TEST REPORT

Project No.: TM-2403000345P
Applicant: PERFECTRON Co., Ltd.
Address: 2F., No.190, Sec 2, Zhongxing Rd., Xindian Dist., New Taipei City, 23146, Taiwan.
Manufacturer: PERFECTRON Co., Ltd.
Address: 2F., No.190, Sec 2, Zhongxing Rd., Xindian Dist., New Taipei City, 23146, Taiwan.
Equipment Under Test (EUT):
Name: MICRO-GRID COMPUTER
Brand Name: PERFECTRON
Model No.: SCH4X2-A9
Added Model(s): N/A

Standards:

FCC 47 CFR Part 15 Subpart B, ICES-003 Issue 7-2020 ANSI C63.4-2014

Date of Sample Receipt : March 20, 2024
Date of Test : April 26, 2024 & April 27, 2024
Date of Issue : November 12, 2024

Remarks:

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Disclaimer

Variants information between/among model numbers / trademarks is provided by the applicant, test results of this test report are applicable to the sample EUT received of main test model name.

Approved By _____ ***Date*** **November 12, 2024**
Jason Lee (Section Manager)

Testing Laboratory 1108

Revision History			
Revision	**Report Number**	**Description**	**Issue Date**
00	TMXD2403001042DE	Original.	November 12, 2024

Note:

Contents

1. General Description

1.1 General Description of EUT

Name of EUT	MICRO-GRID COMPUTER
Brand Name	PERFECTRON
Model No.(s)	SCH4X2-A9
Added Model(s)	N/A

1.2 Details of EUT

EUT Power Rating	110~240V 200W
Highest internal frequency	1000MHz

Accessories Cable List

Cable Type	Core	Length	Category	Shielding/Non-shielding

1.3 Description of Support Units

EUT Devices:

No.	Equipment	Model No.	Brand Name
1	MB	INS8367A	Perfectron
2	CPU(1.0GHz)	i9-13900TE	Intel
3	Memory(64 GB)(DDR4 SO-DIMM)	NA	DSL
4	Storage(SATA SSD)(256 G)	NA	Phison
5	Power	UHP-200-12	Meanwell

Peripherals Devices:

No.	PRODUCT	MANUFACTURER	MODEL NO.	SERIAL NO.
1-4	USB HDD	Transcend	TS1TSJ25MC	N/A
5	USB Mouse	LOGITECT	M-U0026	N/A
6	USB Keyboard	LOGITECH	Y-U0011	1804SY04FP48
7	Monitor	ASUS	MX27UC	K8LMR024567
8	Monitor	GIGABYTE	M28U	SN21490B004523
9	Server PC	Dell	T3610	57TT032
10	Server PC	Dell	Precision 3640 Tower	FQNLFF3
11	Ground	N/A	N/A	N/A

Support Equipment Used in Tested Cable

No.	Cable Type	Core	Length	Shielding/Non-shielding
1-4	USB	N/A	1.4m	Shielding
5	USB	N/A	1.8m	Shielding
6	USB	N/A	1.8m	Shielding
7	DP	N/A	1.8m	Shielding
8	DP	N/A	1.8m	Shielding
9	RJ45	N/A	20m	Non-shielding
10	RJ45	N/A	20m	Non-shielding
11	Ground	N/A	1.8m	Non-shielding

1.4 I/O Port Description

I/O Port Types	Q'TY
1. USB Port	6
2. LAN Port	2
3. Display Port	2

1.5 Decision of Test Mode

The test configuration/ modes are as the following:

Conducted Modes:

1	**DP*2 3840*2160@60Hz**	**120VAC, 60Hz**
2	**DP*2 3840*2160@60Hz**	**230VAC, 60Hz**

Radiation Modes:

1	**DP*2 3840*2160@60Hz**	**120VAC, 60Hz**
	DP*2 3840*2160@60Hz / 1-5GHz	
2	**DP*2 3840*2160@60Hz**	**230VAC, 60Hz**

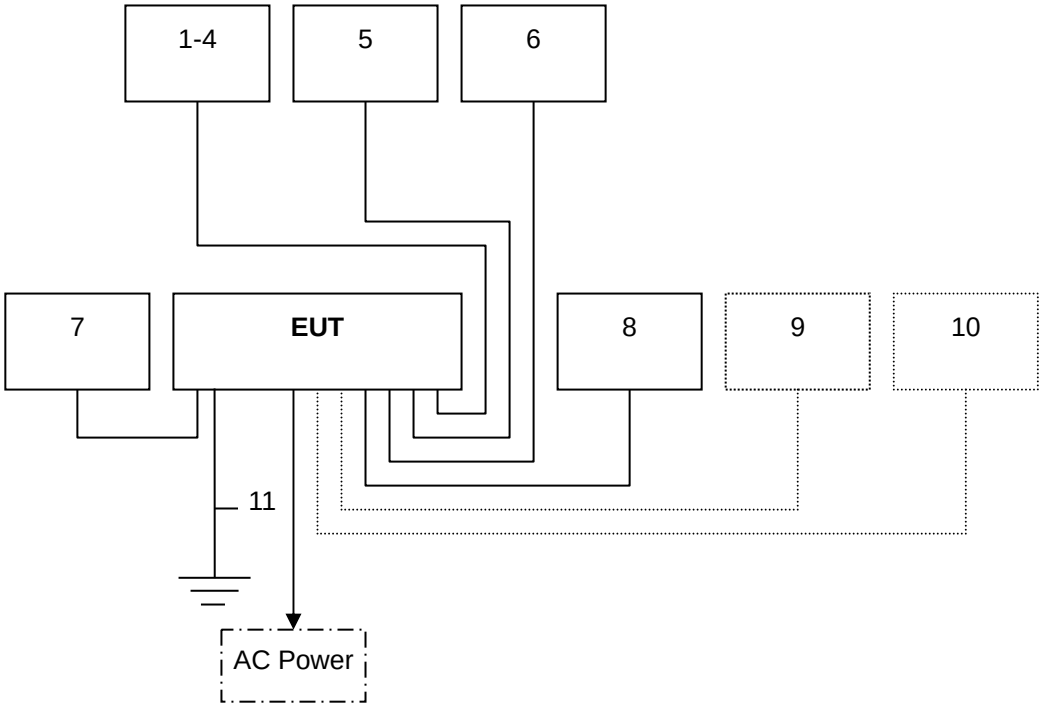
1.6 The Final Test Mode of the EUT

After the preliminary scan, the following test mode was found to produce the highest emission level.

Final Test Mode	
Conducted Emission	**Mode 1**
Radiated Emission Below 1GHz	**Mode 1**
Radiated Emission Above 1GHz	**Mode 1**

Then, the above highest emission mode of the configuration of the EUT and cable was chosen for all final test items.

1.7 Configuration of Tested System



1.8 Operation Procedure

1. Windows 10 boots system.
2. Run Burnintest.exe to activate all peripherals and display “H” pattern on monitor screen.
3. Run Burnintest.exe to activate all peripherals to test EUT.
4. Run Lantest20.exe to ping 192.168.1.20&42 –t (EUT), ping 192.168.1.1&10 –t (Server PC).

1.9 Summary of Results

Emission		
Standard	**Test Type**	**Result**
FCC 47 CFR Part 15 Subpart B, ICES-003 Issue 7-2020 ANSI C63.4-2014	Conducted Emission	PASS
	Radiated Emission	PASS

1.10 Reporting Statements of Conformity

The conformity statement in this report is based solely on the test results, measurement uncertainty is excluded.

1.11 Deviation

No deviation from the mentioned test methods and applicable standards.

2. EMISSION

2.1 Limit

Maximum permissible level of Line Conducted Emission

FREQUENCY (MHz)	Class A(dBuV)		Class B(dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56	56 - 46
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

Note: The lower limit shall apply at the transition frequency.

