

## CE EMC Test Report

**Report No.:** CEBDBO-WTW-P20070557

**Test Model:** EXBC-2000S-8665U

**Series Model:** EXBC-2XXXXXXXXXXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)

**Received Date:** Jul. 28, 2020

**Test Date:** Jul. 30 ~ Aug. 05, 2020

**Issued Date:** Aug. 19, 2020

**Applicant:** Vecow Co., Ltd.

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**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch  
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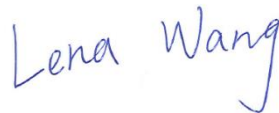
### Release Control Record

Issue No.	Description	Date Issued
CEBDBO-WTW-P20070557	Original Release	Aug. 19, 2020

## 1 Certificate of Conformity

**Product:** EXBC-2000 Series  
**Brand:** Vecow  
**Test Model:** EXBC-2000S-8665U  
**Series Model:** EXBC-2XXXXXXXXXXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)  
**Sample Status:** Engineering Sample  
**Applicant:** Vecow Co., Ltd.  
**Test Date:** Jul. 30 ~ Aug. 05, 2020  
**Standards:** **EN 55032:2015 +AC:2016, Class A**  
**EN 61000-3-2:2014, Class D**  
**EN 61000-3-3:2013**  
**EN 55024:2010**  
**EN 55024:2010 +A1:2015**  
EN 61000-4-2:2009 / IEC 61000-4-2:2008 ED.2.0  
EN 61000-4-3:2006 +A1:2008 +A2:2010 / IEC 61000-4-3:2010 ED. 3.2  
EN 61000-4-4:2012 / IEC 61000-4-4:2012 ED. 3.0  
EN 61000-4-5:2014 +A1:2017 / IEC 61000-4-5:2014 +A1:2017 ED. 3.0  
EN 61000-4-6:2014 +AC:2015 / IEC 61000-4-6:2013 ED.4.0  
EN 61000-4-8:2010 / IEC 61000-4-8:2009 ED. 2.0  
EN 61000-4-11:2004 +A1:2017 / IEC 61000-4-11:2004 +A1:2017 ED. 2.0

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by :  , Date: Aug. 19, 2020  
Lena Wang / Specialist

Approved by :  , Date: Aug. 19, 2020  
Carl Chen / Project Engineer

## 2 Summary of Test Results

Emission				
Standard	Clause	Test Item	Result/Remarks	Verdict
EN 55032:2015 +AC:2016	A.3	Mains terminal disturbance voltage	Minimum passing Class A margin is -24.57 dB at 1.17000 MHz	Pass
EN 55032:2015 +AC:2016	A.3	Asymmetric mode conducted emission at wired network ports	Minimum passing Class A margin is -9.68 dB at 0.47800 MHz	Pass
EN 55032:2015 +AC:2016	A.2	Radiated disturbance 30-1000 MHz	Minimum passing Class A margin is -6.38 dB at 181.91 MHz	Pass
EN 55032:2015 +AC:2016	A.2	Radiated disturbance above 1 GHz	Minimum passing Class A margin is -21.45 dB at 2632.28 MHz	Pass
EN 61000-3-2:2014	-	Harmonic current emissions	Class D The power consumption of EUT is less than 75W and no limits apply.	Pass
EN 61000-3-3:2013	-	Voltage fluctuations and flicker	$P_{st} \leq 1.0$ $d_{max} \leq 4 \%$ $P_{It} \leq 0.65$ $d_c \leq 3.3 \%$ $T_{max} \leq 500 \text{ ms}$	Pass

Immunity				
EN 55024 Clause	Basic standard	Test Item	Result/Remarks	Verdict
4.2.1	EN 61000-4-2:2009 / IEC 61000-4-2:2008 ED. 2.0	Electrostatic discharges (ESD)	Performance Criterion B	Pass
4.2.3.2	EN 61000-4-3:2006 +A1:2008 +A2:2010 / IEC 61000-4-3:2010 ED. 3.2	Continuous radiated disturbances (RS)	Performance Criterion A	Pass
4.2.2	EN 61000-4-4:2012 / IEC 61000-4-4:2012 ED. 3.0	Electrical fast transients (EFT)	Performance Criterion A	Pass
4.2.5	EN 61000-4-5:2014 +A1:2017 / IEC 61000-4-5:2014 +A1:2017 ED. 3.0	Surges	Performance Criterion A	Pass
4.2.3.3	EN 61000-4-6:2014 +AC:2015 / IEC 61000-4-6:2013 ED. 4.0	Continuous conducted disturbances (CS)	Performance Criterion A	Pass
4.2.4	EN 61000-4-8:2010 / IEC 61000-4-8:2009 ED. 2.0	Power-frequency magnetic fields (PFMF)	Performance Criterion A	Pass
4.2.6	EN 61000-4-11:2004 +A1:2017 / IEC 61000-4-11:2004 +A1:2017 ED. 2.0	Voltage dips and interruptions	Voltage Dips: >95 % reduction – 0.5 period, Performance Criterion A 30 % reduction – 25 periods, Performance Criterion A Voltage Interruptions: >95 % reduction – 250 periods, Performance Criterion C	Pass

Note:

1. There is no deviation to the applied test methods and requirements covered by the scope of this report.

2. The above EN / IEC basic standards are applied with latest version if customer has no special requirement.
3. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

## 2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Expanded Uncertainty (k=2) ( $\pm$ )	Maximum allowable uncertainty ( $\pm$ )
Conducted disturbance at mains port using AMN, 150 kHz ~ 30 MHz	2.79 dB	3.4 dB ( $U_{\text{CISPR}}$ )
Asymmetric mode conducted emission using AAN, 150 kHz ~ 30 MHz	4.29 dB	5.0 dB ( $U_{\text{CISPR}}$ )
Radiated disturbance, 30 MHz ~ 1 GHz	4.14 dB	6.3 dB ( $U_{\text{CISPR}}$ )
Radiated disturbance, 1 GHz ~ 6 GHz	5.04 dB	5.2 dB ( $U_{\text{CISPR}}$ )

## 2.2 Modification Record

There were no modifications required for compliance.



### 3 General Information

#### 3.1 General Description of EUT

Product	EXBC-2000 Series
Brand	Vecow
Test Model	EXBC-2000S-8665U
Series Model	EXBC-2XXXXXXXXXXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)
Model Difference	Refer to Note as below
Status of EUT	Engineering Sample
Operating Software	N/A
Power Supply Rating	24 Vdc (Adapter)
Accessory Device	Refer to Note as below
Data Cable Supplied	1.5m non-shielded DC cable with 1 core

Note:

1. This report issued as a duplicate report to BV CPS report no. CEBDBO-WTW-P20070556. The difference compared with original report is changing model name and product name. The change is no effect on any test items, therefore the original test result is kept
2. All models are listed as below.

Brand	Model	Difference
Vecow	EXBC-2000S-8665U	All models are electrically identical, different model names are for marketing purpose.
	EXBC-2XXXXXXXXXXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)	

3. The EUT is authorized for use in specific End-product. Please refer to below table for more details.

Brand	Model	Difference
Vecow	ABP-3000-8665U	All models are electrically identical, different model names are for marketing purpose.
	ABP-3XXXXXXXXXXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)	

4. The following accessory was for the End-product.

Product	Brand	Model	Description
Adapter	FSP	FSP120-AAAN2	I/P: 100-240 Vac, 50-60 Hz, 1.8 A O/P: 24 Vdc, 5 A 1.5 m non-shielded DC cable with 1 core
CPU	Intel	i7-8665UE	Intel Core i7-8665UE @ 1.70GHz
Memory 1	Vecow	VMD4NIT-08G00A	8GB DDR4-2666-19 SODIMM WT
Memory 2	Vecow	VMD4NIT-16G00A	16GB DDR4-2666-19 SODIMM WT
M.2	UD info	N/A	960GB
Motherboard	Vecow	EXBC-2000S-8665U	--

#### 3.2 Features of EUT

The tests reported herein were performed according to the method specified by Vecow Co., Ltd., for detailed feature description, please refer to the manufacturer's specifications or user's manual.

### 3.3 Operating Modes of EUT and Determination of Worst Case Operating Mode

The EUT is designed with AC power of rating 100-240 Vac, 50/60 Hz.

EUT has been pre-tested under following test modes, and test mode 1 was the worst case for final test.

Mode	Test Condition
1	EUT + Full System + LAN 1 & 2 (1Gbps) Link + POE LAN 3 & 4 to CCD (100Mbps) Link + DP 1 & 2 (3840*2160) + USB to HDD R/W + Adapter, 230V/50Hz
2	EUT + Full System + LAN 1 & 2 (1Gbps) Link + POE LAN 3 & 4 to CCD (100Mbps) Link + DP 1 & 2 (3840*2160) + USB to HDD R/W + Adapter, 110V/60Hz
3	EUT + Full System + LAN 1 & 2 (1Gbps) Link + POE LAN 3 & 4 to CCD (100Mbps) Link + DP 1 & 2 (2560*2048) + USB to HDD R/W + Adapter
4	EUT + Full System + LAN 1 & 2 (1Gbps) Link + POE LAN 3 & 4 to CCD (100Mbps) Link + DP 1 & 2 (1920*1080) + USB to HDD R/W + Adapter
5	EUT + Full System + LAN Idle + POE LAN 3 & 4 to CCD Idle + DP 1 & 2 (3840*2160) + USB to HDD R/W + Adapter

Test modes are presented in the report as below.

Mode	Test Condition
Conducted emission test	
-	EUT + Full System + LAN 1 & 2 (1Gbps) Link + POE LAN 3 & 4 to CCD (100Mbps) Link + DP 1 & 2 (3840*2160) + USB to HDD R/W + Adapter
Asymmetric mode conducted emission at wired network ports test	
-	EUT + Full System + LAN 1 & 2 (1Gbps) Link + POE LAN 3 & 4 to CCD (100Mbps) Link + DP 1 & 2 (3840*2160) + USB to HDD R/W + Adapter
The idle mode of conducted emission test at telecom port was pre-tested based on the worst case of link mode. Due to emissions of idle mode being very low compared to link mode, only the link mode data were presented in the test report.	
Radiated emission test	
-	EUT + Full System + LAN 1 & 2 (1Gbps) Link + POE LAN 3 & 4 to CCD (100Mbps) Link + DP 1 & 2 (3840*2160) + USB to HDD R/W + Adapter
Harmonics, Flicker, Immunity tests	
-	EUT + Full System + LAN 1 & 2 (1Gbps) Link + POE LAN 3 & 4 to CCD (100Mbps) Link + DP 1 & 2 (3840*2160) + USB to Flash R/W + Adapter

### 3.4 Test Program Used and Operation Descriptions

#### <Emission Tests>

- The EUT powered by adapter and placed on the test table.
- The EUT linked with Notebook via LAN cable.
- The camera powered by EUT through LAN.
- The EUT sent audio signal to the earphone / Microphone.
- The EUT read and wrote data with HDD via USB Cable.
- The EUT sent "ITU-R BT 471-1" patterns to monitors, and monitors displayed them via DP Cable.
- The EUT linked with Mouse and Keyboard via USB cable.
- The EUT linked with TERMINAL.
- The EUT communicated data with the Notebooks, which acted as communication partners.

### <Immunity Tests>

- a. The EUT powered by adapter and placed on the test table.
- b. The EUT linked with Notebook via LAN cable.
- c. The camera powered by EUT through LAN.
- d. The EUT sent audio signal to the earphone.
- e. The EUT read and wrote data with Flash.
- f. The EUT sent "H" patterns to monitors, and monitors displayed them via DP Cable.
- g. The EUT linked with Mouse and Keyboard via USB cable.
- h. The EUT linked with TERMINAL.
- i. The EUT communicated data with the Notebooks, which acted as communication partners.

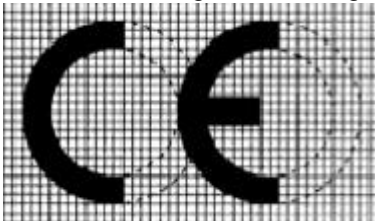
### 3.5 Primary Clock Frequencies of Internal Source

The highest frequency generated or used within the EUT or on which the EUT operates or tunes is 1.9 GHz, provided by Vecow Co., Ltd., for detailed internal source, please refer to the manufacturer's specifications.

### 3.6 Miscellaneous

#### ➤ Affix CE marking

The marking must be placed visibly and legibly on the product or, if not possible due to the nature of the product, be affixed to the packaging and the accompanying document. The CE marking shall consist of the initials 'CE' taking the following form:



The various components of the CE marking must have the same vertical dimension, and may not be smaller than 5 mm. If the CE marking is reduced or enlarged, the proportions given in the graduated drawing above must be respected.

When the product is subject to other Directives covering other aspects and which also provide for the 'CE' marking, the accompanying documents must indicate that the product also conforms to those other Directives.

However, when one or more of those Directives allow the manufacturer, during a transitional period, to choose which arrangements to apply, the 'CE' marking has to indicate conformity only with the Directives applied by the manufacturer. In this case, the particularities of the Directives applied, as published in the Official Journal of the European Union, must be given in the documents, notices or instructions required by the Directives and accompanying such products.

#### ➤ EN 55032 Class A Warning

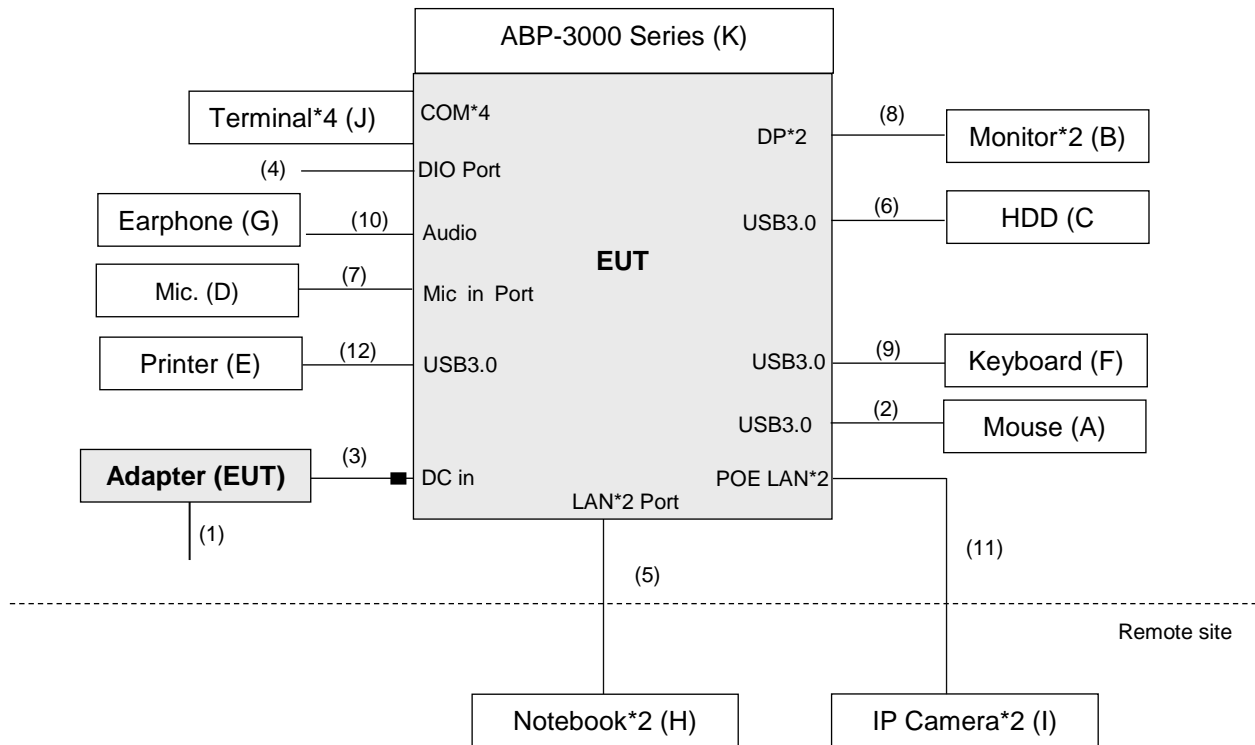
Class A ITE is a category of all other ITE which satisfies the class A ITE limits but not the class B ITE limits. The following warning shall be included in the instructions for use:

Warning: This equipment is compliant with Class A of EN 55032. In a residential environment this equipment may cause radio interference.

