EMC TEST REPORT

Reference No. : **GPRI2101000027EG**

Applicant : **WACO Corp**

Equipment Under Test (EUT) :

Product Name : Undersink Water Purifier

Model Name : HEALSUMM-A

Alt.Model Name : HEALSUMM-Q, HCRO, HQ

Applied Standards : **EN 55014-1:2017,**
EN 55014-2:2015,
EN IEC 61000-3-2:2019,
EN 61000-3-3:2013/A1:2019

Date of Receipt : **2021-01-04**

Date of Test : **2021-06-23 ~ 2021-07-02**

Date of Issue : **2021-07-16**

Test Results : **Complied**

Tested by : ----------
Calix Kim

Reviewed by : ----------
Paul Kang

This test report does not assure KOLAS accreditation.
1) The results of this test report are effective only to the items tested.
2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.

Remarks :
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The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Contents

Revision History

Revision	Report Number	Description
0	F690501-RF-EMG000618	Initial
1		
2		

1. General Information

1.1 Client Information

Applicant : WACO Corp
- Address of Applicant : A-301, Hagye Technotown 10, Nowon-ro 15-gil, Nowon-gu, Seoul, Korea

Manufacturer : WACO Corp
- Address of Manufacturer : A-301, Hagye Technotown 10, Nowon-ro 15-gil, Nowon-gu, Seoul, Korea

Factory : WACO Corp
- Address of Factory :11-19 Mooran 2-gil, Pocheon, Gyeonggi-do, Korea

1.2 Test Laboratory

Name and Address : SGS Korea Co., Ltd.
- Giheung 1 Laboratory : 35, Giheungdanji-ro 121beon-gil, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea
- Giheung 2 Laboratory : 23, Giheungdanji-ro 24beon-gil, Giheung-gu,Yongin-si, Gyeonggi-do, Republic of Korea
- Gunpo Laboratory : 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, 15807, Republic of Korea

Phone : + 82 31 428 5719
Fax : + 82 31 427 2370
e-mail : paul.kang@sgs.com

1.3 General Information of E.U.T.

Classification	Description
Product Name	Undersink Water Purifier
Model Name	HEALSUMM-A
Alt. Model Name	HEALSUMM-Q, HCRO, HQ
Model Differences	- HEALSUMM-Q : Electrical specification is same but only design has modified by filter changes. - HCRO, HQ : Changed for only sales and marketing purpose.
Serial No.	-
EMI Classification	Category Ⅱ
Internal Clock Frequency	65 ㎑
Test Voltage	230 V~, 50 ㎐
Rated Voltage	100-240 V~, 50/60 ㎐, 30 W
Function	The water purifier for house using

1.4 Operating Modes and Conditions

Operating Mode	Conditions
1) Operating	water operating mode

1.4.1 Monitoring Method

- Checking supply water from EUT.

1.5 Auxiliary Equipments

Description	Model	Serial No.	Manufacturer	Note.
-	-	-	-	-

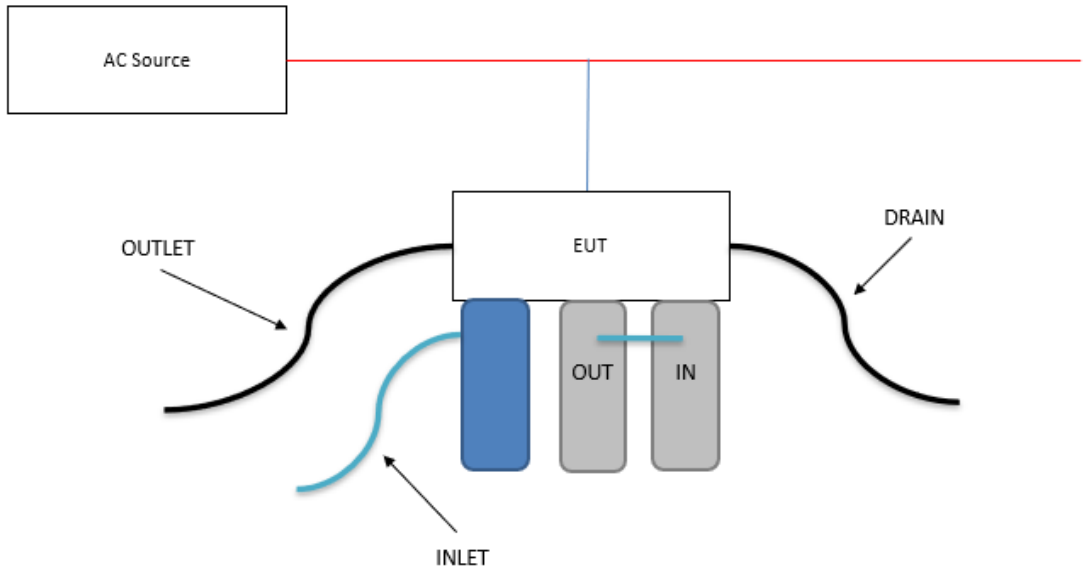
1.6 Cable List

Start		END		Cable Spec.		Used core
Name	I/O Port	Name	I/O Port	Length	Shield	
EUT	AC IN	AC SOURCE	-	1.5	Unshield	No.

1.7 System Configurations

Description	Model	Serial No.	Manufacturer
Booster Pump	HWRP-50GDP	PZ50T-0NE101123	-
Solenoid Valve	HSV-NN	-	-

1.8 Test System Layout



1.9 Modifications

- There was no modified item during the test.

1.10 Applicable Standards for Testing

Standards	Status	Deviation
EN 55014-1:2017	Applicable	No Deviation
EN 55014-2:2015 (Category Ⅱ)	Applicable	No Deviation
EN IEC 61000-3-2:2019	Applicable	No Deviation
EN 61000-3-3:2013/A1:2019	Applicable	No Deviation
EN 61000-4-2:2009	Applicable	No Deviation
EN 61000-4-4:2012	Applicable	No Deviation
EN 61000-4-5:2014	Applicable	No Deviation
EN 61000-4-6:2014/AC:2015	Applicable	No Deviation
EN 61000-4-11:2004	Applicable	No Deviation

1.11 Summary of Test Results

Test Item	Basic Standards	Results
Conducted Emission	EN 55014-1:2017	Complied
Discontinuous Emission	EN 55014-1:2017	Complied
Radiated Emission	EN 55014-1:2017	Complied
Harmonics	EN IEC 61000-3-2:2019	Complied
Flicker	EN 61000-3-3:2013/A1:2019	Complied
Electrostatic Discharge	EN 61000-4-2:2009	Complied
Fast Transients	EN 61000-4-4:2012	Complied
Surges	EN 61000-4-5:2014	Complied
Conducted Immunity	EN 61000-4-6:2014/AC:2015	Complied
Voltage dips and Interruptions	EN 61000-4-11:2004	Complied

Note : Test methods of all test items are performed according to the basic standards in this table.

EMISSION

2.1 Test Results

Test Items	Standards	Test Results
Conducted Emission	EN 55014-1:2017	Complied
Discontinuous Emission	EN 55014-1:2017	Complied
Radiated Emission	EN 55014-1:2017	Complied

2.2 Test Method and Limits

2.2.1 Test Method

Test Items	Measuring Frequency Range	RBW	Measuring Distance
Conducted Emission	0.15 ㎒ ~ 30 ㎒	9 ㎑	-
Radiated Emission	30 ㎒ ~ 1 ㎓	120 ㎑	10 m & 3 m

2.2.2 Test Limits

-Conducted Emission Limits

Frequency Range	Limits(㏈(㎶))		Comment
	Quasi-peak	Average	
0.15 ㎒ ~ 0.5 ㎒	66 to 56	59 to 46	-
0.5 ㎒ ~ 5 ㎒	56	46	
5 ㎒ ~ 30 ㎒	60	50	

Note : The lower limit shall apply at the transition frequencies. The limit decreases linearly with the logarithm of the frequency in the range 0.15 ㎒ to 0.5 ㎒.

-Radiated Emission Limits below 1 ㎓

Frequency Range	Limits(㏈(㎶/m))	Distance
	Quasi-peak	
30 ㎒ ~ 230 ㎒	30	**10 m**
230 ㎒ ~ 1 ㎓	37	
30 ㎒ ~ 230 ㎒	40	**3 m**
230 ㎒ ~ 1 ㎓	47	

2.3 Conducted Emission

The initial preliminary exploratory scans were performed over the measuring frequency range(0.15 ㎒ to 30 ㎒) at mains port using a max hold mode incorporating a Peak detector and/or Average detector and using the software of EMC32(Version V8.52.0 from R&S and Version V10.40.10 from R&S) at mains port. The final test data was measured using a Quasi-Peak detector and C-Average detector.

2.3.1 Test Equipments

Description	Model No.	Manufacturer	S/N	Cal. Due Date
Conducted Emission				
Two-Line V-Network	ENV216	R & S	100190	2022-05-04
Test Receiver	ESCI 7	R & S	100911	2022-02-19
Shield Room	-	SY CORPORATION	-	-
Discontinuous Conducted Emission				
CLICK ANALYZER	DDA55	AFJ	14041948183	2022-03-18
2-LINE V-NETWORK	ENV216	R & S	100415	2022-02-19
Shield Room	-	SY CORPORATION	-	-

Note : The calibration period of every equipment is 1 year.