Maximum permissible level of Radiated Emission

FCC 47 CFR Part 15 Subpart B

Below 1GHz (for digital device / CISPR 22)

FREQUENCY (MHz)	dBuV/m (At 10m)	
	Class A	Class B
30 - 230	40	30
230 - 1000	47	37

Limit tables for non-digital device:

Class A Radiated Emission limit at 10m (for others)

FREQUENCY (MHz)	Field Strength Limit(uV/m)	Field Strength Limit(dBuV/m)
	Quasi - peak	Quasi - peak
30 - 88	90	39
88 - 216	150	43.5
216 – 960	210	46.4
Above 960	300	49.5

Class B Radiated Emission limit at 3m (for others)

FREQUENCY (MHz)	Field Strength Limit(uV/m)	Field Strength Limit(dBuV/m)
	Quasi - peak	Quasi - peak
30 - 88	100	40
88 - 216	150	43.5
216 – 960	200	46
Above 960	500	54

Above 1GHz(for all device)

FREQUENCY (MHz)	Class A(dBuV/m)(At 10m)		Class B(dBuV/m)(At 3m)	
	Average	Peak	Average	Peak
Above 1000	49.5	69.5	54	74

NOTE: (1) The lower limit shall apply at the transition frequencies.
(2) Emission level (dBuV/m) = 20 log Emission level (uV/m).
(3) The measurement above 1GHz is at close-in distances 3m,and determine the limit **L_2** corresponding to the close-in distance **d_2** by applying the following relation: **$L_2 = L_1 (d_1/d_2)$**, where **L_1** is the specified limit in microvolts per metre (**uV/m**) at the distance **d_1** (**10m**), **L_2** is the new limit for distance **d_2** (**3m**).
So the new Class A limit above 1GHz at 3m is as following table:

FREQUENCY (MHz)	Class A(dBuV/m)(At 3m)	
	Average	Peak
Above 1000	60	80

According to FCC Part 15.33 (b), for an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5^{th} harmonic of the highest frequency or 40GHz, whichever is lower

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Below 1GHz

Class A Radiated Emission limit

FREQUENCY (MHz)	(dBuV/m)Q.P. Distances (3m)	(dBuV/m)Q.P. Distances (10m)
30 - 88	50	40
88 - 216	54	43.5
216 - 230	56.9	46.4
230 – 960	57	47
960 - 1000	60	49.5

Class B Radiated Emission limit

FREQUENCY (MHz)	(dBuV/m)Q.P. Distances (3m)	(dBuV/m)Q.P. Distances (10m)
30 - 88	40	30
88 - 216	43.5	33.1
216 - 230	46	35.6
230 – 960	47	37
960 - 1000	54	43.5

Above 1GHz

FREQUENCY (MHz)	Class A(dBuV/m)(At 3m)		Class B(dBuV/m)(At 3m)	
	Average	Peak	Average	Peak
Above 1000	60	80	54	74

Required highest measurement frequency for radiated emissions

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Fx-108	1000
108-500	2000
500-1000	5000
Above 1000	5 x FX up to a maximum of 40 GHz

Note: Fx is the highest fundamental frequency generated and/or used in the ITE or digital apparatus under test.

2.2 Conducted Emission

2.2.1 Test Instruments

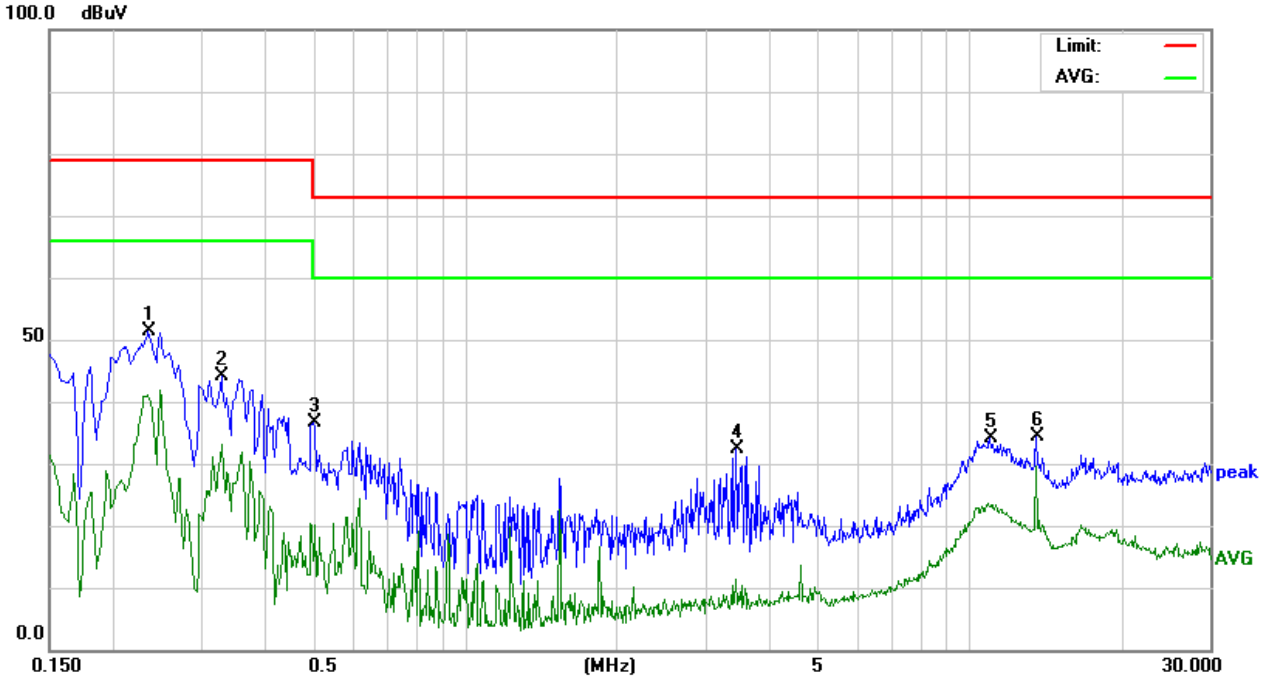
Conducted Emission Room # B					
EQUIPMENT TYPE	Manufacturer	Model Number	Serial Number	Calibration Date	Calibration Due
Attenuator	MCL	HAT-10	SD-C012	03/18/2024	03/17/2025
BNC Cable	EMEC	CFD300-NL	SD-C020	12/28/2023	12/27/2024
EMI Test Receiver	R&S	ESR3	102166	03/05/2024	03/04/2025
LISN	Schwarzbeck	NSLK 8127	01082	03/13/2024	03/12/2025
LISN(EUT)	Schwarzbeck	NSLK 8127	01084	03/13/2024	03/12/2025
Thermo-Hygro Meter	Wisewind	N/A	SD-S017	08/16/2023	08/15/2024
Test S/W	EZ-EMC Ver.CCS-03A1				
Testing Site : No.163-1, Jhongsheng Rd., Xindian Dist., New Taipei City, Taiwan Measurement Uncertainty of Conducted Emission Expanded uncertainty Ulab (k=2) of Conducted Emission is 2.8 dB. Expanded uncertainty CISPR 16-4-2:2011+A1:2014+A2:2018 (k=2) of Conducted Emission measurement is 3.8 dB.					

