TEST REPORT

KCTL Inc. 28, Mosan-gil, Jeongnam-myeon, Hwasung-si, Gyeonggi-do, 18516, Korea TEL: 82 31 286 5881 FAX: 82 31 8059 1154 www.kctl.co.kr	Report No.: KR21-HEC0029 Page (1) of (60)	KCTL

1. Client

- Name : Maltani Corp.
- Address : 80, Eumbongmyeon-ro, Eumbong-myeon, Asan-si, Chungcheongnam-do, 31433 Korea, Republic of
- Date of Receipt : 2021-03-11

2. Use of Report : -

3. Name of Product / Model : CLEAN EDGE 1200 / S-RLP3040-50-C001

4. Manufacturer / Country of Origin : Maltani Corp. / Korea

5. Date of Test : 2021-04-01 - 2021-04-07

6. Location of Test : ■ Permanent Testing Lab □ On Site Testing
(Address: 28 Mosan-gil, Jeongnam-myeon, Hwaseong-si, Gyeonggi-do 18516 Republic of Korea)

7. Test method used : EN 55015:2013 +A1:2015
EN 61547:2009
EN IEC 61000-3-2:2019
IEC 61000-3-2:2018
EN 61000-3-3:2013/A1:2019
IEC 61000-3-3:2013 /A1:2017

8. Test Result : Refer to the test result in the test report

Affirmation	Tested by	Technical Manager
	Name : Jeongwon Kim (Signature)	Name : Byungyeon Kim (Signature)

2021-04-07

KCTL Inc.

REPORT REVISION HISTORY

Date	Revision	Page No
2021-04-07	Originally issued	-

General remarks for test reports

Statement concerning the uncertainty of the measurement systems used for the tests

(may be required by the product standard or client)

☐ **Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:**

Procedure number, issue date and title:

Calculations leading to the reported values are on file with the testing laboratory that conducted the testing.

☒ **Statement not required by the standard or client used for type testing**

The measurement uncertainty was not considered in accordance request of the client.

Contents

1. Applicant information

Applicant:	Maltani Corp.
Address:	80, Eumbongmyeon-ro, Eumbong-myeon, Asan-si, Chungcheongnam-do, 31433 Korea, Republic of
Telephone:	+82-41-534-2151
Fax:	+82-41-534-5822
E-mail:	76lmh@hanmail.net
Contact name:	Moonhee Lee
Manufacturer:	Maltani Corp.
Address:	80, Eumbongmyeon-ro, Eumbong-myeon, Asan-si, Chungcheongnam-do, 31433 Korea, Republic of
Telephone:	+82-41-534-2151
Fax:	+82-41-534-5822
E-mail:	76lmh@hanmail.net
Contact name:	Moonhee Lee

2. Laboratory information

Address

KCTL Inc. Hwasung Lab.

28, Mosan-gil, Jeongnam-myeon, Hwasung-si, Gyeonggi-do, 18516, Korea

Telephone Number: 82 31 286 5881

Facsimile Number: 82 31 8059 1154

FCC Site Designation No: KR0040

KOLAS NO.: KT231

VCCI NO.: 1980

SITE MAP

3. Test system configuration

3.1 Operation environment

	Temperature	Humidity	Pressure
Shielded room(CE)	21.8 °C	40.5 % R.H.	-
Shielded room(RE)	19.2 °C	40.3 % R.H.	-
Chamber 10 m(RE)	21.5 °C	41.1 % R.H.	-
Shielded room(Harmonics)	21.8 °C	40.5 % R.H.	100.8 kPa
Shielded room(flickers)	21.8 °C	40.5 % R.H.	100.8 kPa
Shielded room(ESD)	22.3 °C	42.5 % R.H.	101.1 kPa
Chamber 3 m(RS)	21.1 °C	42.7 % R.H.	100.9 kPa
Shielded room(EFT / BURST)	21.8 °C	41.6 % R.H.	101.1 kPa
Shielded room(SURGE)	21.8 °C	41.6 % R.H.	101.1 kPa
Shielded room(CS)	21.8 °C	41.6 % R.H.	101.1 kPa
Shielded room(DIP)	21.8 °C	41.6 % R.H.	101.1 kPa

Test site

These testing items were performed following locations;

Test item	Test site
Disturbance Voltages	Shielded Room
Radiated Electromagnetic disturbance	Shielded Room
Radiated Emission	Chamber 10 m
Harmonics current, Voltage fluctuations and flickers	Shielded Room
Electrostatic discharge	Shielded Room
Radiated RF immunity	Chamber 3 m
Electric Fast Transient/BURST	Shielded Room
Surge	Shielded Room
Conducted RF immunity	Shielded Room
Voltage dip/interruption	Shielded Room

3.2 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC.
The factors contributing to uncertainties are test receiver, cable loss, antenna factor calibration, Antenna directivity, antenna factor variation with height, antenna phase center variation, antenna frequency interpolation, measurement distance variation, site imperfection, mismatch, and system repeatability. Based on CISPR 16-4-2, the measurement uncertainty level with a 95% confidence level was applied.

Conducted Emission measurement_AMN (Confidence level about 95 %, k = 2)		
Shielded Room	9 kHz ~ 150 kHz : 2.0 dB	
	150 kHz ~ 30 MHz : 2.5 dB	
Radiated Emission measurement (Confidence level about 95 %, k = 2)		
10 m Chamber	30 MHz ~ 1 000 MHz	3 m : 4.9 dB
		10 m : 4.9 dB

3.3 Measurement Program

These test items were performed by software programs;

Test item	Measurement Program	Used
Disturbance Voltages	TEPTO-DV/AM V 4.1.0083 (tsj corporation)	☒
Radiated Electromagnetic disturbance	TEPTO-DV/AM V 4.1.0083 (tsj corporation)	☒
Radiated Emission	TEPTO-DV/RE V 3.1.0047 (tsj corporation)	☒
Radiated RF Immunity	TDK Conducted Immunity Lab _Ver. 11.25 (TDK)	☒
Conducted RF Immunity	TDK Conducted Immunity Lab _Ver. 10.98.0.1 (TDK)	☒
Harmonics and Flicker	NET.CONTROL Ver.3.0.5 (EM TEST)	☒
Electric Fast Transient/Burst Surge Transient/DIP	TEMA 3000 Ver 4.2.1 (EMC PARTNER)	☒

4. Description of EUT

4.1 General information

Specifications	
Product	CLEAN EDGE 1200
Model	S-RLP3040-50-C001
Installation	M-BAR
Power	30 W + 40 W (2ch or 1ch) / General
Luminous Flux (lm)	5,880
CCT (K)	5,000
CRI (Ra)	≥ 80
Size (mm)	L1,280 x W320 x H27
Weight (kg)	4.5
Input Voltage (VAC/Hz)	AC 200-250 50/60

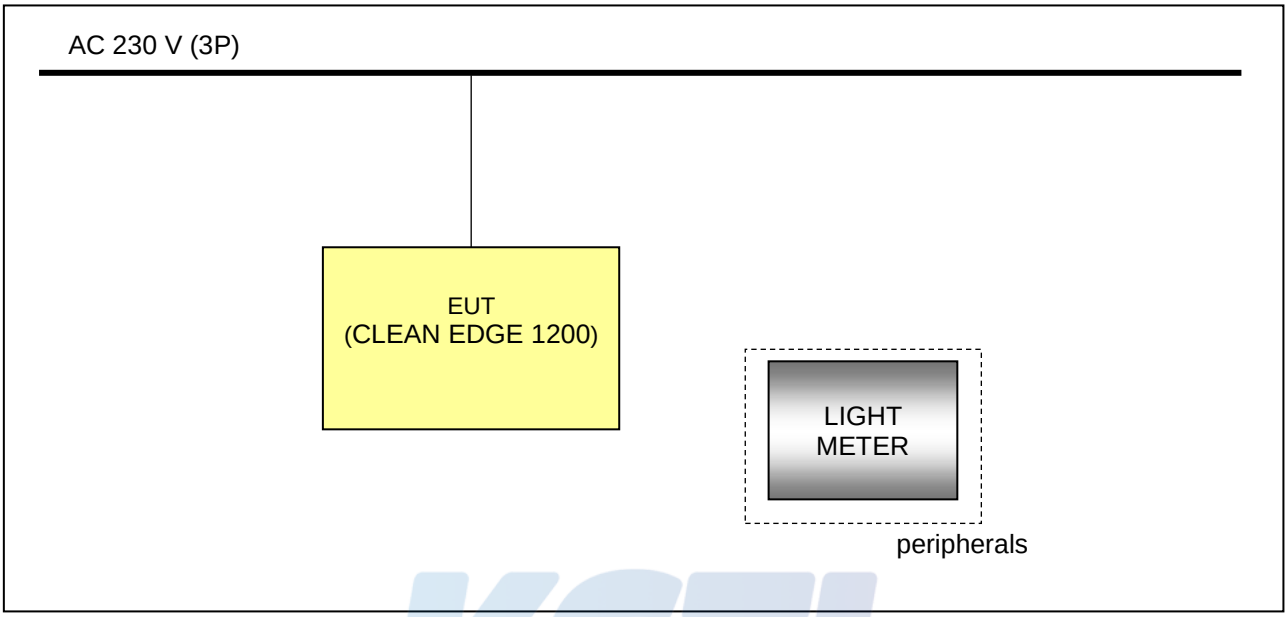
4.2 Product description

Type of product	CLEAN EDGE 1200
Model name (Basic)	S-RLP3040-50-C001
Model name (Variant)	S-RLP3040-40-C001, S-RLP3040-30-C001
Difference	The difference is CCT. S-RLP3040-40-C001 : 4 000 K S-RLP3040-30-C001 : 3 000 K
Serial no	-
Testing voltage	AC 230 V, 50 Hz
Input rating	AC (200-250) V, (50/60) Hz

4.3 Auxiliary equipments

Type	Model / Part #	S/N	Manufacturer
LIGHT METER	TES 1332	-	TES

4.4 Test configuration



	Start		End		Cable	
	Name	I/O port	Name	I/O port	Length (m)	Spec.
-	-	-	-	-	-	-

4.5 Operating conditions

The EUT was configured as normal intended use.

Test mode	Normal operating
1	After powering on the EUT, it was tested while monitoring the LUX value of the EUT using LIGHT METER.

5. Summary of test results

5.1 Summary of EMI emission test results

Applied	Test items	Test method	Result
☒	Disturbance Voltages	EN 55015:2013 +A1:2015	Pass
☒	Radiated Electromagnetic disturbance	EN 55015:2013 +A1:2015	Pass
☒	Harmonics Current Emissions	EN IEC 61000-3-2:2019	Pass
☒	Voltage Fluctuations and Flickers	EN 61000-3-3:2013 +A1:2019	Pass

5.2 Summary of immunity test results

Applied	Test items	Test method	Result
EN 61547:2009			
☒	Electrostatic Discharge	EN 61000-4-2:2009	Pass
☒	Radiated Susceptibility	EN 61000-4-3:2006 +A2:2010	Pass
☒	Electric Fast Transient/Burst	EN 61000-4-4:2012	Pass
☒	Surge Transient	EN 61000-4-5:2014 +A1:2017	Pass
☒	Conducted Susceptibility	EN 61000-4-6:2014	Pass
☒	Voltage Dips and Interruptions	EN 61000-4-11:2004 +A1:2017	Pass

This product complies with the requirements of the EMC Directive 2014/30/EU

5.3 Performance criteria

Performance criterion A:

During the test no change of the luminous intensity shall be
observed and the regulating control, if any, shall operate during the test as intended.
(The luminous intensity shall be deemed to be unchanged if the measured intensities do not deviate by more than 15 %.)