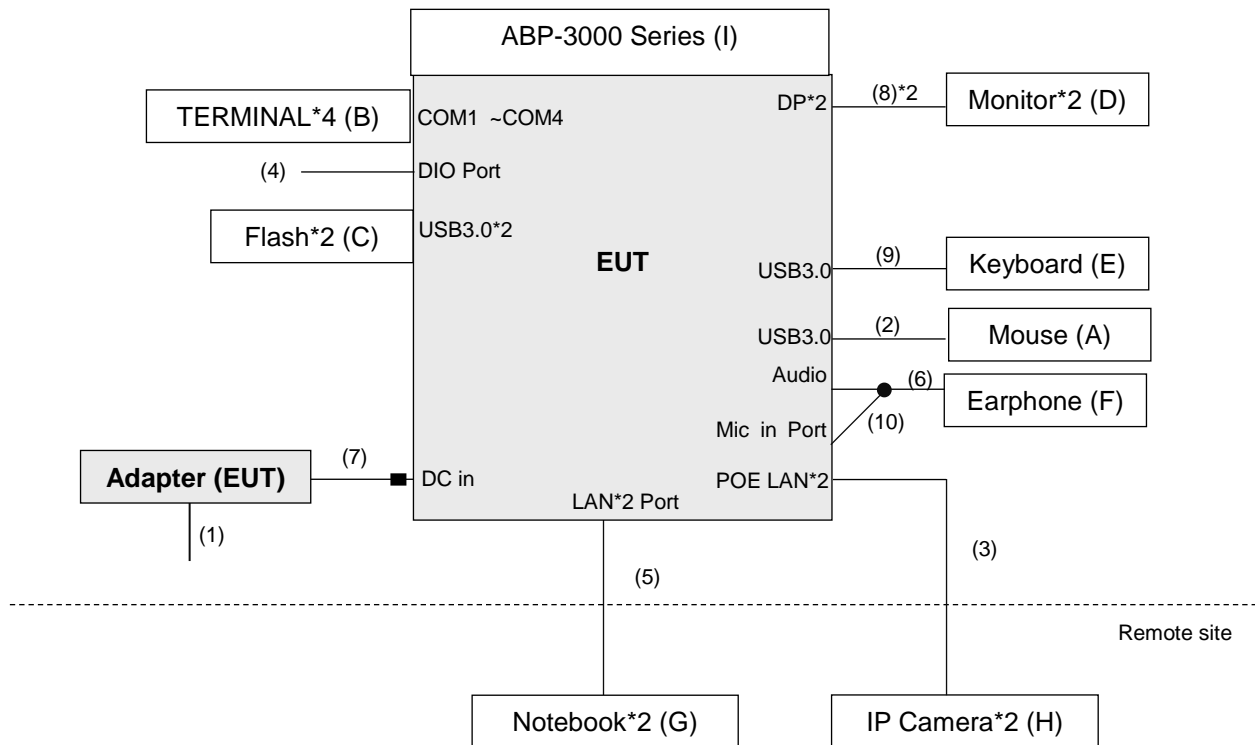
## 4 Configuration and Connections with EUT

### 4.1 Connection Diagram of EUT and Peripheral Devices

Emission tests (Harmonics & Flicker excluded):



Harmonics, Flicker, Immunity tests:



## 4.2 Configuration of Peripheral Devices and Cable Connections

Emission tests (Harmonics & Flicker excluded):

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Mouse	DELL	MOCZUL	CN-049TWY-PRC00-79E-02FW	N/A	--
B.	Monitor	ASUS	MX27U	H3LMRS034164	N/A	--
				J3LMRS000059	N/A	--
C.	3.0 HDD	TOSHIBA	DTB305	45TGCNNST3ZB	N/A	--
D.	MICROPHONE	Labtec	LVA7313	N/A	N/A	--
E.	Printer	EPSON	T22	MEEZ070220	N/A	--
F.	Keyboard	Dell	KB216t	CN-0W33XP-LO300-79R-OUG6-A03	N/A	--
G.	Earphone	PHILIPS	SBC HL150	NA	N/A	
H.	Notebook	DELL	E6440	6QLNM32	N/A	--
		DELL	E6440	FMLNM32	N/A	
I.	IP Camera*2	N/A	N/A	N/A	N/A	Provided by client
J.	TERMINAL*4	N/A	N/A	N/A	N/A	Provided by client
K.	ABP-3000 Series	Vecow	ABP-3000-8665U	N/A	N/A	Provided by client

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Items H acted as communication partners to transfer data.

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	AC Power Cable	1	1.8	N	0	--
2.	Mouse Cable	1	1.8	Y	0	--
3.	DC Cable	1	1.5	N	1	Provided by client
4.	DIO Cable	1	0.5	N	0	Provided by client
5.	LAN Cable	2	10	N	0	RJ45, Cat5e
6.	3.0 HDD Cable	2	0.5	Y	0	--
7.	Mic Cable	1	1.5	N	0	--
8.	DP Cable	2	1.8	Y	0	--
9.	Keyboard Cable	1	1.8	Y	0	--
10.	Earphone Cable	1	1.2	N	0	--
11.	LAN Cable	2	10	N	0	RJ45, Cat5e
12.	USB Cable	1	1.8	Y	0	--

Note:

1. The core(s) is(are) originally attached to the cable(s).
2. The test condition of setup was according to manufacturer's requirement.

**Harmonics, Flicker, Immunity tests:**

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Mouse	DELL	MS111-P	CN-011D3V-71581-1CJ-093M	FCC DoC Approved	--
B.	TERMINAL*4	N/A	N/A	N/A	N/A	Provided by client
C.	Flash*2	Kingston	N/A	N/A	N/A	16GB
D.	Monitor	AOC	U2868PQU	HCXE8JA000360	DOC	--
		ASUS	MX27U			--
E.	Keyboard	DELL	KB4021	CN-05V23T-71581-1AK-01KM-A01	FCC DoC Approved	--
F.	Earphone	Apple	MNHF2AM/A	N/A	N/A	--
G.	Notebook	Dell	E5420	55CF4S1	N/A	--
		DELL	E6440	H4FNM32	N/A	
H.	IP Camera*2	N/A	N/A	N/A	N/A	Provided by client
I.	ABP-3000 Series	Vecow	ABP-3000-8665U	N/A	N/A	Provided by client

**Note:**

1. All power cords of the above support units are non-shielded (1.8m).
2. Items G acted as communication partners to transfer data.

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	AC Power Cable	1	1.8	N	0	--
2.	Mouse Cable	1	1.8	Y	0	--
3.	LAN Cable	2	3	N	0	Cat5e
4.	DIO Cable	1	0.5	N	0	Provided by client
5.	LAN Cable	2	3	N	0	Cat5e
6.	Earphone Cable	1	1.3	N	0	--
7.	DC Cable	1	1.5	N	1	Provided by client
8.	DP Cable	2	1.8	Y	0	--
9.	Keyboard Cable	1	1.8	Y	0	--
10.	Audio Cable	1	0.1	N	0	--

**Note:**

1. The core(s) is(are) originally attached to the cable(s).
2. The test condition of setup was according to manufacturer's requirement.

## 5 Conducted Disturbance at Mains Ports

### 5.1 Limits

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

Notes: 1. The lower limit shall apply at the transition frequencies.  
 2. The limit decreases linearly with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

### 5.2 Test Instruments

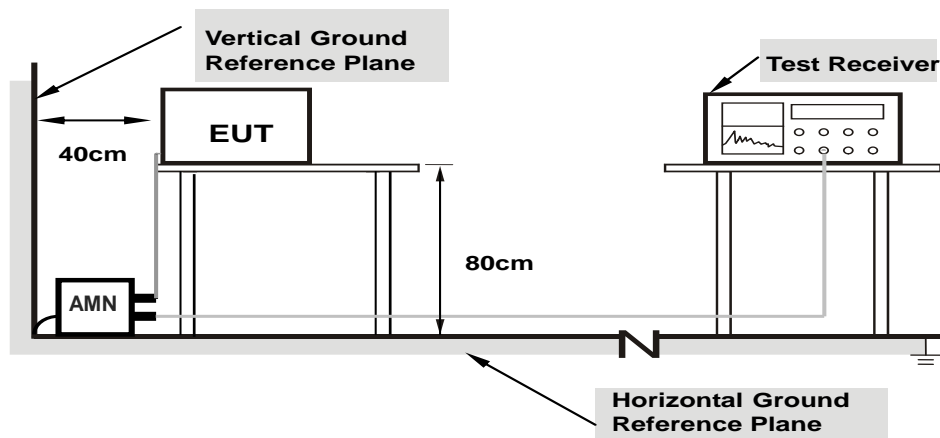
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 11, 2019	Dec. 10, 2020
RF signal cable Woken	5D-FB	Cable-cond1-01	Sep. 05, 2019	Sep. 04, 2020
AMN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 20, 2020	Feb. 19, 2021
AMN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 22, 2019	Aug. 21, 2020
Software ADT	BV ADT_Cond_ V7.3.7.4	NA	NA	NA

Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
 2. The test was performed in HwaYa Shielded Room 1. (Conduction 1)  
 3. The VCCI Site Registration No. is C-12040.

### 5.3 Test Arrangement

- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through an Artificial Mains Network (AMN). Other support units were connected to the power mains through another AMN. The two AMNs provide 50 Ohm/ 50 uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The test results of conducted emissions at mains ports are recorded of six worst margins for quasi-peak (mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.

Note: The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz – 30 MHz.



- Note:
- Support units were connected to second AMN.
  - The distance specified between EUT/AE and other metallic objects is  $\geq 0.8$  m in the measurement arrangement for table-top EUT.
  - According to EN 55032 standard, cables on the RGP must be insulated.



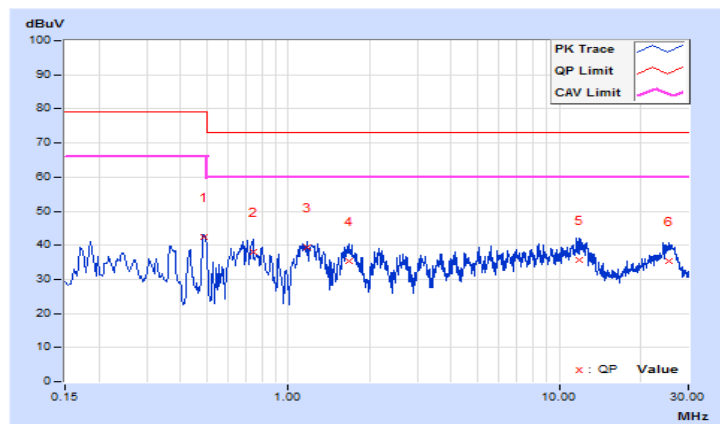
### 5.4 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	23°C, 72%RH
Tested by	Slash Huang	Test Date	2020/7/31

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.48752	9.65	32.90	31.68	42.55	41.33	79.00	66.00	-36.45	-24.67
2	0.74200	9.67	28.39	23.95	38.06	33.62	73.00	60.00	-34.94	-26.38
<b>3</b>	<b>1.17000</b>	<b>9.69</b>	<b>29.75</b>	<b>25.74</b>	<b>39.44</b>	<b>35.43</b>	<b>73.00</b>	<b>60.00</b>	<b>-33.56</b>	<b>-24.57</b>
4	1.67000	9.71	25.67	17.47	35.38	27.18	73.00	60.00	-37.62	-32.82
5	11.86200	9.88	25.74	20.37	35.62	30.25	73.00	60.00	-37.38	-29.75
6	25.44200	9.91	25.59	20.04	35.50	29.95	73.00	60.00	-37.50	-30.05

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

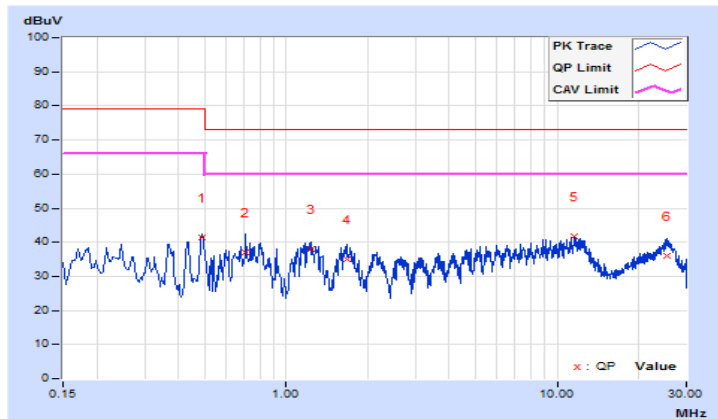


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	23°C, 72%RH
Tested by	Slash Huang	Test Date	2020/7/31

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.48957	9.67	31.80	30.66	41.47	40.33	79.00	66.00	-37.53	-25.67
2	0.71000	9.69	27.29	19.57	36.98	29.26	73.00	60.00	-36.02	-30.74
3	1.23000	9.71	28.32	21.47	38.03	31.18	73.00	60.00	-34.97	-28.82
4	1.67000	9.74	25.37	19.12	35.11	28.86	73.00	60.00	-37.89	-31.14
5	11.53800	9.93	31.68	19.57	41.61	29.50	73.00	60.00	-31.39	-30.50
6	25.38200	10.05	25.81	19.95	35.86	30.00	73.00	60.00	-37.14	-30.00

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

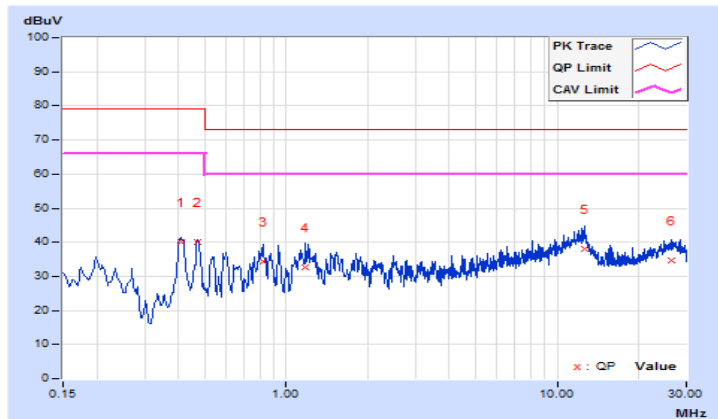


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	110Vac, 60Hz	Environmental Conditions	23°C, 72%RH
Tested by	Slash Huang	Test Date	2020/7/31

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.41000	9.65	30.49	27.14	40.14	36.79	79.00	66.00	-38.86	-29.21
2	0.46936	9.65	30.30	28.78	39.95	38.43	79.00	66.00	-39.05	-27.57
3	0.81800	9.67	24.77	18.73	34.44	28.40	73.00	60.00	-38.56	-31.60
4	1.17400	9.69	22.96	14.74	32.65	24.43	73.00	60.00	-40.35	-35.57
5	12.69400	9.89	28.08	22.17	37.97	32.06	73.00	60.00	-35.03	-27.94
6	26.46600	9.91	24.71	19.26	34.62	29.17	73.00	60.00	-38.38	-30.83

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

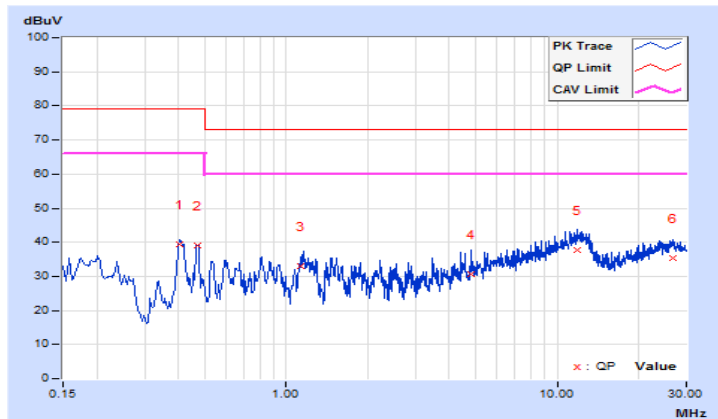


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	110Vac, 60Hz	Environmental Conditions	23°C, 72%RH
Tested by	Slash Huang	Test Date	2020/7/31

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.40200	9.67	29.72	24.78	39.39	34.45	79.00	66.00	-39.61	-31.55
2	0.46860	9.67	29.51	27.58	39.18	37.25	79.00	66.00	-39.82	-28.75
3	1.13780	9.71	23.34	16.83	33.05	26.54	73.00	60.00	-39.95	-33.46
4	4.81800	9.83	20.81	14.37	30.64	24.20	73.00	60.00	-42.36	-35.80
5	11.81400	9.94	27.85	22.36	37.79	32.30	73.00	60.00	-35.21	-27.70
6	26.83000	10.05	25.25	19.70	35.30	29.75	73.00	60.00	-37.70	-30.25

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



## 6 Asymmetric Mode Conducted Emission at Wired Network Ports

### 6.1 Limits

Class A					
Frequency (MHz)	Coupling Device	Voltage Limit (dBuV)		Current limits (dBuA)	
		Quasi-peak	Average	Quasi-peak	Average
0.15-0.5	AAN	97-87	84-74	-	-
0.5-30		87	74	-	-
0.15-0.5	CVP and Current probe	97-87	84-74	53-43	40-30
0.5-30		87	74	43	30
0.15-0.5	Current Probe	-	-	53-43	40-30
0.5-30		-	-	43	30
Class B					
Frequency (MHz)	Coupling Device	Voltage Limit (dBuV)		Current limits (dBuA)	
		Quasi-peak	Average	Quasi-peak	Average
0.15-0.5	AAN	84-74	74-64	-	-
0.5-30		74	64	-	-
0.15-0.5	CVP and Current probe	84-74	74-64	40-30	30-20
0.5-30		74	64	30	20
0.15-0.5	Current Probe	-	-	40-30	30-20
0.5-30		-	-	30	20

