

CE EMC Test Report

Report No.: CE200316D05

Test Model: PE-5004

Series Model: PE-5XXXXXXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)

Received Date: Mar. 16, 2020

Test Date: Mar. 19 to 30, 2020

Issued Date: Apr. 6, 2020

Applicant: Vecow Co.,Ltd.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lin Kou Laboratories

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Release Control Record

Issue No.	Description	Date Issued
CE200316D05	Original release.	Apr. 6, 2020

1 Certificate of Conformity

Product: PCI Express 10G PoE+ Expansion Card
Brand: Vecow
Test Model: PE-5004
Series Model: PE-5XXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)
Sample Status: Engineering Sample
Applicant: Vecow Co.,Ltd.
Test Date: Mar. 19 to 30, 2020
Standards: **EN 55032:2015 +AC:2016, Class A**
EN 61000-3-2:2014 (Not applicable)
EN 61000-3-3:2013 (Not applicable)
EN 55035:2017
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)
Broadband impulse noise disturbances (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:** Apr. 6, 2020
Vivian Chen / Specialist

Approved by :  , **Date:** Apr. 6, 2020
Kenny Meng / Assistant Manager

2 Summary of Test Results

Emission			
Standard	Test Item	Result/Remarks	Verdict
EN 55032:2015 +AC:2016	Conducted emission from the mains power port	Minimum passing Class A margin is -3.24 dB at 0.25125 MHz	Pass
	Asymmetric mode conducted emission at telecommunication ports and tuner ports	Minimum passing Class A margin is -3.02 dB at 0.57771 MHz	Pass
	Radiated emission 30-1000 MHz	Minimum passing Class A margin is -0.52 dB at 151.06 MHz	Pass
	Radiated emission above 1GHz	Minimum passing Class A margin is -4.16 dB at 1500.11 MH	Pass
	Conducted differential voltage emissions	Without tuner port of the EUT.	N/A
EN 61000-3-2:2014	Harmonic current emissions	Test not applicable because port does not exist.	N/A
EN 61000-3-3:2013	Voltage fluctuations and flicker	Test not applicable because port does not exist.	N/A

Immunity				
EN 55035 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 Discharge (ESD)	Performance Criterion A	Pass
4.2.2.2	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
4.2.4	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
4.2.2.3	EN 61000-4-6:2014 +AC:2015 / IEC 61000-4-6:2013 ED. 4.0	Continuous conducted disturbances (CS)	Performance Criterion A	Pass
4.2.3	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	Test not applicable because port does not exist.	N/A
4.2.7	-	Broadband impulse noise disturbances, Repetitive (Applicable only to xDSL ports.)	Without CPE xDSL port of the EUT.	N/A
4.2.7	-	Broadband impulse noise disturbances, Isolated (Applicable only to xDSL ports.)	Without CPE xDSL port of the EUT.	N/A

Note:

1. There is no deviation to the applied test methods and requirements covered by the scope of this report.
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
3. The above EN/IEC basic standards are applied with latest version if customer has no special requirement.
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 mains power port using AMN, 150kHz ~ 30MHz	2.94 dB	3.4 dB (U_{CISPR})
Asymmetric mode conducted emission using AAN, 150kHz ~ 30MHz	3.88 dB	5.0 dB (U_{CISPR})
Radiated emission, 30MHz ~ 1GHz	4.25 dB	6.3 dB (U_{CISPR})
Radiated emission, 1GHz ~ 6GHz	4.61 dB	5.2 dB (U_{CISPR})

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 Description of EUT

Product	PCI Express 10G PoE+ Expansion Card
Brand	Vecow
Test Model	PE-5004
Series Model	PE-5XXXXXXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)
Model Difference	For 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 10G PoE+ Expansion Card and installed in IPC during the test.
2. The EUT maximum data rate is 10Gbps.

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

Mode	Test Condition
A	EUT installed in IPC+ LAN Mode (10Gbps)
B	EUT installed in IPC+ PoE Mode (1Gbps) ^{Note}

Note: As client's request, using the maximum data rate of PoE Load (Supplied by client) is 1Gbps during the test.

3. Test modes are presented in the report as below.

Mode	Test Condition	Input Power
Conducted emission test		
1	EUT installed in IPC+ PoE Mode (1Gbps)	36Vdc (System)
Asymmetric mode conducted emission at telecommunication ports test		
1	EUT installed in IPC+ PoE port 1 Mode (1Gbps)	36Vdc (System)
2	EUT installed in IPC+ LAN port 1 Mode (10Gbps)	
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		
1	EUT installed in IPC+ PoE Mode (1Gbps)	36Vdc (System)
Immunity tests		
1	EUT installed in IPC+ PoE Mode (1Gbps)	36Vdc (System)

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 storage.
- e. IPC sent and received messages to/from Notebook PCs (kept in a remote area) via EUT & PoE+ Spllter with UTP LAN cables. (10m each).
- f. IPC sent "color bars with moving element" patterns to ext. LCD Monitor. Then it displayed color bar patterns 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:

- 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 storage.
- e. IPC sent and received messages to/from Notebook PCs (kept in a remote area) via EUT & PoE+ Spllter with UTP/STP LAN cables. (10m each).
- f. IPC sent color bars patterns to ext. LCD Monitor. Then it displayed color bar patterns on its screen.
- g. Steps d-f were repeated.

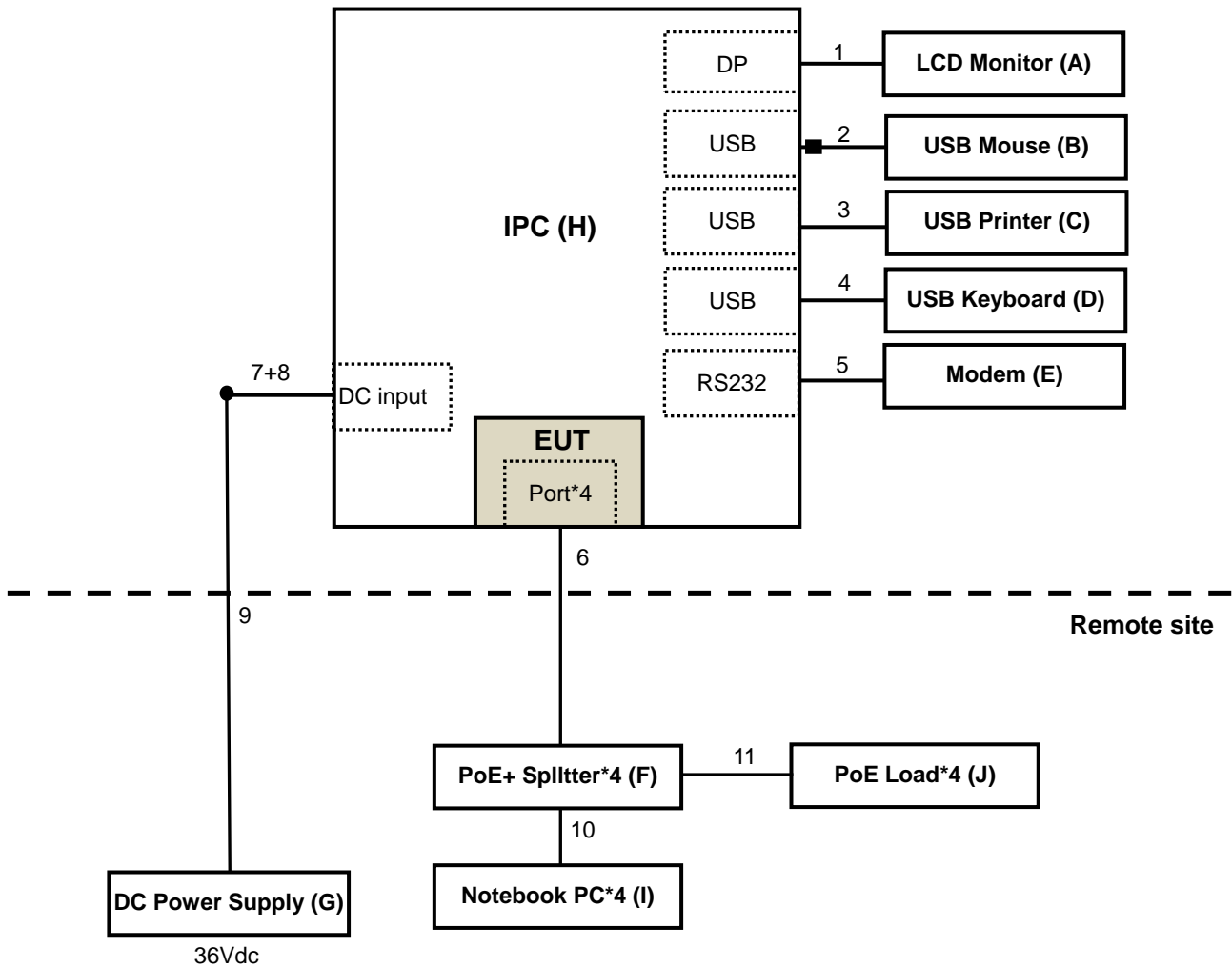
3.5 Primary Clock Frequencies of Internal Source

The highest frequency generated or used within the EUT or on which the EUT operates or tunes is 10GHz, provided by Vecow Co., Ltd., for detailed internal source, please refer to the manufacturer's specifications.

