

## CE EMC Test Report

**Report No.:** CE190611D11

**Test Model:** PE-3004

**Series Model:** PE-3XXXXXXXXXXXXXXXXXX  
("X" can be 0-9, A-Z or blank for marketing purpose)

**Received Date:** Jun. 11, 2019

**Test Date:** Jun. 17 to Aug. 24, 2019

**Issued Date:** Aug. 28, 2019

**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**

<b>Issue No.</b>	<b>Description</b>	<b>Date Issued</b>
CE190611D11	Original release.	Aug. 28, 2019

## 1 Certificate of Conformity

**Product:** PCI Express PoE+ Expansion Card  
**Brand:** Vecow  
**Test Model:** PE-3004  
**Series Model:** PE-3XXXXXXXXXXXXXXXXXX  
("X" can be 0-9, A-Z or blank for marketing purpose)  
**Sample Status:** Engineering sample  
**Applicant:** Vecow Co., Ltd.  
**Test Date:** Jun. 17 to Aug. 24, 2019  
**Standards:** **EN 55032:2015 +AC:2016, Class A**  
**EN 61000-3-2:2014 (Not applicable)**  
**EN 61000-3-3:2013 (Not applicable)**  
**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 (Not applicable)  
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 (Not applicable)

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. 28, 2019  
Sandra Lin / Specialist

**Approved by :**  , **Date:** Aug. 28, 2019  
Jim Hsiang / Associate Technical Manager

## 2 Summary of Test Results

Emission			
Standard	Test Item	Result/Remarks	Verdict
EN 55032:2015 +AC:2016	Conducted emission from the AC mains power port	Minimum passing Class A margin is -13.76 dB at 14.28516 MHz	Pass
	Asymmetric mode conducted emission at telecommunication ports	Minimum passing Class A margin is -3.25 dB at 2.81301 MHz	Pass
	Radiated emission 30-1000 MHz	Minimum passing Class A margin is -4.86 dB at 174.91 MHz	Pass
	Radiated emission above 1GHz	Minimum passing Class A margin is -13.44 dB at 2941.15 MHz	Pass
EN 61000-3-2:2014	Harmonic current emissions	Test not applicable because port does not exists	N/A
EN 61000-3-3:2013	Voltage fluctuations and flicker	Test not applicable because port does not exists	N/A

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 A	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	EUT doesn't connect directly to outdoor cables and EUT consumes DC power	N/A
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	EUT consumes DC power	N/A

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.
4. N/A: Not Applicable

## 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 emission from AC mains power port using AMN, 150kHz ~ 30MHz	2.77 dB	3.4 dB ( $U_{\text{CISPR}}$ )
Asymmetric mode conducted emission using AAN, 150kHz ~ 30MHz	3.94 dB	5.0 dB ( $U_{\text{CISPR}}$ )
Radiated emission, 30MHz ~ 1GHz	4.00 dB	6.3 dB ( $U_{\text{CISPR}}$ )
Radiated emission, 1GHz ~ 6GHz	5.18 dB	5.2 dB ( $U_{\text{CISPR}}$ )

## 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 Description of EUT

Product	PCI Express PoE+ Expansion Card
Brand	Vecow
Test Model	PE-3004
Series Model	PE-3XXXXXXXXXXXXXXXXX (“X” can be 0-9, A-Z or blank for marketing purpose)
Model Difference	Marketing Purpose
Sample Status	Engineering sample
Operating Software	N/A
Power Supply Rating	DC power from IPC
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

1. The EUT is a PCI Express PoE+ Expansion Card with four LAN ports and installed in IPC during the test.
2. The EUT maximum data rate is 1Gbps.

#### 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

1. The EUT was pre-tested under operating and standby condition and the worst emission level was found under **operating condition**.
2. Test modes are presented in the report as below.

Mode	Test Condition	Input Power
<b>Conducted emission test &amp; Radiated emission test</b>		
1	EUT installed in IPC+ *IP Camera (100Mbps)	230Vac/ 50Hz (System)
<b>Asymmetric mode conducted emission at telecommunication ports</b>		
1	EUT installed in IPC+ *IP Camera (100Mbps), LAN port 1, 100Mbps (TFGEN+PING)	230Vac/ 50Hz (System)
	EUT installed in IPC+ *IP Camera (100Mbps), LAN port 4, 100Mbps (TFGEN+PING)	
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.		
<b>Immunity tests (ESD, RS tests excluded)</b>		
1	EUT installed in IPC+ *IP Camera (100Mbps) with Non-Shield LAN cable	230Vac/ 50Hz (System)
<b>Immunity tests (only for ESD test)</b>		
1	EUT installed in IPC+ *IP Camera (100Mbps) with Shield LAN cable	230Vac/ 50Hz (System)
<b>Immunity tests (only for RS test)</b>		
1	EUT installed in IPC+ *IP Camera (100Mbps) with Non-Shield LAN cable	24Vdc

**Note\*:** As client's request, using the maximum data rate of IP camera (Supplied by client) is 100Mbps during the test.

### 3.4 Test Program Used and Operation Descriptions

#### Emission tests:

- a. Installed the EUT into IPC.
- b. Turned on the power of all equipment.
- c. IPC ran a test program to enable all functions.
- d. IPC read and wrote messages from/to HDD.
- e. IP camera ping IPC via EUT with four UTP LAN cables.
- f. IPC sent "color bars with moving element" messages to monitor then displayed "color bars with moving element" messages on its screen.
- g. IPC sent messages to printer and printer printed them out.
- h. IPC sent messages to modem.
- i. Steps d-h were repeated.

#### Immunity tests (RS test excluded):

- a. Installed the EUT into IPC.
- b. Turned on the power of all equipment.
- c. IPC ran a test program to enable all functions.
- d. IPC read and wrote messages from/to HDD.
- e. IP camera ping IPC via EUT with four UTP LAN cables.
- f. IP camera ping IPC via EUT with four STP LAN cables. (**only for ESD test**)
- g. IPC sent "H" messages to monitor then displayed "H" messages on its screen.
- h. Steps d-g were repeated.

#### Immunity tests (Only for RS test):

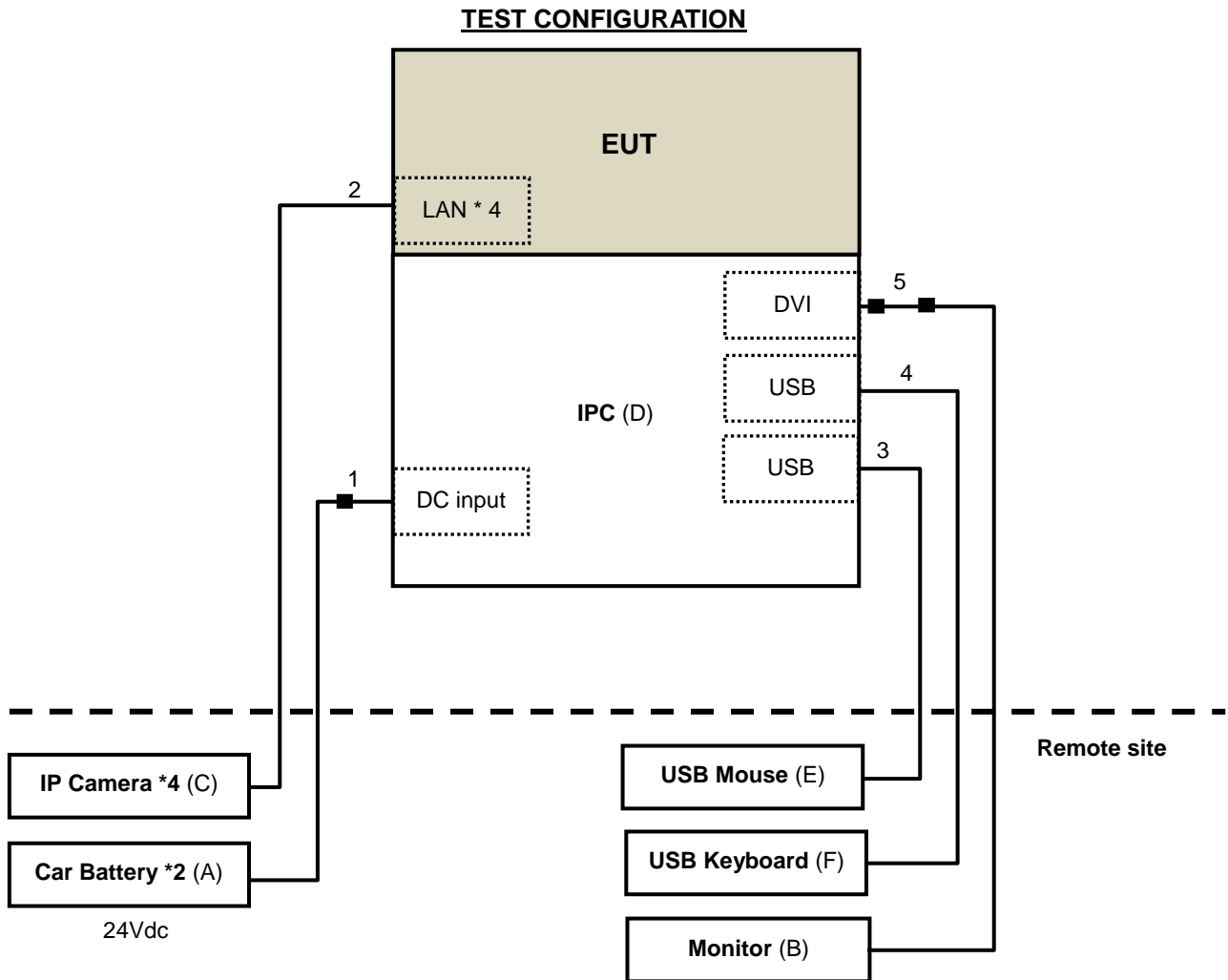
- a. Installed the EUT into IPC.
- b. Turned on the power of all equipment.
- c. IPC ran a test program to enable all functions.
- d. IPC read and wrote messages from/to HDD.
- e. IP camera (kept in a remote area) ping IPC via EUT with four UTP LAN cables.
- f. IPC sent "H" messages to monitor (kept in a remote area) then displayed "H" messages on its screen.
- g. Steps d-f were repeated.

### 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 1000MHz, provided by Vecow Co., Ltd., for detailed internal source, please refer to the manufacturer's specifications.