2.2.2 Measurement Level Calculation

Factor = LISN insertion loss + Cable loss + Pulse Limiter insertion loss
Measurement Level = Reading Level + Factor
Over (Margin) = Measurement Level – Limit

2.2.3 Measurement Data (CE)

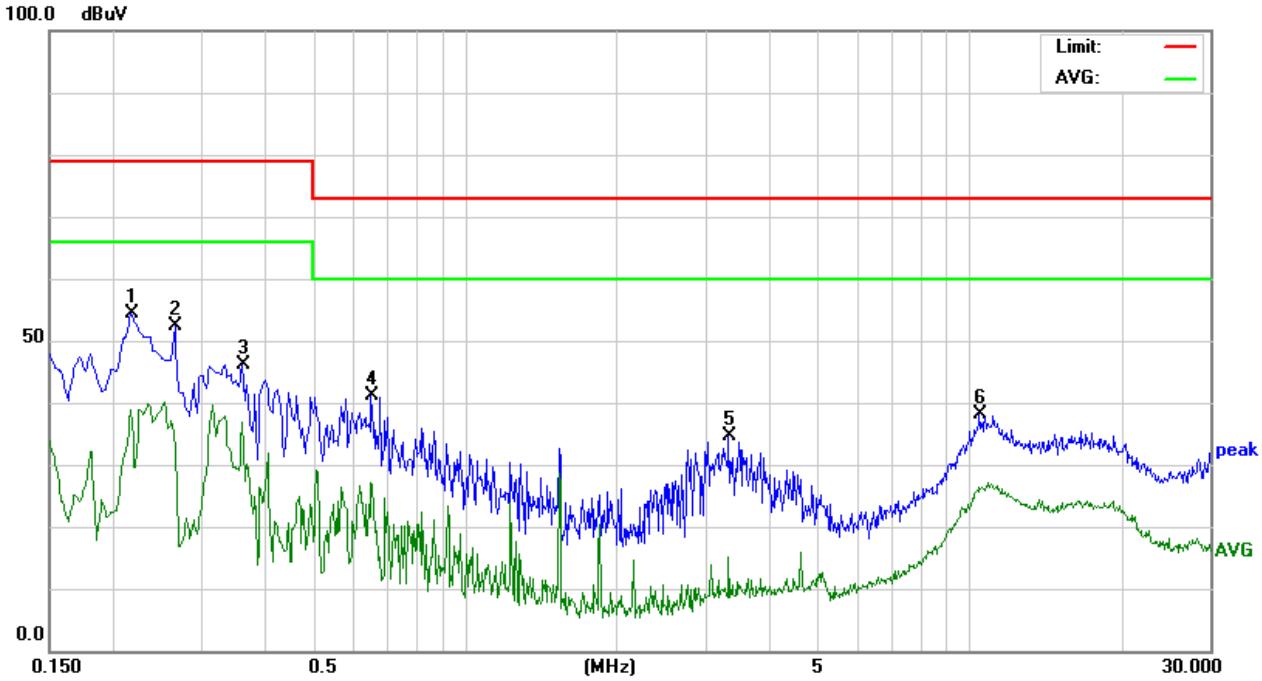
Model No.	SCH4X2-A9	**6dB Bandwidth**	9 kHz
Environmental Conditions	22.5°C, 61% RH	**Test Mode**	Mode 1
Tested by	Jacky Lin	**Phase**	L1
Standard	FCC CLASS A / ICES-003 CLASS A	**Test Date**	2024/04/26



Conducted Emission Readings							
Frequency Range Investigated				**150 kHz to 30 MHz**			
Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector (P/Q/A)	Line (L1/L2)
0.2355	**41.42**	**9.99**	**51.41**	**79.00**	**-27.59**	**P**	**L1**
0.3300	**34.10**	**9.99**	**44.09**	**79.00**	**-34.91**	**P**	**L1**
0.5010	**26.54**	**9.97**	**36.51**	**73.00**	**-36.49**	**P**	**L1**
3.4395	**22.10**	**10.25**	**32.35**	**73.00**	**-40.65**	**P**	**L1**
10.9995	**23.44**	**10.59**	**34.03**	**73.00**	**-38.97**	**P**	**L1**
13.5600	**23.71**	**10.72**	**34.43**	**73.00**	**-38.57**	**P**	**L1**

Note: 1. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line).

Model No.	SCH4X2-A9	6dB Bandwidth	9 kHz
Environmental Conditions	22.5°C, 61% RH	Test Mode	Mode 1
Tested by	Jacky Lin	Phase	L2
Standard	FCC CLASS A / ICES-003 CLASS A	Test Date	2024/04/26



Conducted Emission Readings							
Frequency Range Investigated				150 kHz to 30 MHz			
Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector (P/Q/A)	Line (L1/L2)
0.2175	44.46	9.98	54.44	79.00	-24.56	P	L2
0.2670	42.39	9.99	52.38	79.00	-26.62	P	L2
0.3615	36.19	10.00	46.19	79.00	-32.81	P	L2
0.6540	31.15	10.01	41.16	73.00	-31.84	P	L2
3.3360	24.42	10.25	34.67	73.00	-38.33	P	L2
10.4955	27.54	10.57	38.11	73.00	-34.89	P	L2

Note: 1. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line).

2.3 Radiated Emission

2.3.1 Test Instruments

Below 1GHz

Open Area Test Site # H					
EQUIPMENT TYPE	Manufacturer	Model Number	Serial Number	Calibration Date	Calibration Due
Bilog Antenna	Teseq	CBL 6112D	36995	06/13/2023	06/12/2024
Cable	EMEC	CFD400E-LW	SD-R074	08/10/2023	08/09/2024
EMI Test Receiver	R&S	ESCI	101340	01/22/2024	01/21/2025
Pre-Amplifier	HP	8447D	1937A01554	09/21/2023	09/20/2024
Thermo-Hygro Meter	Wisewind	201A	No. 03	05/23/2023	05/22/2024
Test S/W	EZ-EMC Ver.CCS-03A1				
Testing Site : No.163-1, Jhongsheng Rd., Xindian Dist., New Taipei City, Taiwan Measurement Uncertainty of Radiated Emission Expanded uncertainty Ulab (k=2) of Radiated Emission is 5.1 dB.(30MHz-1000MHz) Expanded uncertainty CISPR 16-4-2:2011+A1:2014+A2:2018 (k=2) of Radiated Emission measurement is 5.2 dB.(30MHz-1000MHz)					

Above 1GHz

Chamber # E					
EQUIPMENT TYPE	Manufacturer	Model Number	Serial Number	Calibration Date	Calibration Due
Horn Antenna	ETS-Lindgren	3117	00139062	06/08/2023	06/07/2024
Microflex Cable x 7m	JMT	LF01	SD-R089	06/07/2023	06/06/2024
K-Type Cable x 1m	JMT	LK01	SD-R087	06/07/2023	06/06/2024
Pre-Amplifier	Com-Power	PAM-118A	551041	06/07/2023	06/06/2024
Signal Analyzer	R&S	FSV40	101269	06/07/2023	06/06/2024
Thermo-Hygro Meter	Wisewind	201A	SD-R046	07/24/2023	07/23/2024
Test S/W	EZ-EMC Ver.CCS-03A1				
Testing Site : No.163-1, Jhongsheng Rd., Xindian Dist., New Taipei City, Taiwan Measurement Uncertainty of Radiated Emission Expanded uncertainty (k=2) of Radiated Emission measurement is 4.6 dB.(1-18GHz) Expanded uncertainty (k=2) of Radiated Emission measurement is 3.8 dB.(18-40GHz) Expanded uncertainty CISPR 16-4-2:2011+A1:2014+A2:2018 (k=2) of Radiated Emission measurement is 5.5 dB.(1-18GHz)					

