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EMC Test Report

Report Number	**ESTCCE2308-007**			
Applicant	Company Name	Xperix Inc.		
	Address	1207, 37, Sagimakgol-ro 62beon-gil, Jungwon-gu, Seongnam-si, Gyeonggi-do, Republic of Korea		
	Contact Person	Byung-joon Jang		
	Factory address	1207, 37, Sagimakgol-ro 62beon-gil, Jungwon-gu, Seongnam-si, Gyeonggi-do, Republic of Korea		
Product	Product type	Authentication Scanner		
	Model No.	BioMini Slim 2	Manufacturer	Xperix Inc.
	Serial No.	NONE	Country of origin	Korea
Other	Receipt Date	1-Aug-23	Receipt Number	ESTC-23-01366
	Issued Date	31-Aug-23	Tested Date	4-Aug-23
Test Result	Complied			
EMC Directive	2014/30/EU			
Standard	EMI Standard	EMS Standard		
	EN 55032:2015+A11:2020 Class A	EN 55035:2017+A11:2020 EN 61000-4-2:2009 EN IEC 61000-4-3:2020 EN 61000-4-4:2012 EN 61000-4-5:2014+A1:2017 EN 61000-4-6:2014+AC:2015 EN IEC 61000-4-11:2020		
Tested by	Keo-il Lee / Test Engineer (Signature)			
Approved by	Jin-Mo Yang / Technical Manager (Signature)			

ESTECH CO., LTD.
140-16, Eongmalli-ro, Majang-myeon, Icheon-si, Gyeonggi-do, R. O. Korea
TEL : +82 31 6318037 FAX : +82 31 6318039

* Note

o Basic Model : BioMini Slim 2
Addtional Model(s) - BMS-2 : FBI PIV FAP20 certified single fingerprint scanner.
- BM-Slim2 : OEM module of BMS-2 without a housing case.

o This is certified that the above mentioned products have been tested for the sample provided by client.

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o This test report is not related to KOLAS accreditation.

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1. Laboratory Information

1.1 General

This EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards and tested in accordance with the measurement procedures as indicated in this report ESTECH Lab attests to accuracy of test data. All measurement reported herein were performed by ESTECH Co., Ltd.

ESTECH Lab. assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

1.2 Test lab.

Corporation Name : ESTECH Co., Ltd.

Head Office : Suite 1015 World Meridian II, 123 Gasan Digital 2-ro,Geumcheon-gu,
Seoul 153-759, R. O. Korea

EMC Test Lab. : 140-16, Eongmalli-ro, Majang-myeon, Icheon-si, Gyeonggi-do, R. O. Korea

1.3 Registration Information

Our Test lab has worked test lab system by ISO/IEC 17025:2017 and was registered, designated or certified by the follow the bodies

MSIT : Designated in accordance with the provisions of Radio Waves Act and International Standard ISO/IEC 17025

FCC : Designated with registration number 659627 under APECTEL MRA between the RRA and the FCC.

VCCI : Registrated in the scope of conducted and radiated measurement,
(R-20023,T-20023,G-20033 and C-20021)

1.4 Measurement Uncertainty Values

Test Items	Uncertainty(*k* = 2)
Radiated Emission (30 MHz to 1 GHz)	3.30 dB
Radiated Emission (1 GHz to 6 GHz)	4.86 dB
Conducted Emission (AC Mains)	2.80 dB
Discontinous Disturbance (AC Mains)	2.30 dB
Disturbance Power (30 MHz to 300 MHz)	3.75 dB
Conducted Emission (Telecommunication)	3.72 dB
Limits concerning harmonic current test	0.87%
Voltage Fluctuations & Flicker test	5.90%
Electrostatic Discharge test	Uncertainty = 5 % It has been demonstrated that the Electrostatic Discharge test meets the specified requirements in the standard with at least 95 % confidence.
Radiated Electromagnetic Fields test	4.78 dB
Electrical Fast Transients/Burst test	Uncertainty = 10 % It has been demonstrated that the Electrical Fast Transients/Burst test meets the specified requirements in the standard with at least 95 % confidence.
Surge Test	Uncertainty = 10 % It has been demonstrated that the Surge Test meets the specified requirements in the standard with at least 95 % confidence.
Conducted Immunity	1.86 dB
Power Frequency Magnetic Field Immunity	Uncertainty = 5 % It has been demonstrated that the Power Frequency Magnetic Field Immunity meets the specified requirements in the standard with at least 95 % confidence.

Decision rule:

The following rules were applied for the statements of conformity regarding whether or not to include the measurement uncertainty of the measuring equipment used in the decision-making according to the instruction of
“Reporting method for conformity of test results (EST-QP17-Q-I02)”.

■ Simple acceptance (Complied/Non-complied or Pass/Fail decision rules that do not taken measurement uncertainty into account) (w = 0)

□ Complied/Non-complied or Pass/Fail decision rules considering measurement uncertainty as guard bands. (w = U) or,

□ Provided by the client _____

2. Description of EUT

2.1 Summary of Equipment Under Test

EUT Name	:	Authentication Scanner
Model Number	:	BioMini Slim 2
Serial Number	:	NONE
Manufacturer	:	Xperix Inc.
Country of origin	:	Korea
Power Rating	:	DC 5.0 V , 500 mA
Testing Voltage	:	AC 230 V, 50 Hz (Notebook Computer USB Power)

2.2 General descriptions of EUT

Sensor	Image Quality Standards	FBI PIV / FBI Mobile ID FAP20
	Live Finger Detection	O
	Sensor Type	Optical
	Resolution	500 ppi
	Gray Scale	256 levels
	Platen Size (W x L mm)	16.5 x 21.0
	Sensing Area (W x H mm)	15.24 x 20.32
	Image Size (W x H pixels)	300 x 400
HW	Interface	USB 2.0 High Speed
	Operating Temperature (℃)	-10 ~ 50℃
	Storage Temperature (℃)	-20 ~ 70℃
	Operating Humidity	10 ~ 90% RH, non-condensing
	Ingress Protection	IP65 (Sensor Surface)
	Dimensions (W x L x H mm)	59 x 32 x 13.5 mm
	Weight (g)	30g
SW	Windows	Windows 7, 8, 8.1, 10 32/64bits
	Linux	Ubuntu, Debian, Fedora, CentOS 32/64bits
	Android Android 4.1(Jelly Bean) and above	O
	Image Format	RAW, BMP, WSQ, ISO19794-4
	Template Type	Xperix, ISO19794-2, ANSI-378

Range of working Voltage		5V±0.5V
Power Consumption (mA)	Idle	85
	Sleep	25
	Capture Single	131
	Inrush (fingerprint put on)	500

3. Measurement Condition

3.1 EUT Operation.

- EUT was in the following mode of operation during all tests.

1. Connected EUT to Notebook Computer.
2. Activated scanning fingerprint and operated continuously fingerprint recognition.
3. Checked status of EUT operation with the test program.

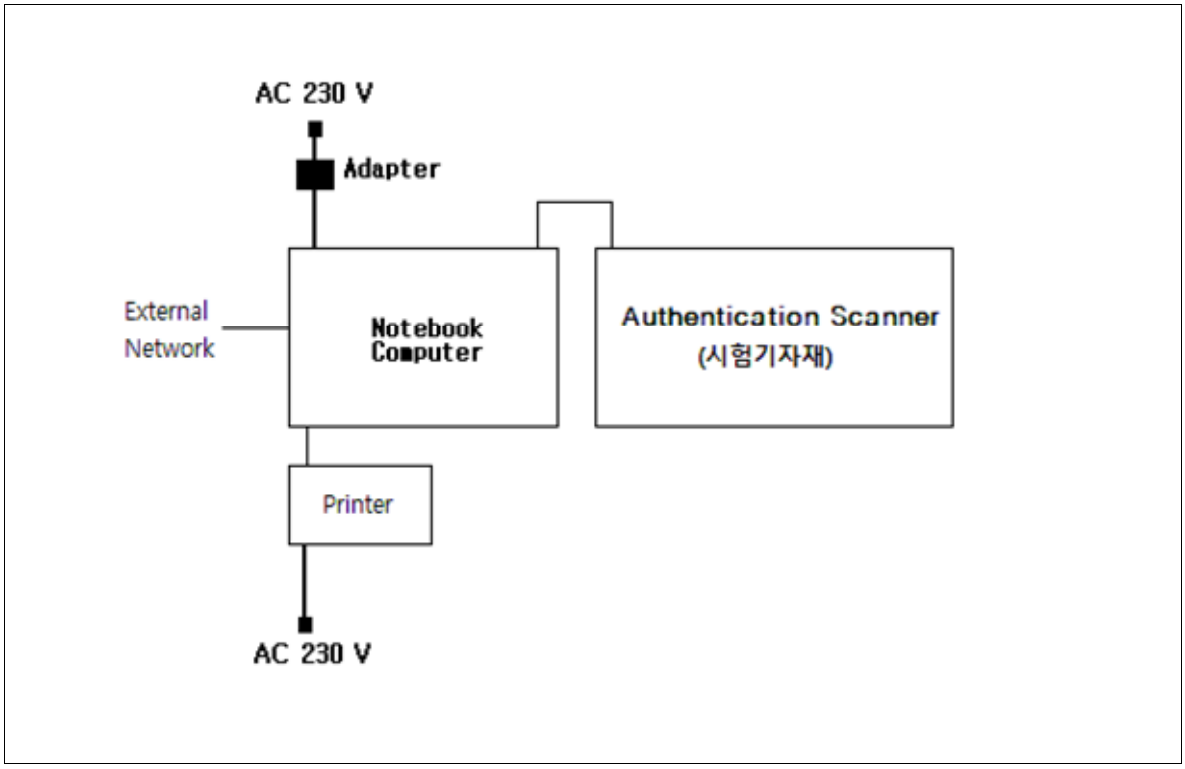
3.2 Cable Connecting

Start Equipment		End Equipment		Cable		Remark
Name	**I/O port**	**Name**	**I/O port**	**Length(m)**	**Shielded**	
Authentication Scanner	USB	Notebook Computer	USB	1.0	Shielded	
Printer	USB Type-B	Notebook Computer	USB	2.0	Shielded	
Notebook Computer	Power	Adapter	-	2.0	Shielded	
Notebook Computer	LAN	External Network	LAN	20.0	Unshielded	

3.3 EUT Configurations

Equipment Name	Model Name	S/N	Manufacturer	Remark (CE ID)
Authentication Scanner	BioMini Slim 2	NONE	Xperix Inc.	**E.U.T**
Notebook Computer	15UD50N	NONE	LG ELECTRONICS	
Adapter	A18-045N2A	NONE	Chicony Power	
Printer	K10229	NONE	CANON VIETNAM CO.,LTD.	