Immunity tests (Only for RS test):



## 4.2 Configuration of Peripheral Devices and Cable Connections

Emission tests:

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	IPC	Vecow	RCS-9000	N/A	N/A	Supplied by client
B.	LCD Monitor	ASUS	MG28UQ	J1LMTF114786	N/A	Provided by Lab
C.	USB Mouse	Microsoft	1113	9170528318292	FCC DoC Approved	Provided by Lab
D.	USB Keyboard	Dell	KB216t	CN-0W33XP-LO300-7CL-1908	FCC DoC Approved	Provided by Lab
E.	Printer	HP	Officejet pro 251dw	CN55FCV019	N/A	Provided by Lab
F.	IP Camera *4	N/A	A301RZ-0309P	WXF1E84H2ASN	FCC DoC Approved	Supplied by client
G.	Modem	ACEEX	1414	0206026747	IFAXDM1414	Provided by Lab
H.	Adapter	Seasonic	SSA-1201-24	N/A	N/A	Supplied by client
I.	RS232 Load *4	N/A	N/A	N/A	N/A	Provided by Lab

Note:

- All power cords of the above support units are non-shielded (1.8m).
- The rating of support unit H is as follows:  
AC I/P: 100-240Vac, 2A, 50/60Hz  
DC O/P: 24V/5A, 120W Max

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DP cable	1	1.8	Y	0	Provided by Lab
2.	USB cable	1	1.8	Y	1	Provided by Lab
3.	USB cable	1	1.8	Y	0	Provided by Lab
4.	USB cable	1	1.5	Y	0	Provided by Lab
5.	LAN cable (Cat.5e)	4	1.5	N	0	Provided by Lab
6.	RS232 cable	1	1.5	Y	0	Provided by Lab
7.	DC power cable	1	1.0	N	0	Supplied by client
8.	AC power cable	1	1.8	N	0	Provided by Lab

Note: The core(s) is(are) originally attached to the cable(s).

**Immunity tests (RS test excluded):**

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	IPC	Vecow	RCS-9000	N/A	N/A	Supplied by client
B.	24" LCD Monitor	DELL	U2410	CN082WXD728720 CC0KDL	N/A	Provided by Lab
C.	USB Mouse	LENOVO	SM-8823	N/A	FCC DoC Approved	Provided by Lab
D.	USB Keyboard	LENOVO	KB1021	N/A	FCC DoC Approved	Provided by Lab
E.	RS232 Load *4	N/A	N/A	N/A	N/A	Provided by Lab
F.	Adapter	Seasonic	SSA-1201-24	N/A	N/A	Supplied by client
G.	IP Camera *4	N/A	A301RZ-0309P	WXF1E84H2ASN	FCC DoC Approved	Supplied by client

Note:

- All power cords of the above support units are non-shielded (1.8m).
- The rating of support unit F is as follows:  
AC I/P: 100-240Vac, 2A, 50/60Hz  
DC O/P: 24V/5A, 120W Max

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DVI cable	1	1.8	Y	2	Provided by Lab
2.	USB cable	1	1.8	Y	0	Provided by Lab
3.	USB cable	1	1.8	Y	0	Provided by Lab
4.	LAN cable (Cat.5e)	4	5.0	N	0	Provided by Lab
	LAN cable (Cat.5e) <only for ESD test>	4	5.0	Y	0	Provided by Lab
5.	DC power cable	1	1.0	N	0	Supplied by client
6.	AC power cable	1	1.8	N	0	Provided by Lab

Note: The core(s) is(are) originally attached to the cable(s).

**Immunity tests (Only for RS test):**

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Car Battery *2	YUASA	75D23R	N/A	N/A	Provided by Lab
B.	24" LCD Monitor	DELL	2408FPb	CN-0G293H-74261- 874-22KS-A00	N/A	Provided by Lab
C.	IP Camera *4	N/A	A301RZ-0309P	WXF1E84H2ASN	FCC DoC Approved	Supplied by client
D.	IPC	Vecow	RCS-9000	N/A	N/A	Supplied by client
E.	USB Mouse	Dell	MS111-L	N/A	FCC DoC Approved	Provided by Lab
F.	USB Keyboard	Dell	SK-8115	N/A	FCC DoC Approved	Provided by Lab

Note: All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC power cable	1	5.0	N	1	Provided by Lab
2.	LAN cable (Cat.5e)	4	5.0	N	0	Provided by Lab
3.	USB cable	1	1.8	Y	0	Provided by Lab
4.	USB cable	1	2.0	Y	0	Provided by Lab
5.	DVI cable	1	1.5	Y	2	Provided by Lab

Note: The core(s) is(are) originally attached to the cable(s).

## 5 Conducted Emission from the AC Mains Power Port

### 5.1 Limits

Frequency range (MHz)	Coupling device	Detector type / bandwidth	Class A limits (dBuV)
0.15 - 0.5	AMN	Quasi-peak / 9kHz	79
0.5 - 30.0			73
0.15 - 0.5		Average / 9kHz	66
0.5 - 30.0			60

Frequency range (MHz)	Coupling device	Detector type / bandwidth	Class B limits (dBuV)
0.15 - 0.5	AMN	Quasi-peak / 9kHz	66 - 56
0.5 - 5			56
5 - 30.0			60
0.15 - 0.5		Average / 9kHz	56 - 46
0.5 - 5			46
5 - 30.0			50

### 5.2 Test Instruments

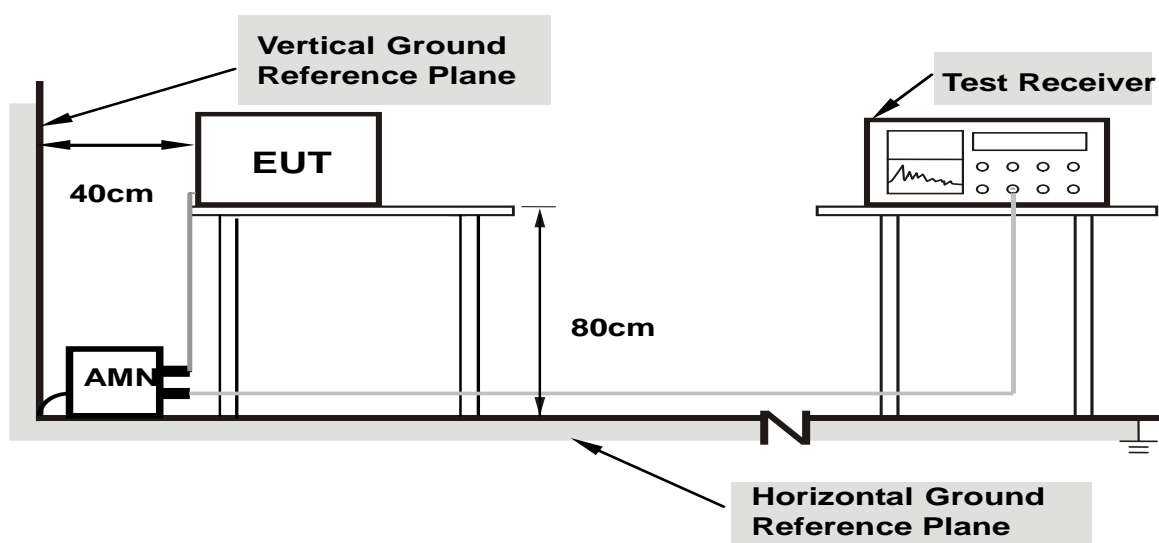
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCS 30	838251/021	Nov. 1, 2018	Oct. 31, 2019
ROHDE & SCHWARZ Artificial Mains Network (For EUT)	ENV216	101195	May 9, 2019	May 8, 2020
LISN With Adapter(for EUT)	101195	N/A	May 9, 2019	May 8, 2020
EMCO L.I.S.N. (For peripherals)	3825/2	9504-2359	Jul. 26, 2018	Jul. 25, 2019
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK8129	8129229	May 14, 2019	May 13, 2020
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK 8121	8121-808	Mar. 15, 2019	Mar. 14, 2020
Software	Cond_V7.3.7.4	NA	NA	NA
RF cable (JYEBAO) With 10dB PAD	5D-FB	Cable-C03-01	Sep. 18, 2018	Sep. 17, 2019
LYNICS Terminator (For EMCO LISN)	0900510	E1-01-300	Jan. 25, 2019	Jan. 24, 2020
LYNICS Terminator (For EMCO LISN)	0900510	E1-01-301	Jan. 25, 2019	Jan. 24, 2020
ROHDE & SCHWARZ Artificial Mains Network (For TV EUT)	ESH3-Z5	100220	Nov. 21, 2018	Nov. 20, 2019
LISN With Adapter(for TV EUT)	100220	NA	Nov. 21, 2018	Nov. 20, 2019

- Note: 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 Shielded Room No. 3.  
 3. The VCCI Site Registration No. C-10274.  
 4. Tested Date: Jun. 17, 2019

### 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/ 50uH 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 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.



- Note:**
1. Support units were connected to second AMN.
  2. The distance specified between EUT/AE and other metallic objects is  $\geq 0.8$  m in the measurement arrangement for table-top EUT.
  3. Cable on the RGP must to be insulated.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.



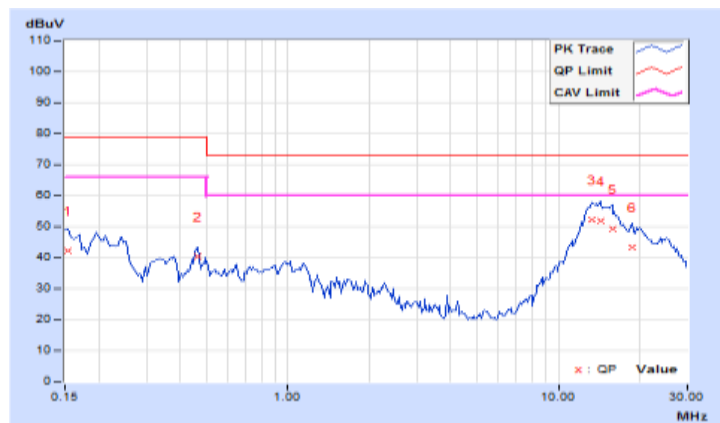
### 5.4 Test Results

<b>Frequency Range</b>	150kHz ~ 30MHz	<b>Detector Function &amp; Bandwidth</b>	Quasi-Peak (QP) / Average (AV), 9kHz
<b>Input Power (System)</b>	230Vac, 50Hz	<b>Environmental Conditions</b>	25°C, 71%RH, 1000mbar
<b>Tested by</b>	John Liao		
<b>Test Mode</b>	Mode 1		

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	0.15391	9.62	32.52	24.24	42.14	33.86	79.00	66.00	-36.86	-32.14
2	0.46250	9.64	30.60	20.42	40.24	30.06	79.00	66.00	-38.76	-35.94
3	13.24219	9.89	42.27	36.06	52.16	45.95	73.00	60.00	-20.84	-14.05
<b>4</b>	<b>14.28516</b>	<b>9.90</b>	<b>41.86</b>	<b>36.34</b>	<b>51.76</b>	<b>46.24</b>	<b>73.00</b>	<b>60.00</b>	<b>-21.24</b>	<b>-13.76</b>
5	15.88281	9.91	39.30	34.27	49.21	44.18	73.00	60.00	-23.79	-15.82
6	18.79297	9.92	33.33	26.27	43.25	36.19	73.00	60.00	-29.75	-23.81