2.3.2 Measurement Level Calculation

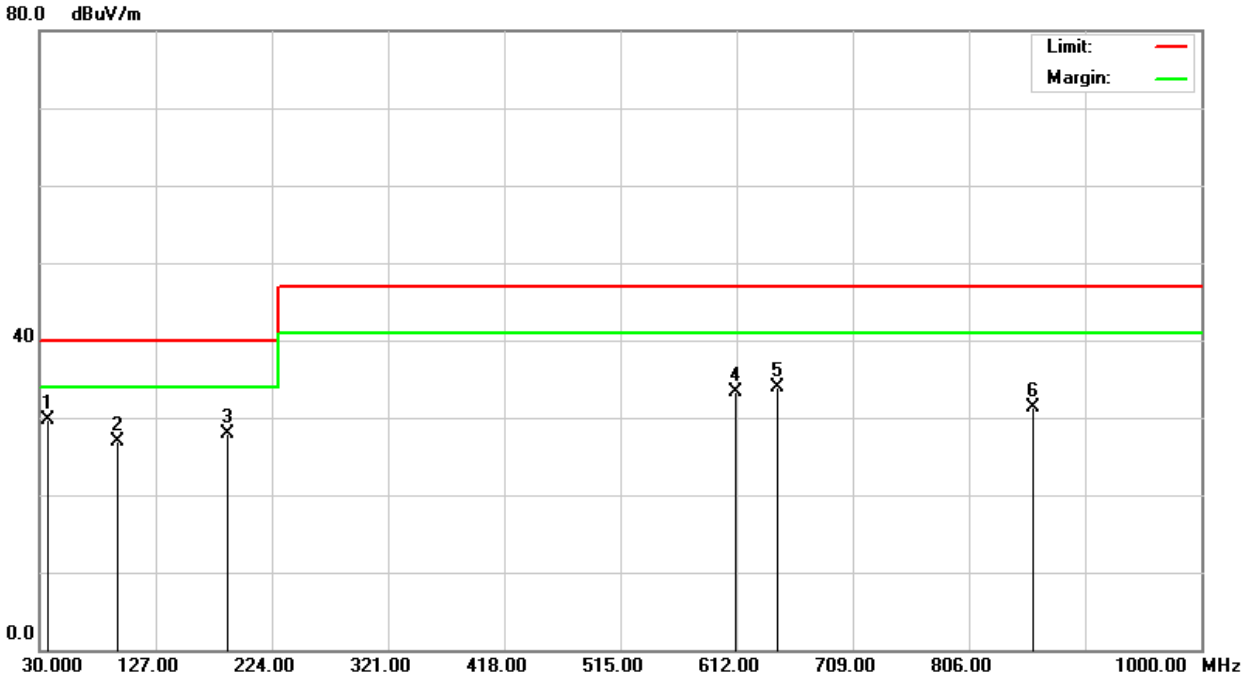
Correction Factor = Antenna Factor + Cable loss- Amplifier Gain
Measurement Level = Reading Level + Correction Factor
Over (Margin) = Measurement Level – Limit

2.3.3 Measurement Data

FCC 47 CFR Part 15 Subpart B

Below 1GHz

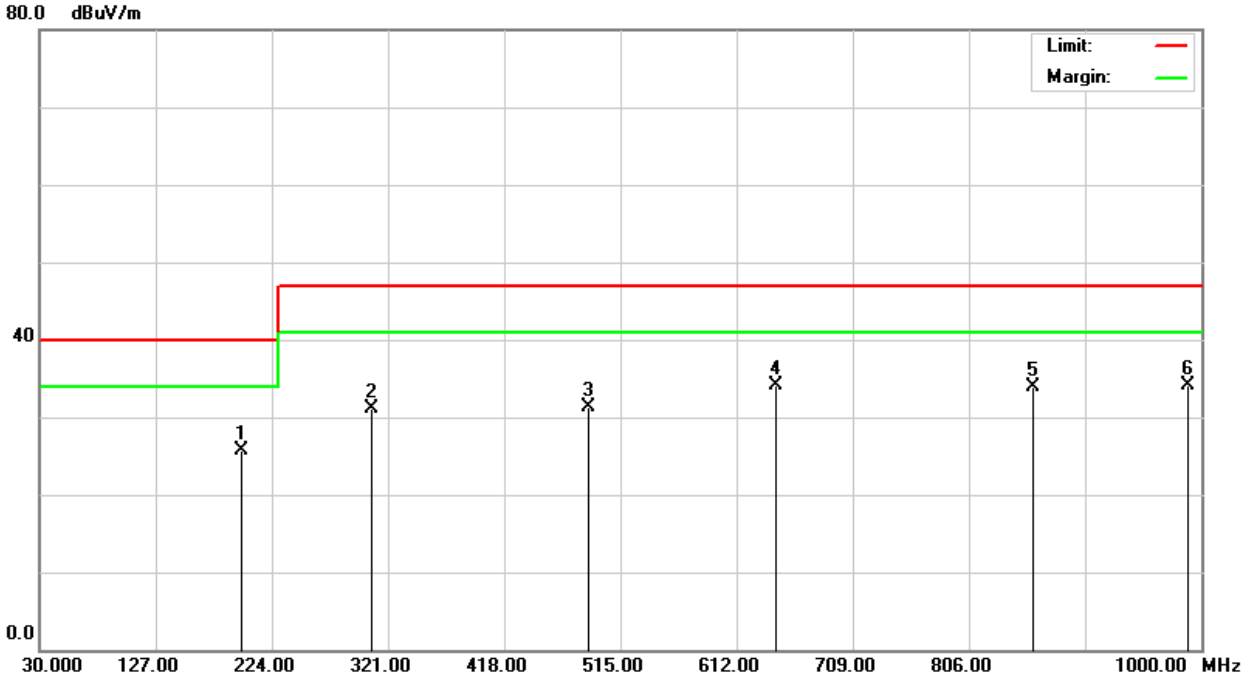
Model No.	SCH4X2-A9	**Test Mode**	Mode 1
Environmental Conditions	19.9ºC, 71% RH	**6dB Bandwidth**	120 kHz
Antenna Pole	Vertical	**Antenna Distance**	10m
Detector Function	Quasi-peak.	**Tested by**	Jacky Lin
Standard	FCC CLASS A W/ CISPR 22 CLASS A LIMIT	**Test Date**	2024/04/27



Radiated Emission Readings									
Frequency Range Investigated				**30 MHz to 1000 MHz at 10m**					
Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Detector (P/Q)	Pol. (H/V)
37.1900	**35.60**	**-5.88**	**29.72**	**40.00**	**-10.28**	**100**	**58**	**Q**	**V**
95.0199	**37.30**	**-10.41**	**26.89**	**40.00**	**-13.11**	**100**	**249**	**Q**	**V**
186.8100	**38.50**	**-10.68**	**27.82**	**40.00**	**-12.18**	**100**	**163**	**Q**	**V**
611.5300	**32.10**	**1.27**	**33.37**	**47.00**	**-13.63**	**400**	**85**	**Q**	**V**
646.2500	**32.40**	**1.55**	**33.95**	**47.00**	**-13.05**	**400**	**334**	**Q**	**V**
860.1900	**26.80**	**4.47**	**31.27**	**47.00**	**-15.73**	**400**	**108**	**Q**	**V**

Note: 1. 30MHz to 1000MHz test is Applicable CISPR 22 standard.
2. P= Peak Reading; Q= Quasi-peak Reading.

Model No.	SCH4X2-A9	Test Mode	Mode 1
Environmental Conditions	19.9°C, 71% RH	6dB Bandwidth	120 kHz
Antenna Pole	Horizontal	Antenna Distance	10m
Detector Function	Quasi-peak.	Tested by	Jacky Lin
Standard	FCC CLASS A W/ CISPR 22 CLASS A LIMIT	Test Date	2024/04/27



Radiated Emission Readings									
Frequency Range Investigated				30 MHz to 1000 MHz at 10m					
Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Detector (P/Q)	Pol. (H/V)
198.7100	35.90	-10.29	25.61	40.00	-14.39	400	13	Q	H
308.0000	36.80	-5.64	31.16	47.00	-15.84	400	101	Q	H
489.1300	32.10	-0.81	31.29	47.00	-15.71	100	82	Q	H
645.2800	32.50	1.55	34.05	47.00	-12.95	100	256	Q	H
860.0700	29.40	4.47	33.87	47.00	-13.13	100	322	Q	H
988.3900	28.80	5.28	34.08	47.00	-12.92	100	178	Q	H

Note: 1. 30MHz to 1000MHz test is Applicable CISPR 22 standard.
2. P= Peak Reading; Q= Quasi-peak Reading.

