

EMC TEST REPORT FOR CE CONFORMANCE

Test Report No.	E20WD-046		
Date of test	Dec. 23, 2019 ~ Dec. 24, 2019	Date of Issuing	Feb. 25, 2020

Applicant	ENERPIA CO., LTD.		
Address	#349-13, Samunjin-ro, Hwawon-eup, Dalseong-gun, Daegu, Korea.		
Manufacturer	ENERPIA CO., LTD.		
Address	#349-13, Samunjin-ro, Hwawon-eup, Dalseong-gun, Daegu, Korea.		
Telephone No.	82-53-474-8050	FAX No.	82-53-473-8050

Type of Equipment	HEATING FILM		
Model Name	DW-410	Serial Number	N/A
Multi Model Name	Refer to 10 Page	Brand Name	N/A

Conform to the following product specifications; EMC DIRECTIVE 2014/30/EU

The equipment complies with the standard; EN 55014-1:2017, EN 61000-3-2:2014, EN 61000-3-3:2013 and EN 55014-2:2015 (Category II).

This test report contains only the result of a single test of the sample supplied for the test.

Tested by: 
 Gwui-Hyun, Song / Research Engineer
 StandardBank / EMC Testing Team

Reviewed by: 
 Seung-Ju, Na / Research Engineer
 StandardBank / EMC Testing Team

Revision History

Issued Date	Issue Report No.	Description
Feb. 25, 2020	E20WD-046	All
-	-	-

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1. TEST SUMMARY

1.1 Test standards and results

STANDARDS		RESULTS
EN 55014-1:2017	Mains Terminal Continuous Disturbance Voltage	Met / PASS
	Mains terminal discontinuous disturbance (Click)	Met / PASS
	Disturbance Power	Met / PASS
	Radiated electromagnetic field	N/A
EN 61000-3-2:2014	Harmonic Current Emissions	Met / PASS
EN 61000-3-3:2013	Voltage Changes, Voltage Fluctuations and Flicker	Met / PASS
EN 55014-2:2015 (Category II)	Electrostatic Discharge Immunity	Met Criterion A / PASS
	Radiated RF E-Field Immunity	N/A
	Electrical Fast Transient/Burst Immunity	Met Criterion A / PASS
	Surge Immunity	Met Criterion A / PASS
	Conducted Disturbance induced by RF fields Immunity	Met Criterion A / PASS
	Voltage Dips and Short Interruptions	Met Criterion A / PASS Met Criterion A / PASS Met Criterion A / PASS

1.2 Additions, deviations, exclusions from standards

- The EUT was tested according to EN 55014-2 (Category II) during the immunity test because the clock frequency is less than 15 MHz.
- The EUT has an internal clock frequency of less than 30 MHz, and the Radiated electromagnetic field test is excluded because the noise power margin of 0 dB to 10 dB is satisfied in the 200 MHz to 300 MHz band during the Disturbance Power test.

1.3 Purpose of the test

To determine whether the equipment under test fulfills the EMC requirements of the standards stated in section 1.1.

1.4 Test Facility

The Electromagnetic compatibility measurement facilities are located on at **48, Gunpocheomdansaneop 2-ro, Gunpo-si, Gyeonggi-do, 15880, Republic of Korea.**

Description details of test facilities were submitted to the **RRA** (National Radio Research Agency) **in accordance with** the requirement of ISO 17025, **FCC** (Federal Communications Commission) **MRA**, **Vietnam MRA**, **TUV SUD CARAT** and approved by **VCCI**.

RRA Designation No. : **KR0144** (Sep. 17, 2009)

KOLAS Accreditation No. : **KT558** (Mar. 27, 2013)

FCC MRA Designation No. : **KR0144** (May 06, 2015)

Vietnam MRA Designation No. : **KR0144** (May 13, 2015)

TUV SUD CARAT Recognition of Agent's Testing (Jan. 10, 2019), Certificate No. : **CARAT 086270 0003**

Rev. 00, VCCI member No. : **3096**

- Resistration No :

C-20024 (Facility for measuring conducted emissions at AC mains power ports) : (Feb. 19, 2018)

T-20025 (Facility for measuring conducted emissions at Telecommunication (Wired) ports) : (Apr. 23, 2018)

R-20071 (Facility for measuring radiated emissions below 1 GHz : 10 m method) : (Apr. 22, 2019)

G-20043 (Facility for measuring radiated emissions above 1 GHz : 3 m method) : (Apr. 23, 2018)

1.5 Criterion description

Criterion	Description
A	The apparatus shall continue to operate as intended during the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.
B	The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. During the test, degradation of performance is allowed, however, no change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.
C	Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls, or by any operation specified in the instructions for use. The following Table 14 serves as a guide to formulate the permissible degradation of the equipment under test (EUT) caused by electromagnetic stress. Not all functions of the apparatus need to be tested. The selection, the specification of functions, and the permissible degradation is left to the responsibility of the manufacturer.

1.6. Measurement Uncertainty

The measurement instrumentation uncertainty consideration contained in CISPR 16-4-2.

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

1.6.1 Conducted Emission test

Test site	Measurement Freq. Range	dB (U_{cispr})	Note
Shield room #2 / On Site	9 kHz ~ 150 kHz	3.3	N/A
	150 kHz ~ 30 MHz	2.4	N/A

1.6.2 Conducted Emission at telecom ports test

Test site	Measurement Freq. Range	dB (U_{cispr})	Note
Shield room #2	150 kHz ~ 30 MHz	4.6	N/A

1.6.3 Radiated Emission test

Test site	Measurement Freq. Range	dB (U_{cispr})	Note
Shield room #1	9 kHz ~ 30 MHz (LLA)	0.9	N/A
	30 MHz ~ 300 MHz (Disturbance Power)	3.4	N/A
10 m SAC Chamber / On Site	30 MHz ~ 1 000 MHz	4.4	N/A
3 m SAC Chamber	1 GHz ~ 18 GHz	5.7	N/A

2. EUT (Equipment Under Test)

2.1 Additional information about the EUT

The ENERPIA CO., LTD. Model DW-410 (referred to as the EUT in this report) is a HEATING FILM.

Product specification described herein was obtained from product data sheet or user's manual.

Chassis Type	Plastic / Metal
LIST OF EACH OSC. Or CRY. FREQ.(FREQ. >= 1 MHz)	-
Number of Layer	-
Power Requirement	AC 230 V, 50 Hz
I/O Port	AC IN
Clock frequency	15 MHz Below

2.2 Peripheral equipment

-. Defined as equipment needed for correct operation of the EUT, but not considered as tested:

DESCRIPTION	MODEL NAME	MANUFACTURE NO.	MANUFACTURE	Remark
HEATING FILM	DW-410	N/A	ENERPIA CO., LTD. / KOREA	EUT

2.3 Mode of operation during the test

-. After connecting as the "Test Set-up Configuration for EUT", the test conducted at the maximum operating condition.

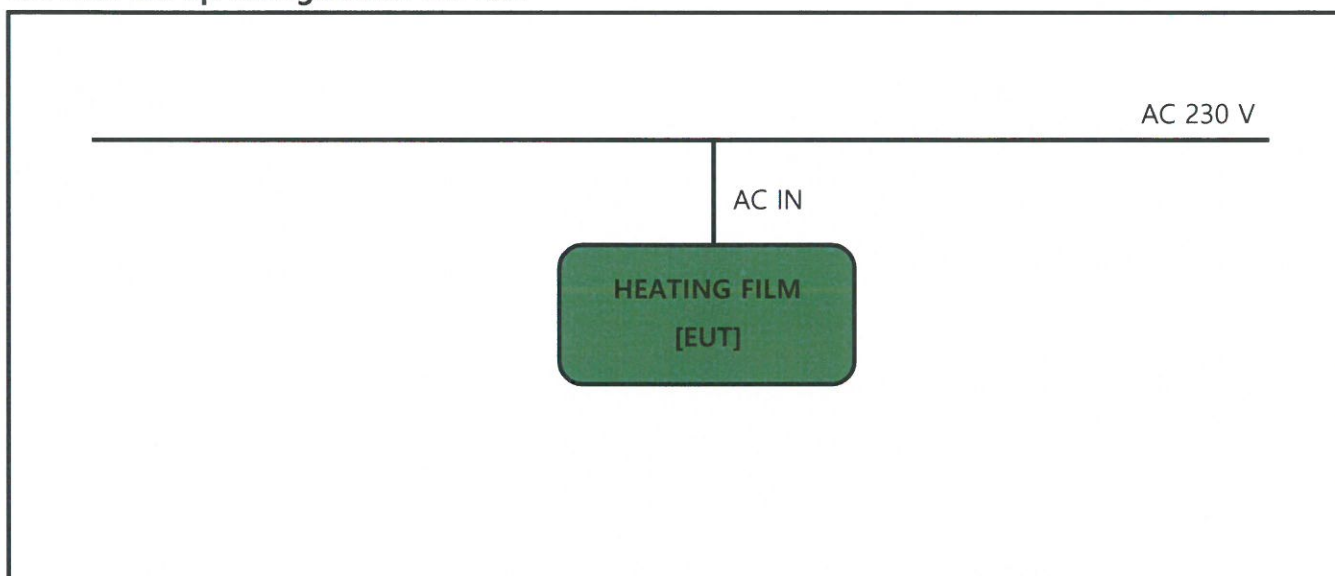
2.4 Alternative type(s)/model(s); also covered by this test report.

Basic Model Name	Multiple Model Name	Model difference
DW-410	EP-305 EP-308 EP-310 DW-305 DW-308 DW-310 EP-410	The temperature controller is identical, and the difference in rated power according to the size of the heating film.

2.5 Cable Description

Ports Name	Shielded	Length (m)	Connector	Connection Point 1	Connection Point 2
AC IN	N	0.6	AC POWER	HEATING FILM [EUT]	POWER

2.6 Test set-up configuration for EUT



3. EUT MODIFICATIONS

-. None.

4. EMISSION TESTS

4.1 MAINS TERMINAL CONTINUOUS DISTURBANCE VOLTAGE

Test Location: Shield Room #2

4.1.1 Operating environment

Ambient temperature	(20.2 ± 0.5) °C
Humidity	(26.7 ± 0.5) % R.H.

4.1.2 Test set-up

The EUT was placed on a wooden table, 0.8 m height above the floor. The EUT was connected to adaptor and the power of adaptor was fed to the EUT through a 50 Ω / 50 μH + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

4.1.3 The using equipment

Description	Model Number	Manufacturer	Serial Number	Last Cal.	Use
EMI RECEIVER	PMM 9010	NARDA	697WW30608	Jun. 14, 2019	☐
MXE TEST RECEIVER	N9038A	KEYSIGHT	MY52260220	Sep. 09, 2019	■
TWO LINE V-NETWORK	ENV216	ROHDE& SCHWARZ	101770	Jan. 07, 2019	■
LISN	LN2-16	EMCIS	LN09009	Jan. 07, 2019	☐
ISN	CAT3 8158	SCHWARZBECK	CAT3 8158 #78	Jun. 21, 2019	☐
8-WIRE ISN	NTFM 8158 CAT5	SCHWARZBECK	211	Oct. 08, 2019	☐
ISN	NTFM 8158 CAT6	SCHWARZBECK	8158-0031	Jan. 10, 2019	☐
ISN	ISN ST08	TESEQ GmbH	32278	Jan. 07, 2019	☐
CDN	CDN S1-75 BNC	EM TEST	P1550168809	Jun. 14, 2019	☐
EMI RECEIVER	PMM 9010	NARDA	697WW30607	Jan. 07, 2019	☐
TWO LINE V-NETWORK	ENV216	ROHDE& SCHWARZ	101771	Jan. 07, 2019	☐
LISN	LN2-16	EMCIS	LN10032	Jun. 14, 2019	☐
ISN	ENY41	ROHDE& SCHWARZ	100026	Jun. 17, 2019	☐
ISN	NTFM 8158 ISN CAT6	SCHWARZBECK	122	Jun. 17, 2019	☐
CDN	CDN S1-75 BNC	EM TEST	P1539164788	Jun. 14, 2019	☐
PREMIUM DTV MODULATOR	TVB597A	TELEVIEW	23.24.20.11. 12.00.00.83	Jun. 14, 2019	☐
EMI RECEIVER	9010	NARDA	495WW10106	Jun. 14, 2019	☐
ARTIFICIAL MAINS NETWORK	L2-16B	PMM	000WX10306	Jun. 14, 2019	☐
LISN	LN2-16	EMCIS	LN10033	Jun. 14, 2019	☐
16A LISN	LS16	AFJ	16011314293	Jan. 07, 2019	☐
TRANSIENT LIMITER	TL-B930M	EMCIS	N/A	Jan. 07, 2019	☐
Pulse Limiter	EPL-30	LIG Nex1	#1	Jan. 08, 2019	☐
LISN	NNLK8121	SCHWARZBECK MESS	12112759-1	Jun. 14, 2019	☐
LISN	NNLK8121	SCHWARZBECK MESS	#711	Apr. 08, 2019	☐
HIGH VOLTAGE PROBE	TK9420	SCHWARZBECK	9420-334	Jun. 14, 2019	☐

All test equipment used is calibrated on a regular basis.