3.4 Test Setup Configuration



4. Electromagnetic Interference Test

4.1 Measurement of radiated emission (Below 1 GHz)

In the range 30 MHz to 1 GHz Eelectric Field strength was measured in accordance with EN 55032:2015+A11:2020 Class A. The test setup was made according to EN 55032:2015+A11:2020 Class A on an 10 m Semi-Anechoic Chamber, which allows a 10 m distance measurement. The height of this table was 0.8 m. The measurement was conducted with both horizontal and vertical antenna polarization. The turntable has fully rotated. For further description of the configuration refer to the picture of the test setup.

4.1.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESCI7	ROHDE & SCHWARZ	100916	12-Jun-24
Logbicon Antenna	VULB 9168	SCHWARZBECK	237	21-Mar-24
Turn Table	DT3000-2t	Innco System GmbH	N/A	N/A
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	N/A
Antenna Master & Turn table controller	CO3000-P	Innco System GmbH	CO3000/1138 /44661018/P	N/A

4.1.2 Environmental conditions

Section	Temperature (°C)	Humidity (% R.H.)
Radiated emission	23.6	53.8
Test Place	10 m Semi-Anechoic Chamber	

4.1.3 Test data

Test Date : 4-Aug-23

(Basic Model)

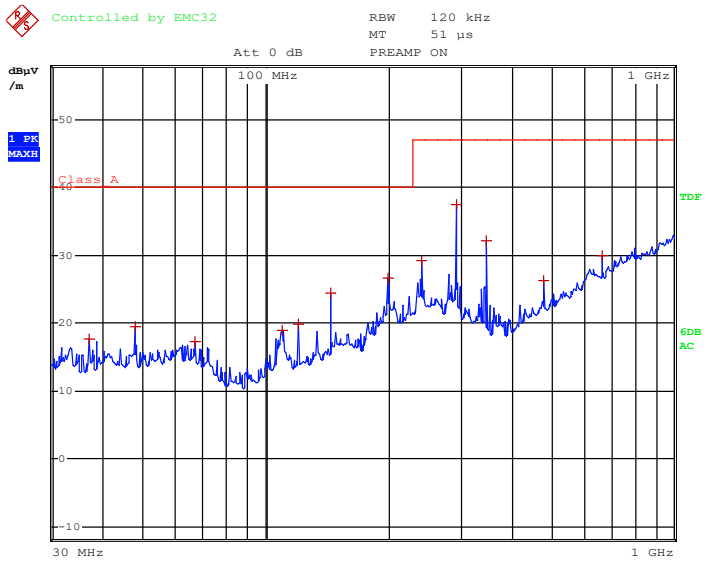
Frequency [MHz]	Reading [dBμV]	Position [V/H]	Height [m]	Correction Factor		Result Value [dBμV/m]		Margin [dB]
				Antenna [dB/m]	Cable etc. [dB]	Limit	Result	
144.00	12.24	V	1.0	12.88	1.60	40.00	26.72	13.28
199.40	14.80	V	1.0	10.12	2.08	40.00	27.00	13.00
240.00	15.73	V	1.0	11.30	2.28	47.00	29.31	17.69
293.30	21.60	V	1.0	13.36	2.61	47.00	37.57	9.43
346.70	15.52	V	1.0	14.30	2.29	47.00	32.11	14.89
876.00	6.60	H	4.0	23.10	4.70	47.00	34.40	12.60
Remark	H : Horizontal, V : Vertical Result Value = Reading + Antenna + Cable loss * The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection							

(Additional Model)

Frequency [MHz]	Reading [dBμV]	Position [V/H]	Height [m]	Correction Factor		Result Value [dBμV/m]		Margin [dB]
				Antenna [dB/m]	Cable etc. [dB]	Limit	Result	
48.00	20.37	V	1.1	13.58	0.99	40.00	34.94	5.06
50.70	8.89	V	1.0	13.67	1.00	40.00	23.56	16.44
110.80	9.79	H	4.0	9.80	1.45	40.00	21.04	18.96
129.00	9.46	H	4.0	11.18	1.55	40.00	22.19	17.81
144.00	14.08	H	4.0	12.88	1.60	40.00	28.56	11.44
199.90	15.09	H	4.0	10.10	2.08	40.00	27.27	12.73
Remark	H : Horizontal, V : Vertical Result Value = Reading + Antenna + Cable loss * The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection							

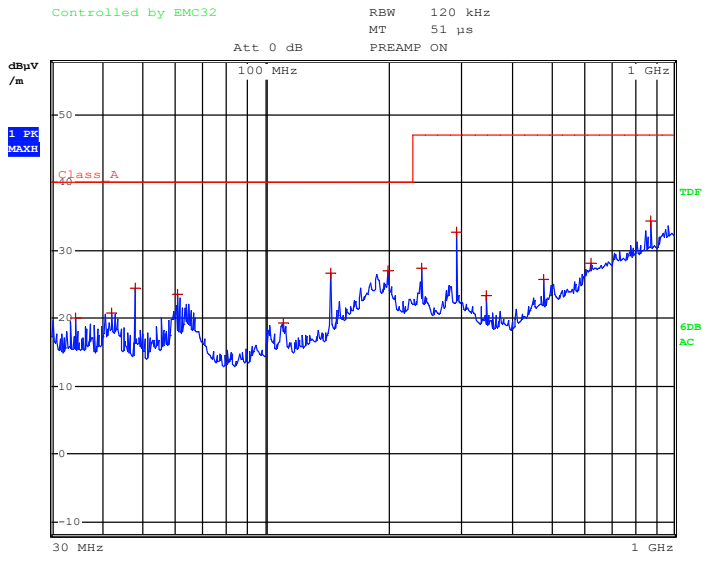
4.1.4 Test data graph

(Basic Model)

Horizontal (30 MHz to 1 GHz)


ESTC-23-01366_HOR

Date: 4.AUG.2023 10:21:06

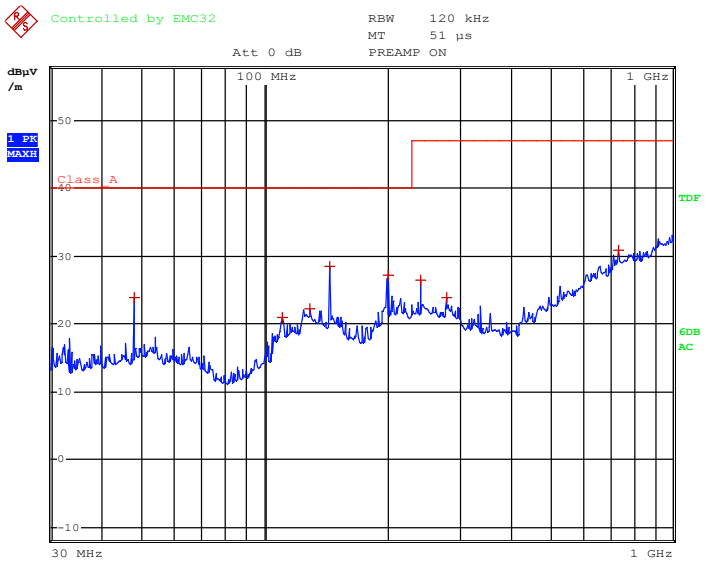
Vertical (30 MHz to 1 GHz)


ESTC-23-01366_VER

Date: 4.AUG.2023 10:06:13

(Additional Model)

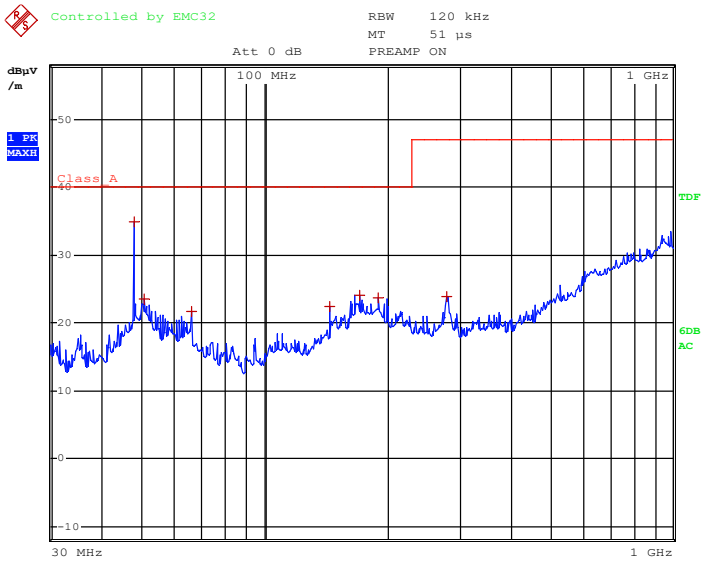
Horizontal (30 MHz to 1 GHz)



ESTC-23-01366-B_HOR

Date: 4.AUG.2023 10:56:59

Vertical (30 MHz to 1 GHz)



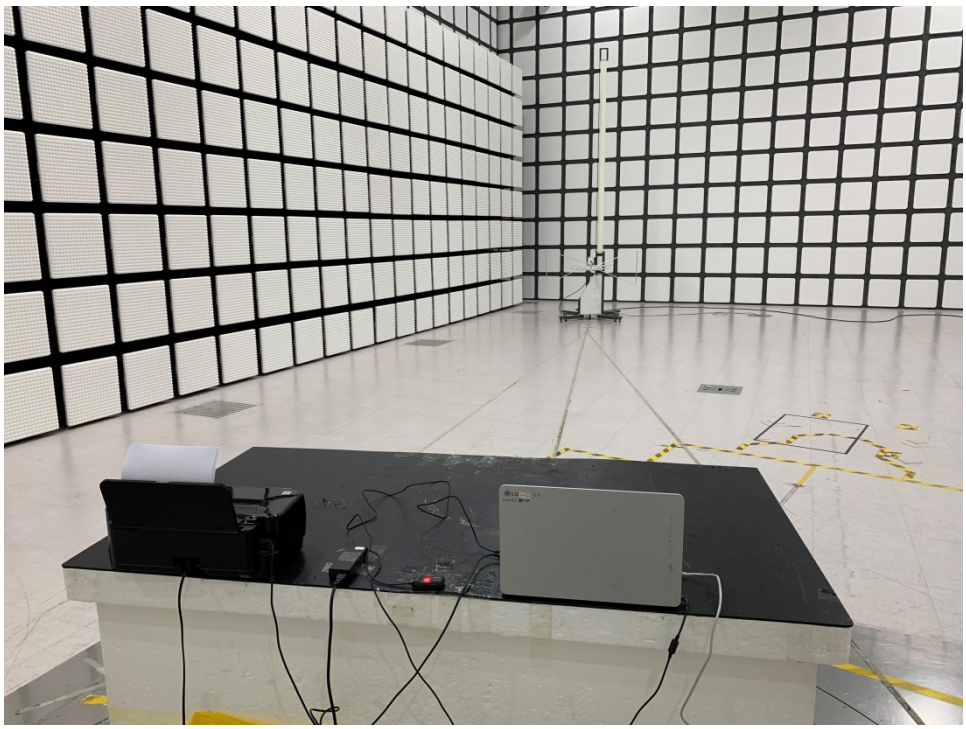
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♦ Setup for Radiated Test