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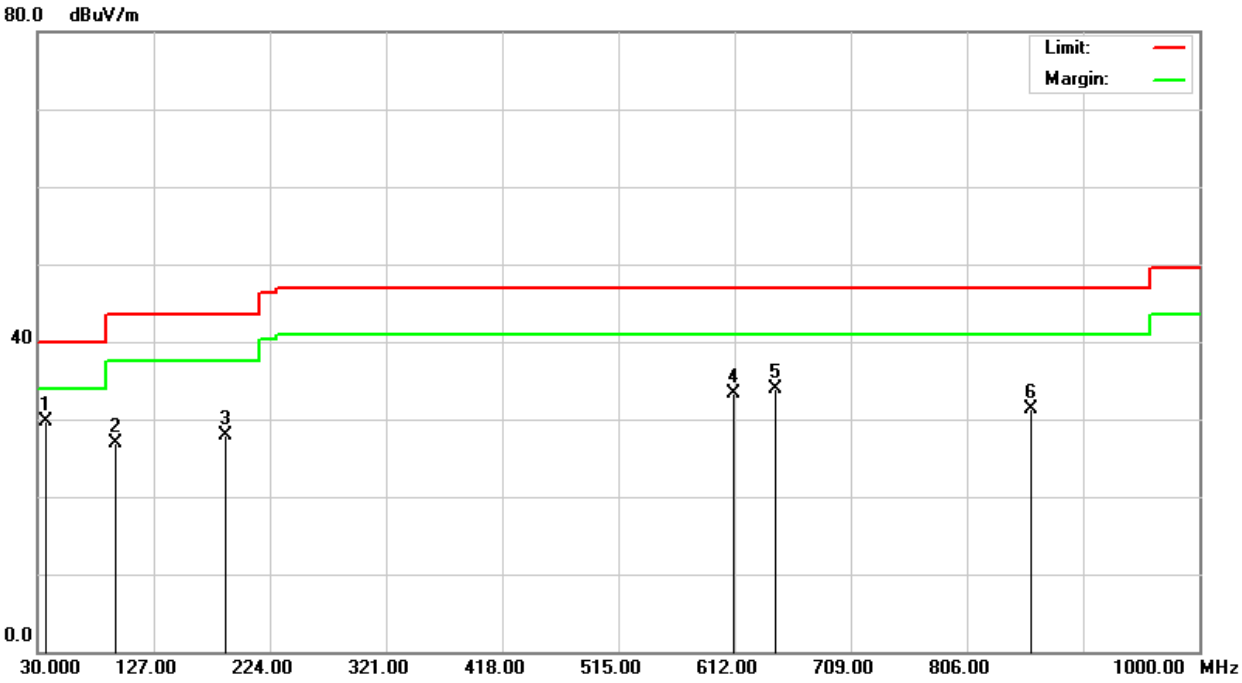
Below 1GHz

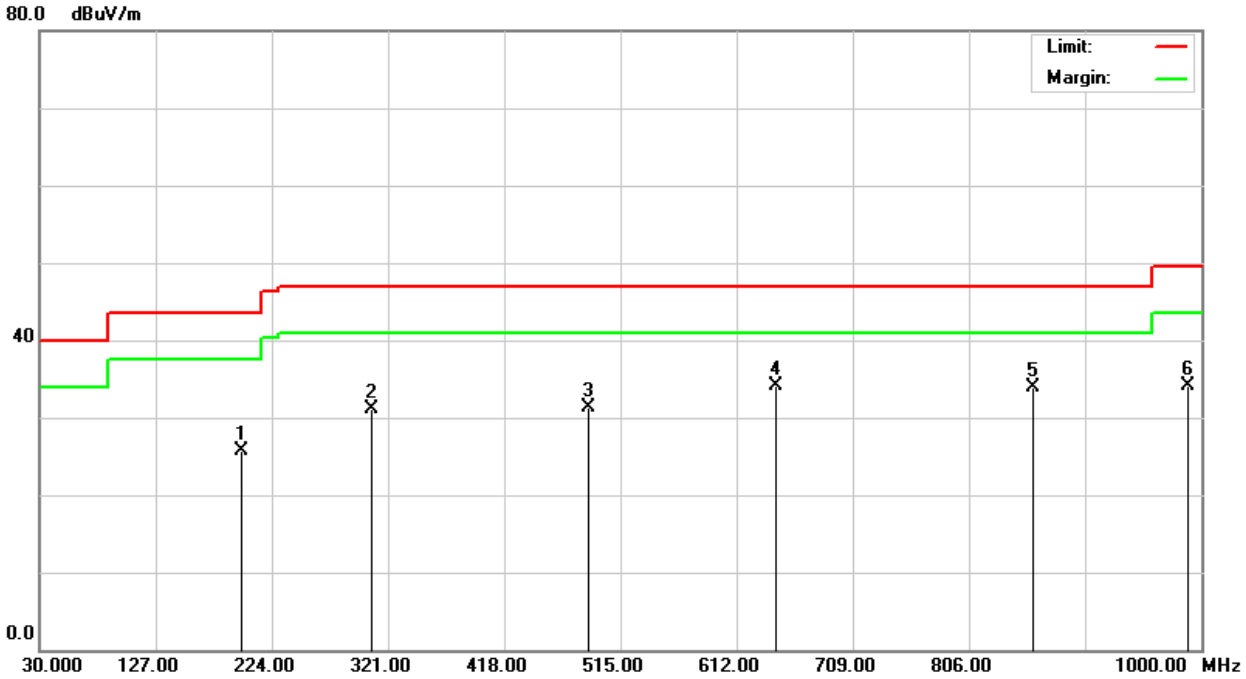
Model No.	SCH4X2-A9	**Test Mode**	Mode 1
Environmental Conditions	19.9ºC, 71% RH	**6dB Bandwidth**	120 kHz
Antenna Pole	Vertical	**Antenna Distance**	10m
Detector Function	Quasi-peak.	**Tested by**	Jacky Lin
Standard	ICES-003 CLASS A	**Test Date**	2024/04/27



Radiated Emission Readings									
Frequency Range Investigated				**30 MHz to 1000 MHz at 10m**					
Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Detector (P/Q)	Pol. (H/V)
37.1900	**35.60**	**-5.88**	**29.72**	**40.00**	**-10.28**	**100**	**58**	**Q**	**V**
95.0199	**37.30**	**-10.41**	**26.89**	**43.50**	**-16.61**	**100**	**249**	**Q**	**V**
186.8100	**38.50**	**-10.68**	**27.82**	**43.50**	**-15.68**	**100**	**163**	**Q**	**V**
611.5300	**32.10**	**1.27**	**33.37**	**47.00**	**-13.63**	**400**	**85**	**Q**	**V**
646.2500	**32.40**	**1.55**	**33.95**	**47.00**	**-13.05**	**400**	**334**	**Q**	**V**
860.1900	**26.80**	**4.47**	**31.27**	**47.00**	**-15.73**	**400**	**108**	**Q**	**V**

Note: 1. P= Peak Reading; Q= Quasi-peak Reading.