2.3.2 Test Site

Shield Room in Gunpo Laboratory (Conducted Emission)
Shield Room in Giheung 2 Laboratory (Discontinuous Conducted Emission)

2.3.3 Environment Conditions and data

- Conducted Emission

Temperature (Minimum 23.5, Maximum 24.5) ℃,
Humidity (Minimum 45.0, Maximum 46.0) % R.H.,
Atmospheric Pressure (Minimum 100.6, Maximum 100.6) ㎪

Test Date : 2021-06-29

-Discontinuous Conducted Emission

Temperature (Minimum 20.1, Maximum 21.3) ℃,
Humidity (Minimum 46.0, Maximum 48.0) % R.H.,
Atmospheric Pressure (Minimum 99.8, Maximum 99.8) ㎪

Test Date : 2021-07-02

- Conducted Emission

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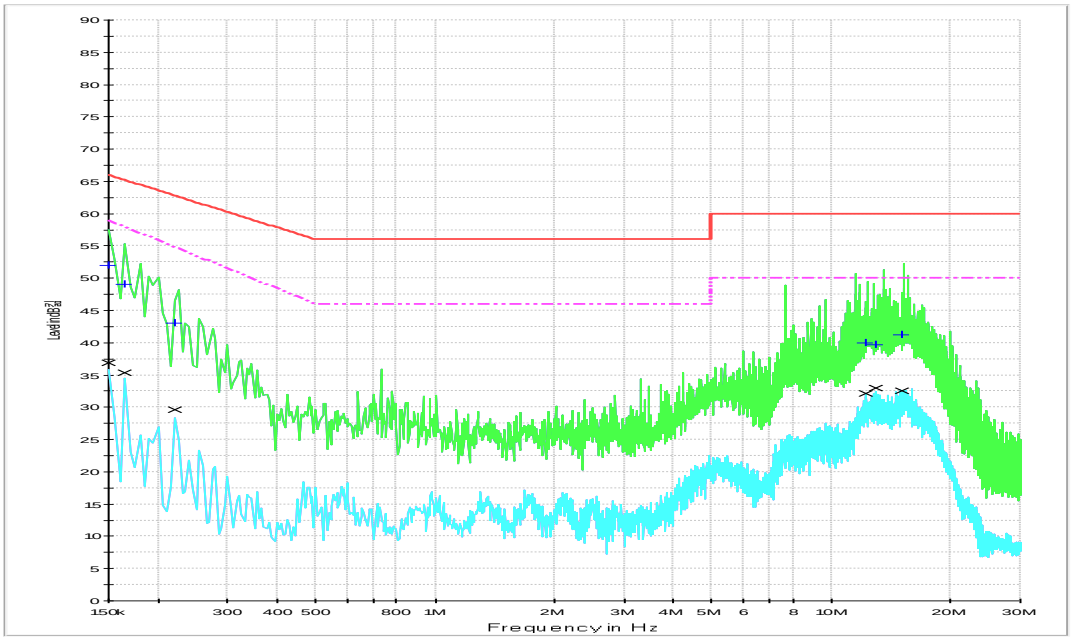

Limit and Margin-QP

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.150 000	52.0	9.000	Off	L1	9.6	14.0	66.0
0.165 000	49.1	9.000	Off	L1	9.6	16.1	65.2
0.220 000	43.1	9.000	Off	L1	9.6	19.8	62.8
12.250 000	40.0	9.000	Off	L1	9.9	20.0	60.0
12.980 000	39.7	9.000	Off	L1	9.9	20.3	60.0
15.105 000	41.2	9.000	Off	L1	9.9	18.8	60.0

Limit and Margin-CAV

Frequency (MHz)	CAverage (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.150 000	36.8	9.000	Off	L1	9.6	22.2	59.0
0.165 000	35.4	9.000	Off	L1	9.6	22.5	58.0
0.220 000	29.6	9.000	Off	L1	9.6	25.3	54.9
12.250 000	32.2	9.000	Off	L1	9.9	17.8	50.0
12.980 000	33.0	9.000	Off	L1	9.9	17.0	50.0
15.105 000	32.5	9.000	Off	L1	9.9	17.5	50.0

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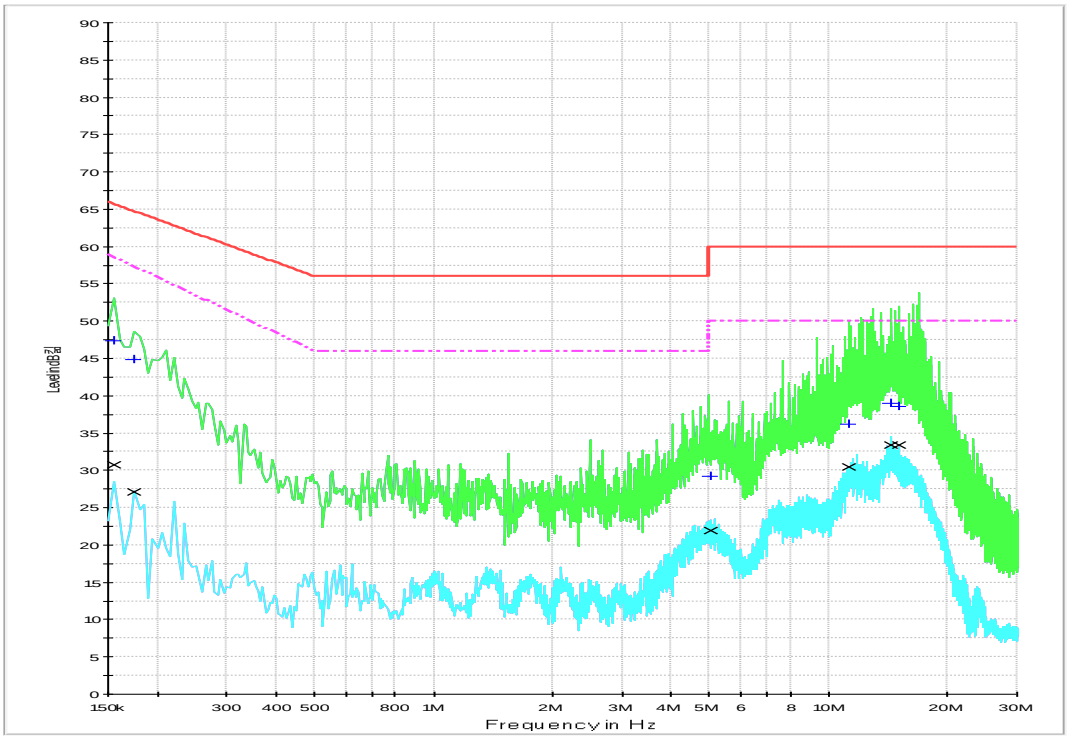


Limit and Margin-QP

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.155 000	47.4	9.000	Off	N	9.6	18.4	65.7
0.175 000	44.8	9.000	Off	N	9.6	19.9	64.7
5.055 000	29.3	9.000	Off	N	9.7	30.7	60.0
11.240 000	36.2	9.000	Off	N	9.9	23.8	60.0
14.370 000	38.9	9.000	Off	N	9.9	21.1	60.0
15.130 000	38.6	9.000	Off	N	9.9	21.4	60.0

Limit and Margin-CAV

Frequency (MHz)	CAverage (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.155 000	30.7	9.000	Off	N	9.6	27.9	58.6
0.175 000	27.1	9.000	Off	N	9.6	30.2	57.3
5.055 000	23.0	9.000	Off	N	9.7	27.0	50.0
11.240 000	30.4	9.000	Off	N	9.9	19.6	50.0
14.370 000	33.4	9.000	Off	N	9.9	16.6	50.0
15.130 000	33.4	9.000	Off	N	9.9	16.6	50.0

Measurement Uncertainty : 3.45 dB (The confidential level is about 95%, *k*=2)
Note : • Corr.: Cable Loss + LISN Factor • Result = Level + Corr. • Margin = Limit – Result

-Discontinuous Conducted Emission

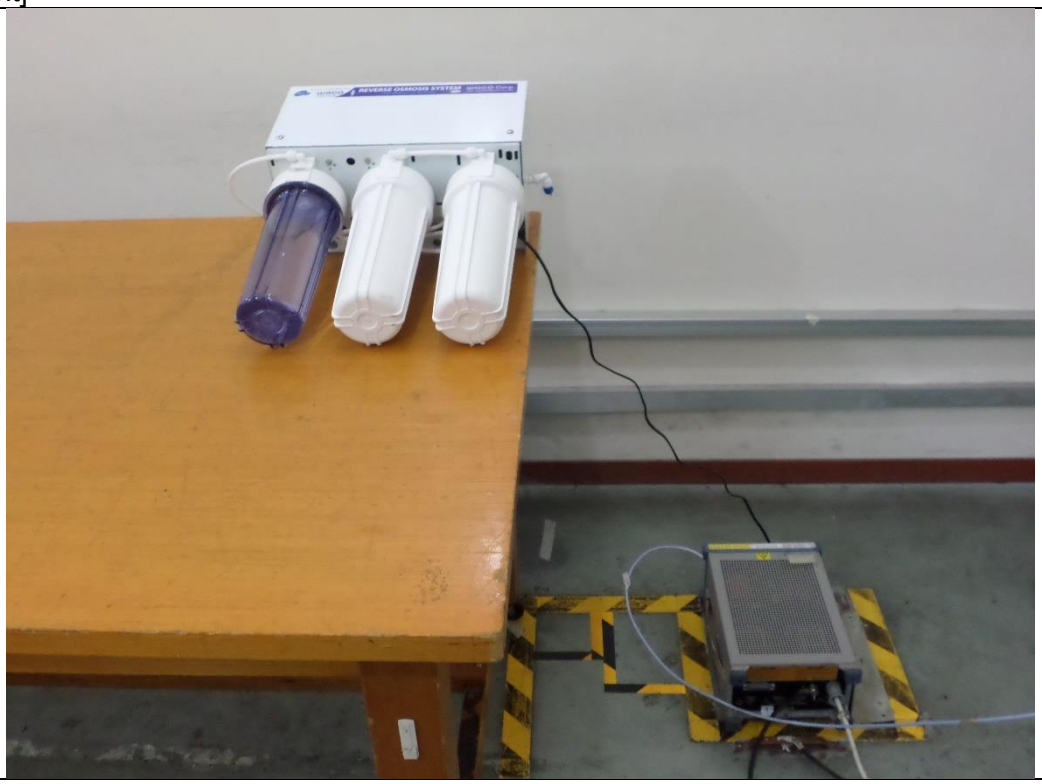
Frequency (MHz)	Count (1) Click*(f)/Min	N (2)	Click Limit Lq=L+i	Clicks (3)	Limit of (4) Count Click	Result
0.15	0 * / 120	0.00	66 + 44 = 110	0	0	**Complied**
0.5	0 * / 120	0.00	56 + 44 = 100	0	0	**Complied**
1.4	0 * / 120	0.00	56 + 44 = 100	0	0	**Complied**
30	0 * / 120	0.00	60 + 44 = 104	0	0	**Complied**