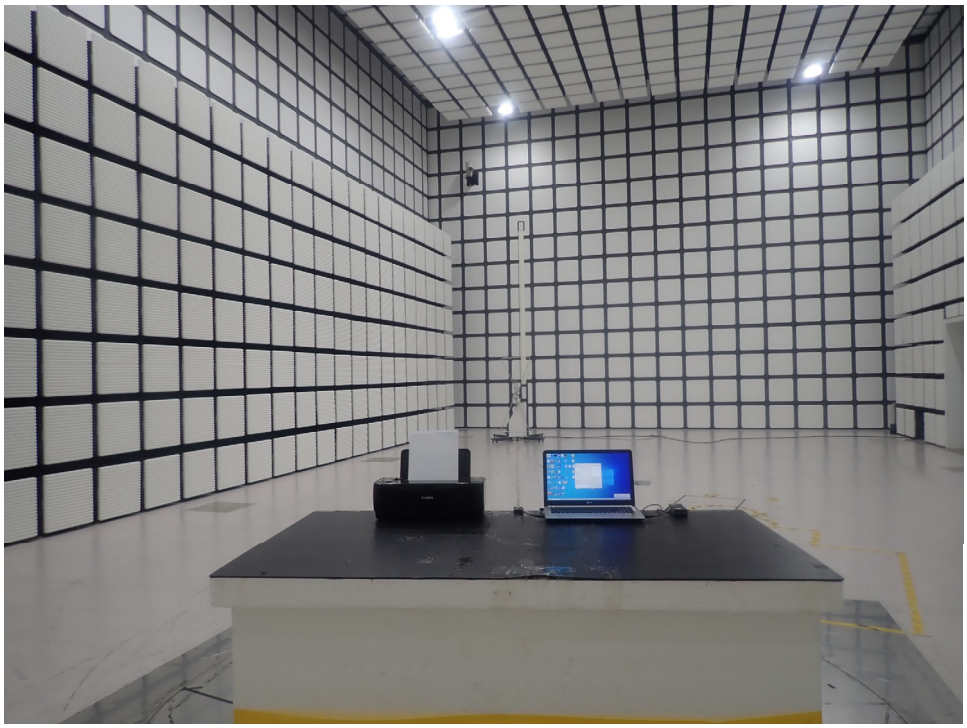
(Basic Model)

[Front]

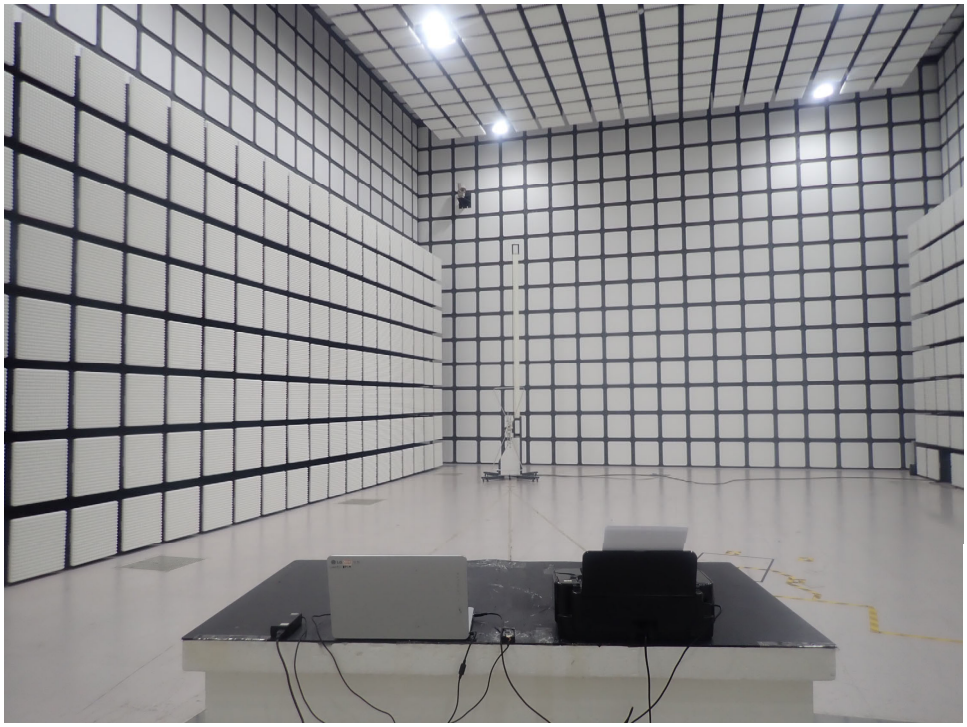

[Rear]


(Additional Model)

[Front]



[Rear]



4.2 Measurement of radiated emission(Above 1 GHz)

Above 1 GHz the radiated emission was measured in accordance with EN 55032:2015+A11:2020 Class A. The test setup was made according to EN 55032:2015+A11:2020 Class A on an 3 m Semi- Anechoic Chamber, which allows a 3 m distance measurement. The height of this table was 0.8 m. The measurement was conducted with both horizontal and vertical antenna polarization. The turntable has fully rotated. For further description of the configuration refer to the picture of the test setup.

4.2.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
Antenna Mast	MA4640-XP-ET	Innco System GmbH	N/A	N/A
Antenna Master & Turn table controller	CO3000	Innco System GmbH	CO3000/931 /38240516/L	N/A
Turn Table	DT1500-S	Innco System GmbH	N/A	N/A
Horn Antenna	BBHA9120D	SCHWARZBECK	469	8-Nov-23
PREAMPLIFIER	8449B	HP	3008A00581	12-Jun-24
Test Receiver	ESU	Rohde & Schwarz	100529	12-Jun-24

4.2.2 Environmental conditions

Section	Temperature (°C)	Humidity (% R.H.)
Radiated emission	23.7	54.0
Test Place	3 m Semi-Anechoic Chamber	

4.2.3 Test data

Test Date : 4-Aug-23

(Basic Model)

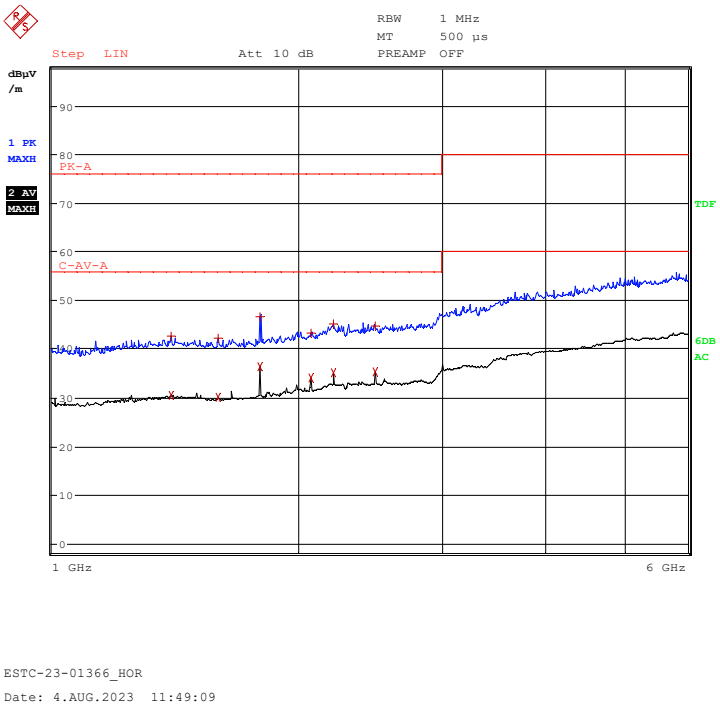
Frequency [MHz]	Reading [dBμV]	Position [V/H]	Height [m]	Correction Factor		Result Value [dBμV/m]		Margin [dB]
				Antenna [dB/m]	Cable etc. [dB]	Limit	Result	
Peak								
1518.00	45.33	H	1.0	25.24	-28.31	76.00	42.26	33.74
1518.00	49.32	V	1.0	25.24	-28.31	76.00	46.25	29.75
1794.00	49.57	H	1.0	25.29	-28.17	76.00	46.69	29.31
1794.00	52.20	V	1.0	25.29	-28.17	76.00	49.32	26.68
2394.00	45.11	H	1.0	27.71	-28.01	76.00	44.81	31.19
2394.00	50.88	V	1.0	27.71	-28.01	76.00	50.58	25.42
Cispr Average								
1518.00	33.09	H	1.0	25.24	-28.31	56.00	30.02	25.98
1518.00	41.46	V	1.0	25.24	-28.31	56.00	38.39	17.61
1794.00	39.20	H	1.0	25.29	-28.17	56.00	36.32	19.68
1794.00	44.27	V	1.0	25.29	-28.17	56.00	41.39	14.61
2394.00	35.63	H	1.0	27.71	-28.01	56.00	35.33	20.67
2394.00	36.71	V	1.0	27.71	-28.01	56.00	36.41	19.59
Remark	H : Horizontal, V : Vertical * Reading = receiver reading + Amplifier Gain * CL = Cable Loss-Amplifier Gain							

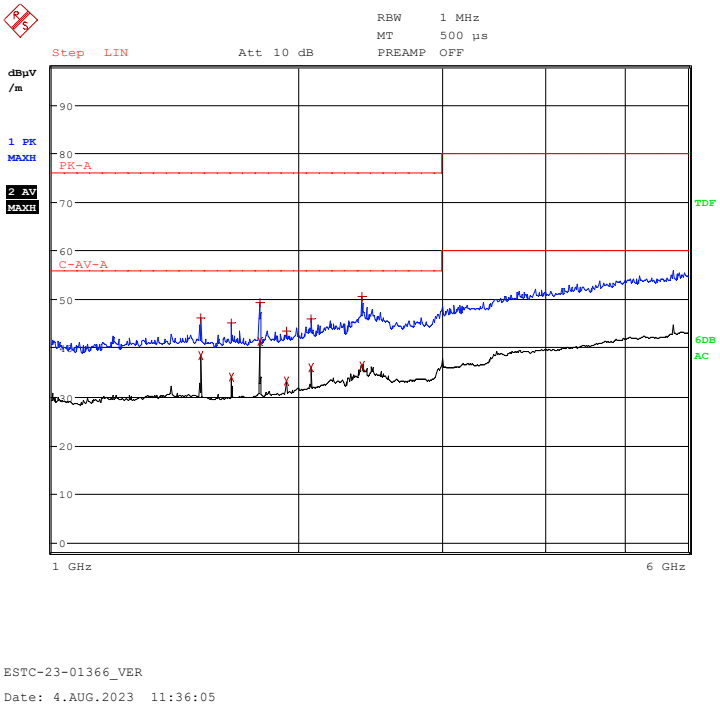
(Additional Model)