Model No.	SCH4X2-A9	Test Mode	Mode 1
Environmental Conditions	19.9°C, 71% RH	6dB Bandwidth	120 kHz
Antenna Pole	Horizontal	Antenna Distance	10m
Detector Function	Quasi-peak.	Tested by	Jacky Lin
Standard	ICES-003 CLASS A	Test Date	2024/04/27



Radiated Emission Readings									
Frequency Range Investigated				30 MHz to 1000 MHz at 10m					
Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Detector (P/Q)	Pol. (H/V)
198.7100	35.90	-10.29	25.61	43.50	-17.89	400	13	Q	H
308.0000	36.80	-5.64	31.16	47.00	-15.84	400	101	Q	H
489.1300	32.10	-0.81	31.29	47.00	-15.71	100	82	Q	H
645.2800	32.50	1.55	34.05	47.00	-12.95	100	256	Q	H
860.0700	29.40	4.47	33.87	47.00	-13.13	100	322	Q	H
988.3900	28.80	5.28	34.08	49.50	-15.42	100	178	Q	H

Note: 1. P= Peak Reading; Q= Quasi-peak Reading.

Above 1GHz

Model No.	SCH4X2-A9	Test Mode	Mode 1
Environmental Conditions	21.5°C, 62% RH	6dB Bandwidth	1 MHz
Antenna Pole	Vertical / Horizontal	Antenna Distance	3m
Highest frequency generated or used	1000MHz	Upper frequency	5000MHz
Detector Function	Peak and average.	Tested by	Jacky Lin
Standard	FCC CLASS A / ICES-003 CLASS A	Test Date	2024/04/27

Radiated Emission Readings							
Frequency Range Investigated				Above 1GHz at 3m			
Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (P/A)	Pol. (H/V)
1714.000	62.69	-7.34	55.35	80.00	-24.65	P	V
2479.000	53.98	-4.49	49.49	80.00	-30.51	P	V
2989.000	54.15	-4.04	50.11	80.00	-29.89	P	V

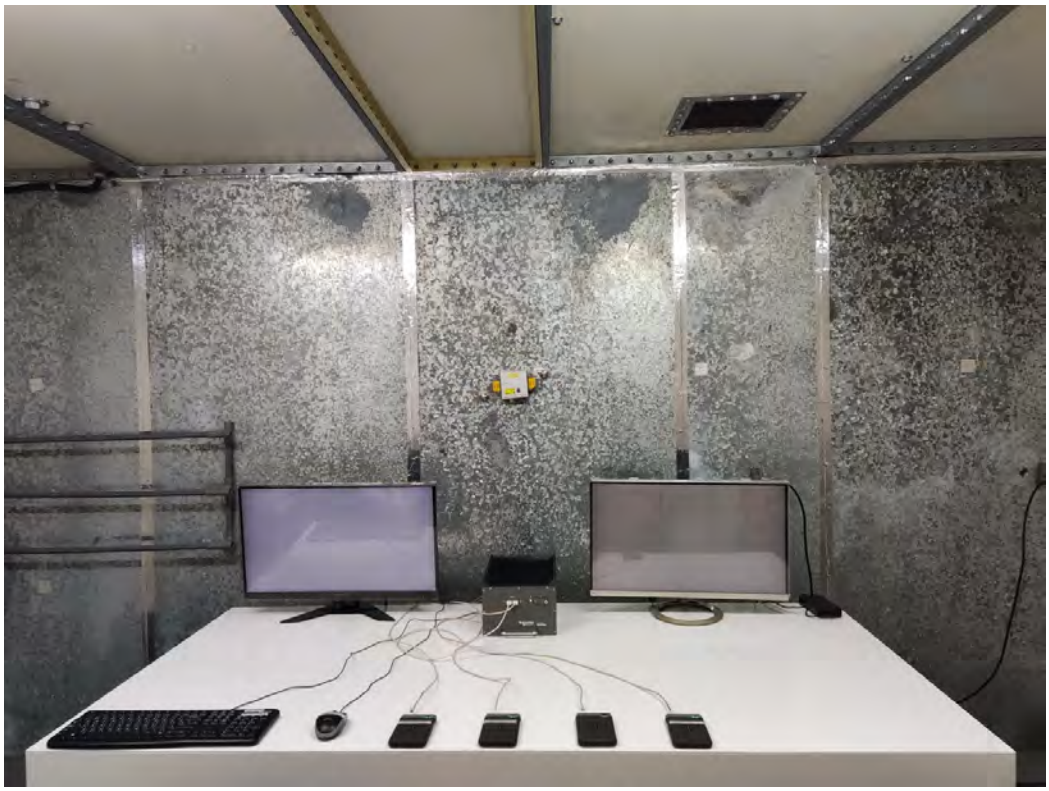
Radiated Emission Readings							
Frequency Range Investigated				Above 1GHz at 3m			
Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (P/A)	Pol. (H/V)
1663.000	61.13	-7.67	53.46	80.00	-26.54	P	H
2615.000	56.62	-4.33	52.29	80.00	-27.71	P	H
4213.000	53.20	-3.32	49.88	80.00	-30.12	P	H

Note: 1. P= Peak Reading; A= Average Reading.

