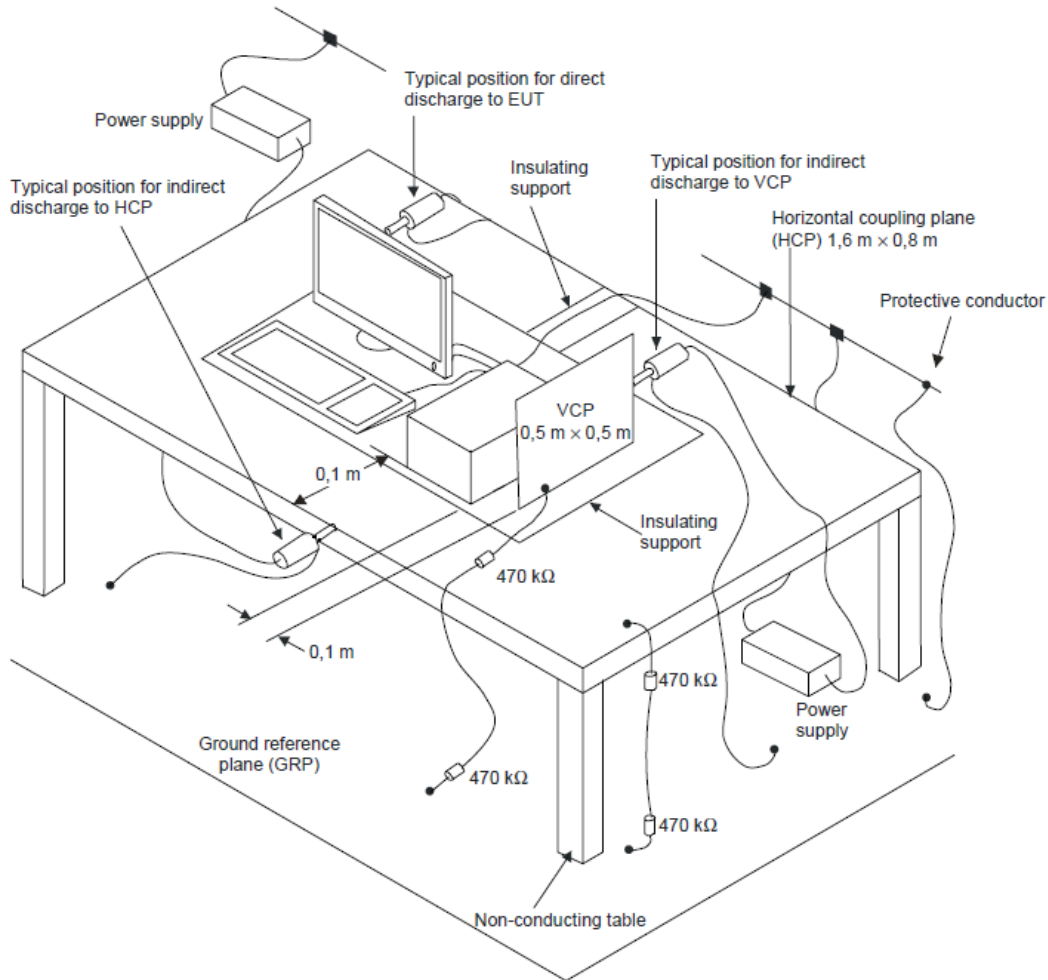
b. Air discharge at apertures and slots and insulating surface:

On those parts of the EUT 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 10 single air discharges shall be applied to the selected test point for each such area.

5.3.4 Deviation from Test Standard

No deviation

5.3.5 Test Setup





5.3.6 Test Result

Test Voltage	230Vac, 50Hz	Test Date	2024/06/20
Environmental Conditions	24°C, 54% RH	Pressure	1007 mbar
Tested by	Guanwei Liao		

Test Results of Direct Application

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

* 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
	±2	±4	±6	
Front	A	B (#1)	B (#1)	B
Back	A	A	A	A
Left	A	A	A	A
Right	A	A	A	A
Top	A	A	A	A
Bottom	A	A	A	A
Other	N/A	N/A	N/A	N/A

* 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
	±2	±4	±6	
Front	A	A	A	A
Back	A	A	A	A
Left	A	A	A	A
Right	A	A	A	A

VCP Discharge				
Test Point	Discharge Level (kV)			Result
	±2	±4	±6	
Front	A	A	A	A
Back	A	A	A	A
Left	A	A	A	A
Right	A	A	A	A

Note:

N/A: Not applicable

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

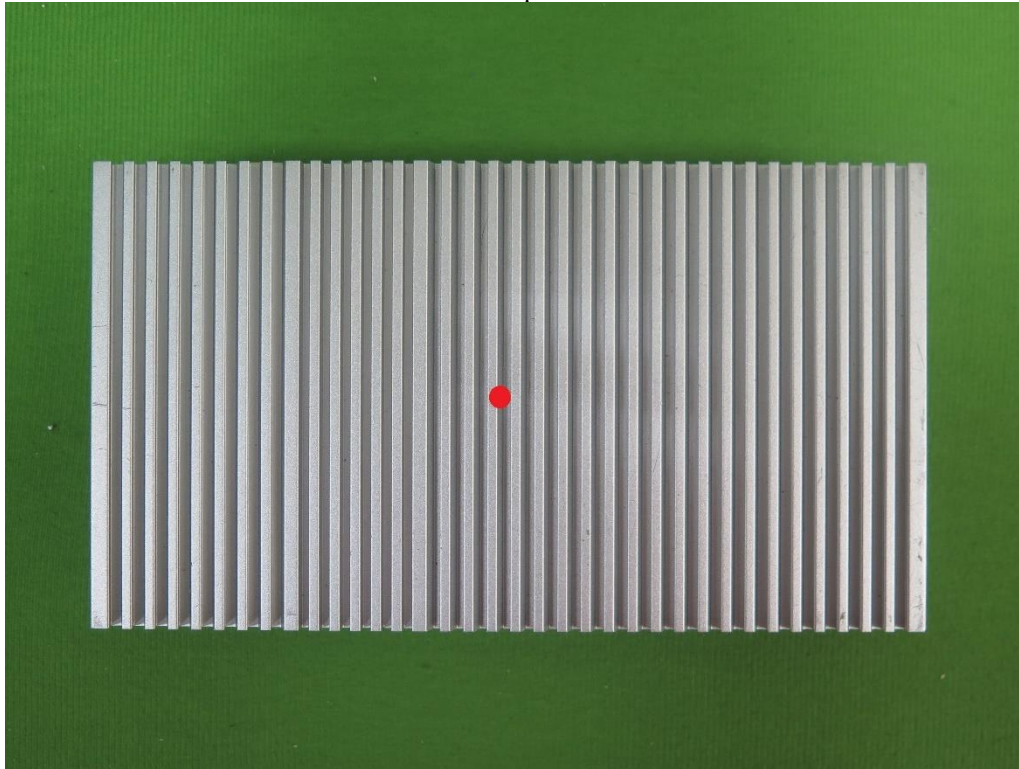


Right

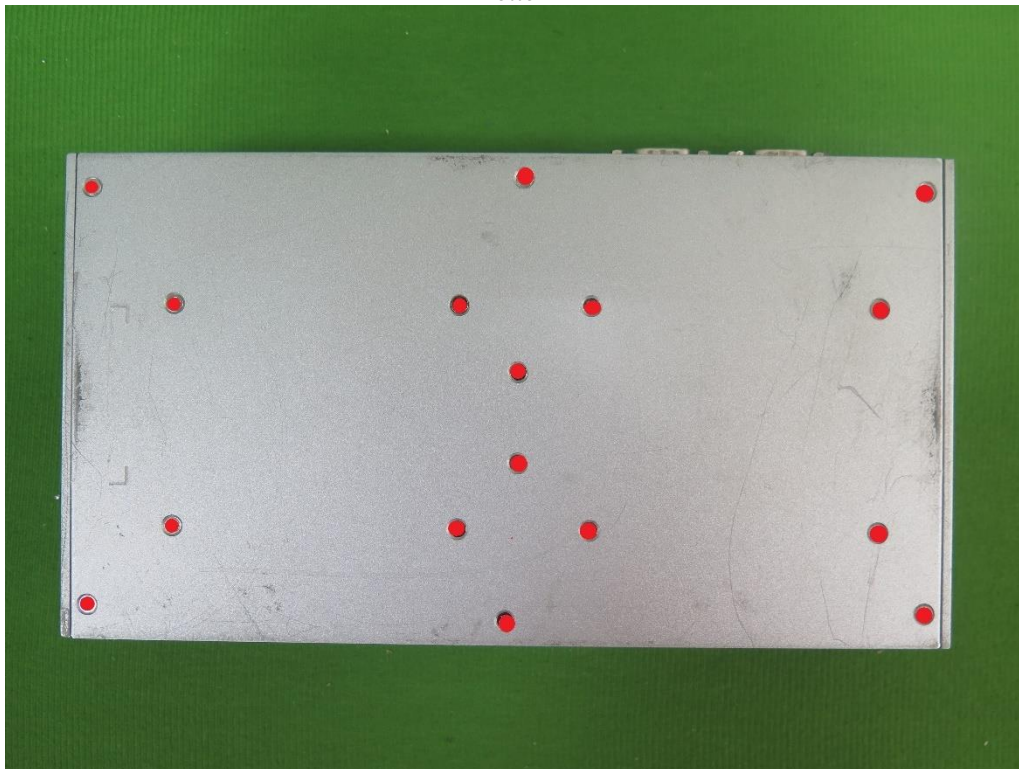


*Red Dot - Contact Discharged
Blue Dot - Air Discharged

Top

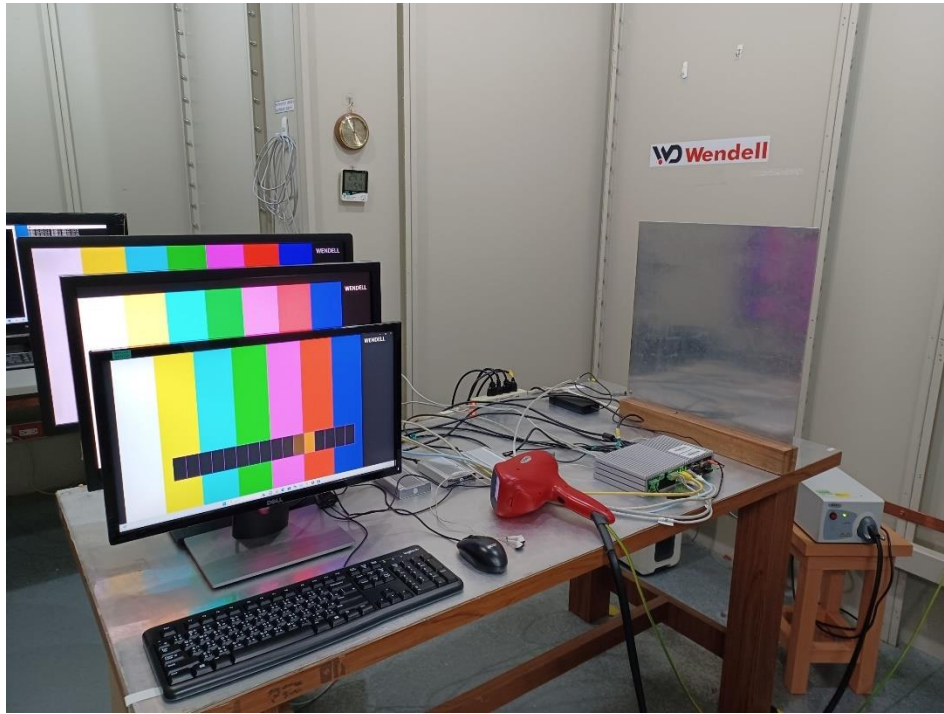


Bottom



*Red Dot - Contact Discharged
Blue Dot - Air Discharged

5.3.7 Photographs of Test Configuration



5.4 Radiated, Radio-frequency, Electromagnetic Field Immunity Test (RS)

5.4.1 Test Specification

Standard	IEC/EN 61000-4-3
Frequency Range	80 MHz - 2000 MHz
Field Strength	10 V/m
Modulation	80%, AM Modulation, 400 Hz Sine Wave
Frequency Step	1%
Polarity of Antenna	Horizontal and Vertical
Test Distance	2.15 m (80 MHz - 1000 MHz) 1 m (1 GHz - 2 GHz)
Antenna Height	1.5 m (80 MHz - 1000 MHz) 1 m (1 GHz - 2 GHz)
Dwell Time	3.0 seconds

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, 2023
3	LINEAR POWER RF AMPLIFIER	TESEQ	CBA1G-300 D	CT-1-163	Aug. 06, 2023
4	LINEAR POWER RF AMPLIFIER	OPHIR	5193	CT-1-083	Aug. 06, 2023
5	LINEAR POWER RF AMPLIFIER	FRANKONIA	FLG-30C	CT-1-061	Aug. 06, 2023
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	Electric Field Probe	FRANKONIA	EFS-10	CT-1-060a1	Sep. 29, 2023
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.