Performance criterion B:

During the test the luminous may change the any value.
After the test the luminous intensity shall be restored to its initial value within 1 min. Regulating controls needs not function during the test, but after the test the mode of the control shall be the same as before the test provided that during the test no mode changing commands were given.

Performance criterion C:

During and after the test change of the luminous intensity is allowed and the lamp(s) may be extinguished. After the test, within 30min, all functions shall return to normal if necessary by temporary interruption of the mains supply and/or operating the regulating control. Additional requirement for lighting equipment incorporating a starting device: After the test the lighting equipment is switch off. After half an hour it is switched on again. The lighting equipment shall start and operate as intended.

6. Test results

6.1 Disturbance Voltages

Testing voltage	AC 230 V, 50 Hz		
Test facility	Shielded room		
Date	2021-04-01		
Temperature (°C)	21.8 °C	Humidity (% R.H.)	40.5 % R.H.
Remarks	Pass		

6.1.1 Limits of disturbance voltages measurement

☒ Mains terminals

Frequency	Limits dB(μV)[a]	
	Quasi-peak	Average
9 kHz ~ 50 kHz	110	-
50 kHz ~ 150 kHz	90 ~ 80 [b]	-
150 kHz ~ 0.5 MHz	66 ~ 56 [b]	56 ~ 46 [b]
0.5 MHz ~ 5 MHz	56 [c]	46 [c]
5 MHz ~ 30 MHz	60	50

[a] At the transition frequency, the lower limit applies.

[b] The limit decreases linearly with the logarithm of the frequency in the ranges 50 kHz - 150 kHz and 150 kHz - 0.5 MHz

[c] For electrode less lamps and luminaries, the limit in the frequency range of 2.51 MHz - 3.0 MHz is 73 dB(μV) quasi-peak and 63 dB(μV) average

☐ Load terminals

Frequency [MHz]	Limits dB(μV)[a]	
	Quasi-peak	Average
0.15 ~ 0.5	80	70
0.5 ~ 30	74	64

[a] At the transition frequency, the lower limit applies.

☐ Control terminals

Frequency [MHz]	Limits dB(㎶)	
	Quasi-peak	Average
0.15 ~ 0.50	84 ~ 74	74 ~ 64
0.5 ~ 30	74	64

Note #1 The limits decrease linearly with the logarithm of the frequency in the range 0.15 ㎒ to 0.5 ㎒

Note #2 The voltage disturbance limits are derived for use with an impedance stabilization network (ISN) which Presents a common mode(asymmetric mode) impedance of 15Ω to the control terminal .

6.1.2 Measurement procedure

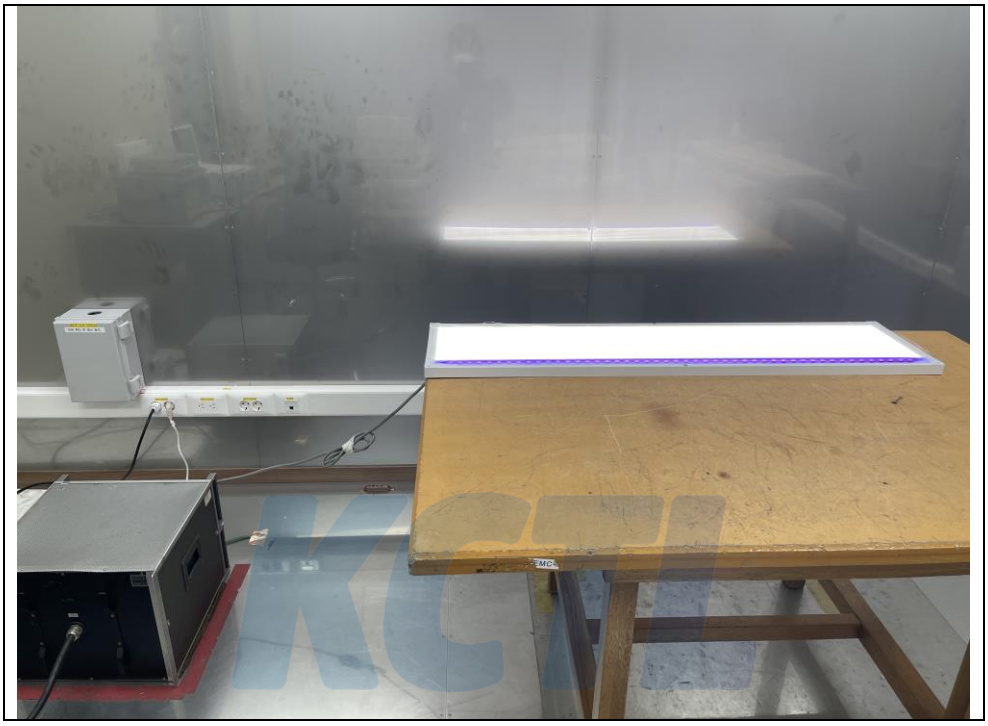
The measurements were performed in a shielded room. EUT was setup as shown in photograph and placed on a non-metallic table height of 0.8 ㎝ above the reference ground plane. The rear of table was located 0.4 ㎝ to the vertical conducted plane. EUT was power through the LISN, which was bonded to the ground plane. The LISN power was filtered. Each EUT power lead, except ground (safety) lead was individually connected through a LISN to input power source. EUT signal cables that hung closer than 0.4 ㎝ to the Horizontal metal ground 0.3 ㎝ ~ 0.4 ㎝ long. The power cord was bundles in the center. All peripheral equipment was powered from a sub LISN. The LISN and ISN were positioned 0.8 ㎝ from the EUT. Peak and Average detection were used in preliminary testing and Quasi-peak and Average detections were used at final measurement.

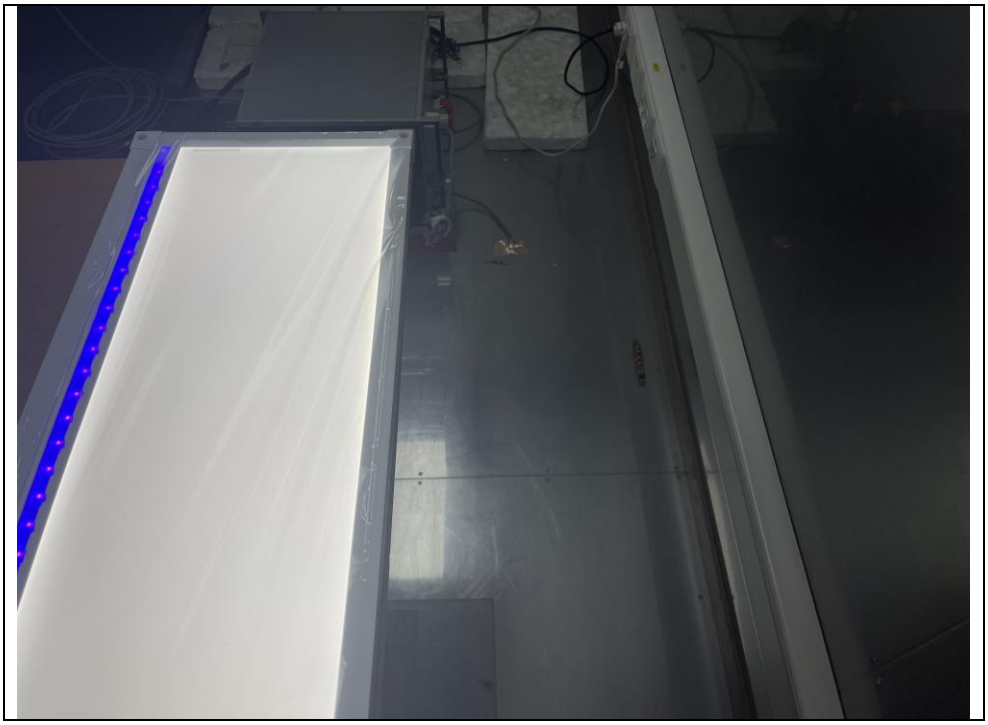
6.1.3 Used equipments

Equipment	Model	Serial No.	Makers	Next Cal. Date	Used
Test Receiver	ESCI	100561	Rohde & Schwarz	2021-09-18	☒
Artifical Mains Network	NSLK8128	8128144	Schwarzbeck	2021-06-19	☒
LOCAL SWITCH MODULE	ESLSM9K200M	1810001	EMC SOLUTIONS	2021-09-17	☒

