TEST REPORT

KCTL Inc.
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Report No.: KR21-YEC0219
Page (1) of (70)

KCTL

1. Client

- Name : Suprema ID Inc.
- Address : 1207, 37, Sagimakgol-ro 62beon-gil, Jungwon-gu, Seongnam-si, Gyeonggi-do, Republic of Korea
- Date of Receipt : 2021-10-15

2. Use of Report : -

3. Name of Product / Model : RealScan S60 / RS S60

4. Manufacturer / Country of Origin : Suprema ID Inc. / Korea

5. Date of Test : 2021-11-02 to 2021-11-04

6. Location of Test : ■ Permanent Testing Lab ☐ On Site Testing
(Address: 52-20 Sinjeong-ro 41beon-gil, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea)

7. Test method used : EN 55032:2015 +A11:2020, Class A
EN 55035:2017 +A11:2020
EN IEC 61000-3-2:2019
EN 61000-3-3:2013 +A1:2019

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

Affirmation	Tested by Name : Youngbin Kim (Signature)	Technical Manager Name : Jaeho Park (Signature)

2021-11-17

KCTL Inc.

REPORT REVISION HISTORY

Date	Revision	Page No
2021-11-17	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**

Contents

1. Applicant information

Applicant:	Suprema ID Inc.
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E-mail:	sypark2@suprema.co.kr
Contact name:	Suyeol Park

Manufacturer:	Suprema ID Inc.
Address:	1207, 37, Sagimakgol-ro 62beon-gil, Jungwon-gu, Seongnam-si, Gyeonggi-do, Republic of Korea
Telephone:	+82-31-710-5628
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E-mail:	sypark2@suprema.co.kr
Contact name:	Suyeol Park

2. Laboratory information

Address

KCTL Inc. (Yongin Lab.)

52-20 Sinjeong-ro 41beon-gil, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea

Telephone Number: 82-31-326-6700

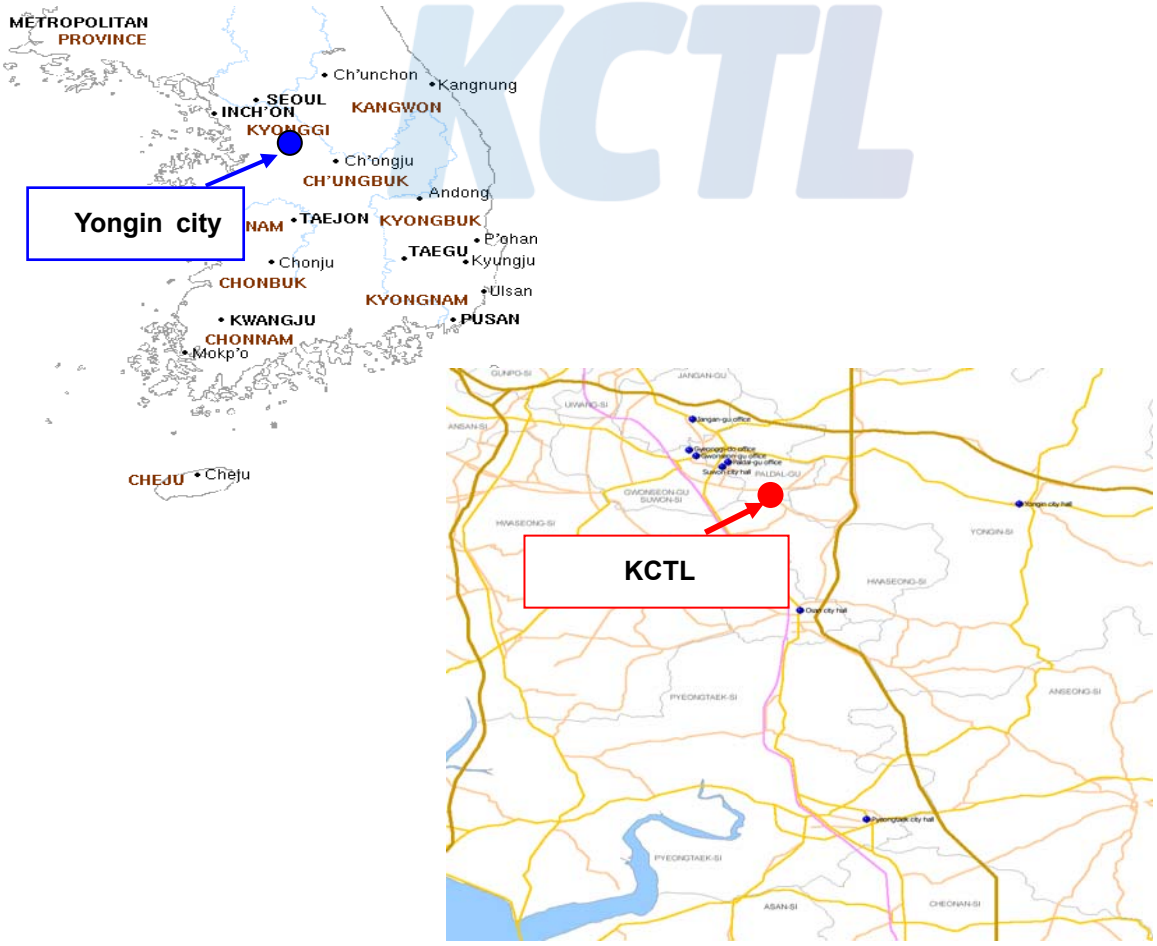
Facsimile Number: 82-505-299-8311

FCC Site Designation No: KR0040

VCCI Registration No. : C-12915, T-11320, R-14386, G-20079

KOLAS NO.: KT231

SITE MAP



3. Test system configuration

3.1 Operation environment

	Temperature	Humidity	Pressure
Chamber 10 m(RE)	20.2 °C	47.3 % R.H.	101.0 kPa
Shielded room(CE)	22.3 °C	38.2 % R.H.	101.1 kPa

Test site

These testing items were performed following locations;

Test item	Test site
Conducted Emission	Shielded Room
Disturbance power	Shielded Room
Discontinuous interference	Shielded Room
Radiated Emission	10 m Chamber
Harmonics current	EMI Test area
Voltage fluctuations and flickers	EMI Test area
Electrostatic discharge	Shielded Room
Radiated RF immunity	RS Chamber #2
Electrical Fast Transient/BURST	Shielded Room
Surge	Shielded Room
Conducted RF immunity	Shielded Room
Magnetic field 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 disturbance measurements_AMN (Confidence level about 95 %, k = 2)		
Shielded Room	9 kHz ~ 150 kHz : 2.0 dB	
	150 kHz ~ 30 MHz : 2.5 dB	
Conducted disturbance measurements_AAN (Confidence level about 95 %, k = 2)		
Shielded Room	150 kHz ~ 30 MHz : 5.2 dB	
Disturbance Power measurements (Confidence level about 95 %, k = 2)		
Shielded Room	30 MHz ~ 300 MHz : 3.7 dB	
Radiated disturbance measurement (Confidence level about 95 %, k = 2)		
10 m Chamber	30 MHz ~ 1 000 MHz	3 m : 4.6 dB
		10 m : 4.6 dB
	1 GHz ~ 6 GHz	3 m : 6.4 dB

3.3 Measurement Program

These test items were performed by software programs;

Test item	Measurement Program	Used
Conducted Emission	EP5CE_V 5.4.0 (TOYO)	☒
Radiated Emission	EP5RE_V 6.0.120 (TOYO)	☒
Disturbance Power	EMC32_V 10.60.10 (R&S)	☐
Radiated Electromagnetic Disturbance	EMC32_V 10.60.10 (R&S)	☐
Discontinuous interference	AFJ Click Meter Soft CMS_V 1.0	☐
Radiated RF Immunity	TDK Radiated Immunity Lab_V 11.25	☒
Conducted RF Immunity	TDK Conducted Immunity Lab_V 11.33.0.1	☒
Conducted RF Immunity	Radimation_V 2020.0.12 (DARE)	☐
Harmonics current emissions, Voltage fluctuations and flicker	IEC Soft_V 2.6(N4L)	☒

4. Description of EUT

4.1 General information

Fingerprint Types	single rolls / single flats / dual-finger flats / four-finger slaps upper & lower palm-prints, writer's palm-prints
Resolution/Gray scale	500 dpi / 256 gray levels
Dimension (W x L x H)	118 x 120 x 19.3 mm // (Foot Rubber Inclusive) 4.64" x 4.74" x 0.76"
Platen Size (W x L)	83.3 x 78.2 mm (3.28" x 3.07")
Capture Size (W x L)	81.28 x 76.2 mm (3.2" x 3.0")
Image Size (W x L)	Flat Single: 800 x 750 Flat Two: 900 x 900 Flat Four: 1600 x 1500 Rolls: 800 x 750
Image Quality Standards	FBI IQS Appendix F
Ingress Protection	IP65
Operating Temperature	-10℃ ~ 55℃
Operating Humidity	From 10 to 90%, non-condensing
Power Supply	USB Host
Weight	220g
Interface	USB 2.0 High Speed
Operating Systems	Windows: 7, 8, 8.1, 10 32 / 64bit Linux: Ubuntu, Debian, Fedora, Cent OS 32 / 64bit Android 5.0+ (Custom 4.0)
Certificate	FBI, KC, CE, FCC, UL, IEC62471, WEEE, RoHS, REACH, WHQL, USB-IF
Sound Interface	Buzzer

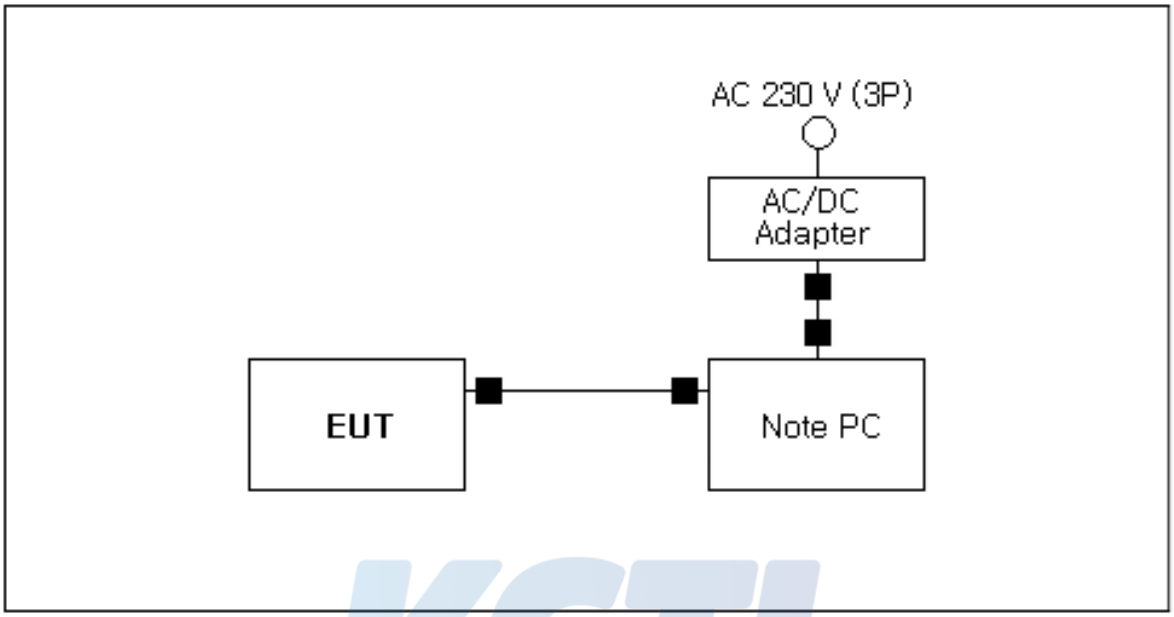
4.2 Product description

Type of product	RealScan S60
Model name (Basic)	RS S60
Model name (Variant)	-
Difference	-
Serial no	-
Testing voltage	230 V, 50 Hz
Input rating	DC 5 V
Internal clock frequency	Below 108 MHz
Note	-

4.3 Auxiliary equipments

Type	Model / Part #	S/N	Manufacturer
Note PC	NT500R5K	-	Samsung Electronics Co., Ltd.
AC/DC Adapter	A13-040N2A	-	Chicony Power Technology Co., Ltd.