The table-top EUT and load, which are placed on a table that is 0.8 meter above ground, are placed with one coincident with the calibration plane such that the distance from antenna to the EUT was 2.15 meter at test frequency 80M - 1GHz. (The distance was 1 meter at test frequency 1G - 2GHz)

Both horizontal and vertical polarization of the antenna and four sides of the EUT are set on measurement.

The EUT shall be positioned so that the four sides of the EUT shall be exposed to the electromagnetic field in sequence. In each position the performance of the EUT will be investigated.

In the case where the most sensitive surface side of the EUT is known throughout the frequency range (for example, via preliminary tests), testing may be restricted to that surface side only. Where it is not possible to determine the most sensitive face with any certainty (for example where different faces are sensitive at different frequencies) all four faces shall be tested.

If the EUT 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 EUT can be repositioned so that the front surface remains within the UFA in order to illuminate those sections of the EUT that were previously outside the UFA.

In order to judge the EUT performance, a CCD camera is used to monitor EUT screen.

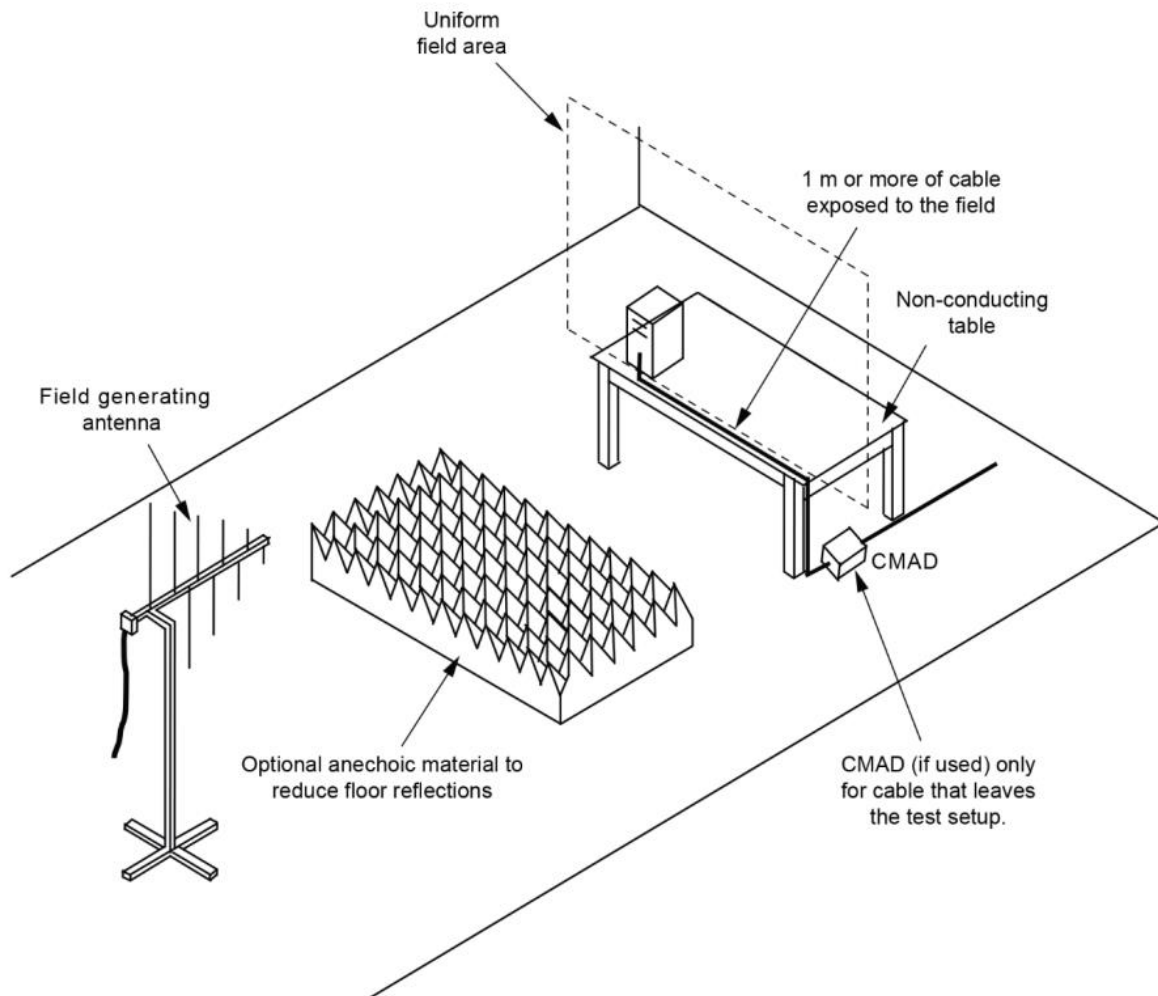
All the scanning conditions are as follows:

	Condition of Test	Remarks
1	Field Strength	10 V/m
2	Radiated Signal	AM 80% Modulated with 400Hz
3	Scanning Frequency	80 M- 2000 MHz
4	Dwell Time	3.0 Seconds
5	Frequency Step Size Δf	1%

5.4.4 Deviation from Test Standard

No deviation

5.4.5 Test Setup





5.4.6 Test Result

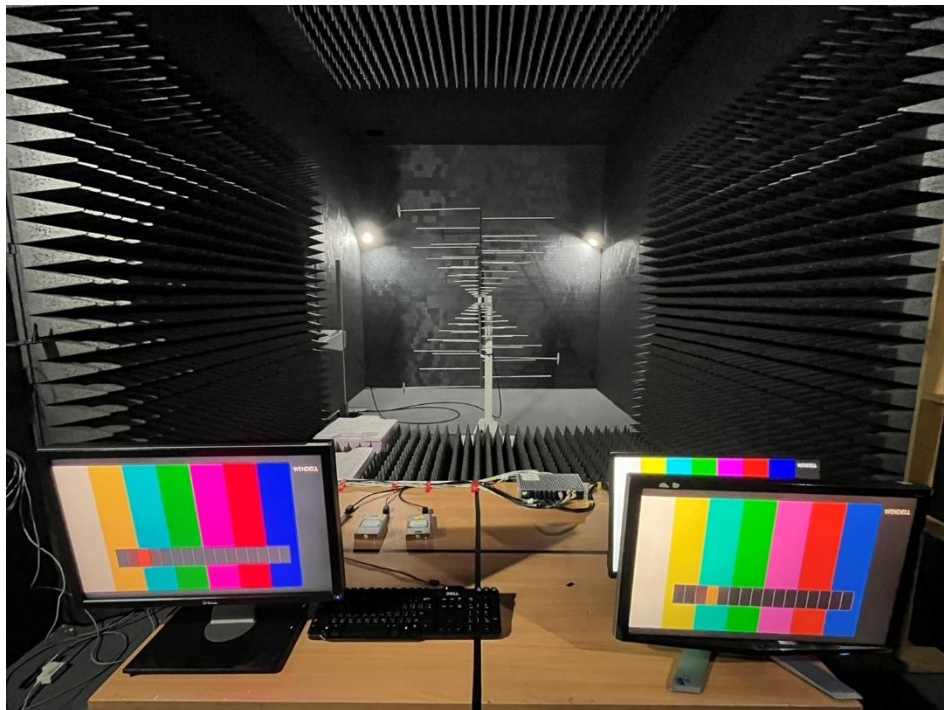
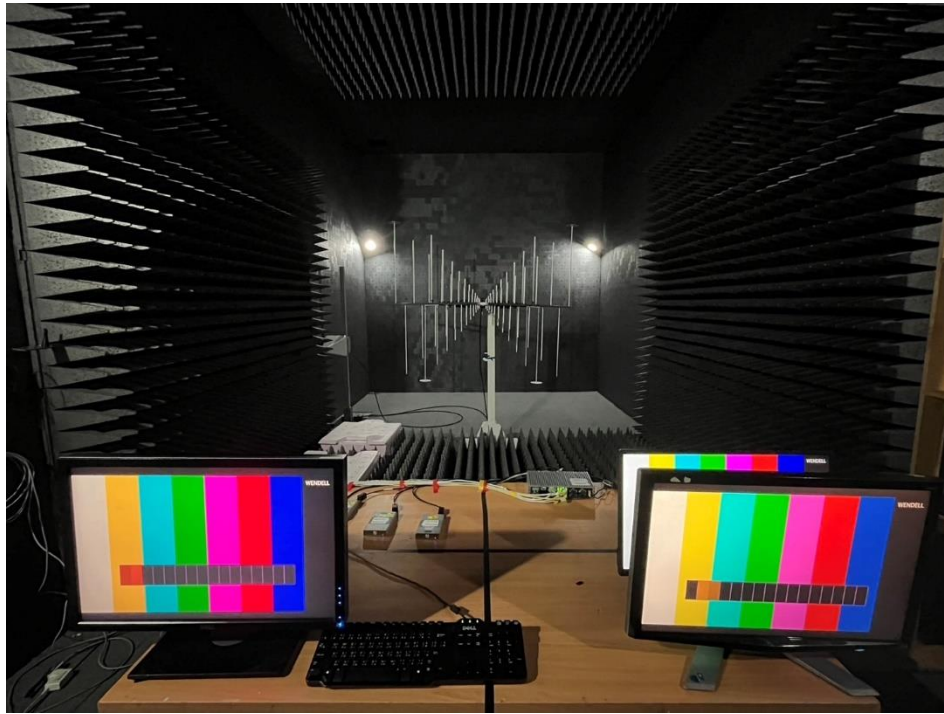
Test Voltage	230Vac, 50Hz	Environmental Conditions	22°C, 51% RH
Tested by	Eric Hsieh	Test Date	2024/06/12