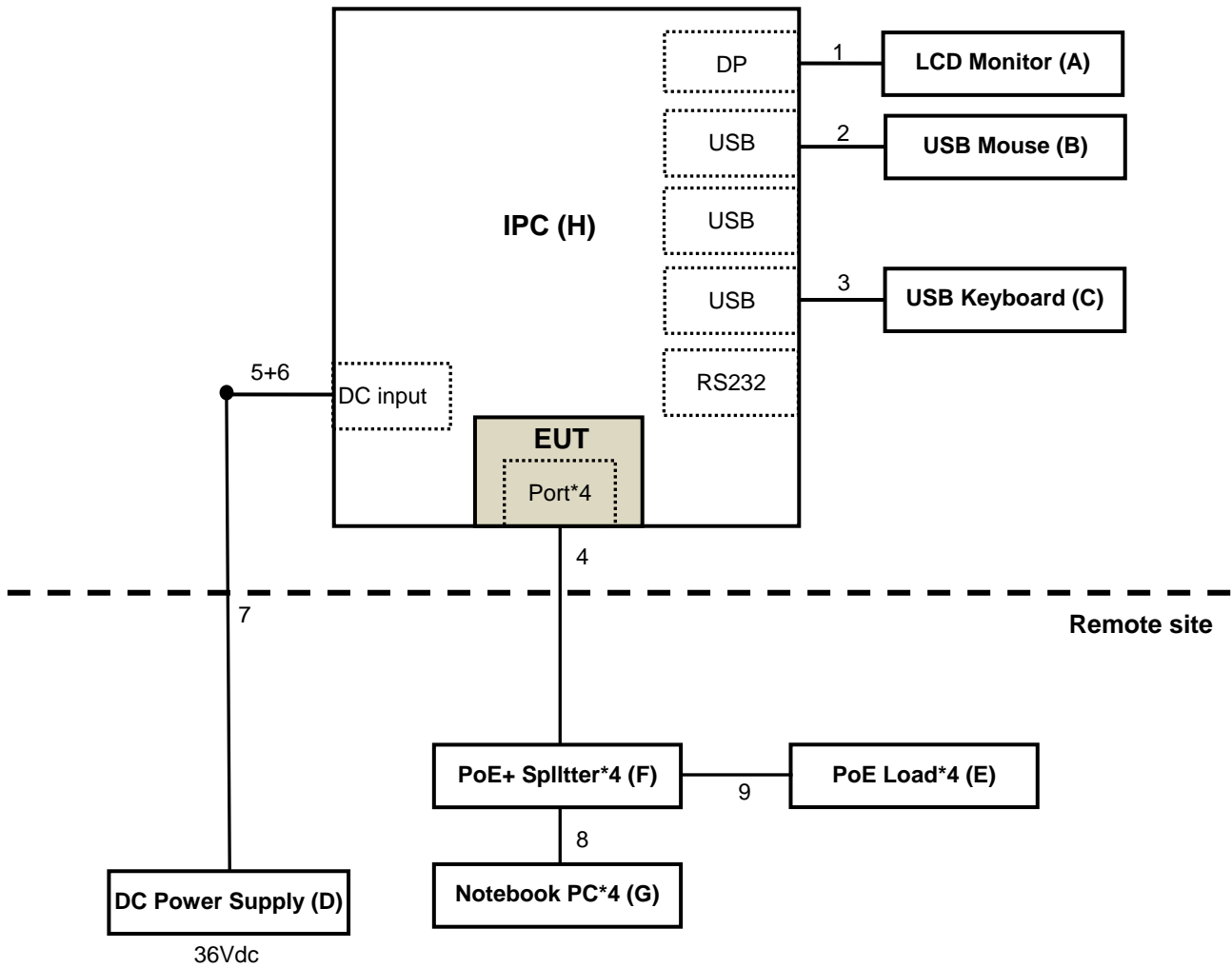
4 Configuration and Connections with EUT

4.1 Connection Diagram of EUT and Peripheral Devices

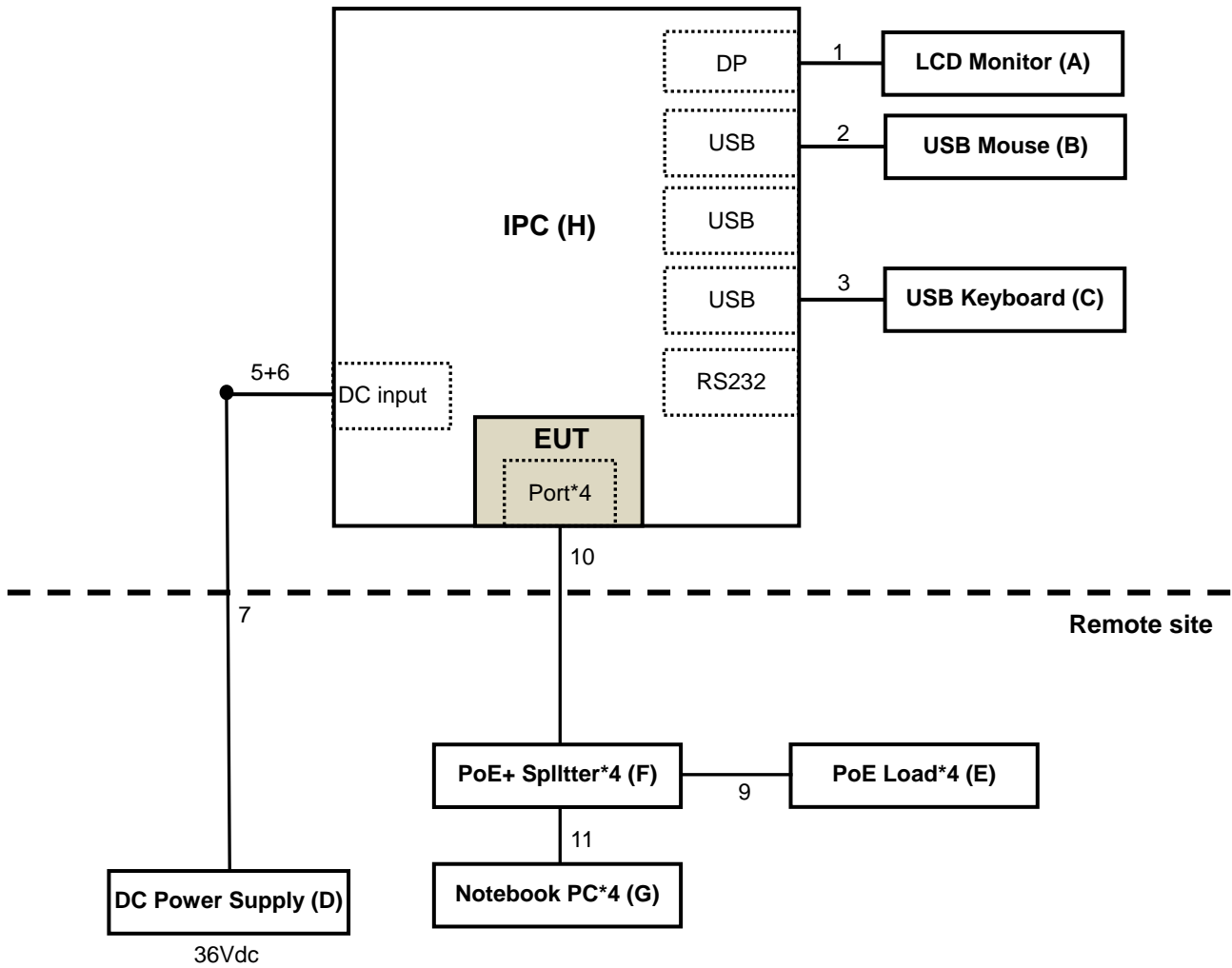
Emission tests:



Immunity tests (ESD excluded):



ESD test:



4.2 Configuration of Peripheral Devices and Cable Connections

Emission tests:

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	LCD Monitor	ASUS	MG28U	H1LMTF041254	N/A	Provided by Lab
B.	USB Mouse	Microsoft	1113	9170528317887	FCC DoC Approved	Provided by Lab
C.	USB PRINTER	HP	HP Officejet Pro 251dw	N/A	N/A	Provided by Lab
D.	USB Keyboard	Dell	KB216t	CN-0W33XP-LO300-7C L-1919	N/A	Provided by Lab
E.	MODEM	ACEEX	1414	980020508	IFAXDM1414	Provided by Lab
F.	10/100/1000M Gigabit PoE+ Spllter *4	GERIO	POE-PD04S	N/A	N/A	Supplied by client
G.	DC Power supply	CHROMA	62150H-600S	62150EC00479	N/A	Provided by Lab
H.	IPC	Vecow	RCS-9000	N/A	N/A	Supplied by client
I.	Notebook PC	LENOVO	T480	PF1EZSAW	N/A	Provided by Lab
	Notebook PC	LENOVO	T480	PF1EK03U	N/A	Provided by Lab
	Notebook PC	SONY	SVS151A12P	275548477001024	N/A	Provided by Lab
	Notebook PC	ASUS	PU401L	ECNXBC012528528	N/A	Provided by Lab
J.	PoE Load *4	N/A	N/A	N/A	N/A	Supplied by client