4.4 Test configuration



	Start		End		Cable	
	Name	I/O port	Name	I/O port	Length (m)	Spec.
1	**EUT**	USB	Note PC	USB	1.0	Shield (Core 2EA)
2	Note PC	DC In	AC/DC Adapter	DC Out	1.5	Unshield (Core 2EA)
3	AC/DC Adapter	Power	AC Main	-	0.8	Unshield

4.5 Operating conditions

The EUT was configured as normal intended use.

Test mode	Normal operating
#1	After configuring the EUT as shown in the above layout, the product was operated normally using the program provided by the customer company, monitoring the operation status, and conducting electromagnetic disturbance and resistance tests.

- The USB cable used in the test was not provided.

5. Summary of test results

5.1 Summary of EMI emission test results

Applied	Test items	Test method	Result
☒	Conducted Emission	EN 55032:2015 +A11:2020	Pass
☒	Radiated Emission	EN 55032:2015 +A11:2020	Pass
☐	Conducted differential voltage	EN 55032:2015 +A11:2020	N/A
☒	Harmonics current	EN IEC 61000-3-2:2019	N/A Note)
☒	Voltage fluctuations and flickers	EN 61000-3-3:2013 +A1:2019	Pass

Note) The rated power is less than 75 W. According to the clause 7 of EN 61000-3-2, no limits apply for the EUT.

5.2 Summary of immunity test results

Applied	Test items	Test method	Result
EN 55035:2017 +A11:2020			
☒	Electrostatic Discharge	EN 61000-4-2:2009	Pass
☒	Radiated, radio-frequency, electromagnetic	EN 61000-4-3:2006 +A2:2010	Pass
☒	Electrical 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
☐	Power Frequency Magnetics	EN 61000-4-8:2010	N/A Note)
☒	Voltage Dips and Interruptions	EN IEC 61000-4-11:2020	Pass

Note) Not applicable as there are no magnetic field sensitive elements.

5.3 Performance criteria

These criteria shall be used during the testing of primary functions where no relevant annex is applicable. When assessing the impact of a disturbance on a function, the assessment should take into consideration the function's performance prior to the application of the disturbance and only identify as failures those changes in performance that are a result of the disturbance.
[Remark_EN 55032:2017]

5.3.1 Performance criterion A

The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operating state is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

5.3.2 Performance criterion B

During the application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test.
After the test, the equipment shall continue to operate as intended without operator intervention; no degradation of performance or loss of function is allowed, below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level (or the permissible performance loss), or recovery time, is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

5.3.3 Performance criterion C

Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A reboot or re-start operation is allowed.
Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

<Broadcast reception function>

Modified test levels and performance criteria

The broadcast reception function shall comply with the general performance criteria given in Clause 8 and any relevant annex with the deviations defined in Table A.2.

NOTE For the continuous RF electromagnetic field immunity test specified in the table clauses 1.2 and 1.3, deviations apply for in-band frequencies. The deviations depend on the class of the broadcast receiver (Group 1 or 2) and are defined in Table A.2.

Table A.2 – Modified test levels for performance criterion A for the broadcast reception function

Performance criteria	Test type table clause	Group 1	Group 2
A	1.2 1.3	The disturbance level is reduced to 1 V/m for in-band frequencies.	No test requirements apply
	2.1 3.1 4.1	The disturbance level is reduced to 1 V for in-band frequencies.	
In-band is defined as the entire tuneable operating range of the selected broadcast reception function. The tuned channel ± 0,5 MHz (lower edge frequency – 0,5 MHz up to the upper edge frequency ± 0,5 MHz of the tuned channel) is excluded from testing. NOTE In some countries, there is a requirement to test the tuned channels. Refer to the relevant regional requirements for guidance.			

<Print function>

Performance criterion A

Apply criterion A as defined in 5.3.1. Additionally, the following shall not occur as a consequence of the application of the disturbance:

- change of operating state;
- unintended pausing of the print operation;
- a change of print quality or legibility, as appropriate to the test pattern;
- change of character font;
- unintended line feed;
- unintended page feed;
- paper feed failure.

Performance criterion B

Apply criterion B as defined in 5.3.2 with the following specifics and additional limitations.

Paper feed failures are allowed only if, after removal of the jammed sheets, the job is automatically recovered and there is no loss of printed information.

Any low-quality print output caused by the application of the disturbance shall not continue beyond the sheet of media being printed, or beyond the typical length of a finished page or sheet printed from continuous roll media.

False indicators are permitted during the test provided that a normal operator response to that false indicator is simple (such as pressing a button). False indicators are not acceptable if they would cause the user to discard printing supplies such as ink, toner or paper, when those supplies are actually not empty or faulty. Any false indicator shall either clear automatically or after the operator's response.

After the disturbance, the print function may print the remainder of the print job at a quality level within the manufacturer's specifications. Alternately, the print function may halt processing of a print job as a result of the disturbance, but only if the operator is capable of reprinting the job (for example, a fax printing job where the image to be printed still resides in local memory). Automatically restarting the print job from the beginning is also acceptable. In any scenario, the pairing of front and back images during double-sided printing shall be correct.

Performance criterion C

Apply criterion C as defined in 5.3.3.

<Scan function>

Performance criterion A

Apply criterion A as defined in 5.3.1. Additionally, the following shall not occur as a consequence of the application of the test:

- change of settings, such as shich side(s) of the page to be scanned, colour or monochrome, and resolution;
- corruption of the image, for example stretching, compressing or change in colour;
- paper feed failures;
- errors in the reading of bar codes.

Performance criterion B

Apply criterion B as defined in 5.3.2. with the following specifiecs and additional limitations:

Document feed failures are allowed only if the original documents are undamaged and, after removal of the famed sheets, the fob is automatically recovered and there is no loss of scanned information.

Performance criterion C

Apply criterion C as defined in 5.3.3.

<Display and display output functions>

Performance criterion A for continuous radiated and conducted disturbances tests

Apply criterion A as defined in 5.3.1. Additionally, an increase in any degradation greater than just perceptible by observation of the image shall not occur as a consequence of the application of the test.

Examples of such degradations are:

- superimposed patterning;
- positional disturbances due to synchronization errors;
- geometric distorition;
- change of contrast of brightvess;
- picture artefacts;
- image loss;
- video data of decoding errors.

Performance criterion A for the power frequency magnetic field tests

Alternative 1: A Ccontinuous magnetic field of 1 A/m:

The fitter (in mm) shall not exceed the value $\frac{\text{(character height in mm +0.3)x2.5}}{33.3}$

Alternative 2: An increased power frequency magnetic field $\leq$ 50 A/m:

The amplitude of the disturbing field shall be increased by a factor K ,where $1 \leq K \leq 50$.

The jitter shall not exceed K times the value given in alternative 1.

The value of K should be chosen to avoid saturation of any magnitec screening materials.

When the EUT is sujected to fields above K = 1 and the performance criterial are satisfied for all relevant functions of the EUT, the EUT SHALL BE DEEMED TO SATISGY THE REQUIREMENT. Whien the EUT is subjected to fields above K = 1(the field level required in table clause 1.1) to assess compliance for those other functions.

Performance criterion B

Apply criterion B as defined in 5.3.2.

Performance criterion C

Apply criterion C as defined in 5.3.3.

<Musical tone generating function>

Performance criterion A

Performance criterion A is subdivided according to the type of equipment and its use. Three subgroups corresponding to different equipment types are defined in Table E.1 and have corresponding performance criteria A1, A2 and A3. The relevant subgroup shall be selected by the manufacturer in accordance with the product specification. The description of criteria A1, A2 and A3 are presented in Table E.2.

Table E.1 – Subgroups and performance criteria A for the musical tone generating function

Equipment type and use	Subgroup	Performance Criteria
High-end quality suitable for professional use or studio recording	1	A1
Middle grade quality suitable for amateur use or home use	2	A2
Entry grade quality for practice or exercise use	3	A3

Table E.2 – Performance criteria for different subgroups given in Table E.1

Description of degradation in performance	Performance Criteria		
	A1	A2	A3
Specific unintended change in the characteristic of the tone generated 1. interruption 2. stopping (or ceasing) 3. holding 4. sudden change in amplification	Not acceptable	Not acceptable	Not acceptable
Specific unintended change in the characteristic of the tone generated 1. frequency 2. harmonic distortion	Not acceptable	Not acceptable if the degradation is beyond the level specified by the manufacturer	Not acceptable if the manufacturer judges such degradations interfere with the continuation of playing music
Other changes in the type of tone generated	Not acceptable	Not acceptable	Not acceptable if the manufacturer judges such degradations interfere with the continuation of playing music
The specified degradations shall be perceptible to a listener. During the test no performance degradation other than that permitted by this table is allowed. After the test the EUT shall operate without performance degradation.			

Performance criterion B

During the test, degradation of performance beyond that defined in criterion A1 of Table E.2 is allowed. However, sudden amplification of tone to a level that exceeds the expected level by more than 6 dB is not allowed. After the test, normal operation of the EUT shall be self-recovered.
In the case of unintended tone holding caused by a MIDI protocol communication error, the EUT can be re-initialised by the operation of the controls by the user controls in accordance with the manufacturer's instructions. Due to the nature of the MIDI protocol, it is necessary to modify the performance criterion B to allow user intervention when the unintended tone holding is caused by a missing MIDI communication error (for example missing a 'NOTE OFF' message).

Performance criterion C

Degradation of the performance beyond that defined in criterion A1 of Table E.2 is permitted provided that the normal operation of the EUT can be restored after the test by operator intervention. However, sudden amplification of tone to a level that exceeds the expected level by more than 6 dB is not allowed.

<Networking functions>

Performance criterion A

Where relevant, during the application of the test the network function shall, as a minimum, operate ensuring that:

- established connections shall be maintained throughout the application of the test;
- no change of operational state or corruption of stored data occurs;
- no increase in error rate above the figure defined by the manufacturer occurs. The manufacturer
- should select the most appropriate performance measurement criteria for the product or system, for example bit error rate, block error rate;
- no request for retry above the figure defined by the manufacturer;
- the data transmission rate does not reduce below the figure defined by the manufacturer;
- no protocol failure occurs;
- the audio noise level at a two-wire analogue interface (supporting telephony) shall satisfy the requirements of Table G.3. The audio level measurements shall be performed at the demodulated frequency of the disturbance using a narrowband filter with a 3 dB bandwidth of 100 Hz using the method defined in table clause G.1.4. See G.6.1.

As described in the example given in J.3.5 the networking function is monitored during testing using direct functions specified elsewhere in this document.

If needed to verify the operation of the protocol, the following functions shall be verified as described in Table H.1 when performing the additional spot frequency tests contained in Clause 5:

- ability to establish a connection,
- ability to clear a connection.

Where an EUT has supervisory functions they shall not be affected. Elements that should be monitored include, but are not limited to:

- alarms,
- signalling lamps,
- printer output errors,
- network traffic rates,
- network monitor errors,
- measured network parameters.

Performance criterion B

Established connections shall be maintained throughout the test, or shall self-recover in a way and timescale that is imperceptible to the user.

The error rate, request for retry and data transmission rates may be degraded during the application of the test. Degradation of the performance as described in criterion A is permitted, provided that the normal operation of the EUT is self-recoverable to the condition established prior to the application of the test.

Where required, as defined in Clause 5, the acceptable operation of the function shall be verified at the completion of the test as described in Table H.1, by confirming the following:

- the EUT's ability to establish a connection,
- the EUT's ability to clear a connection.

During surge testing disconnection is allowed on the analogue/digital data port being tested.

If the EUT is a supervisory equipment, it shall not impact the normal operation of the network being monitored. In addition, any supervisory functions impacted during the period of the test shall return to the state prior to the test. Elements to consider include:

- alarms,
- signalling lamps,
- printer output,
- network traffic rates,
- network monitoring.

Performance criterion C

Degradation of performance as described in criteria A and B is permitted provided that the normal operation of the EUT is self-recoverable to the condition immediately before the application of the test, or can be restored after the test by the operator.

<Audio output function>

Performance criterion A

Devices supporting telephony functions

For devices that support telephony functions the limits of Table G.3 shall apply. With respect to Table G.3,

- the interference ratio (electrical or acoustic) shall meet the limits in column 3; or,
- the acoustic level of the demodulated audio shall be less than the limits in column 4; or,
- the digitally coded level of demodulated audio shall be less than limits in column 5; or,
- the analogue level of the demodulated audio shall be less than the limits in column 6.