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EMC-EMCD-002(Rev.4)

4.1.4 Test data

Test Date	Dec. 23, 2019
Resolution bandwidth	9 kHz
Frequency range	0.15 MHz ~ 30 MHz
Line	"L": Live Line / "N": Neutral Line

[AC POWER]

[LIVE]

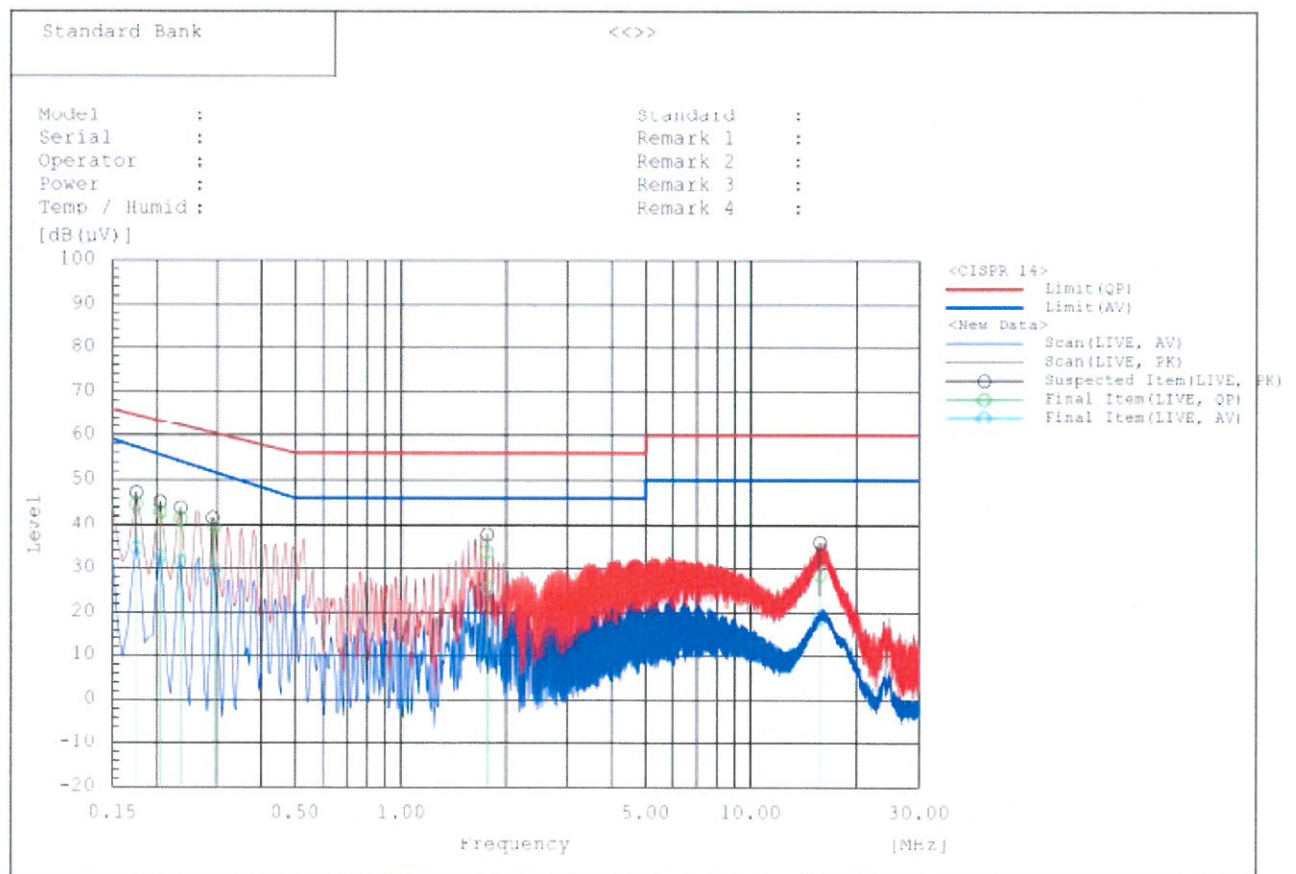
Conducted Emission Test Report

PROFILE

Applicant: ENERPIA CO., LTD.
Type Name: HEATING FILM
Modelname: DW-410
Mode: LIVE

Standard: EN 55014-1
Date: 2019.12.23
Operator: S. G. H
Tem./ Hum.: (20.2 ± 0.5) °C / (26.7 ± 0.5) % R.H.

SCREEN SHOT



Final Result

--- LIVE (QP) ---

No.	Frequency [MHz]	Reading [dB(μV)]	c.f [dB]	Result [dB(μV)]	Limit [dB(μV)]	Margin [dB]
1	0.175	34.6	10.0	44.6	64.7	20.1
2	0.205	33.1	9.8	42.9	63.8	20.9
3	0.235	31.8	9.7	41.5	62.9	21.4
4	0.294	29.7	9.7	39.4	60.4	21.0
5	1.762	24.0	9.7	33.7	56.0	22.3
6	15.702	18.8	9.8	28.6	49.0	21.4

--- LIVE (AV) ---

No.	Frequency [MHz]	Reading [dB(μV)]	c.f [dB]	Result [dB(μV)]	Limit [dB(μV)]	Margin [dB]
1	0.175	24.5	10.0	34.5	54.7	20.2
2	0.205	22.9	9.8	32.7	53.8	21.1
3	0.235	21.6	9.7	31.3	52.9	21.6
4	0.294	20.1	9.7	29.8	50.4	21.6
5	1.762	18.8	9.7	28.5	46.0	20.5
6	15.702	9.2	9.8	19.0	39.0	21.0

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EMC-EMCD-002(Rev.4)

[NEUTRAL]

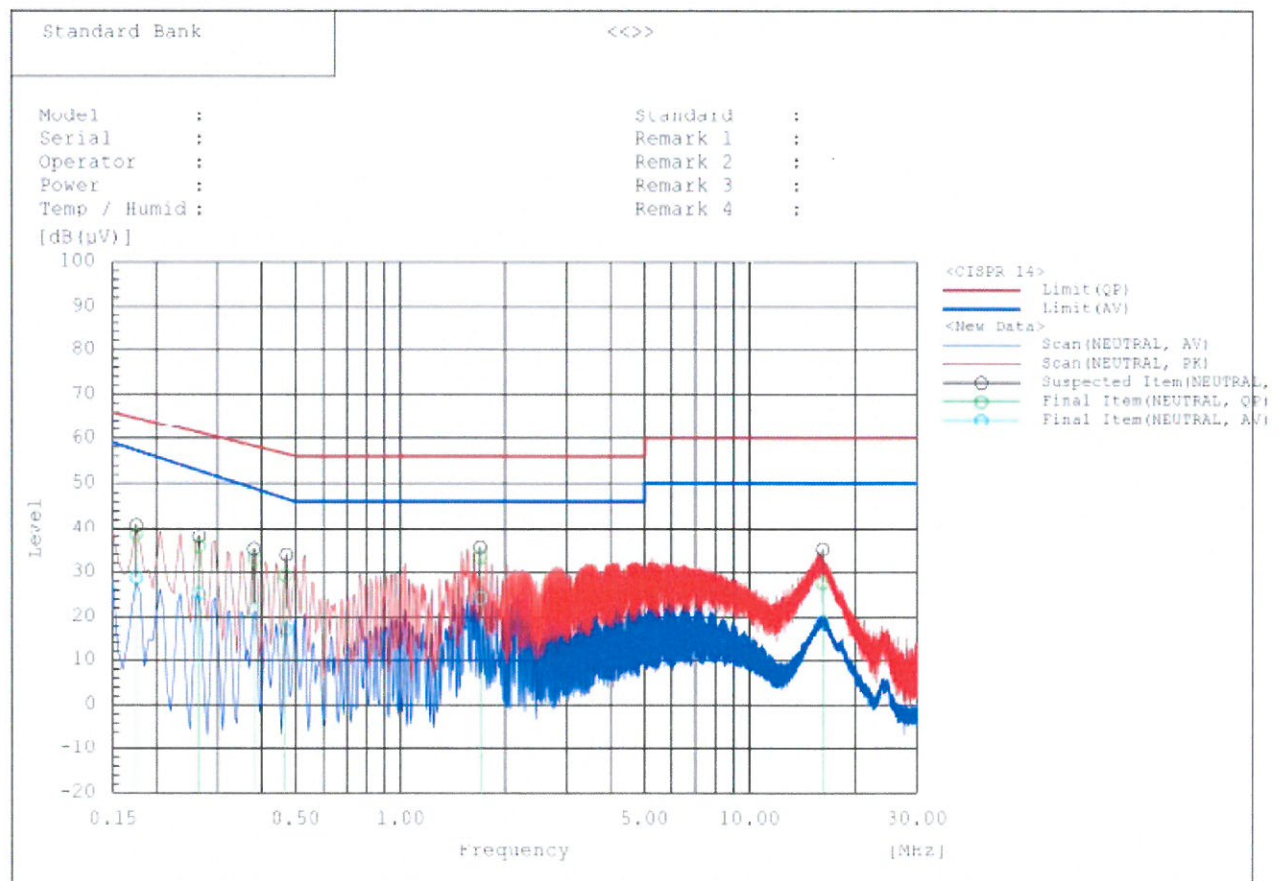
Conducted Emission Test Report

PROFILE

Applicant: ENERPIA CO., LTD.
Type Name: HEATING FILM
Modelname: DW-410
Mode: NEUTRAL

Standard: EN 55014-1
Date: 2019.12.23
Operator: S. G. H
Tem./ Hum.: (20.2 ± 0.5) °C / (26.7 ± 0.5) % R.H.

SCREEN SHOT



Final Result

--- NEUTRAL (QP) ---						
No.	Frequency [MHz]	Reading [dB(μV)]	c.f [dB]	Result [dB(μV)]	Limit [dB(μV)]	Margin [dB]
1	0.175	28.6	10.0	38.6	64.7	26.1
2	0.245	26.2	9.6	35.8	61.3	25.5
3	0.382	23.2	9.8	33.0	58.2	25.2
4	0.486	19.6	9.9	29.4	54.4	25.0
5	1.697	23.6	9.7	33.3	56.9	23.7
6	16.998	17.9	9.8	27.7	60.0	32.3

--- NEUTRAL (AV) ---						
No.	Frequency [MHz]	Reading [dB(μV)]	c.f [dB]	Result [dB(μV)]	Limit [dB(μV)]	Margin [dB]
1	0.175	18.9	10.0	28.9	51.9	23.0
2	0.245	15.7	9.6	25.3	52.9	27.6
3	0.382	12.0	9.8	21.8	48.9	27.1
4	0.486	7.2	9.9	17.1	46.8	29.7
5	1.697	14.6	9.7	24.3	46.9	22.7
6	16.998	9.1	9.8	18.9	50.0	31.1

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4.2 MAINS TERMINAL DISCONTINUOUS DISTURBANCE (CLICK)

Test Location: Shield Room #2

4.2.1 Operating environment

Ambient temperature	(20.4 ± 0.5) °C
Humidity	(26.5 ± 0.5) % R.H.

4.2.2 Test set-up

The EUT was placed on a wooden table, 0.8 meters height above the floor. Power was fed to the EUT through a 50 ohm/ 50 uH + 5 ohm Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

4.2.3 Test equipment used

Description	Model Number	Manufacturer	Serial Number	Last Cal.	Use
CLICK METER	CL55C	AFJ Instruments	55041246208	Jan. 07, 2019	■
TWO LINE V-NETWORK	ENV216	ROHDE&SCHWARZ	101771	Jan. 07, 2019	□
TWO LINE V-NETWORK	ENV216	ROHDE&SCHWARZ	101770	Jan. 07, 2019	■
LISN	NNLK8121	SCHWARZBECK MESS	12112759-1	Jun. 14, 2019	□

All test equipment used is calibrated on a regular basis.

4.2.4 Test data

Test Date	Dec. 23, 2019
Observation time (min)	120
Click Frequency	150 kHz, 500 kHz, 1.4 MHz, 30 MHz

[AC POWER]

[LIVE]

CL55 Test report by AFJ

Title	ENERPIA CO., LTD.	Pass # 1
Date	23/12/2019	Time 120:01.145
Required by		
Executed by		
Required by		
Description		
Model	DW-410	
Serial #		
Type	LIVE	
Report		

First Pass	Rx1 150kHz	Rx2 500kHz	Rx3 1.4MHz	Rx4 30MHz
Short	0	0	0	0
Long	0	0	0	0
Fast Long (< 20ms)	0	0	0	0
Total Clicks	0	0	0	0
Continuous Events	0	0	0	0
Switch Op	0	0	0	0
2 Click	0	0	0	0
Continuous Time	0.00	0.00	0.00	0.00
Limit dBuV	66.00	56.00	56.00	60.00
N	0.00	0.00	0.00	0.00
Offsets	None	None	None	None
Pass	1	1	1	1
Limit dBuV	66.00	56.00	56.00	60.00
Allowed Clicks	0	0	0	0
Second Pass	Rx1 150kHz	Rx2 500kHz	Rx3 1.4MHz	Rx4 30MHz
2th pass Short	0	0	0	0
2th pass Long	0	0	0	0
2th Total Clicks	0	0	0	0
2th Continuous Events	0	0	0	0
2th 2 Click	0	0	0	0
2th Continuous Time	0.00	0.00	0.00	0.00

Status Pass

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EMC-EMCD-002(Rev.4)

[NEUTRAL]

CL55 Test report by AFJ

Title	ENERPIA CO., LTD.	Pass # 1
Date	23/12/2019	Time 120:01.241
Required by		
Executed by		
Required by		
Description		
Model	DW-410	
Serial #		
Type	NEUTRAL	
Report		

First Pass	Rx1 150kHz	Rx2 500kHz	Rx3 1.4MHz	Rx4 30MHz
Short	0	0	0	0
Long	0	0	0	0
Fast Long (< 20ms)	0	0	0	0
Total Clicks	0	0	0	0
Continuous Events	0	0	0	0
Switch Op	0	0	0	0
2 Click	0	0	0	0
Continuous Time	0.00	0.00	0.00	0.00
Limit dBuV	66.00	56.00	56.00	60.00
N	0.00	0.00	0.00	0.00
Offsets	None	None	None	None
Pass	1	1	1	1
Limit dBuV	66.00	56.00	56.00	60.00
Allowed Clicks	0	0	0	0

Second Pass	Rx1 150kHz	Rx2 500kHz	Rx3 1.4MHz	Rx4 30MHz
2th pass Short	0	0	0	0
2th pass Long	0	0	0	0
2th Total Clicks	0	0	0	0
2th Continuous Events	0	0	0	0
2th 2 Click	0	0	0	0
2th Continuous Time	0.00	0.00	0.00	0.00

Status Pass

4.3 DISTURBANCE POWER

Test Location: Shield Room #1

4.3.1 Operating environment

Ambient temperature	(16.3 ± 0.5) °C
Humidity	(31.1 ± 0.5) % R.H.