Measurement Uncertainty : 3.02 dB(The confidential level is about 95%, *k*=2)
Note **:** i = 44 dB (N<0.2), 20log(30/N) dB (0.2<N<30), 0 dB (N>30)
(1) First Time Test,(f)Factor (2) N = Click Rate (3) Allowed number of clicks(1/4)
(4) Are the clicks above click limit (Second Test)

See Appendix A (Discontinuous Conducted Emission)

2.3.4 Photographs of Conducted Emission

[Front]



[Rear]

2.3.5 Photographs of Discontinuous Conducted Emission

2.4 Radiated Emission

The initial preliminary exploratory scans were performed at 3 m distance over the measuring frequency range(30 ㎒ to 1 ㎓) using a max hold mode incorporating a Peak detector and using the software of EP5RE(Version Ver5.3.70 from TOYO). The final test data was measured using a Quasi-Peak detector below 1 ㎓ at 3 m distance. Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency.

2.4.1 Test Equipments

Description	Model No.	Manufacturer	S/N	Cal. Due Date
Test Receiver	ESU26	R & S	100109	2022-02-19
Hybrid Antenna	VULB9163	SCHWARZBECK	01126	2021-12-22
Amplifier	8447F	HP	2944A03909	2021-08-06
3m SEMI-ANECHOIC CHAMBER	-	SY CORPORATION	-	-

Note : All equipment calibration period are 1 year.

2.4.2 Test Site

3m SEMI-ANECHOIC CHAMBER in Gunpo Laboratory (Below 1 ㎓)

2.4.3 Environment Conditions and data

Below 1 ㎓ (3 m method)

Temperature (Minimum 22.5, Maximum 23.6) ℃,
Humidity (Minimum 41.0, Maximum 42.0) % R.H.,
Atmospheric Pressure (Minimum 100.5, Maximum 100.5) ㎪

Test Date : 2021-06-23

Below 1 ㎓ (3 m method)

Freq. (㎒)	Level (dB(㎶))	Pol. (H/V)	A (°)	H (㎝)	AF (dB/m)	CL (dB)	Amp. (dB)	Result (dB(㎶/m))	Limit (dB(㎶/m))	Margin (dB)
44.43	37.50	V	195	105	20.00	0.83	28.10	30.23	40.00	9.77
45.80	39.40	V	281	101	20.08	0.84	28.10	32.22	40.00	7.78
47.50	38.10	V	125	103	20.10	0.85	28.10	30.95	40.00	9.05
51.79	39.20	V	230	100	19.72	0.88	28.10	31.70	40.00	8.30
434.61	43.60	H	128	133	22.00	2.74	28.38	39.96	47.00	7.04
452.64	45.70	H	357	116	21.81	2.77	28.52	41.76	47.00	5.24

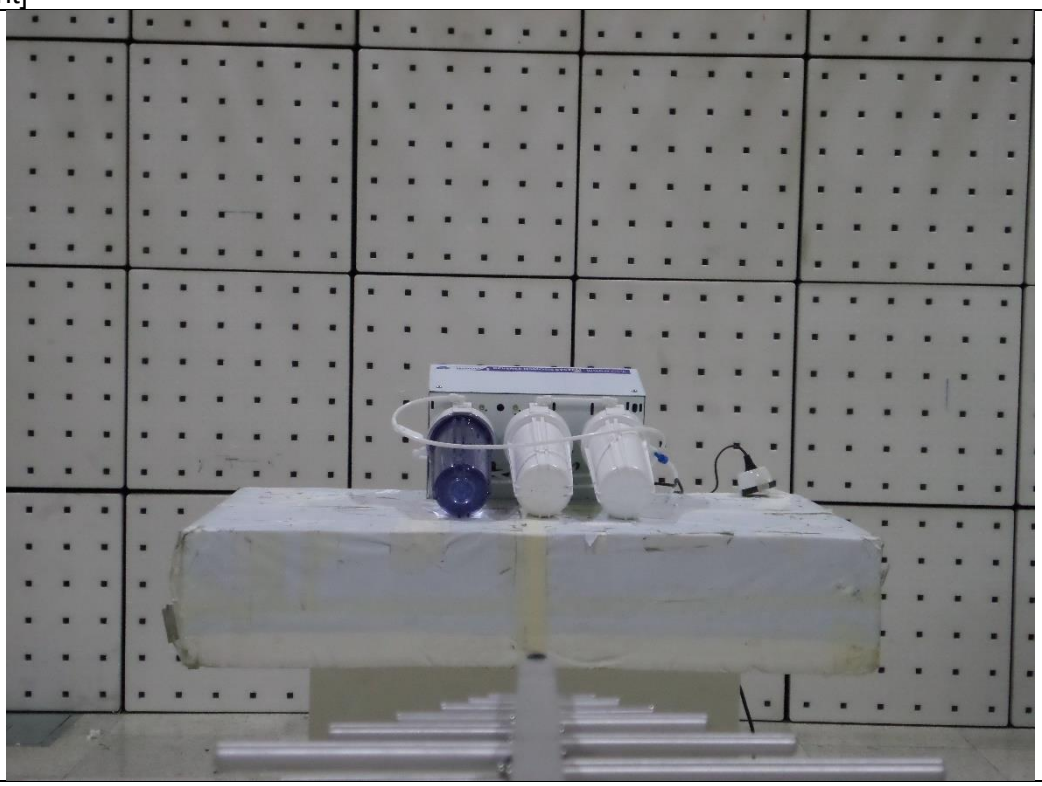
Measurement Uncertainty (Horizontal) : 4.90 ㏈ (The confidential level is about 95%, *k*=2)
Measurement Uncertainty (Vertical) : 4.82 ㏈ (The confidential level is about 95%, *k*=2)

Note: • AF = Antenna Factor • CL = Cable Loss • F/S = Field Strength
• Pol.(H) = Horizontal • Pol.(V) = Vertical • Amp. = Amplifier Gain
• Margin = Limit – F/S • F/S = Level + AF + CL – Amp.
• A : Angle • H : Height

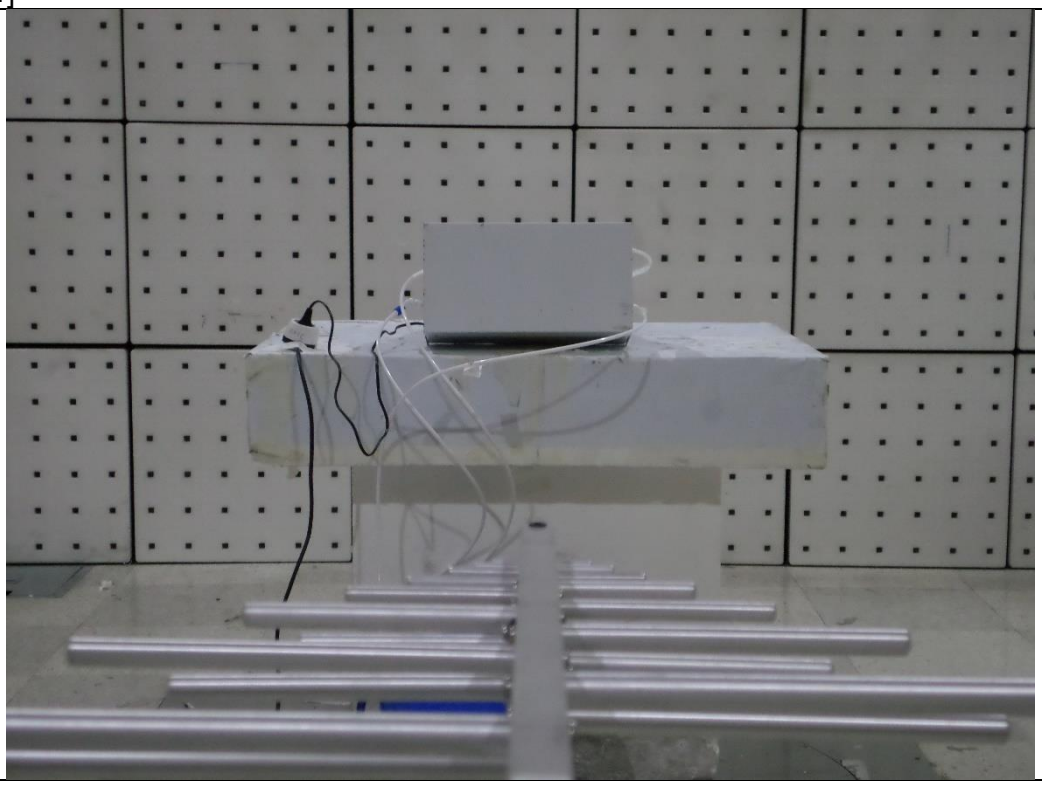
See Appendix B (Radiated Emission)

2.4.4 Photographs of Radiated Emission (3m method below 1 ㎓)

[Front]



[Rear]



Harmonics & Flicker

3.1 Test Results

Test Items	Basic Standards	Test Results
Harmonics	EN IEC 61000-3-2:2019	**Complied**
Flicker	EN 61000-3-3:2013/A1:2019	**Complied**

Note : The calibration period of every equipment is 1 year.