Table G.3 – Performance criterion A – Limits for devices supporting telephony

Type of immunity test	Frequency range MHz	Acoustic or electrical interference ratio	Equivalent direct measurement		
			dB(SPL)	Digital dBm0	Analogue dBm
Conducted [a]	0.15 to 30	− 20 dB	55	-50	-50
	30 to 80	− 10 dB	65	-40	-40
Radiated	80 to 1 000	0 dB	75	-30	-30

[a] At the step in the frequency range, the lower limit shall be applied.

The equivalent direct measurement values are presented to show the equivalency of the interference ratio in comparison to a direct measured value. These values may be used if the direct measurement method of the test is used.
The values within this table are aligned with CISPR 24, noting that the test levels are different between this document and CISPR 24.
For terminals connected to digital wired network ports (such as Ethernet, ISDN), measurements of the demodulated 1 kHz may be performed on a remote AE, ideally of the same design.

NOTE The amplitude demodulation disturbances will arise, almost invariably, from semi-conductor junctions behaving as inadvertent square law detectors. This means that for a 10 dB increase in the applied test level, for example, from 1 V to 3 V, the demodulated line noise will increase by 20 dB. This 20 dB offset was used to derive the values in Table G.3.

For all other devices

The measured acoustic interference ratio and/or the measured electrical interference ratio during the test shall be –20 dB or better.

Performance criterion B

Use the general performance criterion B. See 5.3.2.

Performance criterion C

Use the general performance criterion C. See 5.3.3.

<Telephony function>

Telephony functions, performance criteria

Function to be exercised	Performance criteria		
	A	B	C
Establish new communication	At the additional spot frequency tests [a, c]	Performed before and after the application of the test or disturbance	Performed before and after the application of the test or disturbance
Maintain established communication	Yes In addition, the requirements of Annex G for the audio output function shall be satisfied [c]	Yes [b]	No
Terminate established communication	At the additional spot frequency tests [a, c]	Performed before and after the application of the test or disturbance	Performed before and after the application of the test or disturbance

Communication refers to a telephone call or other form of voice connection.

[a] Applicable to TTE with a dial function that provides dedicated emergency service/safety of life call capability. Where the EUT does not provide this functionality, this limitation shall be stated in the equipment user manual.

[b] Communication shall be established prior to the application of the disturbance, the communication shall be maintained and the quality of that communication (for example, volume setting, the level of background noise) shall be maintained after completion of the test or disturbance.

[c] Where defined in Clause 5 (for the tests in Table 1 to Table 4), these functional tests shall be performed during the additional spot frequency tests.

6. Test results

6.1 Conducted Emission

Testing voltage	230 V, 50 Hz				
Test facility	Shielded room (CE #1)				
Date	2021. 11. 03				
Temperature (°C)	22.3 °C	Humidity (% R.H.)	38.2 % R.H.	Pressure (kPa)	101.1 kPa
Remarks	Pass				

6.1.1 Limits of conducted emissions measurement

☒ AC main

Frequency [MHz]	Resolution Bandwidth [kHz]	Class A Limits (dB(μV))		Class B Limits (dB(μV))	
		Quasi-peak	Average	Quasi-peak	Average
0.15 ~ 0.5	9	79	66	66 ~ 56 [1)]	56 ~ 46 [1)]
0.5 ~ 5	9	73	60	56	46
5 ~ 30	9	73	60	60	50

[1)] The limit decreases linearly with the logarithm of frequency.

☐ Telecommunication

Frequency [MHz]	Resolution Bandwidth [kHz]	Class A Voltage Limits (dB(μV))		Current A Current Limits (dB(μA))	
		Quasi-Peak	Average	Quasi-Peak	Average
0.15 ~ 0.5	9	97 to 87	84 to 74	53 to 43	40 to 30
0.5 ~ 30	9	87	74	43	30
Frequency [MHz]	Resolution Bandwidth [kHz]	Class B Voltage Limits (dB(μV))		Class B Current Limits (dB(μA))	
		Quasi-Peak	Average	Quasi-Peak	Average
0.15 ~ 0.5	9	84 to 74	74 to 64	40 to 30	30 to 20
0.5 ~ 30	9	74	64	30	20

If the reading on the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 seconds at each measurement frequency, the highest reading shall be recorded, with the exception of any brief isolated high reading (which shall be ignored).

6.1.2 Used equipments

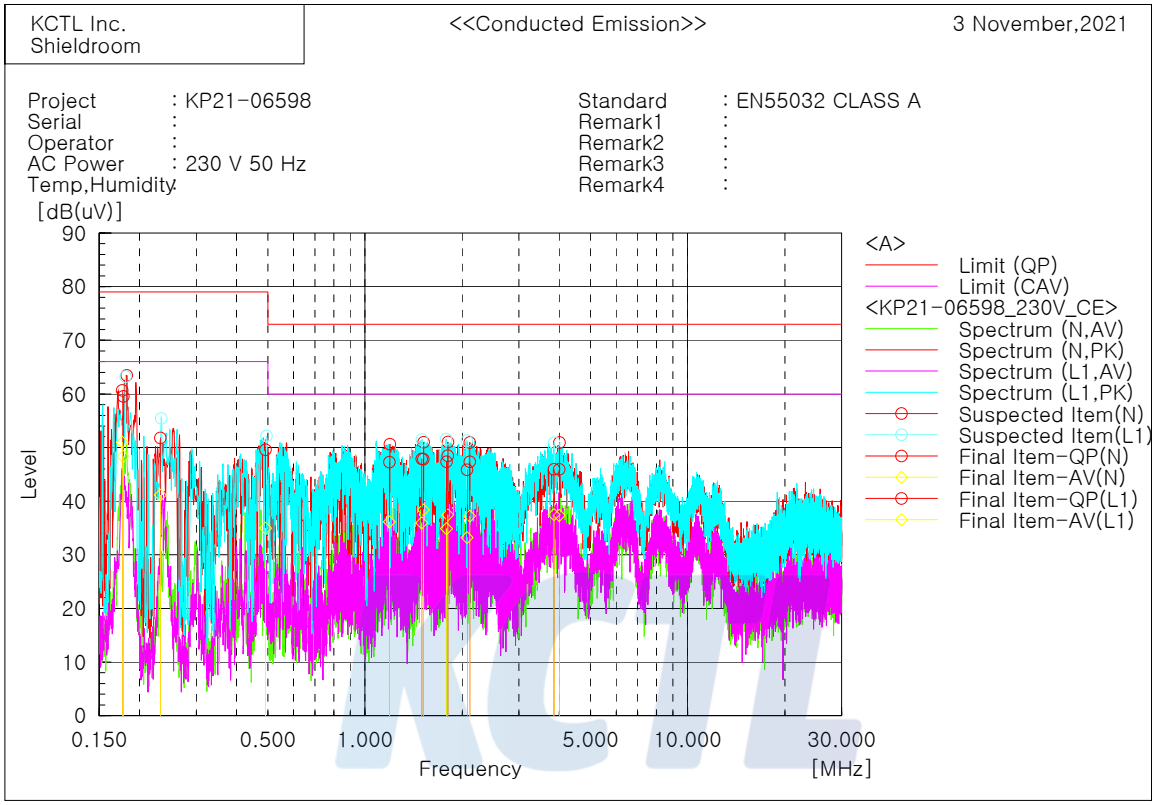
Equipment	Model	Serial No.	Manufacturer	Next Cal. Date	Used
EMI Test Receiver	ESCI	100373	R&S	2022.01.21	☒
Two Line V-Network	ENV216	102579	R&S	2022.05.21	☒
LISN	ESH3-Z5	862770/025	R&S	2022.04.23	☐
EMI Test Receiver	ESCI	100374	R&S	2022.07.08	☐
Two Line V-Network	ENV216	102580	R&S	2022.05.24	☐
Two Line V-Network	ENV216	101718	R&S	2022.07.08	☐
EMI Test Receiver	ESCI	100154	R&S	2022.04.23	☐
Two Line V-Network	ENV216	101719	R&S	2022.07.08	☐
LISN	ESH3-Z5	842966/014	R&S	2022.07.08	☐
ISN	ISN T800	36208	TESEQ	2022.07.09	☐
ISN	ISN T8-Cat6	37172	TESEQ	2022.07.09	☐
ISN	ISN T200A	34520	TESEQ	2022.07.09	☐
CDN	ISN ST08	43553	TESEQ	2022.07.08	☐

6.1.3 Photographs of test setup

* AC Main

6.1.4 Conducted emissions measurement result

* AC Main



Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.17832	49.5	38.3	10.0	59.5	48.3	79.0	66.0	19.5	17.7
2	1.19006	37.5	26.3	9.8	47.3	36.1	73.0	60.0	25.7	23.9
3	1.51501	38.2	28.7	9.7	47.9	38.4	73.0	60.0	25.1	21.6
4	1.80404	38.8	27.7	9.7	48.5	37.4	73.0	60.0	24.5	22.6
5	2.10987	37.6	27.5	9.7	47.3	37.2	73.0	60.0	25.7	22.8
6	3.9989	36.2	27.7	9.7	45.9	37.4	73.0	60.0	27.1	22.6

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.1766	50.7	41.0	10.0	60.7	51.0	79.0	66.0	18.3	15.0
2	0.23184	42.1	31.4	9.7	51.8	41.1	79.0	66.0	27.2	24.9
3	0.49168	39.7	25.1	9.9	49.6	35.0	79.0	66.0	29.4	31.0
4	1.49695	38.2	26.3	9.7	47.9	36.0	73.0	60.0	25.1	24.0
5	1.7882	37.6	25.2	9.7	47.3	34.9	73.0	60.0	25.7	25.1
6	2.07077	36.2	23.5	9.7	45.9	33.2	73.0	60.0	27.1	26.8
7	3.849	36.2	27.8	9.7	45.9	37.5	73.0	60.0	27.1	22.5

6.2 Radiated Emissions

Testing voltage	230 V, 50 Hz				
Test facility	10 m Chamber				
Test distance	10 m				
Date	2021. 11. 02				
Temperature (°C)	20.2 °C	Humidity (% R.H.)	47.3 % R.H.	Pressure (㎪)	101.0 ㎪
Remarks	Pass				

Of those emissions above (*L* – 20 dB), where *L* is the limit level in logarithmic units, record at least the emission levels and the frequencies of the six highest emissions.
The following data lists the significant emission frequencies, measured levels, correction factors (for antenna and cables), orientation of table, polarization and height of antenna, the corrected reading, the limit, and the amount of margin. All measurements were taken utilizing quasi-peak detection unless stated otherwise.
Measurements were performed at an antenna to EUT distance of 10 or 3 meters and elevated between 1 and 4 meters. Both vertical and horizontal antenna polarizations were measured.

Below 1 GHz, peak detector function mode for prescan was used with resolution bandwidth of 120 kHz and a video bandwidth of 300 kHz and sweep method.
The sweep time for prescan set below 200 ms up and final measurement with quasi-peak detector evaluated for suspected frequencies points, which are detected from prescan measurement.

Final measurements consisted of 3 steps.
First step, frequency fine tuning to find exact emission frequency.
Second step, rechecking to search for maximum height and azimuth for interference from EUT
In final step, there are conducted measuring with quasi-peak detector for points
which are detected from 1st step & 2nd step.

6.2.1 Limits of radiated emissions measurement

☒ Limits below 1 GHz

Frequency [MHz]	Resolution Bandwidth [kHz]	Class A Limits (dB(μV/m)) @ 10 m	Class B Limits (dB(μV/m)) @ 10 m
30 ~ 230	120	40	30
230 ~ 1 000	120	47	37

☐ Limits above 1 GHz

Frequency [GHz]	Resolution Bandwidth [MHz]	Class A @ 3 m		Class B @ 3 m	
		Average limit (dB(μV/m))	Peak limit (dB(μV/m))	Average limit (dB(μV/m))	Peak limit (dB(μV/m))
1 ~ 3	1	56	76	50	70
3 ~ 6	1	60	80	54	74
Note - The lower limit applies at the transition frequency.					

Measurements within 20 dB of the limit were then maximized by adjusting turntable position.

Final measurements were made using an C/Average detector.

Results checked manually and points close to the limit line were re-measured.