**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

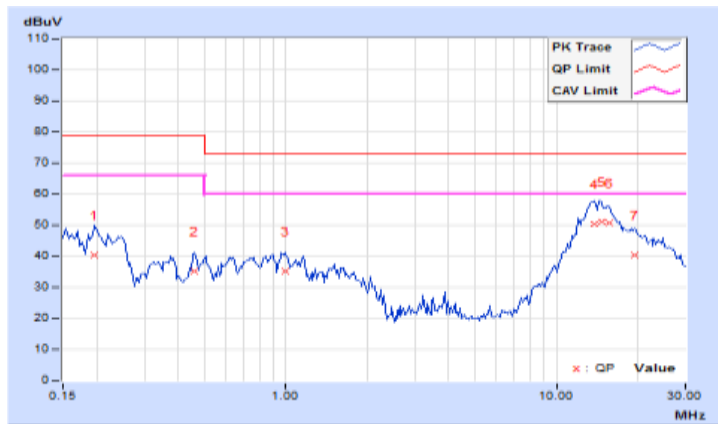


<b>Frequency Range</b>	150kHz ~ 30MHz	<b>Detector Function &amp; Bandwidth</b>	Quasi-Peak (QP) / Average (AV), 9kHz
<b>Input Power (System)</b>	230Vac, 50Hz	<b>Environmental Conditions</b>	25°C, 71%RH, 1000mbar
<b>Tested by</b>	John Liao		
<b>Test Mode</b>	Mode 1		

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	0.19687	9.60	30.80	22.00	40.40	31.60	79.00	66.00	-38.60	-34.40
2	0.45859	9.61	25.68	14.38	35.29	23.99	79.00	66.00	-43.71	-42.01
3	0.98984	9.66	25.43	18.34	35.09	28.00	73.00	60.00	-37.91	-32.00
4	13.83984	9.91	40.54	35.28	50.45	45.19	73.00	60.00	-22.55	-14.81
5	14.64453	9.92	41.05	35.76	50.97	45.68	73.00	60.00	-22.03	-14.32
6	15.69141	9.93	40.83	35.69	50.76	45.62	73.00	60.00	-22.24	-14.38
7	19.59375	9.97	30.40	24.24	40.37	34.21	73.00	60.00	-32.63	-25.79

**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 Telecommunication Ports

### 6.1 Limits

For Class A Equipment

Frequency range (MHz)	Coupling device	Detector type / bandwidth	Voltage limits (dBuV)	Current limits (dBuA)	
0.15 - 0.5	AAN	Quasi-peak / 9kHz	97 – 87	N/A	
0.5 - 30.0			87		
0.15 - 0.5	AAN	Average / 9kHz	84-74		
0.5 - 30.0			74		
0.15 - 0.5	CVP and current probe	Quasi-peak / 9kHz	97 – 87		53 – 43
0.5 - 30.0			87		43
0.15 - 0.5	CVP and current probe	Average / 9kHz	84-74	40 – 30	
0.5 - 30.0			74	30	
0.15 - 0.5	Current Probe	Quasi-peak / 9kHz	N/A	53 – 43	
0.5 - 30.0				43	
0.15 - 0.5	Current Probe	Average / 9kHz		40 – 30	
0.5 - 30.0				30	

For Class B Equipment

Frequency range (MHz)	Coupling device	Detector type / bandwidth	Voltage limits (dBuV)	Current limits (dBuA)
0.15 - 0.5	AAN	Quasi-peak / 9kHz	84 – 74	N/A
0.5 - 30.0			74	
0.15 - 0.5	AAN	Average / 9kHz	74-64	
0.5 - 30.0			64	
0.15 - 0.5	CVP and current probe	Quasi-peak / 9kHz	84 – 74	40 – 30
0.5 - 30.0			74	30
0.15 - 0.5	CVP and current probe	Average / 9kHz	74-64	30 – 20
0.5 - 30.0			64	20
0.15 - 0.5	Current Probe	Quasi-peak / 9kHz	N/A	40 – 30
0.5 - 30.0				30
0.15 - 0.5	Current Probe	Average / 9kHz		30 – 20
0.5 - 30.0				20

## 6.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCS 30	838251/021	Nov. 1, 2018	Oct. 31, 2019
ROHDE & SCHWARZ Artificial Mains Network (For EUT)	ENV216	101195	May 9, 2019	May 8, 2020
LISN With Adapter (for EUT)	101195	N/A	May 9, 2019	May 8, 2020
EMCO L.I.S.N. (For peripherals)	3825/2	9504-2359	Jul. 26, 2018	Jul. 25, 2019
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK8129	8129229	May 14, 2019	May 13, 2020
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK 8121	8121-808	Mar. 15, 2019	Mar. 14, 2020
Software	Cond_V7.3.7.4	NA	NA	NA
Software	ISN_V7.3.7.4	NA	NA	NA
RF cable (JYEBAO)	5D-FB	Cable-C03.01	Sep. 18, 2018	Sep. 17, 2019
LYNICS Terminator (For EMCO LISN)	0900510	E1-01-300	Jan. 25, 2019	Jan. 24, 2020
LYNICS Terminator (For EMCO LISN)	0900510	E1-01-301	Jan. 25, 2019	Jan. 24, 2020
FCC ISN	F-071115-1057-1	20650	Jan. 29, 2019	Jan. 28, 2020

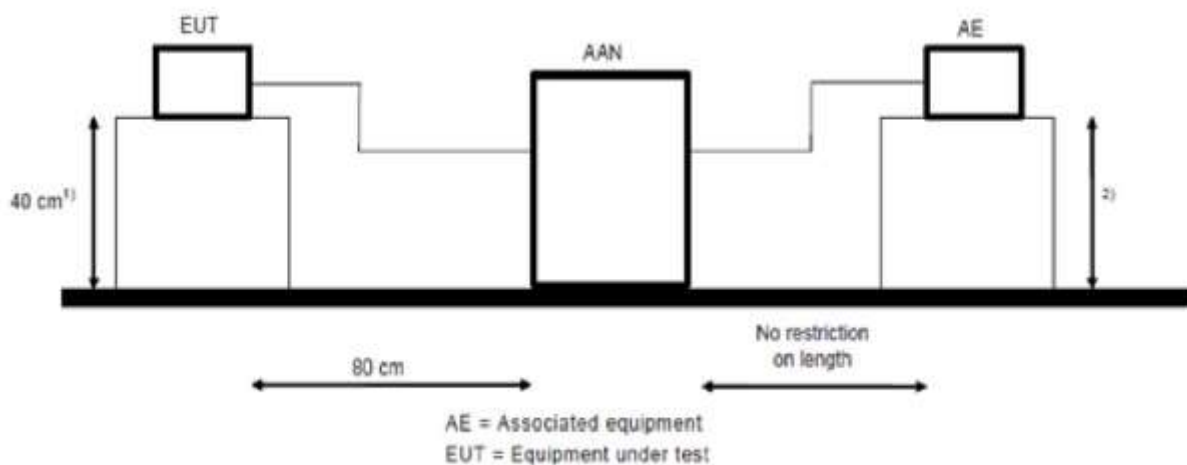
- Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
 2. The test was performed in Shielded Room No. 3.  
 3. The VCCI Site Registration No. T-11651.  
 4. Tested Date: Jun. 17, 2019

### 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.
- It is not necessary to apply the voltage and the current limit if a AAN is used.
- The test results of disturbance at telecommunication 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 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.



- Distance to the reference groundplane (vertical or horizontal).
- Distance to the reference groundplane is not critical.

**Note: Cable on the RGP must be insulated.**

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

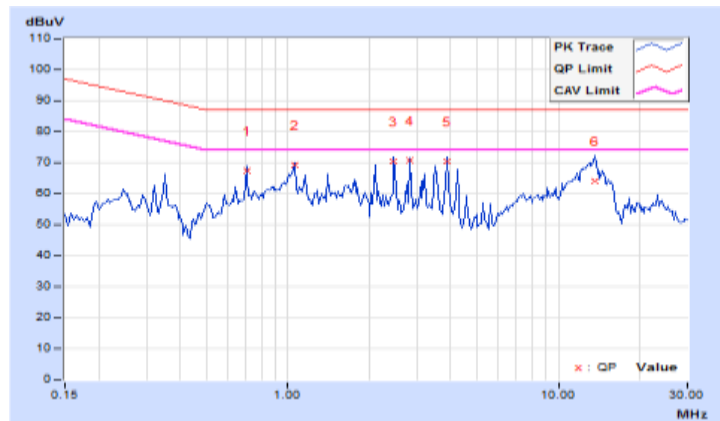
### 6.4 Test Results

<b>Frequency Range</b>	150kHz ~ 30MHz	<b>Detector Function &amp; Bandwidth</b>	Quasi-Peak (QP) / Average (AV), 9kHz
<b>Input Power</b>	230Vac, 50Hz	<b>Environmental Conditions</b>	25°C, 68%RH, 1000mbar
<b>Tested by</b>	John Liao		
<b>Test Mode</b>	Mode 1 - LAN PORT 1 (100Mbps), PING+TFGEN		

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	0.70469	9.41	57.95	57.94	67.36	67.35	87.00	74.00	-19.64	-6.65
2	1.05468	9.36	59.87	59.75	69.23	69.11	87.00	74.00	-17.77	-4.89
3	2.45970	9.28	61.09	61.08	70.37	70.36	87.00	74.00	-16.63	-3.64
<b>4</b>	<b>2.81301</b>	<b>9.28</b>	<b>61.48</b>	<b>61.47</b>	<b>70.76</b>	<b>70.75</b>	<b>87.00</b>	<b>74.00</b>	<b>-16.24</b>	<b>-3.25</b>
5	3.86847	9.28	61.17	61.16	70.45	70.44	87.00	74.00	-16.55	-3.56
6	13.66016	9.61	54.59	48.56	64.20	58.17	87.00	74.00	-22.80	-15.83

**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

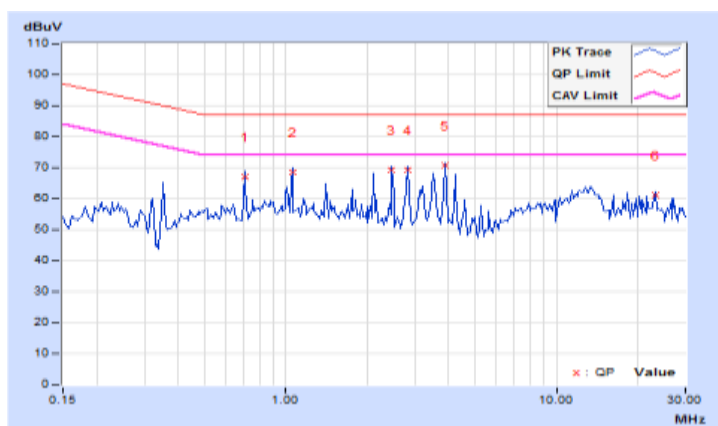


<b>Frequency Range</b>	150kHz ~ 30MHz	<b>Detector Function &amp; Bandwidth</b>	Quasi-Peak (QP) / Average (AV), 9kHz
<b>Input Power</b>	230Vac, 50Hz	<b>Environmental Conditions</b>	25°C, 68%RH, 1000mbar
<b>Tested by</b>	John Liao		
<b>Test Mode</b>	Mode 1 - LAN PORT 4 (100Mbps), PING+TFGEN		