Note:

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

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Display cable	1	1.8	Y	0	Provided by Lab
2.	USB cable	1	1.8	Y	1	Provided by Lab
3.	USB cable	1	1.5	Y	0	Provided by Lab
4.	USB cable	1	1.8	Y	0	Provided by Lab
5.	RS232 cable	1	1.5	Y	0	Provided by Lab
6.	LAN cable	4	10	N	0	Provided by Lab (RJ45 Cat.5e)
7.	DC cable	1	0.12	N	0	Supplied by client
8.	DC cable	1	1.8	N	0	Provided by Lab
9.	DC cable	1	10	N	0	Provided by Lab
10.	LAN cable	4	1.8	N	0	Provided by Lab (RJ45 Cat.5e)
11.	DC cable	4	0.3	N	0	Provided by Lab

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

Immunity tests:

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	24" LCD MONITOR	DELL	P2418HZM	CN-079XVV-TV200-8 CP-053T	N/A	Provided by Lab
B.	USB Mouse	HP	M-UCC31-O	N/A	N/A	Provided by Lab
C.	USB Keyboard	HP	KU-1060	N/A	N/A	Provided by Lab
D.	DC Power supply	CHROMA	62150H-600S	62150EC00479	N/A	Provided by Lab
E.	PoE Load *2	N/A	N/A	N/A	N/A	Supplied by client
F.	10/100/1000M Gigabit PoE+ Spllter *2	GERIO	POE-PD04S	N/A	N/A	Supplied by client
G.	Notebook PC	LENOVO	TP00057A	R9-0JMLFS16/01	N/A	Provided by Lab
	Notebook PC	LENOVO	L440	R90FCKH8	N/A	Provided by Lab
	Notebook PC	SONY	SVS151A12P	275548477001024	N/A	Provided by Lab
	Notebook PC	ASUS	PU401L	ECNXBC012528528	N/A	Provided by Lab
H.	IPC	Vecow	RCS-9000	N/A	N/A	Supplied by client

Note:

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

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Display cable	1	1.8	Y	0	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	4	10	N	0	Provided by Lab (RJ45 Cat.5e)
5.	DC cable	1	0.12	N	0	Supplied by client
6.	DC cable	1	1.8	N	0	Provided by Lab
7.	DC cable	1	10	N	0	Provided by Lab
8.	LAN cable	4	3.0	N	0	Provided by Lab (RJ45 Cat.5e)
9.	DC cable	4	0.1	N	0	Supplied by client
10.	LAN cable	4	10	Y	0	Provided by Lab (RJ45 Cat.5e)
11.	LAN cable	4	10	Y	0	Provided by Lab (RJ45 Cat.5e)

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

5 Conducted Emission from the Mains Power Port

5.1 Limits

Class A			
Frequency range (MHz)	Coupling device	Detector type / bandwidth	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
Class B			
Frequency range (MHz)	Coupling device	Detector type / bandwidth	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

- 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

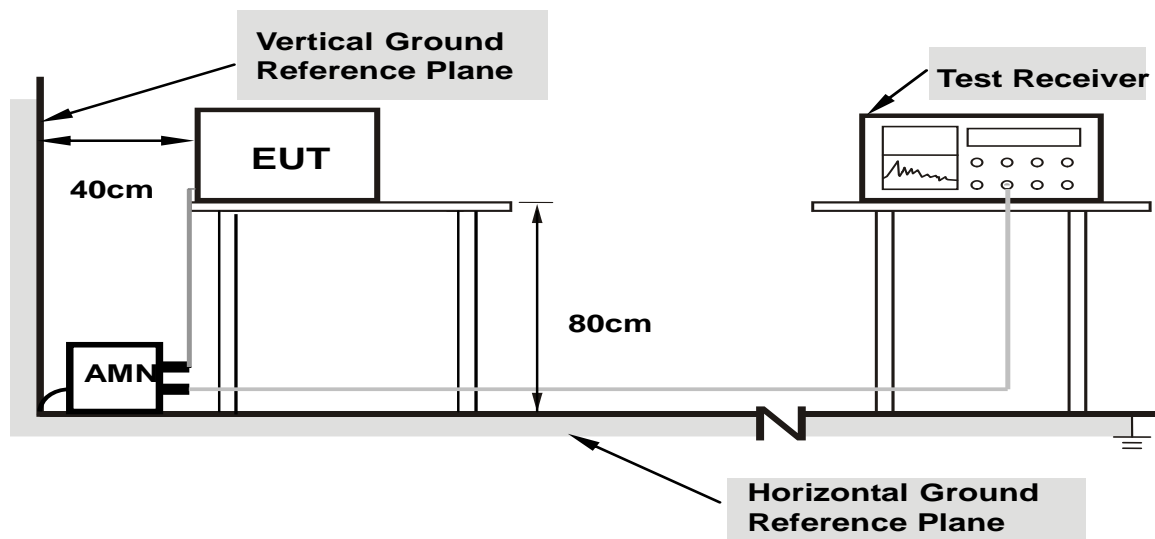
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESR3	102413	Feb. 17, 2020	Feb. 16, 2021
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ESH2-Z5	100104	Dec. 13, 2019	Dec. 12, 2020
LISN With Adapter (for EUT)	AD10	C09Ada-001	Dec. 13, 2019	Dec. 12, 2020
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	847265/023	Oct. 31, 2019	Oct. 30, 2020
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK8129	8129229	May 14, 2019	May 13, 2020
SCHWARZBECK Artificial Mains Network (for EUT)	NSLK 8128	8128-244	Nov. 11, 2019	Nov. 10, 2020
Software	Cond_V7.3.7.4	NA	NA	NA
RF cable (JYEBAO) With 10dB PAD	5D-FB	Cable-C09.01	Aug. 15, 2019	Aug. 14, 2020
SUHNER Terminator (For ROHDE & SCHWARZ LISN)	65BNC-5001	E1-010789	May 13, 2019	May 12, 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. 9.
 3. The VCCI Site Registration No. C-11312.
 4. Tested Date: Mar. 19, 2020

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

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

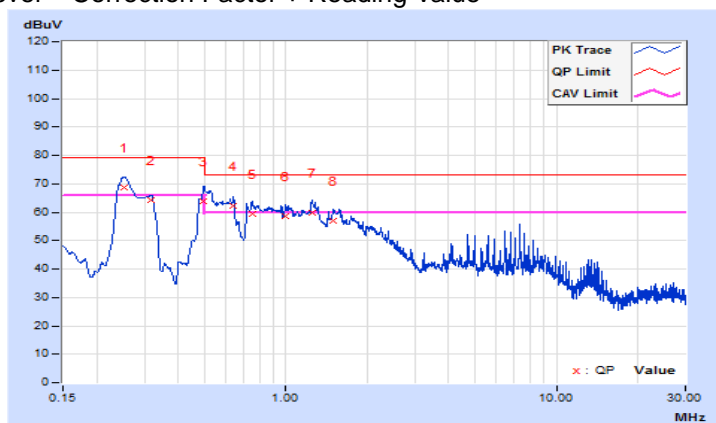
5.4 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power (System)	36Vdc	Environmental Conditions	21°C, 70%RH, 1007mbar
Tested by	Chenghan Wu		
Test Mode	Mode 1		

Phase Of Power : Positive (+)										
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	0.25125	10.40	58.45	52.36	68.85	62.76	79.00	66.00	-10.15	-3.24
2	0.31765	10.40	53.73	38.75	64.13	49.15	79.00	66.00	-14.87	-16.85
3	0.49799	10.40	53.43	46.05	63.83	56.45	79.00	66.00	-15.17	-9.55
4	0.64076	10.39	51.95	37.86	62.34	48.25	73.00	60.00	-10.66	-11.75
5	0.74988	10.39	48.81	41.23	59.20	51.62	73.00	60.00	-13.80	-8.38
6	1.00048	10.38	48.03	41.05	58.41	51.43	73.00	60.00	-14.59	-8.57
7	1.25022	10.39	49.24	41.87	59.63	52.26	73.00	60.00	-13.37	-7.74
8	1.50096	10.40	46.74	39.82	57.14	50.22	73.00	60.00	-15.86	-9.78