6.2.2 Used equipments

Equipment	Model no.	Serial no.	Manufacturer	Next Cal. Date	Used
EMI Test Receiver	ESCI7	100872	R&S	2022.07.08	☒
Amplifier	310N	353132	SONOMA	2022.07.08	☒
Attenuator	8491B 6dB	MY39270721	KEYSIGHT	2022.07.08	☒
Bi-Log Antenna	CBL 6112D	40522	TESEQ	2022.02.26	☒
Preamplifier	8449B	3008A00530	HP	2022.07.08	☐
Horn Antenna	3115	9012-3602	EMCO	2022.03.17	☐

6.2.3 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:

- Below 1 GHz

Result QP[dB(μV/m)] = Reading QP[dB(μV)] + c.f(Antenna Factor [dB/m] + Cable Loss [dB] + 6 dB Att [dB] − Amp Gain [dB])

Result QP : Result, Reading QP : Meter Reading, c.f : Correction For

Margin (QP) = Limit (QP) – Results (QP)

Note1) QP : Abbreviation of Quasi-Peak

- Above 1 GHz

Result PK/CAV [dB(μV/m)] = Reading PK/CAV [dB(μV)] + c.f(Antenna Factor [dB/m] + Cable Loss [dB] − Amp Gain [dB])

Result PK/CAV : Result, Reading PK/CAV : Meter Reading, c.f : Correction Factor

Margin (PK/CAV) = Limit (QP/CAV) – Results (QP/CAV)

Note1) PK : Abbreviation of Peak

Note2) CAV : Abbreviation of CISPR Average

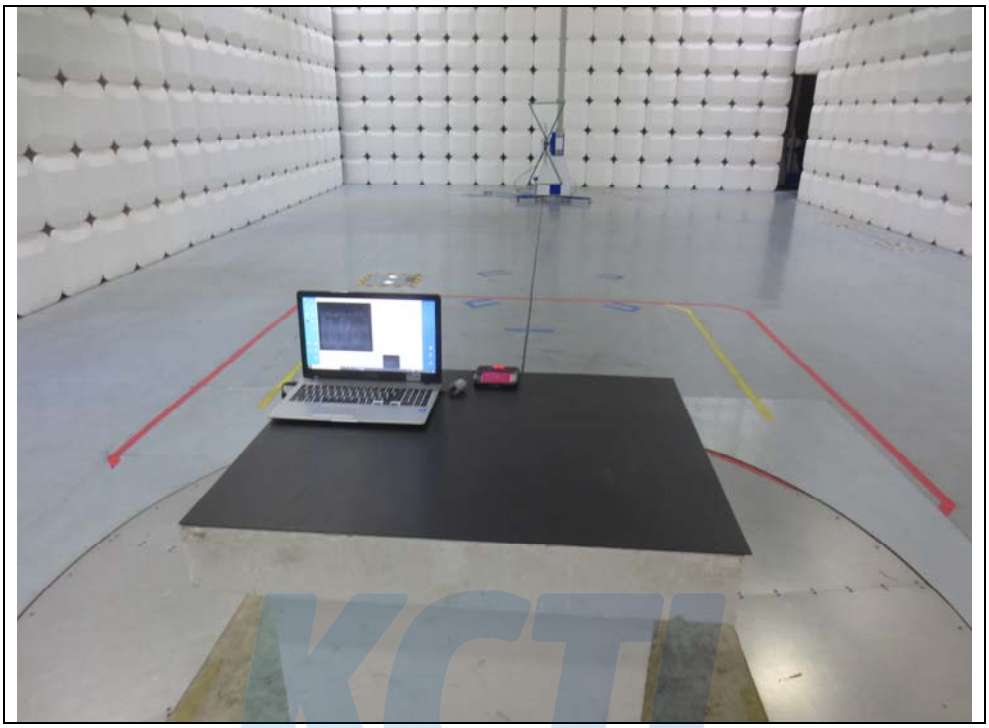
If Reading is 30 dBμV, Antenna Factor 12 dB/m, Cable Loss 5 dB, Attenuator 6 dB, Amp Gain 35 dB

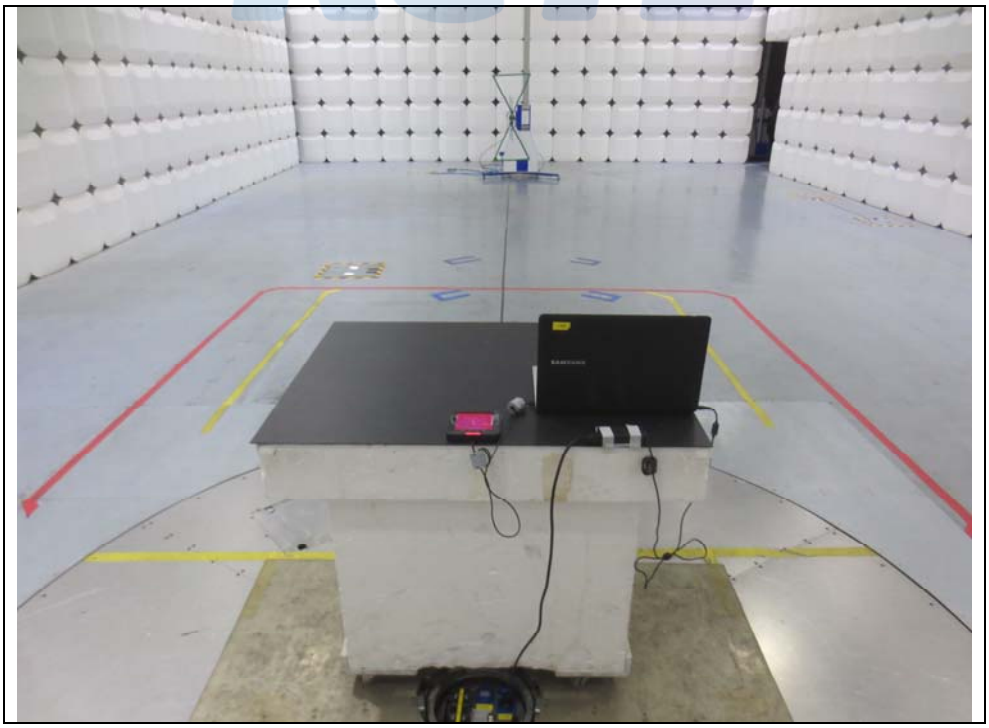
The result is

30 + 12 + 5 + 6 - 35 = 18 dB(μV/m)

6.2.4 Photographs of test setup

* 30 ㎒ ~ 1 ㎓

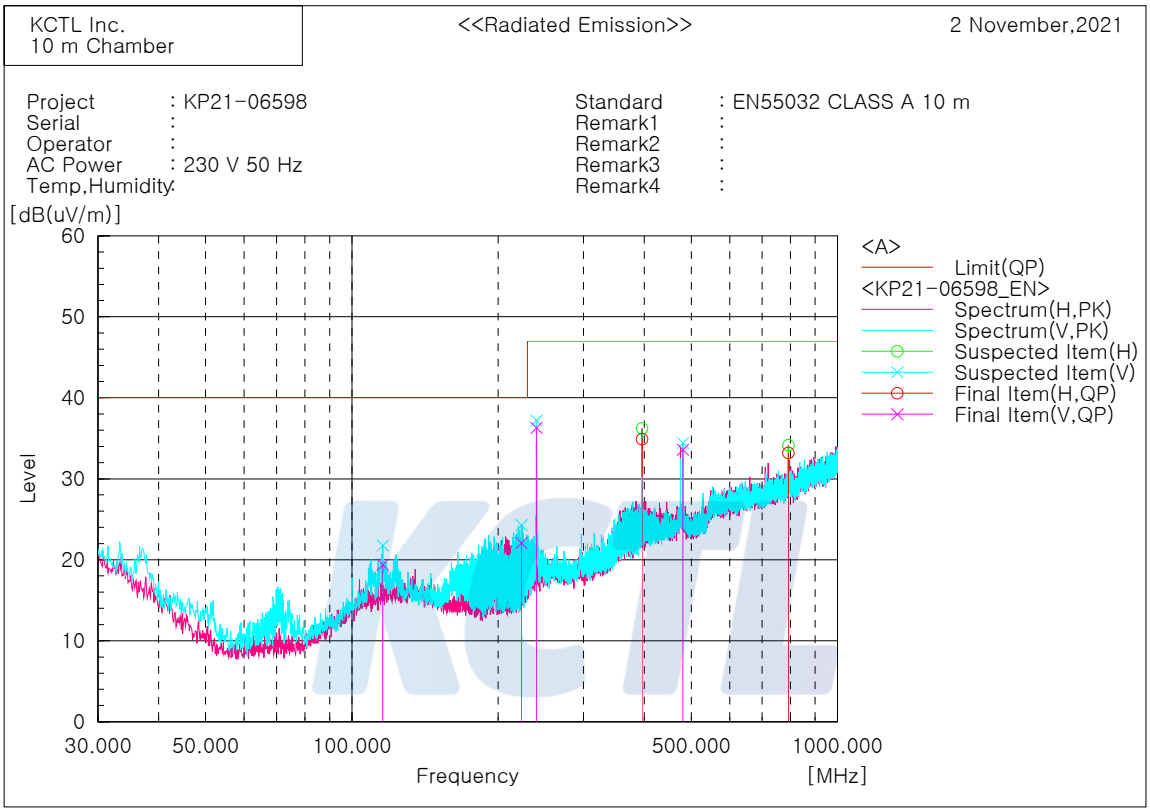




6.2.5 Radiated emissions measurement result

*** Graph and Data**

* 30 ㎒ ~ 1 ㎓



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	115.724	V	30.6	-11.2	19.4	40.0	20.6	203.0	33.0
2	223.394	V	34.5	-12.4	22.1	40.0	17.9	177.0	25.0
3	240.005	V	46.6	-10.3	36.3	47.0	10.7	100.0	25.0
4	395.933	H	39.9	-5.0	34.9	47.0	12.1	310.0	94.0
5	480.080	V	36.5	-2.9	33.6	47.0	13.4	125.0	176.0
6	792.056	H	31.5	1.7	33.2	47.0	13.8	134.0	265.0

6.3 Harmonics Current Emissions

Testing voltage	230 V, 50 Hz				
Test facility	EMI Test area				
Date	2021. 11. 04				
Temperature(°C)	22.7 °C	Humidity (% R.H.)	38.6 % R.H.	Pressure (㎪)	101.0 ㎪
Remarks	N/A				

6.3.1 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.

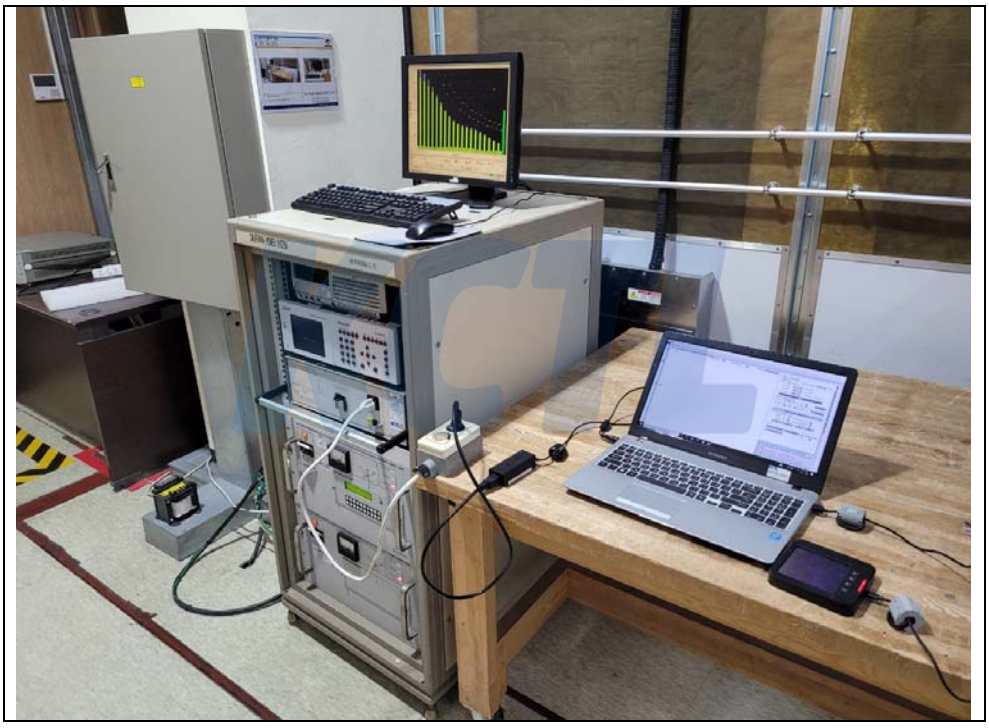
Class D : Equipment having a specified power according to 6.2.2 less than or equal to 600 w, of the following types:

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

6.3.2 Used equipments

Equipment	Model no.	Serial no.	Manufacturer	Next Cal. date	Used
Precision Power Analyzer	PPA5511	162-04046	N4L	2022.07.13	☒
Reference Impedance Network	IEC Standard 555	1B0318253	Voltech	2022.07.13	☒
AC Power Supply	4500L	HK51408	California	2022.07.08	☒

6.3.3 Photographs of test setup



6.3.4 Measurement result

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IEC61000-3-2:2018
Fluctuating Harmonics

Instrument Details	
Instrument Model	PPA5511
Serial Number	162-04046
Firmware Version	2.179
N4L Calibration Date	13rd July 2021
Instrument Version	Standard
Test Settings	
Class	Class A
Mode	Measured
Equipment Under Test	
Brand	Suprema Inc.
Model	KP21-06598
Serial	N/A
Impedance Network ID	N/A

Test Conditions	User Entered	Measured
Rated Voltage	230.000V	230.154V
Rated Current	N/A	390.848mA
Rated Frequency	50.000Hz	49.999Hz
Rated Power	N/A	34.817W

Additional Test Information	
Measured Power Factor	0.3867
Max Current THD	0.00%
Average THC	357.347mA
Max Power	38.165W
Max F.Current	170.994mA
Average F.Current	155.944mA
Minimum Current	100A
Test Duration	2.5 minutes
Additional Test Details	
Operator	N/A
Lab Name	N/A
Location	N/A
Notes	
Signature	

Results	**Test - N/A. Rated Power < 75W**

Test not applicable

With the exception of lighting equipment section 7 of the IEC61000-3-2:2018 standard declares that no Harmonic current limits are specified for equipment with a rated power of 75W or less.

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IEC61000-3-2:2018 Fluctuating Harmonics

Instrument Details

Instrument Model	PPA5511
Instrument Serial	162-04046
Instrument Firmware	2.179

Equipment Under Test

Brand	Suprema Inc.
Model	KP21-06598
Serial	N/A

Extra Test Information

Current THDG	227.48%

	Average	Peak	Limit
THC	357.347mA	381.392mA	N/A
POHC	130.222mA	136.264mA	251.375mA
Voltage Crest Factor	1.419	1.517	N/A
Current Crest Factor	5.218	5.316	N/A

Harmonics Results 1/1

Harmonic	Status	Avg (A)	Avg L(A)	Avg %ofL	Peak (A)	Peak L(A	Peak %ofL
1	N/A	0.15595	N/A	N/A	0.17099	N/A	N/A
2	N/A	0.00594	N/A	N/A	0.00666	N/A	N/A
3	N/A	0.14983	N/A	N/A	0.16402	N/A	N/A
4	N/A	0.00633	N/A	N/A	0.00693	N/A	N/A
5	N/A	0.14256	N/A	N/A	0.15565	N/A	N/A
6	N/A	0.00579	N/A	N/A	0.00662	N/A	N/A
7	N/A	0.13263	N/A	N/A	0.14393	N/A	N/A
8	N/A	0.00513	N/A	N/A	0.00569	N/A	N/A
9	N/A	0.12039	N/A	N/A	0.12915	N/A	N/A
10	N/A	0.005	N/A	N/A	0.00561	N/A	N/A
11	N/A	0.10689	N/A	N/A	0.11333	N/A	N/A
12	N/A	0.00525	N/A	N/A	0.00594	N/A	N/A
13	N/A	0.0931	N/A	N/A	0.09729	N/A	N/A
14	N/A	0.00592	N/A	N/A	0.0068	N/A	N/A
15	N/A	0.08023	N/A	N/A	0.08286	N/A	N/A
16	N/A	0.00678	N/A	N/A	0.00785	N/A	N/A
17	N/A	0.06922	N/A	N/A	0.07075	N/A	N/A
18	N/A	0.00755	N/A	N/A	0.00849	N/A	N/A
19	N/A	0.06068	N/A	N/A	0.06197	N/A	N/A
20	N/A	0.00796	N/A	N/A	0.00892	N/A	N/A
21	N/A	0.05496	N/A	N/A	0.05678	N/A	N/A
22	N/A	0.00813	N/A	N/A	0.00918	N/A	N/A
23	N/A	0.05116	N/A	N/A	0.05374	N/A	N/A
24	N/A	0.00784	N/A	N/A	0.00869	N/A	N/A
25	N/A	0.04862	N/A	N/A	0.05185	N/A	N/A
26	N/A	0.00746	N/A	N/A	0.0083	N/A	N/A
27	N/A	0.04616	N/A	N/A	0.04956	N/A	N/A
28	N/A	0.00682	N/A	N/A	0.00768	N/A	N/A
29	N/A	0.04338	N/A	N/A	0.04645	N/A	N/A
30	N/A	0.00619	N/A	N/A	0.0069	N/A	N/A
31	N/A	0.03987	N/A	N/A	0.04268	N/A	N/A
32	N/A	0.00582	N/A	N/A	0.00659	N/A	N/A
33	N/A	0.03556	N/A	N/A	0.03776	N/A	N/A
34	N/A	0.00565	N/A	N/A	0.00667	N/A	N/A
35	N/A	0.03084	N/A	N/A	0.03206	N/A	N/A
36	N/A	0.00577	N/A	N/A	0.00699	N/A	N/A
37	N/A	0.02606	N/A	N/A	0.02671	N/A	N/A
38	N/A	0.00611	N/A	N/A	0.00737	N/A	N/A
39	N/A	0.02137	N/A	N/A	0.02204	N/A	N/A
40	N/A	0.00642	N/A	N/A	0.00783	N/A	N/A

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IEC61000-3-2:2018 Fluctuating Harmonics

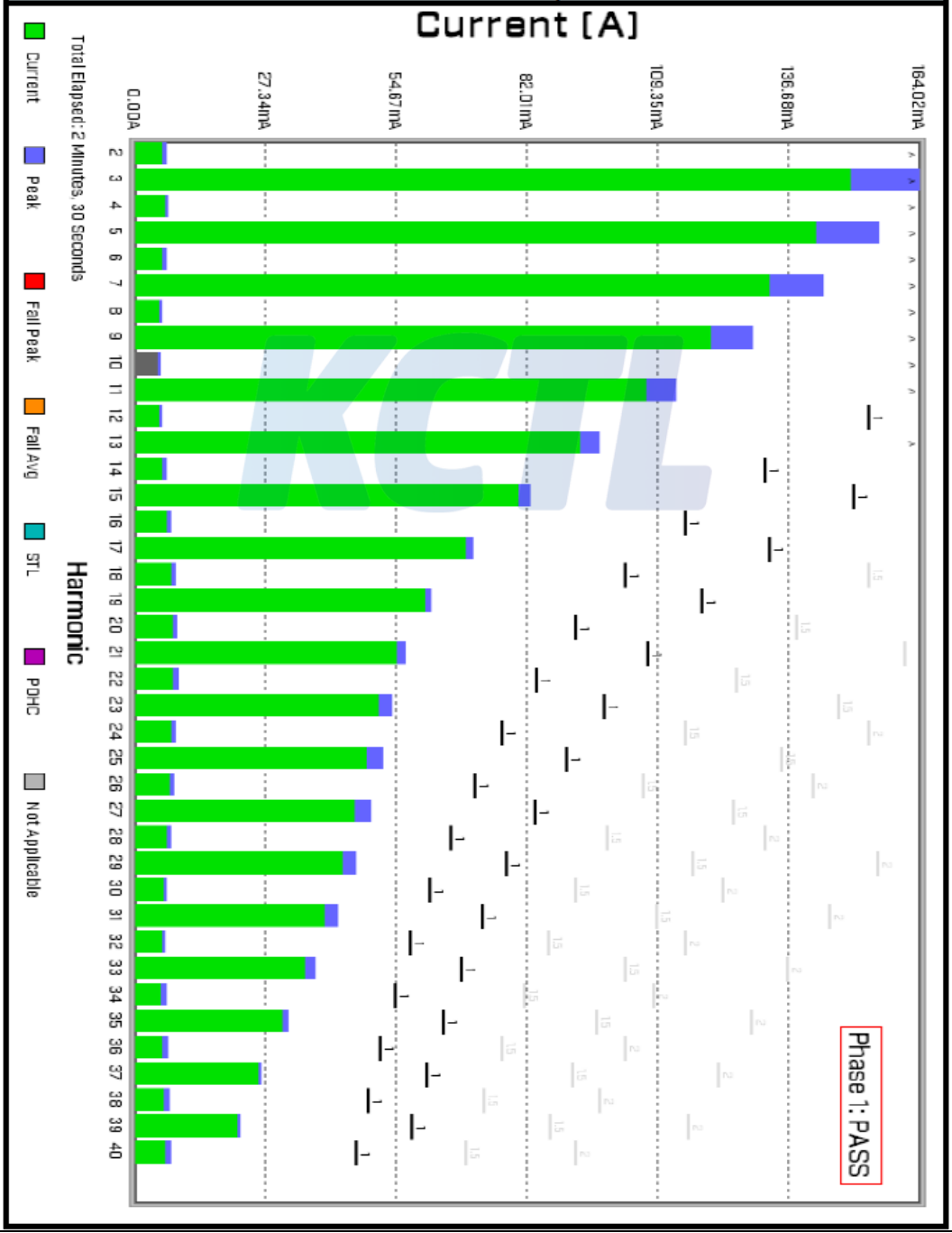
Instrument Details

Instrument Model	PPA5511
Instrument Serial	162-04046
Instrument Firmware	2.179

Equipment Under Test

Brand	Suprema Inc.
Model	KP21-06598
Serial	N/A

Harmonics Results Graph 1/1



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IEC61000-3-2:2018 Fluctuating Harmonics		
Instrument Details		
Instrument Model	PPA5511	
Instrument Serial	162-04046	
Instrument Firmware	2.179	
Equipment Under Test		
Brand	Suprema Inc.	
Model	KP21-06598	
Serial	N/A	
Extra Test Information		
Voltage THDS	0.09%	

Source Results 1/1

Harmonic	Status	Peak (V)	Average (V)	Limit (V)
1	PASS	230.13	230.12	No Limit
2	PASS	0.048892	0.04066	0.460308
3	PASS	0.07912	0.071774	2.071386
4	PASS	0.051592	0.045184	0.460308
5	PASS	0.036478	0.029098	0.920616
6	PASS	0.026508	0.021856	0.460308
7	PASS	0.033428	0.028234	0.690462
8	PASS	0.026561	0.021721	0.460308
9	PASS	0.030682	0.025606	0.460308
10	PASS	0.025918	0.021558	0.460308
11	PASS	0.029064	0.024224	0.230154
12	PASS	0.025669	0.021771	0.230154
13	PASS	0.032381	0.027471	0.230154
14	PASS	0.036801	0.031043	0.230154
15	PASS	0.044961	0.036132	0.230154
16	PASS	0.02768	0.02275	0.230154
17	PASS	0.062297	0.051646	0.230154
18	PASS	0.032968	0.026872	0.230154
19	PASS	0.03545	0.029711	0.230154
20	PASS	0.027681	0.022767	0.230154
21	PASS	0.035162	0.0294	0.230154
22	PASS	0.038324	0.031248	0.230154
23	PASS	0.035669	0.028112	0.230154
24	PASS	0.030418	0.023599	0.230154
25	PASS	0.045115	0.038518	0.230154
26	PASS	0.027037	0.022571	0.230154
27	PASS	0.043085	0.032221	0.230154
28	PASS	0.029495	0.024276	0.230154
29	PASS	0.036477	0.030467	0.230154
30	PASS	0.02898	0.023163	0.230154
31	PASS	0.03415	0.029257	0.230154
32	PASS	0.038786	0.031531	0.230154
33	PASS	0.03507	0.026979	0.230154
34	PASS	0.034413	0.027471	0.230154
35	PASS	0.029733	0.024695	0.230154
36	PASS	0.030179	0.02343	0.230154
37	PASS	0.055162	0.048428	0.230154
38	PASS	0.026441	0.021666	0.230154
39	PASS	0.032621	0.027154	0.230154
40	PASS	0.036016	0.030394	0.230154