6.1.4 Photographs of test setup

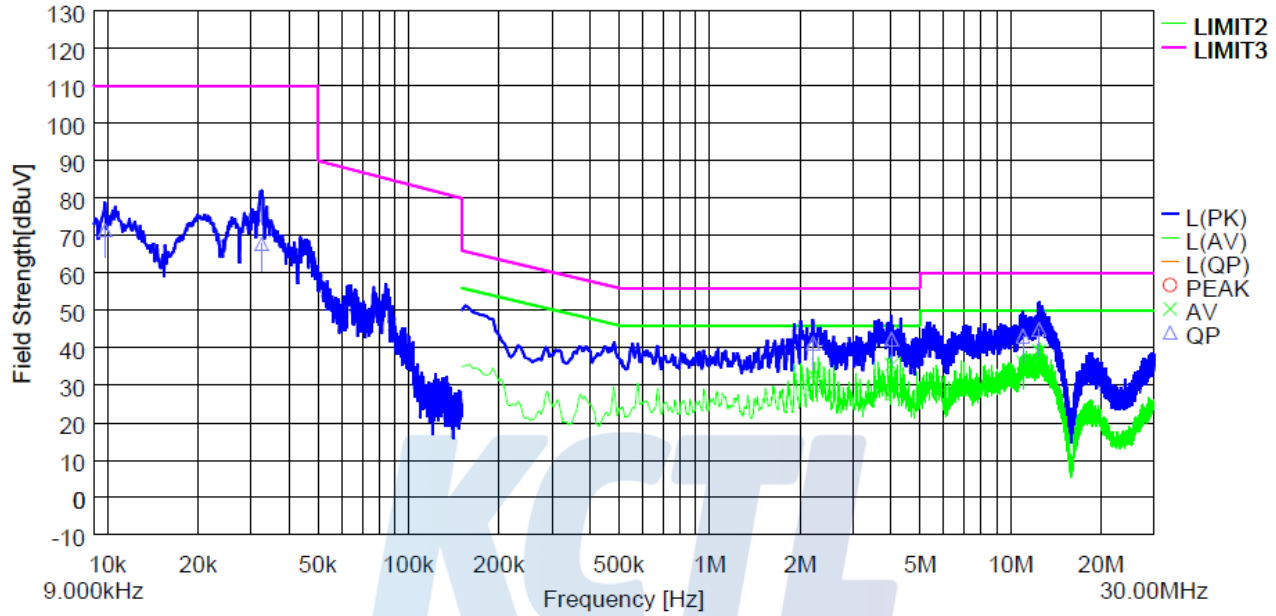
Mains terminals





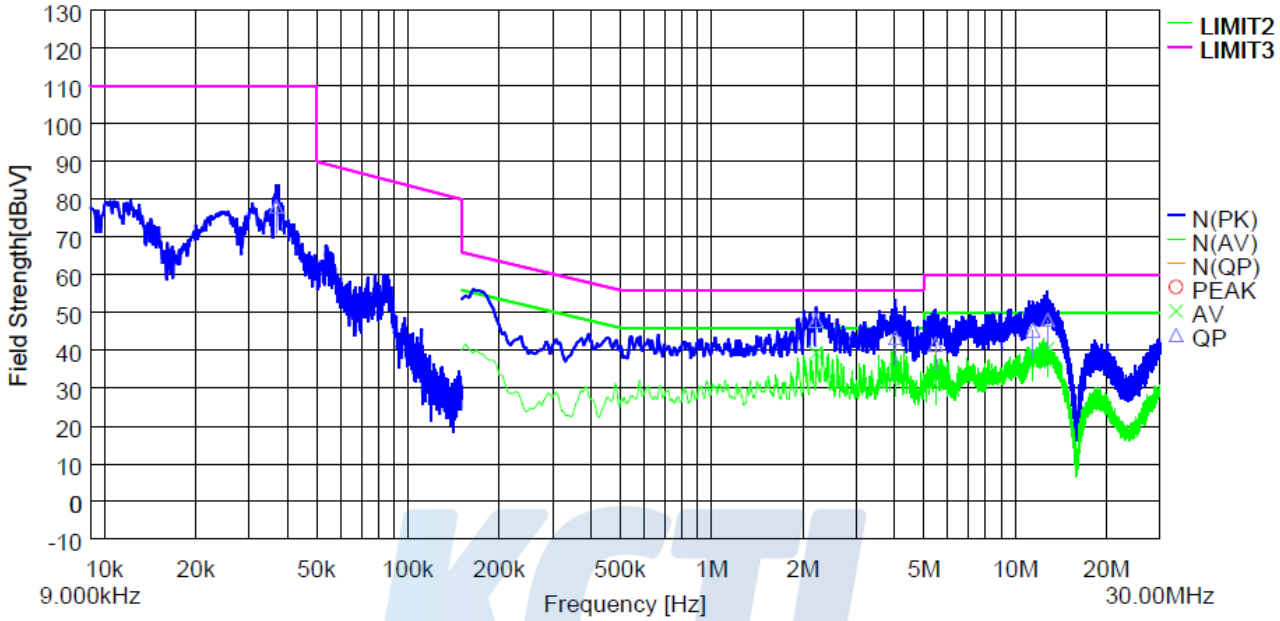
6.1.5 Disturbance Voltages measurement result

Mains terminals



Freq.	Mode	Level			Factor			PEAK	CAV	QP	Limit			Margin		
		PEAK	CAV	QP	LISN	Loss	Gain				PEAK	CAV	QP	PEAK	CAV	QP
[MHz]		[dBuV]			[dB]			[dBuV]			[dBuV]			[dB]		
0.00980	L	---	---	58.70	0.75	12.00	0.00	---	---	71.45	---	---	10.00	---	---	38.55
0.03250	L	---	---	57.22	0.31	10.24	0.00	---	---	67.77	---	---	10.00	---	---	42.23
2.20650	L	---	22.53	31.00	0.12	10.09	0.00	---	32.74	41.21	---	46.00	56.00	---	13.26	14.79
4.02000	L	---	25.24	32.12	0.15	10.12	0.00	---	35.51	42.39	---	46.00	56.00	---	10.49	13.61
11.00800	L	---	25.56	32.75	0.28	10.22	0.00	---	36.06	43.25	---	50.00	60.00	---	13.94	16.75
12.44350	L	---	28.66	34.46	0.29	10.23	0.00	---	39.18	44.98	---	50.00	60.00	---	10.82	15.02

[L]



Freq.	Mode	Level			Factor			PEAK	CAV	QP	Limit			Margin		
		PEAK	CAV	QP	LISN	Loss	Gain				PEAK	CAV	QP	PEAK	CAV	QP
[MHz]		[dBuV]			[dB]			[dBuV]			[dBuV]			[dB]		
0.03680	N	---	---	67.62	0.29	10.20	0.00	---	---	78.11	---	---	10.00	---	---	31.89
2.20650	N	---	29.13	37.72	0.12	10.09	0.00	---	39.34	47.93	---	46.00	56.00	---	6.66	8.07
4.02900	N	---	24.64	33.07	0.15	10.12	0.00	---	34.91	43.34	---	46.00	56.00	---	11.09	12.66
5.46450	N	---	22.59	31.38	0.17	10.14	0.00	---	32.90	41.69	---	50.00	60.00	---	17.10	18.31
11.44450	N	---	28.63	34.92	0.28	10.23	0.00	---	39.14	45.43	---	50.00	60.00	---	10.86	14.57
12.79900	N	---	29.87	37.55	0.29	10.23	0.00	---	40.40	48.08	---	50.00	60.00	---	9.60	11.92

[N]

6.2 Radiated Electromagnetic disturbance

Testing voltage	AC 230 V, 50 Hz		
Test facility	Shielded room		
Date	2021-04-05		
Temperature (°C)	19.2 °C	Humidity (% R.H.)	40.3 % R.H.
Remarks	Pass		

6.2.1 Limits of radiated electromagnetic disturbance measurement

Frequency	Limits for loop diameter dB(㎂) [a]		
	2 m	3 m	4 m
9 kHz ~ 70 kHz	88	81	75
70 kHz ~ 150 kHz	88 ~ 58 [b]	81 ~ 51 [b]	75 ~ 45 [b]
150 kHz ~ 3.0 MHz	58 ~ 22 [b]	51 ~ 15 [b]	49 ~ 9 [b]
3.0 MHz ~ 30 MHz	22	15 ~ 16 [c]	9 ~ 12 [c]

[a] At the transition frequency, the lower limit applies.

[b] Decreasing linearly with the logarithm of the frequency. For electrode less lamps and luminaries, the limit in the frequency range of 2.2 MHz ~ 3.0 MHz is 58 dB(㎂) for 2 m, 51 dB(㎂) for 3 m, and 45 dB(㎂) for 4 m loop diameter.

[c] Increasing linearly with the logarithm of the frequency.

Margin(㏈) = Limit(㏈(㎂)) - QuasiPeak(㏈(㎂))

Note

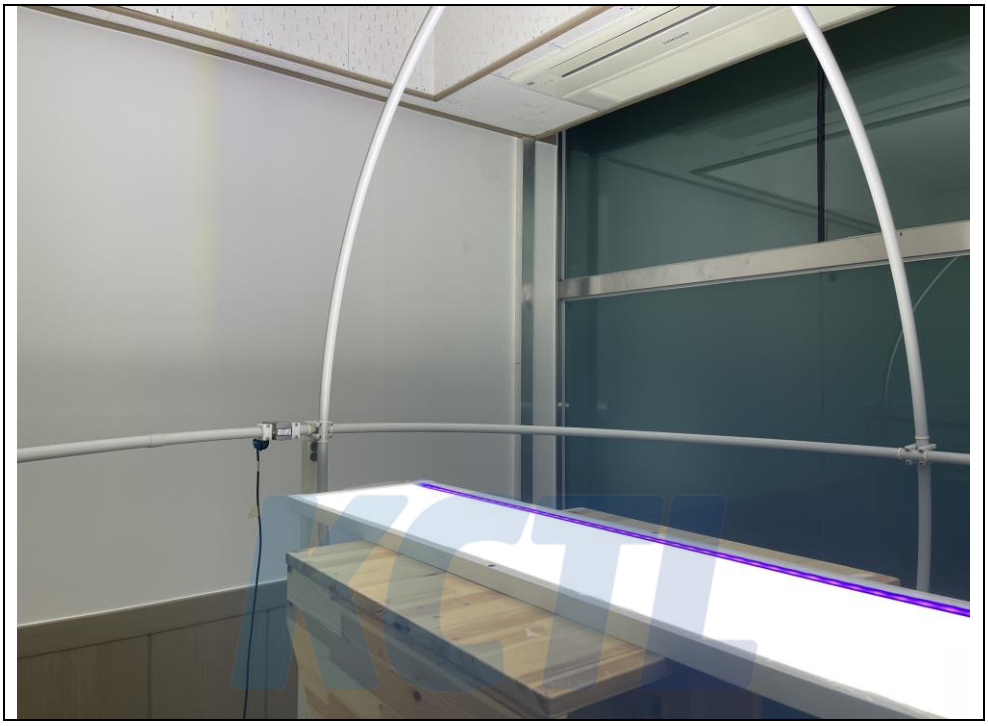
Although the kind and length of the cable that described in section 5.3.3.3 have to be stated to apply "b", but we didn't go through above procedure because our customer asked us to do not fill them in.

6.2.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. Date	Used
EMI TEST RECEIVER	ESCS30	828985/023	Rohde & Schwarz	2021-09-18	☒
Triple loop Antenna	HXYZ 9170	9170-231	Schwarzbeck	-	☒

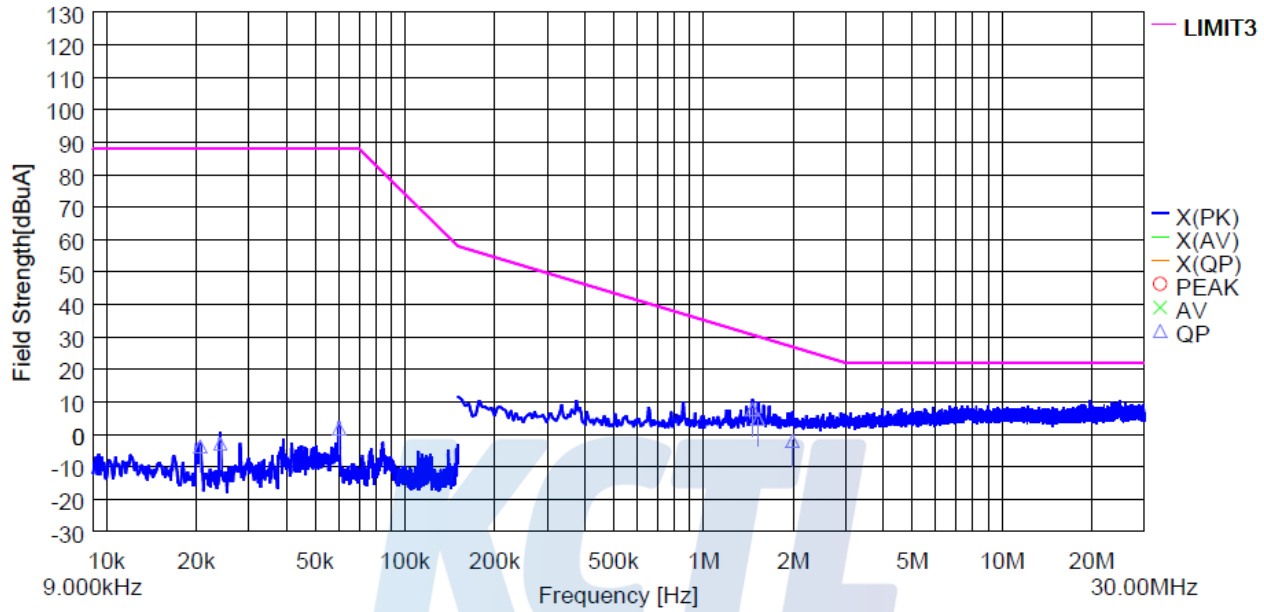
- Triple loop antenna is self-checked every year to ensure validity.

