CE EMC Test Report

Report No.	:	BTL-EMC-1-2311T005
Equipment	:	Micro SD Card
Model Name	:	Industrial Micro SD R1-M, Industrial Micro SDHC R1-M, Industrial Micro SDXC R1-M, Industrial Micro SD R1-SL, Industrial Micro SDHC R1-SL, Industrial Micro SDXC R1-SL, Industrial Micro SDHC MSD-WORM, Industrial Micro SDXC MSD-WORM
Brand Name	:	Apacer
Applicant	:	Apacer Technology Inc.
Address	:	1F., No.32, Zhongcheng Rd., Tucheng Dist., New Taipei City 236, Taiwan R.O.C.
Standard(s)	:	EN 55032:2015+A11:2020 Class B BS EN 55032:2015+A11:2020 Class B AS/NZS CISPR 32:2015+AMD1:2020 Class B CISPR 32:2015+AMD1:2019 Class B EN 55035:2017+A11:2020 BS EN 55035:2017+A11:2020
Date of Receipt	:	2021/12/28
Date of Test	:	2021/12/30 ~ 2022/1/7
Issued Date	:	2023/11/13

The above equipment has been tested and found in compliance with the requirement of the above standards by BTL Inc.

Prepared by : Joe Chang, Engineer

Approved by : Josh Lin, Manager

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Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

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BTL's laboratory quality assurance procedures are in compliance with the **ISO/IEC 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

CONTENTS

REVISION HISTORY

Report No.	Version	Description	Issued Date	Note
BTL-EMC-1-2311T005	R00	Original Report.	2023/11/13	Valid

1 SUMMARY OF TEST RESULTS

Emission			
Standard	Test Item	Limit	Judgment
EN 55032:2015+A11:2020 BS EN 55032:2015+A11:2020 AS/NZS CISPR 32:2015+AMD1:2020 CISPR 32:2015+AMD1:2019	Radiated emissions up to 1 GHz	Class B	PASS
	Radiated emissions above 1 GHz	------	N/A
	Radiated emissions from FM receivers	------	N/A
	Outdoor units of home satellite receiving systems	------	N/A
	Conducted emissions from the AC mains power ports	Class B	PASS
	Asymmetric mode conducted emissions	------	N/A
	Conducted differential voltage emissions	------	N/A

Immunity				
Standard	Reference Standard / Clause	Environmental phenomenon	Performance Criterion Limit	Judgment
EN 55035:2017+A11:2020 BS EN 55035:2017+A11:2020	EN 61000-4-2:2009	Electrostatic discharge	B	PASS
	EN 61000-4-3:2006 +A1:2008+A2:2010 EN IEC 61000-4-3:2020	Continuous RF electromagnetic field disturbances	A	PASS
	EN 61000-4-4:2012	Electrical fast transients / burst	B	N/A
	EN 61000-4-5:2014 EN 61000-4-5:2014 +A1:2017	Surges	NOTE (2)	N/A
	EN 61000-4-6:2014 EN 61000-4-6:2014 +AC:2015	Continuous induced RF disturbances	A	N/A
	EN 61000-4-8:2010	Power frequency magnetic field	A	PASS
	EN 61000-4-11:2004 EN IEC 61000-4-11:2020 +AC:2020-06	Voltage dips and Voltage interruptions	NOTE (3)	N/A
	4.2.7	Broadband impulse noise disturbances, repetitive	------	N/A
	4.2.7	Broadband impulse noise disturbances, isolated	------	N/A

NOTE:
(1) ”N/A” denotes test is not applicable in this Test Report.
(2) For DC network and AC mains power ports is Criterion B.
For analogue/digital data ports:
Port type: unshielded symmetrical is Criterion C.
Port type: coaxial or shielded is Criterion B.
(3) For voltage dips residual voltage < 5 % is Criterion B.
For voltage dips residual voltage 70 % is Criterion C.
For voltage interruptions residual voltage < 5 % is Criterion C.
(4) Both of specific and the latest version of the basic standard are referenced to fulfill the requirements.
(5) The report format version is TP.1.1.1.
(6) At the same test procedures, due to the limits of EN 55032:2015+A11:2020 are severe than EN 55032:2015+A1:2020, BS EN 55032:2015+A1:2020, AS/NZS CISPR 32:2015+AMD1:2020 and CISPR 32:2015+AMD1:2019, when the requirements of EN 55032:2015+A11:2020 are satisfied, the requirements of EN 55032:2015+A1:2020, BS EN 55032:2015+A1:2020, AS/NZS CISPR 32:2015+AMD1:2020 and CISPR 32:2015+AMD1:2019 could be considered as satisfied.

1.1 TEST FACILITY

The test facilities used to collect the test data in this report:

No.18, Ln. 171, Sec. 2, Jiuzong Rd., Neihu Dist., Taipei City 114, Taiwan

☒ C03 ☒ CB06 ☒ CB18 ☒ CB19 ☐ SR01
☒ SR02 ☒ SR03

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y** ± **U**, where expanded uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k = 2**, providing a level of confidence of approximately **95 %**. The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2. The BTL measurement uncertainty is less than the CISPR 16-4-2 U_{cispr} requirement.

A. Radiated emissions up to 1 GHz test:

Test Site	Method	Measurement Frequency Range	Ant. H / V	U (dB)
CB18 (3m)	CISPR	30 MHz ~ 200 MHz	V	3.94
		30 MHz ~ 200 MHz	H	3.74
		200 MHz ~ 1,000 MHz	V	4.10
		200 MHz ~ 1,000 MHz	H	3.98

B. Conducted emissions from the AC mains power ports test:

Test Site	Method	Measurement Frequency Range	U (dB)
C03	CISPR	150 kHz ~ 30 MHz	3.28

C. Immunity tests:

Test Site	Method	Test Item	U
SR02	EN 61000-4-2	Rise time	≤12.5 %
		Peak Current	≤6.0 %
		Current at 30ns	≤6.0 %
		Current at 60ns	≤6.0 %
CB06	EN IEC 61000-4-3	General test 80 MHz~1 GHz 1 GHz~6 GHz	 2.10 dB 2.26 dB
SR03	EN 61000-4-8	PFMF mG Calibration	9.30 %

NOTE:
Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

1.3 TEST ENVIRONMENT CONDITIONS

Test Item	Environment Condition	Tested by
EN 55032		
Radiated emissions up to 1 GHz	20°C, 65%	Loki Chiang
Conducted emissions from the AC mains power ports	20°C, 67%	Ken Lin
EN 55035		
Electrostatic discharge	20°C, 50%, 1014hPa	Kyle Yang
Continuous RF electromagnetic field disturbances	25°C, 55%	Loki Chiang
Power frequency magnetic field	24°C, 56%	Loki Chiang

2 GENERAL INFORMATION

2.1 EUT INFORMATION

Equipment	Micro SD Card
Model Name	Industrial Micro SD R1-M, Industrial Micro SDHC R1-M, Industrial Micro SDXC R1-M, Industrial Micro SD R1-SL, Industrial Micro SDHC R1-SL, Industrial Micro SDXC R1-SL, Industrial Micro SDHC MSD-WORM, Industrial Micro SDXC MSD-WORM
Brand Name	Apacer
Model Difference	Differ in capacity.
Power Source	DC Voltage supplied from host system.
Power Rating	DC 2.7V~3.6V
Products Covered	N/A
Test Model	Industrial Micro SD R1-M
Highest Internal Frequency	50 MHz
EUT Modification(s)	N/A

NOTE:
(1) The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.
(2) In this report, all the test results refer to BTL-EMC-1-2208T076 & BTL-EMC-2-2208T076 report due to the device is identical to the referencing report and, after evaluated, no need to re-test.

2.2 TEST MODES

The test system was pre-tested based on the consideration of all possible combinations of EUT operation modes according to test plan.

Pretest Mode	Description
Mode 1	SD CARD READ / WRITE

Following mode(s) was (were) found to be the worst case(s) and selected for the final test.

Radiated emissions up to 1 GHz test	
Final Test Mode	Description
Mode 1	SD CARD READ / WRITE

Conducted emissions from the AC mains power ports test	
Final Test Mode	Description
Mode 1	SD CARD READ / WRITE

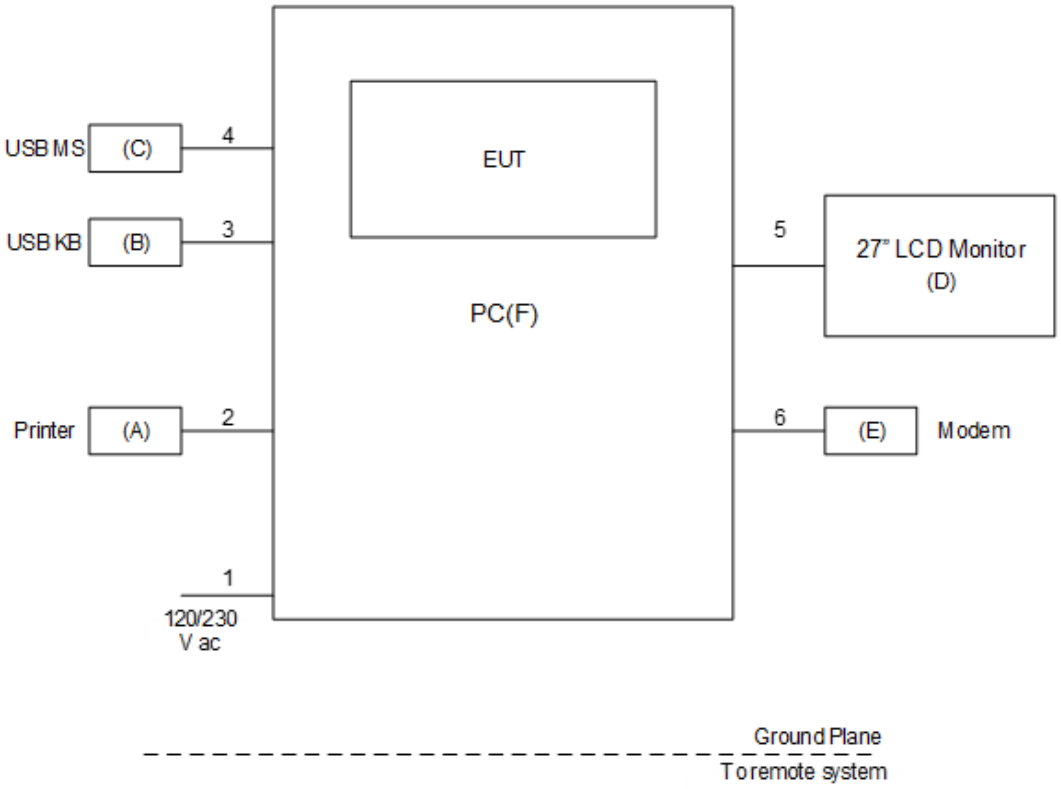
Immunity tests	
Final Test Mode	Description
Mode 1	SD CARD READ / WRITE