3.2 Test Equipments

Equipment	Model	Manufacturer	S/N	Cal. Due Date
H/F Analyzer	DPA 500	EM TEST	V0508100155	2021-11-20
AC Source	ACS 500	EM TEST	V0508100156	2021-11-06

Note : The calibration period of every equipment is 1 year.

3.3 Test Site

Harmonics & Flicker Site in Gunpo Laboratory

3.4 Harmonics Test Data

The measurement was conducted with an automatic harmonics analyzing system, Measured were all harmonics up to order 40.

Temperature (Minimum 23.5, Maximum 24.6) ℃,
Humidity (Minimum 47.0, Maximum 49.0) % R.H.,
Atmospheric Pressure (Minimum 100.2, Maximum 100.2) ㎪

Test Date : 2021-06-28

See Appendix C (Harmonics on AC Mains)

3.5 Flicker Test Data

The measurement was conducted with an automatic flicker system, Measured were all Flicker up to order 12.

Temperature (Minimum 23.5, Maximum 24.6) ℃,
Humidity (Minimum 47.0, Maximum 49.0) % R.H.,
Atmospheric Pressure (Minimum 100.2, Maximum 100.2) ㎪

Test Date : 2021-06-28

See Appendix D (Flicker on AC Mains)

3.6 Photograph of Harmonics & Flicker

IMMUNITY

4.1 Test Results

Test Items	Standards	Test Results
Electrostatic Discharge	EN 61000-4-2:2009	**Complied**
Fast Transients	EN 61000-4-4:2012	**Complied**
Surges	EN 61000-4-5:2014	**Complied**
Conducted Immunity	EN 61000-4-6:2014/AC:2015	**Complied**
Voltage dips and Interruptions	EN 61000-4-11:2004	**Complied**

4.2 Performance Criteria

Criterion 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.

Criterion 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.

Criterion 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.

4.3 Electrostatic Discharge

4.3.1 Test Equipments

Description	Model No.	Manufacturer	S/N	Cal. Due Date
ESD Simulator	ESS-2000	NoiseKen	ESS0746780	2022-05-04
HCP/VCP	-	-	-	-

Note : The calibration period of every equipment is 1 year.

4.3.2 Test Site

Shield Room in Gunpo Laboratory

4.3.3 Environment Conditions

Temperature (Minimum 23.1, Maximum 24.2) ℃,
Humidity (Minimum 45.0, Maximum 46.0) % R.H.,
Atmospheric Pressure (Minimum 101.5, Maximum 101.5) kPa

Test Date : 2021-07-02

4.3.4 Performance Criterion : B

4.3.5 Test Points

No.	Test Points	No.	Test Points
1	HCP/VCP	3	Metal Enclosure
2	Screw	4	Non-Metal Enclosure

4.3.6 Test Results

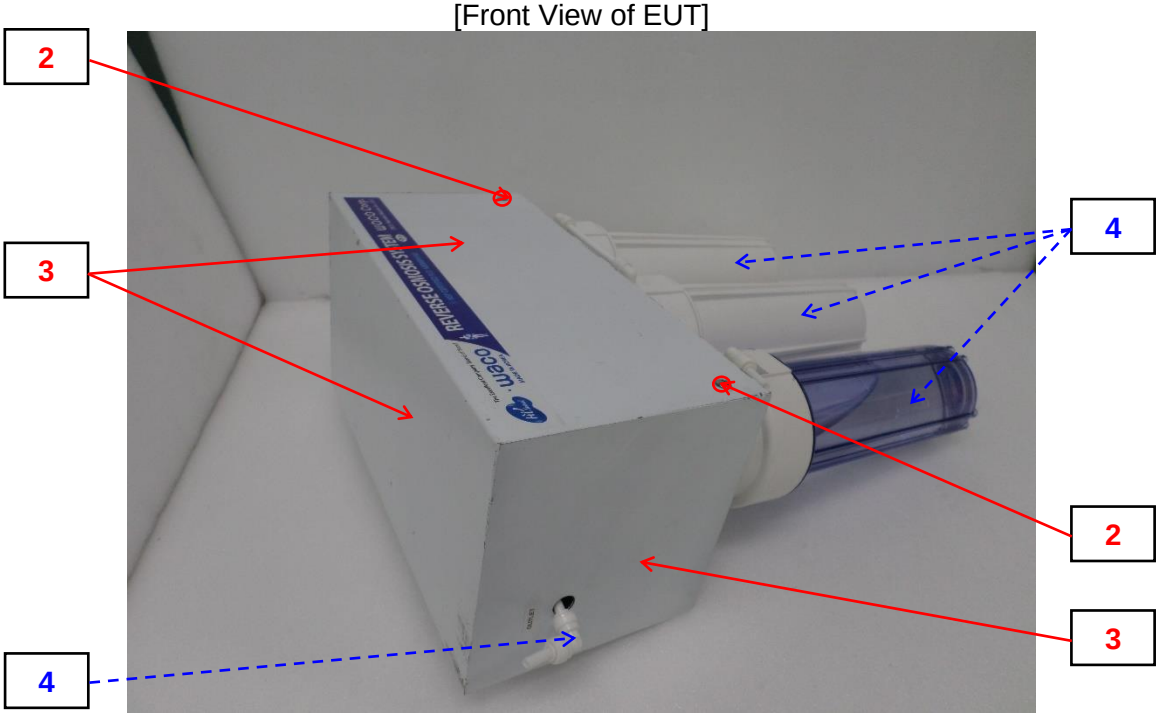
Direct Application											
No.	Discharge Method	Number of Discharge	Level(kV)								Results
			+2	-2	+4	-4	+6	-6	+8	-8	
2	Contact	≥10 times			√	√					**Performance Criteria A**
3	Contact	≥10 times			√	√					**Performance Criteria A**
4	Air	≥10 times							√	√	**Performance Criteria A**
Indirect Application											
No.	Discharge Method	Number of Discharge	Level(kV)								Results
			+2	-2	+4	-4	+6	-6	+8	-8	
1	Contact	≥10 times			√	√					**Performance Criteria A**

Performance Criteria A, the EUT normally operated during and after the test.

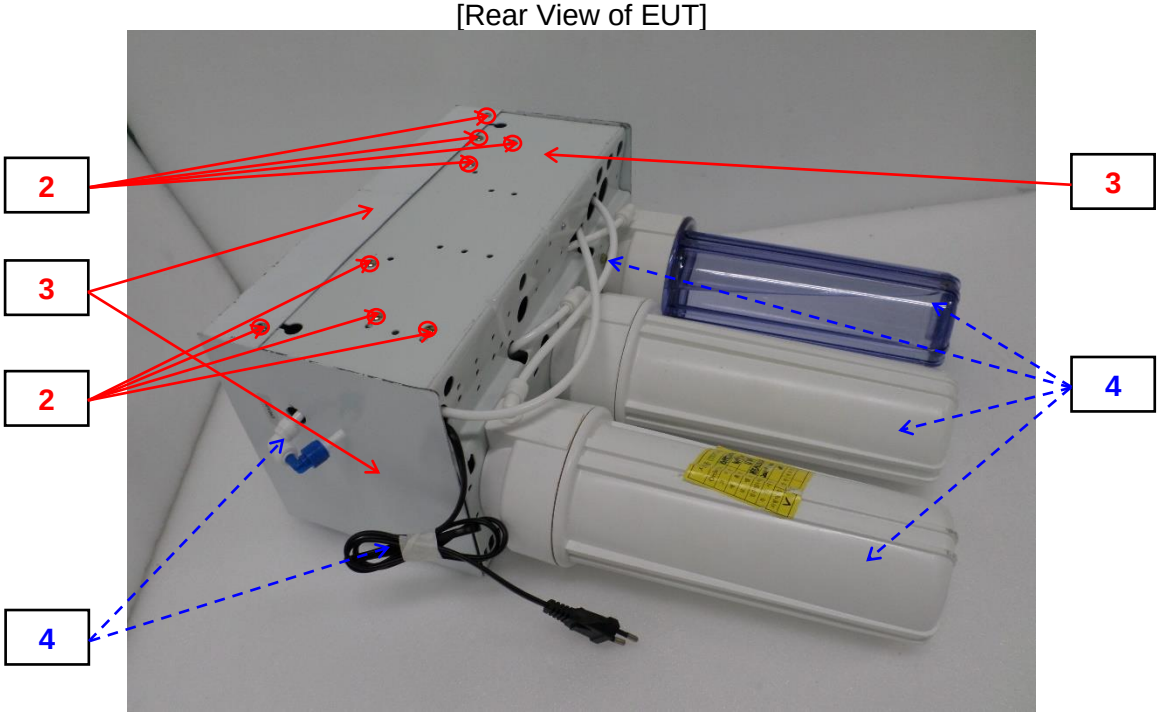
4.3.7 Test Points

Contact
Air

[Front View of EUT]



[Rear View of EUT]



4.3.8 Photograph of Electrostatic Discharge

4.4 Fast Transients/Burst

4.4.1 Test Equipments

Description	Model No.	Manufacturer	S/N	Cal. Due Date
Compact NX Generator	Compact NX	EM TEST	P1636183647	2021-11-06
Motion Driven AC Source	MV2616	EM TEST	V0508100161	2021-11-06