6.2.3 Photographs of test setup



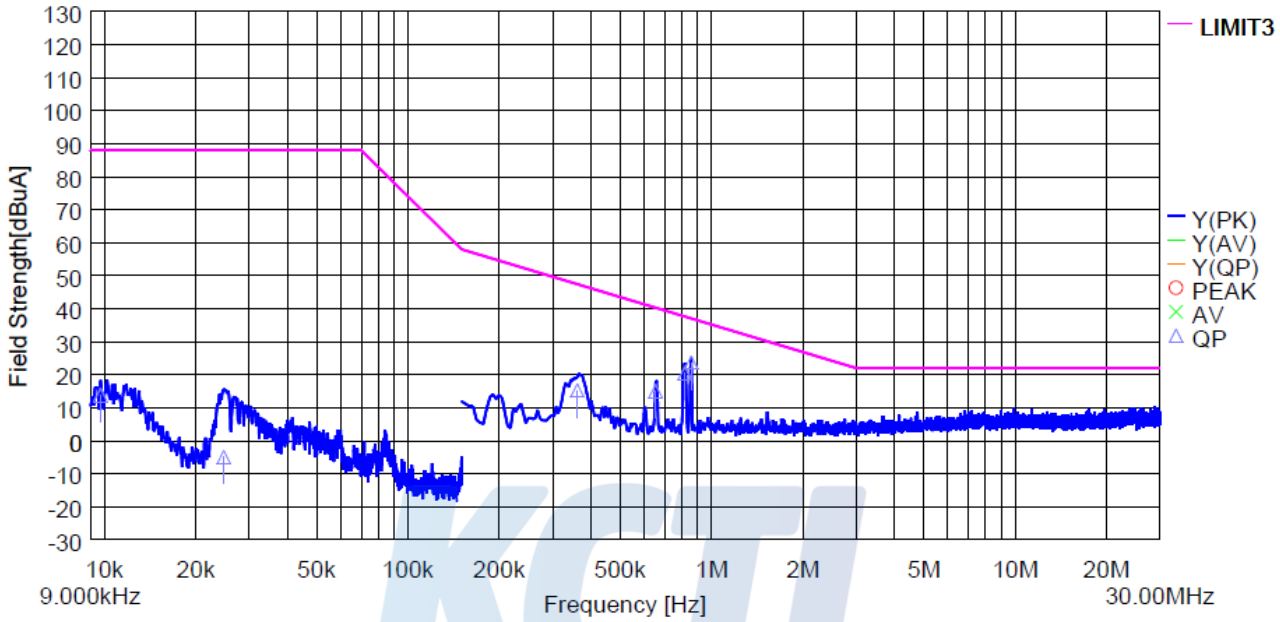
6.2.4 Radiated Electromagnetic disturbance result

Graph and Data



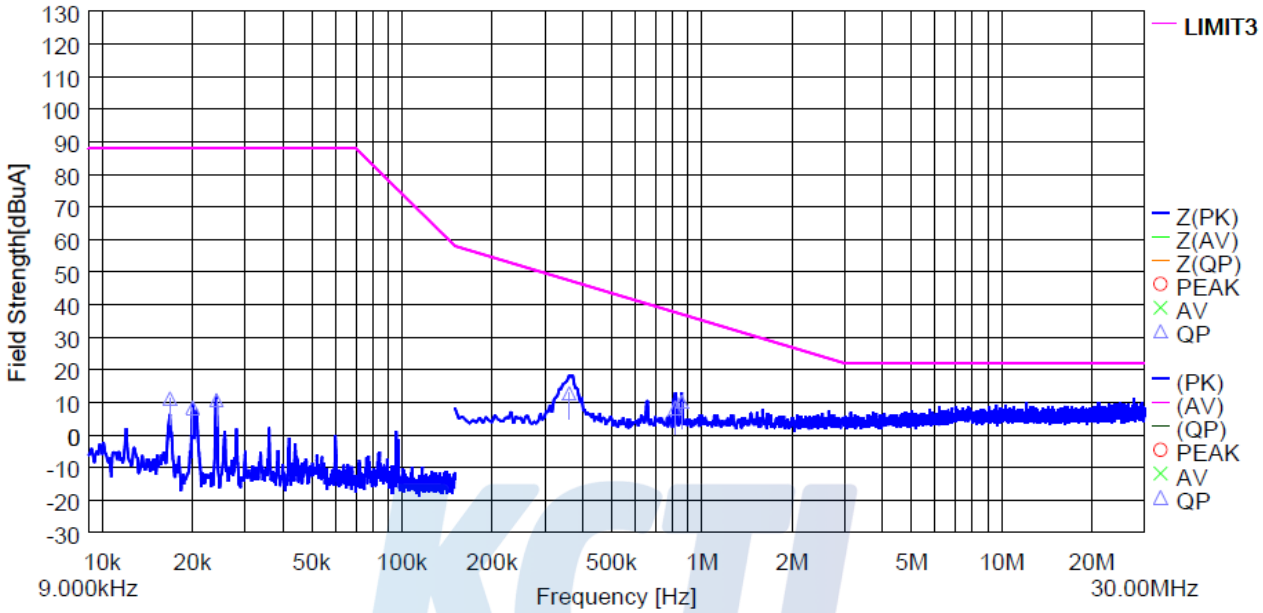
Freq.	Mode	Level			Factor			PEAK	CAV	QP	Limit			Margin		
		PEAK	CAV	QP	Ant.	Loss	Gain				PEAK	CAV	QP	PEAK	CAV	QP
[MHz]		[dBuV]			[dB]			[dBuA]			[dBuA]			[dB]		
0.02060	X	---	---	-3.69	0.00	0.01	0.00	---	---	-3.68	---	---	88.00	---	---	91.68
0.02400	X	---	---	-2.92	0.00	0.02	0.00	---	---	-2.90	---	---	88.00	---	---	90.90
0.06010	X	---	---	1.77	0.00	0.03	0.00	---	---	1.80	---	---	88.00	---	---	86.20
1.45950	X	---	---	7.61	0.00	0.06	0.00	---	---	7.67	---	---	30.66	---	---	22.99
1.52250	X	---	---	4.62	0.00	0.06	0.00	---	---	4.68	---	---	30.15	---	---	25.47
1.98600	X	---	---	-2.13	0.00	0.07	0.00	---	---	-2.06	---	---	26.96	---	---	29.02

[X]



Freq.	Mode	Level			Factor			PEAK	CAV	QP	Limit			Margin		
		PEAK	CAV	QP	Ant.	Loss	Gain				PEAK	CAV	QP	PEAK	CAV	QP
[MHz]		[dBuV]			[dB]			[dBuA]			[dBuA]			[dB]		
0.00970	Y	---	---	13.86	0.00	0.04	0.00	---	---	13.90	---	---	88.00	---	---	74.10
0.02470	Y	---	---	-4.96	0.00	0.02	0.00	---	---	-4.94	---	---	88.00	---	---	92.94
0.36150	Y	---	---	15.18	0.00	0.02	0.00	---	---	15.20	---	---	47.43	---	---	32.23
0.65400	Y	---	---	14.98	0.00	0.02	0.00	---	---	15.00	---	---	40.31	---	---	25.31
0.81600	Y	---	---	20.52	0.00	0.02	0.00	---	---	20.54	---	---	37.65	---	---	17.11
0.85650	Y	---	---	23.63	0.00	0.02	0.00	---	---	23.65	---	---	37.06	---	---	13.41

[Y]



Freq.	Mode	Level			Factor			PEAK	CAV	QP	Limit			Margin		
		PEAK	CAV	QP	Ant.	Loss	Gain				PEAK	CAV	QP	PEAK	CAV	QP
[MHz]		[dBuV]			[dB]			[dBuA]			[dBuA]			[dB]		
0.01680	Z	---	---	11.18	0.00	0.02	0.00	---	---	11.20	---	---	88.00	---	---	76.80
0.02000	Z	---	---	8.45	0.00	0.01	0.00	---	---	8.46	---	---	88.00	---	---	79.54
0.02400	Z	---	---	10.65	0.00	0.02	0.00	---	---	10.67	---	---	88.00	---	---	77.33
0.36150	Z	---	---	12.77	0.00	0.02	0.00	---	---	12.79	---	---	47.43	---	---	34.64
0.81600	Z	---	---	8.44	0.00	0.02	0.00	---	---	8.46	---	---	37.65	---	---	29.19
0.85650	Z	---	---	10.19	0.00	0.02	0.00	---	---	10.21	---	---	37.06	---	---	26.85

[Z]

6.3 Radiated Emissions

Testing voltage	AC 230 V, 50 Hz		
Test facility	10 m Chamber		
Test distance	10 m		
Date	2021-04-02		
Temperature (°C)	21.5 °C	Humidity (% R.H.)	41.1 % R.H.
Remarks	Pass		

6.3.1 Limits of radiated emissions measurement

Frequency [MHz]	Quasi-peak limits (dB(μV/m))
30 ~ 230	30
230 ~ 300	37

At the transition frequency, the lower limit applies.

6.3.2 Measurement procedure

The test was done at a 10 m Chamber with a quasi-peak detector. EUT was placed on a non-metallic table height of 0.8 m above the reference ground plane. Cables were folded back and forth forming a bundle 0.3 m to 0.4 m long and were hanged at a 0.4 m height to the ground plane.

Cables connected to EUT were fixed to cause maximum emission. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.

6.3.3 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. Date	Used
Test Receiver	ESCI	100561	Rohde & Schwarz	2021-09-18	☒
BI-LOG Ant.	CBL6112D	55442	Teseq GmbH	2021-12-27	☒
Amplifier	310N	185938	SONOMA	2021-12-29	☒