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	0.70469	9.41	57.75	57.74	67.16	67.15	87.00	74.00	-19.84	-6.85
2	1.05469	9.36	59.26	59.25	68.62	68.61	87.00	74.00	-18.38	-5.39
3	2.46484	9.28	60.13	60.11	69.41	69.39	87.00	74.00	-17.59	-4.61
4	2.81641	9.28	59.92	59.91	69.20	69.19	87.00	74.00	-17.80	-4.81
5	3.87109	9.28	61.35	61.34	70.63	70.62	87.00	74.00	-16.37	-3.38
6	23.12891	10.10	51.12	49.17	61.22	59.27	87.00	74.00	-25.78	-14.73

**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 Emission at Frequencies up to 1GHz

### 7.1 Limits

For Class A Equipment

Frequency range (MHz)	Distance (m)	Limits (dBuV/m)
30 - 230	10	40
230 - 1000		47
30 - 230	3	50
230 - 1000		57

For Class B Equipment

Frequency range (MHz)	Distance (m)	Limits (dBuV/m)
30 - 230	10	30
230 - 1000		37
30 - 230	3	40
230 - 1000		47

### 7.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCI	100612	Nov. 26, 2018	Nov. 25, 2019
SCHAFFNER BILOG Antenna	CBL6111D	22263	Nov. 23, 2018	Nov. 22, 2019
Sonoma Preamplifier	310N	352922	Feb. 19, 2019	Feb. 18, 2020
ADT. Turn Table	TT100	0401	NA	NA
ADT. Tower	AT100	0401	NA	NA
Software	Radiated_V7.6.15.9.5	NA	NA	NA
ADT RF Switches BOX	EMH-011	08004	Mar. 26, 2019	Mar. 25, 2020
WOKEN RF cable With 5dB PAD	8D	CABLE-ST4-01	Mar. 26, 2019	Mar. 25, 2020

- Note:
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 Open Site No. 4.
  3. The VCCI Site Registration No. R-11038.
  4. Tested Date: Jun. 18, 2019

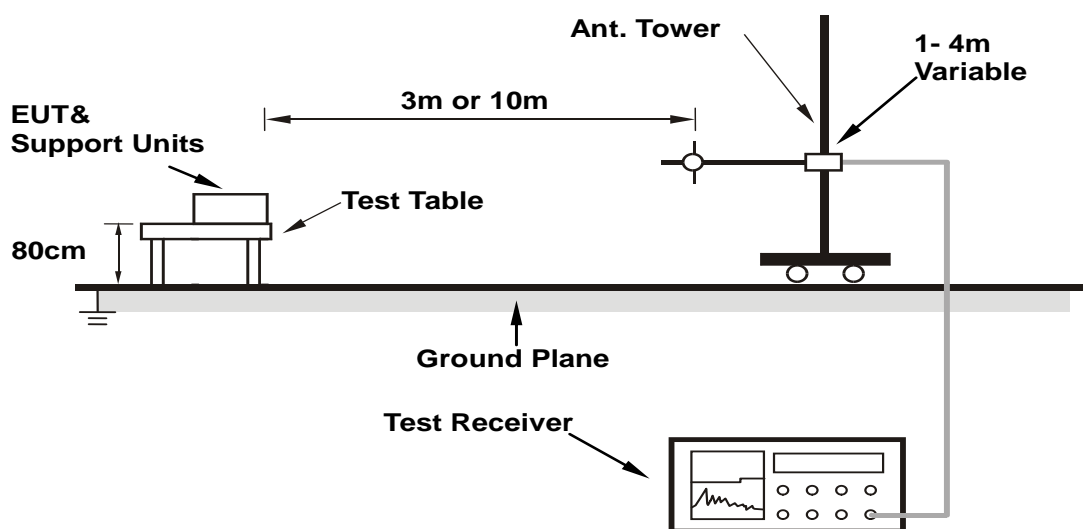


### 7.3 Test Arrangement

- 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 120kHz for quasi-peak detection (QP) at frequency up to 1GHz.
- The measurement distance is the shortest horizontal distance between an imaginary circular periphery just encompassing this arrangement and the calibration point of the antenna.



**Note: Cable on the RGP must be insulated.**

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 7.4 Test Results

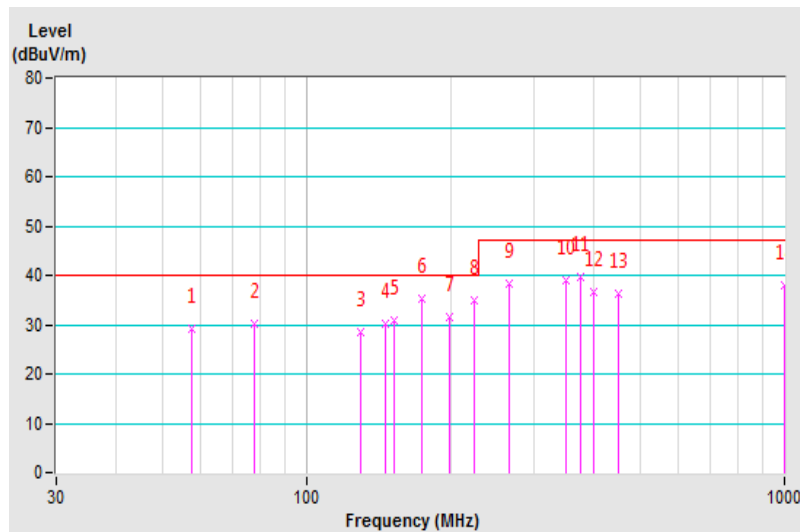
<b>Frequency Range</b>	30MHz ~ 1GHz	<b>Detector Function &amp; Bandwidth</b>	Quasi-Peak (QP), 120kHz
<b>Input Power</b>	230Vac, 50Hz	<b>Environmental Conditions</b>	30°C, 61%RH, 1000mbar
<b>Tested by</b>	Adam Chen		
<b>Test Mode</b>	Mode 1		

#### 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	57.41	29.28 QP	40.00	-10.72	4.00 H	195	49.20	-19.92
2	77.68	30.19 QP	40.00	-9.81	4.00 H	106	48.44	-18.25
3	130.26	28.33 QP	40.00	-11.67	4.00 H	45	42.20	-13.87
4	146.64	30.13 QP	40.00	-9.87	4.00 H	223	44.10	-13.97
5	152.73	30.97 QP	40.00	-9.03	4.00 H	282	45.29	-14.32
<b>6</b>	<b>174.91</b>	<b>35.14 QP</b>	<b>40.00</b>	<b>-4.86</b>	<b>4.00 H</b>	<b>142</b>	<b>50.60</b>	<b>-15.46</b>
7	199.34	31.68 QP	40.00	-8.32	4.00 H	166	47.01	-15.33
8	225.03	34.93 QP	40.00	-5.07	4.00 H	341	49.51	-14.58
9	264.89	38.20 QP	47.00	-8.80	3.56 H	358	50.41	-12.21
10	350.01	39.06 QP	47.00	-7.94	2.57 H	238	49.62	-10.56
11	375.00	39.52 QP	47.00	-7.48	2.14 H	122	49.51	-9.99
12	400.00	36.71 QP	47.00	-10.29	2.07 H	204	45.73	-9.02
13	450.01	36.17 QP	47.00	-10.83	1.89 H	224	44.02	-7.85
14	999.14	37.85 QP	47.00	-9.15	1.00 H	128	34.21	3.64

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

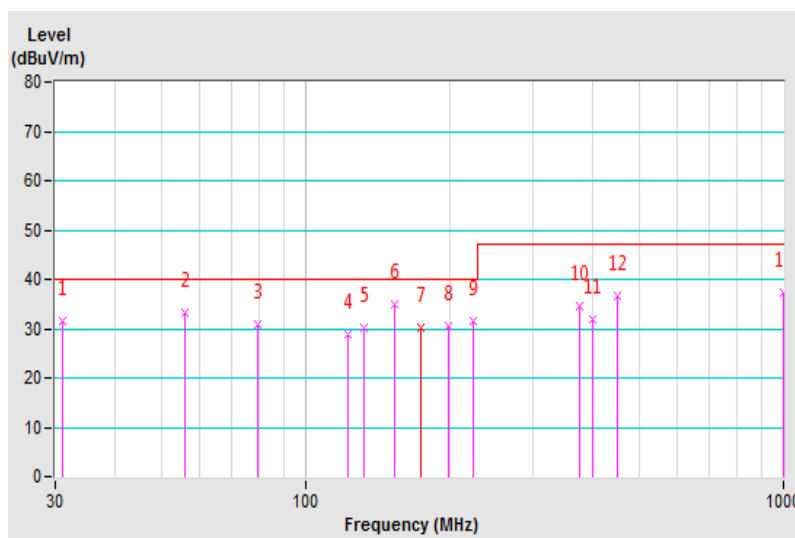


<b>Frequency Range</b>	30MHz ~ 1GHz	<b>Detector Function &amp; Bandwidth</b>	Quasi-Peak (QP), 120kHz
<b>Input Power</b>	230Vac, 50Hz	<b>Environmental Conditions</b>	30°C, 61%RH, 1000mbar
<b>Tested by</b>	Adam Chen		
<b>Test Mode</b>	Mode 1		

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	31.04	31.36 QP	40.00	-8.64	1.37 V	143	39.67	-8.31
2	56.19	33.15 QP	40.00	-6.85	1.58 V	86	52.95	-19.80
3	79.37	30.80 QP	40.00	-9.20	1.66 V	261	48.82	-18.02
4	123.12	28.71 QP	40.00	-11.29	1.00 V	59	42.78	-14.07
5	132.28	30.14 QP	40.00	-9.86	1.00 V	147	44.00	-13.86
6	153.33	35.05 QP	40.00	-4.95	1.00 V	43	49.39	-14.34
7	174.99	30.20 QP	40.00	-9.80	1.00 V	19	45.66	-15.46
8	199.10	30.55 QP	40.00	-9.45	1.00 V	100	45.89	-15.34
9	224.94	31.57 QP	40.00	-8.43	1.00 V	199	46.16	-14.59
10	375.01	34.45 QP	47.00	-12.55	1.00 V	305	44.43	-9.98
11	400.00	31.98 QP	47.00	-15.02	3.38 V	1	41.00	-9.02
12	450.04	36.59 QP	47.00	-10.41	1.00 V	175	44.44	-7.85
13	999.67	37.26 QP	47.00	-9.74	1.64 V	120	33.61	3.65

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 Emission at Frequencies above 1GHz

### 8.1 Limits

For Class A Equipment

Frequency range (MHz)	Distance (m)	Detector type	Limits (dBuV/m)
1000 - 3000	3	Average	56
3000 - 6000			60
1000 - 3000		Peak	76
3000 - 6000			80

For Class B Equipment

Frequency range (MHz)	Distance (m)	Detector type	Limits (dBuV/m)
1000 - 3000	3	Average	50
3000 - 6000			54
1000 - 3000		Peak	70
3000 - 6000			74

#### 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 x $F_x$ 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 highest fundamental frequency generated or used within the EUT or highest frequency at which it operates.