Note : The calibration period of every equipment is 1 year

4.4.2 Test Site

Immunity Test Site in Gunpo Laboratory

4.4.3 Environment Conditions

Temperature (Minimum 23.2, Maximum 25.1) ℃,
Humidity (Minimum 49.0, Maximum 50.0) % R.H.,
Atmospheric Pressure (Minimum 101.2, Maximum 101.2) ㎪

Test Date : 2021-06-29

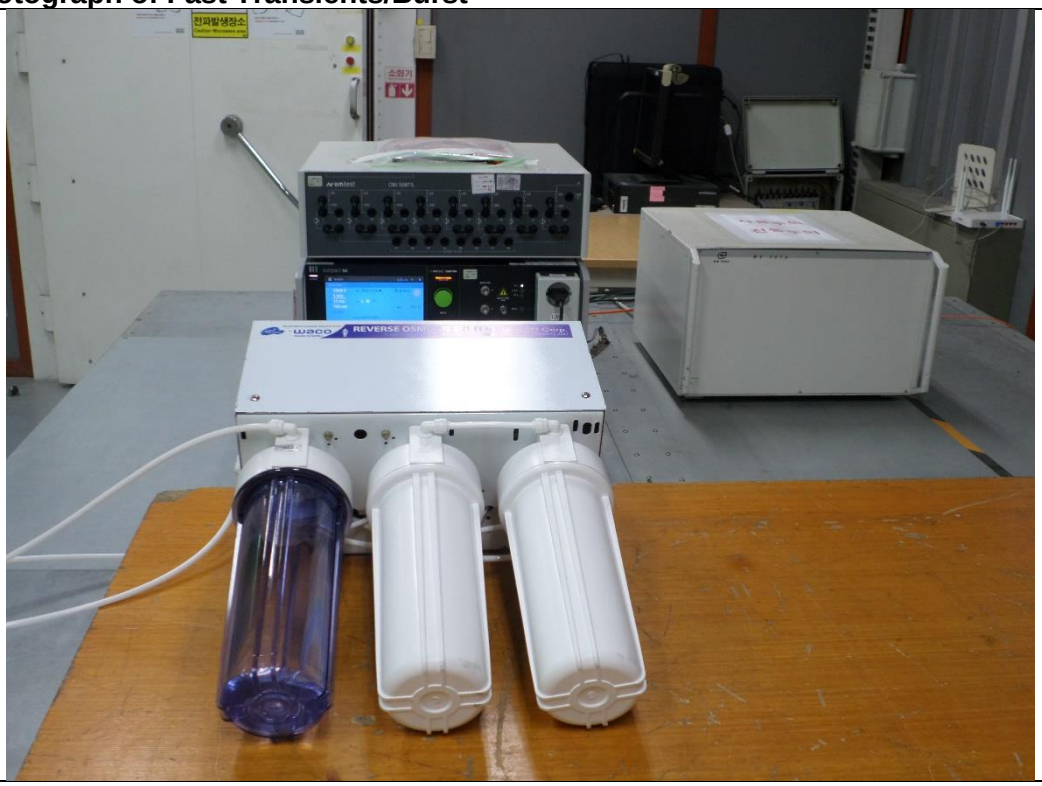
4.4.4 Performance Criterion : B

4.4.5 Test Results

Test Point	Polarity	Coupling	Repetition	Pulse (㎱)	Duration	Test Level (㎸)	Results
L-N	+/-	Direct	5 ㎑	5/50	≥ 2 min	1.0	**Performance Criteria A**

Performance Criteria A, the EUT normally operated during and after the test.

4.4.6 Photograph of Fast Transients/Burst



4.5 Surges

4.5.1 Test Equipments

Description	Model No.	Manufacturer	S/N	Cal. Due Date
Compact NX Generator	Compact NX	EM TEST	P1636183647	2021-11-06
Motion Driven AC Source	MV2616	EM TEST	V0508100161	2021-11-06

Note : The calibration period of every equipment is 1 year

4.5.2 Test Site

Immunity Test Site in Gunpo Laboratory

4.5.3 Environment Conditions

Temperature (Minimum 23.2, Maximum 25.1) ℃,
Humidity (Minimum 49.0, Maximum 50.0) % R.H.,
Atmospheric Pressure (Minimum 101.2, Maximum 101.2) ㎪

Test Date : 2021-06-29

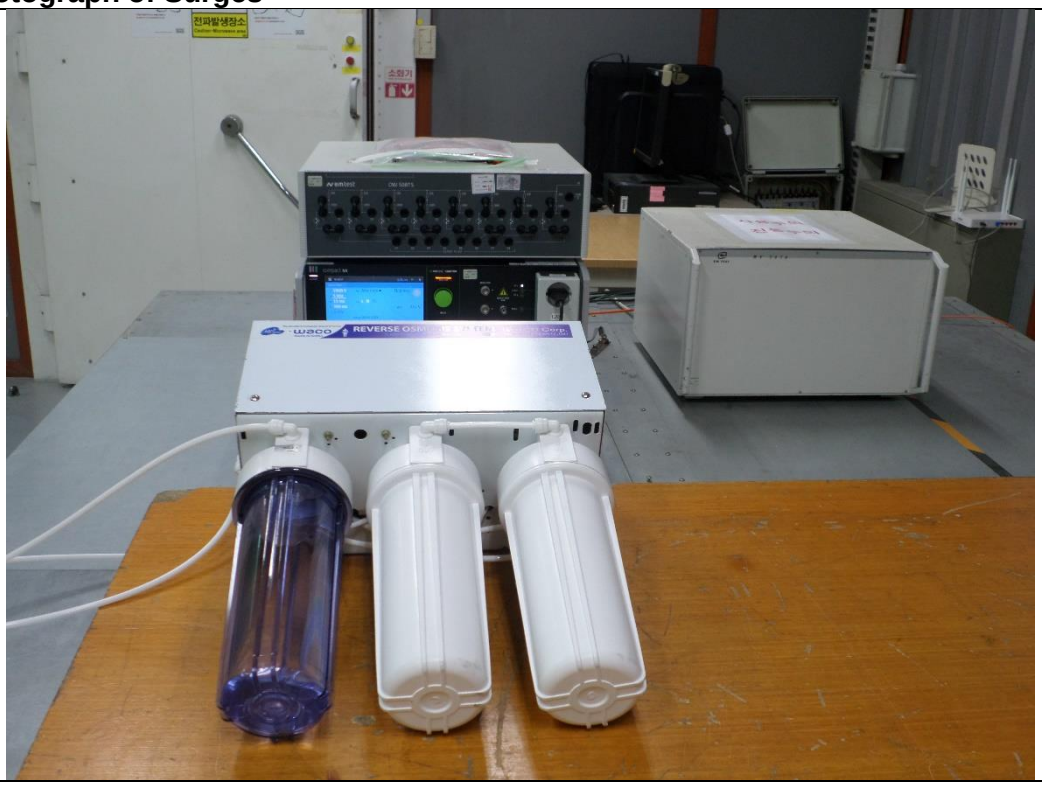
4.5.4 Performance Criterion : B

4.5.5 Test Results

Test Point	Polarity	Coupling	Pulse (㎲)	Number of Surges	Repetition	Phase Angle(˚)	Test Level (㎸)	Results
L-N	+/-	Direct	1.2/50	5	≤ 60 s	90, 270	1.0	**Performance Criteria A**

Performance Criteria A, the EUT normally operated during and after the test.

4.5.6 Photograph of Surges



4.6 Conducted Immunity

4.6.1 Test Equipments

Description	Model No.	Manufacturer	S/N	Cal. Due Date
Power Line Coupling Decoupling Network	FCC-801-M2-16A	Fisher Custom Communication Inc.	04001	2021-09-04
Amplifier	150A250	AR	312201	-
Dual Directional Coupler	DC2600M2	AR	311978	2021-10-22
Signal Generator	SMB100A	R & S	106781	2021-10-22
Voltage Sensor	NRP-Z91	R & S	103092-Jc, 103093-ZH	2021-08-06
Attenuator	300-A-FFN-06	BIRD Electronics Corporation	0433	2021-10-22

Note : The calibration period of every equipment is 1 year

4.6.2 Test Site

Immunity Test Site in Gunpo Laboratory

4.6.3 Environment Conditions

Temperature (Minimum 21.7, Maximum 22.9) ℃,
Humidity (Minimum 46.0, Maximum 47.0) % R.H.,
Atmospheric Pressure (Minimum 101.6, Maximum 101.6) ㎪