Note: The limits decrease linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

### 6.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 11, 2019	Dec. 10, 2020
RF signal cable Woken	5D-FB	Cable-cond1-01	Sep. 05, 2019	Sep. 04, 2020
AMN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 20, 2020	Feb. 19, 2021
AMN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 22, 2019	Aug. 21, 2020
Software ADT	BV ADT_Cond_ V7.3.7.4	NA	NA	NA
AAN	FCC-TLISN-T2-02-09	091393	Dec. 25, 2019	Dec. 24, 2020
AAN	F-071115-1057-1-09	100855	Aug. 14, 2019	Aug. 13, 2020
Capacitive Voltage Probe	F-CVP-1	82	Jul. 31, 2020	Jul. 30, 2021
RF Current Probe	F-33-4	45	Mar. 15, 2020	Mar. 14, 2021
Impedance-stabilization-network TESEQ	ISN ST08	41211	Aug. 26, 2019	Aug. 25, 2020
Impedance-stabilization-network TESEQ	ISN S751	40600	Aug. 26, 2019	Aug. 25, 2020

Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HwaYa Shielded Room 1. (Conduction 1)

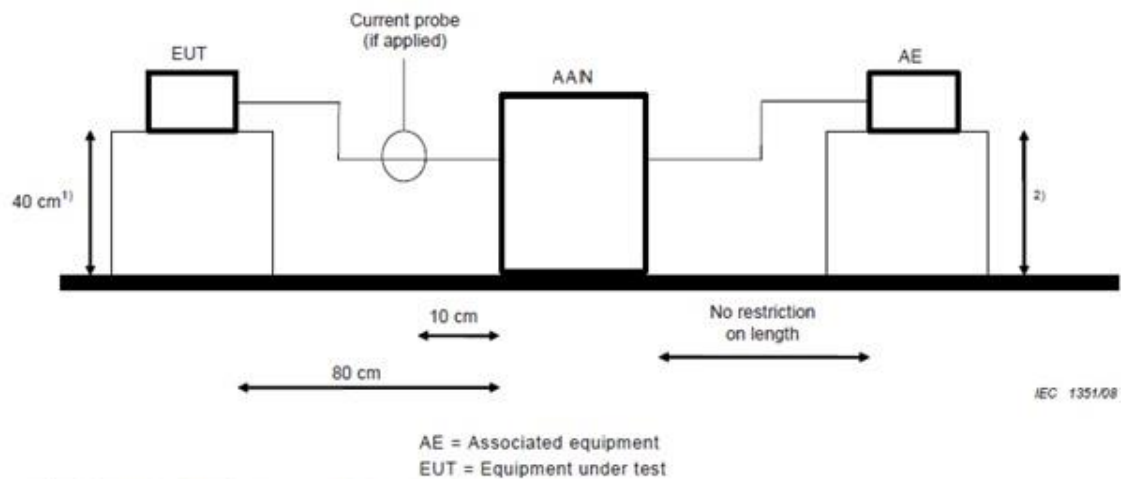
3. The VCCI Site Registration No. is T-11653.

### 6.3 Test Arrangement

#### Method of Using AANs:

- The EUT is placed 0.4 meters from the conducting wall of the shielded room and connected to AAN directly to reference ground plane.
- If voltage measurement is used, measure voltage at the measurement port of the AAN, correct the reading by adding the AAN voltage division factor, and compare to the voltage limit.
- If current measurement is used, measure current with the current probe and compare to the current limit. A 50  $\Omega$  load has to be connected to the measurement port of the AAN during the current measurement.
- It is not necessary to apply the voltage and the current limit if a AAN is used.
- The test results of disturbance at wired network ports are recorded of six worst margins for quasi-peak (mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.

Note: The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz – 30 MHz.



- Note:
- Distance to the reference ground plane (vertical or horizontal).
  - Distance to the reference ground plane is not critical.
  - According to EN 55032 standard, cables on the RGP must be insulated.

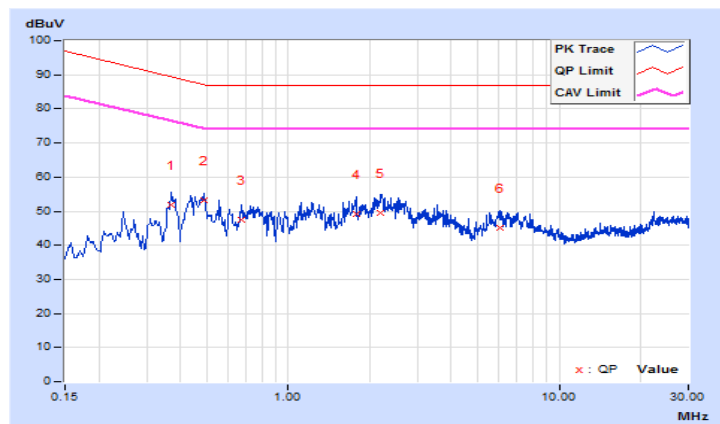
### 6.4 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	23°C, 72%RH
Tested by	Slash Huang	Test Date	2020/7/31
Test Mode	LAN 1 Port with AAN (1Gbps, Traffic)		

No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.37000	9.49	42.30	36.58	51.79	46.07	89.50	76.50	-37.71	-30.43
2	0.48957	9.43	43.62	40.11	53.05	49.54	87.18	74.18	-34.13	-24.64
3	0.67400	9.36	38.23	32.84	47.59	42.20	87.00	74.00	-39.41	-31.80
4	1.77800	9.25	39.96	34.25	49.21	43.50	87.00	74.00	-37.79	-30.50
5	2.20200	9.23	40.37	33.64	49.60	42.87	87.00	74.00	-37.40	-31.13
6	6.06600	9.20	35.96	30.50	45.16	39.70	87.00	74.00	-41.84	-34.30

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

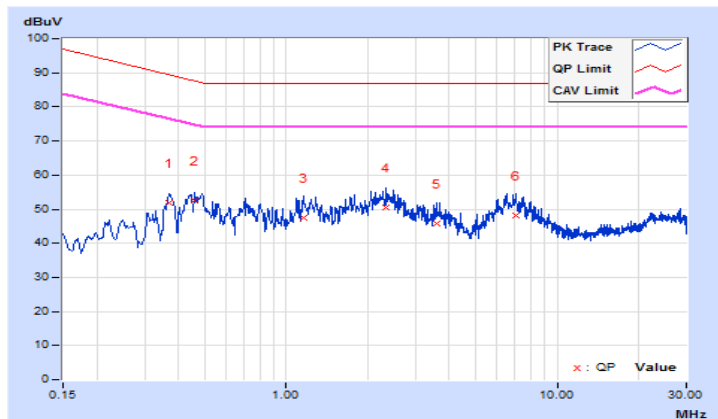


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	23°C, 72%RH
Tested by	Slash Huang	Test Date	2020/7/31
Test Mode	LAN 2 Port with AAN (1Gbps, Traffic)		

No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.37000	9.49	42.41	36.06	51.90	45.55	89.50	76.50	-37.60	-30.95
2	0.45800	9.44	43.15	33.64	52.59	43.08	87.73	74.73	-35.14	-31.65
3	1.15800	9.29	38.28	32.19	47.57	41.48	87.00	74.00	-39.43	-32.52
4	2.33000	9.23	41.14	39.92	50.37	49.15	87.00	74.00	-36.63	-24.85
5	3.58200	9.21	36.72	30.41	45.93	39.62	87.00	74.00	-41.07	-34.38
6	7.07400	9.20	39.06	33.13	48.26	42.33	87.00	74.00	-38.74	-31.67

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



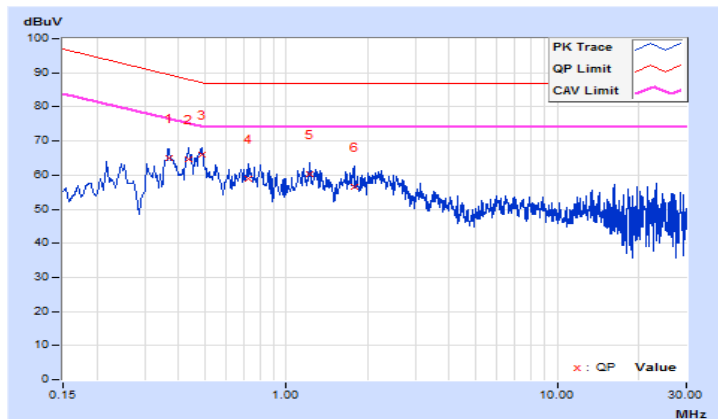


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	23°C, 72%RH
Tested by	Slash Huang	Test Date	2020/7/31
Test Mode	POE LAN 3 Port with AAN (100 Mbps, Traffic)		

No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.36834	9.49	55.51	49.21	65.00	58.70	89.54	76.54	-24.54	-17.84
2	0.43800	9.45	55.17	45.61	64.62	55.06	88.10	75.10	-23.48	-20.04
3	0.48600	9.43	56.65	52.71	66.08	62.14	87.24	74.24	-21.16	-12.10
4	0.72200	9.35	49.69	42.06	59.04	51.41	87.00	74.00	-27.96	-22.59
5	1.22600	9.28	51.02	46.41	60.30	55.69	87.00	74.00	-26.70	-18.31
6	1.78600	9.24	47.28	41.29	56.52	50.53	87.00	74.00	-30.48	-23.47

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

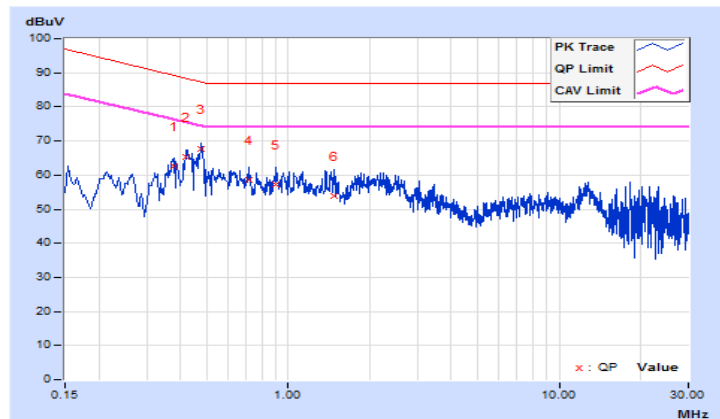


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	23°C, 72%RH
Tested by	Slash Huang	Test Date	2020/7/31
Test Mode	POE LAN 4 Port with AAN (100 Mbps, Traffic)		

No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.37800	9.48	53.17	44.15	62.65	53.63	89.32	76.32	-26.67	-22.69
2	0.42242	9.46	55.87	50.93	65.33	60.39	88.40	75.40	-23.07	-15.01
<b>3</b>	<b>0.47800</b>	<b>9.43</b>	<b>58.20</b>	<b>55.26</b>	<b>67.63</b>	<b>64.69</b>	<b>87.37</b>	<b>74.37</b>	<b>-19.74</b>	<b>-9.68</b>
4	0.71800	9.35	49.37	42.30	58.72	51.65	87.00	74.00	-28.28	-22.35
5	0.89800	9.32	47.98	42.25	57.30	51.57	87.00	74.00	-29.70	-22.43
6	1.47400	9.27	44.44	35.54	53.71	44.81	87.00	74.00	-33.29	-29.19

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



## 7 Radiated Disturbance up to 1 GHz

### 7.1 Limits

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

Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

### 7.2 Test Instruments

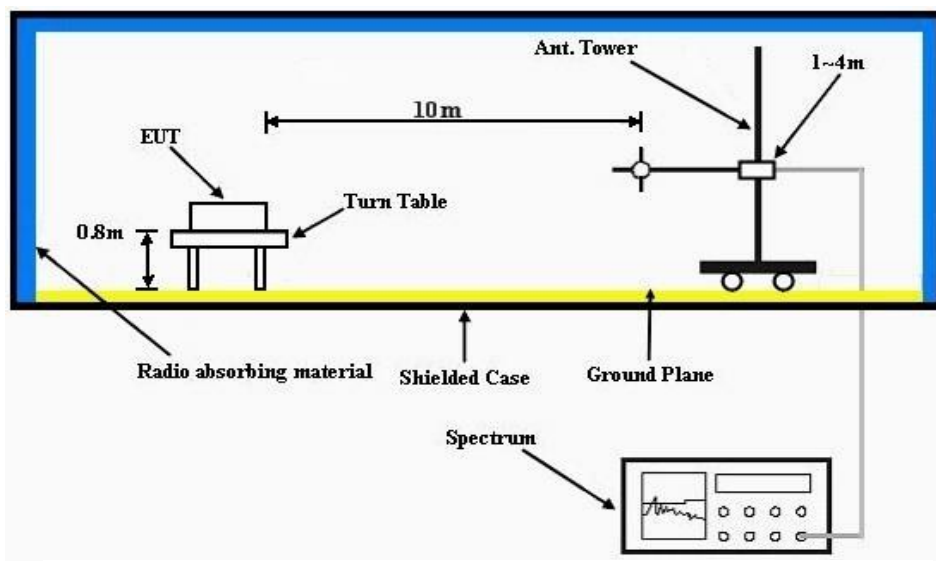
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ (V)	ESR	101240	Oct. 31, 2019	Oct. 30, 2020
Test Receiver ROHDE & SCHWARZ (H)	ESR	101264	Apr. 16, 2020	Apr. 15, 2021
BILOG Antenna SCHWARZBECK (V)	VULB9168	9168-148	Nov. 08, 2019	Nov. 07, 2020
BILOG Antenna SCHWARZBECK (H)	VULB9168	9168-156	Nov. 08, 2019	Nov. 07, 2020
Preamplifier Sonoma (V)	310N	352924	Jun. 08, 2020	Jun. 07, 2021
Preamplifier Sonoma (H)	310N	352923	Jun. 08, 2020	Jun. 07, 2021
RF signal cable (with 5dB PAD) Times (V)	LMR-600 (18M) +LMR- 400 (7M)	CABLE-CH1 (VER) -01	Sep. 05, 2019	Sep. 04, 2020
RF signal cable (with 5dB PAD) Times (H)	LMR-600 (11.8M) +LMR-400 (7M)	CABLE-CH1 (HOR) -01	Sep. 05, 2019	Sep. 04, 2020
Software BV ADT	BV ADT_Radiated_ V8.7.08	NA	NA	NA
Antenna Tower (V)	MFA-440	9707	NA	NA
Antenna Tower (H)	MFA-440	970705	NA	NA
Turn Table	DS430	50303	NA	NA
Controller (V)	MF7802	074	NA	NA
Controller (H)	MF7802	08093	NA	NA

- Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 1.
3. The VCCI Site Registration No. is R-11893.

### 7.3 Test Arrangement

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at an accredited test facility. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is up to 1 GHz.

Note: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for quasi-peak detection (QP) at frequency up to 1 GHz.



Note: According to EN 55032 standard, cables on the RGP must be insulated.