Frequency [MHz]	Reading [dBμV]	Position [V/H]	Height [m]	Correction Factor		Result Value [dBμV/m]		Margin [dB]
				Antenna [dB/m]	Cable etc. [dB]	Limit	Result	
Peak								
1598.00	45.82	H	1.0	25.00	-28.28	76.00	42.54	33.46
1598.00	47.11	V	1.0	25.00	-28.28	76.00	43.83	32.17
2192.00	45.17	H	1.0	28.01	-28.03	76.00	45.15	30.85
2192.00	45.01	V	1.0	28.01	-28.03	76.00	44.99	31.01
2398.00	45.68	H	1.0	27.70	-28.01	76.00	45.37	30.63
2398.00	48.10	V	1.0	27.70	-28.01	76.00	47.79	28.21
Cispr Average								
1598.00	32.65	H	1.0	25.00	-28.28	56.00	29.37	26.63
1598.00	32.96	V	1.0	25.00	-28.28	56.00	29.68	26.32
2192.00	32.31	H	1.0	28.01	-28.03	56.00	32.29	23.71
2192.00	32.83	V	1.0	28.01	-28.03	56.00	32.81	23.19
2398.00	33.04	H	1.0	27.70	-28.01	56.00	32.73	23.27
2398.00	34.87	V	1.0	27.70	-28.01	56.00	34.56	21.44
Remark	H : Horizontal, V : Vertical * Reading = receiver reading + Amplifier Gain * CL = Cable Loss-Amplifier Gain							

4.2.4 Test data graph

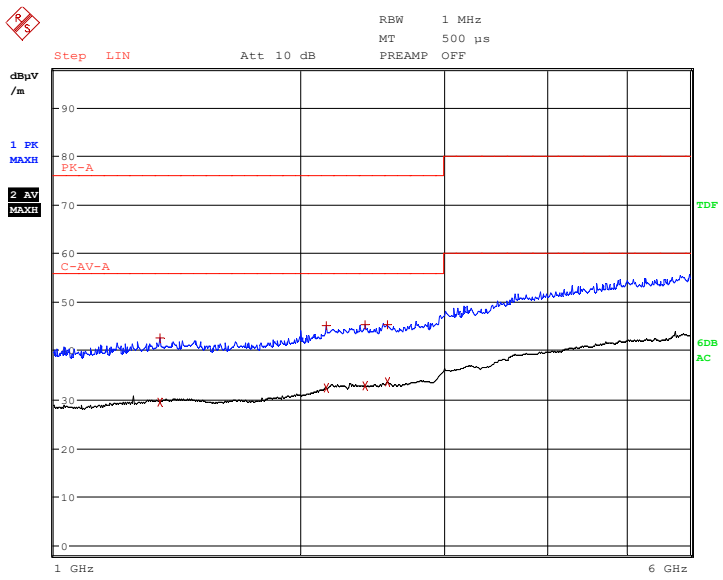
(Basic Model)

Horizontal (1 GHz to 6 GHz)


Vertical (1 GHz to 6 GHz)


(Additional Model)

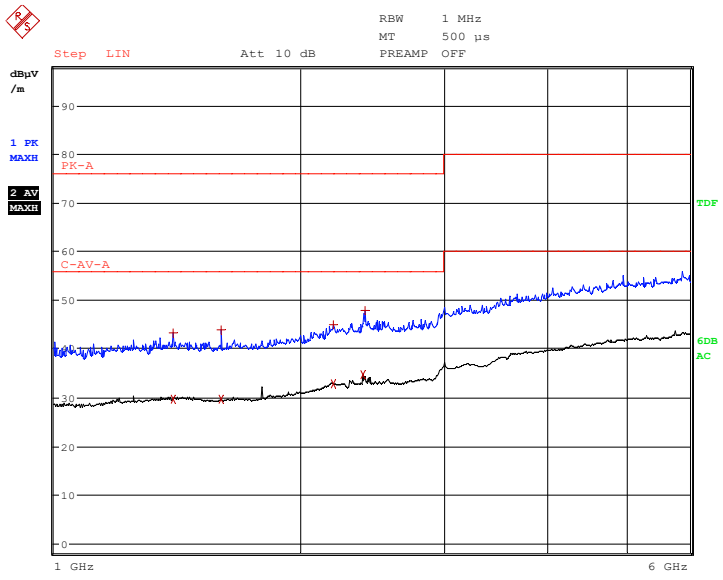
Horizontal (1 GHz to 6 GHz)



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Vertical (1 GHz to 6 GHz)



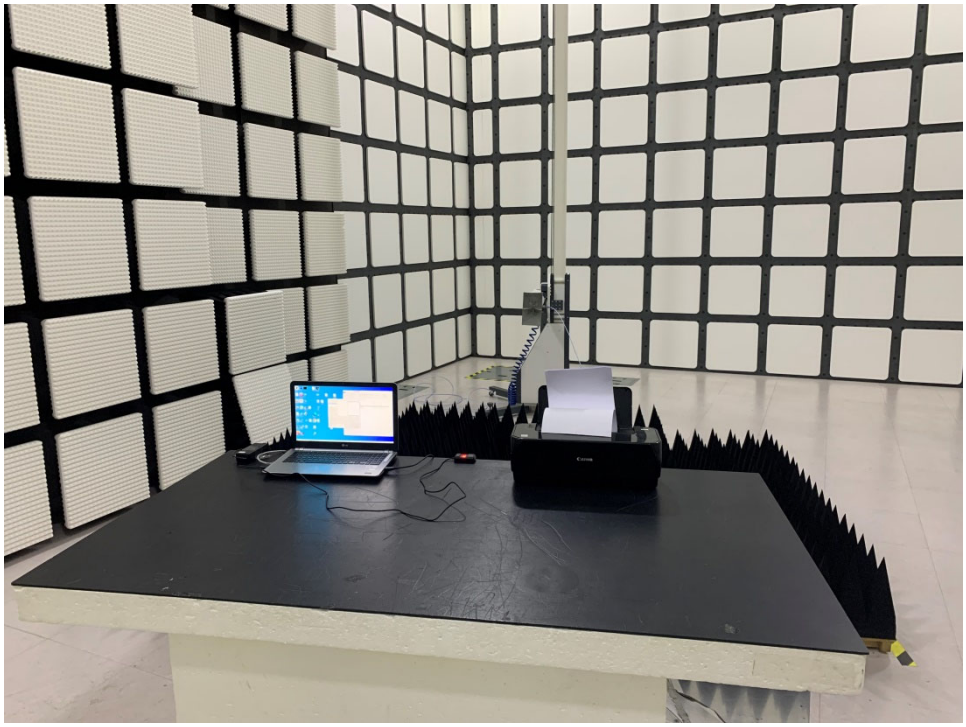
ESTC-23-01366-B_VER

Date: 4.AUG.2023 12:23:45

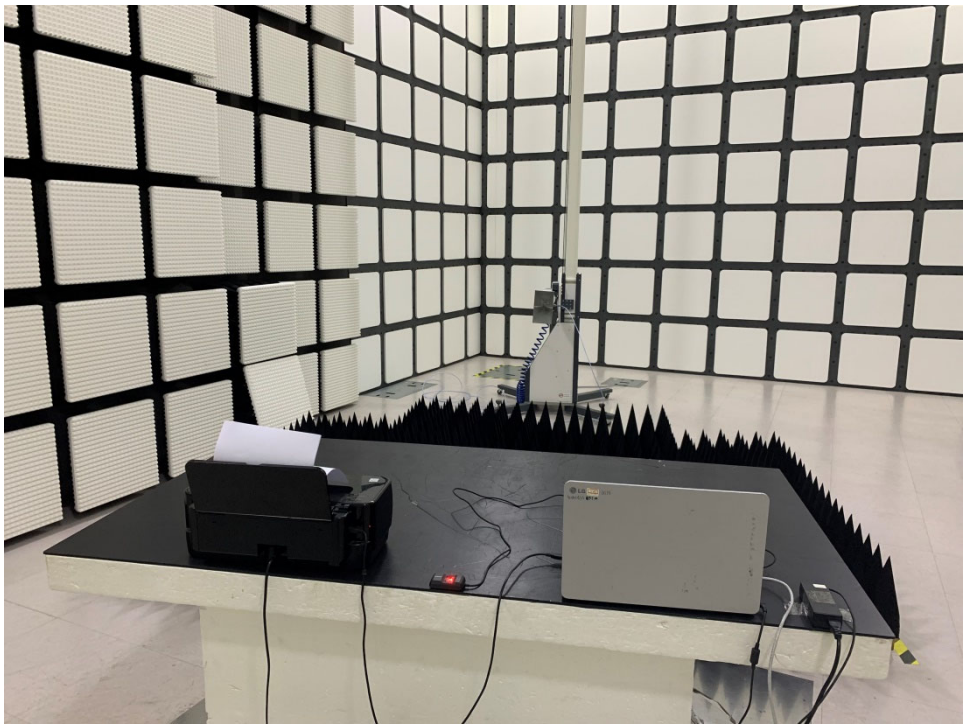
♦ Setup for Radiated Test

(Basic Model)

[Front]

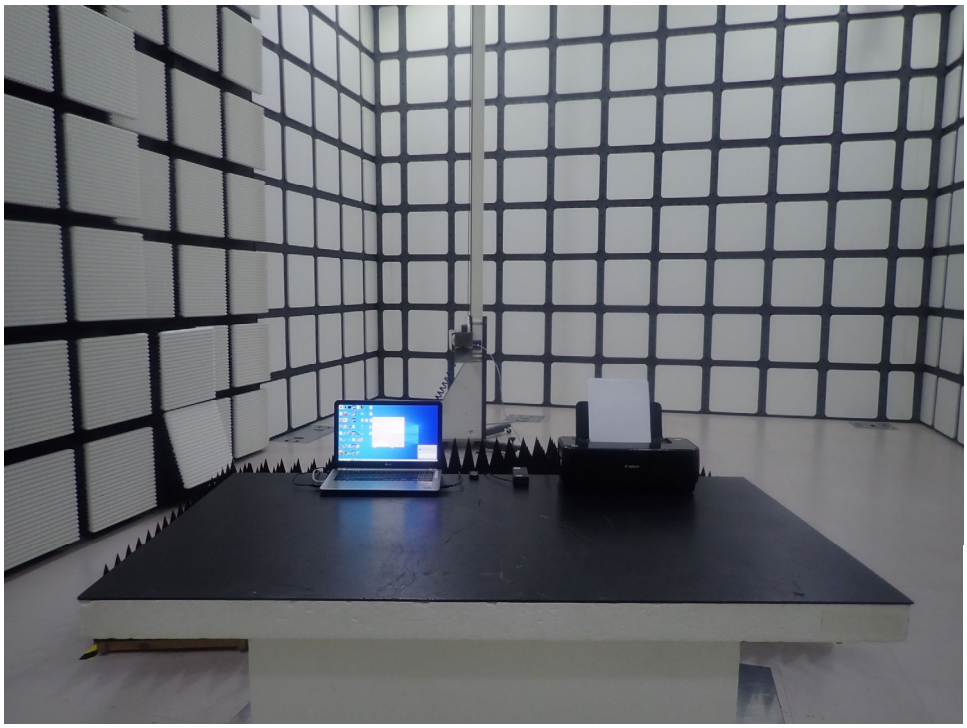


[Rear]