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

## 8.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Agilent Spectrum	E4446A	MY51100009	Jun. 6, 2019	Jun. 5, 2020
Agilent Test Receiver	N9038A	MY50010135	May 29, 2019	May 28, 2020
Agilent Preamplifier	8449B	3008A01924	Feb. 21, 2019	Feb. 20, 2020
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Feb. 21, 2019	Feb. 20, 2020
EMCI Preamplifier	EMC184045B	980235	Feb. 21, 2019	Feb. 20, 2020
ETS Preamplifier	3117-PA	00215857	Nov. 25, 2018	Nov. 24, 2019
Schwarzbeck Horn Antenna	BBHA-9170	212	Nov. 25, 2018	Nov. 24, 2019
EMCO Horn Antenna	3115	9312-4192	Nov. 25, 2018	Nov. 24, 2019
Max Full. Turn Table & Tower	MF7802	MF780208103	NA	NA
Software	Radiated_V8.7.08	NA	NA	NA
SUHNER RF cable With 4dB PAD	SF106-18	Cable-CH7-01	Aug. 13, 2018	Aug. 12, 2019
SUHNER RF cable With 3/4dB PAD	SF102	Cable-CH7-3.6m	Aug. 13, 2018	Aug. 12, 2019
MICRO-TRONICS Notch filter	BRC50703-01	010	May 30, 2019	May 29, 2020
MICRO-TRONICS Band Pass Filter	BRM17690	005	May 30, 2019	May 29, 2020

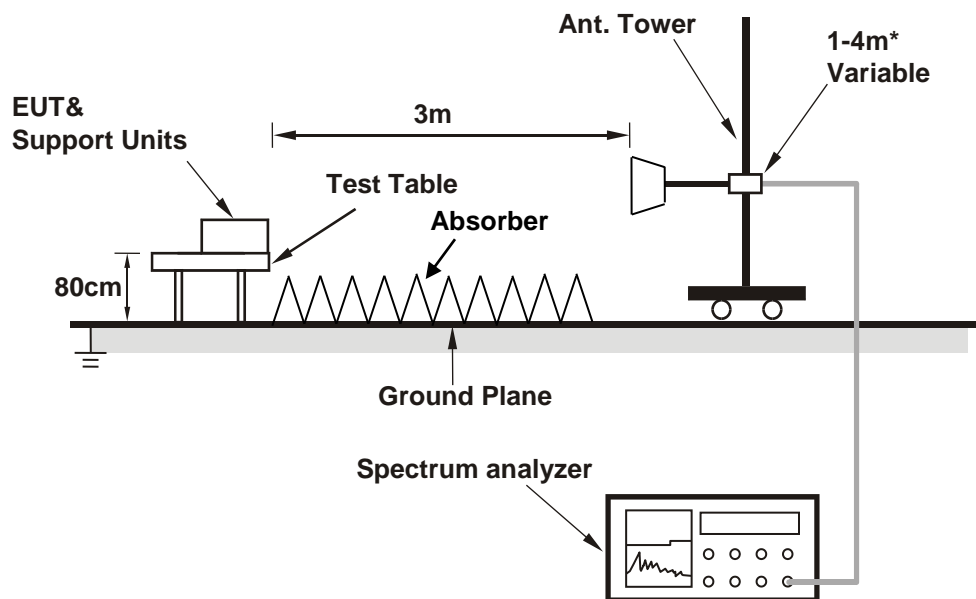
- Note:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
  2. The 3dB beamwidth of the horn antenna is minimum 40 degree (or  $w = 2.18m$  at 3m distance) for 1~6 GHz.
  3. The test was performed in Chamber No. 7.
  4. The VCCI Site Registration No. G-10039
  5. Tested Date: Jun. 19, 2019

### 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 3dB 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 1MHz and video bandwidth is 3MHz for Peak detection (PK) at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for Average detection (AV) at frequency above 1GHz.
- The measurement distance is the shortest horizontal distance between an imaginary circular periphery just encompassing this arrangement and the calibration point of the antenna.



**Note: Cable on the RGP must to be insulated.**

\* :depends on the EUT height and the antenna 3dB beamwidth both.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 8.4 Test Results

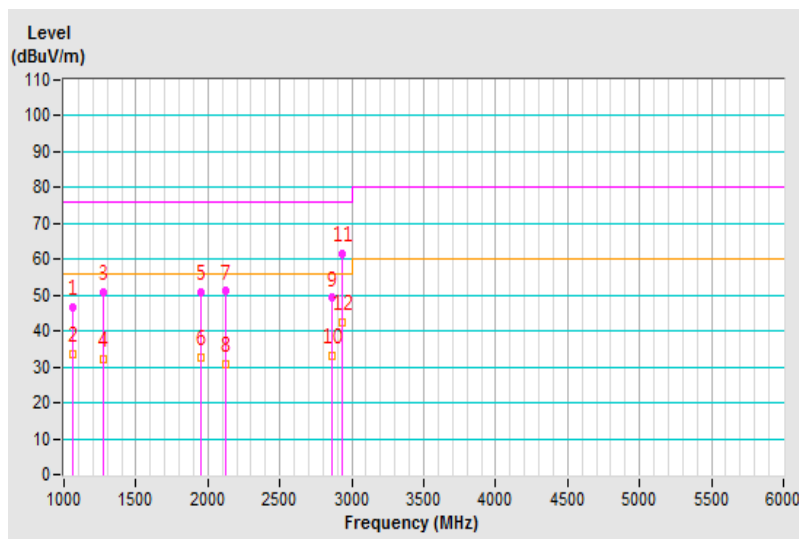
<b>Frequency Range</b>	1GHz ~ 5GHz	<b>Detector Function &amp; Bandwidth</b>	Peak (PK) / Average (AV), 1MHz
<b>Input Power</b>	230Vac, 50Hz	<b>Environmental Conditions</b>	28°C, 78%RH, 998mbar
<b>Tested by</b>	Chenghan Wu		
<b>Test Mode</b>	Mode 1		

#### 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	1064.09	46.76 PK	76.00	-29.24	1.22 H	164	52.56	-5.80
2	1064.09	33.64 AV	56.00	-22.36	1.22 H	164	39.44	-5.80
3	1275.30	50.98 PK	76.00	-25.02	1.36 H	160	56.55	-5.57
4	1275.30	32.31 AV	56.00	-23.69	1.36 H	160	37.88	-5.57
5	1953.49	51.00 PK	76.00	-25.00	1.72 H	116	54.75	-3.75
6	1953.49	32.62 AV	56.00	-23.38	1.72 H	116	36.37	-3.75
7	2123.18	51.16 PK	76.00	-24.84	1.48 H	180	54.51	-3.35
8	2123.18	30.86 AV	56.00	-25.14	1.48 H	160	34.21	-3.35
9	2857.53	49.21 PK	76.00	-26.79	2.25 H	215	50.74	-1.53
10	2857.53	33.17 AV	56.00	-22.83	2.25 H	215	34.70	-1.53
11	2938.10	61.42 PK	76.00	-14.58	2.01 H	127	62.23	-0.81
12	2938.10	42.47 AV	56.00	-13.53	2.01 H	127	43.28	-0.81

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

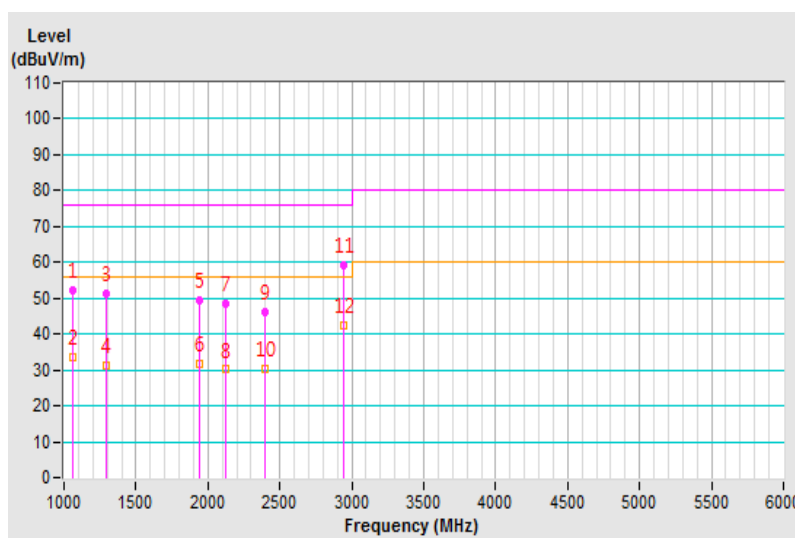


<b>Frequency Range</b>	1GHz ~ 5GHz	<b>Detector Function &amp; Bandwidth</b>	Peak (PK) / Average (AV), 1MHz
<b>Input Power</b>	230Vac, 50Hz	<b>Environmental Conditions</b>	28°C, 78%RH, 998mbar
<b>Tested by</b>	Chenghan Wu		
<b>Test Mode</b>	Mode 1		

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	1063.48	52.10 PK	76.00	-23.90	1.14 V	169	57.90	-5.80
2	1063.48	33.66 AV	56.00	-22.34	1.14 V	169	39.46	-5.80
3	1288.73	51.48 PK	76.00	-24.52	1.32 V	211	57.13	-5.65
4	1288.73	31.41 AV	56.00	-24.59	1.32 V	211	37.06	-5.65
5	1937.00	49.50 PK	76.00	-26.50	1.63 V	122	53.29	-3.79
6	1937.00	31.91 AV	56.00	-24.09	1.63 V	122	35.70	-3.79
7	2128.07	48.38 PK	76.00	-27.62	1.17 V	264	51.76	-3.38
8	2128.07	30.08 AV	56.00	-25.92	1.17 V	264	33.46	-3.38
9	2395.43	46.29 PK	76.00	-29.71	2.24 V	183	49.11	-2.82
10	2395.43	30.50 AV	56.00	-25.50	2.24 V	183	33.32	-2.82
11	2941.15	59.33 PK	76.00	-16.67	2.35 V	145	60.12	-0.79
<b>12</b>	<b>2941.15</b>	<b>42.56 AV</b>	<b>56.00</b>	<b>-13.44</b>	<b>2.35 V</b>	<b>145</b>	<b>43.35</b>	<b>-0.79</b>