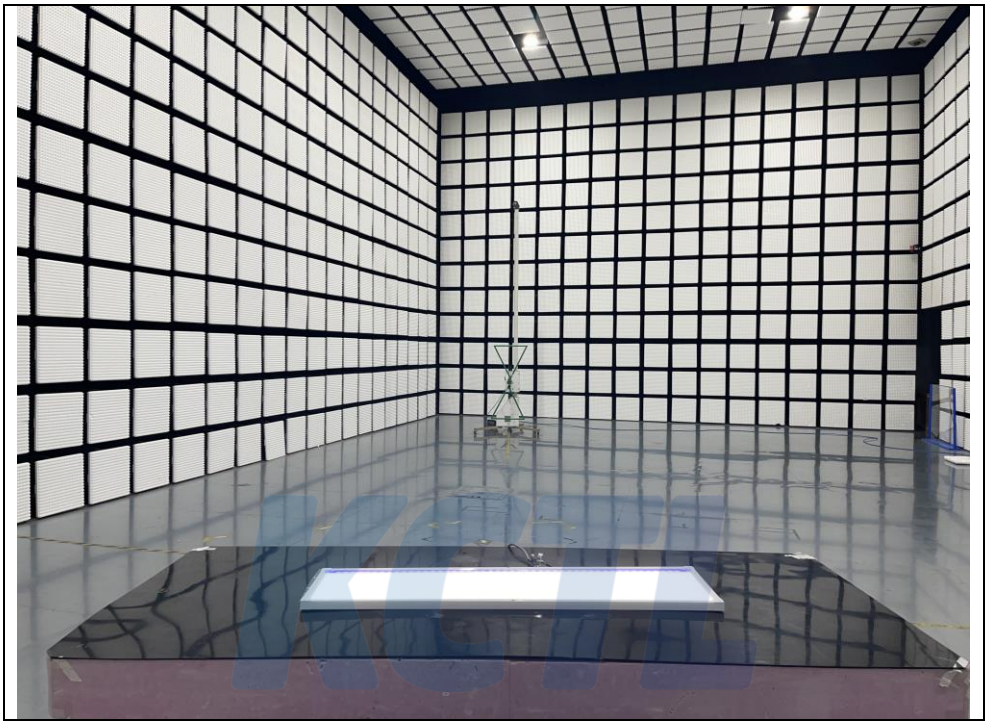
6.3.4 Sample calculation

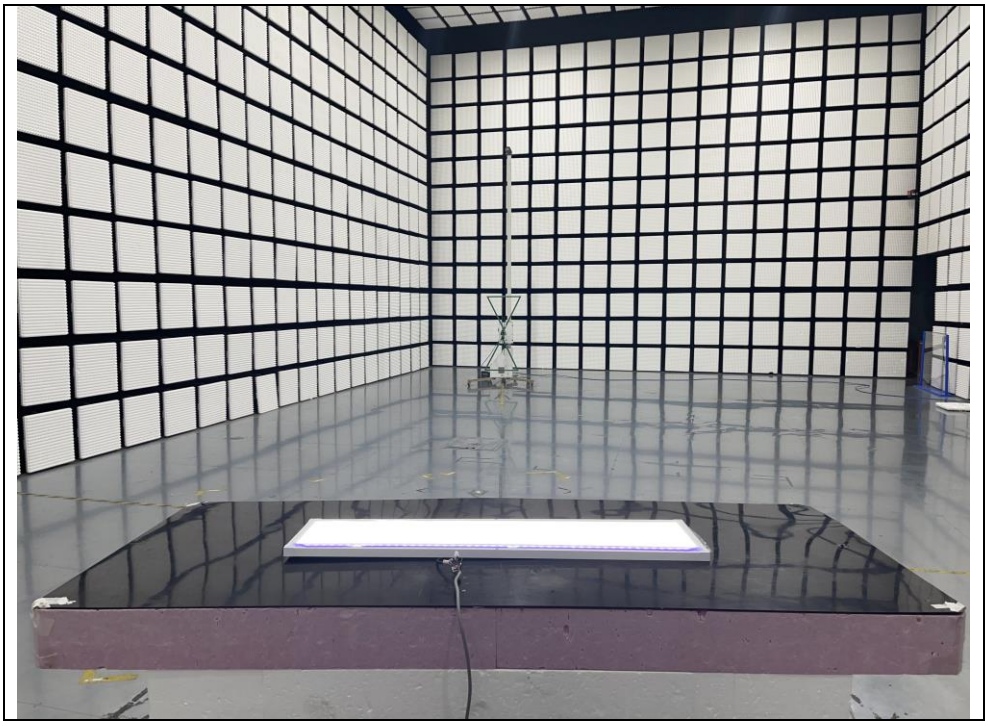
The field strength is calculated adding the antenna Factor, cable loss and, Antenna pad adding, subtracting the amplifier gain from the measured reading.
The sample calculation is as follow:

Result QP[dB(μV/m)] = Reading QP[dB(μV)] + C.Fac [dB/m]
Result QP : The final measure
Reading QP : Instrument readings
C.Fac : ANT FACTOR [dB/m] + LOSS [dB] - GAIN [dB]
ANT FACTOR: Antenna Factor
LOSS: Cable Loss
GAIN: Amplifier Gain

6.3.5 Photographs of test setup

30 ㎒ - 300 ㎒

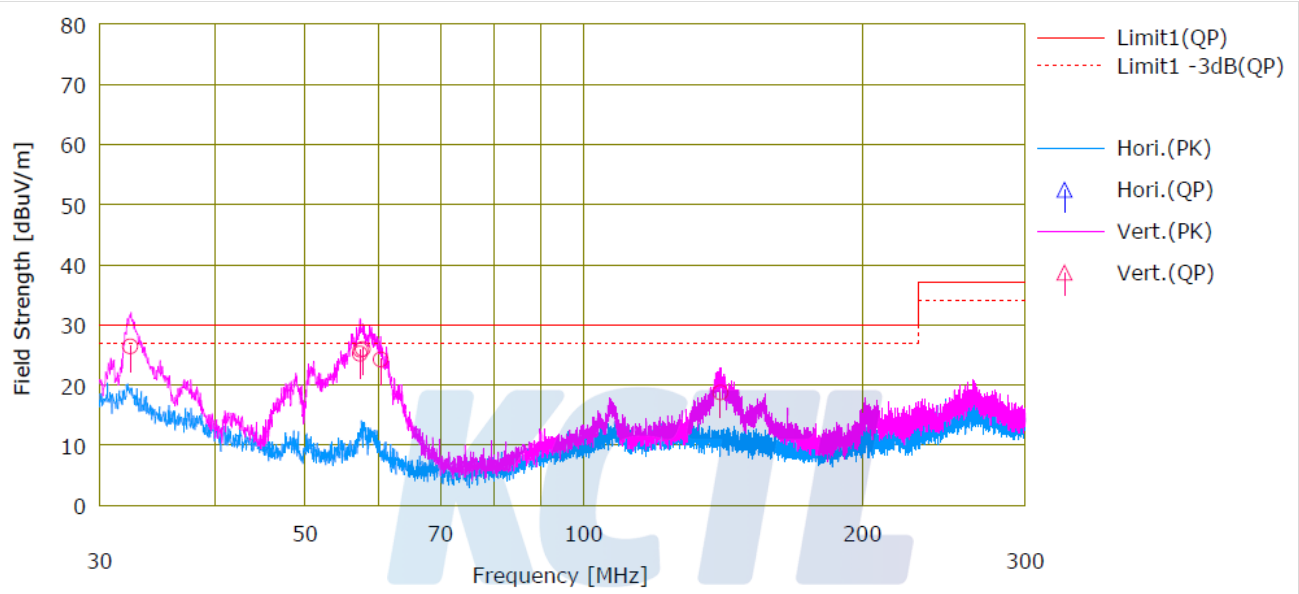




6.3.6 Radiated emissions measurement result

Graph and Data

30 ㎒ - 300 ㎒



No.	Freq.	Reading <QP>	C.Fac	Result <QP>	Limit <QP>	Margin <QP>	Pola.	Height	Angle	Ant. Type	Comment
	[MHz]	[dBuV]	[dB/m]	dBuV/m	dBuV/m	[dB]	[H/V]	[cm]	[deg]		
1	32.387	34.11	-7.70	26.41	30.00	3.59	Vert.	123	360	BI LO	
2	57.339	44.01	-18.79	25.22	30.00	4.78	Vert.	145	0	BI LO	
3	57.472	44.61	-18.79	25.82	30.00	4.18	Vert.	221	203	BI LO	
4	57.781	44.74	-18.78	25.96	30.00	4.04	Vert.	165	146	BI LO	
5	60.390	43.01	-18.76	24.25	30.00	5.75	Vert.	198	228	BI LO	
6	140.606	32.01	-13.25	18.76	30.00	11.24	Vert.	212	81	BI LO	

6.4 Harmonics

Testing voltage	AC 230 V, 50 Hz				
Test facility	Shield Room				
Date	2021-04-01				
Temperature(°C)	21.8 °C	Humidity (% R.H.)	40.5 % R.H	Pressure (kPa)	100.8 kPa
Remarks	Pass				

6.4.1 Measurement procedure

The equipment is supplied in series with shunt(s) Rm or current transformer(s) from a source having the same nominal voltage and frequency as the rated supply voltage and frequency of the equipment. Measurements shall be made under normal load, or conditions for adequate heat discharge, and under normal operating conditions. User's operation controls or automatic programmers shall be set to produce the maximum harmonic component, for each successive harmonic component in turn. For the purpose of harmonic current limitation, equipment is classified as follows :

Class A : Equipment not specified in one of the three other Classes shall be considered as Class A equipment.

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

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 600 W, of the following types:

- Personal computers and personal computer monitors;
- Television receivers.

6.4.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. date	Used
AC/DC Power Source	Netwave 30.5	P2020240957	EM TEST	2021-07-02	☒
DPA 503N	DPA 503N	P2014240512	EM TEST	2021-07-02	☒

6.4.3 Photographs of test setup

6.4.4 Measurement result

Test Report

Report Number :	KP21-01571
Test Standard :	IEC 61000-3-2 (Edition 5) Limits for harmonic current emissions (equipment input current < 16 A per phase)
Tester :	KIM JEONG WON
Test Date :	4/1/2021 3:10:39 PM

Result

E.U.T. :	PASS	Source :	PASS

Software

Name :	net.control	Version :	3.0.5.0

Measures & Analysis

Measure Window :	10 periods	Voltage Range :	500 V
Refresh Interval :	2 s	Current Range :	200 A
Sampling Rate :	6.4 kS/s		
Scaled Window :	Rectangular		
According :	IEC 61000-3-2 (Edition 5) Limits for harmonic current emissions (equipment input current < 16 A per phase)		

Measure Results

Standard Specific Results for IEC 61000-3-2 (Edition 5)

Standard Group:	Industry
Standard Name:	IEC 61000-3-2 (Edition 5) Limits for harmonic current emissions (equipment input current < 16 A per phase)
Device Under Test:	PASS
Power Source:	PASS
Connection Type:	L - N
Classification:	Class C (Rated power > 25 W, Table 2)
Appli. of Limits:	less than or equal to 150 % (Without POHC Enhancement)

Check Harmonics 2..40

First detected harmonic order > 150 %

Line 1: None

Harmonics orders > 150 %	
Line 1:	None
Harmonics orders with average > 100 %	
Line 1:	None

Measured values	
Fundamental Current	
Line 1:	1.553 A
Active input Power	
Line 1:	345.469 W *
Circuit power factor	
Line 1:	0.963 *

* *Absolute value.*

Current Test Result

Average and Maximum harmonic current results

Hn	Average				Maximum				Harmonic Result
	Ieff [%]	of Limit [%]	Limit [%]	Result	Ieff [%]	of Limit [%]	Limit [%]	Result	
1	99.964				100.000				
2	0.112	5.582	2.000	n/a	0.122	4.066	3.000	n/a	n/a
3	6.689	23.143	28.901	PASS	6.710	15.479	43.351	PASS	PASS
4	0.092				0.101				
5	4.211	42.112	10.000	PASS	4.227	28.182	15.000	PASS	PASS
6	0.082				0.093				
7	4.737	67.668	7.000	PASS	4.751	45.247	10.500	PASS	PASS
8	0.077				0.085				
9	1.938	38.756	5.000	PASS	1.948	25.967	7.500	PASS	PASS
10	0.072				0.082				
11	1.574	52.458	3.000	PASS	1.587	35.269	4.500	PASS	PASS
12	0.072				0.081				
13	1.253	41.769	3.000	PASS	1.263	28.073	4.500	PASS	PASS
14	0.076				0.088				
15	0.722	24.071	3.000	PASS	0.732	16.271	4.500	PASS	PASS
16	0.069				0.078				
17	0.356	11.869	3.000	n/a	0.366	8.124	4.500	n/a	n/a
18	0.069				0.077				
19	0.410	13.682	3.000	n/a	0.420	9.326	4.500	n/a	n/a
20	0.068				0.075				

21	0.600	19.990	3.000	n/a	0.610	13.565	4.500	PASS	PASS
22	0.071				0.077				
23	0.796	26.540	3.000	PASS	0.806	17.909	4.500	PASS	PASS
24	0.075				0.085				
25	0.573	19.115	3.000	n/a	0.589	13.087	4.500	n/a	n/a
26	0.076				0.085				
27	0.347	11.582	3.000	n/a	0.360	7.997	4.500	n/a	n/a
28	0.071				0.078				
29	0.384	12.800	3.000	n/a	0.396	8.797	4.500	n/a	n/a
30	0.070				0.079				
31	0.315	10.512	3.000	n/a	0.333	7.407	4.500	n/a	n/a
32	0.072				0.079				
33	0.114	3.812	3.000	n/a	0.125	2.778	4.500	n/a	n/a
34	0.073				0.079				
35	0.292	9.744	3.000	n/a	0.308	6.843	4.500	n/a	n/a
36	0.076				0.086				
37	0.335	11.164	3.000	n/a	0.354	7.872	4.500	n/a	n/a
38	0.080				0.093				
39	0.112	3.748	3.000	n/a	0.125	2.770	4.500	n/a	n/a
40	0.076				0.086				

Note: Harmonic currents less than 0.6 % of the input current measured under the test conditions, or less than 5 mA, whichever is greater, are disregarded.