2.3 EUT OPERATING CONDITION

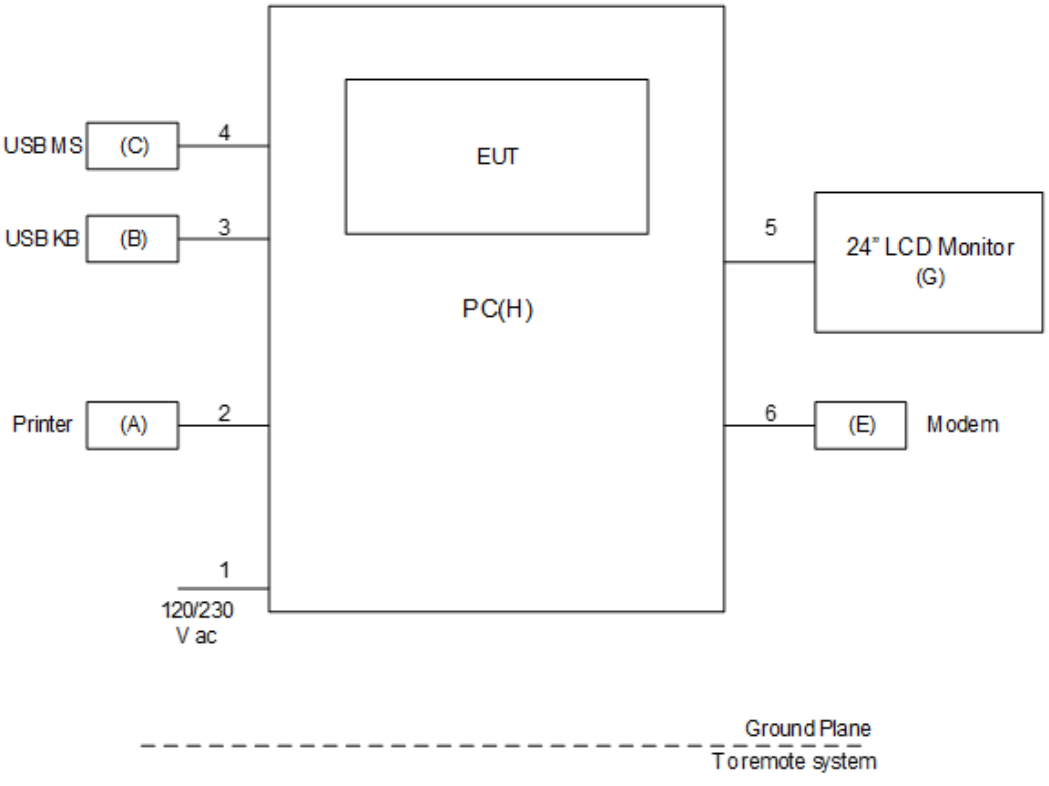
The PC exercise program (BurninTEST V9.0) used during radiated and/or conducted emissions measurement was designed to exercise the various system components in a manner similar to a typical use.

2.4 TESTED CONFIGURATION DIAGRAM

Equipment letters and Cable numbers refer to item numbers described in the tables of clause 2.5.



For Immunity tests



2.5 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Series No.	Remarks
A	Printer	HP	SNPRH-1504	N/A	Furnished by test lab.
B	USB K/B	DELL	KB216t	CN-0W33XP-L0300-797-05TY-A03	Furnished by test lab.
C	USB Mouse	DELL	MOCZUL	CN-049TWY-PRC00-79E-01HA	Furnished by test lab.
D	27” 4K Monitor	ASUS	MX27U	90LM02BB-B106D0	Furnished by test lab.
E	Modem	ACEEX	DM-1414V	8041708	Furnished by test lab.
F	PC	DELL	OptiPlex 7080	9T3HN A00	Furnished by test lab.
G	24” 4K Monitor	DELL	P2415Q	CN-0GTTPW74261-635-0EKL-A03	Furnished by test lab.
H	PC	Lenovo	AY3	L3D7941	Furnished by test lab.

Item	Cable Type	Shielded	Ferrite Core	Length	Remarks
1	Power Cable	YES	NO	1.6m	Type: 3-wire including ground Furnished by test lab.
2	USB Cable	YES	NO	1.6m	Type: USB 2.0 Furnished by test lab.
3	USB Cable	YES	NO	1.4m	Type: USB 2.0 Furnished by test lab.
4	USB Cable	YES	NO	1.4m	Type: USB 2.0 Furnished by test lab.
5	DP Cable	YES	YES	1.6m	Furnished by test lab.
6	RS 232 Cable	NO	NO	1.6m	Furnished by test lab.

3 EMC EMISSION TEST

3.1 RADIATED EMISSIONS UP TO 1 GHZ TEST

3.1.1 LIMITS

Table A.2 – Requirements for radiated emissions at frequencies up to 1 GHz for class A equipment

Table clause	Frequency range MHz	Measurement			Class A limits dB(μV/m)
		Facility (see Table A.1)	Distance m	Detector type / bandwidth	
A2.1	30 to 230	OATS/SAC	10	Quasi Peak / 120 kHz	40
	230 to 1 000				47
A2.2	30 to 230	OATS/SAC	3		50
	230 to 1 000				57
A2.3	30 to 230	FAR	10	Quasi Peak / 120 kHz	42 to 35
	230 to 1 000				42
A2.4	30 to 230	FAR	3		52 to 45
	230 to 1 000				52
Apply only A2.1 or A2.2 or A2.3 or A2.4 across the entire frequency range.					

Table A.4 – Requirements for radiated emissions at frequencies up to 1 GHz for class B equipment

Table clause	Frequency range MHz	Measurement			Class B limits dB(μV/m)
		Facility (see Table A.1)	Distance m	Detector type / bandwidth	
A4.1	30 to 230	OATS/SAC	10	Quasi Peak / 120 kHz	30
	230 to 1 000				37
A4.2	30 to 230	OATS/SAC	3		40
	230 to 1 000				47
A4.3	30 to 230	FAR	10	Quasi Peak / 120 kHz	32 to 25
	230 to 1 000				32
A4.4	30 to 230	FAR	3		42 to 35
	230 to 1 000				42
Apply only table clause A4.1 or A4.2 or A4.3 or A4.4 across the entire frequency range. These requirements are not applicable to the local oscillator and harmonics frequencies of equipment covered by Table A.6.					

Table 1 – Required highest frequency for radiated measurement

Highest internal frequency (F_x)	Highest measured frequency
$F_x \leq 108$ MHz	1 GHz
108 MHz $< F_x \leq 500$ MHz	2 GHz
500 MHz $< F_x \leq 1$ GHz	5 GHz
$F_x > 1$ GHz	$5 \times F_x$ up to a maximum of 6 GHz

NOTE 1 For FM and TV broadcast receivers, F_x is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies.

NOTE 2 F_x is defined in 3.1.18.

NOTE 3 For outdoor units of home satellite receiving systems highest measured frequency shall be 18 GHz.

Where F_x is unknown, the radiated emission measurements shall be performed up to 6 GHz.

NOTE:
(1) The tighter limit applies at the band edges.
(2) Emission level (dBuV/m) = 20log Emission level (uV/m).
(3) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain (if use)
Margin Level = Measurement Value - Limit Value
Calculation example:

Reading Level (dBμV)		Correct Factor (dB/m)		Measurement Value (dBμV/m)
19.11	+	2.11	=	21.22

Measurement Value (dBμV/m)		Limit Value (dBμV/m)		Margin Level (dB)
21.22	-	40	=	-18.78

3.1.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Log-Bicon Antenna	Schwarzbeck	VULB 9168	00984	2021/8/31	2022/8/30
2	Attenuator	INMET	6N-5dB	01	2021/8/31	2022/8/30
3	Pre-Amplifier	EMCI	EMC--1330	980377	2021/5/28	2022/5/27
4	Test Cable	EMCI	EMCCFD400-NM-NM-3500	170202	2021/5/28	2022/5/27
5	Test Cable	EMCI	EMC104-SM-SM-2500	170402	2021/5/28	2022/5/27
6	Test Cable	EMCI	EMCCFD400-NM-NM-8000	200344	2021/5/28	2022/5/27
7	EMI Test Receiver	Keysight	N9038A	MY55420127	2021/6/3	2022/6/2
8	Measurement Software	Farad	EZ_EMC (Ver. NB-03A1-01)	N/A	N/A	N/A

REMARK:
(1) “N/A” denotes no model name, no serial no. or no calibration specified.
(2) All calibration period of equipment list is one year.

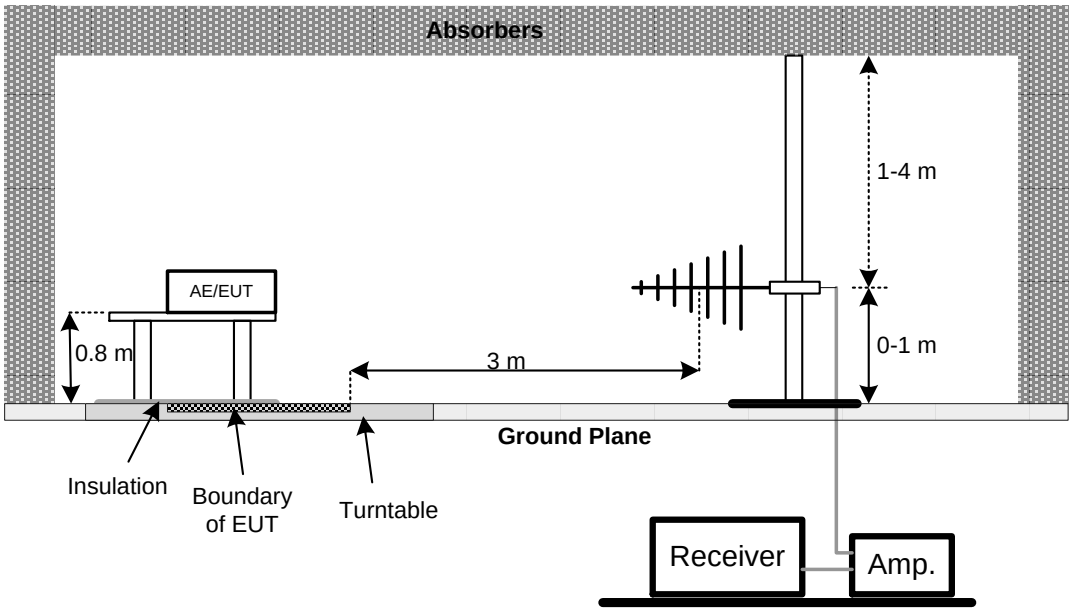
3.1.3 TEST PROCEDURE

a. The separation distance of 3 m was used for measurements up to 1 GHz.
The EUT was placed on the top of a table 0.8 m above the rotating ground in a 3 m semi-anechoic chamber.
b. Cables connecting to AE located outside the measurement area drop directly to, but be insulated from, the RGP (or turntable where applicable), and then be routed directly to the place where they leave the test site. However, cables which would normally be bonded to ground should be bonded to the RGP in accordance with normal practice or the manufacturer's recommendation.
c. The rotating ground was rotated 360 degrees to determine the position of the highest radiation.
d. The height of the receive antenna was varied between 1 m and 4 m. Both horizontal and vertical polarizations of the antenna were checked.
e. For each suspected emission, the EUT was arranged at its worst case and then the antenna was scanned in height to find the maximum.
f. The receiver was set to quasi-peak detect function and specified bandwidth with maximum hold mode.
g. For the actual test configuration, please refer to the related Item - TEST PHOTOS.