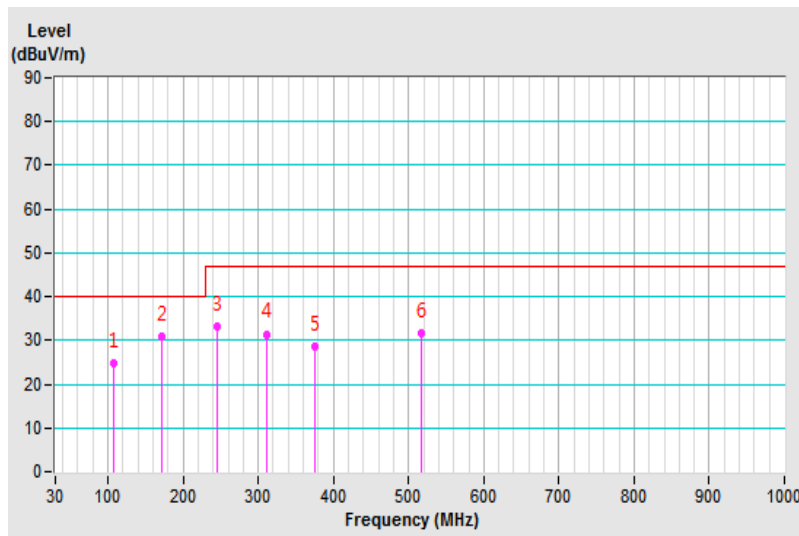
### 7.4 Test Results

Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Tested by	Mick Chou	Environmental Conditions	26°C, 69%RH
Test Date	2020/7/30		

Antenna Polarity & Test Distance : Horizontal at 10 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	107.99	24.66 QP	40.00	-15.34	4.00 H	53	41.12	-16.46
2	172.02	30.77 QP	40.00	-9.23	4.00 H	218	44.67	-13.90
3	245.74	33.25 QP	47.00	-13.75	3.00 H	89	47.69	-14.44
4	311.99	31.45 QP	47.00	-15.55	3.00 H	83	43.68	-12.23
5	375.00	28.71 QP	47.00	-18.29	3.50 H	93	39.39	-10.68
6	517.16	31.50 QP	47.00	-15.50	1.50 H	274	38.86	-7.36

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

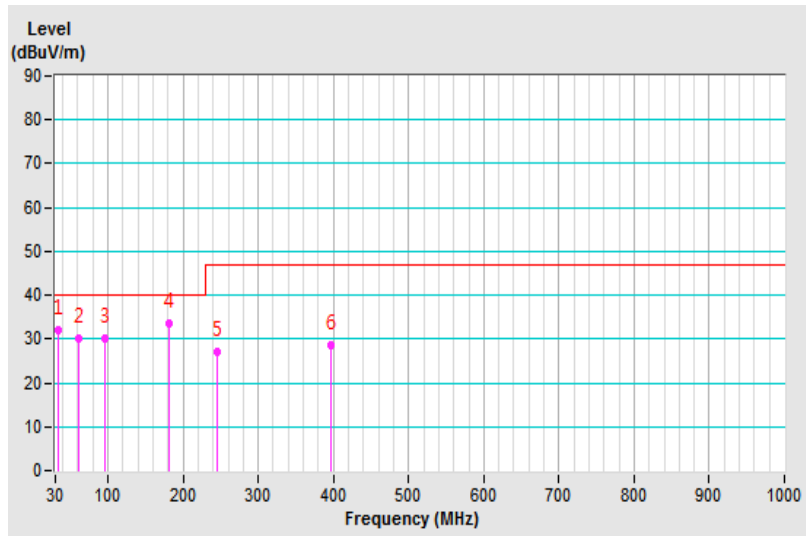


Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Tested by	Mick Chou	Environmental Conditions	26°C, 69%RH
Test Date	2020/7/30		

Antenna Polarity & Test Distance : Vertical at 10 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	33.25	32.17 QP	40.00	-7.83	3.00 V	134	47.15	-14.98
2	60.22	30.15 QP	40.00	-9.85	3.00 V	147	44.37	-14.22
3	96.40	29.98 QP	40.00	-10.02	1.00 V	78	48.61	-18.63
<b>4</b>	<b>181.91</b>	<b>33.62 QP</b>	<b>40.00</b>	<b>-6.38</b>	<b>1.00 V</b>	<b>13</b>	<b>49.03</b>	<b>-15.41</b>
5	245.74	26.91 QP	47.00	-20.09	1.00 V	327	41.80	-14.89
6	396.00	28.53 QP	47.00	-18.47	1.00 V	292	39.20	-10.67

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value



## 8 Radiated Disturbance above 1 GHz

### 8.1 Limits

Frequency (GHz)	Class A (dBuV/m) (at 3 m)		Class B (dBuV/m) (at 3 m)	
	Average	Peak	Average	Peak
1 to 3	56	76	50	70
3 to 6	60	80	54	74

Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

Frequency Range (For unintentional radiators)

Highest frequency generated or used in the EUT or on which the EUT operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 108	1000
108-500	2000
500-1000	5000
Above 1000	Up to 5 times of the highest frequency or 6 GHz, whichever is less

## 8.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ (Above 1GHz)	ESR7	101471	Mar. 11, 2020	Mar. 10, 2021
Spectrum Analyzer Agilent	E4446A	MY51100039	Sep. 05, 2019	Sep. 04, 2020
RF signal cable (with 5dB PAD) Times	LMR-400 (18M)	CABLE-CH2-01	Mar. 23, 2020	Mar. 22, 2021
HORN Antenna (with 4dB PAD) SCHWARZBECK	BBHA 9120 D	9120D-405	Nov. 24, 2019	Nov. 23, 2020
Pre-Amplifier Agilent (Above 1GHz)	8449B	3008A01961	Sep. 05, 2019	Sep. 04, 2020
RF Coaxial Cable JUNFLON+EMC	JUNFLON+EMC104- SM-SM-6000	Cable-CH2- 02(MWX3221308G003+ 130710)	Jan. 18, 2020	Jan. 17, 2021
Software BV ADT	BV ADT_Radiated_ V8.7.08	NA	NA	NA
Software BV ADT	BV ADT_Radiated_ V8.7.08	NA	NA	NA
Antenna Tower BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
RF Coaxial Cable EMCI	EMC102-KM-KM-1000	170819	Oct. 08, 2019	Oct. 07, 2020
RF Coaxial Cable Rosnol	K1K50-UP0279- K1K50-3000	181129-1	Oct. 08, 2019	Oct. 07, 2020

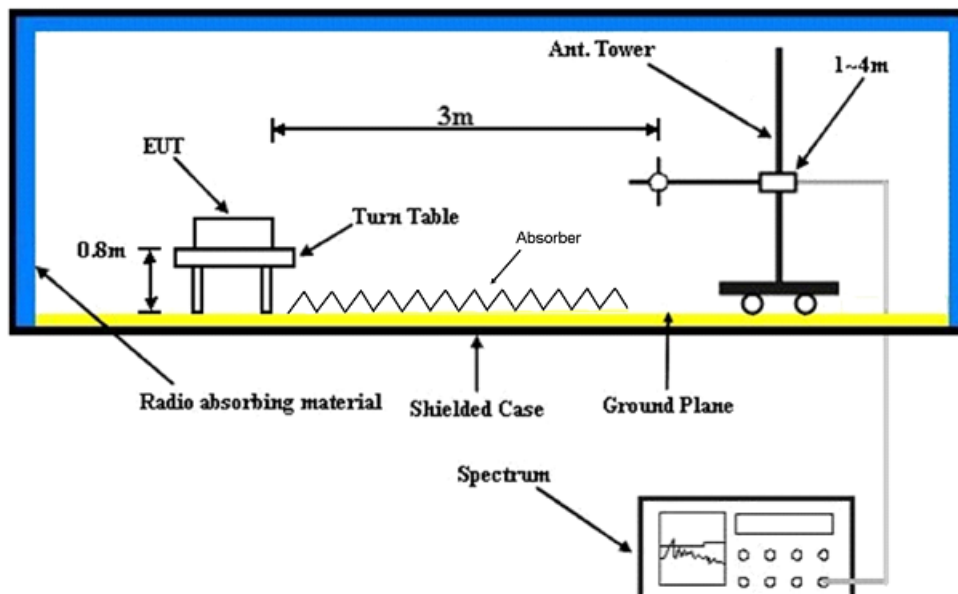
- Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The 3 dB beamwidth of the horn antenna is minimum 30 degree (or  $w = 1.6$  m at 3 m distance) for 1~6 GHz.
3. The test was performed in HwaYa Chamber 2 (966 Chamber 1).
4. The VCCI Site Registration No. is G-10018.



### 8.3 Test Arrangement

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at an accredited chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The height of antenna can be varied from one meter to four meters, the height of adjustment depends on the EUT height and the antenna 3 dB beamwidth both, to detect the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The spectrum analyzer system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

Note: The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for Average detection (AV) at frequency above 1 GHz.



Note: According to EN 55032 standard, cables on the RGP must be insulated.

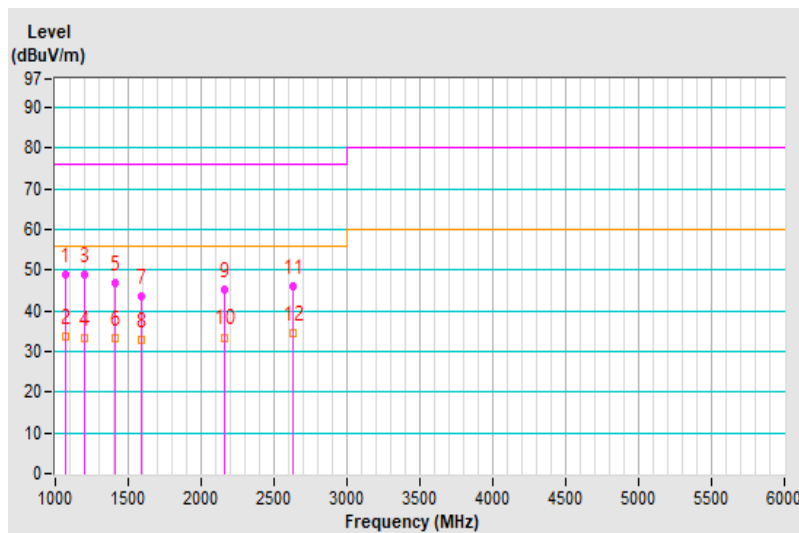
### 8.4 Test Results

Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Tested by	Kai Chu	Environmental Conditions	23°C, 71%RH
Test Date	2020/7/31		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1070.97	48.93 PK	76.00	-27.07	1.00 H	143	53.81	-4.88
2	1070.97	33.78 AV	56.00	-22.22	1.00 H	143	38.66	-4.88
3	1196.79	48.82 PK	76.00	-27.18	1.43 H	356	53.36	-4.54
4	1196.79	33.15 AV	56.00	-22.85	1.43 H	356	37.69	-4.54
5	1410.82	46.73 PK	76.00	-29.27	1.00 H	190	49.88	-3.15
6	1410.82	33.29 AV	56.00	-22.71	1.00 H	190	36.44	-3.15
7	1588.45	43.39 PK	76.00	-32.61	1.00 H	167	46.93	-3.54
8	1588.45	32.69 AV	56.00	-23.31	1.00 H	167	36.23	-3.54
9	2159.20	45.33 PK	76.00	-30.67	1.00 H	174	45.29	0.04
10	2159.20	33.46 AV	56.00	-22.54	1.00 H	174	33.42	0.04
11	2632.28	45.90 PK	76.00	-30.10	1.00 H	188	45.45	0.45
12	2632.28	34.55 AV	56.00	-21.45	1.00 H	188	34.10	0.45

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

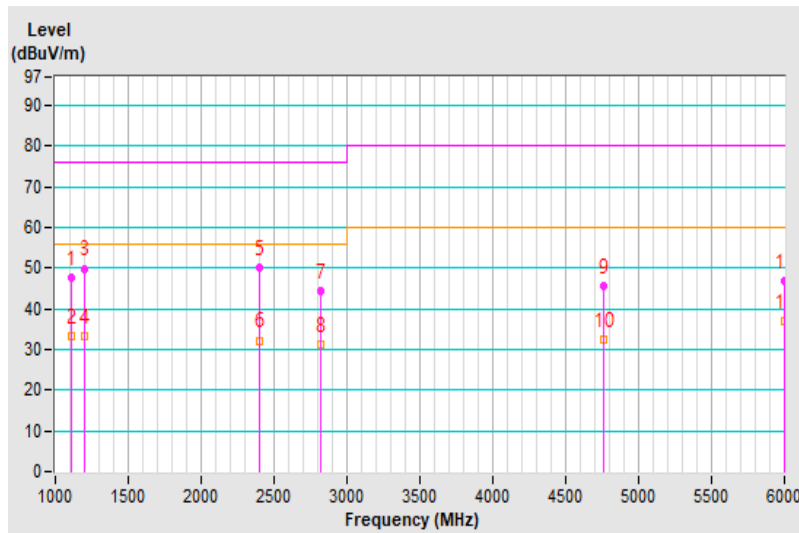


Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Tested by	Kai Chu	Environmental Conditions	23°C, 71%RH
Test Date	2020/7/31		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBUV/m)	Limit (dBUV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBUV)	Correction Factor (dB/m)
1	1107.43	47.66 PK	76.00	-28.34	2.12 V	206	52.43	-4.77
2	1107.43	33.16 AV	56.00	-22.84	2.12 V	206	37.93	-4.77
3	1197.14	49.90 PK	76.00	-26.10	1.00 V	139	54.43	-4.53
4	1197.14	33.31 AV	56.00	-22.69	1.00 V	139	37.84	-4.53
5	2396.39	50.28 PK	76.00	-25.72	1.84 V	217	50.09	0.19
6	2396.39	32.25 AV	56.00	-23.75	1.84 V	217	32.06	0.19
7	2815.69	44.31 PK	76.00	-31.69	1.95 V	198	43.34	0.97
8	2815.69	31.04 AV	56.00	-24.96	1.95 V	198	30.07	0.97
9	4757.63	45.50 PK	80.00	-34.50	1.41 V	64	39.75	5.75
10	4757.63	32.39 AV	60.00	-27.61	1.41 V	64	26.64	5.75
11	5999.99	46.90 PK	80.00	-33.10	1.91 V	298	38.31	8.59
12	5999.99	36.91 AV	60.00	-23.09	1.91 V	298	28.32	8.59

Remarks:

1. Emission Level(dBUV/m) = Raw Value(dBUV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value



## 9 Harmonics Current Measurement

### 9.1 Limits

Limits for Class A equipment		Limits for Class D equipment		
Harmonic Order n	Max. permissible harmonics current A	Harmonic Order n	Max. permissible harmonics current per watt mA/W	Max. permissible harmonics current A
Odd harmonics		Odd Harmonics only		
3	2.30	3	3.4	2.30
5	1.14	5	1.9	1.14
7	0.77	7	1.0	0.77
9	0.40	9	0.5	0.40
11	0.33	11	0.35	0.33
13	0.21	13	0.30	0.21
$15 \leq n \leq 39$	$0.15 \times 15/n$	$15 \leq n \leq 39$	$3.85/n$	$0.15 \times 15/n$
Even harmonics				
2	1.08			
4	0.43			
6	0.30			
$8 \leq n \leq 40$	$0.23 \times 8/n$			

Notes:

1. Class A and Class D are classified according to section 5 of EN 61000-3-2.
2. According to section 7 of EN 61000-3-2, the above limits for all equipment except for lighting equipment having an active input power > 75 W and no limits apply for equipment with an active input power up to and including 75 W.

### 9.2 Classification of Equipment

The EUT is Class D in accordance with EN 61000-3-2 as follows:

Class A	Class B	Class C	Class D
Balanced three-phase equipment, Household appliances excluding equipment as Class D, Tools excluding portable tools, Dimmers for incandescent lamps, audio equipment, equipment not specified in one of the three other classes.	Portable tools.; Arc welding equipment which is not professional equipment	Lighting equipment.	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).

### 9.3 Test Instruments

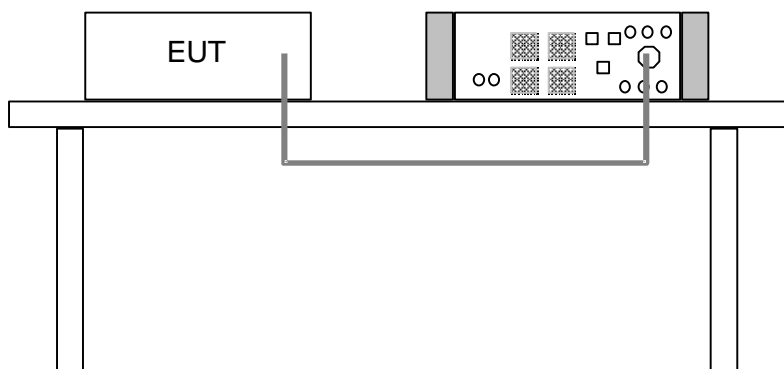
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Schaffner AC Power Source	NSG1007	55616	Oct. 09, 2019	Oct. 08, 2020
Schaffner Signal Conditioning Unit- Lumped Impedance	CCN1000-1-LR1	72224	Oct. 09, 2019	Oct. 08, 2020
Software	CTS 4 V4.19.0	NA	NA	NA

Notes: 1. The test was performed in Hwa Ya EMS Room.

2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### 9.4 Test Arrangement

- The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.
- The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the time necessary for the EUT to be exercised.



### 9.5 Test Results

Test Duration (mins)	3	Tested by	Andy Chang
Fundamental Voltage/Ampere	230.24 Vrms/ 0.463 Arms	Power Frequency	50 Hz
Power Consumption	40.1 W	Power Factor	0.383
Environmental Conditions	22 °C, 56 % RH	Test Date	2020/07/31

Note: 1. Limits are not specified for equipment with a rated power of 75 W or less (other than lighting equipment).

2. According to EN 61000-3-2 the manufacturer shall specify the power of the apparatus. This value shall be used for establishing limits. The specified power shall be within +/-10 % of the measured power.

## 10 Voltage Fluctuations and Flicker Measurement

### 10.1 Limits

Test item	Limit	Note
$P_{st}$	1.0	$P_{st}$ : short-term flicker severity.
$P_{lt}$	0.65	$P_{lt}$ : long-term flicker severity.
$T_{max}$ (ms)	500	$T_{max}$ : maximum time duration during the observation period that the voltage deviation $d(t)$ exceeds the limit for $d_c$ .
$d_{max}$ (%)	4	$d_{max}$ : maximum absolute voltage change during an observation period.
$d_c$ (%)	3.3	$d_c$ : maximum steady state voltage change during an observation period.