Frequency Range (MHz)	Azimuth	Polarity	Field Strength (V/m)	Modulation	Result
80-1000	0, 90, 180, 270	H/V	10	80% AM 400Hz	A
1000-2000	0, 90, 180, 270	H/V	10	80% AM 400Hz	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 (EFT)

5.5.1 Test Specification

Standard	IEC/EN 61000-4-4
Test Voltage	AC Power Port: ± 2 kV Signal Port and Control Port: ± 1 kV
Polarity	Positive & Negative
Impulse Frequency	AC Power Port: 2.5 kHz Signal Ports and Control Ports: 5kHz
Impulse Wave	5/50 ns
Burst Duration	15 ms & 30ms
Burst Period	300 ms
Test Duration	3 min to 5 min for each of positive and negative polarity pulses

5.5.2 Test Instrument

Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	EFT Generator	3ctest	EFT500S	CT-1-165	Sep. 20, 2023
2	Clamp	3ctest	CCC100	CT-1-166	Sep. 20, 2023

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

5.5.3 Test Procedure

The EUT is placed on a table that is 0.8 meter height. A ground reference plane is placed on the table, and uses a 0.1m insulation between the EUT and ground reference plane.

The minimum area of the ground reference plane is 1m*1m, and 0.65mm thick min, and projected beyond the EUT by at least 0.1m on all sides.

For input power ports:

The EUT 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 3 ~ 5 minute. The length of the power lines between the coupling device and the EUT is 0.5m.

5.5.4 Deviation from Test Standard

No deviation



5.5.6 Test Result

Test Voltage	230Vac, 50Hz	Environmental Conditions	22°C, 49% RH
Tested by	Guanwei Liao	Test Date	2024/04/18

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 Port & Control Port	RJ45	1	+/-	A
	PoE	1	+/-	A

Note:

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

5.5.7 Photographs of Test Configuration

Power



Signal



PoE



5.6 Surge Immunity Test

5.6.1 Test Specification

Standard	IEC/EN 61000-4-5
Wave- Shape	Input AC Power Port: 1.2/50 μ s Open Circuit Voltage 8 /20 μ s Short Circuit Current
Test Voltage	Line to line: \pm 0.5kV, Line to earth or ground: \pm 1kV
Surge Input / Output	L1-L2, L1-PE, L2-PE
Polarity	Positive/Negative
Phase Angle	0°/90°/180°/270° (For AC Power Port)
Pulse Repetition Rate	1 time / min. (maximum)
Times	5 positive and 5 negative at selected points

5.6.2 Test Instrument

Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	Surge Generator	HAEFELY	AXOS8	CT-1-059(1)	Aug. 07, 2023
2	Surge CDN	3cTest	CDN-405T8A1	CT-1-074(5)	May 27, 2024

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

5.6.3 Test Procedure

The EUT is placed on a table that is 0.8 meter above a metal ground plane measured 1m*1m minimum and 0.65mm thick minimum and projected beyond the EUT by at least 0.1m on all sides. The length of power cord between the coupling device and the EUT shall be 2m or less.

For input power ports:

The EUT is connected to the power ports through a coupling device that directly couples the surge interference signal.

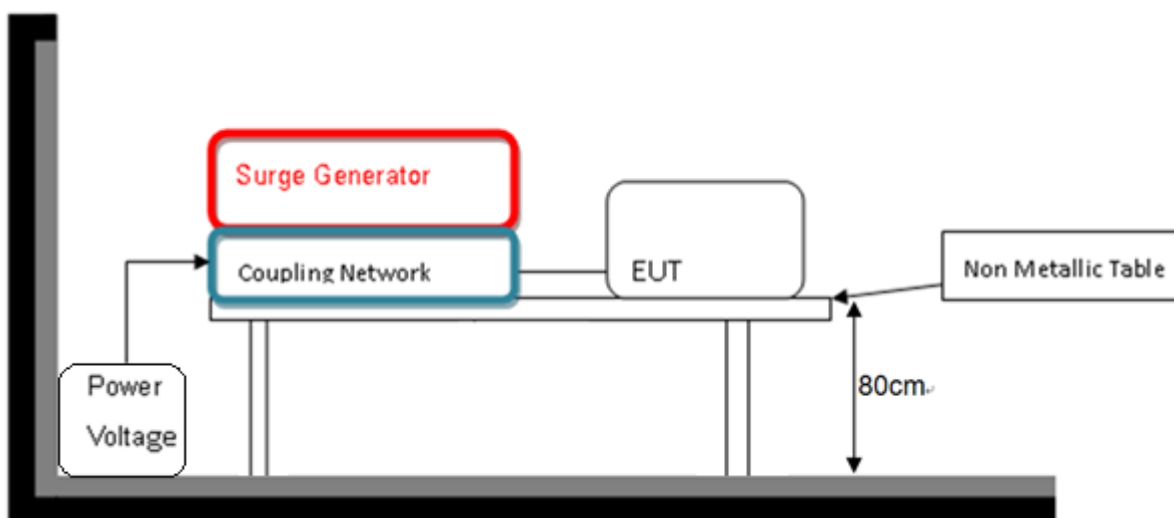
The surge noise shall be applied synchronized to the peak value of the voltage wave. (Positive and negative)

Each of Line to Earth and Line to Line is impressed with a sequence of five surge voltages with interval of 1 minute.