Test Date : 2021-06-30

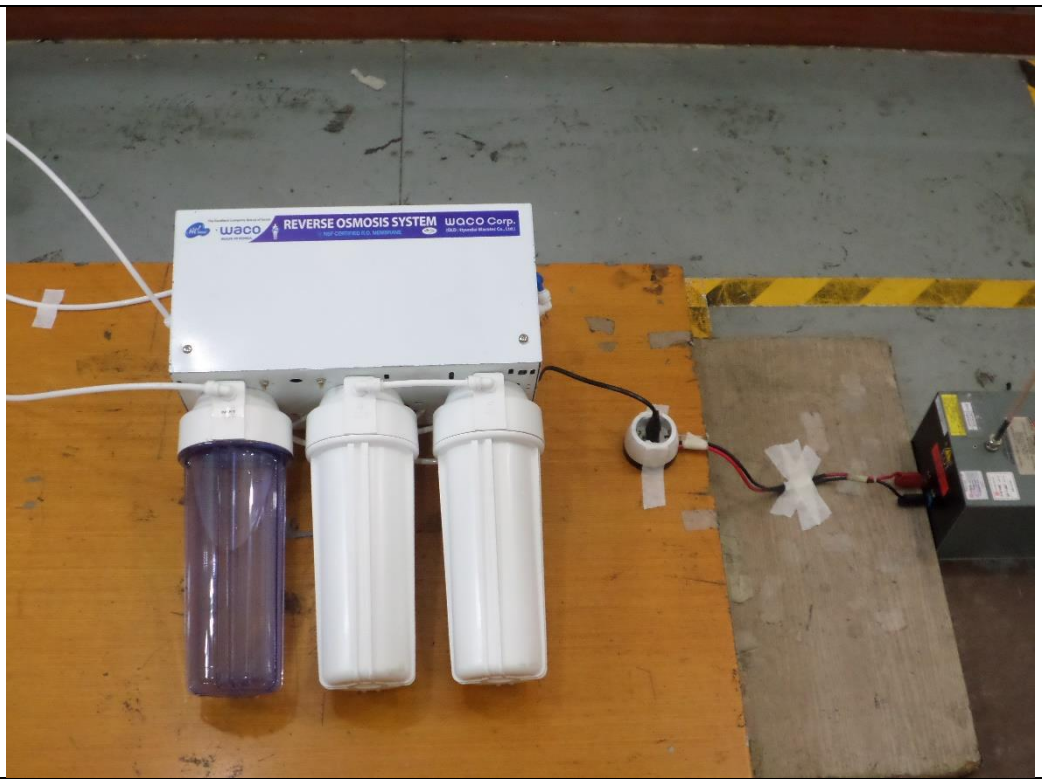
4.6.4 Performance Criterion: A

4.6.5 Test Results

Frequency (㎒)	Test Point	Coupling	Voltage Level	Modulation	Frequency Step	Dwell Time	Results
0.15 ~ 230	AC IN	CDN (M2)	3 V	80% AM(1 ㎑)	1 %	3 s	**Performance Criteria A**

Measurement Uncertainty : 2.23 ㏈ (The confidential level is about 95%, *k*=2)
Performance Criteria A, the EUT normally operated during and after the test.

4.6.6 Photograph of Conducted Immunity



4.7 Voltage Dips and Interruptions

4.7.1 Test Equipments

Description	Model No.	Manufacturer	S/N	Cal. Due Date
Compact NX Generator	Compact NX	EM TEST	P1636183647	2021-11-06
Motion Driven AC Source	MV2616	EM TEST	V0508100161	2021-11-06

Note : The calibration period of every equipment is 1 year

4.7.2 Test Site

Immunity Test Site in Gunpo Laboratory

4.7.3 Environment Conditions

Temperature (Minimum 23.2, Maximum 25.1) ℃,
Humidity (Minimum 49.0, Maximum 50.0) % R.H.,
Atmospheric Pressure (Minimum 101.2, Maximum 101.2) ㎪

Test Date : 2021-06-29

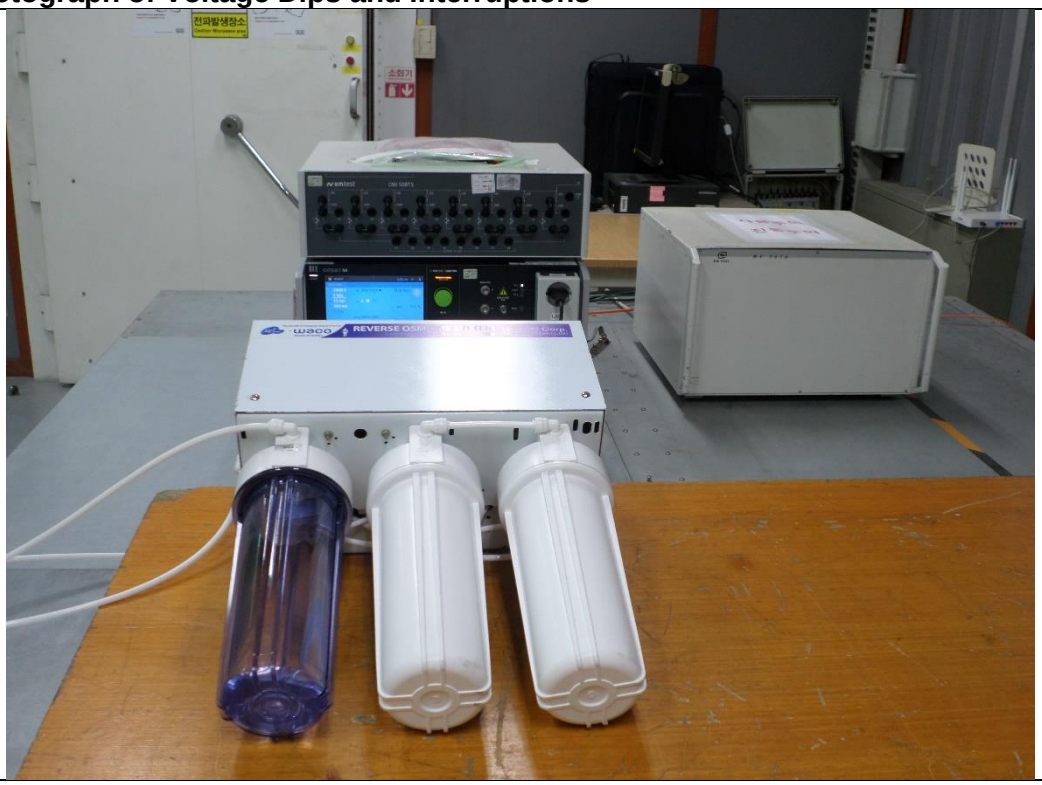
4.7.4 Performance Criterion : B or C

4.7.5 Test Results

Test Voltage (V)	Test Level %U_T	Voltage Dip/Int. %U_T	Duration (㎳/Cycle)	Results
240	0 %	100 %	0.5 Cycle	**Performance Criteria A**
	40 %	60 %	10 Cycle	**Performance Criteria A**
	70 %	30 %	25 Cycle	**Performance Criteria A**
100	0 %	100 %	0.5 Cycle	**Performance Criteria A**
	40 %	60 %	10 Cycle	**Performance Criteria A**
	70 %	30 %	25 Cycle	**Performance Criteria A**

Performance Criteria A, At 0.5, 10, 25 Cycle, The EUT normally operated during and after the test.

4.7.6 Photograph of Voltage Dips and Interruptions



5. Photographs of EUT

[Front View of EUT]

[Rear View of EUT]

[Left View of EUT]

[Right View of EUT]

[Inside of EUT]

[View of Booster Pump]

[View of Solenoid Valve]

Appendix A : Discontinuous Conducted Emission

Mode **Click Measurements**

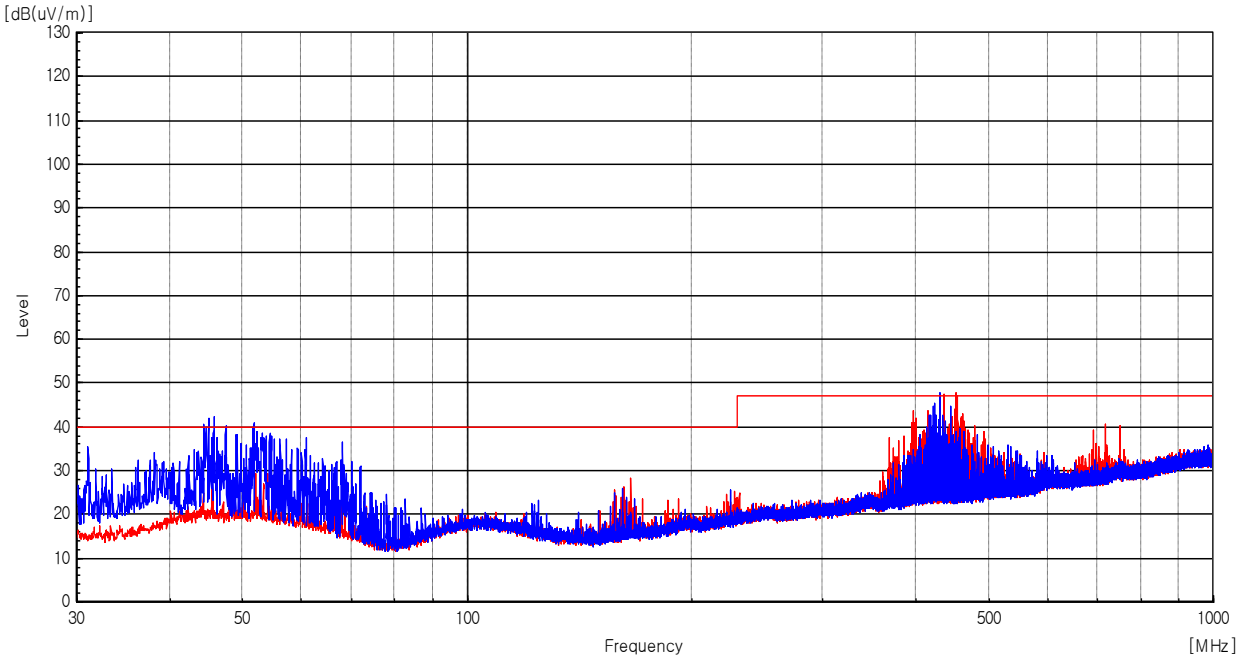
Type of Eut **Other robotic equipment**

Rx 150 KHz Att. [dB]	**10**	Rx 500 kHz Att. [dB]	**10**
Rx 1.4 MHz Att. [dB]	**10**	Rx 30 MHz Att. [dB]	**10**
Rx 150 kHz Input Offset [dB]	**10**	Rx 500 kHz Input Offset [dB]	**10**
Rx 1.4 MHz Input Offset [dB]	**0**	Rx 30 MHz Input Offset [dB]	**0**
External Att. [dB]	**NONE**		
Remote	**NONE**		