### 10.2 Test Instruments

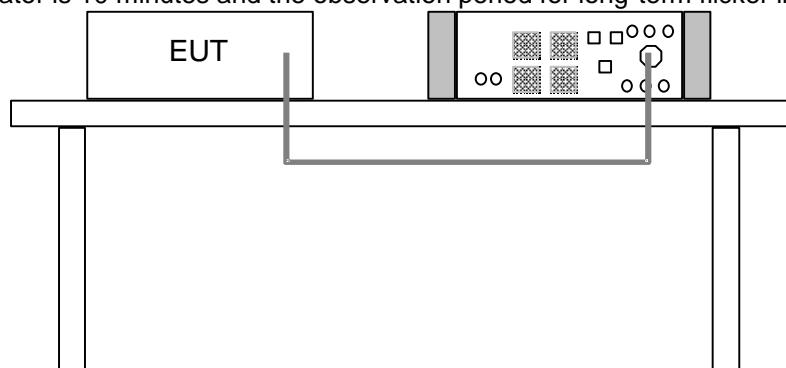
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Schaffner AC Power Source	NSG1007	55616	Oct. 09, 2019	Oct. 08, 2020
Schaffner Signal Conditioning Unit- Lumped Impedance	CCN1000-1-LR1	72224	Oct. 09, 2019	Oct. 08, 2020
Software	CTS 4 V4.19.0	NA	NA	NA

Notes: 1. The test was performed in Hwa Ya EMS Room.

2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### 10.3 Test Arrangement

- The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under normal operating conditions.
- During the flick measurement, the measure time shall include that part of whole operation cycle in which the EUT produce the most unfavorable sequence of voltage changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours.



#### 10.4 Test Results

Observation ( $T_p$ )	120 min.	Tested by	Andy Chang
Fundamental Voltage/Ampere	230.10 Vrms/ 0.463 Arms	Power Frequency	50 Hz
Power Consumption	40.1 W	Power Factor	0.383
Environmental Conditions	22 °C, 56 % RH	Test Date	2020/07/31

Test Parameter	Measurement Value	Limit	Remarks
$P_{st}$	0.064	1.00	Pass
$P_{lt}$	0.064	0.65	Pass
$T_{max}$ (ms)	0	500	Pass
$d_{max}$ (%)	0	4	Pass
$d_c$ (%)	0	3.3	Pass

- Note: (1)  $P_{st}$  means short-term flicker indicator.  
 (2)  $P_{lt}$  means long-term flicker indicator.  
 (3)  $T_{max}$  means accumulated time value of  $d(t)$  with a deviation exceeding 3.3 %.  
 (4)  $d_{max}$  means maximum relative voltage change.  
 (5)  $d_c$  means maximum relative steady-state voltage change.

## 11 General Immunity Requirements

EN 55024:2010 +A1:2015, Immunity requirements				
Clause	Reference standard	Table	Test specification	Performance Criterion
4.2.1	EN 61000-4-2 ESD	1.3	Enclosure port: ±8 kV Air discharge, ±4 kV Contact discharge	B
4.2.3.2	EN 61000-4-3 RS	1.2	Enclosure port: 80-1000 MHz, 3 V/m, 80% AM (1 kHz)	A
4.2.2	EN 61000-4-4 EFT	2.3	Signal ports and telecommunication ports: xDSL equipment: ±0.5 kV, 5/50 (T <sub>r</sub> /T <sub>h</sub> ) ns, 100 kHz others: ±0.5 kV, 5/50 (T <sub>r</sub> /T <sub>h</sub> ) ns, 5 kHz	B
		3.3	Input DC power port: ±0.5 kV, 5/50 (T <sub>r</sub> /T <sub>h</sub> ) ns, 5 kHz	
		4.5	Input AC Power ports: ±1 kV, 5/50 (T <sub>r</sub> /T <sub>h</sub> ) ns, 5 kHz	
4.2.5	EN 61000-4-5 Surge	2.2	Signal and telecommunication ports (direct to outdoor cables): 10/700 (5/320) (T <sub>r</sub> /T <sub>h</sub> ) μs w/o primary protectors: ±1 kV, or with primary protectors fitted: ±4 kV	C
		3.2	Input DC power port (direct to outdoor cables): 1.2/50 (8/20) (T <sub>r</sub> /T <sub>h</sub> ) μs Line to earth: ±0.5 kV	B
		4.4	Input AC Power ports: 1.2/50 (8/20) (T <sub>r</sub> /T <sub>h</sub> ) μs, Line to line: ±1 kV Line to earth: ±2 kV	
4.2.3.3	EN 61000-4-6 CS	2.1	Signal and telecommunication ports (cable length > 3 m): 0.15-80 MHz, 3 V, 80 % AM (1 kHz)	A
		3.1	Input DC power port: 0.15-80 MHz, 3 V, 80 % AM (1 kHz)	
		4.1	Input AC Power ports: 0.15-80 MHz, 3 V, 80 % AM (1 kHz)	
4.2.4	EN 61000-4-8 PFMF	1.1	Enclosure port: 50 or 60 Hz, 1 A/m	A
4.2.6	EN 61000-4-11 Dips & Interruptions	4.2	Input AC Power ports: Voltage Dips: >95 % reduction – 0.5 period 30 % reduction – 25 periods	B C
		4.3	Input AC Power ports: Voltage Interruptions: >95 % reduction – 250 periods	C



## 11.1 Specific Immunity Requirements by Manufacturer

N/A

## 11.2 Performance Criteria

### General Performance Criteria

#### Performance criterion A

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 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.

#### Performance criterion B

After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena 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. During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test. 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.

#### Performance criterion C

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

### Product Specific Performance Criteria

The particular performance criteria which are specified in the normative annexes of EN 55024 take precedence over the corresponding parts of the general performance criteria.

Where particular performance criteria for specific functions are not given, then the general performance criteria shall apply.

Function	Performance criteria A	Performance criteria B	Performance criteria C
Read, write and storage of data	During the test storage devices shall maintain normal operation both in read/write and in standby conditions.	During and after the test failures which can be recovered by read and write retries are permissible (temporary delay in processing caused by this process is acceptable). Normal operation of the EUT shall be restored after the test, self-recovery to the conditions immediately prior to the application of the test is accepted where this is a normal means of recovery. In these cases, operator response is permitted to re-initialise an operation.	Failures during test that result in a delay in processing or a system abort, which after testing can be recovered to normal operation by reset or reboot, are permissible.
Data display	During the test, when seen from the normal viewing distance, the EUT shall operate with no change beyond the manufacturer's specification, in flicker, colour, focus and jitter (except for the power frequency magnetic field test).	Screen disturbances during the application of the test are permissible if they self-recover after removal of the external disturbance.	Failures during the test that cannot self-recover after removal of the external disturbance, but which can be recovered after the test to normal operation by reset or reboot are permissible.
Data input	During testing unintended input from an input device is not allowed. During testing input devices shall maintain the specified quality image data.	During testing keyboard/mouse "lock up" is not allowed. For EUT with manually inputted data that can be confirmed by reading the display, errors are permissible during testing if they can be recognised by the operator and easily corrected.	Failures during test that result in a delay in processing or a system abort, which after testing can be recovered to normal operation by reset or reboot, are permissible.
Data printing	During testing printers shall maintain the specified printing quality and normal operation.	During testing no degradation of the printing quality beyond the manufacturer's specification (such as distortion of character(s) or missing pixels) is permissible. A paper feed failure is allowed if after removal of the jammed sheets the job is automatically recovered and there is no loss of printed information.	During testing printing errors or omission of character(s) which require reprinting are permissible. Input/output failures that occur during testing that can be recovered to normal operation after testing by reset or reboot are also permissible.
Data processing	During testing failures which do not influence the specified operation within the product specification, and which do not prevent automatic recovery are permissible.	During testing failures which are recovered automatically but cause temporary delay in processing are permissible.	Failures during testing that - result in a delay in processing after the external disturbance is removed, but which can be recovered after testing to normal operation by a reset or reboot - result in a system abort, which can be recovered to normal operation after testing by reset or reboot, - are followed by alarms and can be recovered to normal operation by the operator's intervention after testing are permissible.

## 12 Electrostatic Discharge Immunity Test (ESD)

### 12.1 Test Specification

Basic Standard:	EN/IEC 61000-4-2
Discharge Impedance:	330 ohm / 150 pF
Discharge Voltage:	Air Discharge: $\pm 2, \pm 4, \pm 8$ kV (Direct) Contact Discharge: $\pm 2, \pm 4$ kV (Direct/Indirect)
Number of Discharge:	Air – Direct: 10 discharges per location (each polarity) Contact – Direct & Indirect: 25 discharges per location (each polarity) and min. 200 times in total
Discharge Mode:	Single Discharge
Discharge Period:	1-second minimum

### 12.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ELECTROSTATIC DISCHARGE (EMTEST)	Dito	V0701102114	Dec. 02, 2019	Dec. 01, 2020

- Notes: 1. The test was performed in Hwa Ya ESD Room 4.  
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

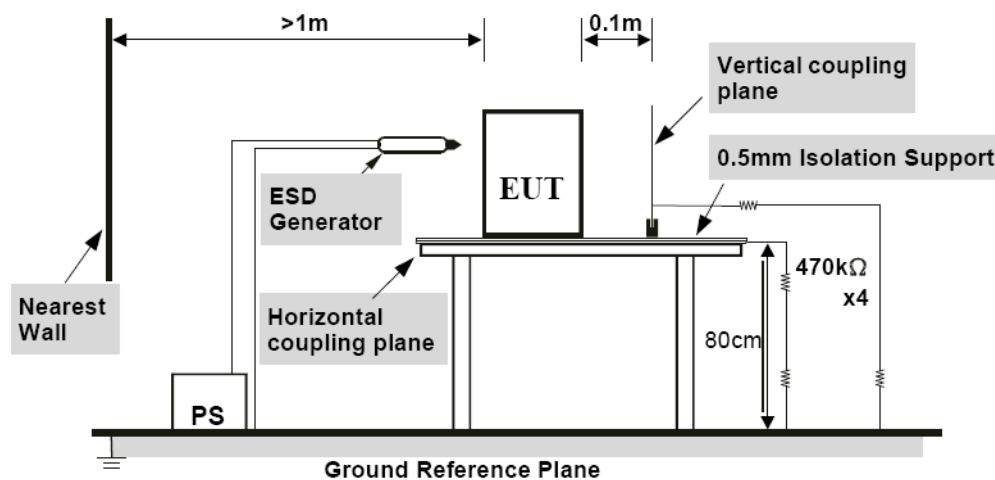
### 12.3 Test Arrangement

The discharges shall be applied in two ways:

- a. Contact discharges to the conductive surfaces and coupling planes:  
The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the test points shall be subjected to at least 50 indirect discharges to the center of the front edge of the horizontal coupling plane. The remaining three test points shall each receive at least 50 direct contact discharges. If no direct contact test points are available, then at least 200 indirect discharges shall be applied in the indirect mode. Test shall be performed at a maximum repetition rate of one discharge per second.
- b. Air discharges at slots and apertures and insulating surfaces:  
On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air discharge method. This investigation should be restricted to those area normally handled by the user. A minimum of 10 single air discharges shall be applied to the selected test point for each such area.

The basic test procedure was in accordance with EN/IEC 61000-4-2:

- a. Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.
- b. The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.
- c. The time interval between two successive single discharges was at least 1 second.
- d. The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the EUT.
- e. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
- f. Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were complete.
- g. At least ten single discharges (in the most sensitive polarity) were applied to the Horizontal Coupling Plane at points on each side of the EUT. The ESD generator was positioned at a distance of 0.1 meters from the EUT with the discharge electrode touching the HCP.
- h. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the Vertical Coupling Plane in sufficiently different positions that the four faces of the EUT were completely illuminated. The VCP (dimensions 0.5 m x 0.5 m) was placed vertically to and 0.1 meters from the EUT.



## 12.4 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Vincent Yang
Environmental Conditions	25 °C, 50 % RH 986 mbar	Test Date	2020/08/05

Test Results of Direct Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Contact Discharge	Air Discharge	Performance Criterion
2, 4, 8	+/-	6-7	NA	Note 1	A
2, 4	+/-	8-13	NA	Note 1	A
8	+/-	8-13	NA	Note 2	B
2	+/-	1-5	Note 1	NA	A
4	+/-	1-5	Note 2	NA	B

Description of test points of direct application: Please refer to following page for representative mark only.

Test Results of Indirect Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Horizontal Coupling Plane	Vertical Coupling Plane	Performance Criterion
2	+/-	Four Sides	Note 1	Note 1	A
4	+/-	Four Sides	Note 2	Note 2	B

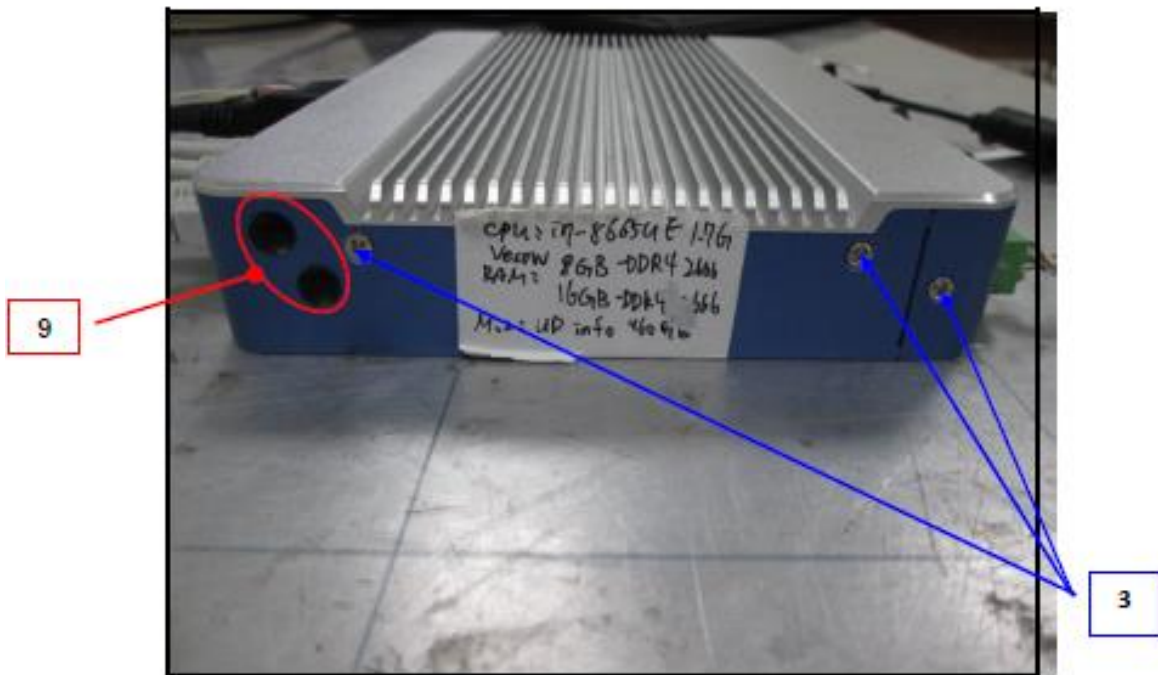
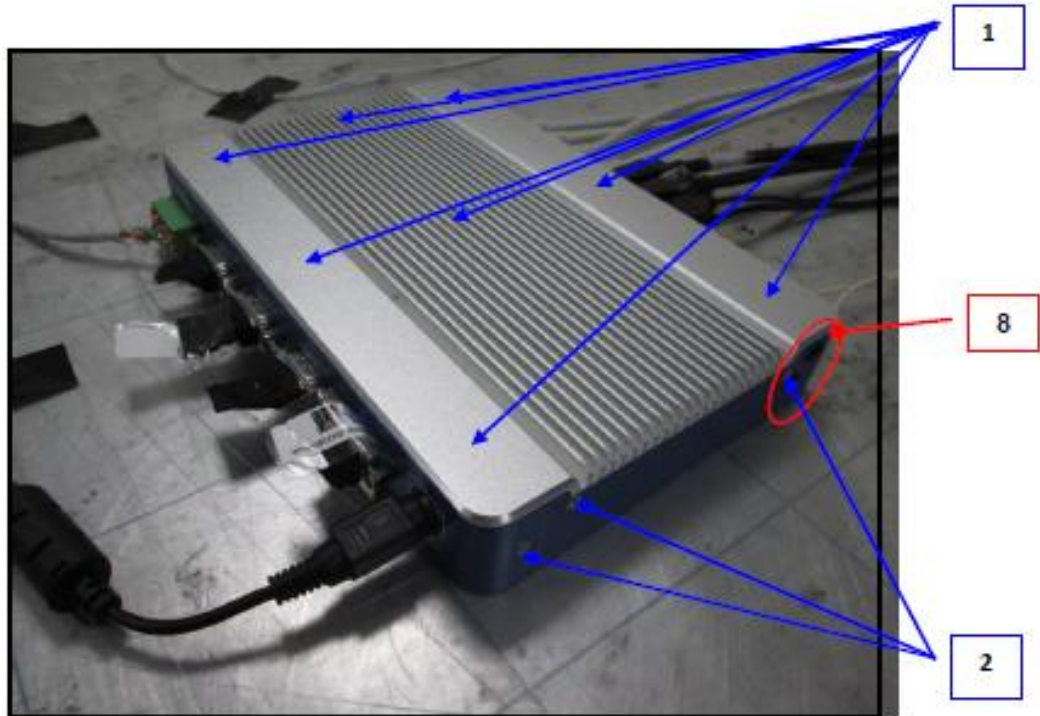
Description of test points of indirect application:

1. Front side                      2. Rear side                      3. Right side                      4. Left side

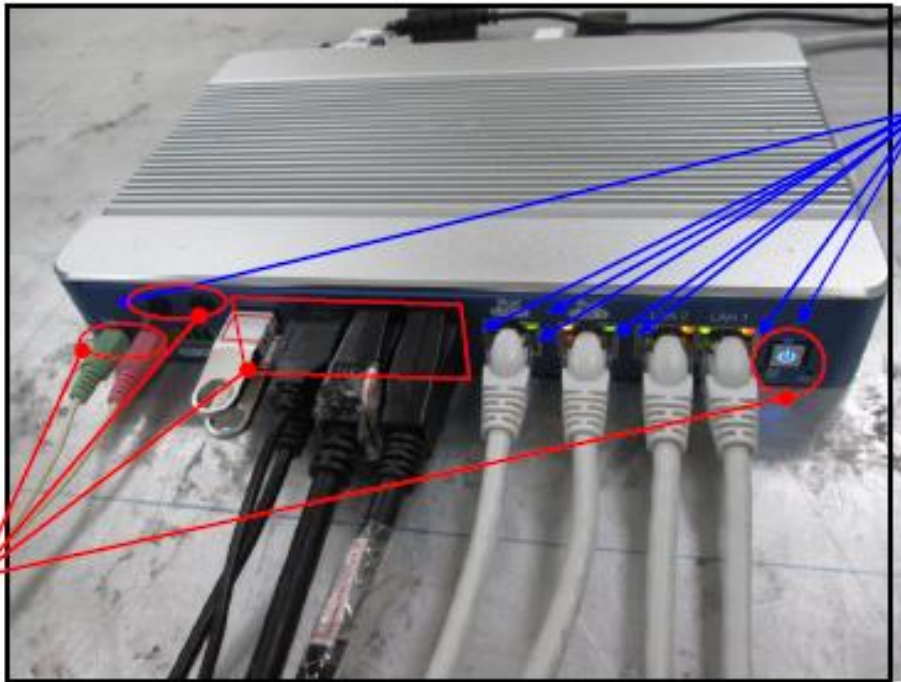
Note: 1. The EUT function was correct during the test.