4.3.2 Test set-up

The EUT was placed on a non-metallic table approximately 0.8 meters above the ground plane. At the rear side of the EUT, a non-metallic table of length 6 m was placed to provide for movement of the absorbing clamp. The absorbing clamp was applied successively to all leads whose length was 25 cm or longer, unscreened and screened. The frequency spectrum from 30 MHz to 300 MHz was scanned and emission levels maximized at each frequency recorded. The AC main cable was varied in length to 6.0 meters in order to determine the maximum emission levels.

4.3.3 The using equipment

Description	Model Number	Manufacturer	Serial Number	Last Cal.	Use
EMI Test Receiver	ESCI7	ROHDE&SCHWARZ	100971	Jun. 14, 2019	☐
EMI TEST RECEIVER	ESCI3	ROHDE&SCHWARZ	100598	Jan. 07, 2019	☒
Absorbing Clamp	MDS21	LUTHI	4179	Jun. 20, 2019	☐
Absorbing Clamp	MDS21	ROHDE&SCHWARZ	100821	Jan. 08, 2019	☒

All test equipment used is calibrated on a regular basis.

4.3.4 Test data

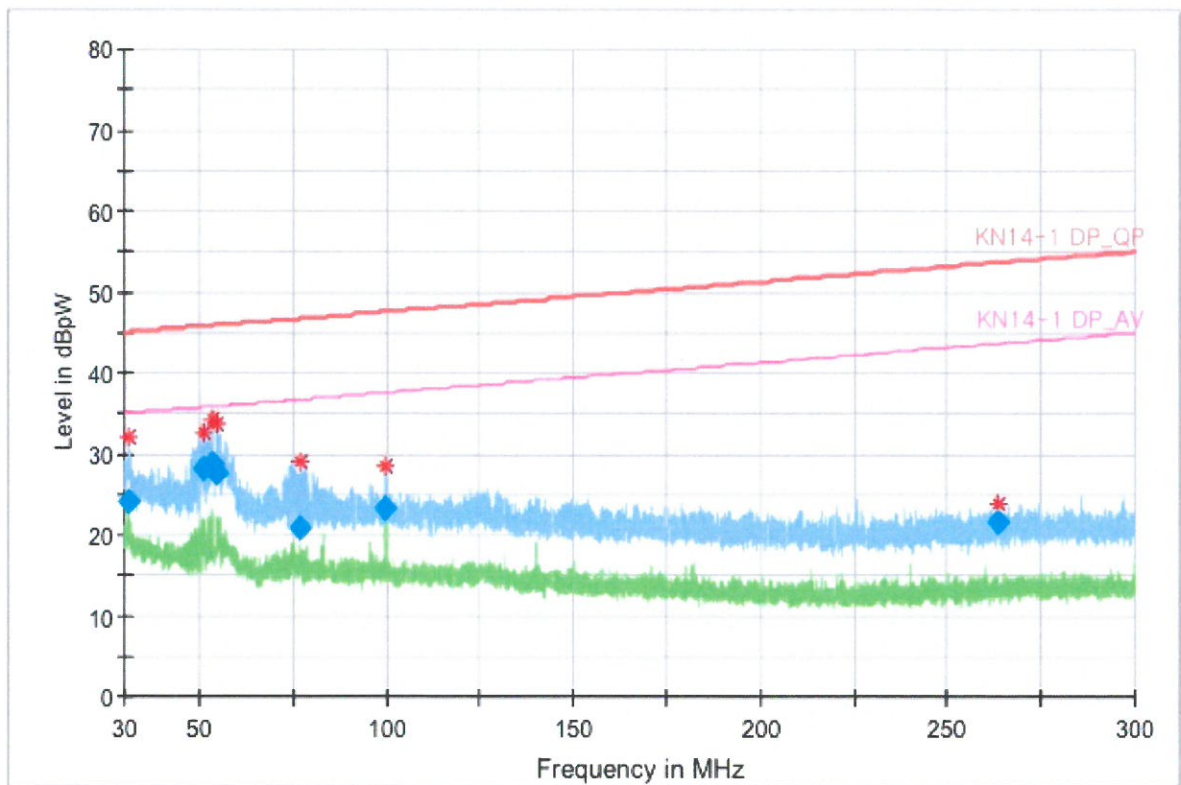
Test Date	Dec. 23, 2019
Resolution bandwidth	120 kHz
Frequency range	30 MHz ~ 300 MHz
Coupling Location	AC IN, Sensor

[AC IN]

Disturbance Power Report

Common Information

Test Model: DW-410
Temp & Humidity: (16.3 ± 0.5) °C / (31.1 ± 0.5) % R.H.
Operator Name: S. G. H
Test Date: 2019.12.23
Description: AC



Final Result

Frequency (MHz)	QuasiPeak (dBpW)	CAverage (dBpW)	Limit (dBpW)	Margin (dB)	Position (cm)	Corr. (dB)
31.417500	24.14	---	45.05	20.92	100.0	9.1
51.262500	28.16	---	45.79	17.63	0.0	6.2
53.557500	28.86	---	45.87	17.02	0.0	6.1
54.671250	27.63	---	45.91	18.29	300.0	6.0
77.013750	20.88	---	46.74	25.86	100.0	5.5
99.862500	23.40	---	47.59	24.19	0.0	5.6
263.651250	21.76	---	53.65	31.89	500.0	3.6

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Tel: (82)31-393-9394 Fax: (82)31-393-9392

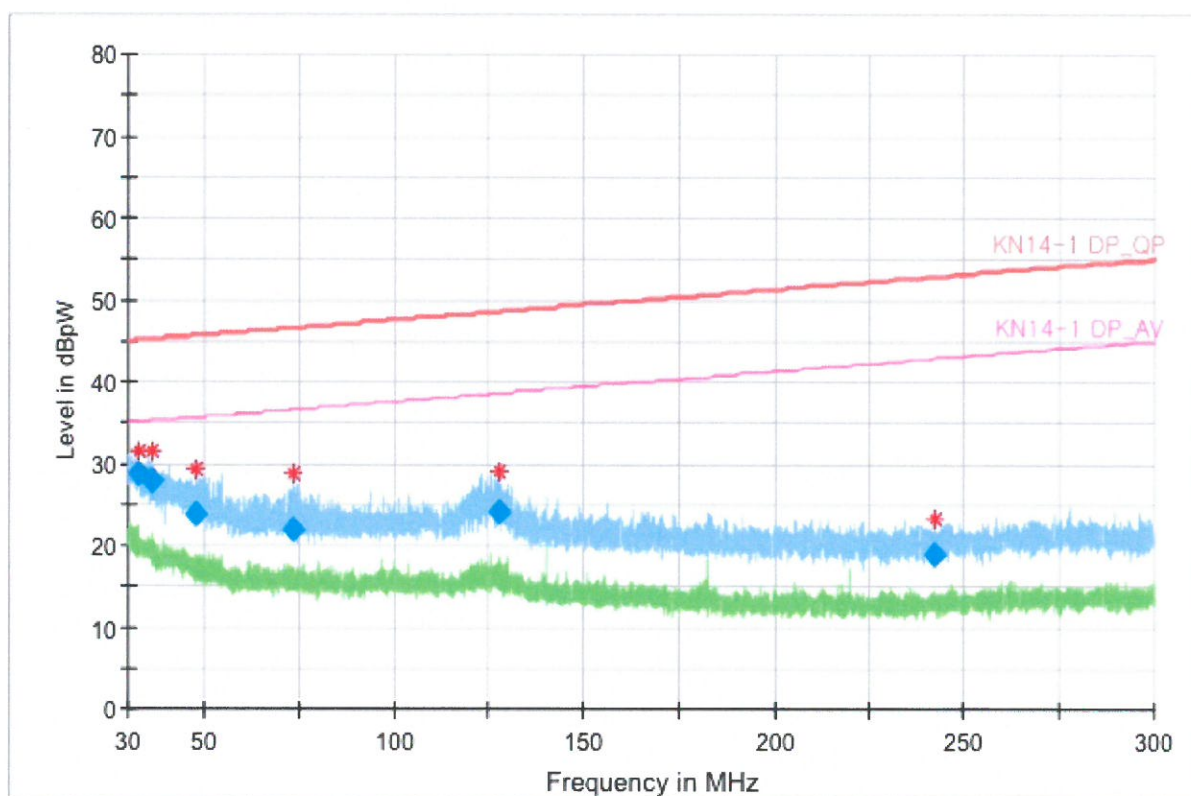
EMC-EMCD-002(Rev.4)

[Sensor]

Disturbance Power Report

Common Information

Test Model: DW-410
Temp & Humidity: (16.3 ± 0.5) °C / (31.1 ± 0.5) % R.H.
Operator Name: S. G. H
Test Date: 2019.12.23
Description: Sensor



Final Result

Frequency (MHz)	QuasiPeak (dBpW)	CAverage (dBpW)	Limit (dBpW)	Margin (dB)	Position (cm)	Corr. (dB)
32.801250	28.75	---	45.10	16.35	100.0	8.8
36.277500	27.87	---	45.23	17.36	300.0	8.3
47.955000	23.71	---	45.67	21.95	400.0	6.2
73.335000	21.98	---	46.61	24.62	200.0	5.6
127.571250	24.14	---	48.61	24.47	100.0	4.8
242.321250	18.83	---	52.86	34.03	100.0	3.2

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EMC - EMCD-002(Rev.4)

4.4 HARMONIC CURRENT EMISSIONS

Test Location: Shield Room #1

4.4.1 Operating environment

Ambient temperature	(16.5 ± 0.5) °C
Humidity	(31.3 ± 0.5) % R.H.

4.4.2 Test set-up

Harmonics of the fundamental current were measured up to 2 kHz using a universal power analyzer. The measurements were carried out under steady conditions and using average. Before making measurements, it is necessary for the EUT to decide which class the EUT fulfills into; A, B, C or D.

4.4.3 Measurement uncertainty

The uncertainty of our equipments for harmonic measurement is 0.2 %.(Confidence level about 95 %, $k = 2$)

4.4.4 The using equipment

Description	Model Number	Manufacturer	Serial Number	Last Cal.	Use
Precision Power Analyzer	LMG670	ZIMMER	1781512	Jun. 21, 2019	■
Reference Impedance	NI2415	ZIMMER	A1605110	Jun. 22, 2018	■
AC Power Source	390AMXT-UPC32	PACIFIC	0184/Master	Jan. 09, 2019	■
AC Power Source	390AMXT-UPC32	PACIFIC	0184/Slave	Jan. 09, 2019	■
Magnetics Module	134310	PACIFIC	0357	N/A	■
Magnetics Module	134310	PACIFIC	0361	N/A	■

All test equipment used is calibrated on a regular basis.

4.4.5 Test data

Test Date	Dec. 23, 2019
Class	A
Test Result	Pass
Remarks	See next page for Harmonics on AC Mains test data.