5.6.4 Deviation from Test Standard

No deviation

5.6.5 Test Setup





5.6.6 Test Result

Test Voltage	230Vac, 50Hz	Environmental Conditions	21°C, 49% RH
Tested by	Guanwei Liao	Test Date	2024/06/20

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

Note:

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

5.6.7 Photographs of Test Configuration



5.7 Continuous Conducted Disturbances (CS)

5.7.1 Test Specification

Standard	IEC/EN 61000-4-6
Frequency Range	0.15 MHz - 80 MHz
Voltage Level	3 V(rms) 10 V(rms) at specified spot frequencies as below: 2 MHz, 3 MHz, 4 MHz, 6.2 MHz, 8.2 MHz, 12.6 MHz, 16.5 MHz, 18.8 MHz, 22 MHz and 25 MHz.
Modulation	AM Modulation, 80%, 400 Hz Sine Wave
Frequency Step	1% of fundamental
Dwell Time	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-1-065-1	May 30, 2024
7	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 EUT is placed on 0.1m insulation table between the EUT and ground reference plane.

For input power ports:

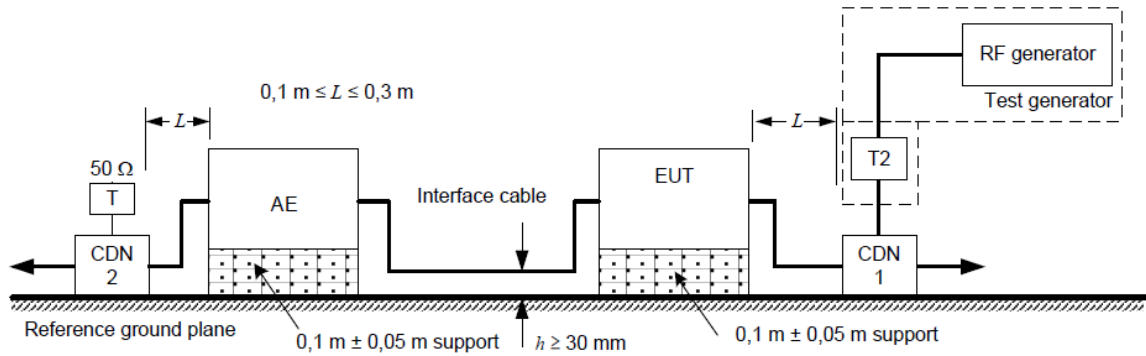
The EUT is connected to the power ports through a coupling and decoupling networks for power supply lines. And directly couples the disturbances signal into EUT.

Auxiliary equipment (AE) required for the defined operation of the EUT according to the specifications of the product committee.

5.7.4 Deviation from Test Standard

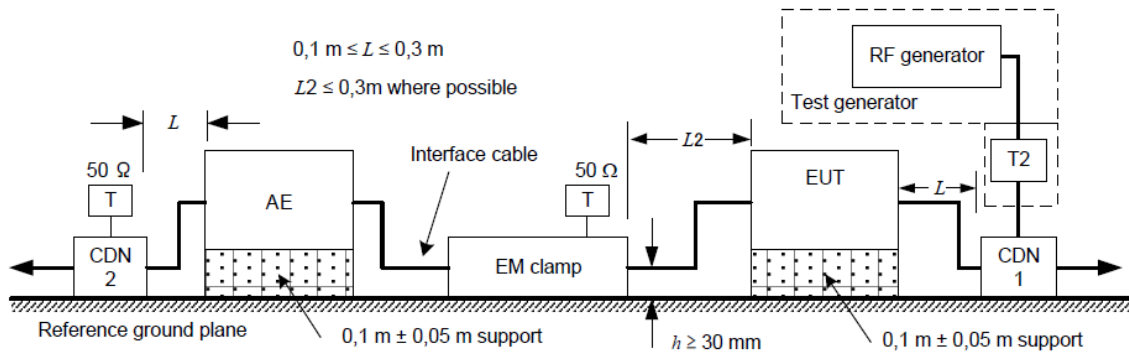
No deviation

5.7.5 Test Setup



The interface cable is set at 1 m if possible.

a) Schematic setup for a 2-port EUT connected to only 1 CDN



Note:

T: Termination 50 Ω

T2: Power attenuator (6 dB)

CDN: Coupling and decoupling network

Injection clamp: current clamp or EM clamp



5.7.6 Test Result

Test Voltage	230Vac, 50Hz	Environmental Conditions	25°C, 50% RH
Tested by	Dennis Chen	Test Date	2024/06/19