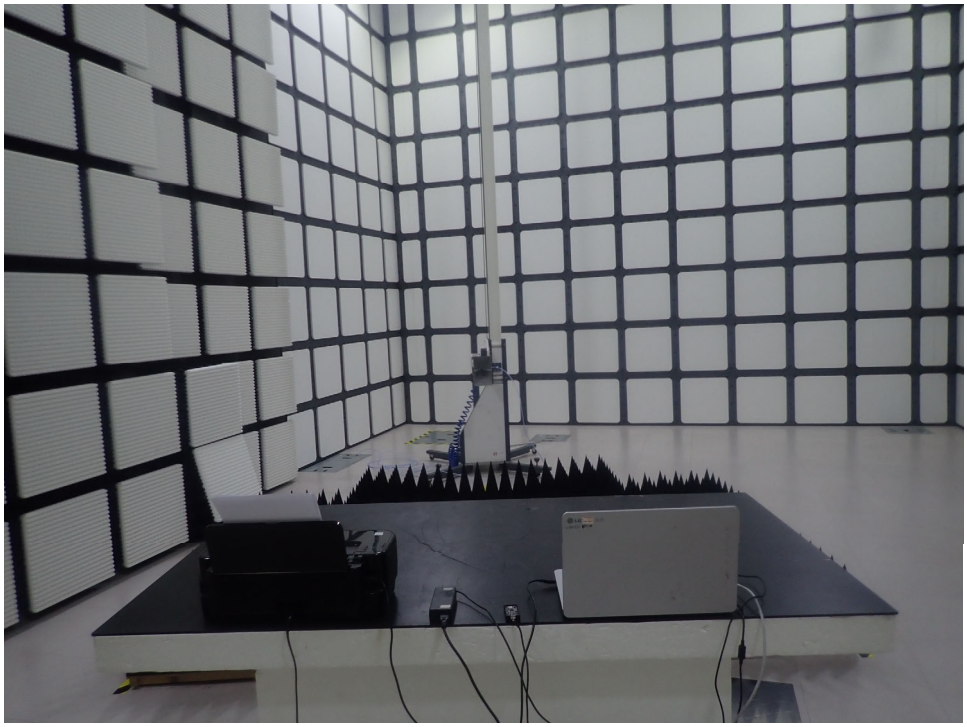


(Additional Model)

[Front]



[Rear]



4.3 Conducted emission test

The continuous disturbance voltage of AC Mains was measured in accordance to EN 55032 :2015+A11:2020 Class A. The test setup was made according to EN55032:2015+A11:2020 Class A in a shielded Room. The EUT was placed on a non-conductive table at least 0.8 m above the ground plane. A grounded vertical reference plane was positioned in a distance of 0.4 m from the EUT. The distance from the EUT to other metal surfaces was at least 0.8 m. The EUT was only earthen by its power cord through the line impedance stabilizing network. The power cord has been bundled to a length of 1.0 m. The test receiver with Quasi peak detector.

4.3.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
LISN	NNLK8121	SCHWARZBECK	#695	12-Jun-24
LISN	ENV216	ROHDE & SCHWARZ	101231	12-Jun-24
Pulse Limiter	ESH3-Z2	ROHDE & SCHWARZ	102772	12-Jun-24
TEST RECEIVER	ESPI	ROHDE & SCHWARZ	100005	30-Jun-24

4.3.2 Environmental conditions

Section	Temperature (°C)	Humidity (% R.H.)
Conducted emission	23.7	53.5
Test Place	Shielded Room	

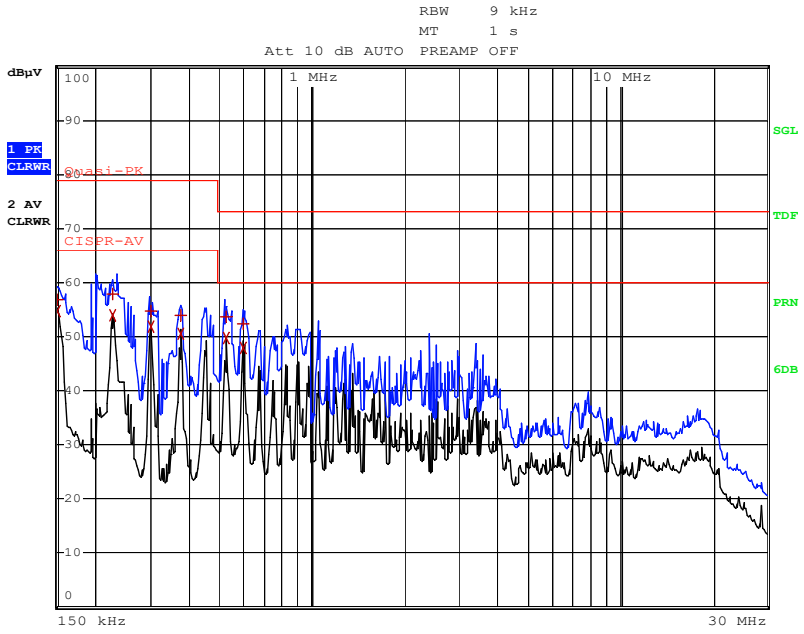
4.3.3 Test data

Test Date : 4-Aug-23

Frequency (MHz)	Correction Factor (dB)		Line (H/N)	Quasi-peak Value (dBμV)			Cispr-Average Value (dBμV)		
	LISN	Cable etc.		Limit	Reading	Result	Limit	Reading	Result
0.15	0.05	0.17	N	79.00	57.36	57.58	66.00	54.46	54.68
0.20	0.04	0.16	N	79.00	58.44	58.64	66.00	34.75	34.95
0.23	0.05	0.16	H	79.00	57.76	57.97	66.00	53.93	54.14
0.30	0.05	0.17	H	79.00	54.69	54.91	66.00	51.76	51.98
0.53	0.04	0.20	H	73.00	53.74	53.98	60.00	49.64	49.88
0.60	0.04	0.20	N	73.00	54.22	54.46	60.00	46.02	46.26
Remark	* H : Hot Line, N : Neutral Line * Correction factor=LISN factor + Cable loss								

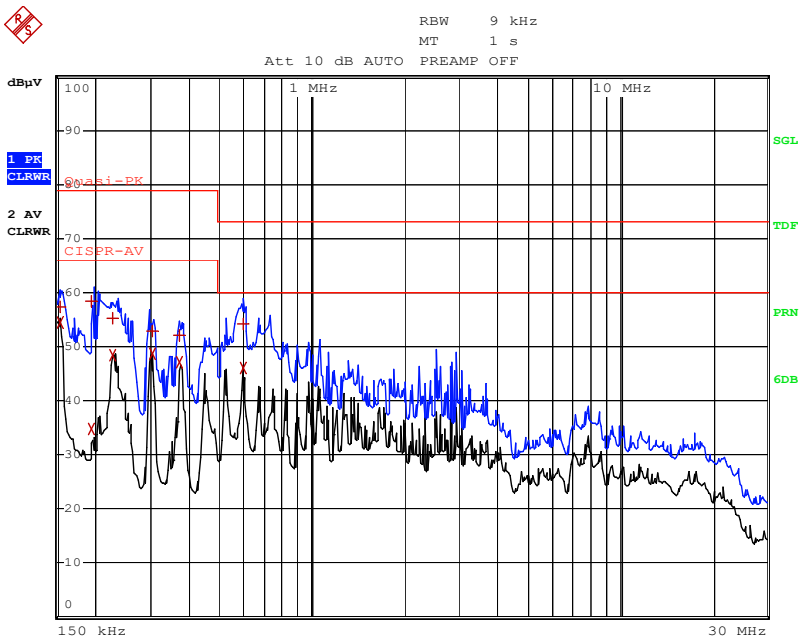
4.3.4 Test data graph

[HOT LINE]



Comment: ESTC-23-01366_HOT
Date: 4.AUG.2023 09:26:43

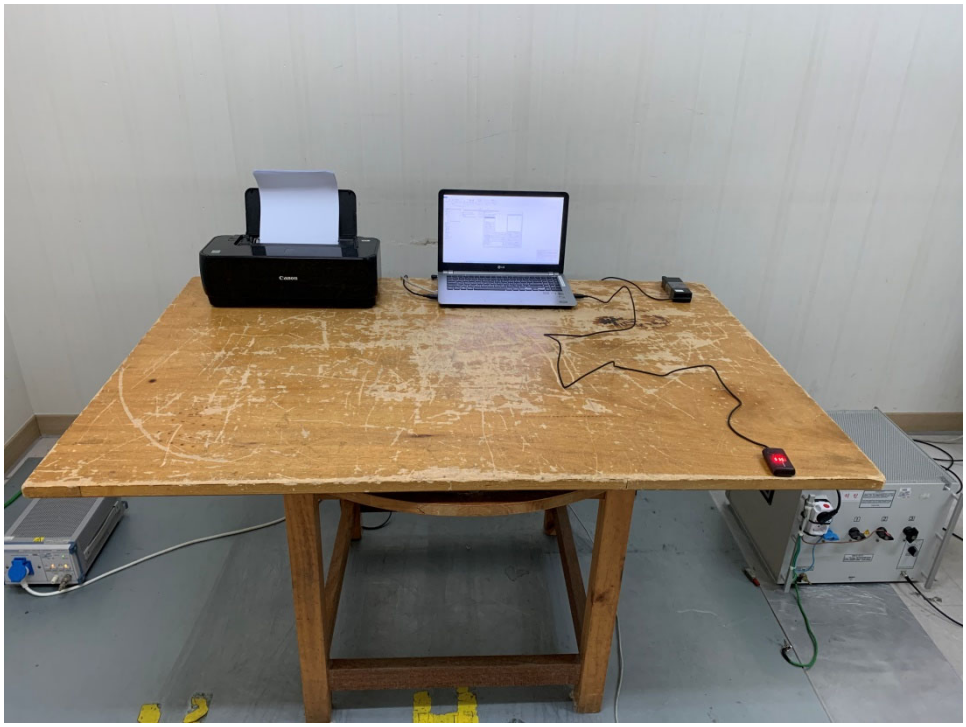
[NEUTRAL LINE]



Comment: ESTC-23-01366_NEUTRAL
Date: 4.AUG.2023 09:29:01

◆ Setup for Conducted Test : 0.15 MHz ~ 30 MHz

[Front]



[Rear]



4.3.5 Test data (Telecommunication Port) - N/A

Test Date :

Frequency (MHz)	Correction Factor (dB)		Line (T)	Quasi-peak Value (dBμV)			Cispr-Average Value (dBμV)		
	ISN	Cable etc.		Limit	Reading	Result	Limit	Reading	Result
Remark	T : Telecommunicaton port * Result Value=Reading+Correction Factor * Correction Factor=ISN factor+Cable loss * This product does not have a communication port.								