2. There were disturbance noises on screen during the test, but self-recoverable after the test.

### Description of Test Points

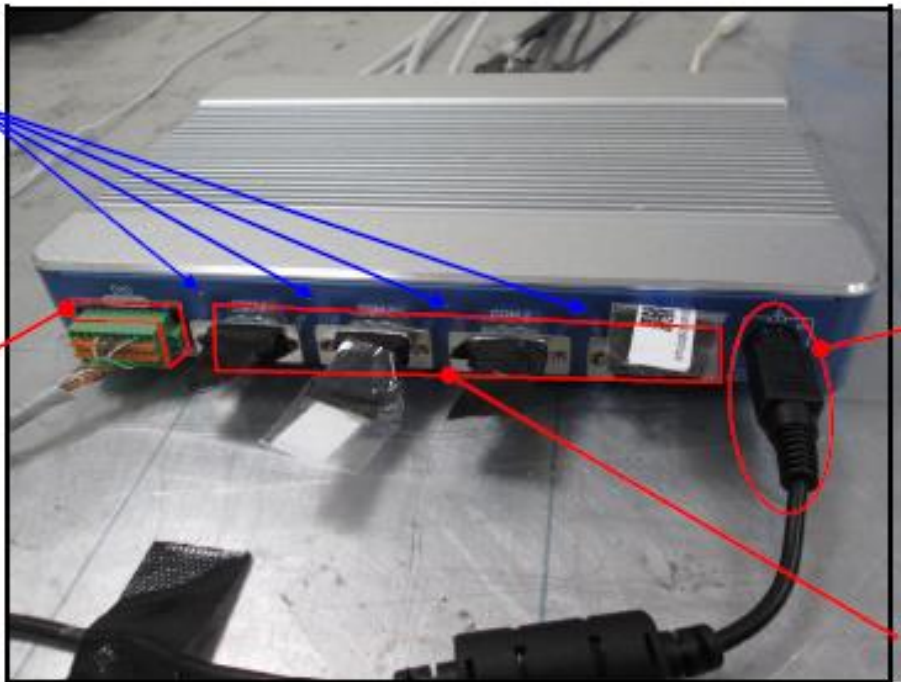






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### 13 Radiated, Radio-frequency, Electromagnetic Field Immunity Test (RS)

#### 13.1 Test Specification

Basic Standard:	EN/IEC 61000-4-3
Frequency Range:	80 MHz - 1000 MHz
Field Strength:	3 V/m
Modulation:	1 kHz Sine Wave, 80 %, AM Modulation
Frequency Step:	1 % of preceding frequency value
Polarity of Antenna:	Horizontal and Vertical
Antenna Height:	1.55 m
Dwell Time:	3 seconds

#### 13.2 Test Instruments

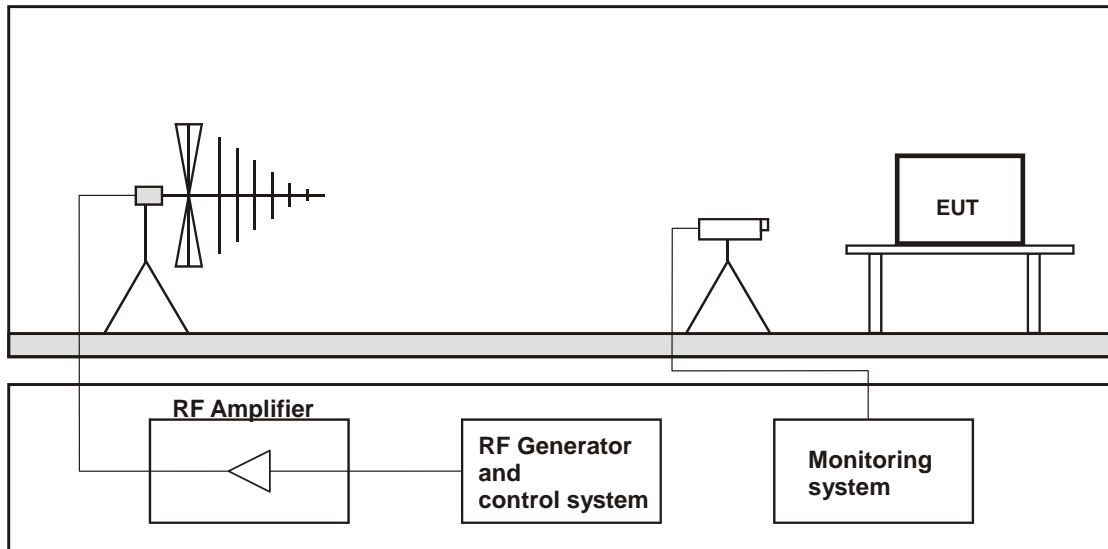
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
BONN Power Amp	BLMA 1060-100/50D	118694	NA	NA
BBA Power Amp	B250C125	101011	NA	NA
Power Sensor	NRP-Z91	101572	May 22, 2020	May 21, 2021
Power Sensor	NRP-Z91	101573	May 22, 2020	May 21, 2021
Signal Generator	SMB100A	105801	Dec. 03, 2019	Dec. 02, 2020
R&S Software	EMC32 Version 8.52.0	NA	NA	NA
Stacked Log-Per Antenna	STLP9149	9149-141	NA	NA
High GAIN LOG-Periodic Antenna	HL046E	100114	NA	NA

- Notes:
1. The test was performed in Hwa Ya RS Room 2.
  2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
  3. The transmit antenna was located at a distance of 3 meters from the EUT.

### 13.3 Test Arrangement

The test procedure was in accordance with EN/IEC 61000-4-3.

- The testing was performed in a modified semi-anechoic chamber.
- The frequency range is swept from 80 MHz to 1000 MHz, with the signal 80 % amplitude modulated with a 1 kHz sine wave.
- The field strength level was 3 V/m.
- The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.



### 13.4 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Vincent Yang
Environmental Conditions	25 °C, 58 % RH	Test Date	2020/07/31

Frequency (MHz)	Polarity	Azimuth(°)	Applied Field Strength		Observation	Performance Criterion
			(V/m)	Modulation		
80 -1000	V&H	0	3	80% AM (1 kHz)	Note 1	A
80 -1000	V&H	90	3	80% AM (1 kHz)	Note 1	A
80 -1000	V&H	180	3	80% AM (1 kHz)	Note 1	A
80 -1000	V&H	270	3	80% AM (1 kHz)	Note 1	A

Note: 1. The EUT function was correct during the test.

## 14 Electrical Fast Transient/Burst Immunity Test (EFT)

### 14.1 Test Specification

Basic Standard:	EN/IEC 61000-4-4
Test Voltage:	Signal / telecommunication port: $\pm 0.5$ kV Input DC power port: N/A Input AC power port: $\pm 1$ kV
Impulse Repetition Frequency:	xDSL telecommunication port: 100 kHz others: 5 kHz
Impulse Wave Shape:	5/50 ns
Burst Duration:	0.75 ms for 100 kHz Repetition Frequency 15 ms for 5 kHz Repetition Frequency,
Burst Period:	300 ms
Test Duration:	1 min.

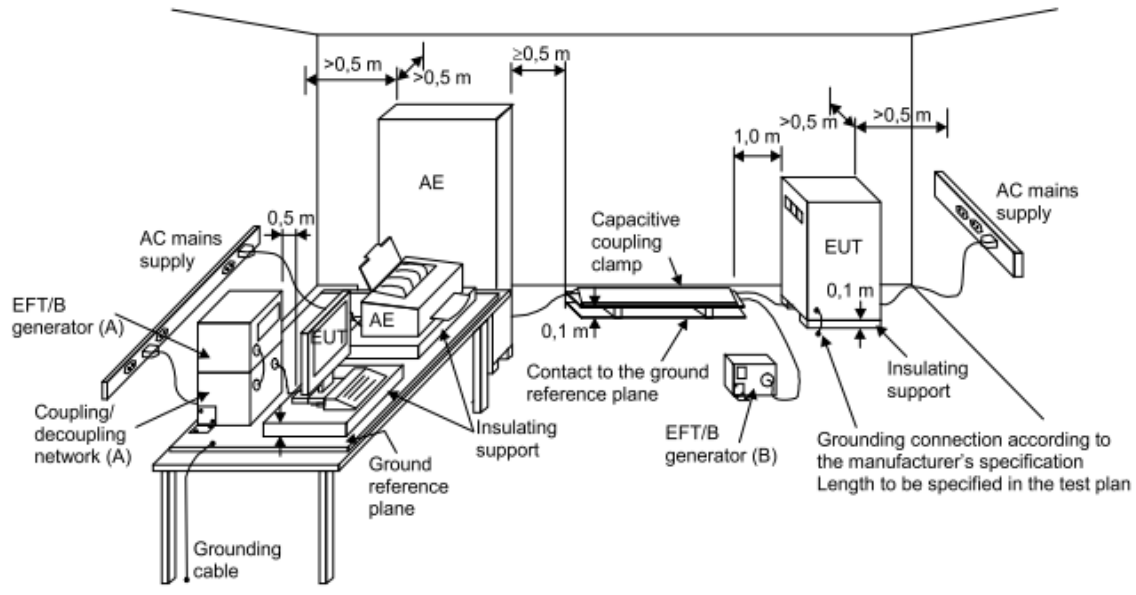
### 14.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
EFT Generator TESEQ	NSG 3040	2251	Mar. 20, 2020	Mar. 19, 2021
Capacitive Coupling clamp EMC-Partner	CN-EFT1000	364	Mar. 20, 2020	Mar. 19, 2021
EFT Adapter WONPRO	WA	EF1Ada-001	NA	NA
Three-phase coupling decoupling network TESEQ	CDN 3043-C32	5007	Mar. 20, 2020	Mar. 19, 2021

- Notes: 1. The test was performed in Hwa Ya EFT Room 1.  
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### 14.3 Test Arrangement

- Both positive and negative polarity discharges were applied.
- The distance between any coupling devices and the EUT should be 0.5 m for table-top equipment testing, and 1.0 m for floor standing equipment.
- The duration time of each test sequential was 1 minute.
- The transient/burst waveform was in accordance with EN/IEC 61000-4-4, 5/50 ns.



IEC 645/12

### 14.4 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Vincent Yang
Environmental Conditions	25 °C, 50 % RH	Test Date	2020/08/05

#### Input AC power port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
1	L1	+/-	Note 1	A
1	L2	+/-	Note 1	A
1	PE	+/-	Note 1	A
1	L1-L2-PE	+/-	Note 1	A

#### Signal / telecommunication port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5	LAN 1	+/-	Note 1	A
0.5	LAN 2	+/-	Note 1	A
0.5	LAN 3 (POE)	+/-	Note 1	A
0.5	LAN 4 (POE)	+/-	Note 1	A

Note: 1. The EUT function was correct during the test.

## 15 Surge Immunity Test

### 15.1 Test Specification

Basic Standard:	EN/IEC 61000-4-5
Wave-Shape:	Signal / telecommunication port (direct to outdoor cables*): 10/700 $\mu$ s Open Circuit Voltage 5/320 $\mu$ s Short Circuit Current Input DC power port (direct to outdoor cables*): 1.2/50 $\mu$ s Open Circuit Voltage 8/20 $\mu$ s Short Circuit Current Input AC power port: 1.2/50 $\mu$ s Open Circuit Voltage 8/20 $\mu$ s Short Circuit Current
Test Voltage:	Signal and telecommunication ports**: w/o primary protectors: N/A, with primary protectors fitted: N/A Input DC power port: Line to earth or ground: N/A Input AC power ports: Line to line: $\pm 1$ kV, Line to earth or ground: $\pm 2$ kV
AC Phase Angle (degree):	0°, 90°, 180°, 270°
Pulse Repetition Rate:	1 time / 60 sec.
Number of Tests:	5 positive and 5 negative at selected points

\* This test is only applicable only to ports, which according to the manufacturer's specification, may connect directly to outdoor cables.

\*\* For ports where primary protection is intended, surges are applied at voltages up to 4 kV with the primary protectors fitted. Otherwise the 1 kV test level is applied without primary protection in place.

### 15.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Universal Surge Coupling De-Coupling Network em test	CNV 508T5	P1508149592	Aug. 20, 2019	Aug. 19, 2020
Universal Surge Coupling De-Coupling Network TESEQ	CDN HSS-2	41008	Aug. 19, 2019	Aug. 18, 2020
Modular Impulse Generator TESEQ	NSG 3060 / CDN 3061	1796 / 1554	Mar. 19, 2020	Mar. 18, 2021
Telecom surge module TESEQ	NSG 3060	1799	Mar. 19, 2020	Mar. 18, 2021

Notes: 1. The test was performed in Hwa Ya Surge Room 1.

2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### 15.3 Test Arrangement

a. Input AC/DC Power ports:

The surge is to be applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).

For double-insulated products without PE or external earth connections, the test shall be done in a similar way as for grounded products but without adding any additional external grounded connections. If there are no other possible connections to earth, line-to-ground tests may be omitted.

b. Signal and telecommunication ports,

- Unshielded unsymmetrical interconnection lines:

The surge is applied to the lines via the capacitive coupling. The coupling / decoupling networks shall not influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length.

- Unshielded symmetrical interconnections communication lines:

The surge is applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor cannot be specified. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length.

- High speed communications lines

Prior to the test, the correct operation of the port shall be verified; the external connection shall then be removed and the surge applied directly to the port's terminals with no coupling /decoupling network. After the surge, the correct operation of the port shall again be verified.

- Shielded lines:

- Direct application,

The EUT is isolated from ground and the surge is applied to its metallic enclosure; the termination (or auxiliary equipment) at the port(s) under test is grounded. This test applies to equipment with single or multiple shielded cables.

Rules for application of the surge to shielded lines:

- a) Shields grounded at both ends

- The surge injection on the shield.

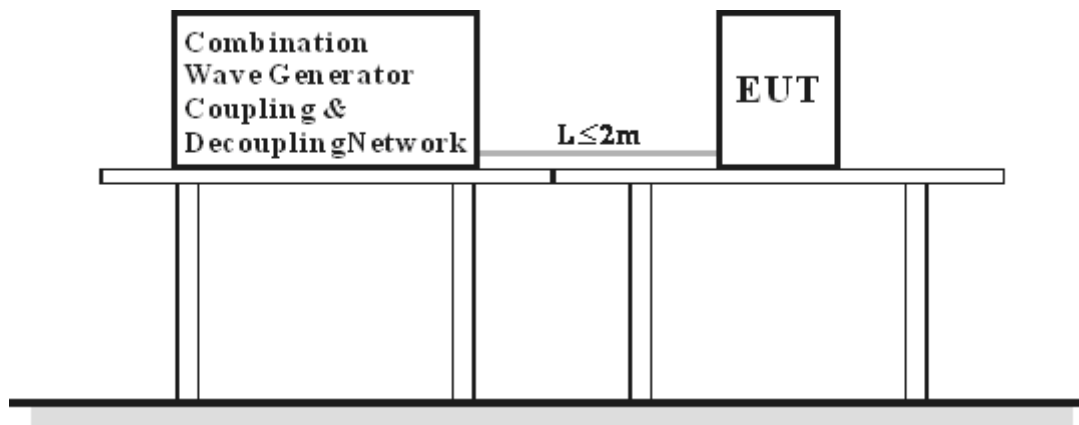
- b) Shields grounded at one end

- If in the installation the shield is connected only at the auxiliary equipment, test shall be done in that configuration but with the generator still connected to the EUT side. If cable lengths allow, the cables shall be on insulated supports 0,1 m above the ground plane or cable tray.