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

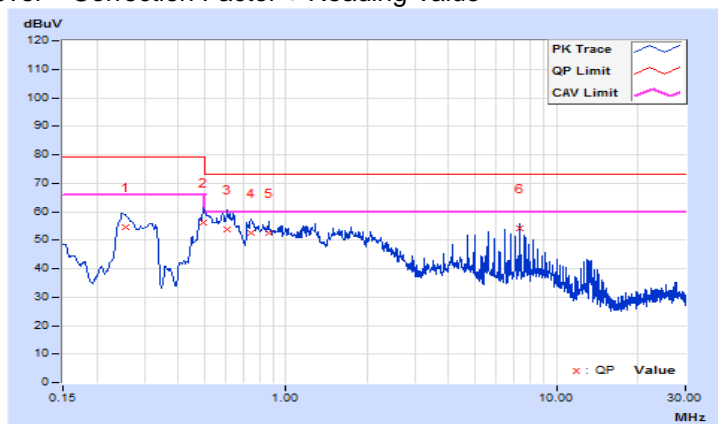


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power (System)	36Vdc	Environmental Conditions	21°C, 70%RH, 1007mbar
Tested by	Chenghan Wu		
Test Mode	Mode 1		

Phase Of Power : Negative (-)										
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	0.25458	10.40	44.30	38.26	54.70	48.66	79.00	66.00	-24.30	-17.34
2	0.49799	10.41	45.88	39.01	56.29	49.42	79.00	66.00	-22.71	-16.58
3	0.60948	10.40	43.28	34.19	53.68	44.59	73.00	60.00	-19.32	-15.41
4	0.74594	10.39	42.11	34.60	52.50	44.99	73.00	60.00	-20.50	-15.01
5	0.86363	10.39	42.06	36.86	52.45	47.25	73.00	60.00	-20.55	-12.75
6	7.34991	10.62	43.42	37.94	54.04	48.56	73.00	60.00	-18.96	-11.44

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 and Tuner Ports

6.1 Limits

Class A				
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
Class B				
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

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.

6.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESR3	102413	Feb. 17, 2020	Feb. 16, 2021
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ESH2-Z5	100104	Dec. 13, 2019	Dec. 12, 2020
LISN With Adapter (for EUT)	AD10	C09Ada-001	Dec. 13, 2019	Dec. 12, 2020
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	847265/023	Oct. 31, 2019	Oct. 30, 2020
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK8129	8129229	May 14, 2019	May 13, 2020
SCHWARZBECK Artificial Mains Network (for EUT)	NSLK 8128	8128-244	Nov. 11, 2019	Nov. 10, 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-C09.01	Aug. 15, 2019	Aug. 14, 2020
SUHNER Terminator (For ROHDE & SCHWARZ LISN)	65BNC-5001	E1-010789	May 13, 2019	May 12, 2020
FCC ISN	F-071115-1057-1	20652	Jan. 20, 2020	Jan. 19, 2021
TESEQ ISN	ISN T8-Cat6	53159	Mar. 10, 2020	Mar. 9, 2021

- 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. 9.
 3. The VCCI Site Registration No. T-11587
 4. Tested Date: Mar. 20, 2020

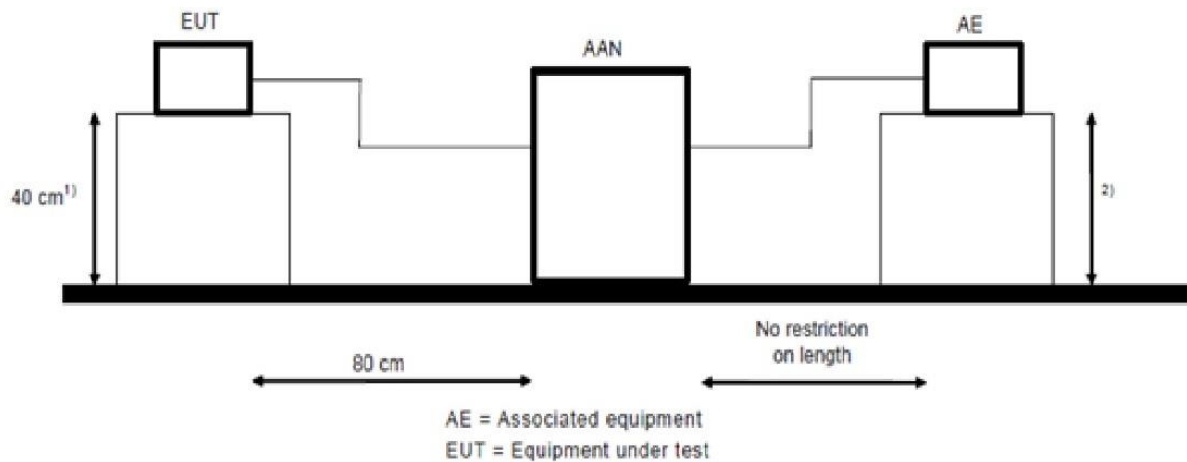
6.3 Test Arrangement

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 an 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.
- Screened ports including TV broadcast receiver tuner ports are tested with a common-mode impedance of 150Ω.



1) Distance to the reference groundplane (vertical or horizontal).

2) 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.

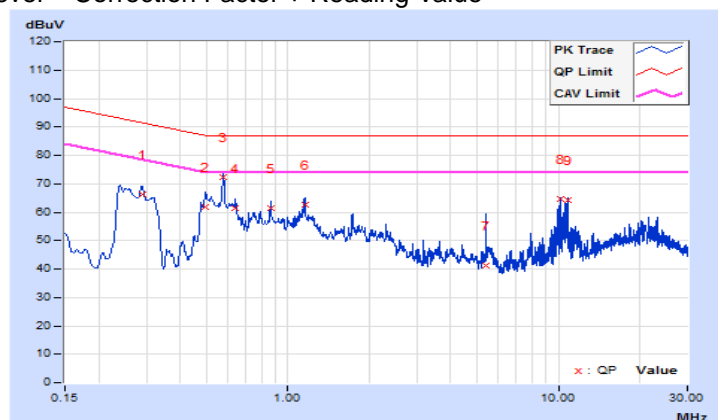
6.4 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power (System)	36Vdc	Environmental Conditions	20°C, 81%RH, 1006mbar
Tested by	Chenghan Wu		
Test Mode	Mode 1 – PoE port (1Gbps, TFGEN+PING)		

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	0.28891	9.56	56.64	50.78	66.20	60.34	91.56	78.56	-25.36	-18.22
2	0.49799	9.44	52.21	45.92	61.65	55.36	87.03	74.03	-25.38	-18.67
3	0.57771	9.41	62.72	61.57	72.13	70.98	87.00	74.00	-14.87	-3.02
4	0.64076	9.39	52.05	41.84	61.44	51.23	87.00	74.00	-25.56	-22.77
5	0.86754	9.34	52.19	50.71	61.53	60.05	87.00	74.00	-25.47	-13.95
6	1.15297	9.31	53.27	51.09	62.58	60.40	87.00	74.00	-24.42	-13.60
7	5.37927	9.26	31.93	26.23	41.19	35.49	87.00	74.00	-45.81	-38.51
8	10.24331	9.34	55.40	55.08	64.74	64.42	87.00	74.00	-22.26	-9.58
9	10.79462	9.37	54.82	54.49	64.19	63.86	87.00	74.00	-22.81	-10.14

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

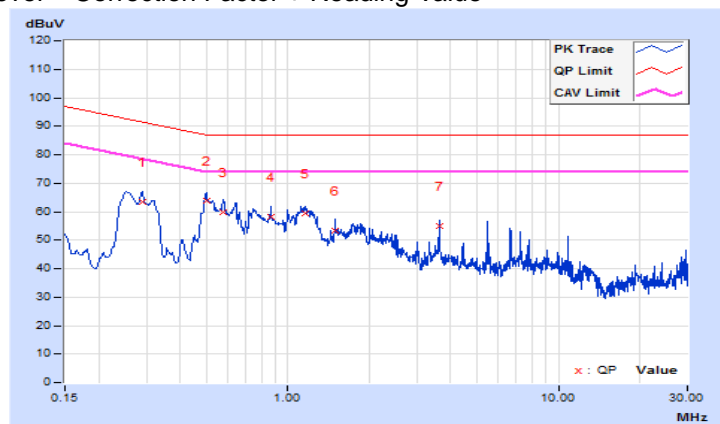


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power (System)	36Vdc	Environmental Conditions	20°C, 81%RH, 1006mbar
Tested by	Chenghan Wu		
Test Mode	Mode 2 – LAN port (10Gbps, TFGEN+PING)		

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	0.28967	9.77	53.72	48.13	63.49	57.90	91.53	78.53	-28.04	-20.63
2	0.49845	9.68	53.99	48.66	63.67	58.34	87.03	74.03	-23.36	-15.69
3	0.57467	9.67	50.02	44.64	59.69	54.31	87.00	74.00	-27.31	-19.69
4	0.86363	9.63	48.53	45.19	58.16	54.82	87.00	74.00	-28.84	-19.18
5	1.15297	9.63	49.61	43.67	59.24	53.30	87.00	74.00	-27.76	-20.70
6	1.50096	9.64	43.71	40.10	53.35	49.74	87.00	74.00	-33.65	-24.26
7	3.62800	9.63	45.23	39.01	54.86	48.64	87.00	74.00	-32.14	-25.36

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

Class A			
Frequency range (MHz)	Distance (m)	Limits (dBuV/m)	
30 - 230	10	40	
230 - 1000		47	
30 - 230	3	50	
230 - 1000		57	
Class B			
Frequency range (MHz)	Distance (m)	Limits (dBuV/m)	
30 - 230	10	30	
230 - 1000		37	
30 - 230	3	40	
230 - 1000		47	
FM Receivers			
Frequency range (MHz)	Distance (m)	Class B limits (dBuV/m)	
		Fundamental	Harmonics
30 - 230	10	50	42
230 - 300			42
300 - 1000			46
30 - 230	3	60	52
230 - 300			52
300 - 1000			56

These relaxed limits apply only to emissions at the fundamental and harmonic frequencies of the local oscillator. Signals at all other frequencies shall be compliant with the limits given in Table A.4 of EN 55032.