Test Report

was tested according to

EN 61000-4-7:2002 + A1:2009

EN 61000-3-2:2014 (Table 1)

Test result was

OK

Test Settings

Test

Measuring Standard	EN 61000-4-7:2002 + A1:2009
Limits	EN 61000-3-2:2014 (Table 1)
Test Date	23.12.2019
Test Time	23:10:30
Measurement Duration	00:02:30
EUT Classification	Class A
EUT / Measurement Setup	
Power Supply	
Nominal Voltage	230V
Nominal Frequency	50Hz

EUT Details

Brand	ENERPIA CO., LTD.
Model	DW-410

Laboratory Details

Name	
Address	

Test Equipment

Power Meter

Manufacturer	ZES ZIMMER Electronic Systems GmbH
Model	LMG670
Serial Number	01781512
Software Version	3.001-R51143
Analysis Software	ZES ZIMMER LMG600 Control 3.001-R51143

Additional Measurands - Informative

Additional Measurands

$U_{rms, L1}$	229.614 V	$U_{pp, L1}$	649.621 V	$U_{dc, L1}$	201.124 mV
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EMC - EMCD-002(Rev.4)

U _{cf, L1}	1.41557	I _{rms, L1}	540.291 mA	I _{pp, L1}	1.67251 A
I _{dc, L1}	-4.76701 mA	I _{cf, L1}	1.55577	P _{L1}	123.987 W
Q _{L1}	4.2139 var	S _{L1}	124.058 VA	PF _{L1}	0.99942
f _{cycle, L1}	50.0 Hz				

Result Overview

Test Name	Test Result	Limit Usage	Info
Supply Voltage Frequency Test (61000-4-7) [L1]	OK		50.00 Hz (50.00 Hz ± 0.5%)
Supply peak voltage test (61000-4-7) [L1]	OK		
Positive peak test	OK		All positive peak values within the allowed range
Negative peak test	OK		All negative peak values within the allowed range
Supply peak position test (61000-4-7) [L1]	OK		All peak values within the allowed range
Supply Voltage Harmonic Distortion Test (61000-4-7) [L1]	OK		
Voltage Distortion H2	OK	6.8%	0.01% < 0.20%
Voltage Distortion H3	OK	3.5%	0.03% < 0.90%
Voltage Distortion H4	OK	3.1%	0.01% < 0.20%
Voltage Distortion H5	OK	3.6%	0.01% < 0.40%
Voltage Distortion H6	OK	1.5%	0.00% < 0.20%
Voltage Distortion H7	OK	4.4%	0.01% < 0.30%
Voltage Distortion H8	OK	1.1%	0.00% < 0.20%
Voltage Distortion H9	OK	2.8%	0.01% < 0.20%
Voltage Distortion H10	OK	2.1%	0.00% < 0.20%
Voltage Distortion H11	OK	6.2%	0.01% < 0.10%
Voltage Distortion H12	OK	3.5%	0.00% < 0.10%
Voltage Distortion H13	OK	3.7%	0.00% < 0.10%
Voltage Distortion H14	OK	1.9%	0.00% < 0.10%
Voltage Distortion H15	OK	3.6%	0.00% < 0.10%
Voltage Distortion H16	OK	1.1%	0.00% < 0.10%
Voltage Distortion H17	OK	3.0%	0.00% < 0.10%
Voltage Distortion H18	OK	0.7%	0.00% < 0.10%
Voltage Distortion H19	OK	2.8%	0.00% < 0.10%
Voltage Distortion H20	OK	0.6%	0.00% < 0.10%
Voltage Distortion H21	OK	1.4%	0.00% < 0.10%
Voltage Distortion H22	OK	0.6%	0.00% < 0.10%
Voltage Distortion H23	OK	1.3%	0.00% < 0.10%
Voltage Distortion H24	OK	0.9%	0.00% < 0.10%
Voltage Distortion H25	OK	2.1%	0.00% < 0.10%
Voltage Distortion H26	OK	0.7%	0.00% < 0.10%
Voltage Distortion H27	OK	1.3%	0.00% < 0.10%
Voltage Distortion H28	OK	0.6%	0.00% < 0.10%
Voltage Distortion H29	OK	1.2%	0.00% < 0.10%
Voltage Distortion H30	OK	0.4%	0.00% < 0.10%
Voltage Distortion H31	OK	0.9%	0.00% < 0.10%
Voltage Distortion H32	OK	0.4%	0.00% < 0.10%
Voltage Distortion H33	OK	1.0%	0.00% < 0.10%
Voltage Distortion H34	OK	0.8%	0.00% < 0.10%
Voltage Distortion H35	OK	1.2%	0.00% < 0.10%
Voltage Distortion H36	OK	0.6%	0.00% < 0.10%
Voltage Distortion H37	OK	1.2%	0.00% < 0.10%
Voltage Distortion H38	OK	0.6%	0.00% < 0.10%
Voltage Distortion H39	OK	0.7%	0.00% < 0.10%
Voltage Distortion H40	OK	0.4%	0.00% < 0.10%
Frequency groups up to	OK		

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9kHz (61000-4-7) [L1]			
Table 1 Harmonic Current			
Test (61000-3-2) [L1]			
Harmonic Current Test			
100%			
100% Test H2	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H3	OK	0.3%	Limit met (0.007 A ≤ 2.300 A)
100% Test H4	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H5	OK	0.6%	Limit met (0.007 A ≤ 1.140 A)
100% Test H6	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H7	OK	0.8%	Limit met (0.006 A ≤ 0.770 A)
100% Test H8	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H9	OK	1.5%	Limit met (0.006 A ≤ 0.400 A)
100% Test H10	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H11	OK	1.6%	Limit met (0.005 A ≤ 0.330 A)
100% Test H12	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H13	OK		No test required (0.005 A ≤ 0.005 A)
100% Test H14	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H15	OK		No test required (0.004 A ≤ 0.005 A)
100% Test H16	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H17	OK		No test required (0.004 A ≤ 0.005 A)
100% Test H18	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H19	OK		No test required (0.003 A ≤ 0.005 A)
100% Test H20	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H21	OK		No test required (0.002 A ≤ 0.005 A)
100% Test H22	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H23	OK		No test required (0.002 A ≤ 0.005 A)
100% Test H24	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H25	OK		No test required (0.002 A ≤ 0.005 A)
100% Test H26	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H27	OK		No test required (0.001 A ≤ 0.005 A)
100% Test H28	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H29	OK		No test required (0.001 A ≤ 0.005 A)
100% Test H30	OK		No test required (0.000 A

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100% Test H31	OK		$\leq 0.005 \text{ A}$ No test required (0.001 A $\leq 0.005 \text{ A}$)
100% Test H32	OK		No test required (0.000 A $\leq 0.005 \text{ A}$)
100% Test H33	OK		No test required (0.001 A $\leq 0.005 \text{ A}$)
100% Test H34	OK		No test required (0.000 A $\leq 0.005 \text{ A}$)
100% Test H35	OK		No test required (0.001 A $\leq 0.005 \text{ A}$)
100% Test H36	OK		No test required (0.000 A $\leq 0.005 \text{ A}$)
100% Test H37	OK		No test required (0.001 A $\leq 0.005 \text{ A}$)
100% Test H38	OK		No test required (0.000 A $\leq 0.005 \text{ A}$)
100% Test H39	OK		No test required (0.001 A $\leq 0.005 \text{ A}$)
100% Test H40	OK		No test required (0.000 A $\leq 0.005 \text{ A}$)
Harmonic Current Test 150%	OK		
150% Test H2	OK		No test required (0.000 A $\leq 0.005 \text{ A}$)
150% Test H3	OK	0.2%	Limit met (0.007 A $\leq 3.450 \text{ A}$)
150% Test H4	OK		No test required (0.000 A $\leq 0.005 \text{ A}$)
150% Test H5	OK	0.4%	Limit met (0.007 A $\leq 1.710 \text{ A}$)
150% Test H6	OK		No test required (0.000 A $\leq 0.005 \text{ A}$)
150% Test H7	OK	0.6%	Limit met (0.006 A $\leq 1.155 \text{ A}$)
150% Test H8	OK		No test required (0.000 A $\leq 0.005 \text{ A}$)
150% Test H9	OK	1.0%	Limit met (0.006 A $\leq 0.600 \text{ A}$)
150% Test H10	OK		No test required (0.000 A $\leq 0.005 \text{ A}$)
150% Test H11	OK	1.1%	Limit met (0.005 A $\leq 0.495 \text{ A}$)
150% Test H12	OK		No test required (0.000 A $\leq 0.005 \text{ A}$)
150% Test H13	OK		No test required (0.005 A $\leq 0.005 \text{ A}$)
150% Test H14	OK		No test required (0.000 A $\leq 0.005 \text{ A}$)
150% Test H15	OK		No test required (0.004 A $\leq 0.005 \text{ A}$)
150% Test H16	OK		No test required (0.000 A $\leq 0.005 \text{ A}$)
150% Test H17	OK		No test required (0.004 A $\leq 0.005 \text{ A}$)
150% Test H18	OK		No test required (0.000 A $\leq 0.005 \text{ A}$)
150% Test H19	OK		No test required (0.003 A $\leq 0.005 \text{ A}$)
150% Test H20	OK		No test required (0.000 A $\leq 0.005 \text{ A}$)
150% Test H21	OK		No test required (0.002 A

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150% Test H22	OK		≤ 0.005 A) No test required (0.000 A ≤ 0.005 A)
150% Test H23	OK		No test required (0.002 A ≤ 0.005 A)
150% Test H24	OK		No test required (0.000 A ≤ 0.005 A)
150% Test H25	OK		No test required (0.002 A ≤ 0.005 A)
150% Test H26	OK		No test required (0.000 A ≤ 0.005 A)
150% Test H27	OK		No test required (0.001 A ≤ 0.005 A)
150% Test H28	OK		No test required (0.000 A ≤ 0.005 A)
150% Test H29	OK		No test required (0.001 A ≤ 0.005 A)
150% Test H30	OK		No test required (0.000 A ≤ 0.005 A)
150% Test H31	OK		No test required (0.001 A ≤ 0.005 A)
150% Test H32	OK		No test required (0.000 A ≤ 0.005 A)
150% Test H33	OK		No test required (0.001 A ≤ 0.005 A)
150% Test H34	OK		No test required (0.000 A ≤ 0.005 A)
150% Test H35	OK		No test required (0.001 A ≤ 0.005 A)
150% Test H36	OK		No test required (0.000 A ≤ 0.005 A)
150% Test H37	OK		No test required (0.001 A ≤ 0.005 A)
150% Test H38	OK		No test required (0.000 A ≤ 0.005 A)
150% Test H39	OK		No test required (0.001 A ≤ 0.005 A)
150% Test H40	OK		No test required (0.000 A ≤ 0.005 A)
Harmonic Current Test	OK		
200%			
200% Test H2	OK		No test required (0.000 A ≤ 0.005 A)
200% Test H3	OK	0.2%	Limit met (0.007 A ≤ 4.600 A)
200% Test H4	OK		No test required (0.000 A ≤ 0.005 A)
200% Test H5	OK	0.3%	Limit met (0.007 A ≤ 2.280 A)
200% Test H6	OK		No test required (0.000 A ≤ 0.005 A)
200% Test H7	OK	0.4%	Limit met (0.006 A ≤ 1.540 A)
200% Test H8	OK		No test required (0.000 A ≤ 0.005 A)
200% Test H9	OK	0.8%	Limit met (0.006 A ≤ 0.800 A)
200% Test H10	OK		No test required (0.000 A ≤ 0.005 A)
200% Test H11	OK	0.8%	Limit met (0.005 A ≤ 0.660 A)
200% Test H12	OK		No test required (0.000 A

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200% Test H13	OK		$\leq 0.005 \text{ A}$ No test required ($0.005 \text{ A} \leq 0.005 \text{ A}$)
200% Test H14	OK		No test required ($0.000 \text{ A} \leq 0.005 \text{ A}$)
200% Test H15	OK		No test required ($0.004 \text{ A} \leq 0.005 \text{ A}$)
200% Test H16	OK		No test required ($0.000 \text{ A} \leq 0.005 \text{ A}$)
200% Test H17	OK		No test required ($0.004 \text{ A} \leq 0.005 \text{ A}$)
200% Test H18	OK		No test required ($0.000 \text{ A} \leq 0.005 \text{ A}$)
200% Test H19	OK		No test required ($0.003 \text{ A} \leq 0.005 \text{ A}$)
200% Test H20	OK		No test required ($0.000 \text{ A} \leq 0.005 \text{ A}$)
200% Test H21	OK		No test required ($0.002 \text{ A} \leq 0.005 \text{ A}$)
200% Test H22	OK		No test required ($0.000 \text{ A} \leq 0.005 \text{ A}$)
200% Test H23	OK		No test required ($0.002 \text{ A} \leq 0.005 \text{ A}$)
200% Test H24	OK		No test required ($0.000 \text{ A} \leq 0.005 \text{ A}$)
200% Test H25	OK		No test required ($0.002 \text{ A} \leq 0.005 \text{ A}$)
200% Test H26	OK		No test required ($0.000 \text{ A} \leq 0.005 \text{ A}$)
200% Test H27	OK		No test required ($0.001 \text{ A} \leq 0.005 \text{ A}$)
200% Test H28	OK		No test required ($0.000 \text{ A} \leq 0.005 \text{ A}$)
200% Test H29	OK		No test required ($0.001 \text{ A} \leq 0.005 \text{ A}$)
200% Test H30	OK		No test required ($0.000 \text{ A} \leq 0.005 \text{ A}$)
200% Test H31	OK		No test required ($0.001 \text{ A} \leq 0.005 \text{ A}$)
200% Test H32	OK		No test required ($0.000 \text{ A} \leq 0.005 \text{ A}$)
200% Test H33	OK		No test required ($0.001 \text{ A} \leq 0.005 \text{ A}$)
200% Test H34	OK		No test required ($0.000 \text{ A} \leq 0.005 \text{ A}$)
200% Test H35	OK		No test required ($0.001 \text{ A} \leq 0.005 \text{ A}$)
200% Test H36	OK		No test required ($0.000 \text{ A} \leq 0.005 \text{ A}$)
200% Test H37	OK		No test required ($0.001 \text{ A} \leq 0.005 \text{ A}$)
200% Test H38	OK		No test required ($0.000 \text{ A} \leq 0.005 \text{ A}$)
200% Test H39	OK		No test required ($0.001 \text{ A} \leq 0.005 \text{ A}$)
200% Test H40	OK		No test required ($0.000 \text{ A} \leq 0.005 \text{ A}$)
POHC Test	OK		POHC Limit met ($0.005 \text{ A} \leq 0.251 \text{ A}$)
100% Test H2	OK		No test required ($0.000 \text{ A} \leq 0.005 \text{ A}$)
100% Test H3	OK	0.3%	Limit met ($0.007 \text{ A} \leq$