4.3.6 Test data graph

N/A

♦ Setup for Conducted Test : 0.15 MHz ~ 30 MHz

[Front]
N/A

[Rear]
N/A

4.4 Limits concerning harmonic current test – N/A

The harmonics on AC Mains in the frequency from 0 kHz to 2 kHz were measured in accordance to EN IEC 61000-3-2:2019+A1:2021
The objective of this standard is to set limits for harmonic emissions of equipment within its scope, so that, with due allowance for the emissions from other equipment, compliance with the limits ensures that harmonic disturbance do not exceed the compatibility levels defined in EN IEC 61000-3-2:2019+A1:2021.

For the purpose of harmonic current limitation, equipment is classified as follows.

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

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

Class B : - Portable tools;
- Arc welding equipment which is not professional equipment.

Class C : - Lighting equipment.

Class D : Equipment having a specified power 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).

4.4.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
Test System	PHF555	HAEFELY	080419-11	12-Jul-24
Harmonic & FlickerTest System	DPA 500N	EM Test AG	V1033107193	19-Jul-24

4.4.2 Environmental Conditions

Section	Temperature (°C)	Humidity (% R.H.)
Harmonic test	-	-

◆ Setup Figure

N/A

4.4.3 Test data

Test Date :

This test does not require
because the EUT is powered by PC USB port.

4.5 Limits Concerning Voltage Fluctuations & Flicker test – N/A

The voltage fluctuations on AC mains in the frequency range from 0 kHz to 2 kHz were measured in accordance to EN 61000-3-3:2013+A1:2019+A2:2021.

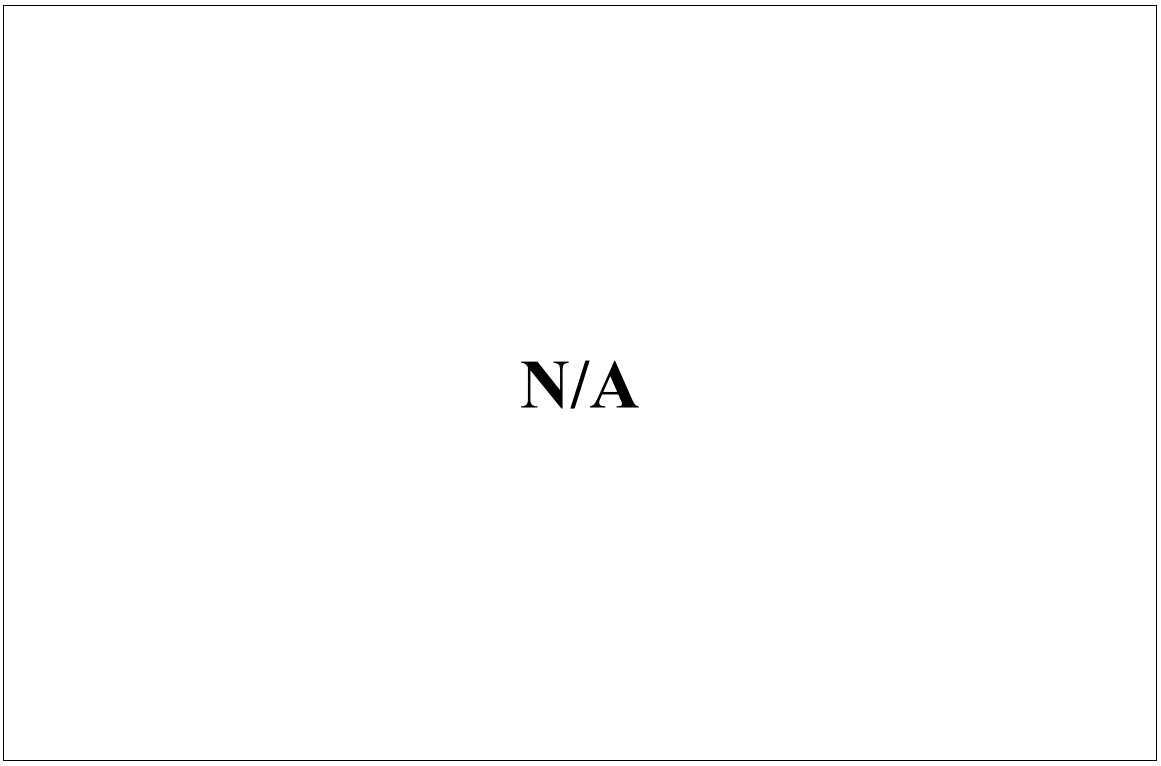
4.5.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
Test System	PHF555	HAEFELY	080419-11	12-Jul-24
Harmonic & FlickerTest System	DPA 500N	EM Test AG	V1033107193	19-Jul-24

4.5.2 Environmental Conditions

Section	Temperature (°C)	Humidity (% R.H.)
Flicker test	-	-

◆ Setup Figure



4.5.3 Test data

Test Date :

This test does not require because
the EUT is powered by PC USB port.

5. Electromagnetic Susceptibility Test

5.1 Electrostatic Discharge test

5.1.1 Test Standard

- Standard : EN 61000-4-2:2009
- Performance appraisal standard : B
- Energy storage capacitance : 150 pF ± 10 %
- Discharge resistance : 330 Ω± 10 %
- Charging resistance : 50 MΩ(50 MΩ~ 100 MΩ)
- Tolerance of the output voltage indication : ±5 %
- Polarity of the output voltage : Positive(+) and Negative(-)
- Holding time : at least 5 s
- Discharge, Mode of operation : Single discharge
- Interval discharge time : At least 1 s
- Repetition time(each polarity) : 10 for discharges.
- Test voltage : Contact discharge : ± 4 kV, Air discharge : ± (2, 4, 8) kV

5.1.2 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
ELECTROSTATIC DISCHARGE SIMULATOR	ESS-2002	NOISEKEN	ESS0452848	8-Nov-23

5.1.3 Environmental Conditions

Temperature (°C)	Humidity (% R.H.)	Pressure (kPa)
23.9	54.2	100.0

5.1.4 Test data

Test Date : 4-Aug-23

(Basic Model)

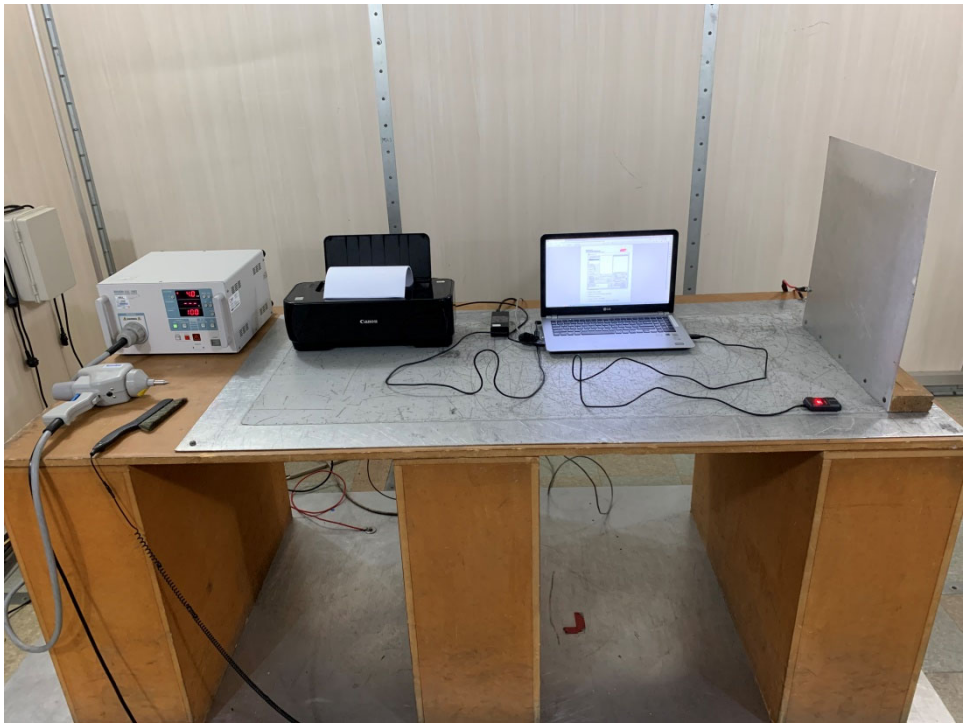
Test Method	No.	Position	Discharge method	Criterion	Result	Remark
Indirect	Horizontal coupling plane		Contact discharge	B	A	
	Vertical coupling plane			B	A	
Direct	1	The USB Port in the front	Air discharge	B	A	
	2	The scanner part in the front	Air discharge	B	A	
	3	The cover in the front	Air discharge	B	A	
	4	The cover in the rear	Air discharge	B	A	
	5	The cover in the left	Air discharge	B	A	
	6	The cover in the right	Air discharge	B	A	
Reference		Line color : RED- RED / BLUE- Air				

(Additional Model)

Test Method	Position	Discharge method	Criterion	Result	Remark
Indirect	Horizontal coupling plane	Contact discharge	B	A	
	Vertical coupling plane		B	A	
Direct	This is a model without an external case, and only indirect discharge is tested.				
Reference	Line color : RED- RED / BLUE- Air				

◆ Setup Figure

(Basic Model)

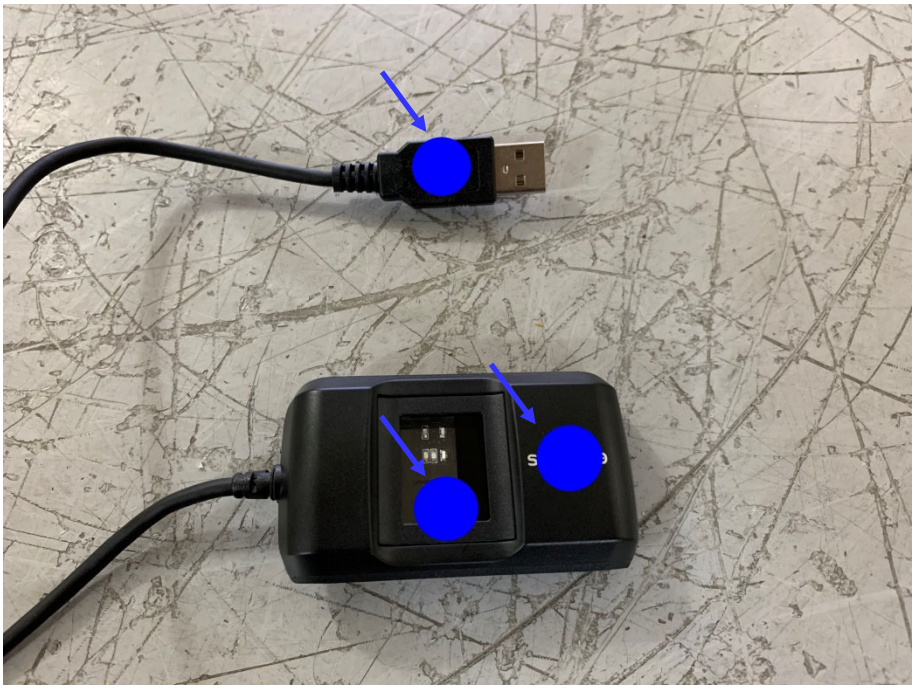


(Additional Model)