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

7.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCS 30	100027	May 13, 2019	May 12, 2020
Schwarzbeck Bilog Antenna	VULB9168	9168-303	Nov. 11, 2019	Nov. 10, 2020
Agilent Preamplifier	8447D	2944A08119	Feb. 19, 2020	Feb. 18, 2021
ADT. Turn Table	TT100	0205	NA	NA
ADT. Tower	AT100	0205	NA	NA
Software	Radiated_V7.6.15.9.5	NA	NA	NA
ADT RF Switches BOX	EMH-011	1001	Oct. 24, 2019	Oct. 23, 2020
Pacific RF cable With 5dB PAD	8D	CABLE-ST2-01	Oct. 24, 2019	Oct. 23, 2020

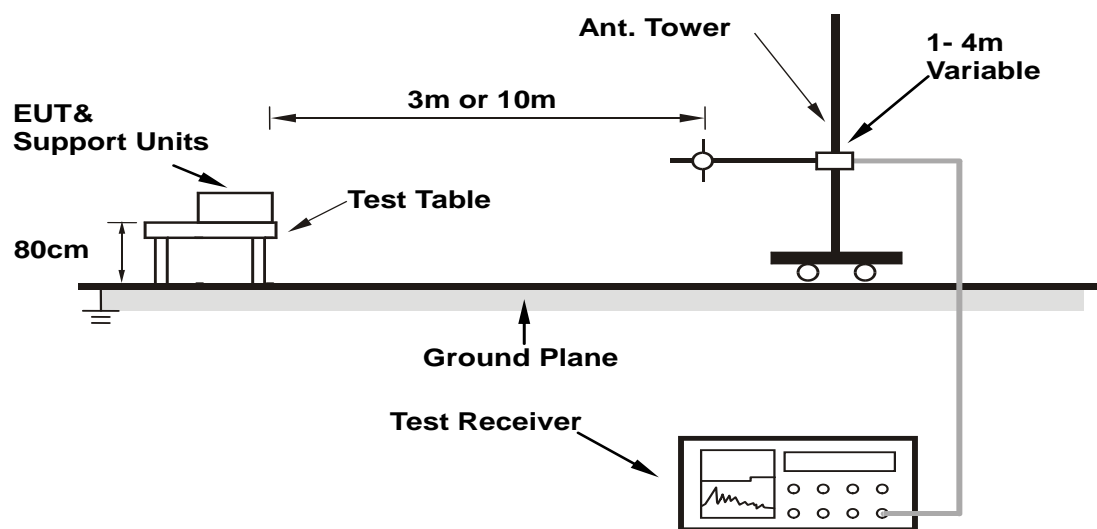
- Note:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in Open Site No. 2.
 3. The VCCI Site Registration No. R-10237.
 4. Tested Date: Mar. 20, 2020

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

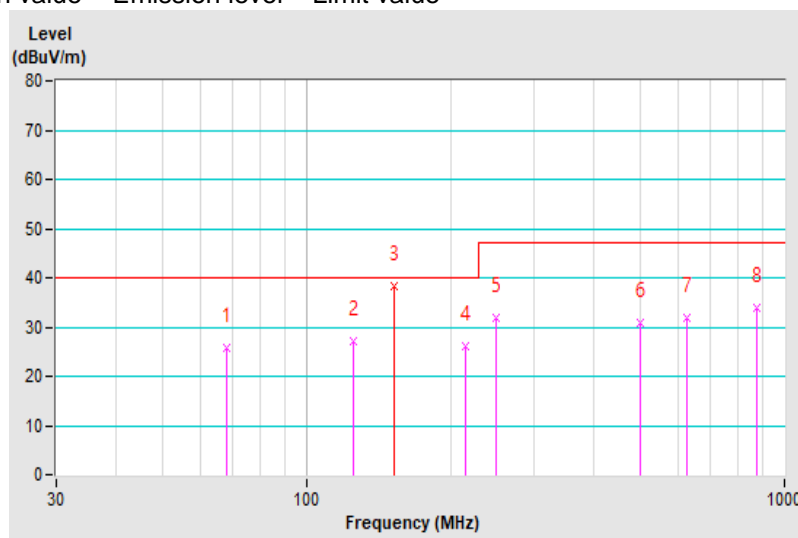
Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Input Power (System)	36Vdc	Environmental Conditions	22°C, 73%RH, 1006mbar
Tested by	Paul Chen		
Test Mode	Mode 1		

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	68.28	25.84 QP	40.00	-14.16	4.00 H	69	37.68	-11.84
2	125.01	27.20 QP	40.00	-12.80	4.00 H	295	38.25	-11.05
3	152.40	38.17 QP	40.00	-1.83	4.00 H	274	47.38	-9.21
4	215.92	26.08 QP	40.00	-13.92	4.00 H	253	37.86	-11.78
5	250.00	31.70 QP	47.00	-15.30	3.74 H	327	41.33	-9.63
6	500.02	30.73 QP	47.00	-16.27	1.91 H	155	34.12	-3.39
7	625.02	31.71 QP	47.00	-15.29	1.31 H	317	32.25	-0.54
8	874.98	33.80 QP	47.00	-13.20	1.00 H	280	29.05	4.75

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

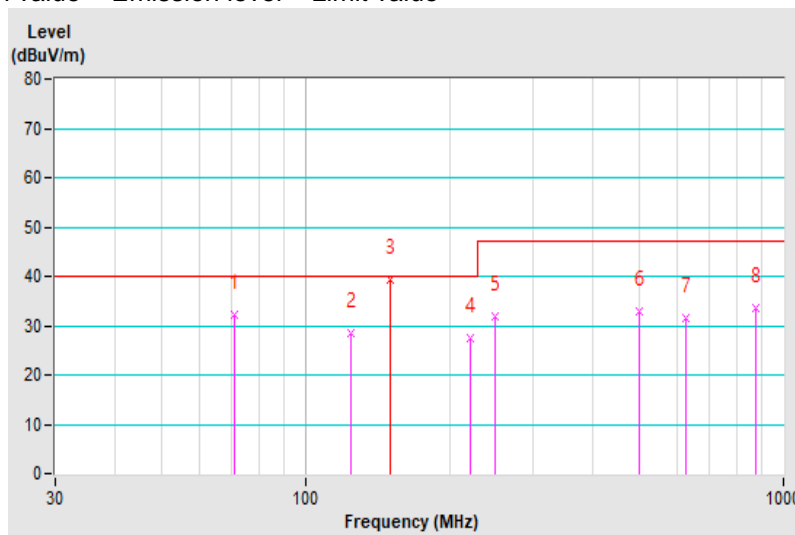


Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Input Power (System)	36Vdc	Environmental Conditions	22°C, 73%RH, 1006mbar
Tested by	Paul Chen		
Test Mode	Mode 1		

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	70.89	32.33 QP	40.00	-7.67	1.36 V	46	44.64	-12.31
2	124.99	28.46 QP	40.00	-11.54	1.00 V	321	39.51	-11.05
3	151.06	39.48 QP	40.00	-0.52	1.00 V	1	48.71	-9.23
4	222.08	27.36 QP	40.00	-12.64	1.00 V	332	39.06	-11.70
5	250.00	31.91 QP	47.00	-15.09	1.00 V	243	41.54	-9.63
6	500.00	32.78 QP	47.00	-14.22	1.00 V	188	36.17	-3.39
7	625.01	31.41 QP	47.00	-15.59	3.23 V	340	31.95	-0.54
8	875.02	33.69 QP	47.00	-13.31	2.15 V	52	28.92	4.77

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

Class A			
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
Class B			
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

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

Required highest frequency for radiated measurement

Highest internal frequency (F_x) (MHz)	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.