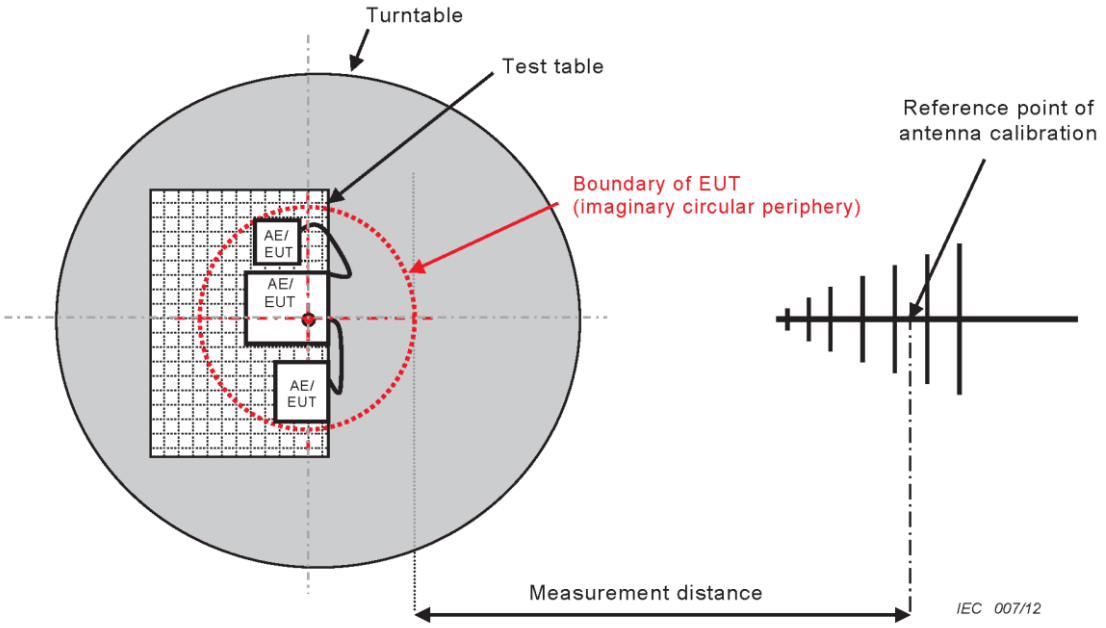
3.1.4 DEVIATION FROM TEST STANDARD

No deviation.

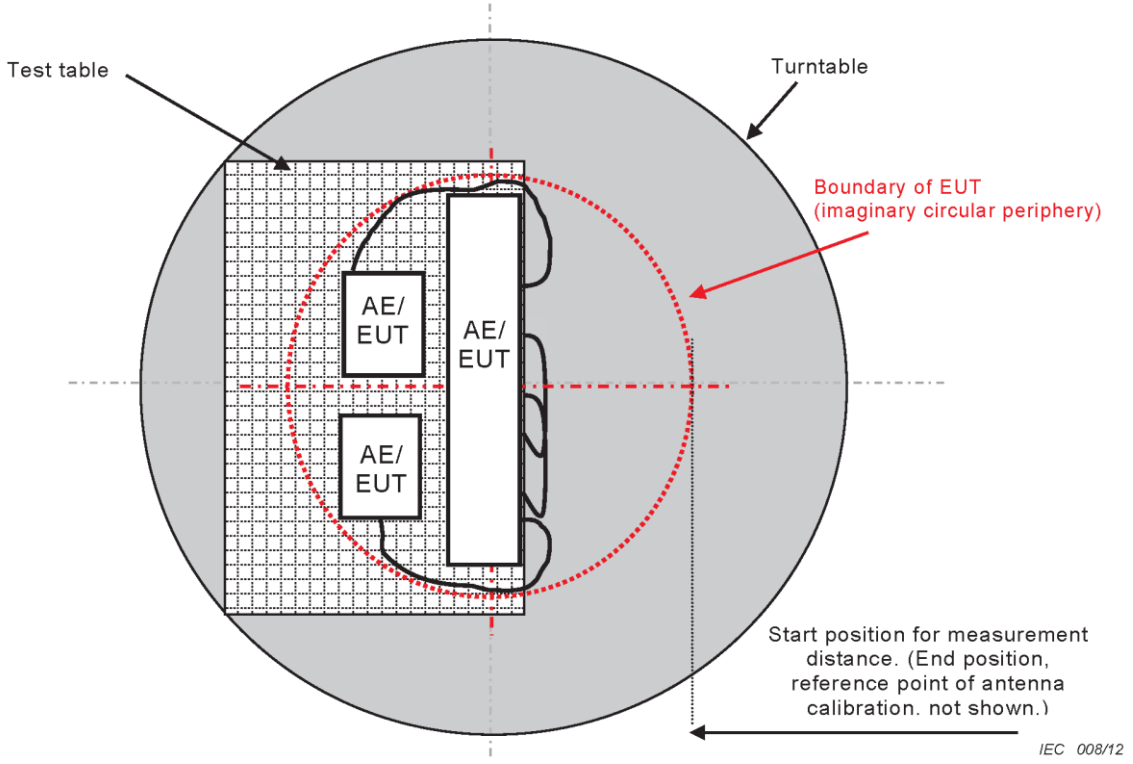
3.1.5 TEST SETUP



3.1.6 MEASUREMENT DISTANCE



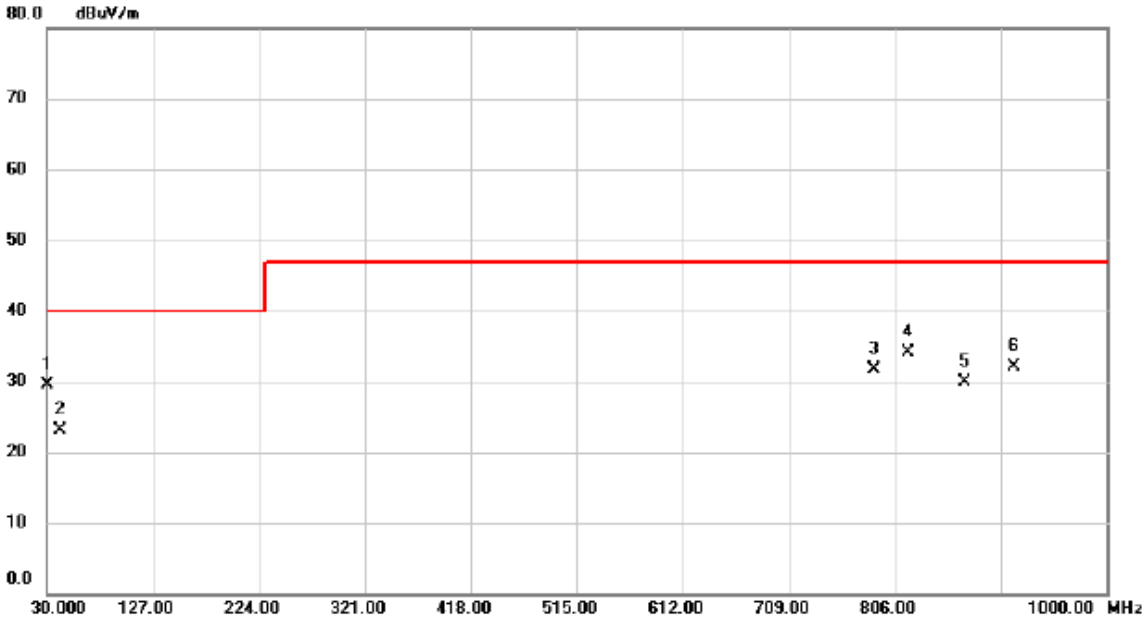
Measurement distance



Boundary of EUT, Local AE and associated cabling

3.1.7 TEST RESULT

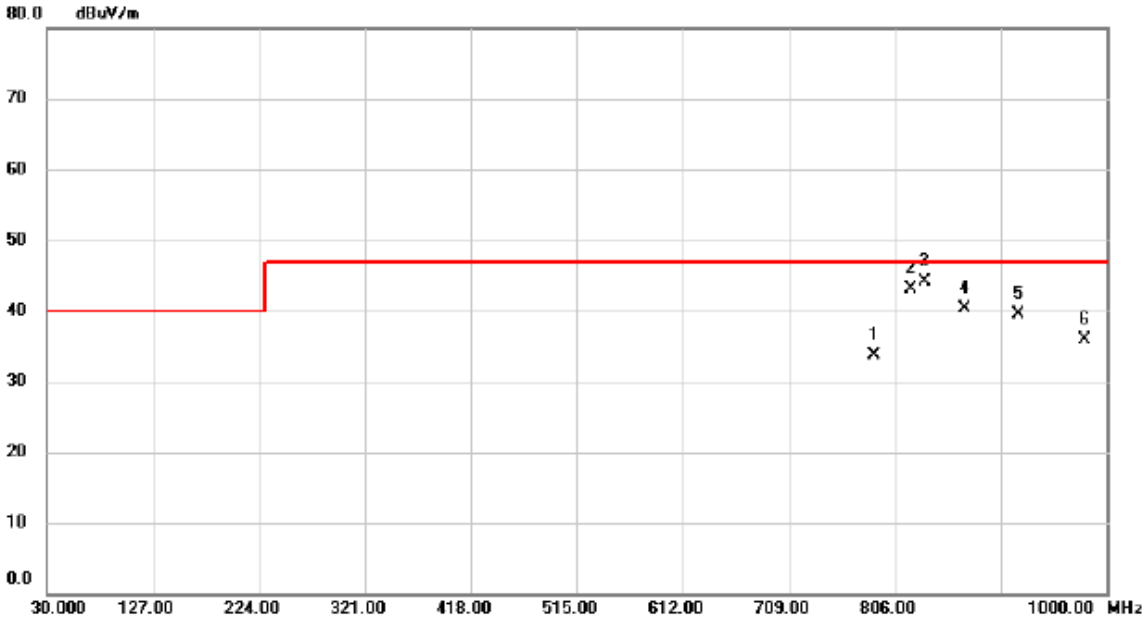
Test Mode	Mode 1	Tested Date	2022/1/3
Test Voltage	AC 230V/50Hz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	30.0000	43.51	-14.06	29.45	40.00	-10.55	QP	163	0	
2		42.6100	36.49	-13.42	23.07	40.00	-16.93	QP	100	10	
3		786.6000	33.57	-1.80	31.77	47.00	-15.23	QP	100	209	
4		818.6100	35.58	-1.38	34.20	47.00	-12.80	QP	100	198	
5		870.0200	30.69	-0.79	29.90	47.00	-17.10	QP	200	0	
6		914.6400	32.41	-0.31	32.10	47.00	-14.90	QP	200	121	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	Mode 1	Tested Date	2022/1/3
Test Voltage	AC 230V/50Hz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		786.6000	35.51	-1.80	33.71	47.00	-13.29	QP	100	154	
2		820.5500	44.53	-1.35	43.18	47.00	-3.82	QP	100	0	
3	*	834.1300	45.35	-1.18	44.17	47.00	-2.83	QP	100	358	
4		870.0200	41.17	-0.79	40.38	47.00	-6.62	QP	100	350	
5		918.5200	39.82	-0.34	39.48	47.00	-7.52	QP	100	0	
6		979.6300	35.53	0.38	35.91	47.00	-11.09	QP	200	46	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