	150 kHz	500 kHz	1.4 MHz	30 MHz
First Run				
Short	0	1	0	0
Long	0	0	0	0
Long (10< t ≤20 ms)	0	0	0	0
Tot. Clicks Corr	0	1	0	0
Events	0	0	0	0
Time(s)	0.00	0.00	0.00	0.00
Sw.Op.	0	0	0	0
5.4.3.5 events	0	0	0	0
Limit dBuV	66	56	56	60
N	0.00	0.01	0.01	0.01
	PASS	**PASS**	**PASS**	**PASS**

150 kHz	No Clicks	500 kHz	Istantaneus switchings: Exempt from amplitude limits
1.4 MHz	No Clicks	30 MHz	No Clicks

Appendix B : Radiated Emission (3m method)



Appendix C : Harmonics on AC Mains

Test Report	
Report Number :	IEC 61000-3-2 (Ed5-1) - Class A (230V - 50Hz)
Test Standard :	IEC 61000-3-2 (Edition 5.1) Limits for harmonic current emissions (equipment input current < 16 A per phase)
Test Date :	6/28/2021 1:52:12 PM

Result			
E.U.T. :	PASS	Source :	PASS

(Date) (Sign)

Climatic Conditions					
Temperature :	(23.5~24.6) °C	Pressure :	(100.2~100.2) kPa	Humidity :	(47.0~49.0) %

Software			
Name :	net.control	Version :	3.1.0.0

Measures & Analysis			
Measure Window :	10 periods	Voltage Range :	500 V
Refresh Interval :	2 s	Current Range :	50 A
Sampling Rate :	6.4 kS/s		
Scaled Window :	Rectangular		
According :	IEC 61000-3-2 (Edition 5.1) Limits for harmonic current emissions (equipment input current < 16 A per phase)		

Measure Results
Standard Specific Results for IEC 61000-3-2 (Edition 5.1)

Standard Group:	Industry
Standard Name:	IEC 61000-3-2 (Edition 5.1)
	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 A
Appli. of Limits:	less than or equal to 150 % (Without POHC Enhancement)

Current limits are disabled because rated power is less than 75W.

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:	0.066 A		
Active input Power			
Line 1:	13.523 W *		
Circuit power factor			
Line 1:	0.359 *		

** Absolute value.*

Current Test Result

Average and Maximum harmonic current results									
Hn	Average				Maximum				Harmonic Result
	Ieff [A]	of Limit [%]	Limit [A]	Result	Ieff [A]	of Limit [%]	Limit [A]	Result	
1	0.065				0.066				
2	0.001				0.002				
3	0.057				0.058				
4	0.003				0.004				
5	0.055				0.056				
6	0.002				0.002				
7	0.053				0.053				
8	0.002				0.002				
9	0.051				0.051				
10	0.002				0.002				
11	0.047				0.047				
12	0.002				0.002				
13	0.043				0.043				
14	0.002				0.002				
15	0.039				0.039				
16	0.002				0.002				
17	0.034				0.034				
18	0.002				0.002				
19	0.030				0.030				
20	0.002				0.002				
21	0.026				0.026				
22	0.002				0.002				
23	0.022				0.022				
24	0.001				0.002				
25	0.018				0.019				
26	0.001				0.002				
27	0.015				0.015				
28	0.001				0.002				
29	0.013				0.013				
30	0.001				0.002				
31	0.011				0.011				
32	0.001				0.002				
33	0.009				0.010				
34	0.001				0.002				
35	0.009				0.009				
36	0.001				0.002				
37	0.008				0.008				
38	0.001				0.002				
39	0.008				0.008				
40	0.001				0.002				

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.

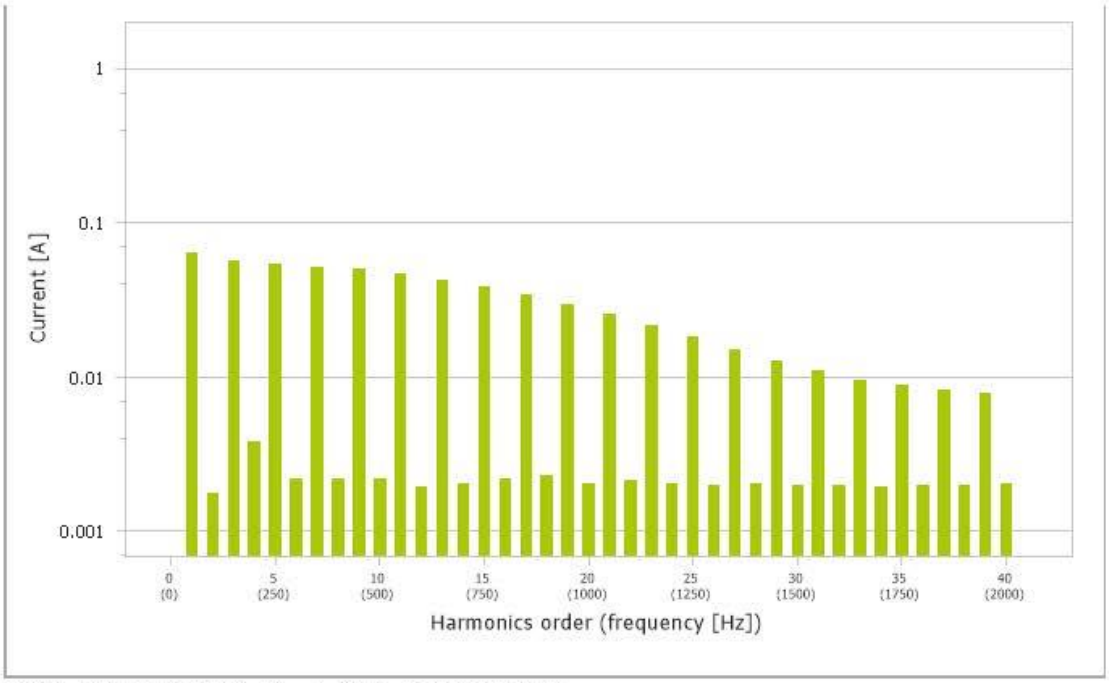
Voltage Source Verification

Harmonic voltage results				
Hn	Ueff [V]	Ueff [%]	Limit [%]	Result
1	232.187	100.951		
2	0.087	0.038	0.200	PASS
3	0.108	0.047	0.900	PASS
4	0.021	0.009	0.200	PASS
5	0.039	0.017	0.400	PASS
6	0.014	0.006	0.200	PASS
7	0.066	0.029	0.300	PASS
8	0.016	0.007	0.200	PASS
9	0.031	0.014	0.200	PASS
10	0.023	0.010	0.200	PASS
11	0.077	0.033	0.100	PASS
12	0.019	0.008	0.100	PASS
13	0.068	0.030	0.100	PASS
14	0.015	0.006	0.100	PASS
15	0.065	0.028	0.100	PASS
16	0.017	0.008	0.100	PASS
17	0.057	0.025	0.100	PASS
18	0.021	0.009	0.100	PASS
19	0.041	0.018	0.100	PASS
20	0.022	0.009	0.100	PASS
21	0.061	0.027	0.100	PASS
22	0.021	0.009	0.100	PASS
23	0.050	0.022	0.100	PASS
24	0.023	0.010	0.100	PASS
25	0.046	0.020	0.100	PASS
26	0.022	0.009	0.100	PASS
27	0.052	0.023	0.100	PASS
28	0.023	0.010	0.100	PASS
29	0.032	0.014	0.100	PASS
30	0.016	0.007	0.100	PASS
31	0.057	0.025	0.100	PASS
32	0.016	0.007	0.100	PASS
33	0.030	0.013	0.100	PASS
34	0.014	0.006	0.100	PASS
35	0.048	0.021	0.100	PASS
36	0.014	0.006	0.100	PASS
37	0.033	0.014	0.100	PASS
38	0.017	0.007	0.100	PASS
39	0.024	0.010	0.100	PASS
40	0.014	0.006	0.100	PASS

Maximum Harmonics

Maximum Harmonics (Line 1)

Hn	Frequency	Current				
	[Hz]	eff [A]	eff[%]	of Limit [%]	Limit [A]	Time Window
1	50	0.066	99.903	-	-	7
2	100	0.002	2.713	0.11	1.62	463
3	150	0.058	87.657	1.667	3.45	162
4	200	0.004	5.91	0.601	0.645	461
5	250	0.056	84.802	3.254	1.71	21
6	300	0.002	3.405	0.496	0.45	459
7	350	0.053	80.855	4.593	1.155	9
8	400	0.002	3.368	0.641	0.345	461
9	450	0.051	77.743	8.501	0.6	21
10	500	0.002	3.366	0.8	0.276	461
11	550	0.047	72.254	9.577	0.495	62
12	600	0.002	2.99	0.853	0.23	459
13	650	0.043	65.804	13.706	0.315	172
14	700	0.002	3.166	1.054	0.197	452
15	750	0.039	59.334	17.302	0.225	45
16	800	0.002	3.375	1.284	0.173	451
17	850	0.034	52.567	17.373	0.199	124
18	900	0.002	3.565	1.526	0.153	451
19	950	0.03	46.184	17.059	0.178	154
20	1000	0.002	3.18	1.512	0.138	450
21	1050	0.026	39.804	16.25	0.161	169
22	1100	0.002	3.326	1.739	0.125	450
23	1150	0.022	33.915	15.164	0.147	154
24	1200	0.002	3.134	1.788	0.115	451
25	1250	0.019	28.551	13.876	0.135	152
26	1300	0.002	3.09	1.91	0.106	450
27	1350	0.015	23.408	12.287	0.125	152
28	1400	0.002	3.138	2.089	0.099	449
29	1450	0.013	19.82	11.174	0.116	150
30	1500	0.002	3.069	2.188	0.092	448
31	1550	0.011	17.05	10.275	0.109	148
32	1600	0.002	3.052	2.322	0.086	460
33	1650	0.01	14.952	9.592	0.102	148
34	1700	0.002	3.044	2.46	0.081	146
35	1750	0.009	13.813	9.399	0.096	147
36	1800	0.002	3.114	2.665	0.077	456
37	1850	0.008	12.661	9.107	0.091	146
38	1900	0.002	3.085	2.787	0.073	456
39	1950	0.008	12.191	9.243	0.087	144
40	2000	0.002	3.188	3.032	0.069	457