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

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

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	MY51210137	Jun. 6, 2019	Jun. 5, 2020
Agilent Preamplifier	8449B	3008A01292	Feb. 20, 2020	Feb. 19, 2021
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Feb. 20, 2020	Feb. 19, 2021
EMCI Preamplifier	EMC184045B	980235	Feb. 20, 2020	Feb. 19, 2021
ETS Preamplifier	3117-PA	00215857	Nov. 24, 2019	Nov. 23, 2020
Schwarzbeck Horn Antenna	BBHA-9170	212	Nov. 24, 2019	Nov. 23, 2020
EMCO Horn Antenna	3115	6714	Nov. 24, 2019	Nov. 23, 2020
Max Full. Turn Table	MF7802	MF780208216	NA	NA
Software	Radiated_V8.7.08	NA	NA	NA
KIK + WOKEN RF cable With 3/4dB PAD	K1K50-UP0279-K1K50 -3000+WC01	Cable-CH10(3m) -04 +Cable-CH10-03	Jul. 10, 2019	Jul. 9, 2020
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

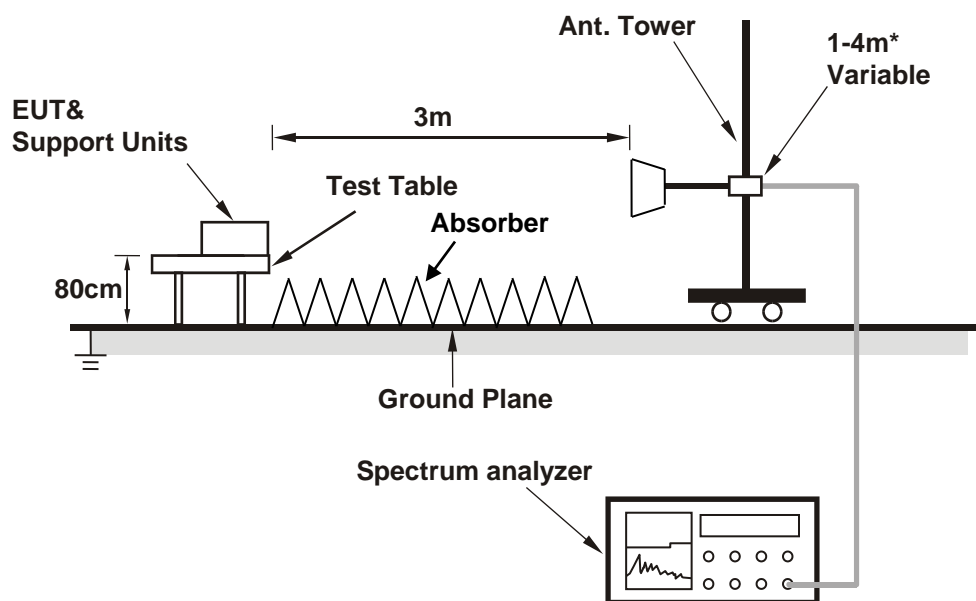
- Note:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The 3dB beamwidth of the horn antenna is minimum 41degree (or $w = 2.24m$ at 3m distance) for 1~6 GHz.
 3. The test was performed in Chamber No. 10.
 4. The VCCI Site Registration No. G-10427
 5. Tested Date: Mar. 20, 2020

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 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

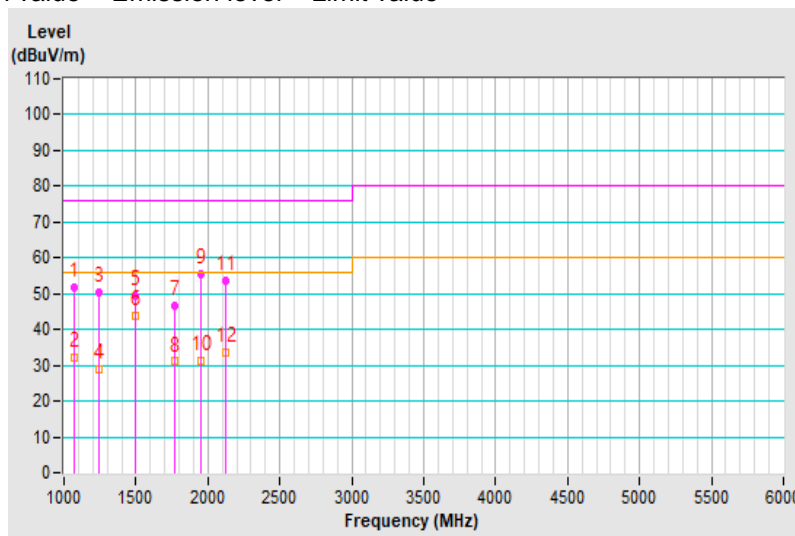
Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Input Power (System)	36Vdc	Environmental Conditions	20°C, 64%RH, 1006mbar
Tested by	Vincent Lin		
Test Mode	Mode 1		

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	1065.92	51.84 PK	76.00	-24.16	2.69 H	255	54.82	-2.98
2	1065.92	32.32 AV	56.00	-23.68	2.69 H	255	35.30	-2.98
3	1239.49	50.52 PK	76.00	-25.48	1.12 H	149	54.24	-3.72
4	1239.49	28.80 AV	56.00	-27.20	1.12 H	149	32.52	-3.72
5	1500.08	49.57 PK	76.00	-26.43	1.00 H	132	52.38	-2.81
6	1500.08	44.00 AV	56.00	-12.00	1.00 H	132	46.81	-2.81
7	1774.02	46.81 PK	76.00	-29.19	1.72 H	8	48.23	-1.42
8	1774.02	31.05 AV	56.00	-24.95	1.72 H	8	32.47	-1.42
9	1954.60	55.67 PK	76.00	-20.33	1.08 H	123	57.27	-1.60
10	1954.60	31.35 AV	56.00	-24.65	1.08 H	123	32.95	-1.60
11	2126.17	53.55 PK	76.00	-22.45	2.00 H	202	54.68	-1.13
12	2126.17	33.53 AV	56.00	-22.47	2.00 H	202	34.66	-1.13

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

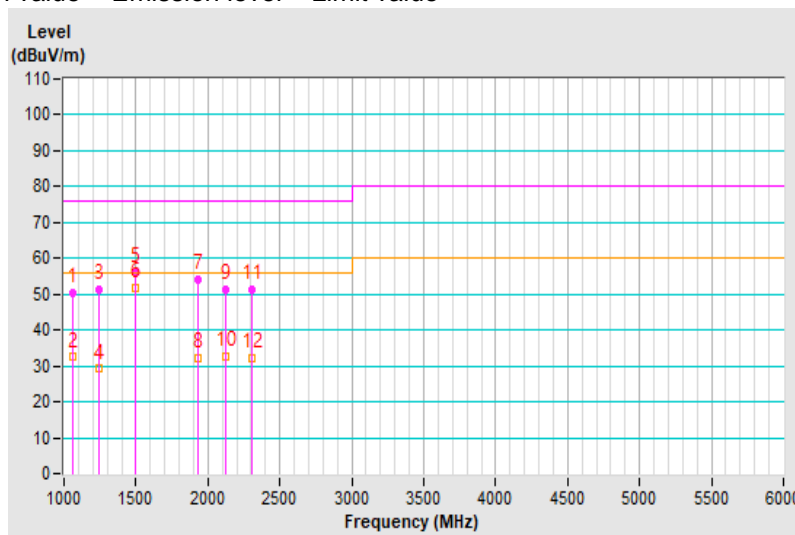


Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Input Power (System)	36Vdc	Environmental Conditions	20°C, 64%RH, 1006mbar
Tested by	Vincent Lin		
Test Mode	Mode 1		

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	1064.40	50.57 PK	76.00	-25.43	2.58 V	117	53.54	-2.97
2	1064.40	32.43 AV	56.00	-23.57	2.58 V	117	35.40	-2.97
3	1240.51	51.31 PK	76.00	-24.69	2.50 V	195	55.03	-3.72
4	1240.51	29.20 AV	56.00	-26.80	2.50 V	195	32.92	-3.72
5	1500.11	56.07 PK	76.00	-19.93	2.56 V	7	58.88	-2.81
6	1500.11	51.84 AV	56.00	-4.16	2.56 V	7	54.65	-2.81
7	1928.02	54.12 PK	76.00	-21.88	2.43 V	152	55.73	-1.61
8	1928.02	32.39 AV	56.00	-23.61	2.43 V	152	34.00	-1.61
9	2126.75	51.45 PK	76.00	-24.55	2.11 V	0	52.59	-1.14
10	2126.75	32.54 AV	56.00	-23.46	2.11 V	0	33.68	-1.14
11	2309.52	51.33 PK	76.00	-24.67	1.00 V	178	51.71	-0.38
12	2309.52	32.12 AV	56.00	-23.88	1.00 V	178	32.50	-0.38

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 55035:2017, Immunity requirements

Reference standard	Test specification	Performance Criterion
EN/IEC 61000-4-2 ESD	Enclosure port: ±8kV Air discharge, ±4kV Contact discharge	B
EN/IEC 61000-4-3 RS	Enclosure port: Swept freq. test : 80-1000 MHz, 3V/m, 80% AM (1kHz), Spot freq. test : 1800, 2600, 3500, 5000 MHz (±1 %), 3V/m, 80% AM (1kHz)	A
EN/IEC 61000-4-4 EFT	Analogue/digital data ports (cable length > 3m): xDSL equipment: ±0.5kV, 5/50 (t _r /t _w) ns, 100kHz others: ±0.5kV, 5/50 (t _r /t _w) ns, 5kHz DC network power port(cable length > 3m): ±0.5kV, 5/50 (t _r /t _w) ns, 5kHz AC mains power ports: ±1.0kV, 5/50 (t _r /t _w) ns, 5kHz	B
EN/IEC 61000-4-6 CS	Analogue/digital data ports (cable length > 3m) ; DC network power ports (cable length > 3m) ; AC mains power ports 0.15-10 MHz, 3V, 80% AM (1kHz), 10-30 MHz, 3V-1V, 80% AM (1kHz), 30-80 MHz, 1V, 80% AM (1kHz)	A
EN/IEC 61000-4-8 PFMF	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.