3.2 CONDUCTED EMISSIONS MEASUREMENT AT AC MAINS POWER PORTS TEST

3.2.1 LIMITS

Table A.9 – Requirements for conducted emissions from the AC mains power ports of Class A equipment

Applicable to 1. AC mains power ports (3.1.1)				
Table clause	**Frequency range MHz**	**Coupling device (see Table A.8)**	**Detector type / bandwidth**	**Class A limits dB(μV)**
A9.1	0,15 to 0,5	AMN	Quasi Peak / 9 kHz	79
	0,5 to 30			73
A9.2	0,15 to 0,5	AMN	Average / 9 kHz	66
	0,5 to 30			60
Apply A9.1 and A9.2 across the entire frequency range.				

Table A.10 – Requirements for conducted emissions from the AC mains power ports of Class B equipment

Applicable to 1. AC mains power ports (3.1.1)				
Table clause	**Frequency range MHz**	**Coupling device (see Table A.8)**	**Detector type / bandwidth**	**Class B limits dB(μV)**
A10.1	0,15 to 0,5	AMN	Quasi Peak / 9 kHz	66 to 56
	0,5 to 5			56
	5 to 30			60
A10.2	0,15 to 0,5	AMN	Average / 9 kHz	56 to 46
	0,5 to 5			46
	5 to 30			50
Apply A10.1 and A10.2 across the entire frequency range.				

NOTE:
(1) The tighter limit applies at the band edges.
(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.
(3) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor (if use)
Margin Level = Measurement Value – Limit Value
Calculation example:

Reading Level (dBμV)		Correct Factor (dB)		Measurement Value (dBμV)
38.22	+	3.45	=	41.67

Measurement Value (dBμV)		Limit Value (dBμV)		Margin Level (dB)
41.67	-	60	=	-18.33

3.2.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	TWO-LINE V-NETWORK	R&S	ENV216	101050	2021/6/10	2022/6/9
2	Test Cable	EMCI	EMCCFD400-NM-NM-5000	151209	2021/12/17	2022/12/16
3	EMI Test Receiver	R&S	ESR	101854	2021/12/6	2022/12/5
4	Measurement Software	Farad	EZ_EMC (Ver. NB-03A1-01)	N/A	N/A	N/A

REMARK:
(1) “N/A” denotes no model name, no serial no. or no calibration specified.
(2) All calibration period of equipment list is one year.

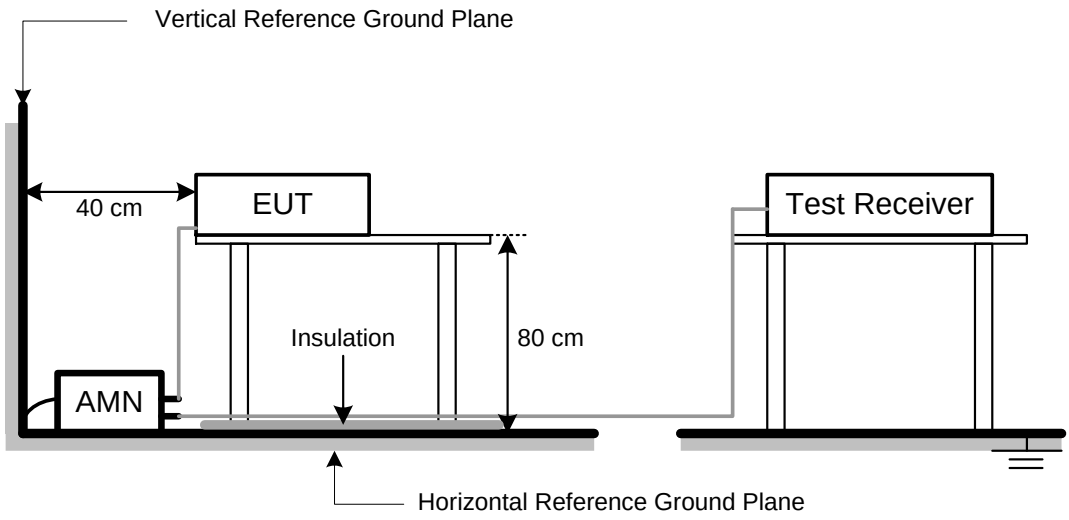
3.2.3 TEST PROCEDURE

a. The EUT was placed 0.8 m above the horizontal ground plane with the EUT being connected to the power mains through an AMN.
   All other support equipment were powered from an additional AMN.
   The AMN provides 50 Ohm/50uH of impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle to keep the cable above 40 cm.
c. Excess I/O cables that are not connected to a peripheral shall be bundled in the center.
   The end of the cable will be terminated, using the correct terminating impedance.
   The overall length shall not exceed 1 m.
d. Cables connecting to AE located outside the measurement area drop directly to, but be insulated from, the RGP (or turntable where applicable), and then be routed directly to the place where they leave the test site. However, cables which would normally be bonded to ground should be bonded to the RGP in accordance with normal practice or the manufacturer’s recommendation.
e. The AMN is spaced at least 80 cm from the nearest part of the EUT chassis.
f. The receiver was set to quasi-peak and average detect function and specified bandwidth with maximum hold mode.
g. For the actual test configuration, please refer to the related Item - TEST PHOTOS.

3.2.4 DEVIATION FROM TEST STANDARD

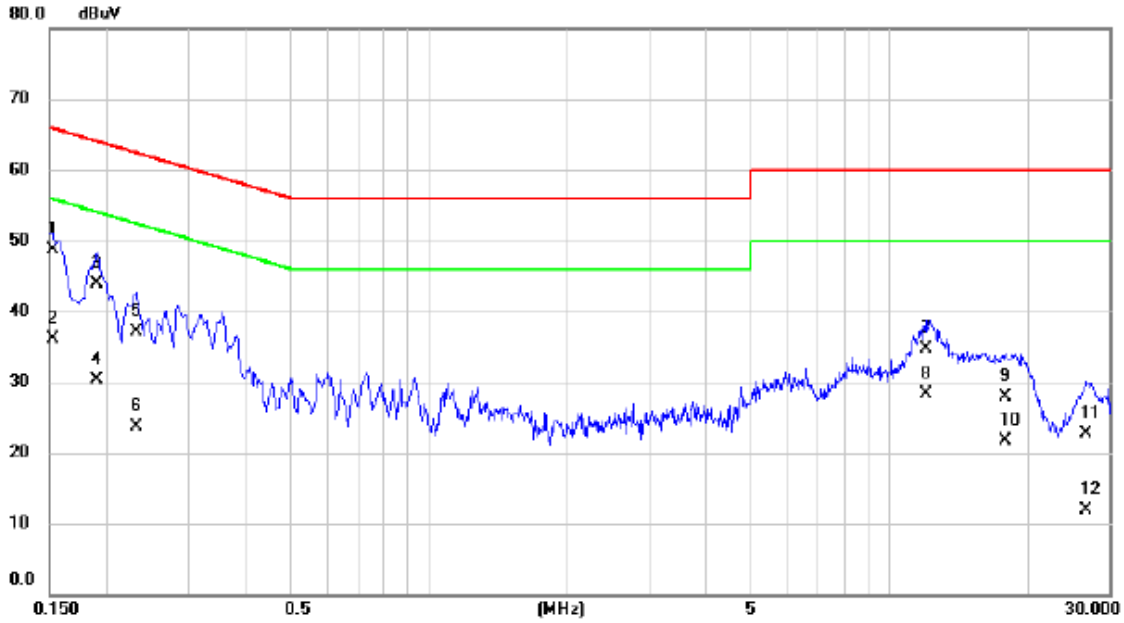
No deviation.