For products which do not have metallic enclosures, the surge is applied directly to the shielded cable.

- Alternative coupling method for testing single cables in a multi-shield configuration,

Surges are applied in close proximity to the interconnection cable under test by a wire. The length of the cable between the port(s) under test and the device attached to the other end of the cable shall be the lesser of: the maximum length permitted by the EUT's specification, or 20 m. Where the length exceeds 1 m, excess lengths of cables shall be bundled at the approximate centre of the cables with the bundles 30 cm to 40 cm in length.



#### 15.4 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Ryan Cheng
Environmental Conditions	24 °C, 50 % RH	Test Date	2020/08/03

#### Input AC power port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5, 1	L1-L2	+/-	Note 1	A
0.5, 1, 2	L1-PE	+/-	Note 1	A
0.5, 1, 2	L2-PE	+/-	Note 1	A

Note: 1. The EUT function was correct during the test.

## 16 Immunity to Conducted Disturbances Induced by RF Fields (CS)

### 16.1 Test Specification

Basic Standard:	EN/IEC 61000-4-6
Frequency Range:	0.15 MHz - 80 MHz
Voltage Level:	3 V
Modulation:	1 kHz Sine Wave, 80 %, AM Modulation
Frequency Step:	1 % of preceding frequency value
Dwell Time	3 seconds

### 16.2 Test Instruments

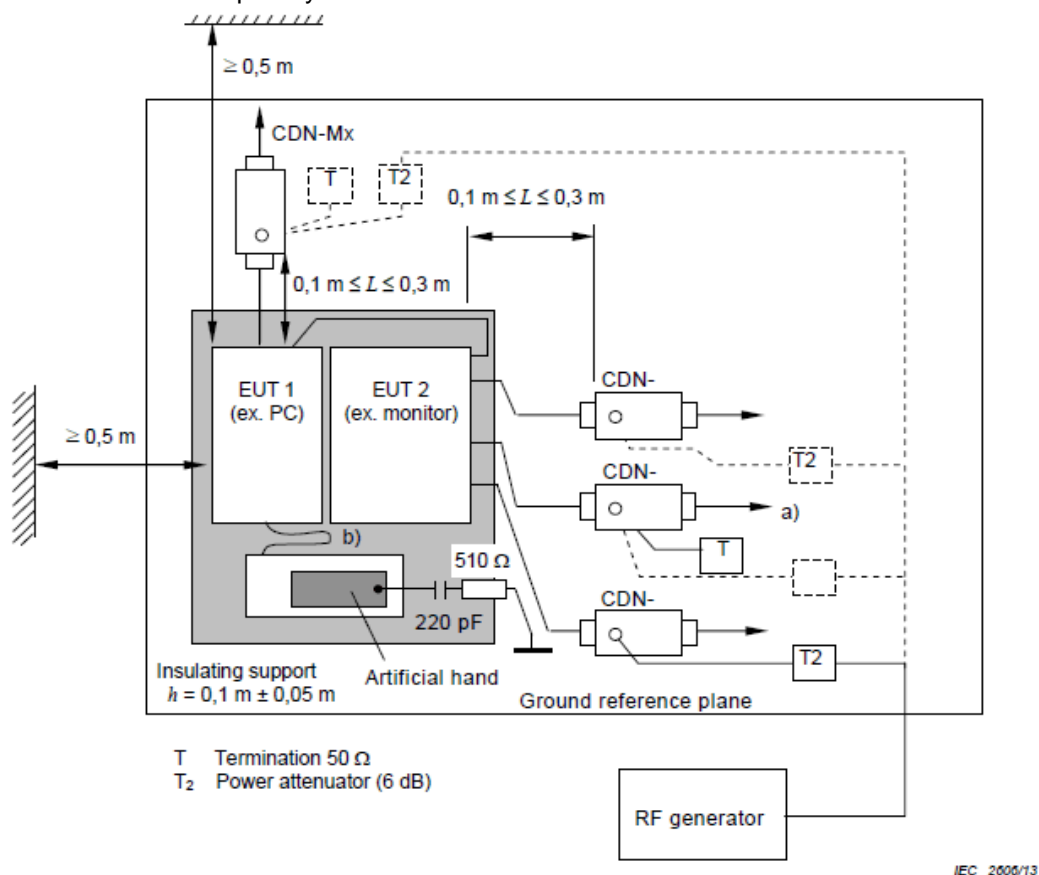
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
FCC POWER LINE COUPLING DECOUPLING NETWORK	FCC-801-M3-25A	03056	Mar. 04, 2020	Mar. 03, 2021
FCC SIGNAL LINE POWER LINE COUPLING DECOUPLING NETWORK	F-090407-1004-1	100923	Mar. 05, 2020	Mar. 04, 2021
Coupling Decoupling Network TESEQ	CDN T8-10	43230	Mar. 04, 2020	Mar. 03, 2021
Coupling Decoupling Network TESEQ	CDN T8-10	43229	Mar. 05, 2020	Mar. 04, 2021
Coupling Decoupling Network TESEQ	CDN S751S	35791	Mar. 05, 2020	Mar. 04, 2021
EMI Injection Clamp	F203I-23MM	434	Mar. 31, 2020	Mar. 30, 2021
Amplifier Research Power Amplifier	75A250AM2	307804	NA	NA
Signal Generator ROHDE & SCHWARZ	SMB 100A	105489	Aug. 21, 2019	Aug. 20, 2020
POWER METER BOONTON	4232A	107402	Jul. 13, 2020	Jul. 12, 2021
POWER SENSOR BOONTON	51011-EMC	33105	Jul. 13, 2020	Jul. 12, 2021
POWER SENSOR BOONTON	51011-EMC	33107	Jul. 13, 2020	Jul. 12, 2021
Software	ADT_CS_V37	NA	NA	NA
6dB Attenuator	6NFNF150ATT	NA	NA	NA

- Notes: 1. The test was performed in Hwa Ya CS Room 1.  
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.



### 16.3 Test Arrangement

- The EUT shall be tested within its intended operating and climatic conditions.
- An artificial hand was placed on the hand-held accessory and connected to the ground reference plane.
- One of the CDNs not used for injection was terminated with 50 ohm, providing only one return path. All other CDNs were coupled as decoupling networks.
- The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal is modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. Where the frequency is swept incrementally, the step size shall not exceed 1 % of the preceding frequency value.
- Attempts should be made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.



- Only one of the CDNs not used for injection shall be terminated with 50 Ω, providing only one return path. All other CDNs shall be configured as decoupling networks.
- Interconnecting cables ( $\leq 1$  m) belonging to the EUT shall remain on the insulating support.

#### 16.4 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Timothy Chen
Environmental Conditions	25 °C, 57 % RH	Test Date	2020/07/31

Frequency (MHz)	Level (Vrms)	Tested Line	Injection Method	Return Path	Observation	Performance Criterion
0.15 – 80	3	AC Power	CDN-M3	CDN-T8	Note 1	A
0.15 – 80	3	LAN 1	CDN-T8	CDN-M3	Note 1	A
0.15 – 80	3	LAN 2	CDN-T8	CDN-M3	Note 1	A
0.15 – 80	3	LAN3 (POE)	CDN-T8	CDN-M3	Note 1	A
0.15 – 80	3	LAN 4 (POE)	CDN-T8	CDN-M3	Note 1	A

Note: 1. The EUT function was correct during the test.

## 17 Power Frequency Magnetic Field Immunity Test

### 17.1 Test Specification

Basic Standard:	EN/IEC 61000-4-8
Frequency Range:	50 Hz
Field Strength:	1 A/m
Observation Time:	1 minute
Inductance Coil:	Rectangular type, 1 m x 1 m

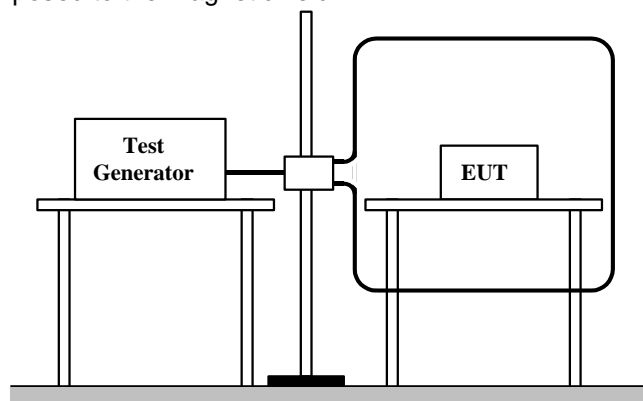
### 17.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
F.W.BELL 4190 Gaussmeter	4190	0743043	Apr. 01, 2020	Mar. 31, 2021
Schaffner AC Power Source	NSG1007	55616	Oct. 09, 2019	Oct. 08, 2020
Schaffner Signal Conditioning Unit- Lumped Impedance	CCN1000-1-LR1	72224	Oct. 09, 2019	Oct. 08, 2020
Multi turn Magnetic TESEQ	INA702/INA2141	268/1427	Oct. 09, 2019	Oct. 08, 2020

- Notes: 1. The test was performed in Hwa Ya EMS Room.  
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### 17.3 Test Arrangement

- The equipment is configured and connected to satisfy its functional requirements.
- The power supply, input and output circuits shall be connected to the sources of power supply, control and signal.
- The cables supplied or recommended by the equipment manufacturer shall be used. 1 meter of all cables used shall be exposed to the magnetic field.



#### 17.4 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Andy Chang
Environmental Conditions	25 °C, 58 % RH	Test Date	2020/07/31

Application	Frequency (Hz)	Field Strength (A/m)	Observation	Performance Criterion
X - Axis	50	1	Note 1	A
Y - Axis	50	1	Note 1	A
Z - Axis	50	1	Note 1	A

Note: 1. The EUT function was correct during the test.

## 18 Voltage Dips and Interruptions

### 18.1 Test Specification

Basic Standard:	EN/IEC 61000-4-11
Test levels:	Voltage Dips: >95 % reduction – 0.5 period 30 % reduction – 25 periods Voltage Interruptions: >95 % reduction – 250 periods
Interval between Event:	Minimum ten seconds
Sync Angle (degrees):	0° / 180°
Test Cycle:	3 times

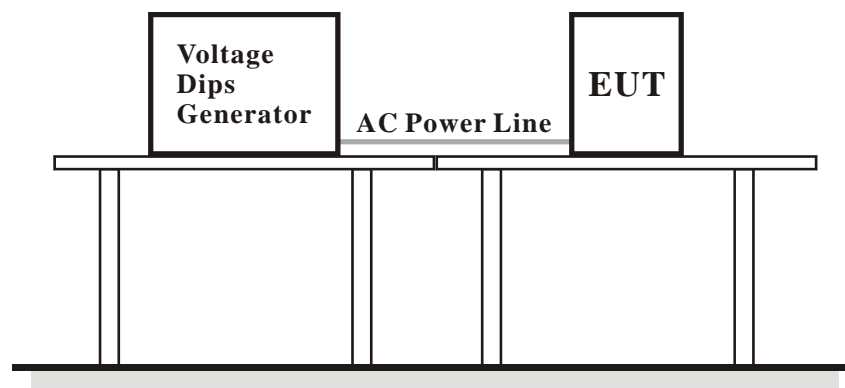
### 18.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
EFT Generator TESEQ	NSG 3040	2251	Mar. 20, 2020	Mar. 19, 2021
DIP Generator TESEQ	INA 6502-CIB	229	Mar. 30, 2020	Mar. 29, 2021

- Notes: 1. The test was performed in Hwa Ya DIP Room.  
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### 18.3 Test Arrangement

The EUT shall be tested for each selected combination of test levels and duration with a sequence of 3 dips/interruptions with intervals of 10 s minimum (between each test event). Each representative mode of operation shall be tested. Abrupt changes in supply voltage shall occur at 0 degree crossover point of the voltage waveform.



#### 18.4 Test Results

Input Power	100-240 Vac, 50 Hz	Tested by	Vincent Yang
Environmental conditions	25 °C, 50 % RH	Test Date	2020/08/05

Input Power for testing: 230 Vac, 50 Hz (Nominal input Voltage)					
Voltage Reduction (%)	Duration (period)	Interval (sec)	Times	Observation	Performance Criterion
>95	0.5	10	3	Note 1	A
30	25	10	3	Note 1	A
>95	250	10	3	Note 2	C

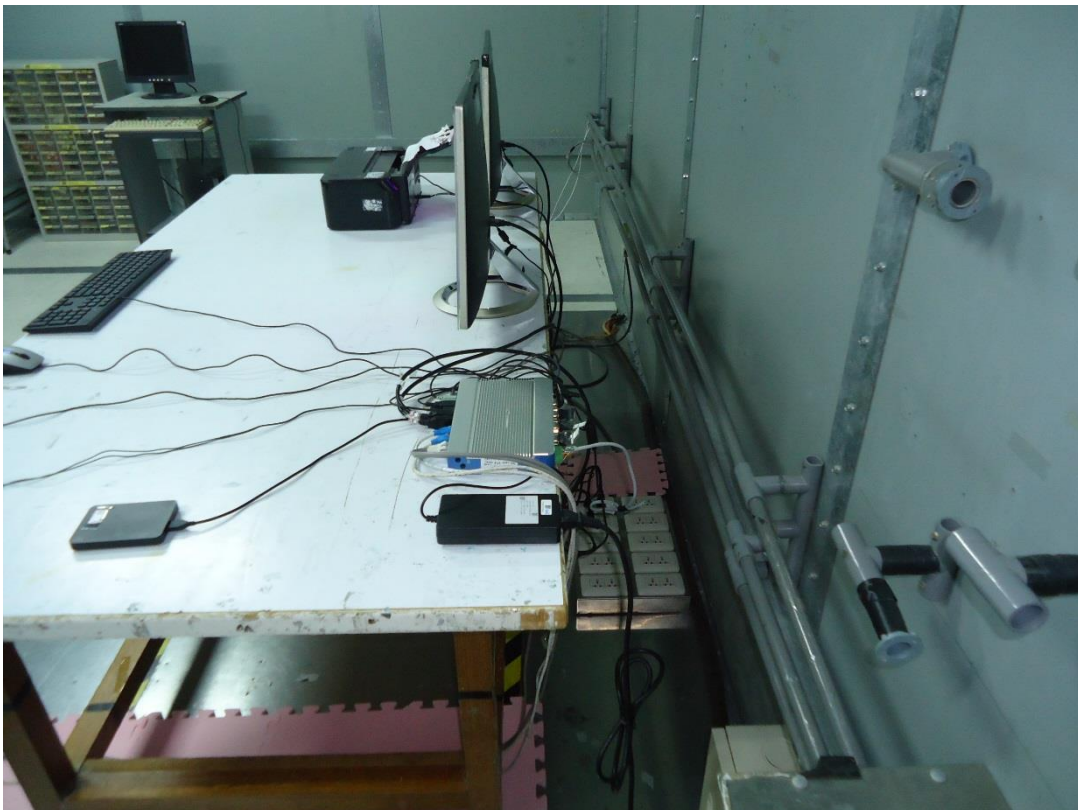
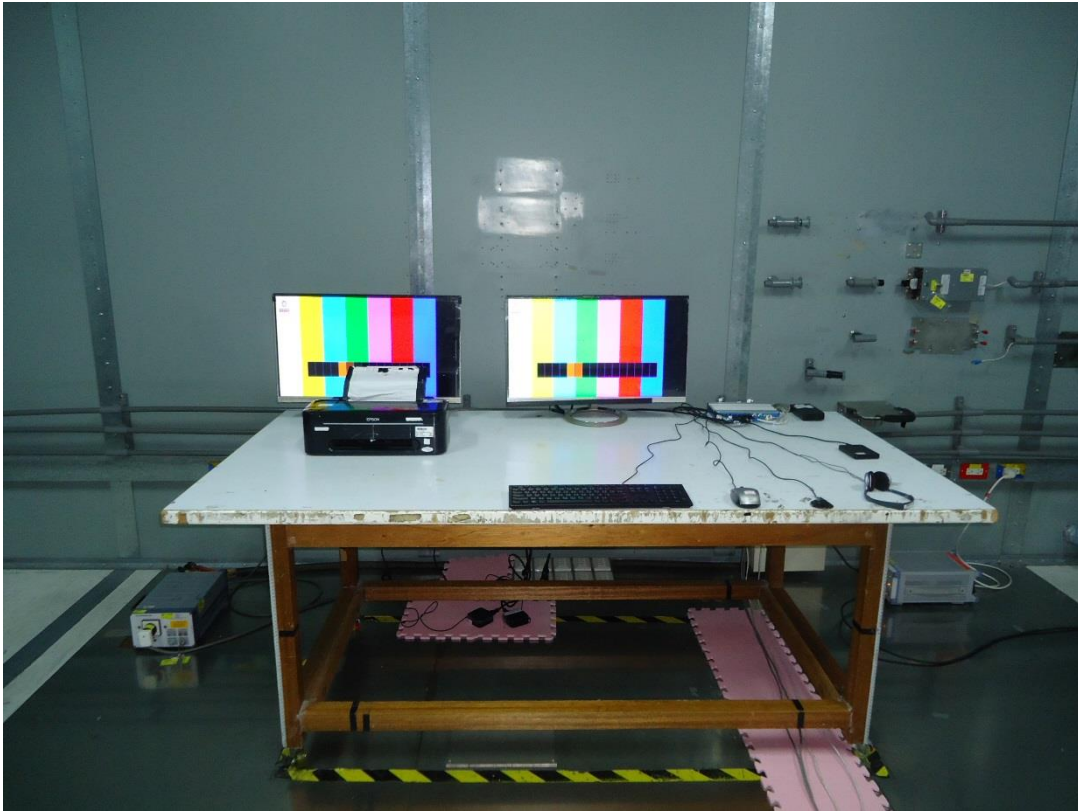
Input Power for testing: 240 Vac, 50 Hz (Maximum rated input voltage)					
Voltage Reduction (%)	Duration (period)	Interval (sec)	Times	Observation	Performance Criterion
>95	0.5	10	3	Note 1	A
30	25	10	3	Note 1	A
>95	250	10	3	Note 2	C

Input Power for testing: 100 Vac, 50 Hz (Minimum rated input voltage)					
Voltage Reduction (%)	Duration (period)	Interval (sec)	Times	Observation	Performance Criterion
>95	0.5	10	3	Note 1	A
30	25	10	3	Note 1	A
>95	250	10	3	Note 2	C

- Note: 1. The EUT function was correct during the test.  
 2. The EUT shutdown during the test, and must be recovered manually.