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100% Test H4	OK		2.300 A) No test required (0.000 A ≤ 0.005 A)
100% Test H5	OK	0.6%	Limit met (0.007 A ≤ 1.140 A)
100% Test H6	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H7	OK	0.8%	Limit met (0.006 A ≤ 0.770 A)
100% Test H8	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H9	OK	1.5%	Limit met (0.006 A ≤ 0.400 A)
100% Test H10	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H11	OK	1.6%	Limit met (0.005 A ≤ 0.330 A)
100% Test H12	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H13	OK		No test required (0.005 A ≤ 0.005 A)
100% Test H14	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H15	OK		No test required (0.004 A ≤ 0.005 A)
100% Test H16	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H17	OK		No test required (0.004 A ≤ 0.005 A)
100% Test H18	OK		No test required (0.000 A ≤ 0.005 A)
100% Test H19	OK		No test required (0.003 A ≤ 0.005 A)
100% Test H20	OK		No test required (0.000 A ≤ 0.005 A)
150% Test H21	OK		No test required (0.002 A ≤ 0.005 A)
100% Test H22	OK		No test required (0.000 A ≤ 0.005 A)
150% Test H23	OK		No test required (0.002 A ≤ 0.005 A)
100% Test H24	OK		No test required (0.000 A ≤ 0.005 A)
150% Test H25	OK		No test required (0.002 A ≤ 0.005 A)
100% Test H26	OK		No test required (0.000 A ≤ 0.005 A)
150% Test H27	OK		No test required (0.001 A ≤ 0.005 A)
100% Test H28	OK		No test required (0.000 A ≤ 0.005 A)
150% Test H29	OK		No test required (0.001 A ≤ 0.005 A)
100% Test H30	OK		No test required (0.000 A ≤ 0.005 A)
150% Test H31	OK		No test required (0.001 A ≤ 0.005 A)
100% Test H32	OK		No test required (0.000 A ≤ 0.005 A)
150% Test H33	OK		No test required (0.001 A ≤ 0.005 A)
100% Test H34	OK		No test required (0.000 A

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150% Test H35	OK	$\leq 0.005 \text{ A}$ No test required (0.001 A $\leq 0.005 \text{ A}$)
100% Test H36	OK	No test required (0.000 A $\leq 0.005 \text{ A}$)
150% Test H37	OK	No test required (0.001 A $\leq 0.005 \text{ A}$)
100% Test H38	OK	No test required (0.000 A $\leq 0.005 \text{ A}$)
150% Test H39	OK	No test required (0.001 A $\leq 0.005 \text{ A}$)
100% Test H40	OK	No test required (0.000 A $\leq 0.005 \text{ A}$)

4.5 VOLTAGE CHANGES, VOLTAGE FLUCTUATIONS AND FLICKER

Test Location: Shield Room #1

4.5.1 Operating environment

Ambient temperature	(16.5 ± 0.5) °C
Humidity	(31.3 ± 0.5) % R.H.

4.5.2 Test set-up

The voltage changes at the supply terminals were measured across the complex reference impedance $Z = 0.4 + j0.25\Omega$. The short-term flicker values are measured during a time interval of 10 minutes. D_c = relative voltage change between two steady states and D_{max} = maximum single voltage change, are measured over the reference impedance.

4.5.3 Measurement uncertainty

The uncertainty of our equipment for flicker measurement is 5 %.(Confidence level about 95 %, $k = 2$)

4.5.4 The using equipment

Description	Model Number	Manufacturer	Serial Number	Last Cal.	Use
Precision Power Analyzer	LMG670	ZIMMER	1781512	Jun. 19, 2019	■
Reference Impedance	NI2415	ZIMMER	A1605110	Jun. 22, 2018	■
AC Power Source	390AMXT-UPC32	PACIFIC	0184/Master	Jan. 09, 2019	■
AC Power Source	390AMXT-UPC32	PACIFIC	0184/Slave	Jan. 09, 2019	■
Magnetics Module	134310	PACIFIC	0357	N/A	■
Magnetics Module	134310	PACIFIC	0361	N/A	■

All test equipment used is calibrated on a regular basis.

4.5.5 Test data

Test Date	Dec. 23, 2019
Test Result	PASS
Remarks	See next page for Voltage Fluctuations on AC mains test data.

Test Report

was tested according to

EN 61000-4-15:2011

EN 61000-3-3:2013

Test result was

OK

Test Settings

Test

Measuring Standard	EN 61000-4-15:2011
Limits	EN 61000-3-3:2013
Test Date	23.12.2019
Test Time	23:33:20
Measurement Duration	02:00:00
EUT Classification	Class A
EUT / Measurement Setup	
Dmax limit	4%
Number of Pst intervals	12
Pst interval	00:10:00
Cooldown time after interval	00:00:00
Plt interval	02:00:00
Power Supply	
Nominal Voltage	230V
Nominal Frequency	50Hz

EUT Details

Brand	ENERPIA CO., LTD.
Model	DW-410

Laboratory Details

Name	
Address	

Test Equipment

Power Meter

Manufacturer	ZES ZIMMER Electronic Systems GmbH
Model	LMG670
Serial Number	01781512
Software Version	3.001-R51143
Analysis Software	ZES ZIMMER LMG600 Control 3.001-R51143

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EMC - EMCD-002(Rev.4)

Additional Measurands - Informative

Additional Measurands

$U_{rms, L1}$	229.429 V	$U_{pp, L1}$	649.206 V	$U_{dc, L1}$	227.015 mV
$U_{cf, L1}$	1.41597	$I_{rms, L1}$	529.311 mA	$I_{pp, L1}$	1.65306 A
$I_{dc, L1}$	-5.33463 mA	$I_{cf, L1}$	1.57158	P_{L1}	121.365 W
Q_{L1}	4.24885 var	S_{L1}	121.439 VA	PF_{L1}	0.99939
$f_{cycle, L1}$	50.0 Hz	$P_{st, L1(1)}$	0.01453	$P_{st, L1(2)}$	0.01318
$P_{st, L1(3)}$	0.01319	$P_{st, L1(4)}$	0.01321	$P_{st, L1(5)}$	0.01326
$P_{st, L1(6)}$	0.01318	$P_{st, L1(7)}$	0.01323	$P_{st, L1(8)}$	0.01329
$P_{st, L1(9)}$	0.01322	$P_{st, L1(10)}$	0.01321	$P_{st, L1(11)}$	0.01329
$P_{st, L1(12)}$	0.01332	$P_{fl, L1}$	0.01335		

Result Overview

Test Name	Test Result	Limit Usage	Info
Dc Test [L1]	OK	5.5%	$0.2\% \leq 3.3\%$
Dmax Test [L1]	OK	4.5%	$0.2\% \leq 4.0\%$
Pst Test [L1]	OK	1.5%	$0.015 \leq 1.000$
Plt Test [L1]	OK	2.1%	$0.013 \leq 0.650$
Tmax Test [L1]	OK		

5. IMMUNITY TESTS.

5.1 ELECTROSTATIC DISCHARGE IMMUNITY TEST

The measurement of the Immunity against Electrostatic Discharge was performed in the EMS Room.

Test Location: EMS Room #2

5.1.1 Operating environment

Ambient temperature (15 ~ 35) °C	(18.0 ± 0.5) °C
Humidity (30 ~ 60) % R.H.	(37.4 ± 0.5) % R.H.
Atmospheric pressure (86.0 ~ 106.0) kPa	(102.0 ± 0.1) kPa

5.1.2 Test set-up

The EUT and all local support equipment were placed on non-metallic support 0.8 m above a reference ground plane (RGP) and were put into operation in accordance with the specified operating mode.

5.1.3 Measurement uncertainty

It has been demonstrated that the ESD generator meets the specified requirements in the standard with at least a 95 % confidence.

5.1.4 The using equipment

Description	Model Number	Manufacturer	Serial Number	Last Cal.	Use
ESD Generator	Dito	EM TEST	P1938232189	Nov. 04, 2019	☐
Digital Luminance Meter	TES-1330A	TES	N/A	Jun. 26, 2019	☐
DTV MODULATOR	TVB599A	TELEVIEW	N/A	Jun. 14, 2019	☐
Electrostatic Discharge Simulator	ESS-B3011A	NoiseKen	ESS16X4216	Feb. 08, 2019	☒
Electrostatic Discharge GUN	GT-30RA	NoiseKen	ESS16X4226	N/A	☒
PREMIUM DTV MODULATOR	TVB597A	TELEVIEW	23.24.20.11.12. 00.00.83	Jun. 14, 2019	☐
DIGITAL LIGHT METER	LX1330B	N/A	S698829	Jun. 20, 2019	☐
ESD Generator	Dito	EM TEST	V1207111926	Jan. 08, 2019	☐

All test equipment used is calibrated on a regular basis.

5.1.5 Test data

Test Date	Dec. 24, 2019
Test levels	Contact discharge 4 kV, Air discharge (2, 4, 8) kV
Number of discharges	20 times at all test point (Air Discharge) 20 times at all test point (Contact Discharge)
Polarity	Positive / Negative
EUT-position	Table Top
Required performance criterion	B
Test result	Met Criterion A
Monitoring of the EUT	Observed the EUT by visually for during the test.

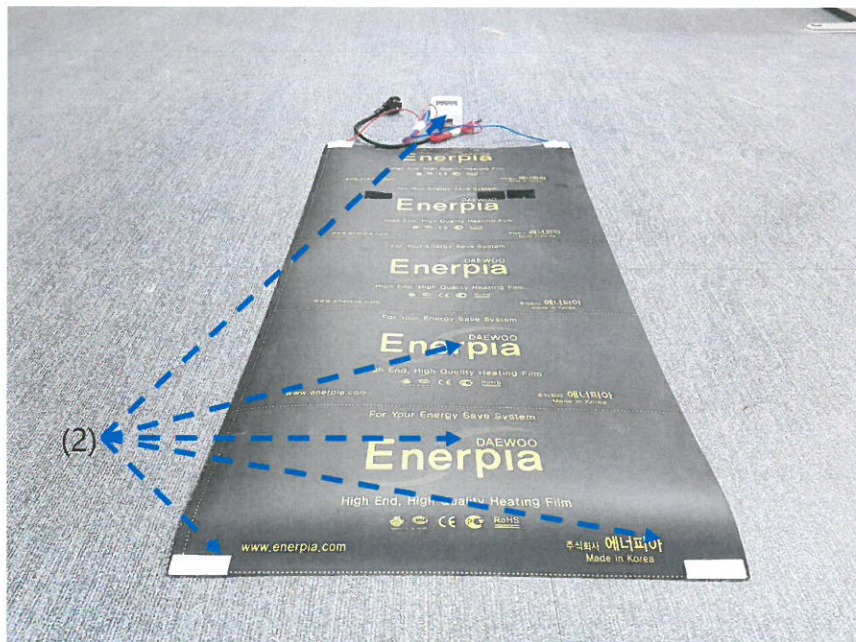
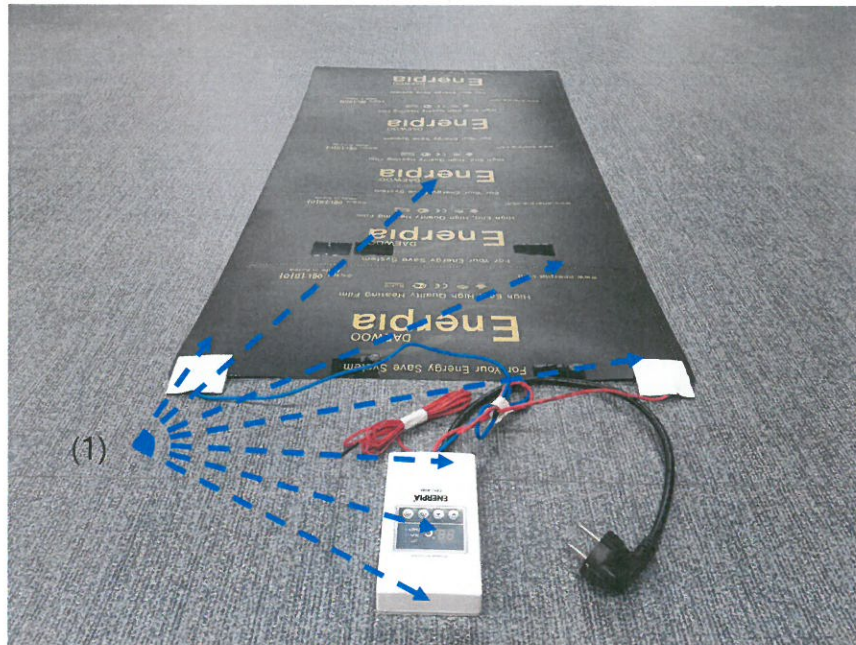
The test results of selected points of the EUT

Point		Test level [± kV]	Pass /Fail	Description
Indirect Discharge	HCP	4 (Contact)	Pass	- There was no deviation from normal operating condition.
	VCP		Pass	
Direct Discharge	1. EUT Front (Non-metal)	2 / 4 / 8 (Air)	Pass	- There was no deviation from normal operating condition.
	2. EUT Rear (Non-metal)	2 / 4 / 8 (Air)	Pass	
	3. EUT Left (Non-metal)	2 / 4 / 8 (Air)	Pass	
	4. EUT Right (Non-metal)	2 / 4 / 8 (Air)	Pass	