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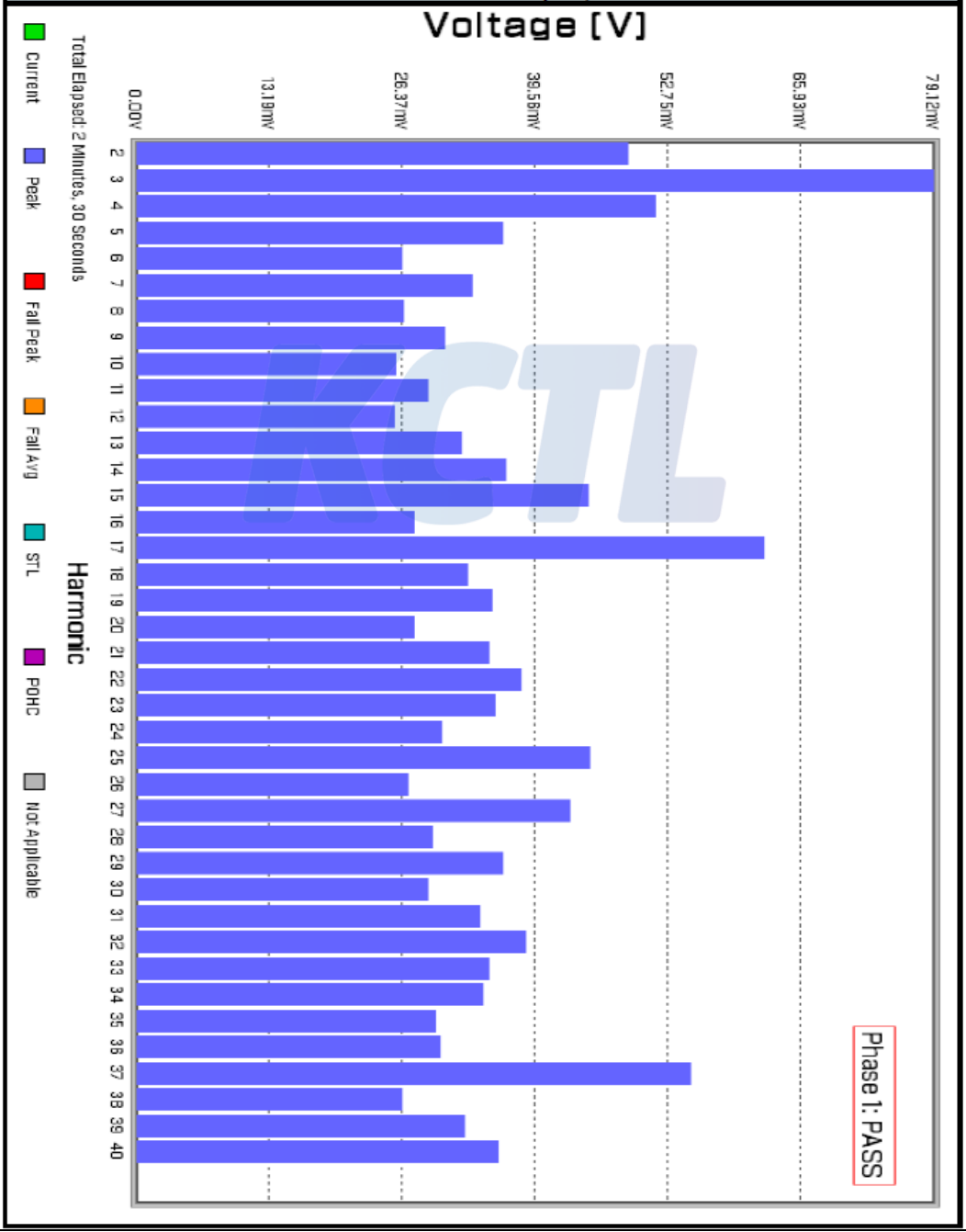
IEC61000-3-2:2018 Fluctuating Harmonics		
Instrument Details		
Instrument Model	PPA5511	
Instrument Serial	162-04046	
Instrument Firmware	2.179	
Equipment Under Test		
Brand	Suprema Inc.	
Model	KP21-06598	
Serial	N/A	

Source Results Graph 1/1



6.4 Voltage Fluctuations and Flickers

Testing voltage	230 V, 50 Hz				
Test facility	EMI Test area				
Date	2021. 11. 04				
Temperature(°C)	22.7 °C	Humidity (% R.H.)	38.6 % R.H.	Pressure (㎪)	101.0 ㎪
Remarks	Pass				

6.4.1 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

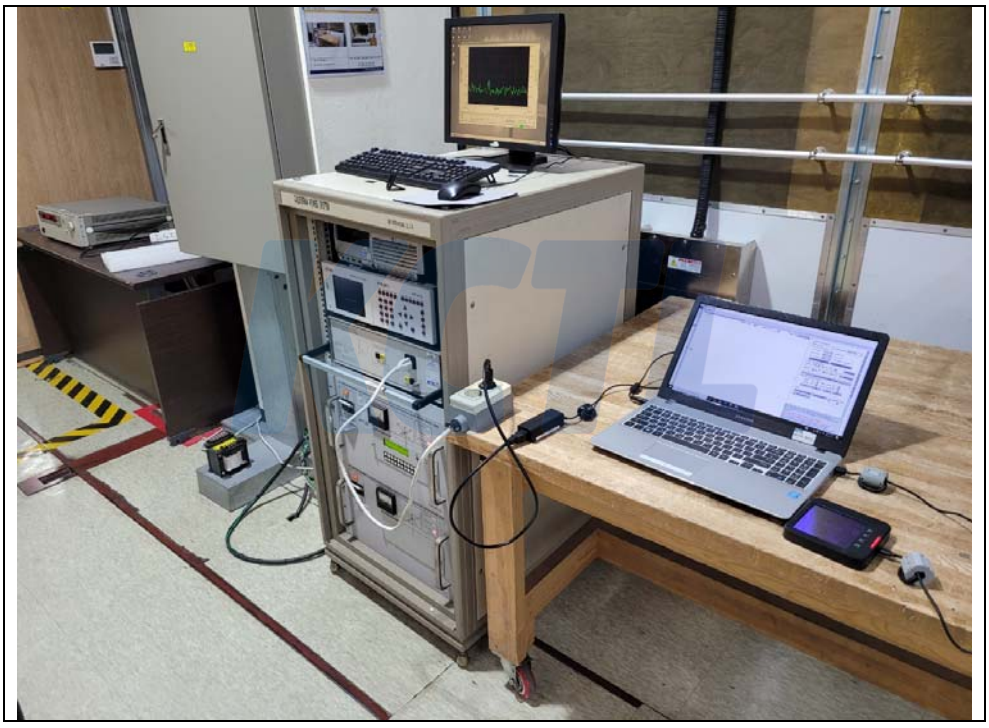
P_{st} = 10 min

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.

6.4.2 Used equipments

Equipment	Model no.	Serial no.	Manufacturer	Next Cal. date	Used
Precision Power Analyzer	PPA5511	162-04046	N4L	2022.07.13	☒
Reference Impedance Network	IEC Standard 555	1B0318253	Voltech	2022.07.13	☒
AC Power Supply	4500L	HK51408	California	2022.07.08	☒

6.4.3 Photographs of test setup



6.4.4 Measurement result

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IEC61000-3-3:2013 Ed.3.0
Flickermeter

Instrument Details	
Instrument Model	PPA5511
Serial Number	162-04046
Firmware Version	2.179
N4L Calibration Date	13rd July 2021
Instrument Version	Standard
Test Settings	
Class	Voltage
Mode	Normal (4.0%)
Minimum Current	10A
PST	10 minutes
PLT	1 PSTs
Equipment Under Test	
Brand	Suprema ID Inc.
Project	KP21-06598
Serial	N/A
Impedance Network ID	N/A

Test Conditions		
	User Entered	Measured
Rated Voltage	230.000V	230.104V
Rated Current	N/A	N/A
Rated Frequency	50.000Hz	49.999Hz
Rated Power	N/A	N/A
D max	0.0480% (Limit: 4.0%)	
T max	0.0000 s (Limit: 0.5 s)	
DC max	0.0123% (Limit: 3.3%)	
Inrush Test	0.03631% (Limit: 4.0%)	
Inrush Results	Phase1: Pass	
Additional Test Details		
Operator	N/A	
Lab Name	N/A	
Location	N/A	
Notes		
Signature		

Results	Phase1: PASS

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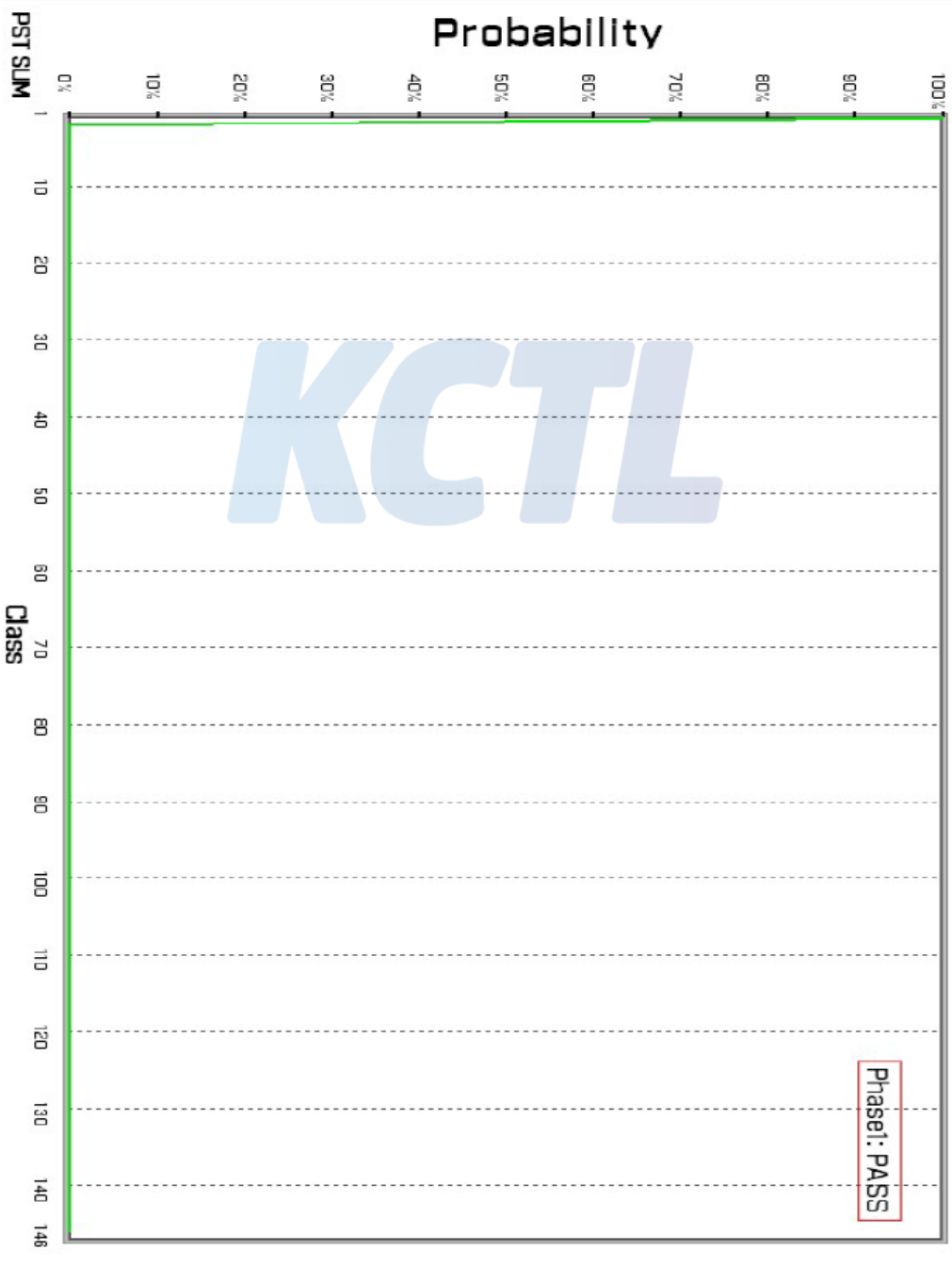
IEC61000-3-3:2013 Ed.3.0 Flickermeter		
Instrument Details		
Instrument Model	PPA5511	
Instrument Serial	162-04046	
Instrument Firmware	2.179	
Equipment Under Test		
Brand	Suprema ID Inc.	
Project	KP21-06598	
Serial	N/A	
Inrush Current Results		
Test Number	Dmax (%)	Running Average (%)	Status
1	0.0322938	0.0322938	OK
2	0.0389934	0.0356436	OK
3	0.0368178	0.036035	OK
4	0.0314891	0.0348985	OK
5	0.0276685	0.0348985	Lowest
6	0.0298858	0.033896	OK
7	0.0426769	0.0353595	OK
8	0.0377059	0.0356947	OK
9	0.029701	0.0349455	OK
10	0.0496686	0.0349455	Highest
11	0.0353336	0.0349886	OK
12	0.0417769	0.0356674	OK
13	0.0422359	0.0362645	OK
14	0.0490546	0.0373304	OK
15	0.043577	0.0378109	OK
16	0.0287175	0.0371614	OK
17	0.0335813	0.0369227	OK
18	0.0410795	0.0371825	OK
19	0.0332355	0.0369503	OK
20	0.0335097	0.0367592	OK
21	0.0340939	0.0366189	OK
22	0.0342011	0.036498	OK
23	0.0372827	0.0365354	OK
24	0.0316262	0.0363122	OK