◆ Test Point

(Basic Model)

[Position – Front side]


[Position – Rear side]

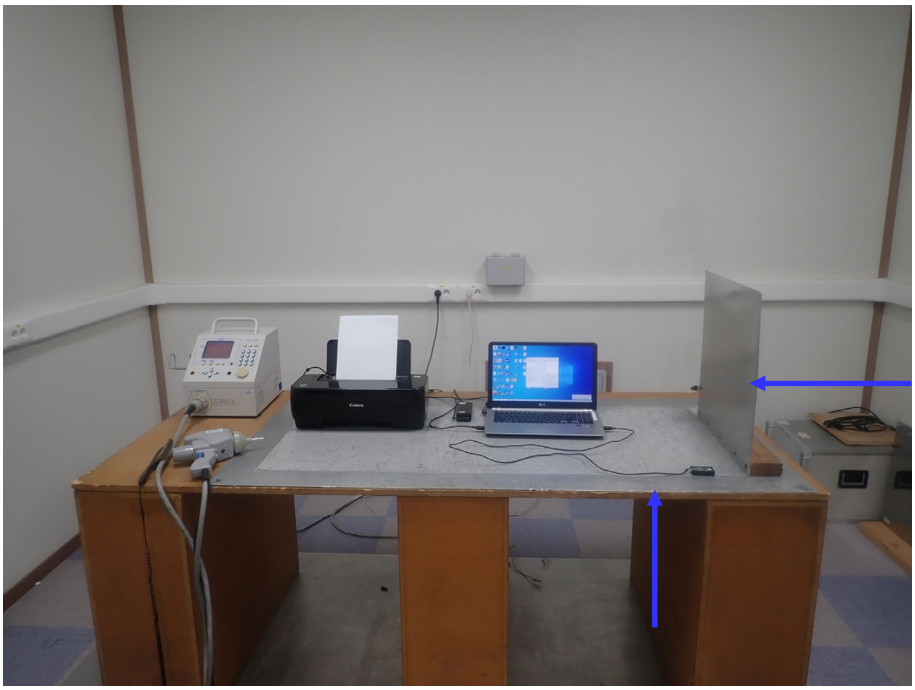

[Position – Left side]



[Position – Right side]



(Additional Model)

[Position – Front side]


5.2 Radiated Electromagnetic Fields test

5.2.1 Test Standard

- Standard : EN IEC 61000-4-3:2020
- Criterion standard : A
- Frequency Range : 80 MHz ~ 1 000 MHz / Spot Frequencys : (1 800, 2 600, 3 500, 5 000) MHz ± 1 %
- Test Angle : 0°, 90°, 180°, 270°
- Sweep Capability : 1.5×10^{-3} decade/s
- Step Size : 1 % of Fundamental
- Antenna Polarity : Horizontally/Vertically
- Measurement Distance : 3 m
- Modulation : AM 80 % with 1 kHz sine wave
- Dwell time : 3 s
- Field Strength: 3 V/m

-During continuous RF disturbance testing, additional spot frequency tests are required for equipment with a primary function of telephony. The additional spot frequencies are: 80 MHz; 120 MHz; 160 MHz; 230 MHz; 434 MHz; 460 MHz; 600 MHz; 863 MHz and 900 MHz(±1 %)

5.2.2 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
Hybrid Log Periodic Antenna	LPDA-0803	TDK	130243	N/A
POWER AMPLIFIER	MT400	PRANA	1601-1800	N/A
TEST System (RADIFIELD Amplifier)	RFS1006B	DARE	15I00045SN016	N/A
TEST System (SIGNAL GENERATOR)	RGN6000B	DARE	15I00075SN001	12-Jun-24
Common Mode Absorption Device	CMAD1614	SCHWARZBECK	149	7-Nov-23

5.2.3 Environmental Conditions

Temperature (°C)	Humidity (% R.H.)	Pressure (kPa)
23.6	53.6	100.0

5.2.4 Test data

Test Date : 4-Aug-23

(Basic Model)

Range of Frequency (MHz)	Position	Polarity	Electromagnetic Intensity (V/m)	Criterion	Result
80 MHz ~ 1 GHz	Front side	H	3	A	A
		V	3	A	A
	Right side	H	3	A	A
		V	3	A	A
	Left side	H	3	A	A
		V	3	A	A
	Rear side	H	3	A	A
		V	3	A	A
(1.8, 2.6, 3.5, 5.0) GHz ± 1 %	Front side	H	3	A	A
		V	3	A	A
	Right side	H	3	A	A
		V	3	A	A
	Left side	H	3	A	A
		V	3	A	A
	Rear side	H	3	A	A
		V	3	A	A
Reference		H : Horizontality, V : Verticality			

(Additional Model)

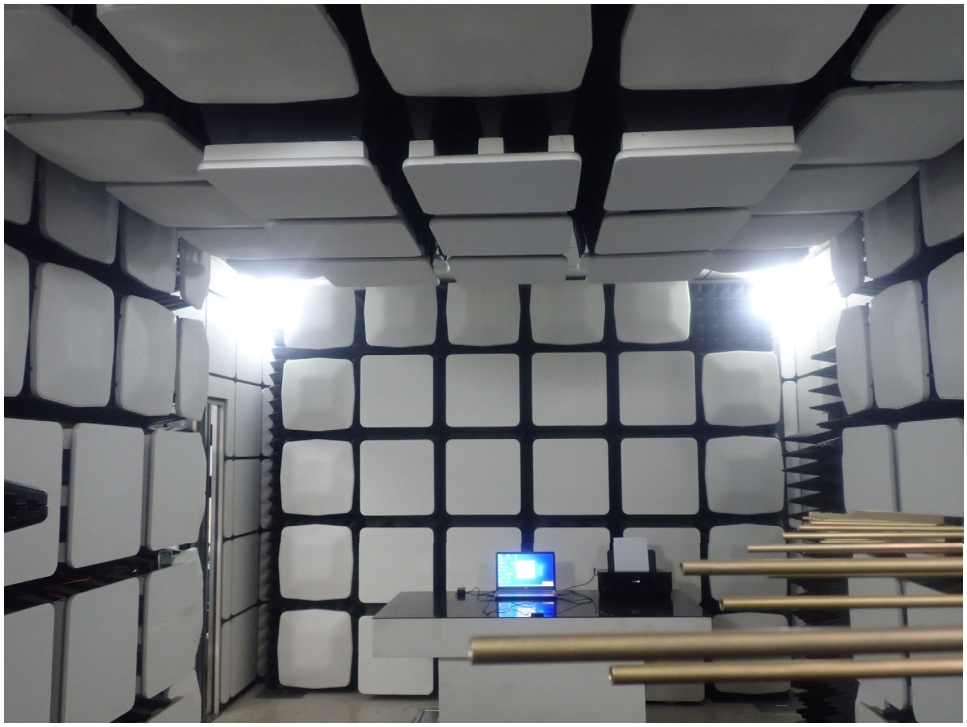
Range of Frequency (MHz)	Position	Polarity	Electromagnetic Intensity (V/m)	Criterion	Result
80 MHz ~ 1 GHz	Front side	H	3	A	A
		V	3	A	A
	Right side	H	3	A	A
		V	3	A	A
	Left side	H	3	A	A
		V	3	A	A
	Rear side	H	3	A	A
		V	3	A	A
(1.8, 2.6, 3.5, 5.0) GHz ± 1 %	Front side	H	3	A	A
		V	3	A	A
	Right side	H	3	A	A
		V	3	A	A
	Left side	H	3	A	A
		V	3	A	A
	Rear side	H	3	A	A
		V	3	A	A
Reference		H : Horizontality, V : Verticality			

◆ Setup Figure

(Basic Model)



(Additional Model)



5.3 Electrical Fast Transients/Burst test

5.3.1 Test Standard

- Standard : EN 61000-4-4:2012
- Performance appraisal standard : B
- Test voltage : AC power : ±1 kV , DC port : ±0.5 kV(more than 3 m only), Analogue/digital port : ±0.5 kV
- Polarity : Positive(+), Negative(-)
- Repetition Frequency : 5 kHz
- Duration Time : 60 s

5.3.2 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
EMC IMMUNITY TESTER	IMU4000 F-S-D-V	EMC PARTNER	IMU400F-S-D-V1517	28-Nov-23

5.3.3 Environmental Conditions

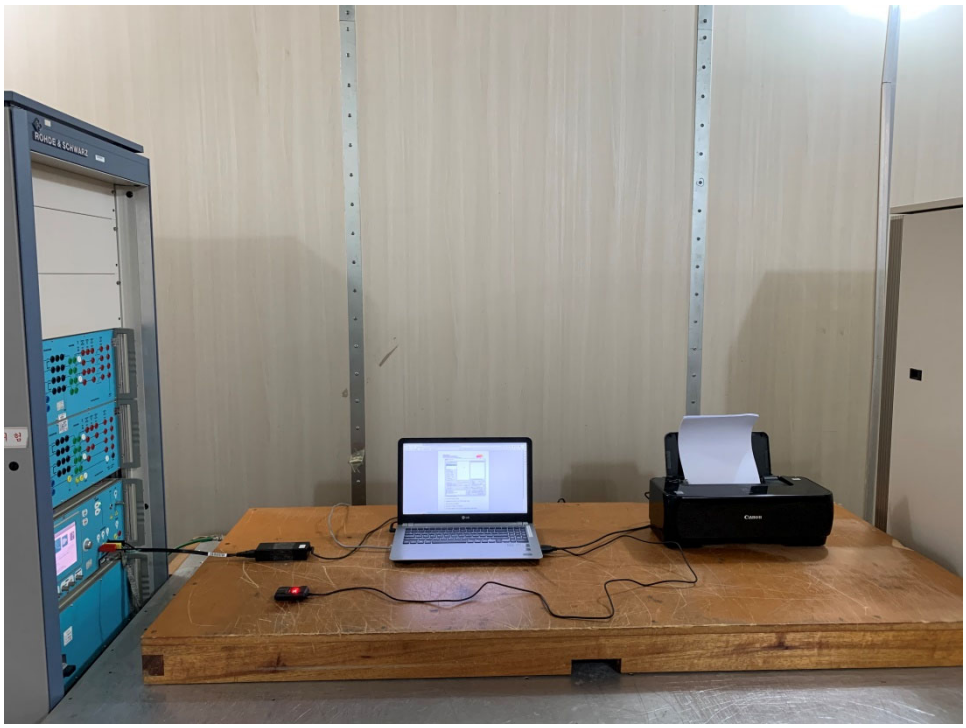
Temperature (°C)	Humidity (% R.H.)	Pressure (kPa)
24.0	53.8	100.0

5.3.4 Test data

Test Date : 4-Aug-23

Tested Point		Test Voltage	DurationTime (s)	Criterion	Result	Remark
Input AC	L1-L2-PE	±1 kV	60 s	B	A	
Reference		L1: Line, L2: Neutral, PE: Protective earth (Ground). * For DC power network , applicable only to ports which, according to the manufacturer's specification, support cable lengths greater than 3 m. * For Analogue/digital port, applicable only to ports which, according to the manufacturer's specification, support cable lengths greater than 3 m.				