5.1.6 ESD Test Point & Test Result

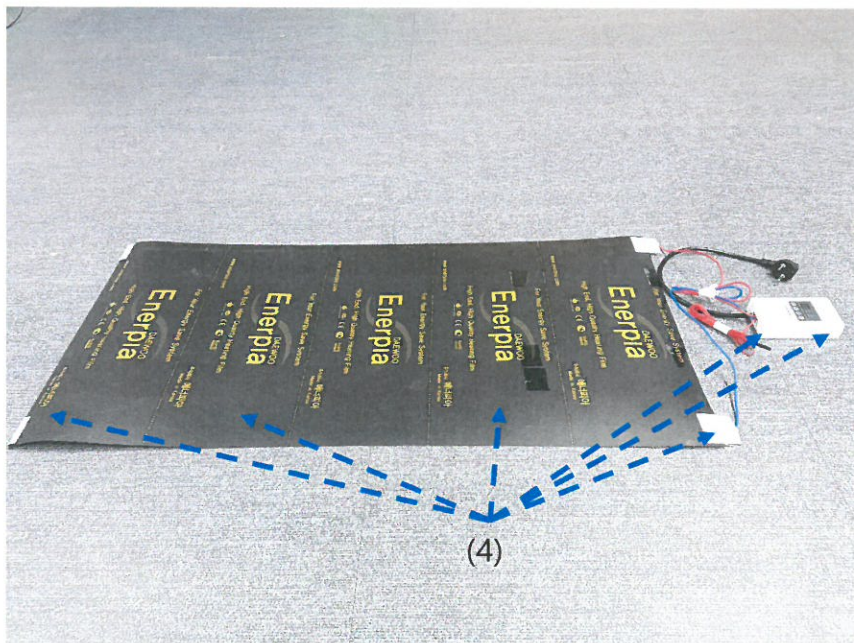
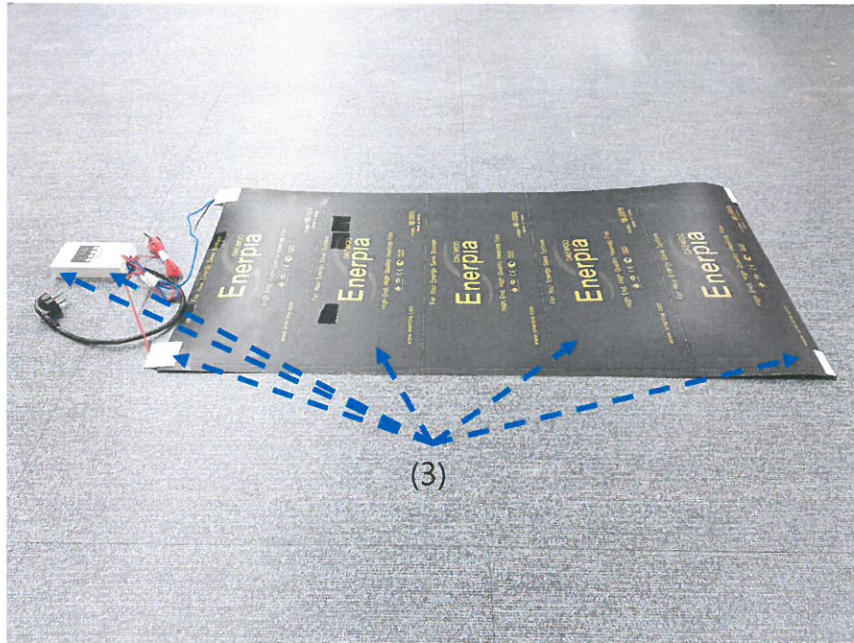
Air Discharge : 

Contact Discharge : 



Air Discharge : 

Contact Discharge : 



5.2 ELECTRICAL FAST TRANSIENT/BURST IMMUNITY TEST

The measurement of the Immunity Fast Transient/Burst was performed in the EMS Room.

Test Location: EMS Room #1

5.2.1 Operating environment

Ambient temperature	$(18.2 \pm 0.5) ^\circ\text{C}$
Humidity	$(38.3 \pm 0.5) \% \text{ R.H.}$
Atmospheric pressure	$(102.0 \pm 0.1) \text{ kPa}$

5.2.2 Test set-up

The EUT was placed on non-metallic support 0.8 m above a reference ground plane (RGP) and was put into operation according to the specified operating mode. If the manufacturer provides a non-detachable supply cable more than 0.5 m long with the equipment, the excess length of this cable shall be folded to avoid a flat coil and situated at a distance of 0.1 m above the ground reference plane.

5.2.3 Measurement uncertainty

It has been demonstrated that the burst generator meets the specified requirements in the standard with at least a 95 % confidence.

5.2.4 The using equipment

Description	Model Number	Manufacturer	Serial Number	Last Cal.	Use
Ultra Compact Simulator	UCS 500 N5	EM TEST	V1207111923	Jan. 08, 2019	■
Motorized Variac	MV2616	EM TEST	V1207111924	Jan. 08, 2019	■
CAPACITIVE COUPLING CLAMP	HFK	EM TEST	P1318118318	Jan. 08, 2019	□
Digital Luminance Meter	TES-1330A	TES	N/A	Jun. 26, 2019	□
DTV MODULATOR	TVB599A	TELEVIEW	N/A	Jun. 14, 2019	□
Immunity Tests (Burst)	IMU4000	EMC-PARTNER	IMU F-S-D-V-1504	Agu. 29, 2019	□
Fast Transient/Burst Simulator	FNS-AX3-A16C	NOISEKEN	FNS1531628	Jan. 07, 2019	□
Coupling Clamp	15-00009A	NOISEKEN	FNS1561660	Jan. 08, 2019	□
PREMIUM DTV MODULATOR	TVB597A	TELEVIEW	23.24.20.11. 12.00.00.83	Jun. 14, 2019	□
EMC TESTING SYSTEM (SURGE, BURST)	SEPN 4532T	3CTEST	ES3741701	Feb. 19, 2019	□
Ultra Compact Simulator	UCS 500 N5	EM TEST	V1234114048	Jan. 08, 2019	□
Coupling / Decoupling Network for Burst and Surge	CNI 503 A4	EM TEST	V1234114049	Jan. 08, 2019	□
DIGITAL LIGHT METER	LX1330B	N/A	S698829	Jun. 20, 2019	□

All test equipment used is calibrated on a regular basis.

5.2.5 Test data

Test Date	Dec. 24, 2019
Nominal Mains Voltage (V_{NOM})	230 Vac
Test level	± 1 kV (AC Mains)
Burst frequency	5 kHz
Polarity	Positive / Negative
Coupling time	120 s
Coupling methods	AC mains - Coupling/decoupling network (CDN)
Lines for test	AC Mains of the EUT
Type of line & length	Unshielded, 0.5 m (AC mains)
EUT-position	Table Top
Required performance criterion	B
Test result	Met Criterion A
Monitoring of the EUT	Observed the EUT by visually for during the test.

The test results.

Line for test	Coupling Method	Test level [$\pm$ kV]	Pass/Fail	Description
AC-mains (L1 + L2 + PE)	CDN	1	Pass	- There was no deviation from normal operating condition.

5.3 SURGE IMMUNITY TEST

The measurement of the Immunity Surge Transients was performed in the EMS Room.

Test Location: EMS Room #1

5.3.1 Operating environment

Ambient temperature	(18.3 ± 0.5) °C
Humidity	(38.3 ± 0.5) % R.H.
Atmospheric pressure	(102.0 ± 0.1) kPa

5.3.2 Test set-up

The EUT and all local support equipment were placed on a non-metallic support 0.8 m above a reference ground plane (RGP) and were put into operation in accordance with the specified operating mode.

5.3.3 Measurement uncertainty

It has been demonstrated that the surge generator meets the specified requirements in the standard with at least a 95 % confidence.

5.3.4 The using equipment

Description	Model Number	Manufacturer	Serial Number	Last Cal.	Use
Ultra Compact Simulator	UCS 500 N5	EM TEST	V1207111923	Jan. 08, 2019	■
Motorized Variac	MV2616	EM TEST	V1207111924	Jan. 08, 2019	■
Digital Luminance Meter	TES-1330A	TES	N/A	Jun. 26, 2019	□
DTV MODULATOR	TVB599A	TELEVIEW	N/A	Jun. 14, 2019	□
Immunity Tests	IMU4000	EMC-PARTNER	IMU F-S-D-V-1504	Jan. 07, 2019	□
EMC IMMUNITY TEST SYSTEM (Surge)	EMC PRO PLUS	Thermo KeyTek	0701273	Jan. 07, 2019	□
Telecom coupler-decoupler	CM-TELCD	Thermo KeyTek	0612361	Jan. 08, 2019	□
SURGE COUPLING NETWORK	CN-R40C05	EMC PARTNER	CN-R40C05-1538	Jan. 08, 2019	□
PREMIUM DTV MODULATOR	TVB597A	TELEVIEW	23.24.20.11.12.00.00.83	Jun. 14, 2019	□
EMC TESTING SYSTEM (SURGE, BURST)	SEPN 4532T	3CTEST	ES3741701	Feb. 19, 2019	□
Ultra Compact Simulator	UCS 500 N5	EM TEST	V1234114048	Jan. 08, 2019	□
Coupling / Decoupling Network for Burst and Surge	CNI 503 A4	EM TEST	V1234114049	Jan. 08, 2019	□
DIGITAL LIGHT METER	LX1330B	N/A	S698829	Jun. 20, 2019	□

All test equipment used is calibrated on a regular basis.

5.3.5 Test data

Test Date	Dec. 24, 2019
Nominal Mains Voltage (V_{NOM})	230 Vac
Test level	± 0.5 kV, ± 1 kV (Line-Line of AC main) ± 0.5 kV, ± 1 kV, ± 2 kV (Line-PE of AC main)
Number of surge	5 times per each polarity
Polarity	Positive / Negative
Angle	90° / 270°
Repetition rate	1 time / 1 min
Coupling methods	AC mains - Coupling/decoupling network (CDN)
Lines for test	AC mains of the EUT
Type of line & length	Unshielded, 0.5 m (AC mains)
EUT-position	Table Top
Required performance criterion	B
Test result	Met Criterion A
Monitoring of the EUT	Observed the EUT by visually for during the test.

The test results

Line for test	Coupling Method	Test level [$\pm$ kV]	Pass/Fail	Description
AC-mains (L1+L2)	CDN	0.5, 1	Pass	- There was no deviation from normal operating condition.
AC-mains (L1+PE)	CDN	0.5, 1, 2	Pass	- There was no deviation from normal operating condition.
AC-mains (L2+PE)	CDN	0.5, 1, 2	Pass	- There was no deviation from normal operating condition.

5.4 CONDUCTED RF FIELDS IMMUNITY TEST

The measurement of the Immunity against Conducted RF Field was performed in the EMS Room.

Test Location: EMS Room #1

5.4.1 Operating environment

Ambient temperature	(18.4 ± 0.5) °C
Humidity	(38.3 ± 0.5) % R.H.
Atmospheric pressure	(102.0 ± 0.1) kPa

5.4.2 Test set-up

The EUT and all local support equipment were placed on a non-metallic support 0.1 m above a reference ground plane (RGP) and were put into operation in accordance with the specified operating mode.

5.4.3 Measurement uncertainty

The measurement uncertainty is 0.17 V for 1 V, 0.50 V for 3 V and 1.70 V for 10 V.

Measurement uncertainty is calculated in accordance with WECC 19-1990. The measurement uncertainty is given with a confidence of 95 %. The measurement uncertainty is calculated as the uncertainty of the electric field intensity detected by the power meter. The uncertainty calculations exclude influence of phenomena like inhomogeneity of the electric field intensity.

5.4.4 The using equipment

Description	Model Number	Manufacturer	Serial Number	Last Cal.	Use
Continuous Wave Generator	CWS 500N1	EM TEST	V1207111925	Jan. 08, 2019	■
COAXIAL FIXED ATTENUATOR	ATT6	EM TEST	0312-13	Jan. 07, 2019	■
Coupling and Decoupling Network	CDN-M2/M3N	EM TEST	0312-43	Jan. 07, 2019	■
Electromagnetic Injection Clamp	EM101	Luthi	36091	Jan. 09, 2019	□
MICROPHONE	MP201	BSWA	530231	Jun. 24, 2019	□
SOUND ACOUSTIC TESTER	TST-1000	TESTEK	150063	Jun. 17, 2019	□
Digital Luminance Meter	TES-1330A	TES	N/A	Jun. 26, 2019	□
DTV MODULATOR	TVB599A	TELEVIEW	N/A	Jun. 14, 2019	□
Continuous Wave Simulator	CWS 500N	EM TEST	V0849104500	Jan. 08, 2019	□
ATTENUATOR	ATT6/75	EM TEST	1208-15	Jan. 07, 2019	□
CDN	M2/M3	EM TEST	1208-65	Jan. 07, 2019	□
ElectroMagnetic Injection Clamp	EM101	Luthi	35924	Jun. 18, 2019	□
Microphone	7012	ACO	12159	Jan. 16, 2019	□
1 kHz BAND PASS FILTER	TK-BPF1K	TESTEK	150071-F	Jan. 08, 2018	□
Conditioning Amplifier	NEXUS	Bruel & Kjaer	2218582	-	□
Audio Analyzer	UPL	ROHDE&SCHWARZ	100016	Jun. 14, 2019	□
Impedance Box	TIB-R1	TESTEK	N/A	N/A	□
PREMIUM DTV MODULATOR	TVB597A	TELEVIEW	23.24.20.11. 12.00.00.83	Jun. 14, 2019	□
Injection Probe	F-140	FCC	08719	Jan. 08, 2019	□
CDN	CDN M5/75A	EMTEST	0912-83	Jun. 14, 2019	□
Preamplifier	2669	Bruel & Kjaer	2170829	-	□
DIGITAL LIGHT METER	LX1330B	N/A	S698829	Jun. 20, 2019	□

All test equipment used is calibrated on a regular basis.