04th November 2021				Ph:1 Page 3/4				IECSoft v2_6
IEC61000-3-3:2013 Ed.3.0 Flickermeter								
Instrument Details								
Instrument Model	PPA5511							
Instrument Serial	162-04046							
Instrument Firmware	2.179							
Equipment Under Test								
Brand	Suprema ID Inc.							
Project	KP21-06598							
Serial	N/A							
Flicker Test Results								
PST no.	Status	DC (%)	Dmax (%)	Tmax (s)	PST	PST Lim	PLT	PLT Lim
1	Phase1: PASS	0.01232	0.04802	0.00000	0.08226	1.00000	0.08226	0.65000

04th November 2021	Ph:1 Page 4/4	IECSoft v2_6
IEC61000-3-3:2013 Ed.3.0 Flickermeter		
Instrument Details		
Instrument Model	PPA5511	
Instrument Serial	162-04046	
Instrument Firmware	2.179	
Equipment Under Test		
Brand	Suprema ID Inc.	
Project	KP21-06598	
Serial	N/A	
Flicker PST Sum Graph		



6.5 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	230 V, 50 Hz				
Test facility	Shielded room				
Date	2021. 11. 03				
Temperature (°C)	22.2 °C	Humidity (% R.H.)	38.6 % R.H.	Pressure (㎪)	101.1 ㎪
Remarks	Pass - A: There was no change of operation status during above testing. - B: The connection of EUT is cot off during the test. After the test, EUT is getting back to normal operation.				

6.5.1 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.

6.5.2 Used equipments

Equipment	Model No.	Serial No.	Manufacturer	Next Cal. Date	Used
ESD Simulator	ESS-2000	ESS0442747	Noiseken	2022.03.08	☒
ESD Gun	GT-30RA	ESS1991383	Noiseken	2022.03.08	☒
ESD Gun	DITO	P1339124876	EM TEST	2022.01.22	☐
HCP	-	-	-	-	☒
VCP	-	-	-	-	☒

6.5.3 Photographs of test setup

6.5.4 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
-	-	-

Air discharge

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

6.6 Radio Frequency Electromagnetic Fields

Frequency & Level	80 MHz ~ 1 GHz, 3 V/m				
Spot Frequency	1.8 GHz, 2.6 GHz, 3.5 GHz, 5 GHz (± 1 %)				
Modulation	80 % AM (1 kHz)				
Frequency Step	1 % step				
Dwell time	1 s (Spot: 5 s)				
Distance	3 m from EUT to tip of antenna				
Testing Voltage	230 V, 50 Hz				
Test facility	RS Chamber #2				
Date	2021. 11. 04				
Temperature (°C)	22.8 °C	Humidity (% R.H.)	41.6 % R.H.	Pressure (㎪)	100.9 ㎪
Remarks	Pass - A: There was no change of operation status during above testing.				

6.6.1 Measurement procedure

The test was performed at 3 ㎜ 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 ㎜ above the floor.

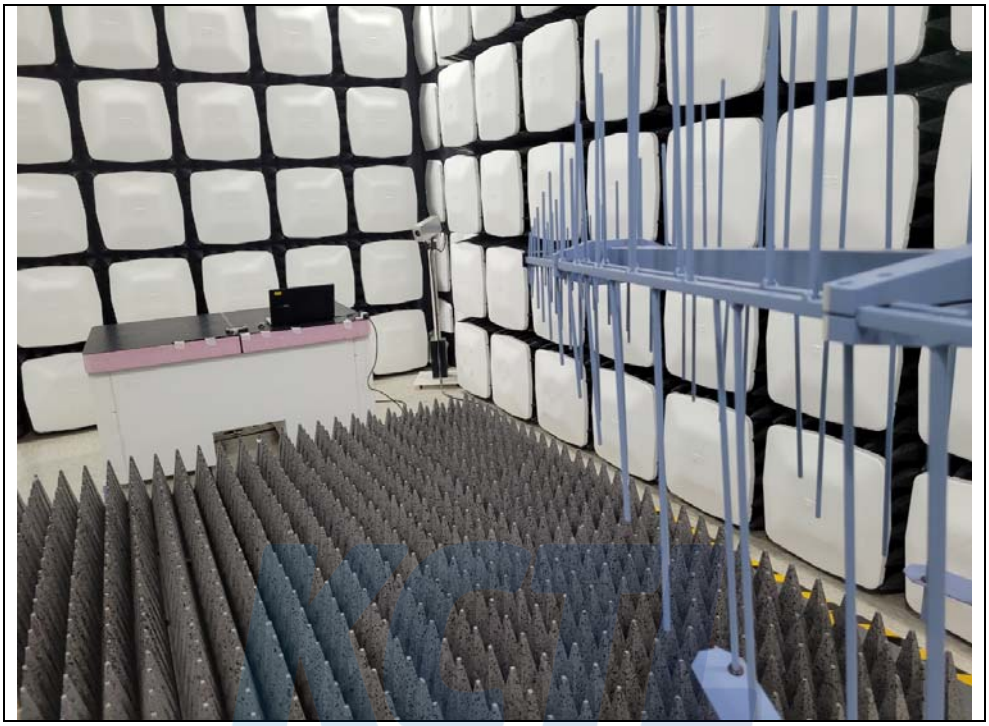
The EUT was tested all sides, horizontal and vertical polarization.

6.6.2 Used equipments

Equipment	Model no.	Serial no.	Manufacturer	Next Cal. date	Used
Signal Generator	SMIQ06B	100733	R&S	2022.07.09	☒
EPM SERIES POWER METER	N1914A	MY59070021	KEYSIGHT	2022.04.01	☒
E-SERIES AVG POWER SENSOR	E9304A	MY59050007	KEYSIGHT	2022.04.01	☒
E-SERIES AVG POWER SENSOR	E9304A	MY59050009	KEYSIGHT	2022.04.01	☒
Dual Directional Coupler	DC6180A	0350834	A/R	2022.04.23	☒
Dual Directional Coupler	DC7200A	0349435	A/R	2022.07.09	☒
Log Periodic Antenna	HL046	100030	R&S	-	☒
Microwave Log.-Per. Antenna	STLP 9149	00510	SCHWARZBECK	-	☒
Power Amplifier	250W1000C	0353319	A/R	-	☒
Power Amplifier	100S1G6AB	0349689	A/R	-	☒
SWITCH CONTROLLER	RSM-02	44006	TDK	-	☒
System Interface	SI-300	TRS-100-00091	TDK	-	☒
Audio Analyzer	UPV	100688	R&S	2022.06.04	☐
Audio Analyzer	UPA3	841215/019	R&S	2022.07.08	☐
Measuring Amplifier	2636	1369250	B&K	-	☐
Microphone	4192	2954616	B&K	2022.04.27	☐
Microphone Preamplifier	2669	3032478	B&K	-	☐
1kHz Band Pass Filter	TK-BPF1K	150074-F	TESTEK	2022.07.08	☐
IMPEDANCE BOX	TIB-R1	150018	TESTEK	2022.01.21	☐

6.6.3 Photographs of test setup

(80 MHz ~ 1 GHz)



(1.8 GHz, 2.6 GHz, 3.5 GHz, 5 GHz)

6.6.4 Measurement result

* Enclosure

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

* Audio output function (☐ Acoustic / ☐ Electrical)

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

* Telecommunications terminal equipment (☐ SPL / ☐ reference level)

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

☐ Spot frequency

80, 120, 145, 160, 230, 375, 435, 460, 600, 814, 835 MHz (± 1 %)

6.7 Electrical Fast Transient/Burst

Coupling	☒ AC main ☐ Signal: Clamp ☐ Telecommunication: Clamp				
Test level	☒ AC main: ± 1 kV Peak ☐ Signal: ± 0.5 kV Peak ☐ Telecommunication: ± 0.5 kV Peak				
Repetition frequency	5 kHz, Tr/Th = 5 / 50 ns				
Coupling time (Minimum)	60 s				
Testing voltage	230 V, 50 Hz				
Test facility	Shielded room				
Date	2021. 11. 03				
Temperature (°C)	22.1 °C	Humidity (% R.H.)	38.5 % R.H.	Pressure (㎪)	101.0 ㎪
Remarks	Pass - A: There was no change of operation status during above testing.				

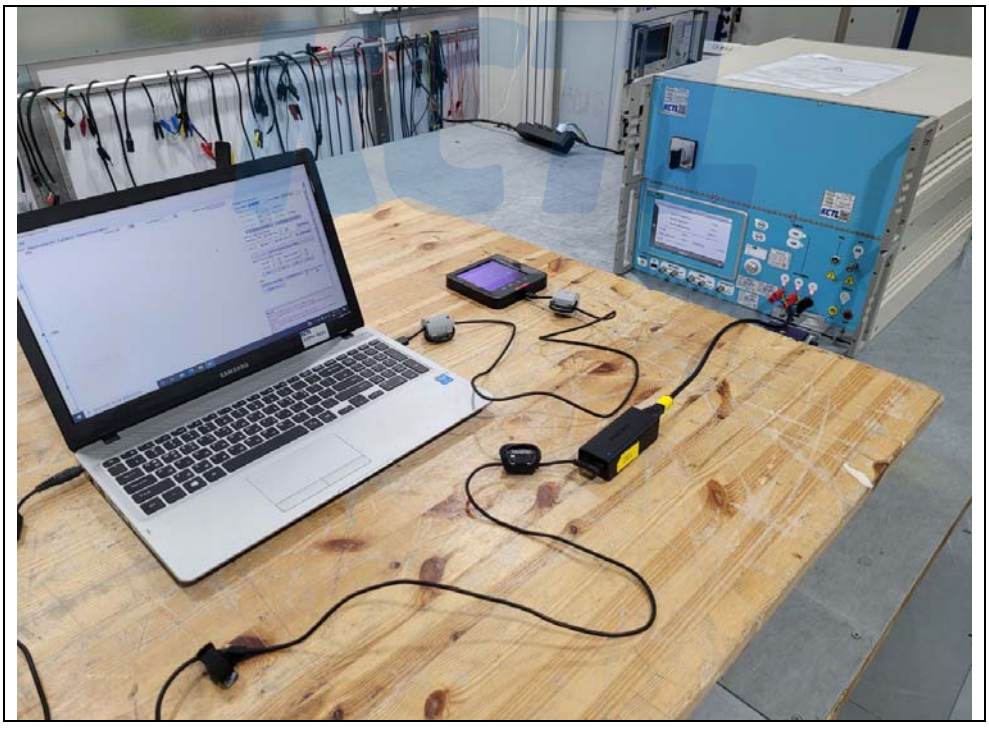
6.7.1 Measurement procedure

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 m wooden table.
For tabletop equipment, EUT was placed on a 0.1 m 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 m.