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 General Immunity Requirements

### EN 55024:2010/ EN55024:2010 +A1:2015, Immunity requirements

Clause	Reference standard	Table	Test specification	Performance Criterion
4.2.1	EN/IEC 61000-4-2 ESD	1.3	Enclosure port: ±8kV Air discharge, ±4kV Contact discharge	B
4.2.3.2	EN/IEC 61000-4-3 RS	1.2	Enclosure port: 80-1000 MHz, 3V/m, 80% AM (1kHz)	A
4.2.2	EN/IEC 61000-4-4 EFT	2.3	Signal ports and telecommunication ports: xDSL equipment: ±0.5kV, 5/50 (T <sub>r</sub> /T <sub>h</sub> ) ns, 100kHz others: ±0.5kV, 5/50 (T <sub>r</sub> /T <sub>h</sub> ) ns, 5kHz	B
		3.3	Input DC power port: ±0.5kV, 5/50 (T <sub>r</sub> /T <sub>h</sub> ) ns, 5kHz	
		4.5	Input AC Power ports: ±1kV, 5/50 (T <sub>r</sub> /T <sub>h</sub> ) ns, 5kHz	
4.2.3.3	EN/IEC 61000-4-6 CS	2.1	Signal and telecommunication ports(cable length > 3m): 0.15-80 MHz, 3V, 80% AM (1kHz)	A
		3.1	Input DC power port: 0.15-80 MHz, 3V, 80% AM (1kHz)	
		4.1	Input AC Power ports: 0.15-80 MHz, 3V, 80% AM (1kHz)	
4.2.4	EN/IEC 61000-4-8 PFMF	1.1	Enclosure port: 50 or 60 Hz, 1A/m	A

## 9.1 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.

### Particular 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.

## 10 Electrostatic Discharge Immunity Test (ESD)

### 10.1 Test Specification

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

### 10.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
KeyTek, ESD Simulator	MZ-15/EC	0504259	Nov. 12, 2018	Nov. 11, 2019

- Note:
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 ESD Room No. 1.
  3. Tested Date: Jun. 29, 2019

### 10.3 Test Arrangement

The discharges shall be applied in two ways:

- a. Contact discharges to the conductive surfaces and coupling planes:

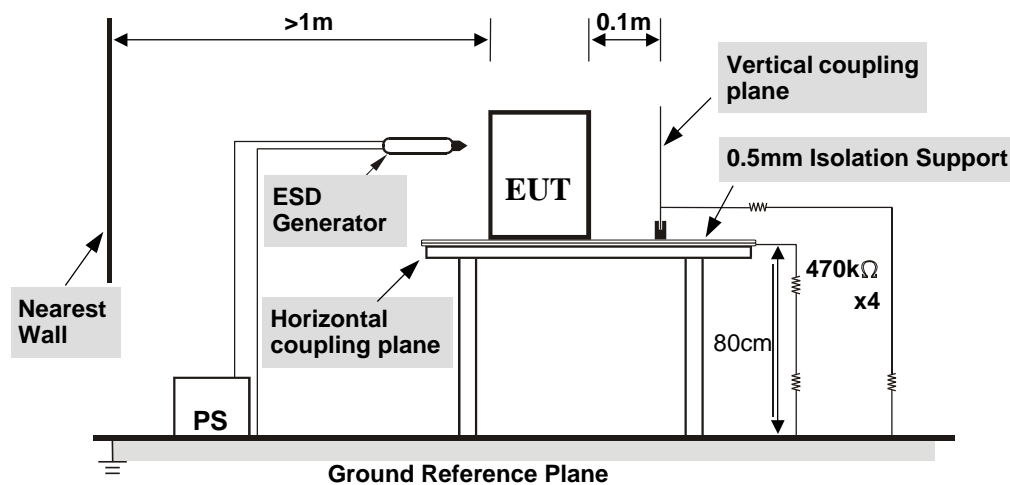
The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the test points shall be subjected to at least 50 indirect discharges to the center of the front edge of the horizontal coupling plane. The remaining three test points 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 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.



#### TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the **Ground Reference Plane**. The **GRP** consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A **Horizontal Coupling Plane** (1.6m x 0.8m) was placed on the table and attached to the **GRP** by means of a cable with 940kΩ total impedance. The equipment under test, was installed in a representative system as described in section 7 of EN/IEC 61000-4-2, and its cables were placed on the **HCP** and isolated by an insulating support of 0.5mm thickness. A distance of 1-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 10.4 Test Results

Input Power (System)	230 Vac, 50 Hz	Tested by	Todd Chang
Environmental Conditions	25 °C, 42% RH 998 mbar	Test mode	Mode 1

#### Test Results of Direct Application

Discharge Level (kV)	Polarity (+/-)	Test Point	Contact Discharge	Air Discharge	Performance Criterion
2, 4	+/-	1, 2	Note	NA	A
2, 4, 8	+/-	3	NA	Note	A

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

#### Test Results of Indirect Application

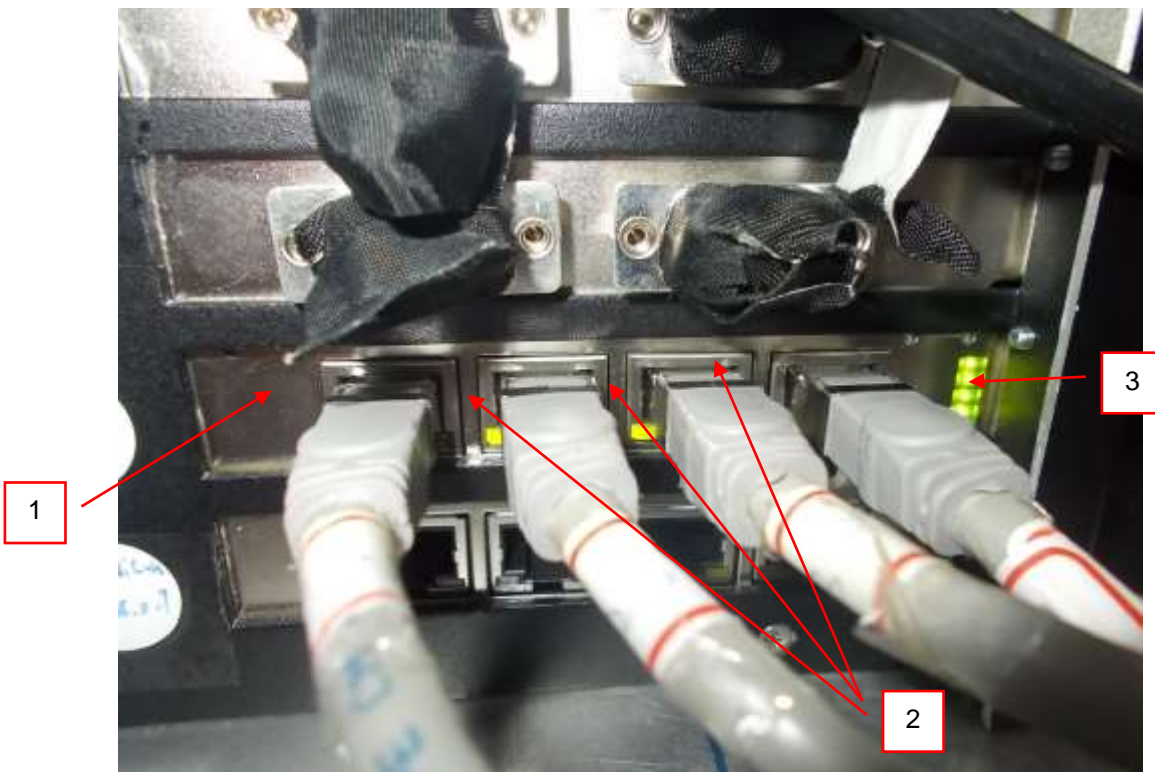
Discharge Level (kV)	Polarity (+/-)	Test Point	Horizontal Coupling Plane	Vertical Coupling Plane	Performance Criterion
2, 4	+/-	Four Sides	Note	Note	A

Description of test points of indirect application:

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

Note: The EUT function was correct during the test.

#### Description of Test Points



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

### 11.1 Test Specification

Basic Standard:	EN/IEC 61000-4-3
Frequency Range:	80 MHz - 1000 MHz
Field Strength:	3 V/m
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Polarity of Antenna:	Horizontal and Vertical
Antenna Height:	1.5m
Dwell Time:	3 seconds

### 11.2 Test Instruments

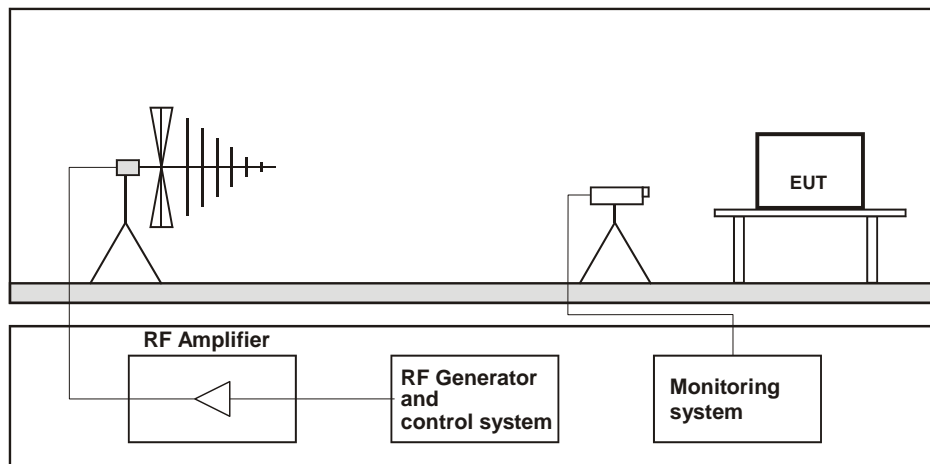
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
BONN Power Amp	BLMA 1060-100/50D	118694	NA	NA
BBA Power Amp	B250C125	101011	NA	NA
Power Sensor	NRP-Z91	101572	Jan. 24, 2019	Jan. 23, 2020
Power Sensor	NRP-Z91	101573	Jan. 18, 2019	Jan. 17, 2020
Signal Generator	SMB100A	105801	Jan. 17, 2019	Jan. 16, 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

- Note:
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.
  4. Tested Date: Aug. 24, 2019

### 11.3 Test Arrangement

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

- The testing was performed in a fully anechoic chamber.
- The frequency range is swept from 80 MHz to 1000 MHz, with the signal 80% amplitude modulated with a 1kHz 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.