5.4.5 Test data

Test Date	Dec. 24, 2019
Test level	3 V (AM 80 %, 1 kHz)
Frequency range	0.15 MHz ~ 230 MHz
Frequency step	1 %
Dwell time at each frequency	1.5×10^{-3} decades/s
Coupling methods	AC mains – Coupling / Decoupling Network (CDN)
Lines for test	AC Mains of the EUT
Type of line & length	Unshielded, 0.3 m (AC mains)
EUT-position	Table Top
Required performance criterion	A
Test result	Met Criterion A
Monitoring of the EUT	Observed the EUT by visually for during the test.

The test results

Freq. Range [MHz]	Coupling Method	Line for test	Test level [V]	Pass/Fail	Description
0.15 ~ 230	CDN (M3)	AC mains	3	Pass	- There was no deviation from normal operating condition.

5.5 MAINS SUPPLY VOLTAGE DIPS AND SHORT INTERRUPTIONS IMMUNITY TEST

The measurement of the Immunity Mains Supply Voltage Dips and Interruptions was performed in the EMS Room.

Test Location: EMS Room #1

5.5.1 Operating environment

Ambient temperature	(18.2 ± 0.5) °C
Humidity	(38.0 ± 0.5) % R.H.
Atmospheric pressure	(102.0 ± 0.1) kPa

5.5.2 Test set-up

The EUT and all local support equipment were placed on a non-metallic support 0.8 m above a reference ground plane (RGP) and was put into operation in accordance with the specified operating mode.

5.5.3 Measurement uncertainty

It has been demonstrated that the voltage dips and interruptions generator meet the specified requirements in the standard with at least a 95 % confidence.

5.5.4 The using equipment

Description	Model Number	Manufacturer	Serial Number	Last Cal.	Use
Ultra Compact Simulator	UCS 500 N5	EM TEST	V1207111923	Jan. 08, 2019	■
Motorized Variac	MV2616	EM TEST	V1207111924	Jan. 08, 2019	■
Digital Luminance Meter	TES-1330A	TES	N/A	Jun. 26, 2019	□
DTV MODULATOR	TVB599A	TELEVIEW	N/A	Jun. 14, 2019	□
Immunity Tests	IMU4000	EMC-PARTNER	IMU F-S-D-V-1504	Jan. 07, 2019	□
PREMIUM DTV MODULATOR	TVB597A	TELEVIEW	23.24.20.11. 12.00.00.83	Jun. 14, 2019	□
DIGITAL LIGHT METER	LX1330B	N/A	S698829	Jun. 20, 2019	□
DC POWER SUPPLY	ZX-1600HA	TAKASAGO	N/A	Dec. 10, 2019	□
DC POWER SUPPLY	ZX-1600HA	TAKASAGO	N/A	Dec. 10, 2019	□

All test equipment used is calibrated on a regular basis.

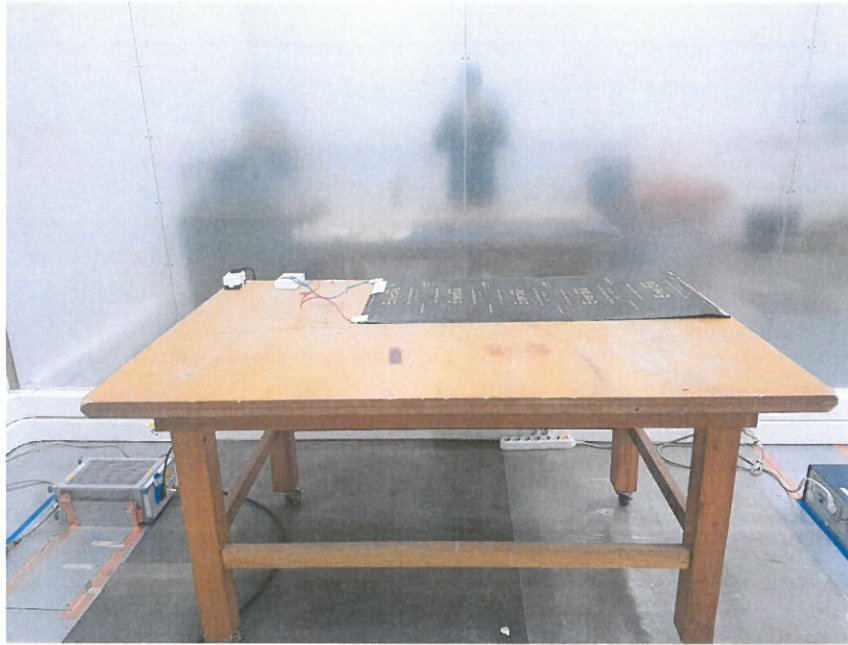
5.5.5 Test data

Test Date	Dec. 24, 2019
Nominal Mains Voltage (V_{NOM})	230 Vac
Level of Reduction (dip)	25 cycle at 30 %, 10 cycle at 60 %, 0.5 cycle at 100 %
Level of Reduction (Interruption)	-
No. of dips/interruption	3
Interval	10 s
Type of line & length	Unshielded, 0.5 m
EUT-position	Table Top
Required performance criterion	C, C, C
Test result	Met criterion A, A, A
Monitoring of the EUT	Observed the EUT by visually for during the test.

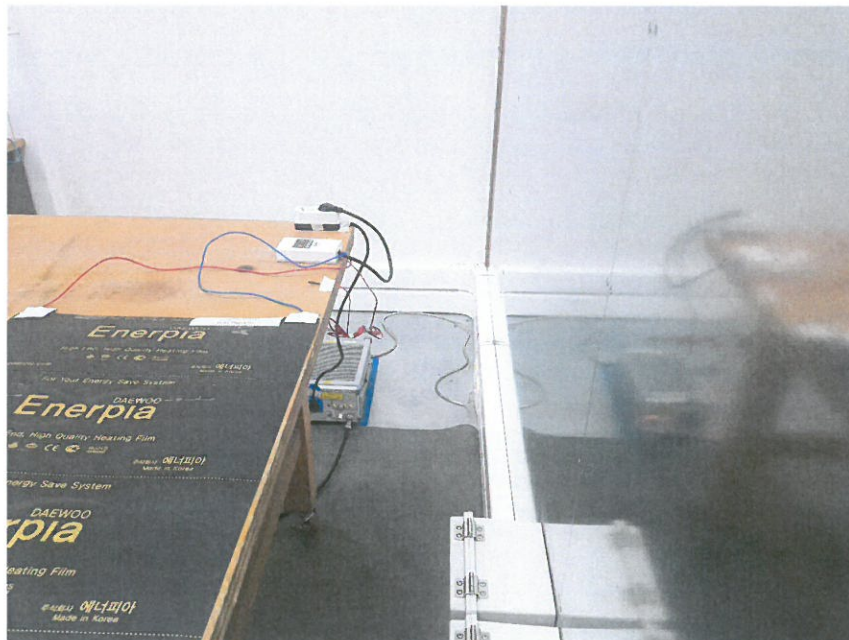
The test results

Test	Reduction (% of V_{NOM})	Reduction Period (cycle)	Pass / Fail	Description
Voltage dips	30	25 cycle	Pass	- There was no deviation from normal operating condition.
	60	10 cycle	Pass	- There was no deviation from normal operating condition.
	100	0.5 cycle	Pass	- There was no deviation from normal operating condition.

1. TEST SET-UP PHOTOS: (MAINS TERMINAL CONTINUOUS DISTURBANCE VOLTAGE)



FRONT



REAR

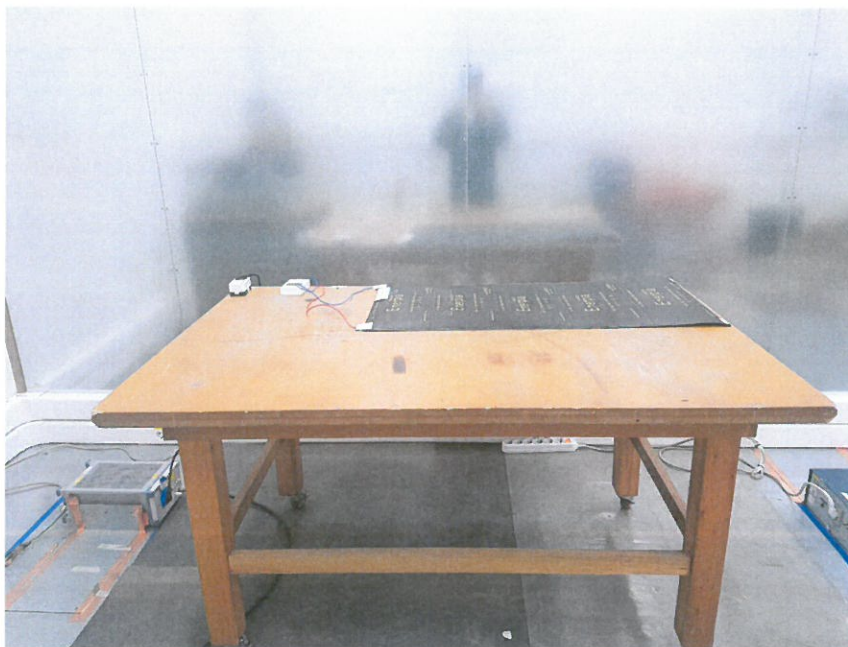
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2. TEST SET-UP PHOTOS: (MAINS TERMINAL DISCONTINUOUS DISTURBANCE (CLICK))



Front



REAR

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EMC-EMCD-002(Rev.4)

3. TEST SET-UP PHOTOS: (DISTURBANCE POWER)

[AC IN]



[Sensor]



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EMC-EMCD-002(Rev.4)

4. TEST SET-UP PHOTOS: (HARMONICS & VOLTAGE FLUCTUATIONS ON AC MAINS)



HARMONIC



FLICKER

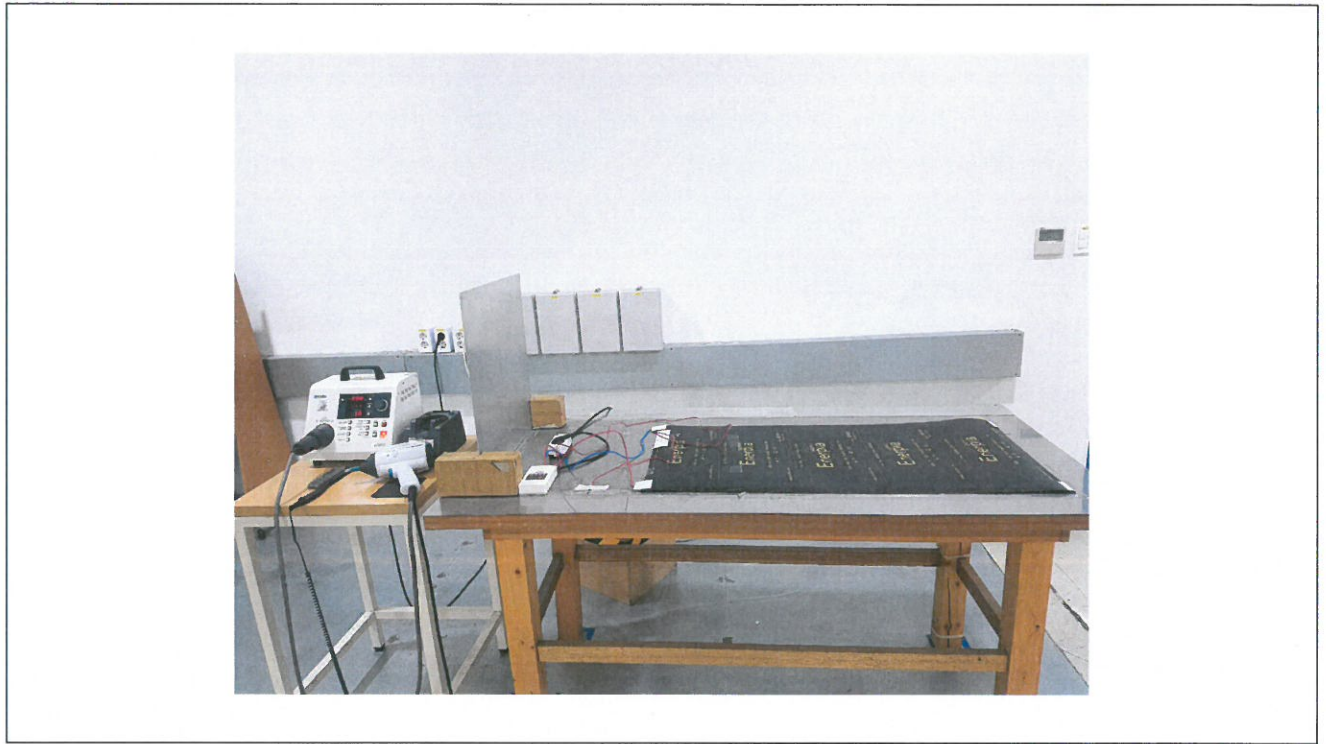
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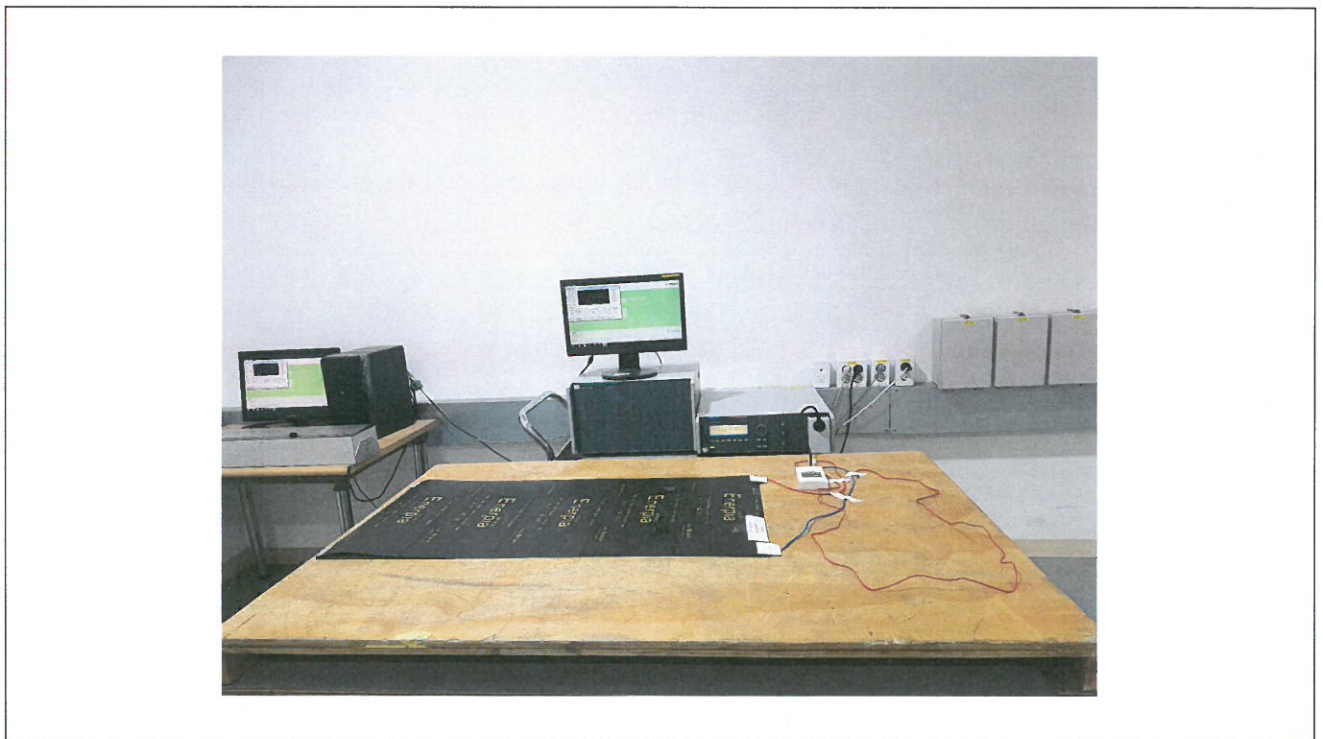
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5. TEST SET-UP PHOTO: (ELECTROSTATIC DISCHARGE IMMUNITY)