Voltage Source Verification

Harmonic voltage results				
Hn	Ueff [V]	Ueff [%]	Limit [%]	Result
1	229.771	99.900		
2	0.192	0.083	0.200	PASS
3	0.056	0.024	0.900	PASS
4	0.075	0.032	0.200	PASS
5	0.057	0.025	0.400	PASS
6	0.048	0.021	0.200	PASS
7	0.050	0.022	0.300	PASS
8	0.037	0.016	0.200	PASS
9	0.046	0.020	0.200	PASS
10	0.031	0.014	0.200	PASS
11	0.037	0.016	0.100	PASS
12	0.028	0.012	0.100	PASS
13	0.024	0.010	0.100	PASS
14	0.022	0.009	0.100	PASS

15	0.021	0.009	0.100	PASS
16	0.020	0.009	0.100	PASS
17	0.015	0.007	0.100	PASS
18	0.018	0.008	0.100	PASS
19	0.017	0.007	0.100	PASS
20	0.016	0.007	0.100	PASS
21	0.015	0.007	0.100	PASS
22	0.022	0.010	0.100	PASS
23	0.021	0.009	0.100	PASS
24	0.023	0.010	0.100	PASS
25	0.014	0.006	0.100	PASS
26	0.020	0.008	0.100	PASS
27	0.013	0.006	0.100	PASS
28	0.015	0.007	0.100	PASS
29	0.015	0.007	0.100	PASS
30	0.007	0.003	0.100	PASS
31	0.020	0.009	0.100	PASS
32	0.007	0.003	0.100	PASS
33	0.013	0.006	0.100	PASS
34	0.009	0.004	0.100	PASS
35	0.018	0.008	0.100	PASS
36	0.014	0.006	0.100	PASS
37	0.013	0.006	0.100	PASS
38	0.014	0.006	0.100	PASS
39	0.016	0.007	0.100	PASS
40	0.012	0.005	0.100	PASS

6.5 Voltage Fluctuations and Flickers

Testing voltage	AC 230 V, 50 Hz				
Test facility	Shield Room				
Date	2021-04-01				
Temperature(°C)	21.8 °C	Humidity (% R.H.)	40.5 % R.H	Pressure (kPa)	100.8 kPa
Remarks	Pass				

6.5.1 Measurement procedure

EUT was connected to the power analyzer system.

Measurement was performed to obtain the desired flicker parameters.

The measuring time depends on which parameters are to be measured.

P_{lt} = 2 h

P_{st} = 10 min

Controls and automatic programs shall be set to produce the most unfavorable sequence of voltage changes, using only those combinations of controls and programs are mentioned by the manufacturer in the instruction manual.

6.5.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. date	Used
AC/DC Power Source	Netwave 30.5	P2020240957	EM TEST	2021-07-02	☒
DPA 503N	DPA 503N	P2014240512	EM TEST	2021-07-02	☒

6.5.3 Photographs of test setup

6.5.4 Measurement result

Test Report

Report Number :	KP21-01571
Test Standard :	IEC 61000-3-3 (Edition 3) Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection
Tester :	KIM JEONG WON
Test Date :	4/1/2021 3:00:53 PM

Result

E.U.T. :	Test passed

Software

Name :	net.control	Version :	3.0.5.0

Flicker Results

Standard Specific Results for IEC 61000-3-3 (Edition 3)

Standard Group:	Industry
Standard Name:	IEC 61000-3-3 (Edition 3) Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection
Test Condition:	General Test Conditions
Analysis Status:	PASS

Flicker Measurements Settings

Main line:	230V, 50Hz
Flicker Meter:	230V / 50Hz
Flicker Impedance:	Zref
Observation Time:	1 × 10 min
Measurements done:	1

Flicker Measurements

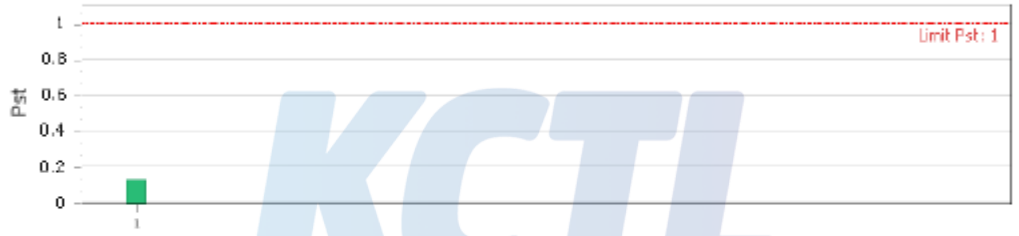
	P_{lt}	Max P_{st}	Max D_c	Max D_{max}	Max T_{max}
Line 1:	0.056	0.129	0.007	0.201	0
Limits:	0.65	1	3.3	4	0.5
Results:	PASS	PASS	PASS	PASS	PASS

Pst Data

Flicker (Line 1)

Meas. No.	P0,1	P1s	P3s	P10s	P50s	Pst	dc [%]	dmax [%]	Tmax [s]
1	0.041	0.037	0.035	0.032	0.026	0.129	0.007	0.201	0

Short-term Flicker Severity (Pst) (Line 1)



Long-term Flicker Severity (Plt) (Line 1)

6.6 Electrostatic Discharge

Test level	☒ Contact: ± 4 kV ☒ Air: ± 2 kV, ± 4 kV, ± 8 kV ☒ HCP: ± 4 kV ☒ VCP: ± 4 kV				
Discharge impedance	330 Ω / 150 ㎊				
Number of discharge (Each polarity)	☒ Contact: 10 ☒ Air: 10 ☒ HCP / VCP: 10				
Interval between discharges	1 s				
Testing voltage	AC 230 V, 50 Hz				
Test facility	Shielded room				
Date	2021-04-07				
Temperature(°C)	22.3 °C	Humidity (% R.H.)	42.5 % R.H.	Pressure (㎪)	101.1 ㎪
Remarks	Pass - A: There was no change of operation status during above testing.				

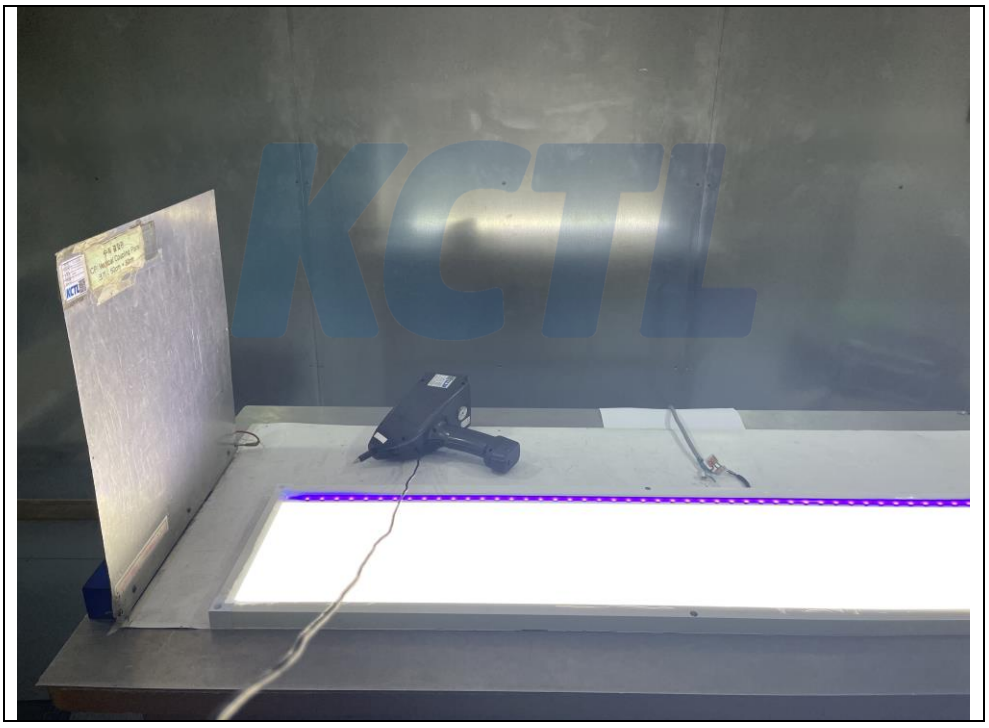
6.6.1 Measurement procedure

A ground reference plane was located on the floor, and connected to earth via a low Impedance connection. The return cable of the ESD generator was connected to the reference plane.
In case of floor standing equipment, EUT was placed on the reference plane on 0.1 ㎜ of insulating Support. In case of table top equipment, EUT was placed on a wooden table 0.8 ㎜ above the reference grounded floor. A horizontal coupling plane (HCP) was placed on the table, and Connected to the reference plane via a 470 ㏀ resistor located in each end (0.5 ㎜ insulating support between EUT and HCP). In both cases a vertical coupling plane(VCP) OF 0.5 X 0.5 ㎜ was located 0.1 ㎜ from the EUT's sides. The VCP was connected to the reference plane in the same matter as the HCP.

6.6.2 Used equipments

Equipment	Model No.	Serial No.	Makers	Next Cal. Date	Used
ESD SIMULATOR	ONYX30	179461	HAEFELY	2022-02-23	☒
HCP	-	-	-	-	☒
VCP	-	-	-	-	☒

6.6.3 Photographs of test setup

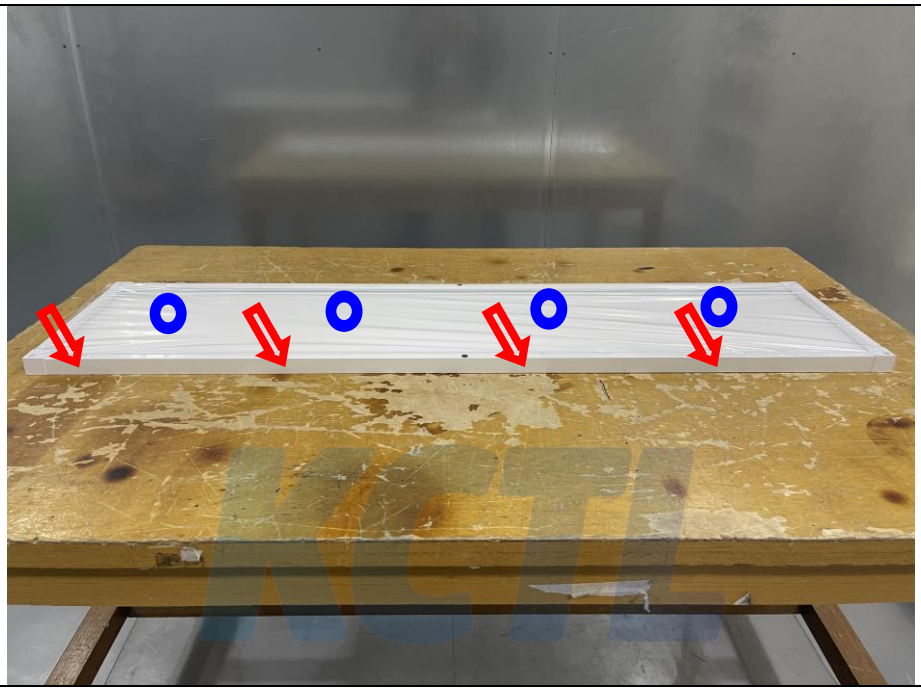


6.6.4 Measurement result

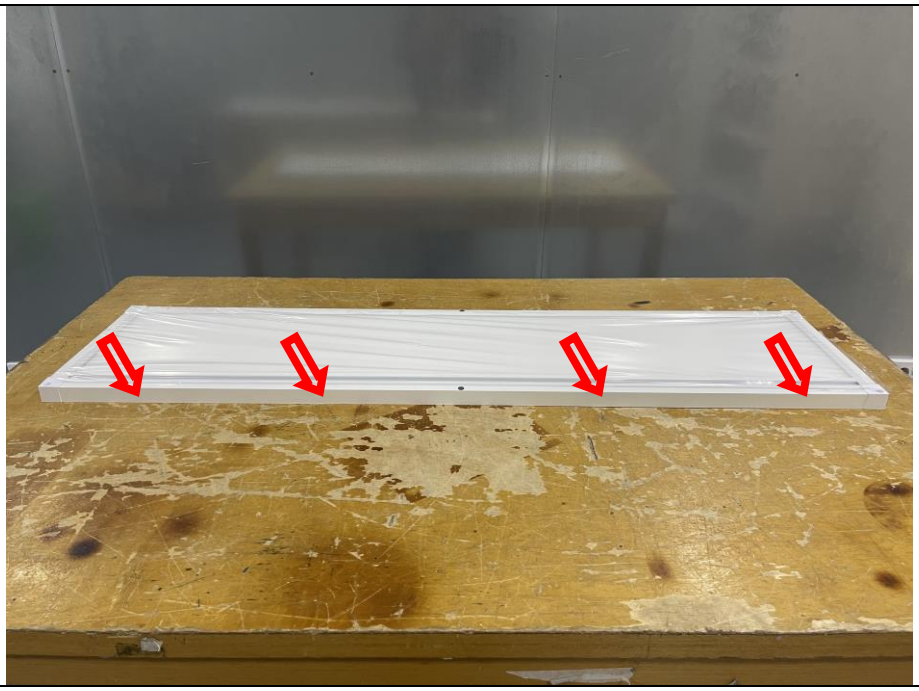
Electrostatic Discharge (Test Point)