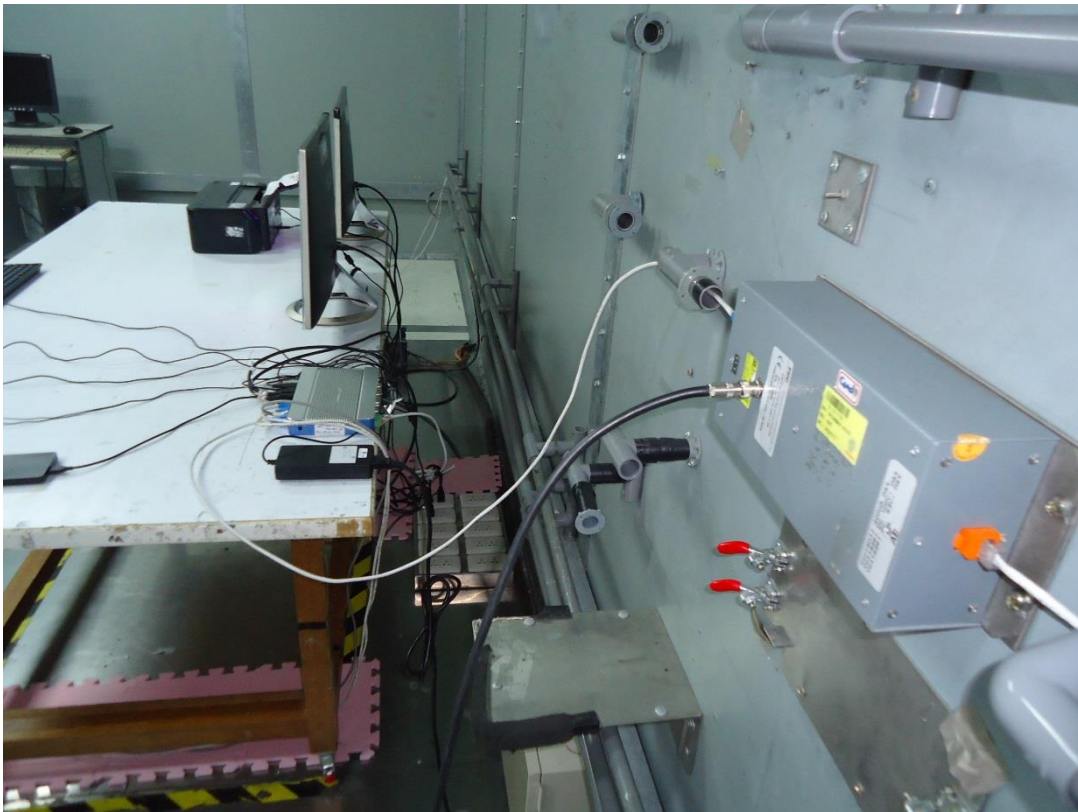
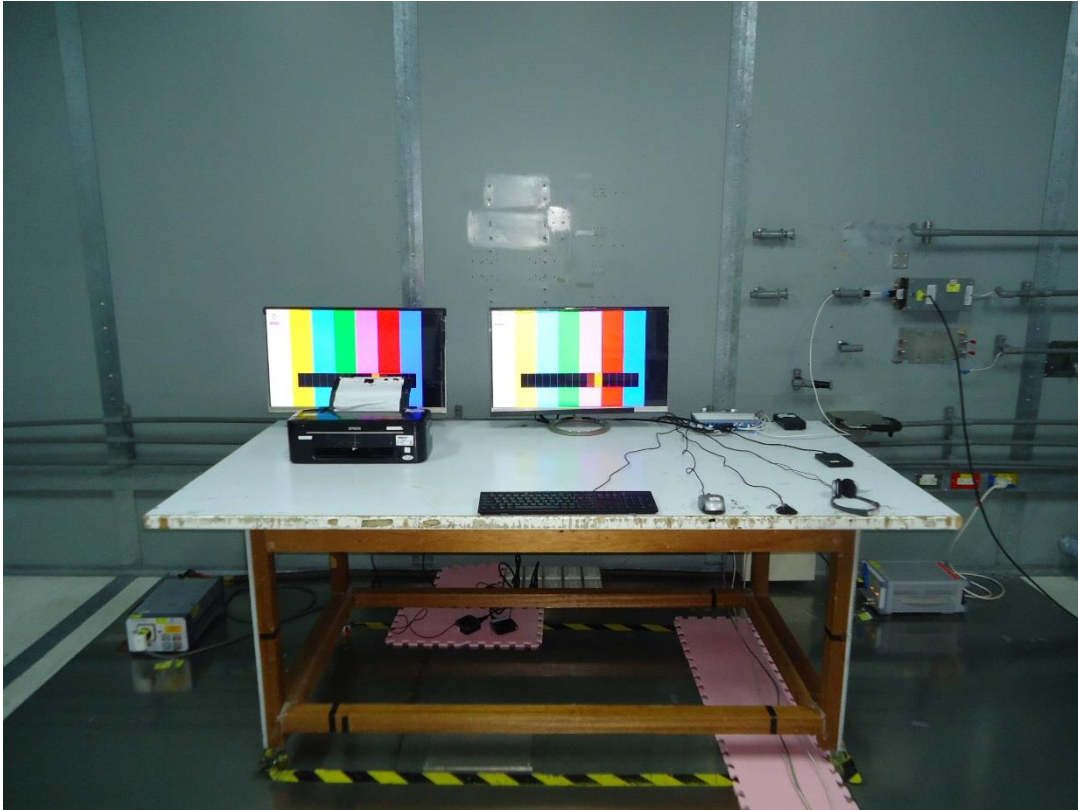
## 19 Pictures of Test Arrangements

### 19.1 Conducted Disturbance at Mains Ports



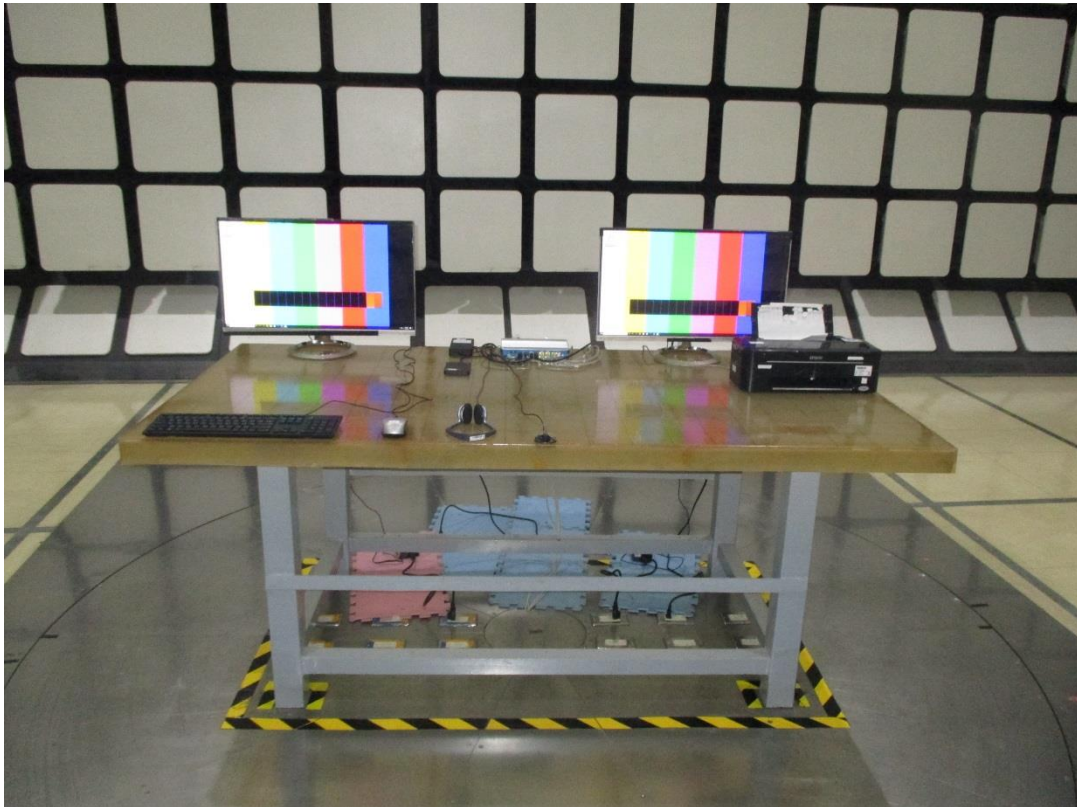


## 19.2 Asymmetric Mode Conducted Emission at Wired Network Ports





### 19.3 Radiated Disturbance up to 1 GHz



#### 19.4 Radiated Disturbance above 1 GHz

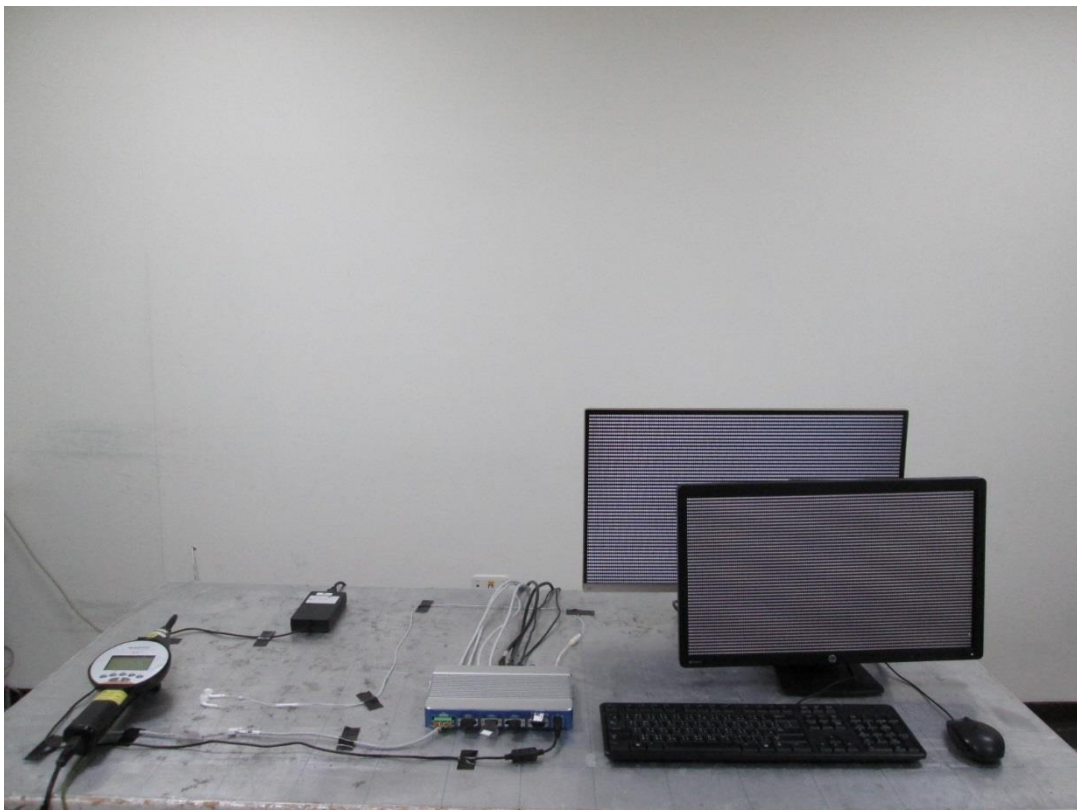




## 19.5 Harmonics Current, Voltage Fluctuations and Flicker Measurement



## 19.6 Electrostatic Discharge Immunity Test (ESD)



### 19.7 Radio-frequency, Electromagnetic Field Immunity Test (RS)



### 19.8 Electrical Fast Transient/Burst Immunity Test (EFT)

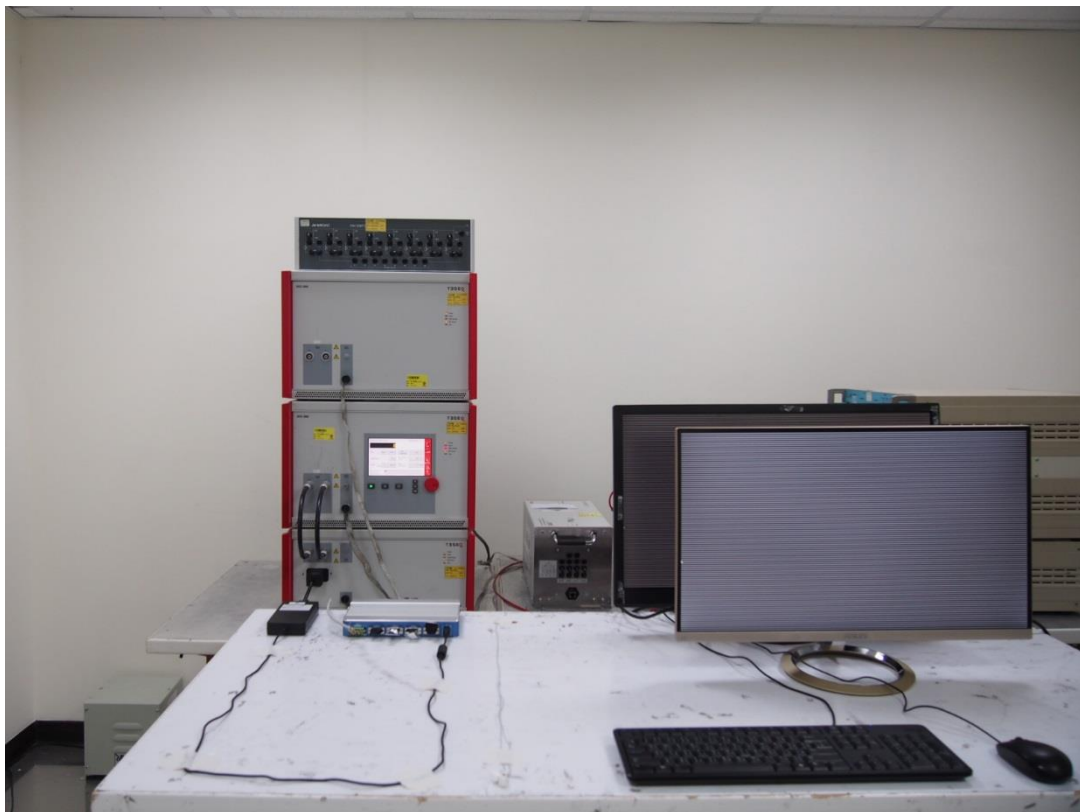
AC ports



LAN ports



### 19.9 Surge Immunity Test





## 19.10 Conducted Disturbances Induced by RF Fields (CS)

AC ports



LAN ports



POE ports



19.11 Power Frequency Magnetic Field Immunity Test (PFMF)



## 19.12 Voltage Dips and Interruptions





## Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

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The address and road map of all our labs can be found in our web site also.

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