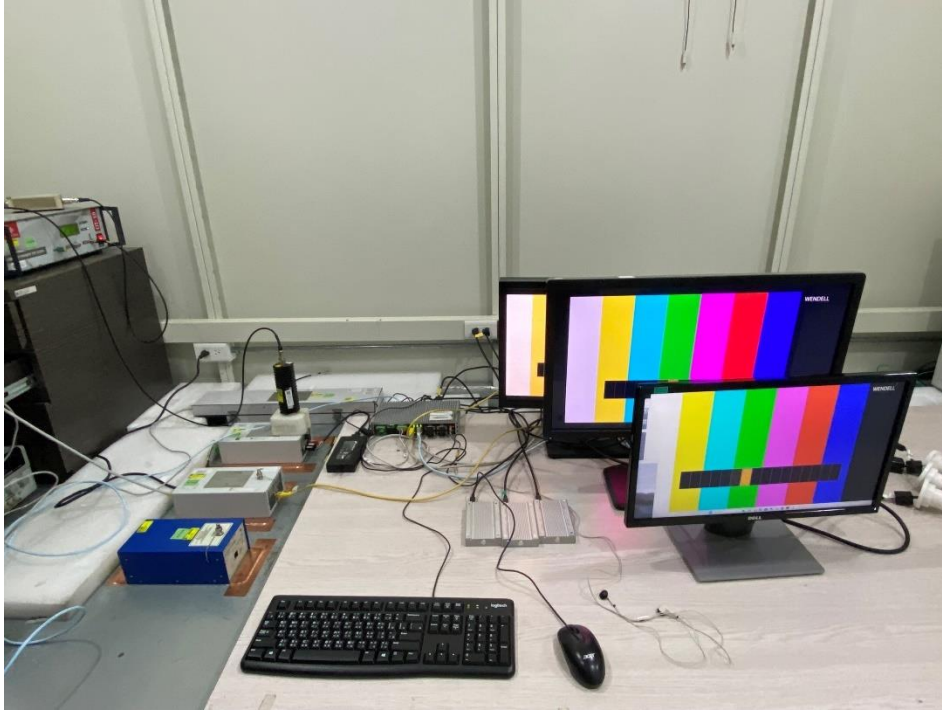
Frequency Range (MHz)	Tested Port	Injection Method	Test Level (V _{r.m.s.})	Modulation	Result
0.15 - 80	AC Power	CDN-M2 +M3(M3)	3	80% AM 400Hz	A
0.15 - 80	RJ45	CLAMP	3	80% AM 400Hz	A
0.15 - 80	PoE	CDN RJ45S	3	80% AM 400Hz	A
2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22, 25	AC Power	CDN-M2 +M3(M3)	10	80% AM 400Hz	A
2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22, 25	RJ45	CLAMP	10	80% AM 400Hz	A
2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22, 25	PoE	CDN RJ45S	10	80% AM 400Hz	A

Note:

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

5.7.7 Photographs of Test Configuration

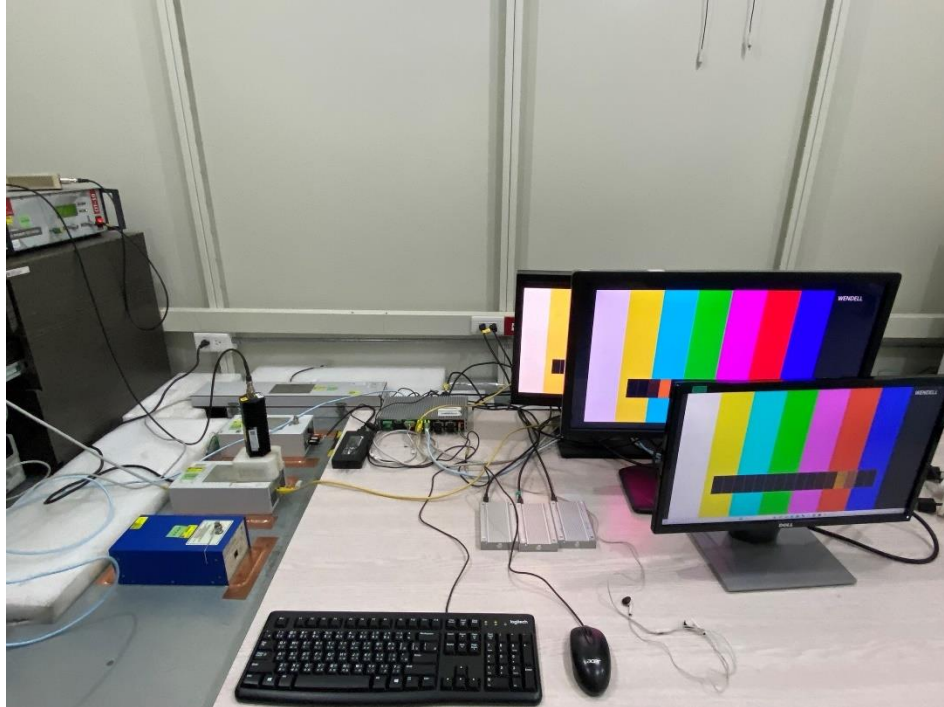
Power



Signal



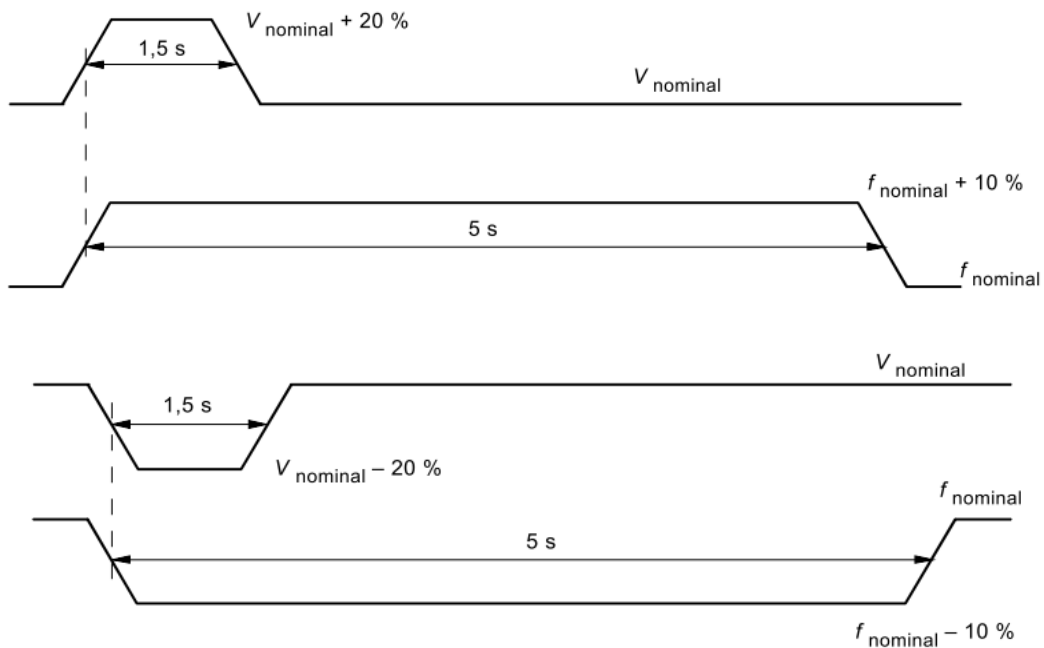
PoE



5.8 Power Supply Short-Term Variation

5.8.1 Test Specification

Basic Standard	Power Supply Short-Term Variation
Test Level	$\pm 20\%$ voltage for 1.5 s, $\pm 10\%$ frequency for 5 s



5.8.2 Test Instrument

Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	AC Power Source	Chroma	61503	CT-1-016	Sep. 06, 2023

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

5.8.3 Test Procedure

The EUT and support units were placed on 0.8 meter height wooden table away from ground floor.

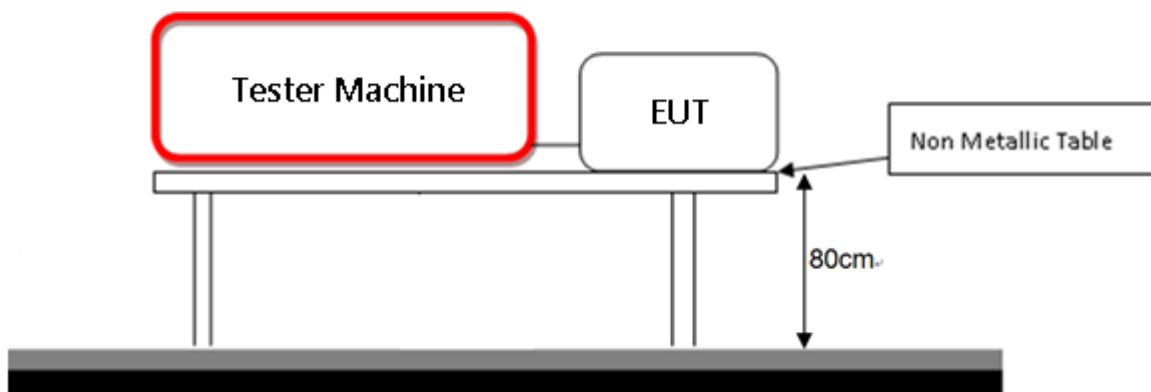
Set the parameter of test and then performed the test.

Recorded result during test procedure.

5.8.4 Deviation from Test Standard

No deviation

5.8.5 Test Setup





5.8.6 Test Result

Test Voltage	230Vac, 50Hz	Environmental Conditions	25°C, 50% RH
Tested by	Andy Li	Test Date	2024/06/21

AC Power Port		
Supply Voltage	Frequency	Result
$V_{\text{nominal}} + 20\%$	$f_{\text{nominal}} + 10\%$	A
$V_{\text{nominal}} - 20\%$	$f_{\text{nominal}} - 10\%$	A

Note:

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

5.8.7 Photographs of Test Configuration



5.9 Power Supply Failure

5.9.1 Test Specification

Basic Standard	Power Supply Failure
Test Level	60 s interruption
Test Times	3 breaks

5.9.2 Test Instrument

Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	Power Source	Chroma	61503	CT-1-016	Sep. 06, 2023

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

5.9.3 Test Procedure

The EUT and support units were placed on 0.8 meter height wooden table away from ground floor.

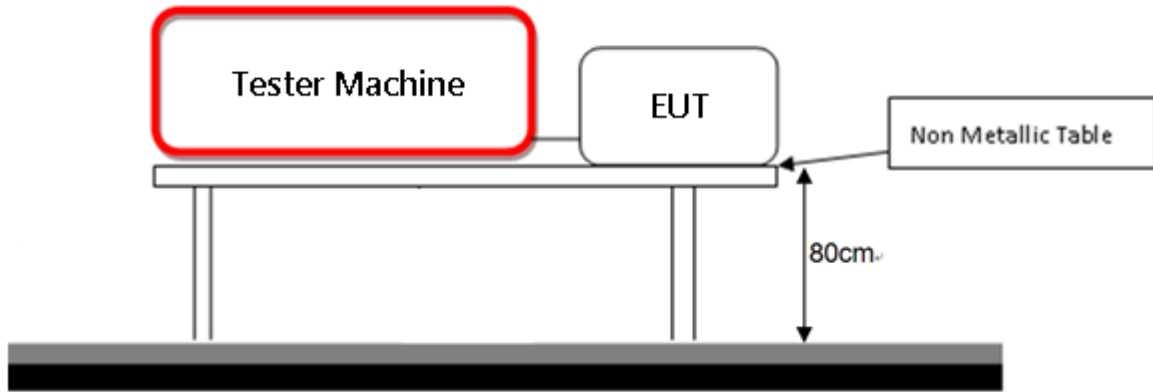
Set the parameter of test and then performed the test.

Recorded result during test procedure.

5.9.4 Deviation from Test Standard

No deviation

5.9.5 Test Setup





5.9.6 Test Result

Test Voltage	230Vac, 50Hz	Environmental Conditions	25°C, 50% RH
Tested by	Andy Li	Test Date	2024/06/21

AC Power Port		
Test Item	Times	Result
60 s interruption	3 breaks	C (#1)

Note:

Criteria C: (#1) The EUT was shut down during the test, and must be recovered manually.

5.9.7 Photographs of Test Configuration



< End Page >