APPENDIX

Photograph of Testing General Set-up

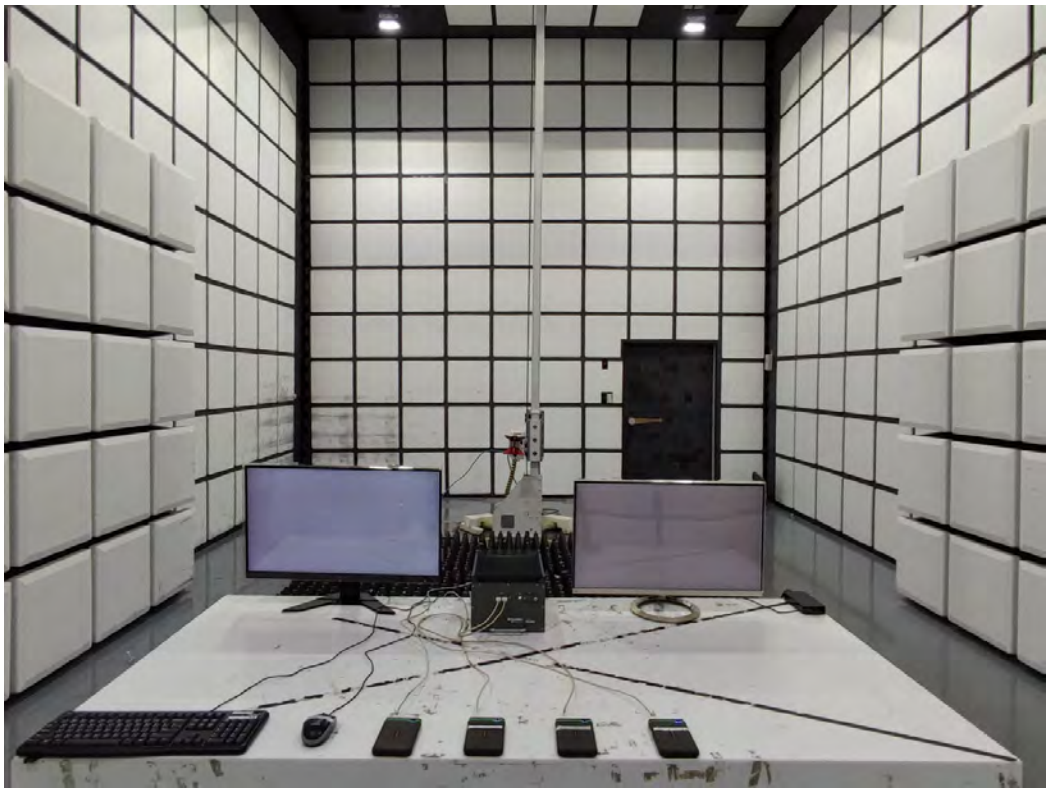
CE Testing Set-up

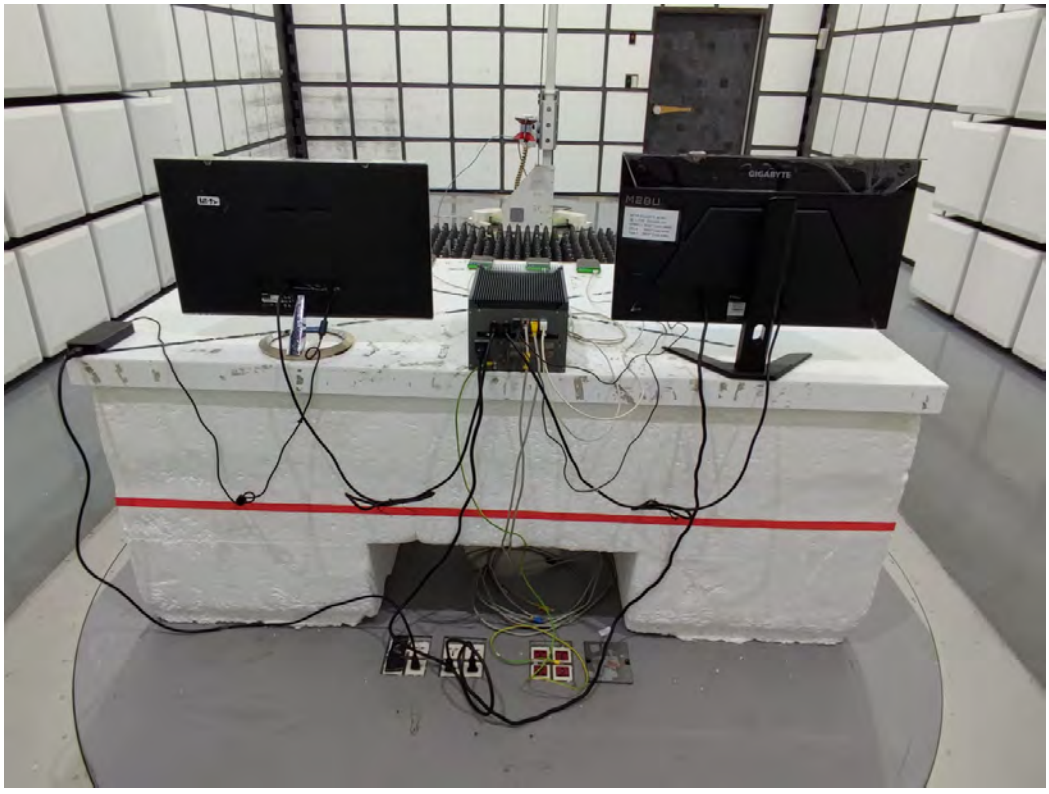


RE Testing Set-up

Below 1GHz

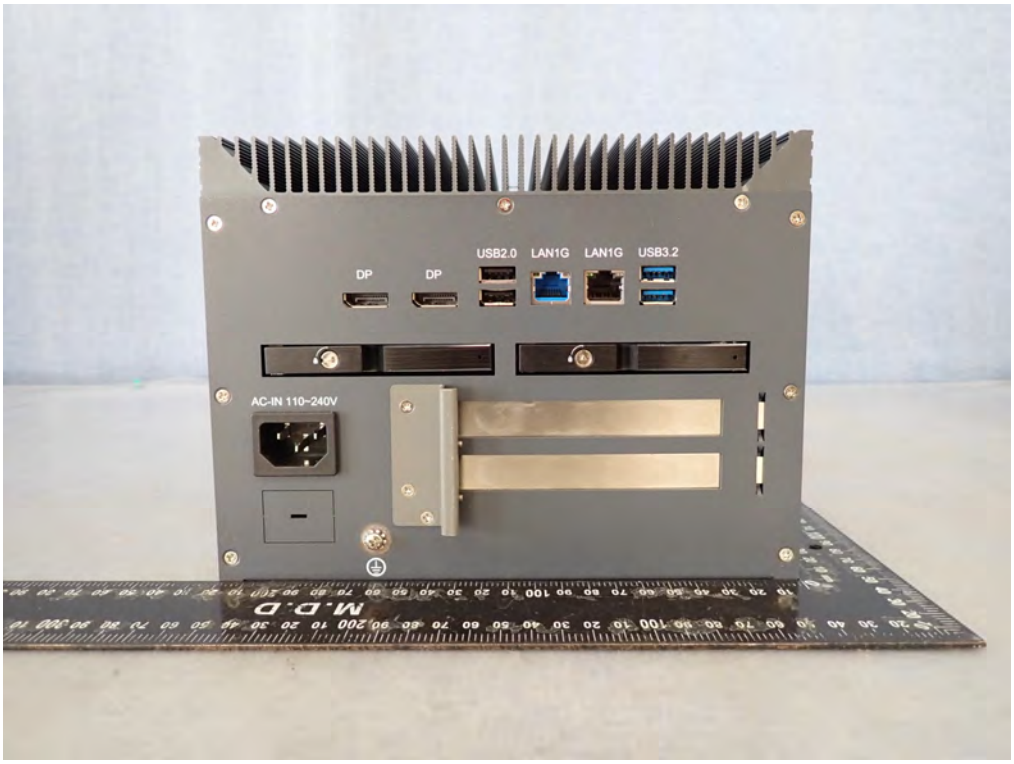
Above 1GHz