Air discharge	○
Contact discharge	⇨

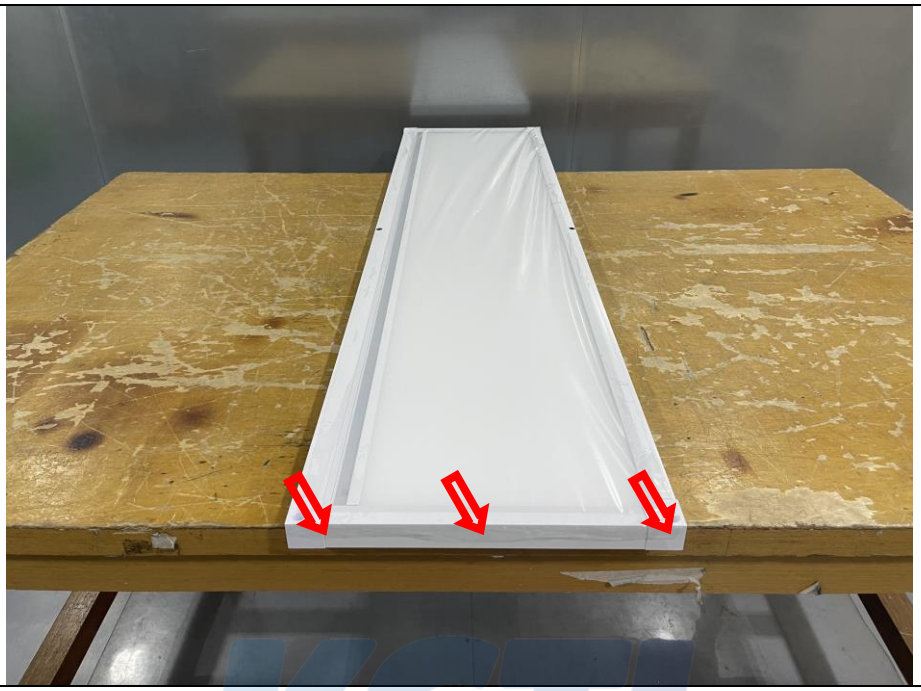
[Front]



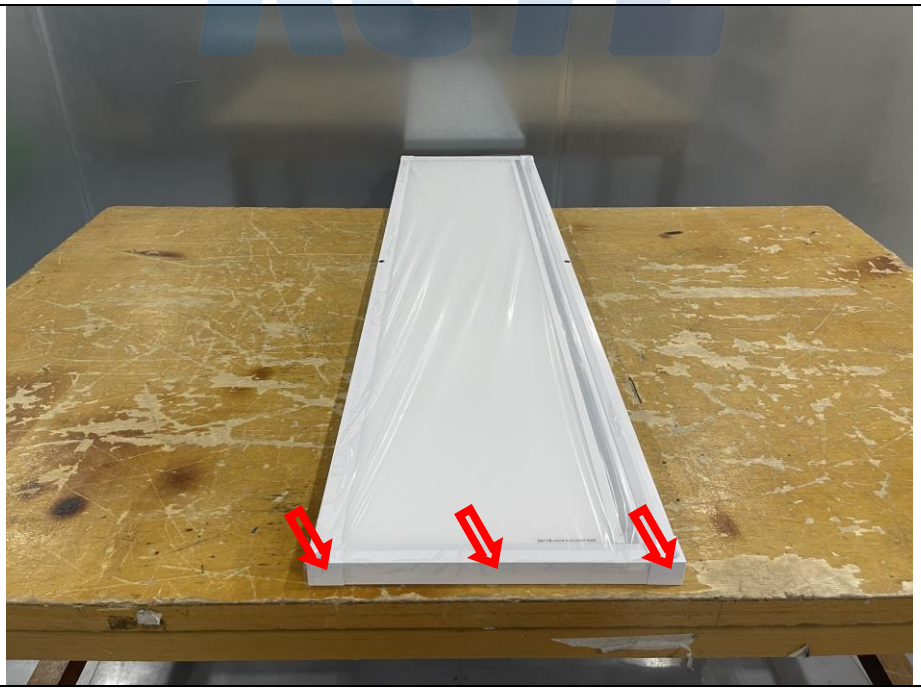
[Rear]



[Left]



[Right]



HCP/VCP discharge

Location(EUT)	Applied level (±)	Result
HCP (All 4 sides)	± 4 kV	A
VCP (All 4 sides)	± 4 kV	A

Contact discharge

Location(EUT)	Applied level (±)	Result
Front	± 4 kV	A
Rear	± 4 kV	A
Left	± 4 kV	A
Right	± 4 kV	A

Air discharge

Location(EUT)	Applied level (±)	Result
Front	± 2 kV, ± 4 kV, ± 8 kV	A
Rear	± 2 kV, ± 4 kV, ± 8 kV	-
Left	± 2 kV, ± 4 kV, ± 8 kV	-
Right	± 2 kV, ± 4 kV, ± 8 kV	-

Lux Meter

Before	After
233 Lux	235 Lux

6.7 Radiated Susceptibility

Tested frequency	80 MHz ~ 1 GHz				
Test level & Modulation	3 V/m, 80 % Amplitude Modulation (1 kHz)				
Frequency Step	1 % step				
Dwell time	1 s				
Distance	3 m from EUT to tip of antenna				
Testing Voltage	AC 230 V, 50 Hz				
Test facility	Fully anechoic chamber (3 m)				
Date	2021-04-05				
Temperature(°C)	21.1 °C	Humidity (% R.H.)	42.7 % R.H.	Pressure (㎪)	100.9 ㎪
Remarks	Pass - A: There was no change of operation status during above testing.				

6.7.1 Measurement procedure

The test was performed at 3 m full anechoic chamber.

For floor standing equipment, the EUT was standing on the floor.

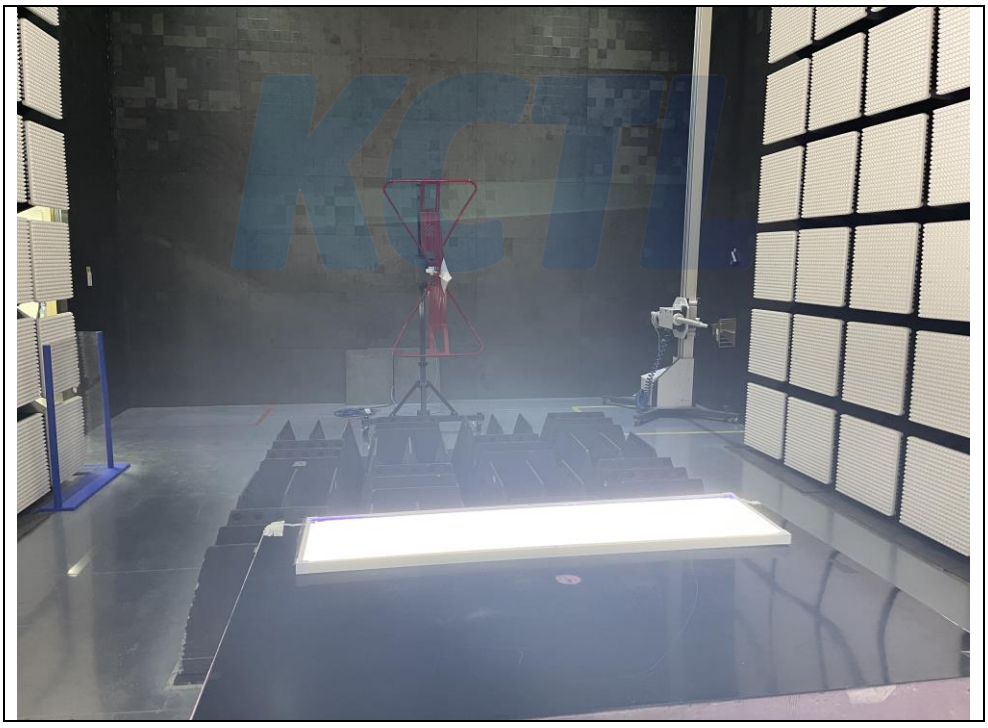
For tabletop equipment, the EUT was located on a wooden table 0.8 m above the floor.

The EUT was tested all sides, horizontal and vertical polarization.

6.7.2 Used equipments

Equipment	Model no.	Makers	Serial no.	Next Cal. date	Used
ESG VECTOR SIGNAL GENERATOR	E4438C	AGILENT	MY42080689	2021-09-17	☒
Power Meter	NRVD	ROHDE&SCHWARZ	101176	2021-12-30	☒
Power Sensor	NRV-Z51	ROHDE&SCHWARZ	100921	2021-12-30	☒
Power Sensor	NRV-Z51	ROHDE&SCHWARZ	100922	2021-12-30	☒
Power Amplifier	250W1000A	Amplifier Research	0330410	-	☒
BiConiLog Antenna	3142E	ETS-LINDGREN	00224673	-	☒
Directional Coupler	DC6180A	Amplifier Research	0352757	2022-02-18	☒
RF RELAY MATRIX	RFM-S3A3C1LR	TSJ	04339	-	☒

6.7.3 Photographs of test setup



6.7.4 Measurement result

Location(EUT)	Antenna polarization	Result
Front side	Horizontal	A
	Vertical	A
Rear side	Horizontal	A
	Vertical	A
Left side	Horizontal	A
	Vertical	A
Right side	Horizontal	A
	Vertical	A

Lux Meter

Location(EUT)	Antenna polarization	Before	After
Front side	Horizontal	230 Lux	232 Lux
	Vertical	235 Lux	232 Lux
Rear side	Horizontal	231 Lux	234 Lux
	Vertical	231 Lux	235 Lux
Left side	Horizontal	229 Lux	230 Lux
	Vertical	239 Lux	229 Lux
Right side	Horizontal	233 Lux	231 Lux
	Vertical	231 Lux	240 Lux

6.8 Electric Fast Transient/Burst

Coupling	☒ AC main ☐ DC Line ☐ Control: Clamp ☐ Telecommunication: Clamp				
Test level	☒ AC main: ± 1 kV Peak ☐ DC Line: ± 0.5 kV Peak ☐ Control: ± 0.5 kV Peak ☐ Telecommunication: ± 0.5 kV Peak				
Repetition frequency	5 kHz, Tr/Th = 5 / 50 ㎱				
Coupling time (Minimum)	120 s				
Testing voltage	AC 230 V, 50 Hz				
Test facility	Shielded room				
Date	2021-04-07				
Temperature(°C)	21.8 °C	Humidity (% R.H.)	41.6 % R.H.	Pressure (㎪)	101.1 ㎪
Remarks	Pass - A: There was no change of operation status during above testing.				