6/6IEC 61000-3-2 (Ed5-1) - Class A (230V - 50Hz)28-06-2021

- Comparison test to check for deviation

Comparison of average harmonic current results				
Hn	File #1	File #2		Computed tolerance [A]
	value [A]	value [A]	diff. [A]	
1	0.065	0.064	-0.001	-
2	0.001	0.001	0.000	0.0540
3	0.057	0.056	-0.001	0.1150
4	0.003	0.004	0.000	0.0215
5	0.055	0.054	-0.001	0.0570
6	0.002	0.002	0.000	0.0150
7	0.053	0.052	-0.001	0.0385
8	0.002	0.002	0.000	0.0115
9	0.051	0.050	-0.001	0.0200
10	0.002	0.002	0.000	0.0092
11	0.047	0.046	-0.001	0.0165
12	0.002	0.002	0.000	0.0077
13	0.043	0.042	-0.001	0.0105
14	0.002	0.002	0.000	0.0066
15	0.039	0.038	0.000	0.0075
16	0.002	0.002	0.000	0.0058
17	0.034	0.034	0.000	0.0066
18	0.002	0.002	0.000	0.0051
19	0.030	0.030	0.000	0.0059
20	0.002	0.002	0.000	0.0046
21	0.026	0.026	0.000	0.0054
22	0.002	0.002	0.000	0.0042
23	0.022	0.022	0.000	0.0049
24	0.001	0.001	0.000	0.0038
25	0.018	0.019	0.000	0.0045
26	0.001	0.001	0.000	0.0035
27	0.015	0.015	0.000	0.0042
28	0.001	0.001	0.000	0.0033
29	0.013	0.013	0.000	0.0039
30	0.001	0.001	0.000	0.0031
31	0.011	0.011	0.000	0.0036
32	0.001	0.001	0.000	0.0029
33	0.009	0.009	0.000	0.0034
34	0.001	0.001	0.000	0.0027
35	0.009	0.009	0.000	0.0032
36	0.001	0.001	0.000	0.0026
37	0.008	0.008	0.000	0.0030
38	0.001	0.001	0.000	0.0024
39	0.008	0.008	0.000	0.0029
40	0.001	0.001	0.000	0.0023

Appendix D : Flicker on AC Mains

Test Report	
Report Number :	IEC 61000-3-3 (Ed3-2) - General Test conditions (230V - 50Hz)
Test Object :	HEALSUMM-A
Customer :	WACO Corp.
Test Standard :	IEC 61000-3-3 (Edition 3.2) 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 Date :	6/28/2021 4:45:29 PM

Result	
E.U.T. :	Test passed

Customer	
Name : WACO Corp.	Contact Person :
Phone :	eMail :
Address :	

Test Object / Product	
Name : HEALSUMM-A	Operation Mode : Operating
Serial Number :	Connection :
Description :	

Climatic Conditions					
Temperature :	(23.5~24.6) °C	Pressure :	(100.2~100.2) kPa	Humidity :	(47.0~49.0) %

Software			
Name :	net.control	Version :	3.1.0.0

Flicker Results
Standard Specific Results for IEC 61000-3-3 (Edition 3.2)

Standard Group: Industry

Standard Name: IEC 61000-3-3 (Edition 3.2)
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:	12 × 10 min
Measurements:	12

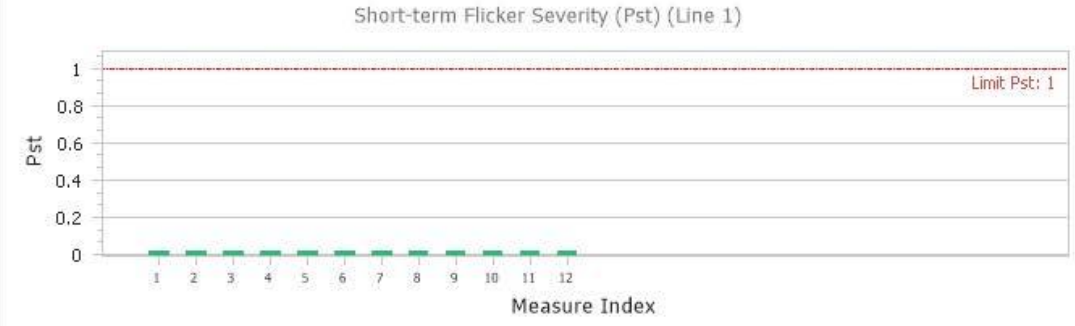
Flicker Measurements					
	P_{lt}	Max P_{st}	Max d_c	Max d_{max}	Max T_{max}
Line 1:	0.028	0.028	0	< 0.2	0
Limits:	0.65	1	3.3	4	0.5
Results:	PASS	PASS	PASS	PASS	PASS

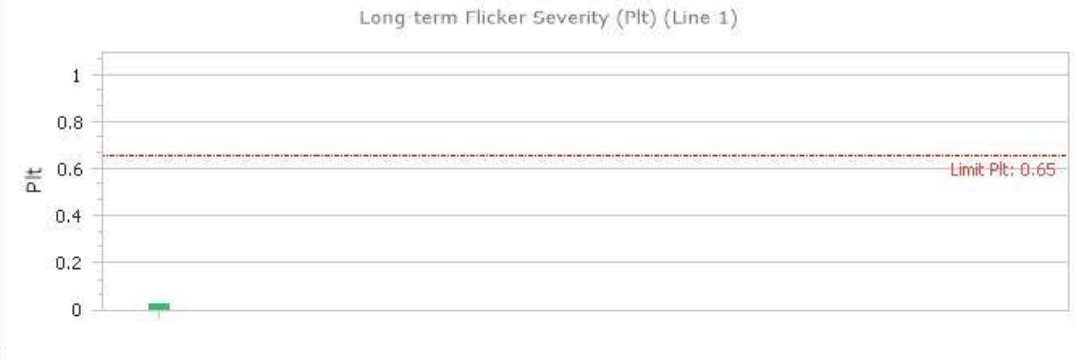
Flicker Individual Measurements												
Measurement	P_{st} [ ]			d_c [%]			d_{max} [%]			T_{max} [s]		
	Value	Limit	Result	Value	Limit	Result	Value	Limit	Result	Value	Limit	Result
#1	0.03	1.00	PASS	0.00	3.30	PASS	< 0.2	4.00	PASS	0.00	0.50	PASS
#2	0.03	1.00	PASS	0.00	3.30	PASS	< 0.2	4.00	PASS	0.00	0.50	PASS
#3	0.03	1.00	PASS	0.00	3.30	PASS	< 0.2	4.00	PASS	0.00	0.50	PASS
#4	0.03	1.00	PASS	0.00	3.30	PASS	< 0.2	4.00	PASS	0.00	0.50	PASS
#5	0.03	1.00	PASS	0.00	3.30	PASS	< 0.2	4.00	PASS	0.00	0.50	PASS
#6	0.03	1.00	PASS	0.00	3.30	PASS	< 0.2	4.00	PASS	0.00	0.50	PASS
#7	0.03	1.00	PASS	0.00	3.30	PASS	< 0.2	4.00	PASS	0.00	0.50	PASS
#8	0.03	1.00	PASS	0.00	3.30	PASS	< 0.2	4.00	PASS	0.00	0.50	PASS
#9	0.03	1.00	PASS	0.00	3.30	PASS	< 0.2	4.00	PASS	0.00	0.50	PASS
#10	0.03	1.00	PASS	0.00	3.30	PASS	< 0.2	4.00	PASS	0.00	0.50	PASS
#11	0.03	1.00	PASS	0.00	3.30	PASS	< 0.2	4.00	PASS	0.00	0.50	PASS
#12	0.03	1.00	PASS	0.00	3.30	PASS	< 0.2	4.00	PASS	0.00	0.50	PASS

Pst Data

Flicker (Line 1)

Meas. No.	P0,1	P1s	P3s	P10s	P50s	Pst	dc [%]	dmax [%]	Tmax [s]
1	0	0	0	0.001	0.005	0.028	0	0.056	0
2	0	0	0	0.001	0.005	0.028	0	0.042	0
3	0	0	0	0.001	0.005	0.028	0	0.041	0
4	0	0	0	0.001	0.005	0.028	0	0.041	0
5	0	0	0	0.001	0.005	0.028	0	0.038	0
6	0	0	0	0.001	0.005	0.028	0	0.036	0
7	0	0	0	0.001	0.005	0.028	0	0.043	0
8	0	0	0	0.001	0.005	0.028	0	0.044	0
9	0	0	0	0.001	0.005	0.028	0	0.041	0
10	0	0	0	0.001	0.005	0.028	0	0.042	0
11	0	0	0	0.001	0.005	0.028	0	0.04	0
12	0	0	0	0.001	0.005	0.028	0	0.037	0





28-06-20213/3IEC 61000-3-3 (Ed3-2) - General Test conditions (230V - 50Hz)

- End of the Report -