3.2.5 TEST SETUP



3.2.6 TEST RESULT

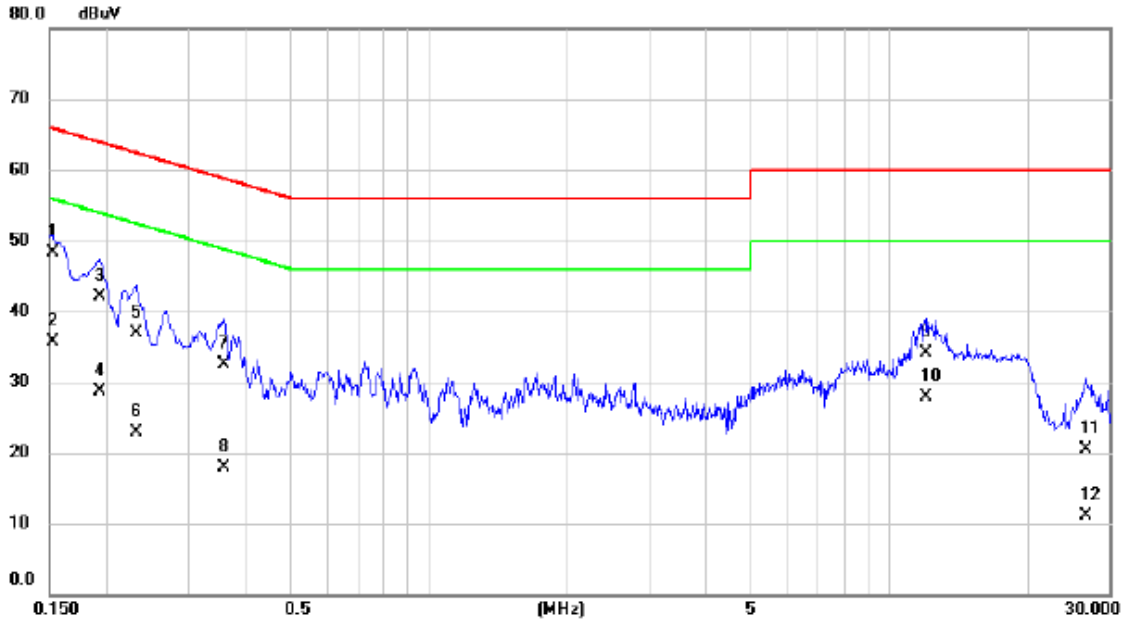
Test Mode	Mode 1	Tested Date	2022/1/4
Test Voltage	AC 230V/50Hz	Phase	Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1522	39.00	9.61	48.61	65.88	-17.27	QP	
2		0.1522	26.50	9.61	36.11	55.88	-19.77	AVG	
3		0.1905	34.30	9.62	43.92	64.01	-20.09	QP	
4		0.1905	20.60	9.62	30.22	54.01	-23.79	AVG	
5		0.2310	27.50	9.62	37.12	62.41	-25.29	QP	
6		0.2310	14.10	9.62	23.72	52.41	-28.69	AVG	
7		11.9805	24.80	9.83	34.63	60.00	-25.37	QP	
8		11.9805	18.40	9.83	28.23	50.00	-21.77	AVG	
9		17.8395	18.10	9.90	28.00	60.00	-32.00	QP	
10		17.8395	11.80	9.90	21.70	50.00	-28.30	AVG	
11		26.7653	12.70	9.97	22.67	60.00	-37.33	QP	
12		26.7653	1.90	9.97	11.87	50.00	-38.13	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	Mode 1	Tested Date	2022/1/4
Test Voltage	AC 230V/50Hz	Phase	Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1522	38.60	9.62	48.22	65.88	-17.66	QP	
2		0.1522	26.00	9.62	35.62	55.88	-20.26	AVG	
3		0.1928	32.50	9.62	42.12	63.92	-21.80	QP	
4		0.1928	19.10	9.62	28.72	53.92	-25.20	AVG	
5		0.2310	27.30	9.62	36.92	62.41	-25.49	QP	
6		0.2310	13.20	9.62	22.82	52.41	-29.59	AVG	
7		0.3592	22.90	9.62	32.52	58.75	-26.23	QP	
8		0.3592	8.30	9.62	17.92	48.75	-30.83	AVG	
9		11.9783	24.20	9.83	34.03	60.00	-25.97	QP	
10		11.9783	18.00	9.83	27.83	50.00	-22.17	AVG	
11		26.6393	10.50	9.96	20.46	60.00	-39.54	QP	
12		26.6393	1.20	9.96	11.16	50.00	-38.84	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

4 IMMUNITY TEST

4.1 STANDARD COMPLIANCE/SEVERITY LEVEL/CRITERION

Environmental phenomenon and Reference Standard	Test Specification	Test Ports	Performance Criteria
Electrostatic discharges EN 61000-4-2 IEC 61000-4-2 (ESD)	±8 kV air discharge ±4 kV contact discharge	Enclosure ports (Direct Mode)	B
	±4 kV HCP discharge ±4 kV VCP discharge	Enclosure ports (Indirect Mode)	B
Continuous RF electromagnetic field disturbances, swept test EN IEC 61000-4-3 IEC 61000-4-3 (RS)	80 MHz to 1000 MHz 3 V/m (unmodulated, rms), 1 kHz, 80 %, AM modulated	Enclosure ports	A
Continuous RF electromagnetic field disturbances, spot test EN IEC 61000-4-3 IEC 61000-4-3 (RS)	1800 MHz ±1 % MHz, 2600 MHz ±1 % MHz, 3500 MHz ±1 % MHz, 5000MHz ±1 % MHz 3 V/m (unmodulated, rms), 1 kHz, 80 %, AM modulated	Enclosure ports	A
Electrical fast transients / burst EN 61000-4-4 IEC 61000-4-4 (EFT/BURST)	±0.5 kV(peak), 5/50 ns Tr/Th 5 kHz Repetition Frequency For CPE xDSL ports repetition frequency is 100 kHz.	Analogue/digital data ports **NOTE (1)**	B
	±0.5 kV(peak), 5/50 ns Tr/Th 5 kHz Repetition Frequency	DC network power ports	B
	±1 kV(peak), 5/50 ns Tr/Th 5 kHz Repetition Frequency	AC mains power ports	B
Surges EN 61000-4-5 IEC 61000-4-5	Port type: unshielded symmetrical Apply: lines to ground		
	Apply where primary protection is intended ±1 kV and ±4 kV, 10/700 (5/320) µs Tr/Th	Analogue/digital data ports **NOTE (1)(3)**	C
	Apply where primary protection is not intended ±1 kV, 10/700 (5/320) µs Tr/Th	Analogue/digital data ports **NOTE (1)(3)**	C
	Port type: coaxial or shielded Apply: shield to ground		
	±0.5 kV, 1.2/50 (8/20) µs Tr/Th	Analogue/digital data ports **NOTE(1)**	B
	Surges are applied line to reference ground for each individual line ±0.5 kV, 1.2/50 (8/20) µs Tr/Th	DC network power ports **NOTE (1)(2)**	B
	Apply between line and line ±1 kV, 1.2/50 (8/20) µs Tr/Th Apply between line and earth (ground) ±2 kV, 1.2/50 (8/20) µs Tr/Th	AC mains power ports	B

Environmental phenomenon and Reference Standard or Clause	Test Specification	Test Ports	Performance Criteria
Continuous induced RF disturbances EN 61000-4-6 IEC 61000-4-6 (CS)	0.15 MHz to 10 MHz, 3 V 10 MHz to 30 MHz, 3 V to 1 V 30 MHz to 80 MHz, 1 V (unmodulated, rms.), 80 % AM (1 kHz)	Analogue/digital data ports **NOTE (1)**	A
	0.15 MHz to 10 MHz, 3 V 10 MHz to 30 MHz, 3 V to 1 V 30 MHz to 80 MHz, 1 V (unmodulated, rms.), 80 % AM (1 kHz)	DC network power ports **NOTE (1)**	A
	0.15 MHz to 10 MHz, 3 V 10 MHz to 30 MHz, 3 V to 1 V 30 MHz to 80 MHz, 1 V (unmodulated, rms.), 80 % AM (1 kHz)	AC mains power ports	A
Power frequency magnetic field EN 61000-4-8 IEC 61000-4-8 (PFMF)	50, 60 Hz, 1 A/m	Enclosure ports	A
Voltage dips and Voltage interruptions EN IEC 61000-4-11 IEC 61000-4-11	Voltage dips Residual voltage <5 %, 0.5 cycles	AC mains power ports	B
	Voltage dips Residual voltage 70 %, 25 cycles for 50 Hz, 30 cycles for 60 Hz	AC mains power ports **NOTE (4)**	C
	Voltage interruptions Residual voltage <5 %, 250 cycles for 50 Hz, 300 cycles for 60 Hz	AC mains power ports **NOTE (4)**	C
Broadband impulse noise disturbances, repetitive 4.2.7	Impulse frequency and Test Level 0.15 MHz to 0.5 MHz, 107 dBµV 0.5 MHz to 10.5 MHz, 107 dBµV to 36 dBµV 10 MHz to 30 MHz, 36 dBµV to 30 dBµV	Analogue/digital data ports **NOTE (1)(5)(6)**	A
	Burst duration and Burst period 0.70 ms 8.3 ms (for 60 Hz) 10 ms (for 50 Hz)		
Broadband impulse noise disturbances, isolated 4.2.7	Impulse frequency and Test Level 0.15 MHz to 30 MHz, 110 dBµV	Analogue/digital data ports **NOTE (1)(5)(7)**	B
	Burst duration 0.24 ms, 10 ms, 300 ms		

NOTE:
(1) Applicable only to ports which, according to the manufacturer's specification, support cable lengths greater than 3 m.
(2) Applicable only to ports which, according to the manufacturer's specification, may connect directly to outdoor cables.
(3) Where the surge coupling network for the 10/700 (5/320) µs waveform affects the functioning of high speed data ports, the test shall be carried out using a 1,2/50 (8/20) µs waveform and appropriate coupling network.
(4) Apply at only one supply frequency of the MME.
(5) Applicable only to CPE xDSL ports.
(6) Apply period based on the AC mains frequency.
(7) Apply all burst durations.

4.2 GENERAL PERFORMANCE CRITERIA

According to EN 55035 standard, the general performance criteria as following:

Criterion A (Clause 8.2)	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.
Criterion B (Clause 8.3)	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.
Criterion C (Clause 8.4)	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.

4.3 ELECTROSTATIC DISCHARGE IMMUNITY TEST (ESD)

4.3.1 TEST SPECIFICATION

Reference Standard	EN 61000-4-2 / IEC 61000-4-2
Discharge Impedance	330 ohm / 150 pF
Required Performance Criterion	B
Discharge Voltage	Air Discharge: ±2 kV, ±4 kV, ±8 kV Contact Discharge: ±4 kV
Polarity	Positive & Negative
Number of Discharge	Minimum 20 times at each test point
Discharge Mode	Single Discharge
Discharge Period	1 s minimum

4.3.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	ESD Simulator	TESEQ	NSG 437	1446	2021/9/2	2022/9/1

REMARK:
(1) “N/A” denotes no model name, no serial no. or no calibration specified.
(2) All calibration period of equipment list is one year.