6.8.1 Measurement procedure

A ground reference plane was located on the floor.
EFT generator was connected to reference ground plane via low impedance connection.
For floor standing equipment, EUT was placed on a 0.1 ㎜ wooden table.
For tabletop equipment, EUT was placed on a 0.1 ㎜ above the ground reference plane.
Test generator and coupling/decoupling network was placed on, and bounded to, the ground reference plane. When using the coupling clamp, the minimum distance between the coupling plates and all other conductive surfaces, except the ground reference plane beneath the coupling clamp, Shall be 0.5 ㎜.

6.8.2 Used equipments

Equipment	Model no.	Makers	Serial no.	Next Cal. Date	Used
EMC IMMUNITY TESTER	IMU3000	EMC PARTNER	105684-2076	2021-06-23	☒

6.8.3 Photographs of test setup

AC Main

6.8.4 Measurement result

AC main

Coupling point	(+)	**(-)**	Result
L	+ 1 kV	- 1 kV	A
N	+ 1 kV	- 1 kV	A
PE	+ 1 kV	- 1 kV	A
L – N	+ 1 kV	- 1 kV	A
L – PE	+ 1 kV	- 1 kV	A
N – PE	+ 1 kV	- 1 kV	A
L – N – PE	+ 1 kV	- 1 kV	A

DC Line

Coupling point	(+)	(-)	Result
-	-	-	-

Telecommunication

Coupling point	(+)	(-)	Result
-	-	-	-

Lux Meter

Before	After
229 Lux	241 Lux

6.9 Surge Transient

Coupling	☒ AC main: Direct ☐ Control: Direct / CDN				
Test level	☐ AC main: (Below 25 W)	☐Differential mode: ± 0.5 kV ☐Common mode: ± 0.5 kV, ± 1 kV			
	☒ AC main: (Above 25 W)	☒Differential mode: ± 0.5 kV, ± 1 kV ☒Common mode: ± 0.5 kV, ± 1 kV, ± 2 kV			
	☐ Control: ± 0.5 kV, ± 1 kV				
Coupling Impedance	☒ Differential mode: 18 ㎌ ☐ 40 Ω+ 0.5 ㎌	☒ Common mode: 10 Ω + 9 ㎌ ☐ Direct			
Surge pulse shape	Tr/Th = 1.2 / 50 ㎲				
Angles	90 °, 270 °				
Number of surge	5				
Coupling time	30 s				
Testing Voltage	AC 230 V, 50 Hz				
Test facility	Shielded room				
Date	2021-04-07				
Temperature(°C)	21.8 °C	Humidity (% R.H.)	41.6 % R.H.	Pressure (㎪)	101.1 ㎪
Remarks	Pass - A: There was no change of operation status during above testing.				

6.9.1 Measurement procedure

A ground reference plane was located on the floor. SURGE generator was connected to reference ground plane via low impedance connection. For floor standing equipment & table top equipment, EUT was placed on a wooden table.

6.9.2 Used equipments

Equipment	Model no.	Makers	Serial no.	Next Cal. Date	Used
EMC IMMUNITY TESTER	IMU3000	EMC PARTNER	105684-2076	2021-06-23	☒

6.9.3 Photographs of test setup

6.9.4 Measurement result

AC main

Coupling point	(+)	(-)	Result
L-N	+ 0.5 kV, + 1 kV	- 0.5 kV, - 1 kV	A
L-PE	+ 0.5 kV, + 1 kV, + 2 kV	- 0.5 kV, - 1 kV, - 2 kV	A
N-PE	+ 0.5 kV, + 1 kV, + 2 kV	- 0.5 kV, - 1 kV, - 2 kV	A

Control

Coupling point	(+)	(-)	Result
-	-	-	-

Lux Meter

Before	After
232 Lux	235 Lux

6.10 Conducted Susceptibility

Tested frequency & Test level	0.15 MHz ~ 80 MHz (3 V)				
Modulation	80 % Amplitude Modulation (1 kHz)				
Frequency Step	1 % step				
Dwell time	1 s				
Coupling method	☒ AC main: CDN(M3) ☐ DC Line: CDN(M2) ☐ Telecommunication: Clamp				
Testing Voltage	AC 230 V, 50 Hz				
Test facility	Shielded room				
Date	2021-04-07				
Temperature(°C)	21.8 °C	Humidity (% R.H.)	41.6 % R.H.	Pressure (㎪)	101.1 ㎪
Remarks	Pass - A: There was no change of operation status during above testing.				

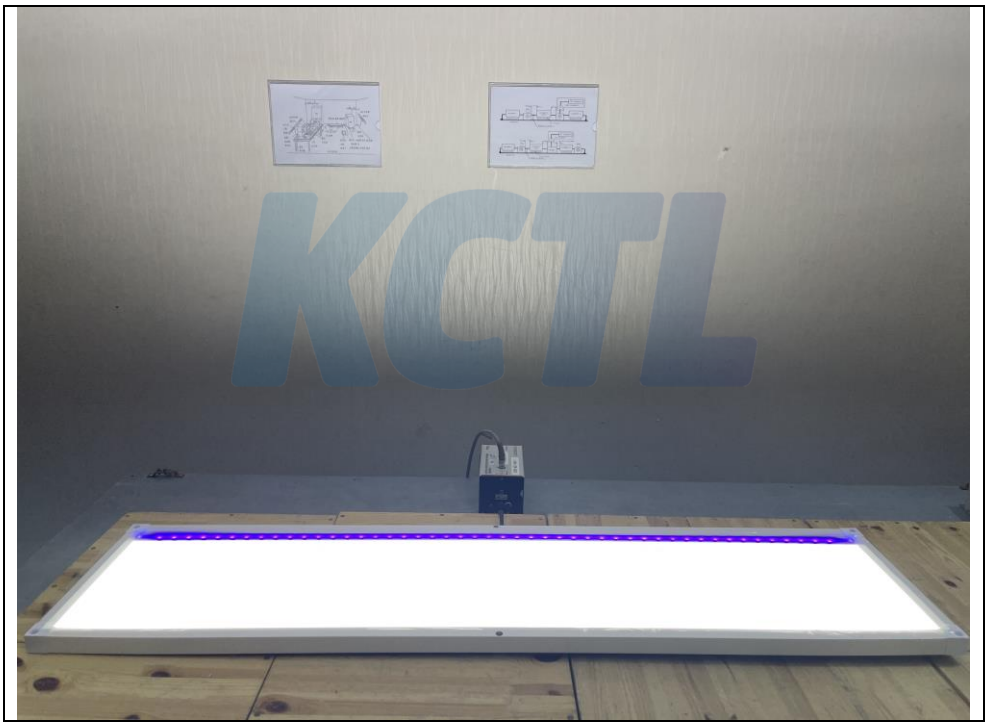
6.10.1 Measurement procedure

A ground reference plane was located on the floor.
The test was performed on a ground reference plane on a 0.1 ㎝ wooden table. This test were Performed using CDN for mains, clamp for signal and injection probe. The frequency range was swept from 0.15 ㎒ to 80 ㎒. This frequency range was Modulated with 1 ㎑ sine wave at 80 %.
The signal generators provided the modulated frequency at a 1 % step size.
The power and all network cable, I/O cables longer than 3 ㎝ length were tested.

6.10.2 Used equipments

Equipment	Model no.	Makers	Serial no.	Next Cal. date	Used
Conducted Immunity Test System	CIT-10/75	Frankonia EMV-Mess-Systeme GmbH	102C31213	2021-12-29	☒
Coupling/Decoupling Network	CDN M016	Teseq GmbH	47899	2021-09-17	☒

6.10.3 Photographs of test setup



6.10.4 Measurement result

AC main

Coupling point	Coupling method	Result
Power	CDN (M016)	A

DC Line

Coupling point	Coupling method	Result
-	-	-

Telecommunication

Coupling point	Coupling method	Result
-	-	-

Lux Meter

Before	After
229 Lux	235 Lux

6.11 Voltage Dips and Interruptions

Number of dips	3 T				
Duration	10 s				
Phase	Zero crossing				
Testing Voltage	AC 200 V, AC 250 V, 50 Hz				
Test facility	Shielded room				
Date	2021-04-07				
Temperature(°C)	21.8 °C	Humidity (% R.H.)	41.6 % R.H.	Pressure (㎪)	101.1 ㎪
Remarks	Pass				

6.11.1 Measurement procedure

The dips/interruption test is only applicable to AC mains.
The dips/interruptions were applied at zero crossing.

6.11.2 Used equipments

Equipment	Model no.	Makers	Serial no.	Next Cal. date	Used
EMC IMMUNITY TESTER	IMU3000	EMC PARTNER	105684-2076	2021-06-23	☒
EMC IMMUNITY TESTER	VAR-EXT1000	EMC PARTNER	VAR-EXT1000-1603	2021-06-22	☒

6.11.3 Photographs of test setup

6.11.4 Measurement result

AC 200 V, AC 250 V, 50 Hz

Test Level (%UT)	Dip/Int. (%UT)	Duration /Period	Angle (°)	Count number	Result
70 %	30 %	10 Period	0	3T	A
0 %	100 %	0.5 Period	0 / 180	3T	A

Comment:

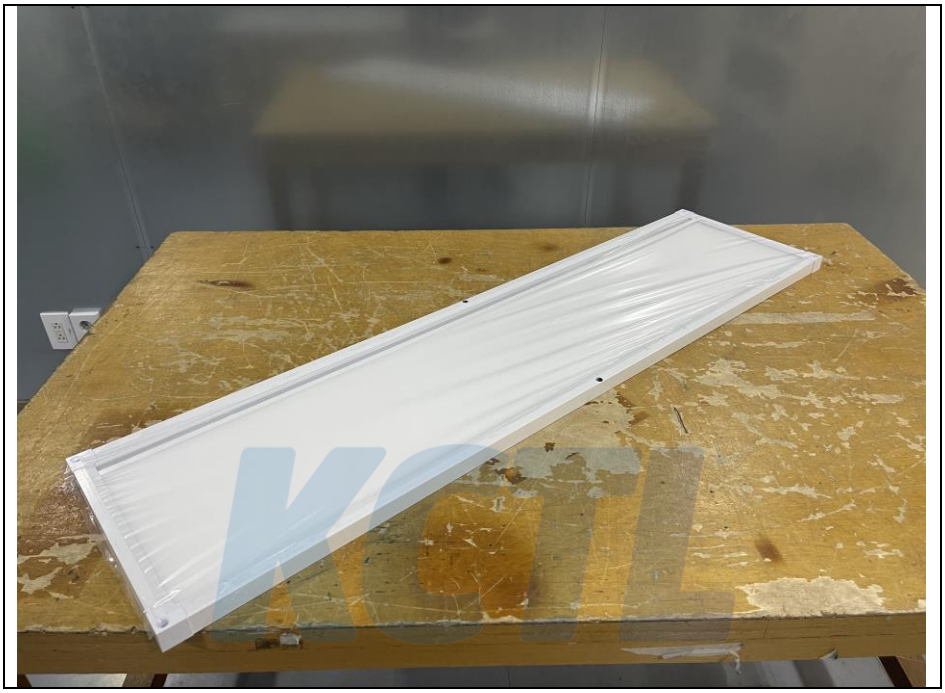
A: There was no change of operation status during above testing.

Lux Meter

Test Level	Dip/Int.	Before	After
70 %	30 %	227 Lux	231 Lux
0 %	100 %	225 Lux	237 Lux

7. EUT photographs

Front View



Rear View

Inside