#### Table-top Equipment

The EUT installed in a representative system as described in section 7 of EN/IEC 61000-4-3 was placed on a non-conductive table 0.8 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 11.4 Test Results

Input Power	24Vdc	Tested by	Matt Lan
Environmental Conditions	23 °C, 58% RH	Test mode	Mode 1

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

Note: The EUT function was correct during the test.

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

### 12.1 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: N/A
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.

### 12.2 Test Instruments

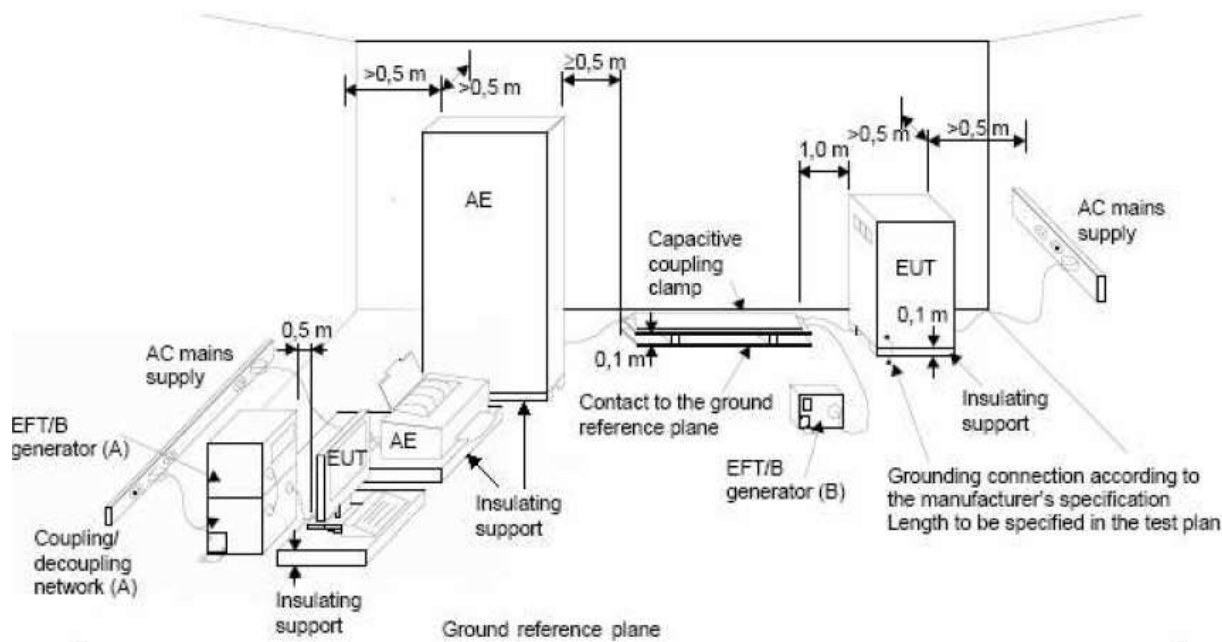
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Haefely, EFT Generator	PEFT 4010	154954	Apr. 23, 2019	Apr. 22, 2020
Haefely, Capacitive Clamp	IP4A	155173	Apr. 23, 2019	Apr. 22, 2020

- Note:
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 EFT Room.
  3. Tested Date: Jun. 26, 2019



### 12.3 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.



#### NOTE:

- location for supply line coupling
- location for signal lines coupling

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 12.4 Test Results

Input Power (System)	230 Vac, 50 Hz	Tested by	Josh Lin
Environmental Conditions	24°C, 76% RH	Test mode	Mode 1

#### Telecommunication port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5	RJ45 (PoE)	+/-	Note	A

Note: The EUT function was correct during the test.

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

#### 13.1 Test Specification

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

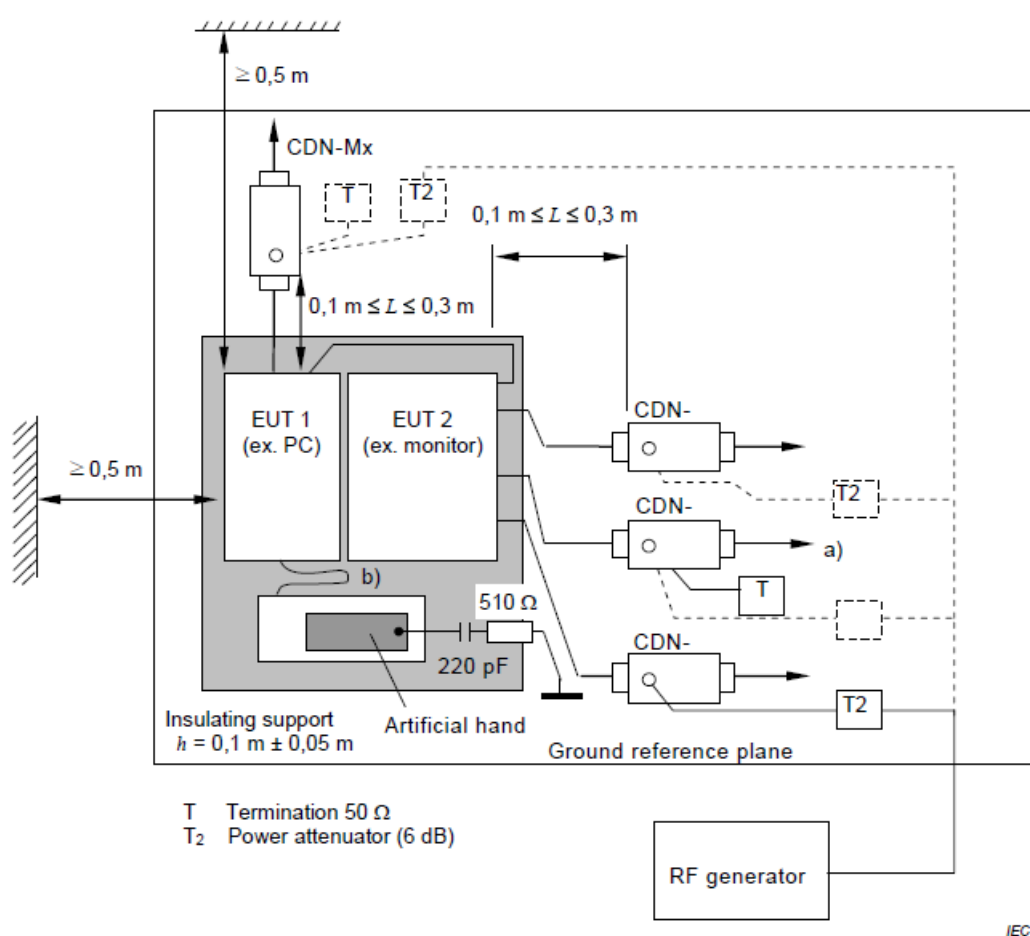
#### 13.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ Signal Generator	SML03	101801	Jan. 14, 2019	Jan. 13, 2020
Digital Sweep Function Generator	8120	984801	NA	NA
AR Power Amplifier	75A250AM1	306331	NA	NA
FCC Coupling Decoupling Network	FCC-801-M2-16A	01047	Jun. 19, 2019	Jun. 18, 2020
FISCHER CUSTOM COMMUNICATIONS EM Injection Clamp	F-203I-23mm	455	NA	NA
FISCHER CUSTOM COMMUNICATIONS Current Injection Clamp	F-120-9A	361	Jul. 24, 2018	Jul. 23, 2019
B&K Ear Simulator	4185	2553594	NA	NA
EM TEST Coupling Decoupling Network	CDN M1/32A	306508	Jun. 19, 2019	Jun. 18, 2020
TESEQ Coupling Decoupling Network	CDN T800	34428	Jun. 19, 2019	Jun. 18, 2020
TESEQ Coupling Decoupling Network	CDN T800	29459	Jun. 19, 2019	Jun. 18, 2020
FCC Coupling Decoupling Network	FCC-801-T4	02031	Jun. 19, 2019	Jun. 18, 2020
EM TEST Coupling Decoupling Network	CDN T2	306509	Jun. 19, 2019	Jun. 18, 2020
R&S Power Sensor	NRV-Z5	837878/039	Nov. 10, 2018	Nov. 9, 2019
R&S Power Meter	NRVD	837794/040	Nov. 10, 2018	Nov. 9, 2019
TESEQ Coupling Decoupling Network	CDN M232	37702	Jun. 19, 2019	Jun. 18, 2020
TESEQ Coupling Decoupling Network	CDN M332	41258	Jun. 19, 2019	Jun. 18, 2020
TESEQ Coupling Decoupling Network	CDN M332	41256	Jun. 19, 2019	Jun. 18, 2020
TESEQ Coupling Decoupling Network	CDN T400A	28569	Jun. 19, 2019	Jun. 18, 2020
TESEQ Coupling Decoupling Network	CDN T8-10	40376	Jun. 19, 2019	Jun. 18, 2020
TESEQ Coupling Decoupling Network	ISN ST08	41212	Jun. 19, 2019	Jun. 18, 2020
FCC Coupling Decoupling Network	FCC-801-M5-50A	100018	Jan. 21, 2019	Jan. 20, 2020
Software	CS_V7.4.2	NA	NA	NA

- Note:
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 CS Room No. 1.
  3. Tested Date: Jun. 21, 2019

### 13.3 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.



- Note:**
- The EUT clearance from any metallic obstacles shall be at least 0,5 m.
  - Interconnecting cables ( $\leq 1$  m) belonging to the EUT shall remain on the insulating support.
  - The equipment to be tested is placed on an insulating support of 0.1 meters height above a ground reference plane. All relevant cables shall be provided with the appropriate coupling and decoupling devices at a distance between 0.1 meters and 0.3 meters from the projected geometry of the EUT on the ground reference plane.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 13.4 Test Results

Input Power (System)	230 Vac, 50 Hz	Tested by	Todd Chang
Environmental Conditions	25 °C, 63% RH	Test mode	Mode 1

Frequency (MHz)	Level (Vrms)	Tested Line	Injection Method	Return Path	Observation	Performance Criterion
0.15 – 80	3	RJ45 (PoE)	CDN-T8-10	CDN-M3	Note	A

Note: The EUT function was correct during the test.