4.3.3 TEST PROCEDURE

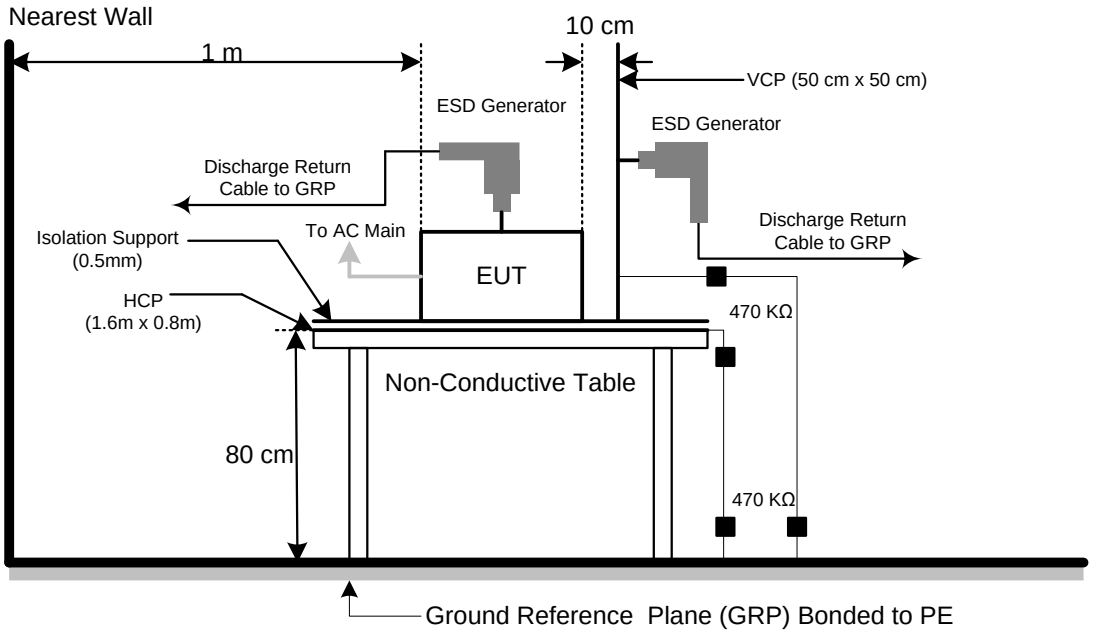
The configuration consisted of a wooden table 0.8 m high standing on the Ground Reference Plane. The GRP consisted of a sheet of aluminum at least 0.25 mm thick, and 2.5 m square connected to the protective grounding system. A Horizontal Coupling Plane (1.6 m x 0.8 m) was placed on the table and attached to the GRP by means of a cable with 940k total impedance. The equipment under test was installed in a representative system as described in EN 61000-4-2, and its cables were placed on the HCP and isolated by an insulating support of 0.5 mm thickness. A distance of 1 m minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.
The test generator necessary to perform direct and indirect application of discharges to the EUT in the following manner:

a. The test shall be performed with single discharges. On each pre-selected point at least 10 single discharges (in the most sensitive polarity) shall be applied.
   NOTE 1 The minimum number of discharges applied is depending on the EUT; for products with synchronized circuits the number of discharges should be larger.
   For the time interval between successive single discharges an initial value of 1 s is recommended. Longer intervals may be necessary to determine whether a system failure has occurred.
   NOTE 2 The points to which the discharges should be applied may be selected by means of an exploration carried out at a repetition rate of 20 discharges per second, or more.
   Vertical Coupling Plane (VCP):
   The coupling plane, of dimensions 0.5 m x 0.5 m, is placed parallel to, and positioned at a distance 0.1 m from, the EUT, with the Discharge Electrode touching the coupling plane.
   The four faces of the EUT will be performed with electrostatic discharge.
   Horizontal Coupling Plane (HCP):
   The coupling plane is placed under to the EUT. The generator shall be positioned vertically at a distance of 0.1 m from the EUT, with the Discharge Electrode touching the coupling plane.
   The four faces of the EUT will be performed with electrostatic discharge.
b. Air discharges at insulation surfaces of the EUT.
   It was at least ten single discharges with positive and negative at the same selected point.

4.3.4 DEVIATION FROM TEST STANDARD

No deviation.

4.3.5 TEST SETUP



4.3.6 TEST RESULT

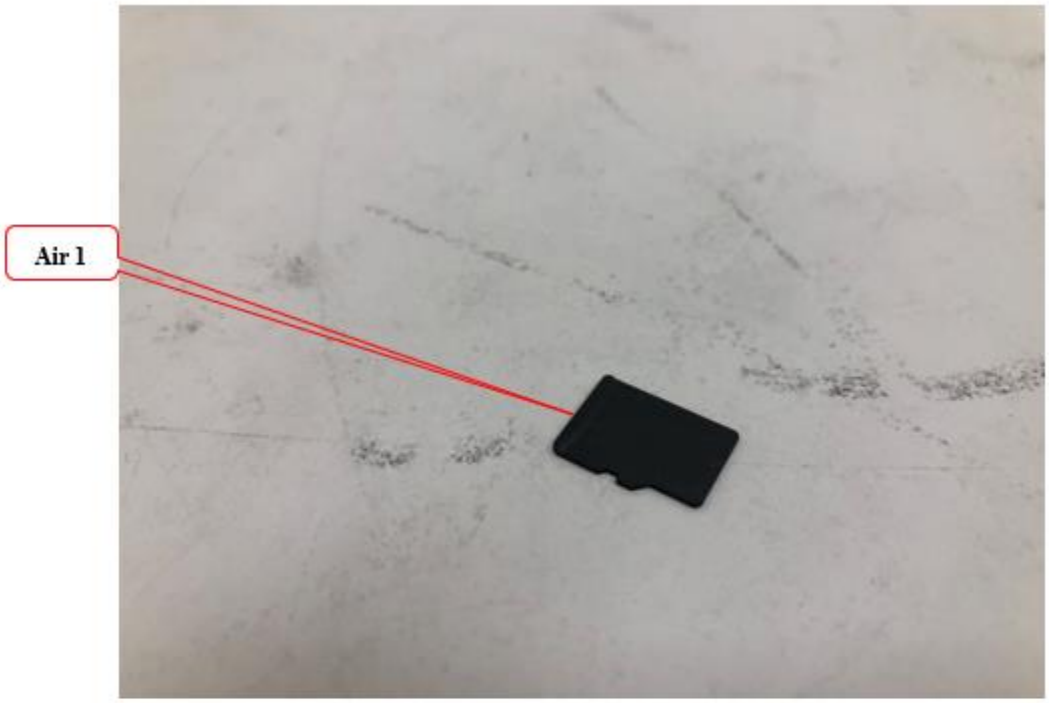
Test Mode	Mode 1		
Test Voltage	AC 230V/50Hz	Test Date	2022/1/4

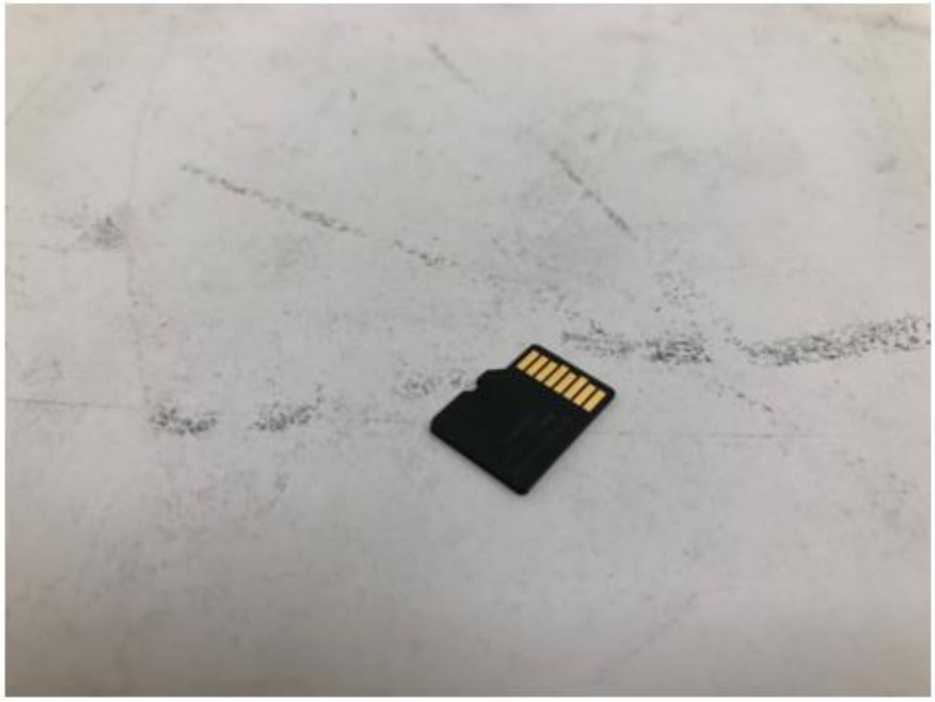
Mode	Air Discharge								Contact Discharge							
Level	2 kV		4 kV		8 kV		15 kV		4 kV		6 kV		8 kV		10 kV	
Location	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N
1	A	A	A	A	A	A	-	-	-	-	-	-	-	-	-	-
Perform Criterion	B						-		-		-					
Result	A						-		-		-					
Judgment	PASS						-		-		-					

Mode	HCP Discharge								VCP Discharge							
Level	4 kV		6 kV		8 kV		10 kV		4 kV		6 kV		8 kV		10 kV	
Location	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N
1	A	A	-	-	-	-	-	-	A	A	-	-	-	-	-	-
2	A	A	-	-	-	-	-	-	A	A	-	-	-	-	-	-
3	A	A	-	-	-	-	-	-	A	A	-	-	-	-	-	-
4	A	A	-	-	-	-	-	-	A	A	-	-	-	-	-	-
Perform Criterion	B		-						B		-					
Result	A		-						A		-					
Judgment	PASS		-						PASS		-					

NOTE:
(1) “P/N” denotes the Positive (P) or Negative (N) polarity of the output voltage.
(2) The Indirect (HCP/VCP) discharges description of test point as following:
1. left side; 2.right side; 3.front side; 4.rear side.
(3) ”N/A” denotes test is not applicable in device.
(4) Test location(s) in which discharge (Air and contact discharge) to be applied illustrated by photos shown in next page(s).

Photo(s) shown the location(s) of ESD evaluated





4.4 RADIATED, RADIO-FREQUENCY, ELECTROMAGNETIC FIELD IMMUNITY TEST (RS)

4.4.1 TEST SPECIFICATION

Reference Standard	EN IEC 61000-4-3 / IEC 61000-4-3
Required Performance Criterion	A
Frequency Range	80 MHz to 1000 MHz 1800 MHz ±1 % MHz, 2600 MHz ±1 % MHz, 3500 MHz ±1 % MHz, 5000 MHz ±1 % MHz
Field Strength	3 V/m (unmodulated, rms)
Modulation	1 kHz Sine Wave, 80 %, AM Modulation
Frequency Step	1 % of fundamental
Polarity of Antenna	Horizontal and Vertical
Test Distance	3 m
Antenna Height	1.15 m
Dwell Time	at least 3 s

4.4.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Readout Unit	WAVECONTROL	SMP2	20SN1431	2021/2/9	2022/2/8
2	E-Field Probe	WAVECONTROL	WPF8	20WP041180	2021/2/9	2022/2/8
3	Signal Generator	R&S	SMT06	832080/007	2021/6/10	2022/6/9
4	Antenna	AR	ATL80M1G	0356579	N/A	N/A
5	Power Amplifier	AR	250W1000AM1	326727	N/A	N/A
6	Antenna	SCHWARZBECK	STLP 9149	413	N/A	N/A
7	Power Amplifier	MILMEGA	AS0860B-50/50	1075970	N/A	N/A
8	RF Power Meter	BOONTON	4232A	10179	2021/3/16	2022/3/15
9	Power Sensor	BOONTON	51075A	36855	2021/3/16	2022/3/15
10	Power Sensor	BOONTON	51075A	36856	2021/3/16	2022/3/15
11	Measurement Software	AUDIX	i2 (Ver. 5.161006)	N/A	N/A	N/A

REMARK:
(1) “N/A” denotes no model name, no serial no. or no calibration specified.
(2) All calibration period of equipment list is one year.