Product Specific Performance Criteria

The particular performance criteria which are specified in the normative annexes of EN 55035 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

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 (Indirect/ Direct)
Number of Discharge:	Air – Direct: 10 discharges per location (each polarity) Contact – Direct & Indirect: 10 discharges per location (each polarity)
Discharge Mode:	Single Discharge
Discharge Period:	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. 8, 2019	Nov. 7, 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 ESD Room No. 2.
 3. Tested Date: Mar. 30, 2020

10.3 Test Arrangement

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

- Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.
- The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.
- The time interval between two successive single discharges was at least 1 second.
- 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.
- Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
- 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.
- 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**.
- 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.

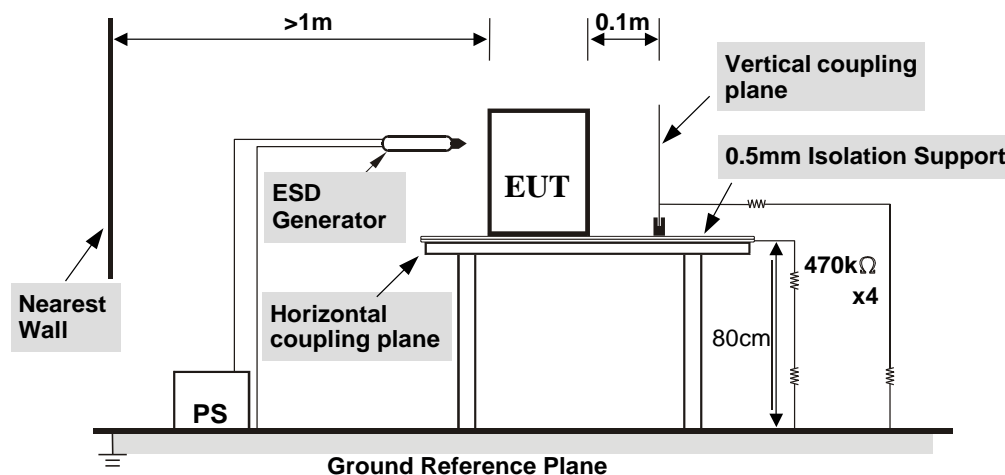


TABLE-TOP EQUIPMENT

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 940k Ω 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	36Vdc (System)	Tested by	Thomas Cheng
Environmental Conditions	22 °C, 47% RH 1010 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	+/-	3-4	NA	Note	A

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

Test Results of Indirect Application

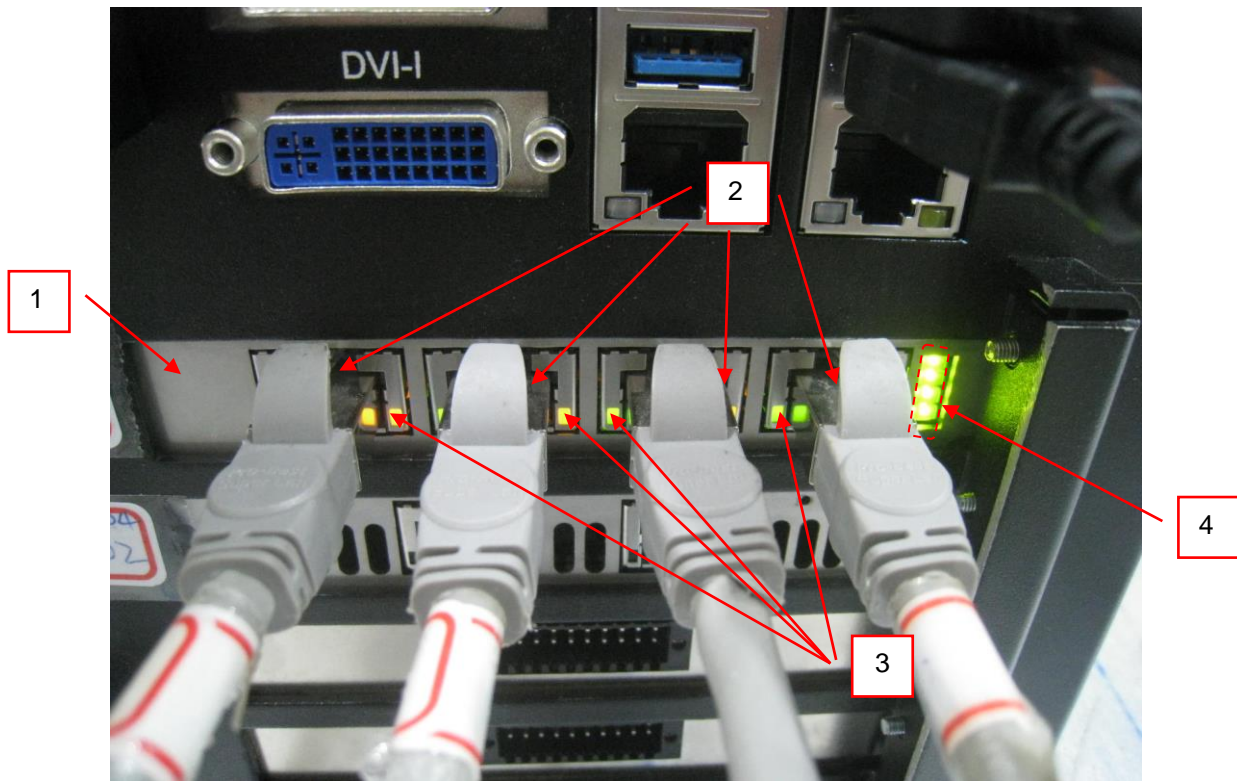
Discharge Level (kV)	Polarity (+/-)	Test Point	Horizontal Coupling Plane	Vertical Coupling Plane	Performance Criterion
2, 4	+/-	Four Sides	Note	Note	A

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
Swept Frequency Range:	80 MHz - 1000 MHz
Spot Frequencies:	1800, 2600, 3500, 5000 MHz (± 1 %)
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
AgilentSignal Generator	E8257D	MY48050465	Jun. 7, 2019	Jun. 6, 2020
BONN RF Amplifier	BSA 0125-800	1912556	NA	NA
TESTQAmplifier	CBA 1G-275	T44344	NA	NA
AR RF Amplifier	35S4G8AM4	0326094	NA	NA
AR RF Amplifier	100S1G4M3	0329249	NA	NA
AR Controller	SC1000M3	305910	NA	NA
ETS Electric Field Sensor	HI-6105	00217912	Aug. 13, 2019	Aug. 12, 2020
BOONTON RF Voltage Meter	4232A	10180	May 29, 2019	May 28, 2020
BOONTON Power Sensor	51011-EMC	34152	May 29, 2019	May 28, 2020
BOONTON Power Sensor	51011-EMC	34153	May 29, 2019	May 28, 2020
ARLog-Periodic Antenna	AT6080	0329465	NA	NA
EMCO BiconiLog Antenna	3141	1001	NA	NA
ARHigh Gain Antenna	AT4010	0329800	NA	NA
SchwarzbeckLOG ANTENNA	Stlp 9149	9149-260	NA	NA
CHANCE MOST Full Anechoic Chamber (9x5x3m)	Chance Most	RS-002	Feb. 5, 2020	Feb. 4, 2021
Software	RS_V7.6	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 RS Room No.2.
 3. The transmit antenna was located at a distance of 3 meters from the EUT.
 4. Tested Date: Mar. 26, 2020

11.3 Test Arrangement

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

- a. The testing was performed in a fully anechoic chamber.
- b. The swept frequency range is from 80 MHz to 1000 MHz and the spot frequencies are 1800, 2600, 3500, 5000 MHz ($\pm 1\%$), with the signal 80% amplitude modulated with a 1kHz sine wave.
- c. The dwell time of the amplitude modulated carrier was applied in 3 s at each of the frequencies during the scan. The sensitive frequencies (e.g. clock frequencies or frequencies identified by the manufacturer or obtained as outcome of the test) shall be analyzed in addition to the stepped frequencies.
- d. The field strength level was 3 V/m.
- e. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