## 14 Power Frequency Magnetic Field Immunity Test

### 14.1 Test Specification

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

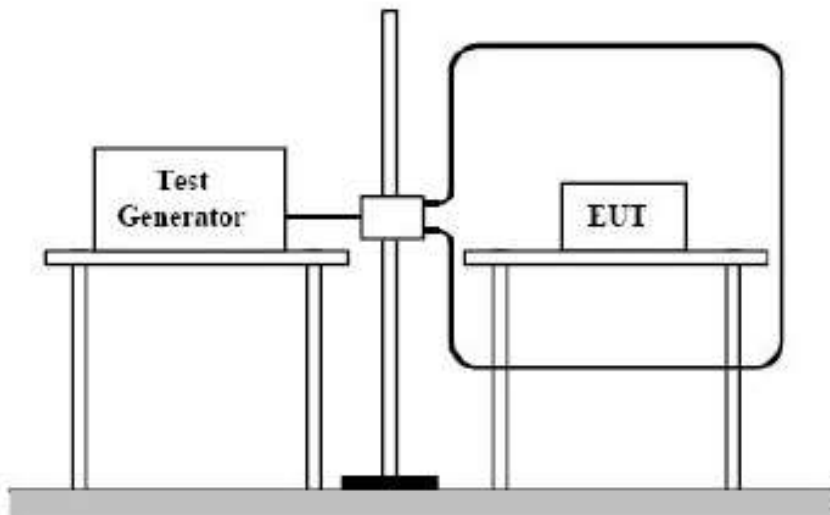
### 14.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
HAEFELY Magnetic Field Tester	MAG 100	083794-06	NA	NA
COMBINOVA Magnetic Field Meter	MFM10	224	Apr. 23, 2019	Apr. 22, 2020

- Note:
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 EMS Room No. 1
  3. Tested Date: Jun. 26, 2019

### 14.3 Test Arrangement

- a. The equipment is configured and connected to satisfy its functional requirements.
- b. The power supply, input and output circuits shall be connected to the sources of power supply, control and signal.
- c. 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.



#### TABLETOP EQUIPMENT

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.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

#### 14.4 Test Results

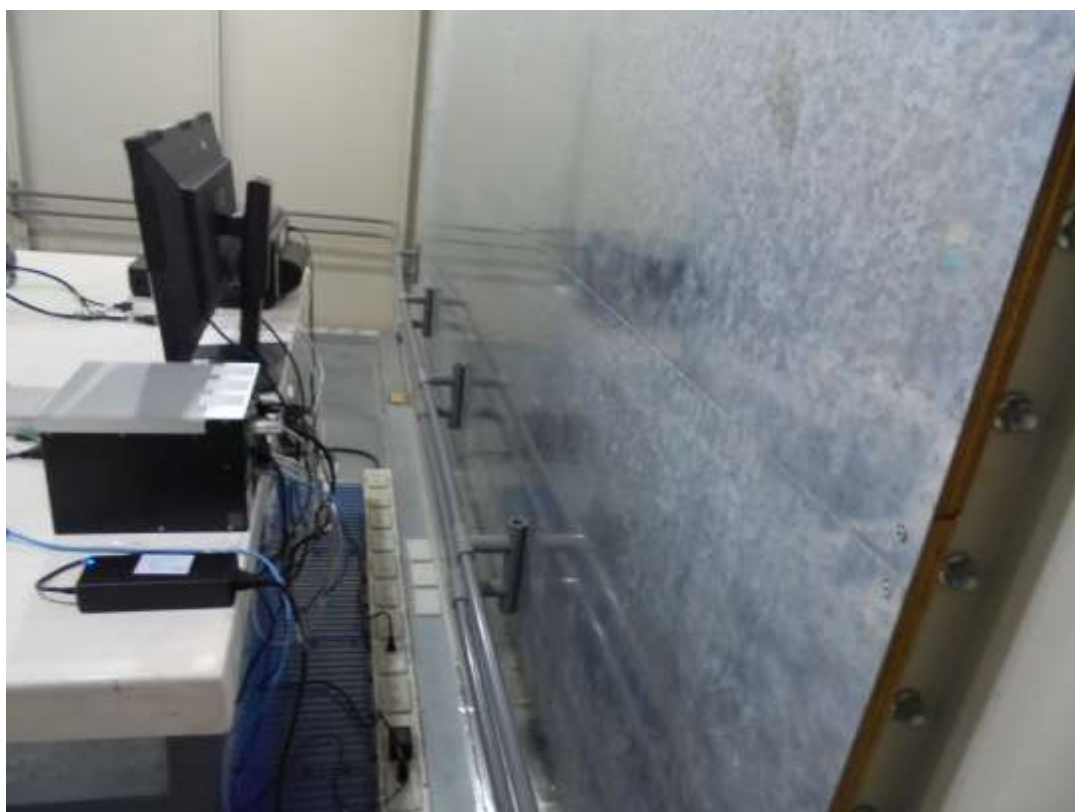
Input Power (System)	230 Vac, 50 Hz	Tested by	Xun Lee
Environmental Conditions	25 °C, 70% RH	Test mode	Mode 1

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

Note: The EUT function was correct during the test.

## 15 Pictures of Test Arrangements

### 15.1 Conducted Emission from the AC Mains Power Port



## 15.2 Asymmetric Mode Conducted Emission at Telecommunication Ports





### 15.3 Radiated Emission at Frequencies up to 1GHz



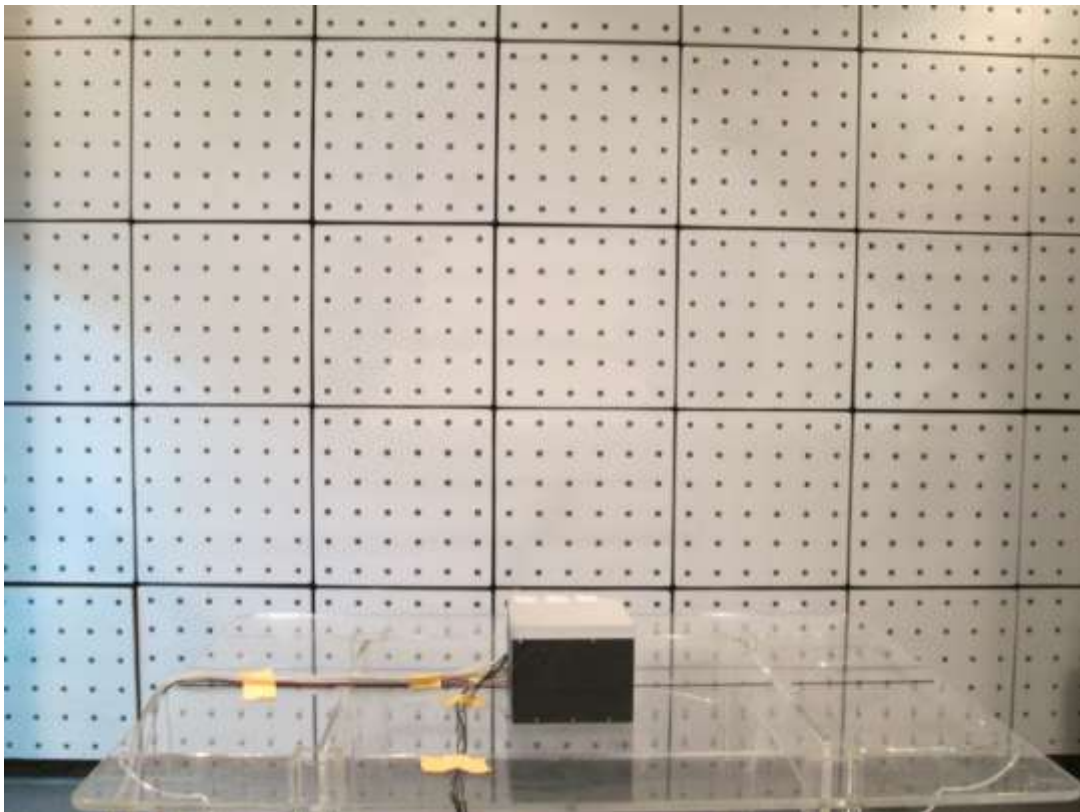
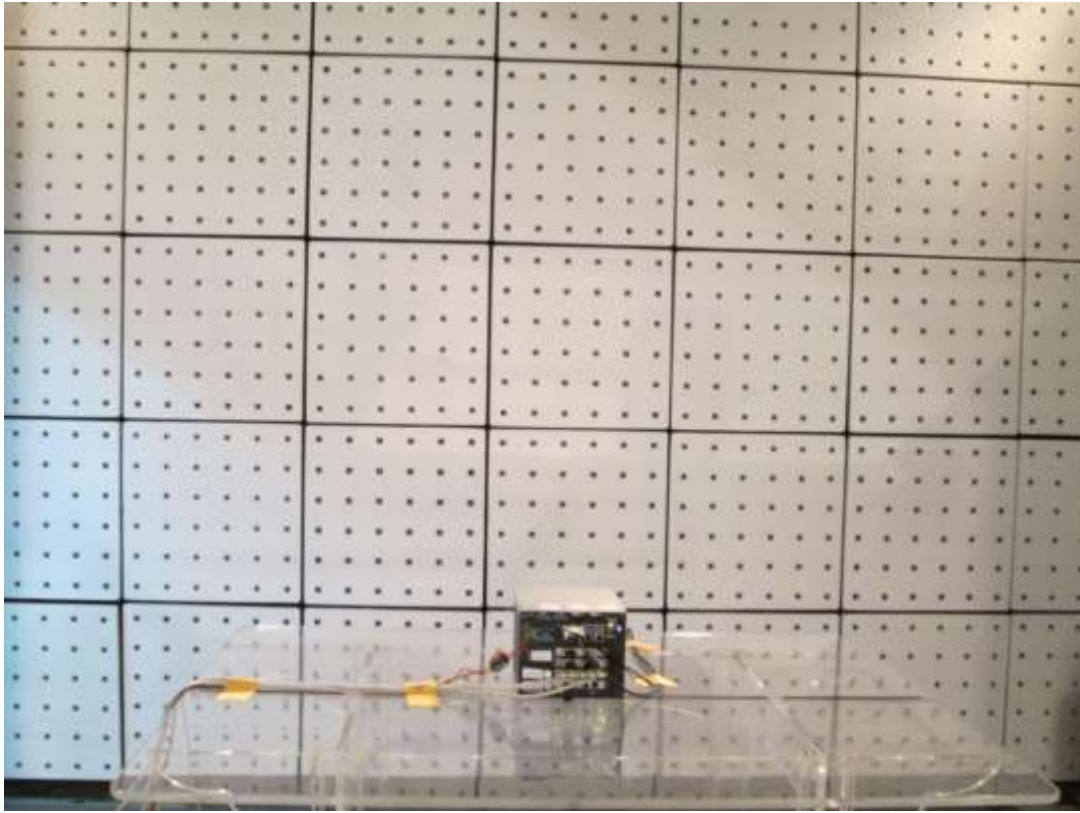
#### 15.4 Radiated Emission at Frequencies above 1GHz



## 15.5 Electrostatic Discharge Immunity Test (ESD)



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



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

LAN



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

LAN



## 15.9 Power Frequency Magnetic Field Immunity Test (PFMF)



## 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.

If you have any comments, please feel free to contact us at the following:

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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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