4.4.3 TEST PROCEDURE

The testing was performed in a fully-anechoic chamber.
The testing distance from antenna to the EUT was 3 m.

The EUT installed in a representative system as described in EN IEC 61000-4-3 / IEC 61000-4-3 was placed on a non-conductive table 0.8 m in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

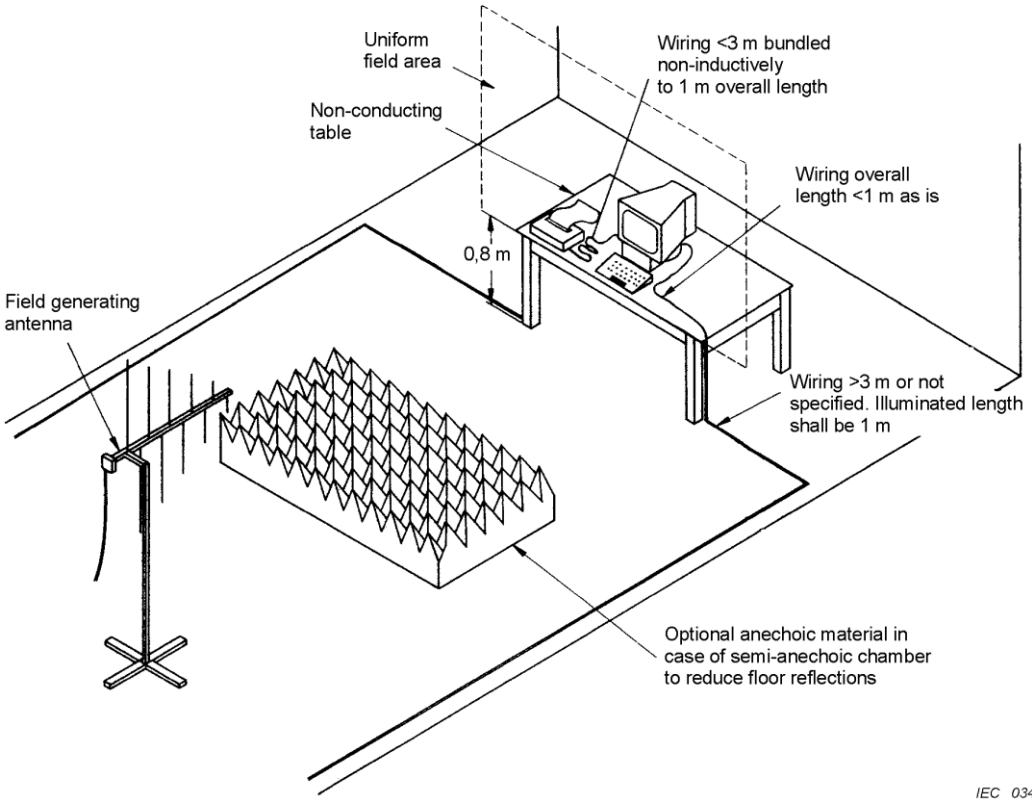
The other condition as following manner:

a. The field strength is 3 V/m (unmodulated, rms).
b. The frequency ranges are swept from 80 MHz to 1000 MHz, 1800 MHz ±1 % MHz, 2600 MHz ±1 % MHz, 3500 MHz ±1 % MHz and 5000 MHz ±1 % MHz with the signal 80 % amplitude modulated with a 1 kHz sine wave. The rate of sweep did not exceed 1.5 x 10^{-3} decade/s. Where the frequency range is swept incrementally, the step size was 1 % of fundamental.
c. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
d. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

4.4.4 DEVIATION FROM TEST STANDARD

No deviation.

4.4.5 TEST SETUP



4.4.6 TEST RESULT

Test Mode	Mode 1		
Test Voltage	AC 230V/50Hz	Test Date	2022/1/5

Frequency (MHz)	Applied Voltage(V/m) – 80% AM 1kHz	Polarity	Azimuth	Criterion	Observation	Result
80~1000	3	V & H	Rear	A	A	PASS
			Front		A	
			Left		A	
			Right		A	

Frequency (MHz)	Applied Voltage(V/m) – 80% AM 1kHz	Polarity	Azimuth	Criterion	Observation	Result
1800±1% 2600±1% 3500±1% 5000±1%	3	V & H	Rear	A	A	PASS
			Front		A	
			Left		A	
			Right		A	

NOTE:
(1) ”N/A” denotes test is not applicable in device.

4.5 POWER FREQUENCY MAGNETIC FIELD IMMUNITY TEST (PFMF)

4.5.1 TEST SPECIFICATION

Reference Standard	EN 61000-4-8 / IEC 61000-4-8
Required Performance Criterion	A
Frequency Range	50 or 60 Hz
Field Strength	1 A/m
Observation Time	1 minute
Inductance Coil	Rectangular type, 1 m x 1 m

4.5.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Magnetic Field Test Generator	FCC	F-1000-4-8-G-125A	04029	N/A	N/A
2	Magnetic Field Immunity Loop	FCC	F-1000-4-8/9/10-L-1M	04018	N/A	N/A
3	EMF Tester	TES	TES-1390	190405289	2021/6/15	2022/6/14

REMARK:
(1) “N/A” denotes no model name, no serial no. or no calibration specified.
(2) All calibration period of equipment list is one year.

4.5.3 TEST PROCEDURE

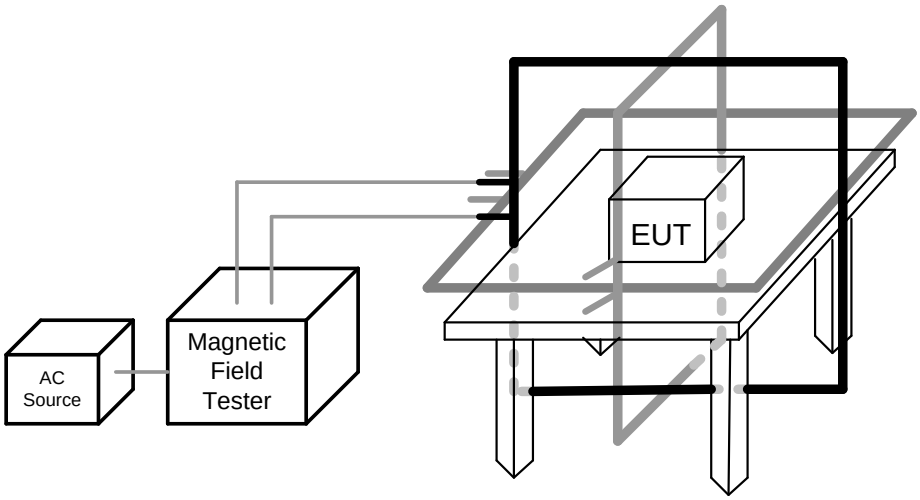
The equipment shall be subjected to the test magnetic field by using the induction coil of standard dimension (1 m x 1 m). The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.

The other condition as following manner:
a. The equipment cabinets shall be connected to the safety earth directly on the GRP via the earth terminal of the EUT.
b. The cables supplied or recommended by the equipment manufacturer shall be used. 1 m of all cables used shall be exposed to the magnetic field.

4.5.4 DEVIATION FROM TEST STANDARD

No deviation.

4.5.5 TEST SETUP



4.5.6 TEST RESULT

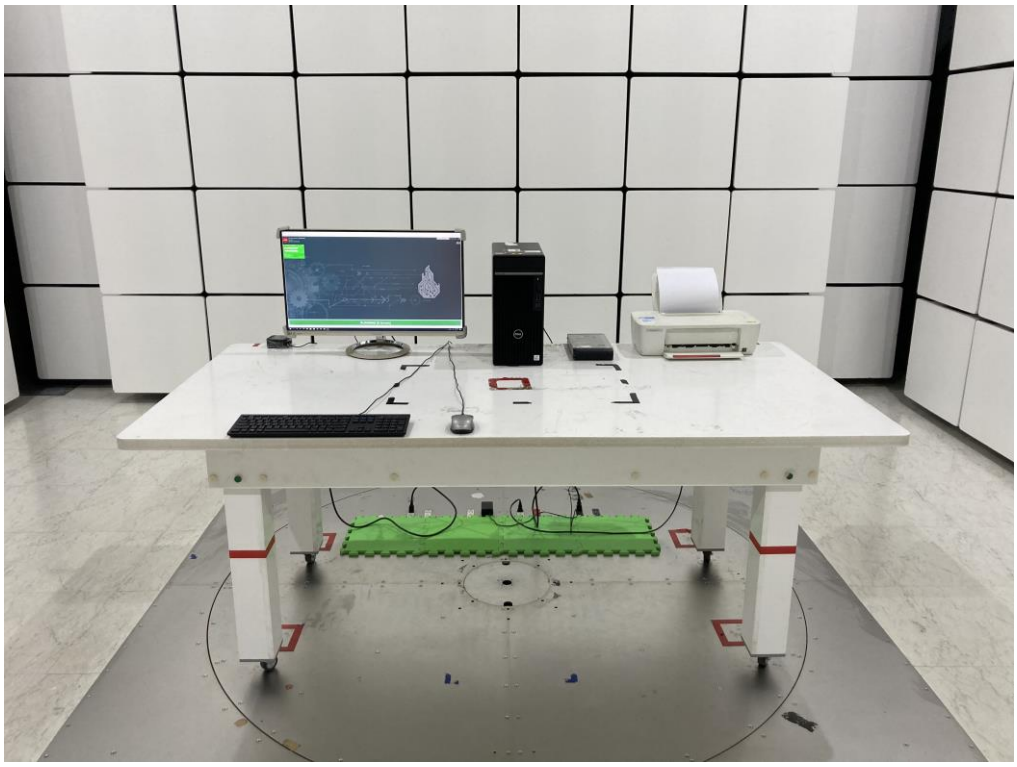
Test Mode	Mode 1		
Test Voltage	AC 230V/50Hz	Test Date	2022/1/5