6. TEST SET-UP PHOTO: (EFT/BURST)



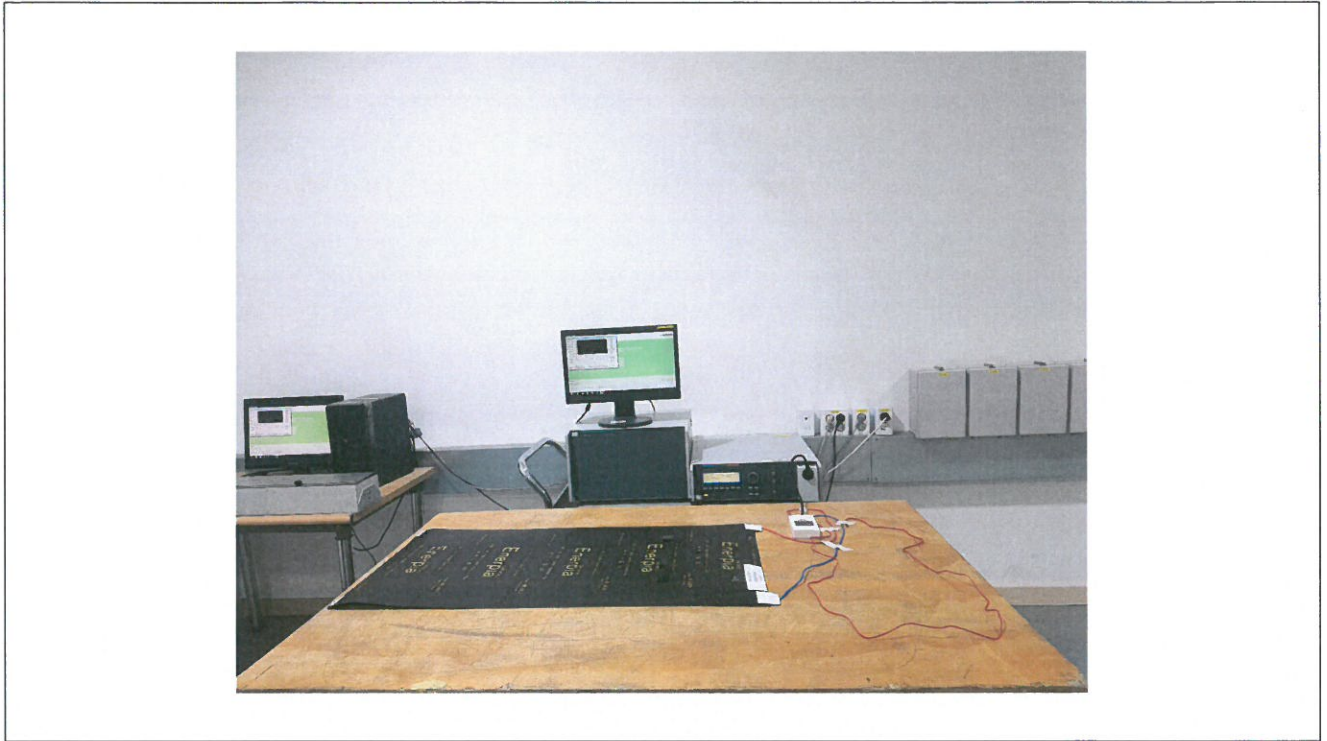
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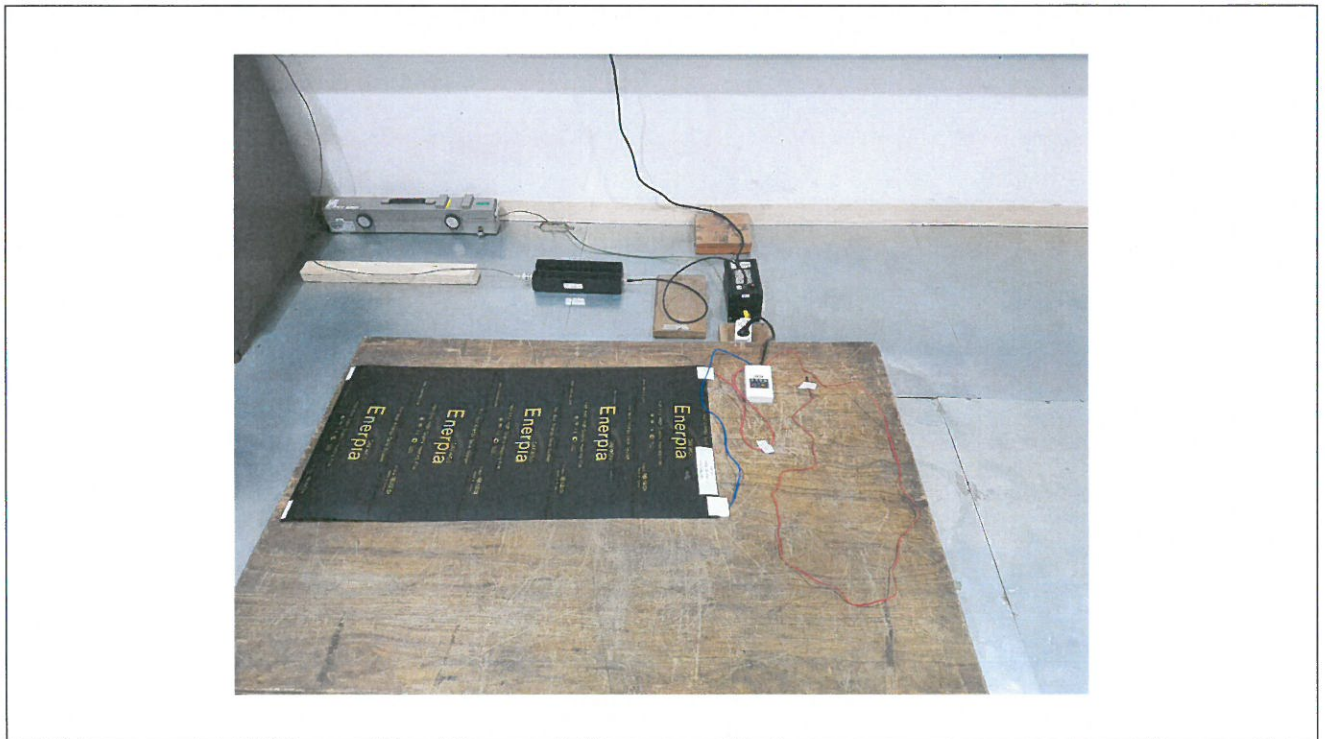
Tel: (82)31-393-9394 Fax: (82)31-393-9392

EMC-EMCD-002(Rev.4)

7. TEST SET-UP PHOTO: (SURGE)



8. TEST SET-UP PHOTO: (CONDUCTED RF FIELDS)



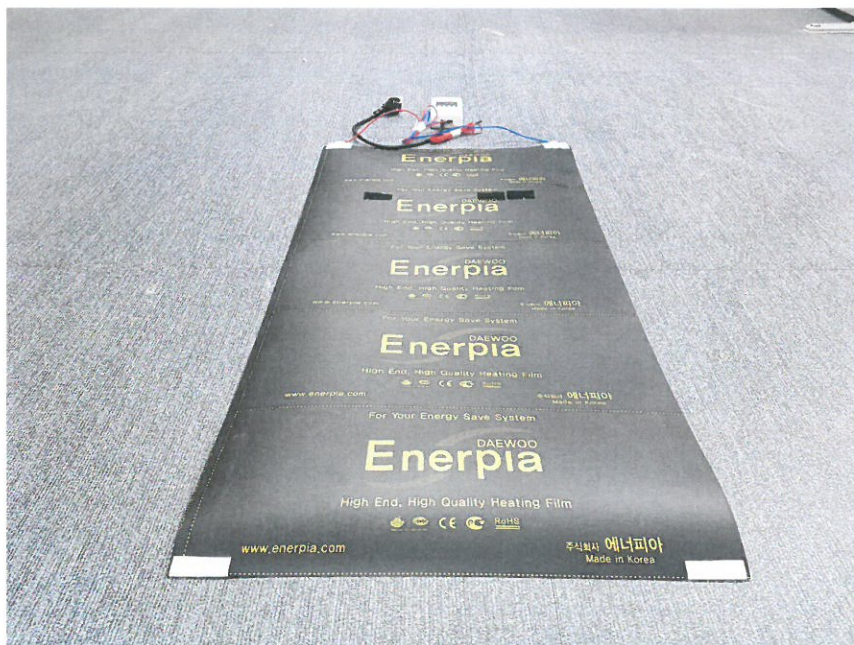
9. TEST SET-UP PHOTO: (MAINS SUPPLY VOLTAGE DIPS AND SHORT INTERRUPTIONS)



10. PHOTOGRAPHS OF EUT



Front



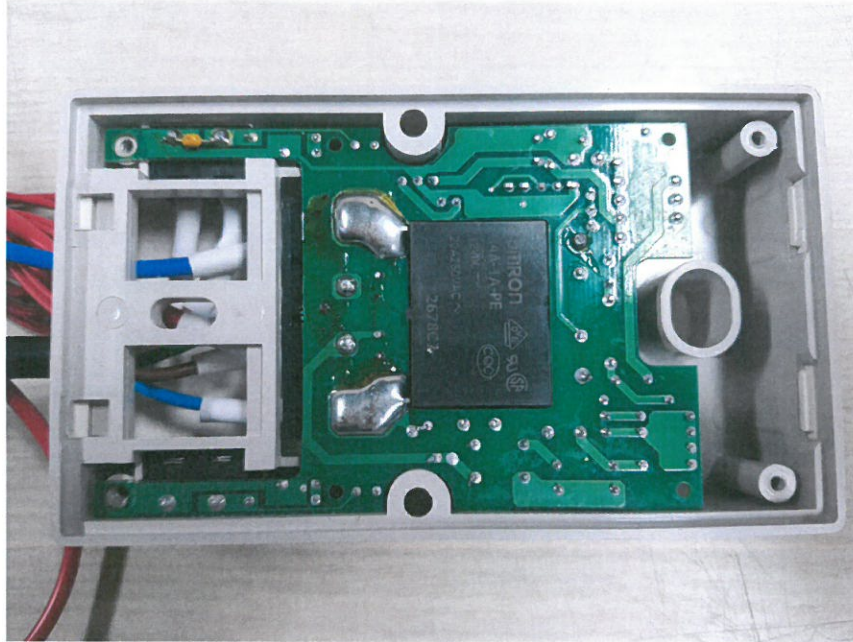
Rear

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48, Gunpocheomdansaneop 2-ro, Gunpo-si, Gyeonggi-do, 15880, Republic of Korea

Tel: (82)31-393-9394 Fax: (82)31-393-9392

EMC-EMCD-002(Rev.4)



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