◆ Setup Figure



5.4 Surge Test

5.4.1 Test Standard

- Standard : EN 61000-4-5:2014+A1:2017
- Performance appraisal standard : B
- Test voltage AC : line to earth : ±2 kV with (1.2/50) μs , line to line : ±1 kV with (1.2/50) μs
- DC network power port(Line to Reference ground) : ±0.5 kV with (1.2/50) μs
- Analogue/digital port(Line to ground , Unshield Symmetrical) : ±(1 & 4) kV with (10/700) μs
  for Primary protection / ±1 kV and (10/700) μs for No Primary protection
- Coaxial or shielded port(shield to ground) : ±0.5 kV with (1.2/50) μs
- Polarity : Positive(+), Negative(-)
- Repetition rate:max 1/min.
- Five positive & negative pulses line-to-neutral at 90° and 270° phase

5.4.2 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
EMC IMMUNITY TESTER	IMU4000 F-S-D-V	EMC PARTNER	IMU400F-S-D-V1517	28-Nov-23

5.4.3 Environmental Conditions

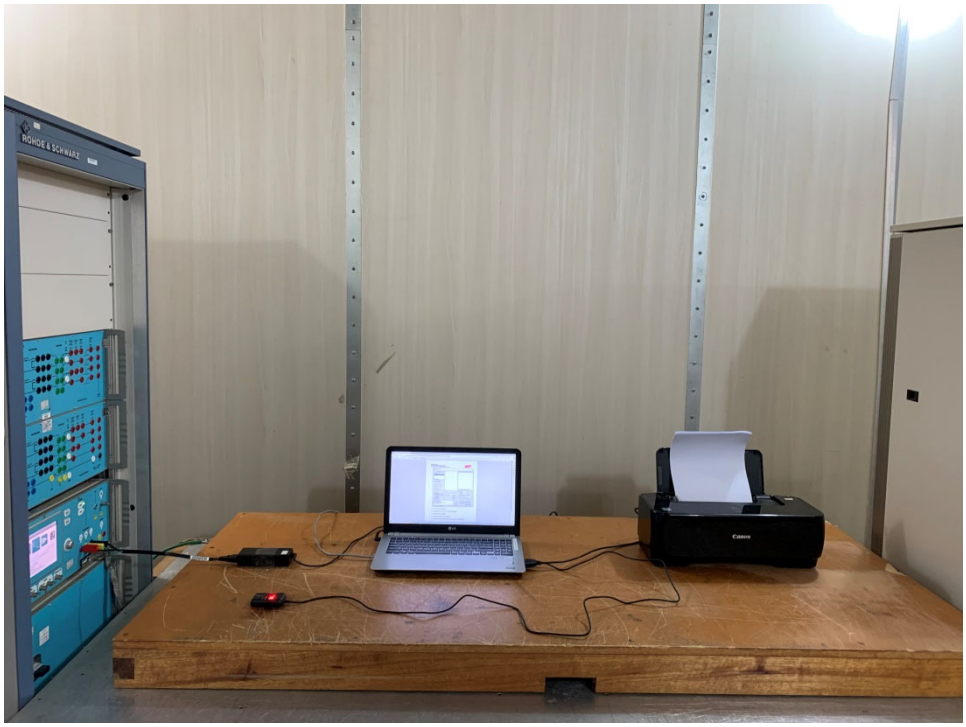
Temperature (°C)	Humidity (% R.H.)	Pressure (kPa)
24.1	53.7	100.0

5.4.4 Test data

Test Date : 4-Aug-23

Tested Point		Test Voltage	Criterion	Result	Remark
Input AC	L1 - L2	±(0.5,1) kV	B	A	
	L1 - PE	±(0.5,1,2) kV	B	A	
	L2 - PE	±(0.5,1,2) kV	B	A	
Reference		L1: Line, L2: Neutral, PE: Protective earth (Ground) * For DC power network ,applicable only to ports which, according to the manufacturer's specification, may connect directly to outdoor cables. * For Analogue/digital ports are applicable to ports which satisfy all the following conditions:may connect directly to cables that leave the building structure, defined as an antenna port (3.1.3), a wired network port (3.1.34), or a broadcast receiver tuner port (3.1.8).			

◆ Setup Figure



5.5 Conducted Immunity test

5.5.1 Test Standard

- Standard : EN 61000-4-6:2014+AC:2015
- Performance appraisal standard : A
- Frequency Range : (0.15 to 80) MHz
- Test Voltage : 3.0 V at (0.15 to 10) MHz , (3.0 to 1.0) V at (10 to 30) MHz , 1.0 V at (30 to 80) MHz
- Modulation : AM 80 % with 1 kHz sine wave
- Dwell time : 3 s
- Sweep Capability : 1.5×10-3 decade/s
- Step Size : 1 % of Fundamental

5.5.2 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
Continuous Wave Simulator	CWS 500N	EM TEST	P1548168222	30-Nov-23
ATTENUATOR	50FH-006-300-2	AMPLIFIER RESERCH	NONE	13-Jun-24
Coupling Decoupling Network	CDN M016	Teseq GmbH	27445	12-Jun-24

5.5.3 Environmental Conditions

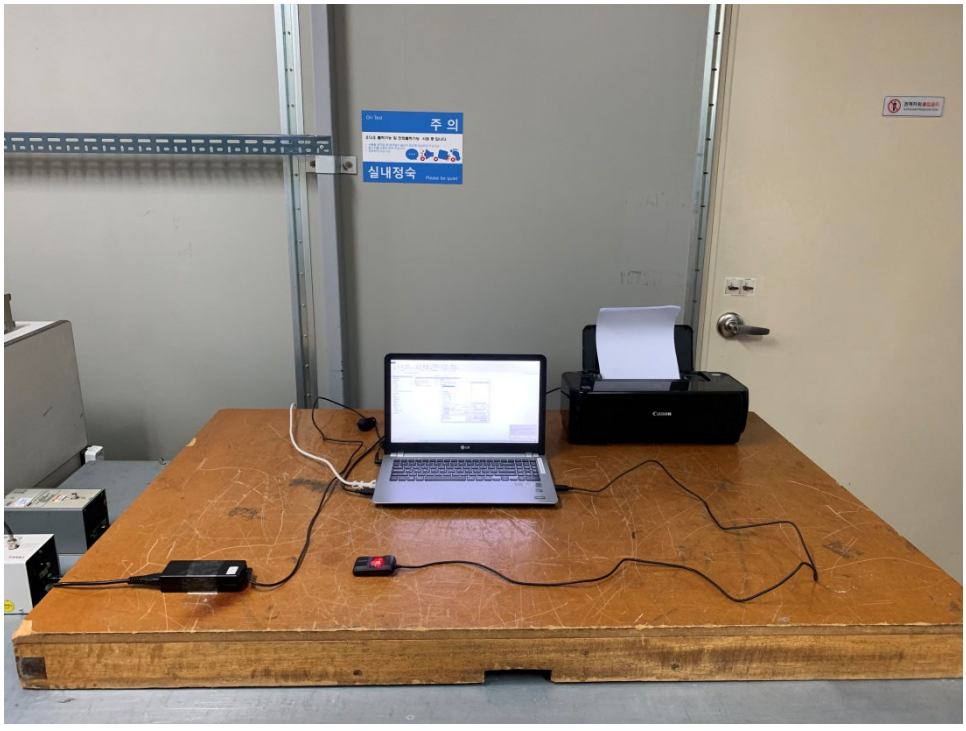
Temperature (°C)	Humidity (% R.H.)	Pressure (kPa)
23.9	54.0	100.0

5.5.4 Test data

Test Date : 4-Aug-23

Tested point	Freq [MHz]	Level [V]	Criterion	Result	Remark
AC Mains(M3)	0.15 to 10	3.0	A	A	
	10 to 30	3.0 to 1.0	A	A	
	30 to 80	1.0	A	A	
Reference	* For DC power network , applicable only to ports which, according to the manufacturer's specification, support cable lengths greater than 3 m. * For Analogue/digital port, applicable only to ports which, according to the manufacturer's specification, support cable lengths greater than 3 m.				

◆ Setup Figure



5.6 Power Frequency Magnetic Field Immunity - N/A

5.6.1 Test Standard

- Standard : EN 61000-4-8:2010
- Performance appraisal standard and test level 1 A/m : A
- Axis of Orientation : X, Y Z axis
- Test frequency : (50 or 60) Hz

5.6.2 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
Magnetic field test system	MFS 100	HAEFELY	154006	29-Nov-23

5.6.3 Environmental Conditions

Temperature (°C)	Humidity (% R.H.)	Pressure (kPa)
-	-	-

5.6.4 Test data – N/A

Test Date :

Test Point	Freq. range [Hz]	Axis	TestLevel [A/m]	Criterion	Result
Enclosure	(50/60) Hz	X	1	A	-
Enclosure	(50/60) Hz	Y	1	A	-
Enclosure	(50/60) Hz	Z	1	A	-
Remark	* Applicable only to equipment containing devices intrinsically susceptible to magnetic fields, such as CRT monitors, Hall effect elements, electro-dynamic microphones, magnetic field sensors or audio frequency transformers.				

◆ Setup Figure

N/A

5.7 Voltage Dips and Interruptions test

5.7.1 Test Standard

- Standard : EN IEC 61000-4-11:2020
- Performance appraisal standard and Voltage Reduction
  >95 % 250 cycles : C , >95 % 0.5 cycles : B, 30 % 25 cycles : C
- Number of pulses : 3 at each level
- Recovery time between pulses : 10 s
- Test angles : 0°,90° ,270°

5.7.2 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
EMC IMMUNITY TESTER	IMU4000 F-S-D-V	EMC PARTNER	IMU400F-S-D-V1517	28-Nov-23
DIP SIMULATOR (VARIAC)	VAR-EXT1000	EMC PARTNER	VAR-EXT1000-1580	28-Nov-23

5.7.3 Environmental Conditions

Temperature (°C)	Humidity (% R.H.)	Pressure (kPa)
23.7	53.9	100.0

5.7.4 Test data

Test Date : 4-Aug-23

Voltage Reduction	Duration Cycles	Criterion	Result	Remark
> 95 %	0.5	B	A	
30%	25	C	A	
> 95 %	250	C	A	
Reference	* Changes to occur at 0 degree crossover point of the voltage waveform. If the EUT does not demonstrate compliance when tested with 0 degree switching, the test shall be repeated with the switching occurring at both 90 degrees and 270 degrees.			

◆ Setup Figure



6. EUT Photographs

[Front]


[Rear]


[Inside]