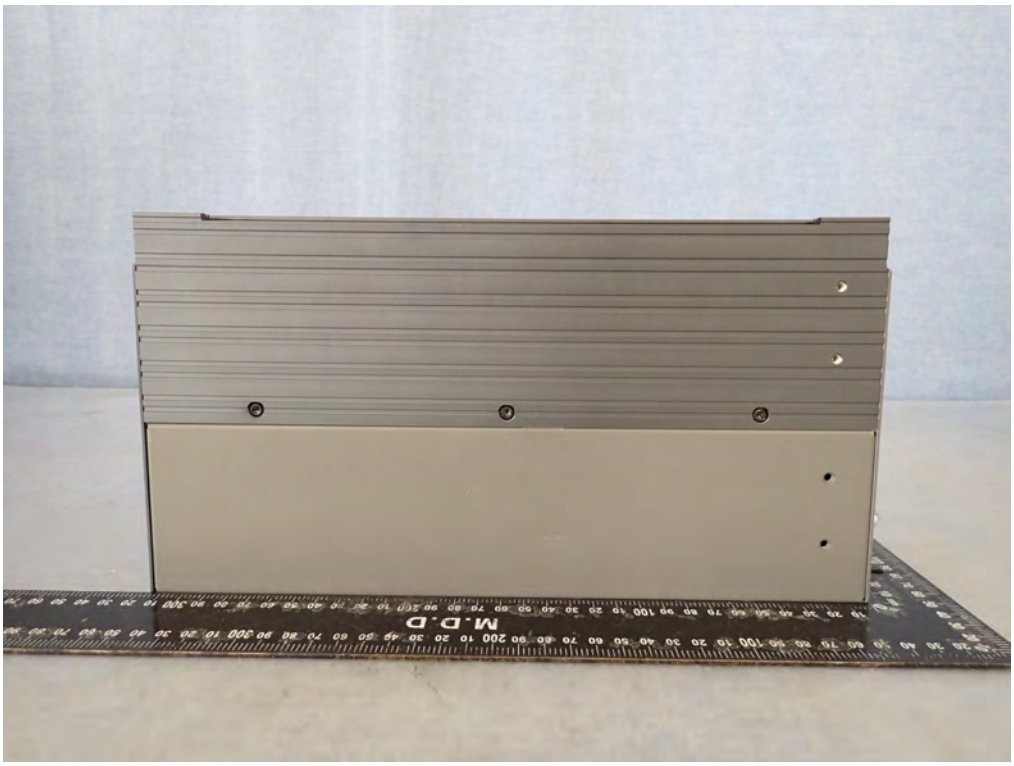


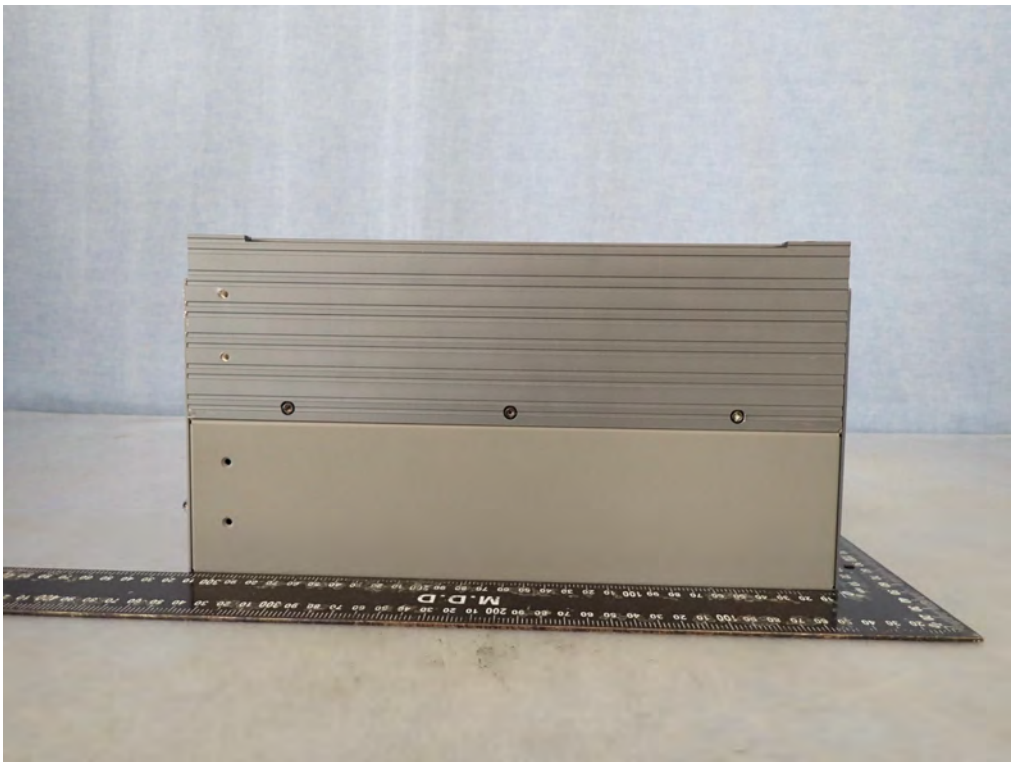


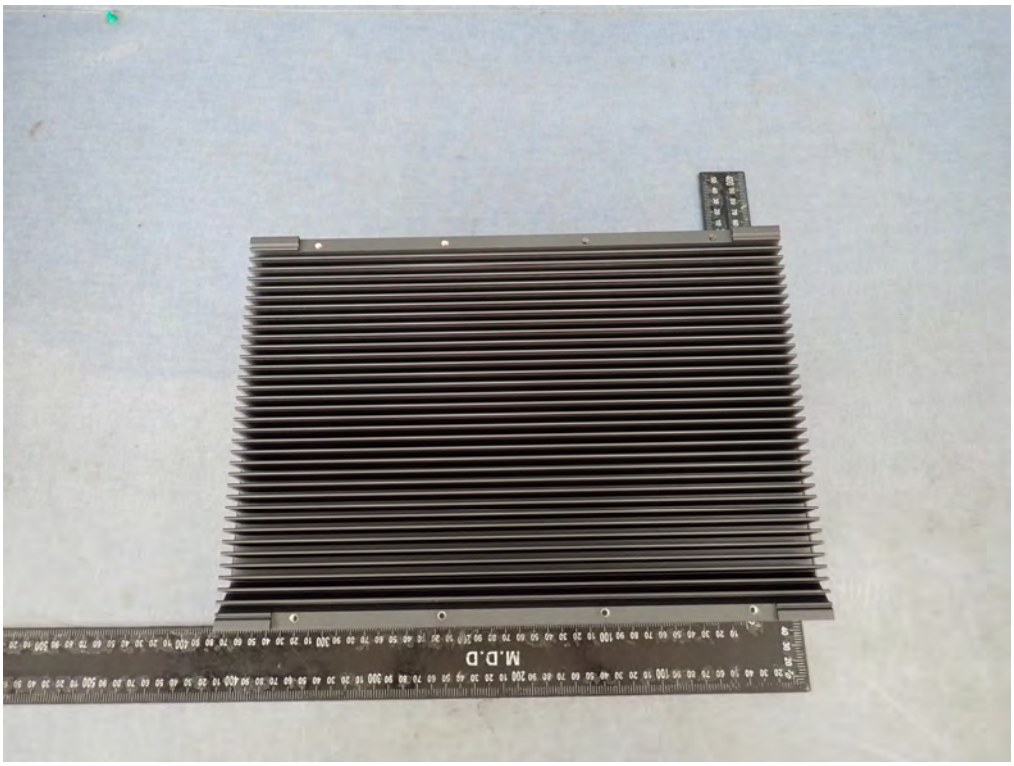
Photographs of EUT Unit

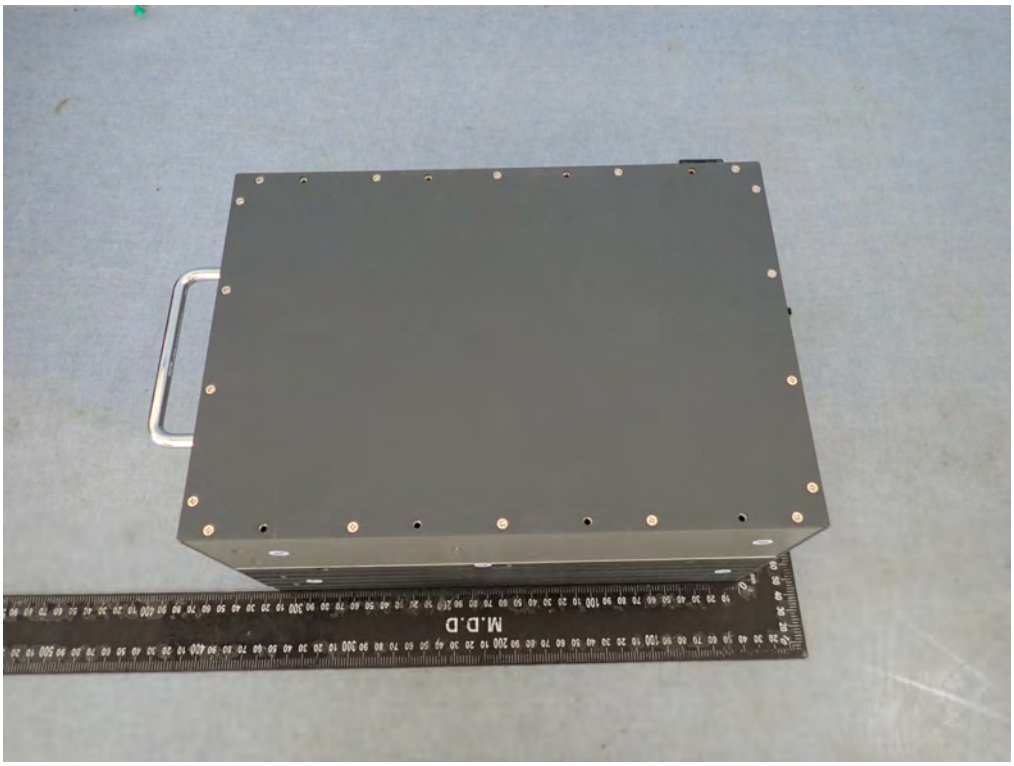
Exterior











** End of Report **