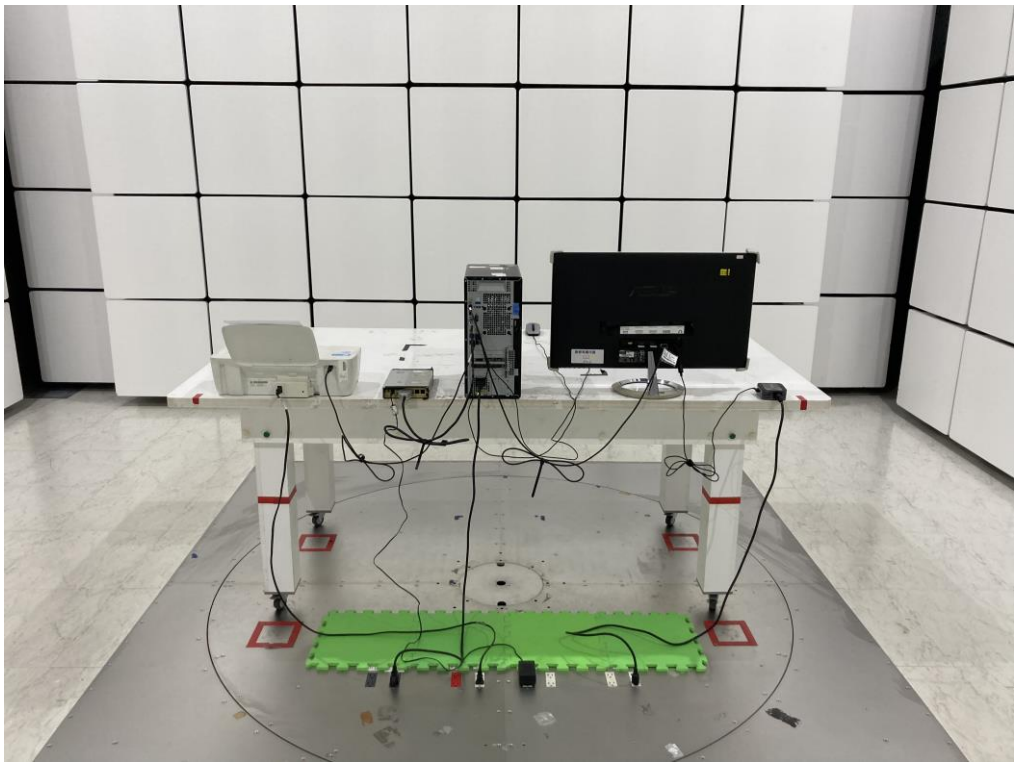
Test Frequency (Hz)	Magnetic Field (A/m)	Direction	Criterion	Observation	Result
50	1	X Y Z	A	A	PASS
60	1	X Y Z	A	A	PASS

NOTE:
(1) "N/A" denotes test is not applicable in device.

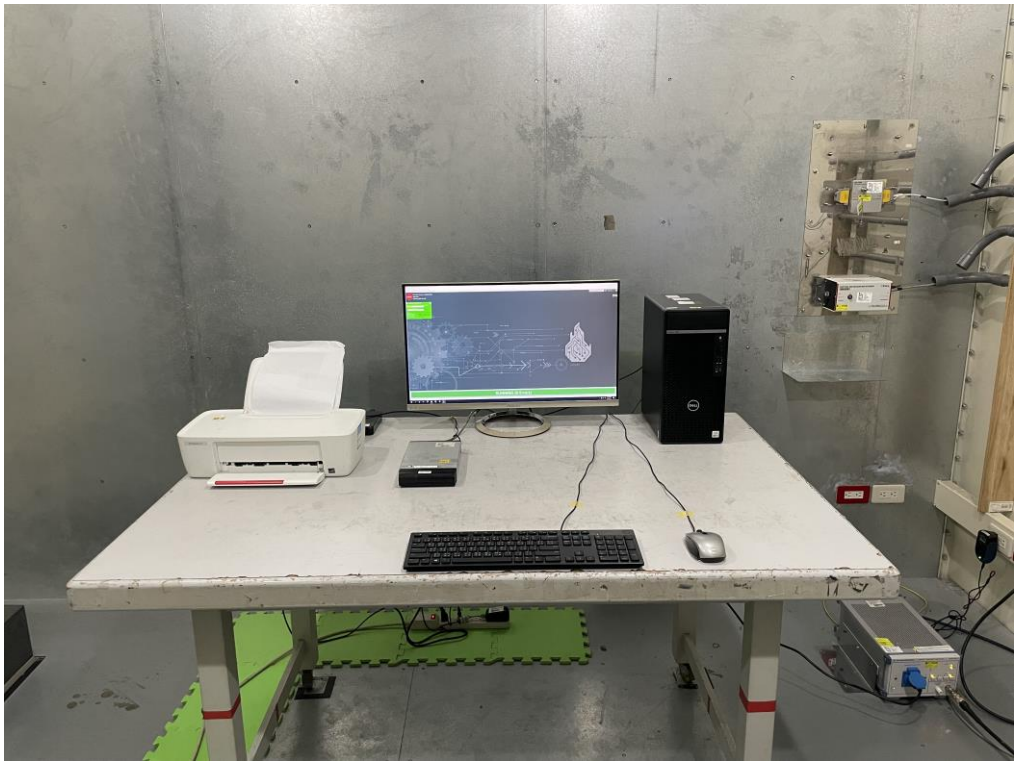
5 TEST PHOTOS

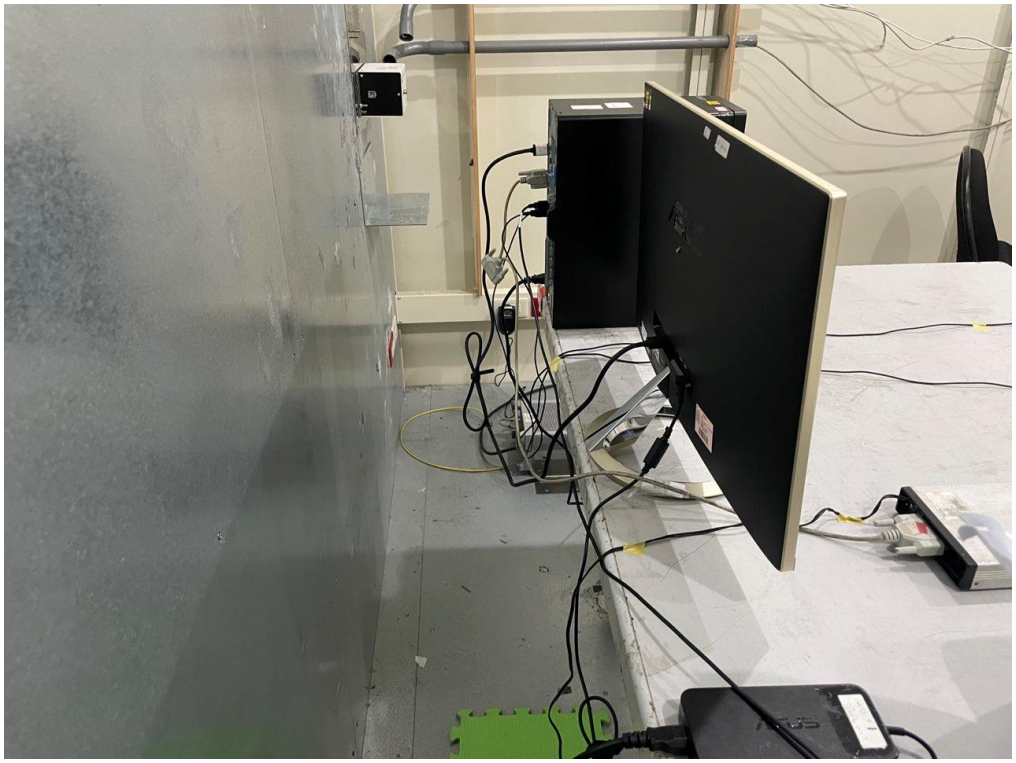
Radiated emissions up to 1 GHz test photos





Conducted emissions AC mains power port test photos

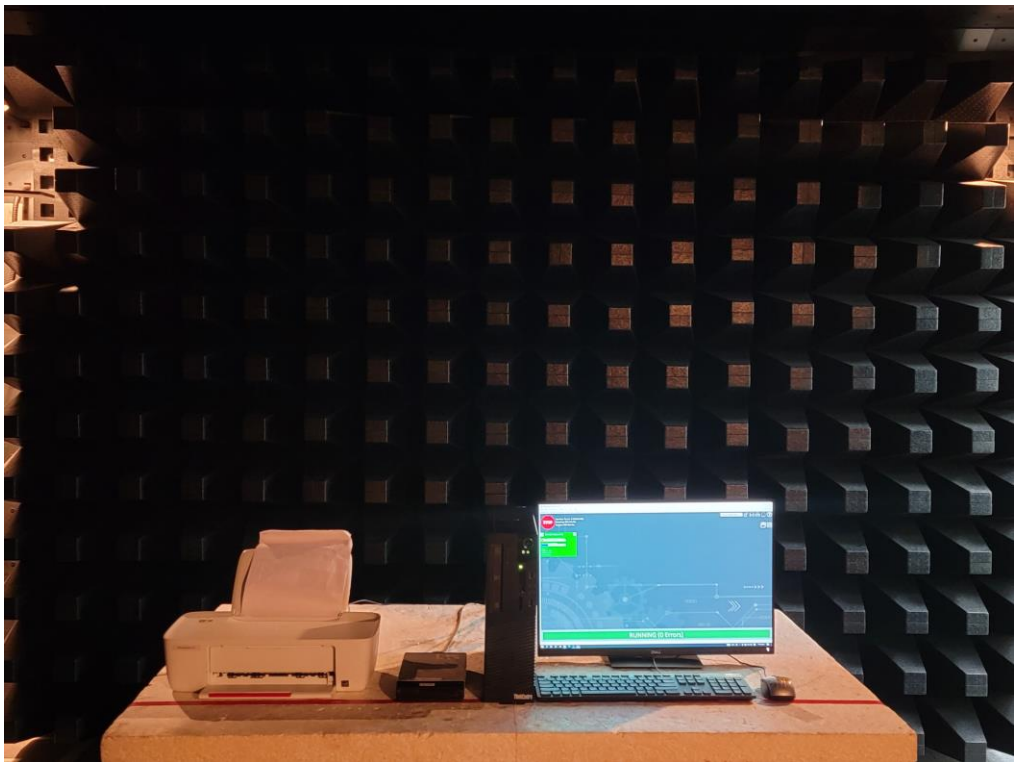




Immunity test photos

Electrostatic discharge immunity

Radiated, radio-frequency, electromagnetic field immunity



Power frequency magnetic field immunity

6 EUT PHOTOS

Please refer to document Appendix No.: EP-2311T005-1 (APPENDIX-EUT PHOTOS).

End of Test Report