6.7.2 Used equipments

Equipment	Model no.	Serial no.	Manufacturer	Next Cal. date	Used
EMC IMMUNITY TESTER	IMU4000	IMU4000 D-1501	EMC PARTNER	2022.07.26	☒
CAPACITIVE COUPLING CLAMP	CCL	904228	THERMO FISHER SCIENTIFIC	2022.06.10	☐
EMC IMMUNITY TEST SYSTEM	IMU3000	105684-2107	EMC PARTNER	2022.05.20	☐
CAPACITIVE COUPLING CLAMP	CN-EFT1000	CN-EFT1000-1880	EMC PARTNER	2022.05.21	☐
EMC IMMUNITY TEST SYSTEM	EMC PRO PLUS	905220	THERMO FISHER SCIENTIFIC	2022.06.10	☐
3-PHASE COUPLING DECOUPLING NETWORK	CDN-A	109037-3044	EMC PARTNER	2022.06.09	☐

6.7.3 Photographs of test setup



6.7.4 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

* Signal

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

* Telecommunication

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

6.8 Surge Transient

Coupling	☒ AC main: Direct ☐ Signal: Direct ☐ Telecommunication: Direct				
Test level	☒ AC main: ☒ Differential mode: ± 0.5 kV, ± 1 kV ☒ Common mode: ± 0.5 kV, ± 1 kV, ± 2 kV ☐ Signal: ± 0.5 kV, ± 1 kV ☐ Telecommunication: ± 0.5 kV, ± 1 kV				
Coupling Impedance	☒ Differential mode: 2 Ω + 18 μF ☒ Common mode: 12 Ω + 9 μF ☐ 40 Ω + 0.5 μF ☐ Direct				
Surge pulse shape	Tr/Th = 1.2 / 50 μs				
Angles	90 °, 270 °				
Number of surge	5				
Coupling time	30 s				
Testing Voltage	230 V, 50 Hz				
Test facility	Shielded room				
Date	2021. 11. 03				
Temperature (°C)	22.1 °C	Humidity (% R.H.)	38.4 % R.H.	Pressure (㎪)	101.0 ㎪
Remarks	Pass - A: There was no change of operation status during above testing.				

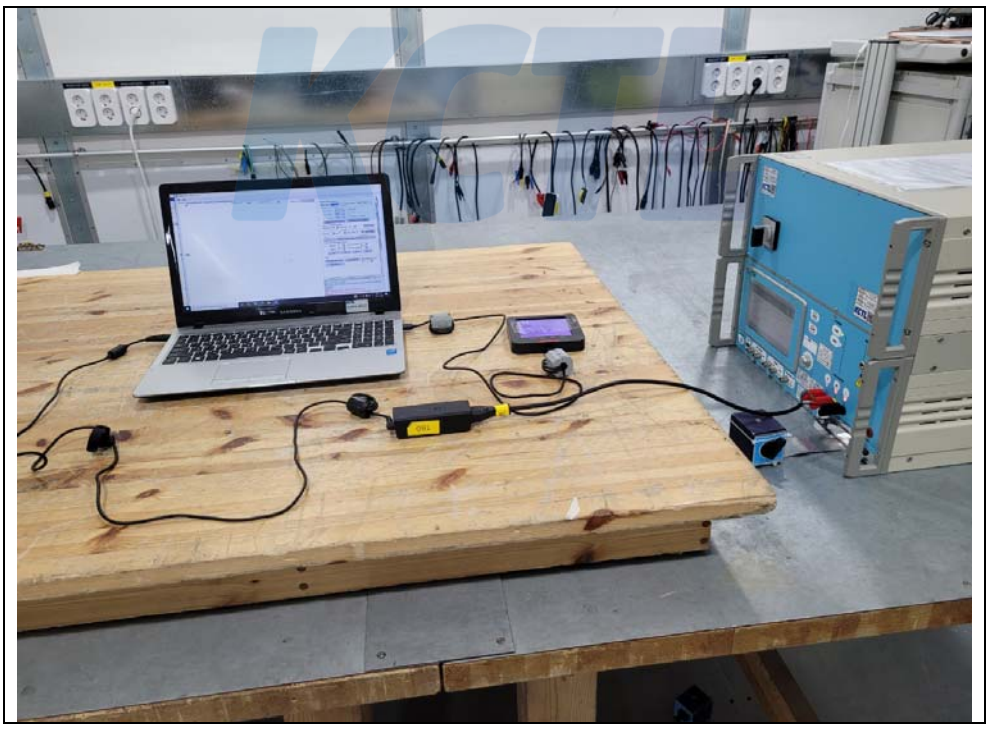
6.8.1 Measurement procedure

A ground reference plane was located on the floor. 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.

6.8.2 Used equipments

Equipment	Model no.	Serial no.	Manufacturer	Next Cal. date	Used
EMC IMMUNITY TESTER	IMU4000	IMU4000 D-1501	EMC PARTNER	2022.07.26	☒
EMC IMMUNITY TEST SYSTEM	IMU3000	105684-2107	EMC PARTNER	2022.05.20	☐
EMC IMMUNITY TEST SYSTEM	EMC PRO PLUS	905220	THERMO FISHER SCIENTIFIC	2022.05.21	☐
COUPLER DECOUPLER NETWORK	CDN-UTP8 ED3	106326-1600	EMC PARTNER	2022.05.21	☐
SURGE COUPLING NETWORK(RESISTER)	CN-R40C05	CN-R40C05-1559	EMC PARTNER	2022.05.21	☐
3-PHASE COUPLING DECOUPLING NETWORK	CDN-A	109037-3044	EMC PARTNER	2022.06.09	☐

6.8.3 Photographs of test setup



6.8.4 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

* Signal

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

6.9 Conducted Susceptibility

Frequency & Level	0.15 kHz ~ 10 MHz, 3 V 10 MHz ~ 30 MHz, 3 V ~ 1 V 30 MHz ~ 80 MHz, 1 V				
Modulation	80 % AM (1 kHz)				
Frequency Step	1 % step				
Dwell time	1 s				
Coupling method	☒ AC main: CDN (M016) ☐ Signal: EM INJECTION CLAMP ☐ Telecommunication: CDN (T8-10) ☐ Audio output function: CDN (M016) ☐ Telecommunications terminal equipment				
Testing Voltage	230 V, 50 Hz				
Test facility	Shielded room				
Date	2021. 11. 03				
Temperature (°C)	22.0 °C	Humidity (% R.H.)	38.0 % 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.
The test was performed on a ground reference plane on a 0.1 m 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 m length were tested.

6.9.2 Used equipments

Equipment	Model no.	Serial no.	Manufacturer	Next Cal. date	Used
Signal Generator	SMT 02	833414/019	R&S	2022.07.09	☒
Power Amplifier	75A250AM2	0344844	A/R	-	☒
Millivoltmeter	URV5	836671/003	R&S	2022.05.20	☒
10 V INSERTION UNIT	URV5-Z2	DE10501	R&S	2022.05.20	☒
10 V INSERTION UNIT	URV5-Z2	DE10502	R&S	2022.05.20	☒
Directional Coupler	DC2000	14262	A/R	2022.01.21	☒
Attenuator	SA3N25-06	N/A	Fairview Microwave	2022.01.21	☒
SIGNAL GENERATOR	CTR1004B	CTR04-2001001	DARE	2022.05.20	☐
POWER SENSOR	RPR2006C	RPR6C-2001005	DARE	2022.05.20	☐
POWER SENSOR	RPR2006C	RPR6C-2001006	DARE	2022.05.20	☐
POWER AMPLFIER	RPA0925A-075	AMP02-2001001	DARE	2022.05.21	☐
Attenuator	40-6-34	JW703	WEINSCHEL	2022.07.09	☐
Terminator	50LH50 NF	86050	Alan	2022.07.09	☐
CDN	FCC-801-M2-16A	161225	FCC	2022.07.08	☐
CDN	FCC-801-M3-25A	101510	FCC	2022.07.08	☐
CDN	FCC-801-C1-BNC-75	130078	FCC	2022.07.08	☐
CDN	FCC-801-T4	85	FCC	2022.04.23	☐
CDN	CDN T8-10	42006	TESEQ	2022.04.23	☐
CDN	ISN ST08	43553	TESEQ	2022.07.08	☐
CDN	CDN M016	43260	TESEQ	2022.07.08	☐
CDN	CDN M016	43261	TESEQ	2022.07.08	☐
CDN	CDN M016	43262	TESEQ	2022.07.08	☒
CDN	CDN M5PE	00004	SCHWARZ BECK	2022.06.09	☐
EM INJECTION CLAMP	KEMZ801A	59580	TESEQ	2022.06.10	☐
DECOUPLING CLAMP	FCC-205-ADC	1	FCC	2022.01.22	☐
Artificial Hand	FCC-AH-1	44	FCC	-	☐
Artificial Hand	FCC-AH-1	45	FCC	-	☐
AUDIO ANALYZER	UPV	100688	R&S	2022.06.04	☐
AUDIO ANALYZER	UPA3	841215/019	R&S	2022.07.08	☐
Measuring Amplifier	2636	1369250	B&K	-	☐
Microphone	4192	2954616	B&K	2022.04.27	☐
Microphone Preamplifier	2669	3032478	B&K	-	☐
1kHz Band Pass Filter	TK-BPF1K	150074-F	TESTEK	2022.07.08	☐
IMPEDANCE BOX	TIB-R1	150018	TESTEK	2022.01.21	☐

6.9.3 Photographs of test setup

6.9.4 Measurement result

* AC main

Coupling point	Coupling method	Result
Power	CDN (M016) S/N: 43262	A

* Signal

Coupling point	Coupling method	Result
-	-	-

* Telecommunication

Coupling point	Coupling method	Result
-	-	-

* Audio output function (☐ Acoustic / ☐ Electrical)

Coupling point	Coupling method	Result
-	-	-

* Telecommunications terminal equipment (☐ SPL / ☐ reference level)

Coupling point	Coupling method	Result
-	-	-

☐ Spot frequency

0.2, 1, 7.1, 13.56, 21, 27.12, 40.68, 52 MHz (± 1 %)

6.10 Voltage Dips and Interruptions

Number of dips	3 T				
Duration	10 s				
Phase	Zero crossing (0 °, 180 °)				
Testing Voltage	100 V, 50 Hz / 240 V, 50 Hz 100 V, 60 Hz / 240 V, 60 Hz				
Test facility	Shielded room				
Date	2021. 11. 03				
Temperature (°C)	22.1 °C	Humidity (% R.H.)	38.3 % R.H.	Pressure (㎪)	101.0 ㎪
Remarks	Pass				

6.10.1 Measurement procedure

The dips/interruption test is only applicable to AC mains.

The dips/interruptions were applied at zero crossing.

6.10.2 Used equipments

Equipment	Model no.	Serial no.	Manufacturer	Next Cal. date	Used
ULTRA COMPACT GENERATOR	UCS 500N5P	P1251107280	EM TEST	2022.04.02	☐
Motor Variac	MV2616	P1246105272	EM TEST	-	☐
EMC IMMUNITY TESTER	IMU4000	IMU4000 D-1501	EMC PARTNER	2022.05.21	☒
External 16A Variac	VAR-EXT1000	VAR-EXT1000-1626	EMC PARTNER	-	☒
Dip Simulator	PFS75	PFS75-1501	EMC PARTNER	2022.01.21	☐
Dip Simulator	SRC75	SRC75-18UH-1501	EMC PARTNER	2022.01.21	☐

6.10.3 Photographs of test setup

6.10.4 Measurement result

* 100 V, 50 Hz / 240 V, 50 Hz

Test Level (%UT)	Dip/Int. (%UT)	Duration /Period	Angle (°)	Count number	Result
0 %	100 %	0.5 Period	0, 180	3T	A
70 %	30 %	25 Period	0	3T	A
0 %	100 %	250 Period	0	3T	A

* 100 V, 60 Hz / 240 V, 60 Hz

Test Level (%UT)	Dip/Int. (%UT)	Duration /Period	Angle (°)	Count number	Result
0 %	100 %	0.5 Period	0, 180	3T	A
70 %	30 %	30 Period	0	3T	A
0 %	100 %	300 Period	0	3T	A

Comment:

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

(0.5 Period, 25/30 Period, 250/300 period)

- Evaluation result A with battery built-in product. (Note PC)

7. EUT photographs

Front View

Rear View

Left View

Right View

Inside