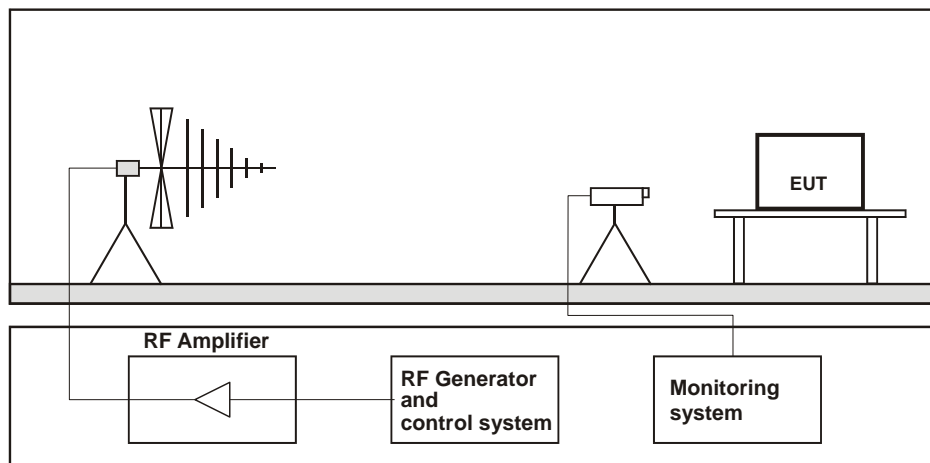


Table-top Equipment

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	36Vdc (System)	Tested by	Thomas Cheng
Environmental Conditions	22 °C, 66% RH	Test mode	Mode 1

Frequency (MHz)	Polarity	Azimuth(°)	Applied Field Strength		Observation	Performance Criterion	Remark
			(V/m)	Modulation			
80 - 1000	V&H	0	3	80% AM (1kHz)	Note	A	-
		90	3	80% AM (1kHz)	Note	A	
		180	3	80% AM (1kHz)	Note	A	
		270	3	80% AM (1kHz)	Note	A	
1800, 2600, 3500, 5000 MHz (±1 %)	V&H	0	3	80% AM (1kHz)	Note	A	
		90	3	80% AM (1kHz)	Note	A	
		180	3	80% AM (1kHz)	Note	A	
		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:	Analogue/digital data port (cable length > 3m): ± 0.5 kV DC network power port (cable length > 3m): NA AC mains power port: NA
Impulse Repetition Frequency:	100kHz : applicable only to xDSL port 5kHz : others
Impulse Wave Shape :	5/50 ns
Burst Duration:	0.75 ms for 100kHz Repetition Frequency 15 ms for 5kHz Repetition Frequency
Burst Period:	300 ms
Test Duration:	1 min.

12.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
TESEQ, EFT Simulator	NSG 3060	1572	May 22, 2019	May 21, 2020
TESEQ, CDN	CDN 3083-B100	303	May 22, 2019	May 21, 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 EMS Room No. 2.
 3. Tested Date: Mar. 26, 2020

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:	0.15 MHz - 10 MHz: 3V 10 MHz - 30 MHz: 3-1 V 30 MHz - 80 MHz: 1V
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Dwell Time	3 seconds

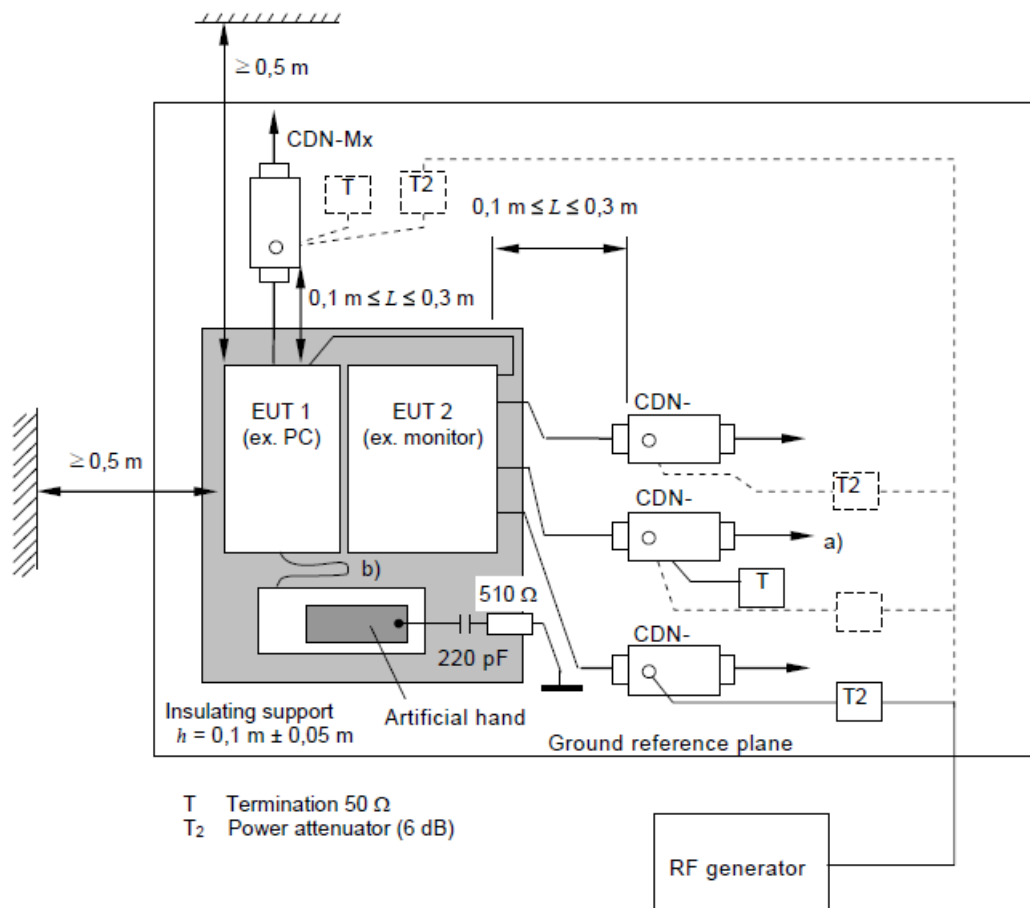
13.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ Signal Generator	SML03	101801	Jan. 17, 2020	Jan. 16, 2021
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. 31, 2019	Jul. 30, 2020
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. 8, 2019	Nov. 7, 2020
R&S Power Meter	NRVD	837794/040	Nov. 8, 2019	Nov. 7, 2020
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 T8-10	40376	Jun. 19, 2019	Jun. 18, 2020
TESEQ Coupling Decoupling Network	CDN S751S	35791	Mar. 5, 2020	Mar. 4, 2021
TESEQ Coupling Decoupling Network	CDN S200	53490	May 28, 2019	May 27, 2020
TESEQ Coupling Decoupling Network	CDN S400	52115	Jul. 23, 2019	Jul. 22, 2020
TESEQ Coupling Decoupling Network	ISN ST08	41212	Jun. 19, 2019	Jun. 18, 2020
FCC Coupling Decoupling Network	FCC-801-M5-50A	100018	Jan. 20, 2020	Jan. 19, 2021
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: Mar. 24, 2020

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.
- The dwell time of the amplitude modulated carrier was applied in 3s at each of the frequencies during the scan. The sensitive frequencies (e.g. clock frequencies or frequencies identified by the manufacturer or obtained as outcome of the test) shall be analyzed in addition to the stepped frequencies.
- 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 ($\leq 1 \text{ m}$) 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	36Vdc (System)	Tested by	Thomas Cheng
Environmental Conditions	22 °C, 62% RH	Test mode	Mode 1

Frequency (MHz)	Level (Vrms)	Tested Line	Injection Method	Return Path	Observation	Performance Criterion	Remark
0.15 – 10	3	LAN	CDN-T8-10	CDN-M3	Note	A	-
10 – 30	3 – 1	LAN	CDN-T8-10	CDN-M3	Note	A	
30 – 80	1	LAN	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

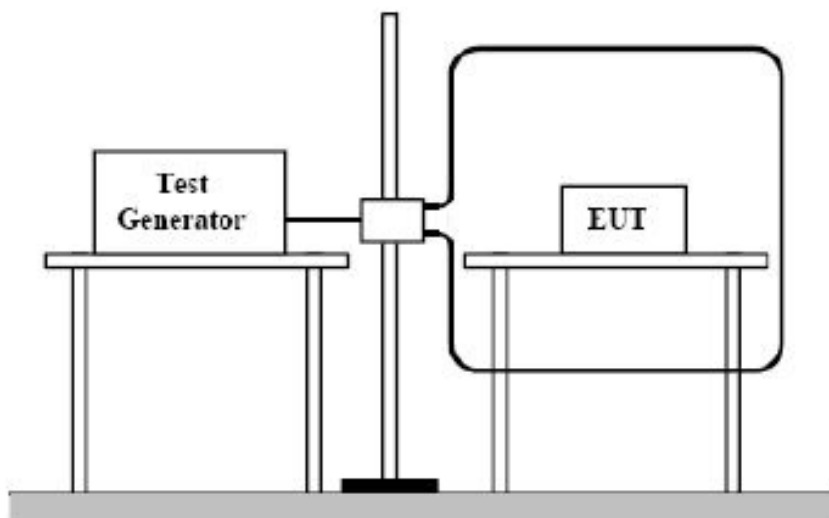
14.2 Test Instruments

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: Mar. 25, 2020

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

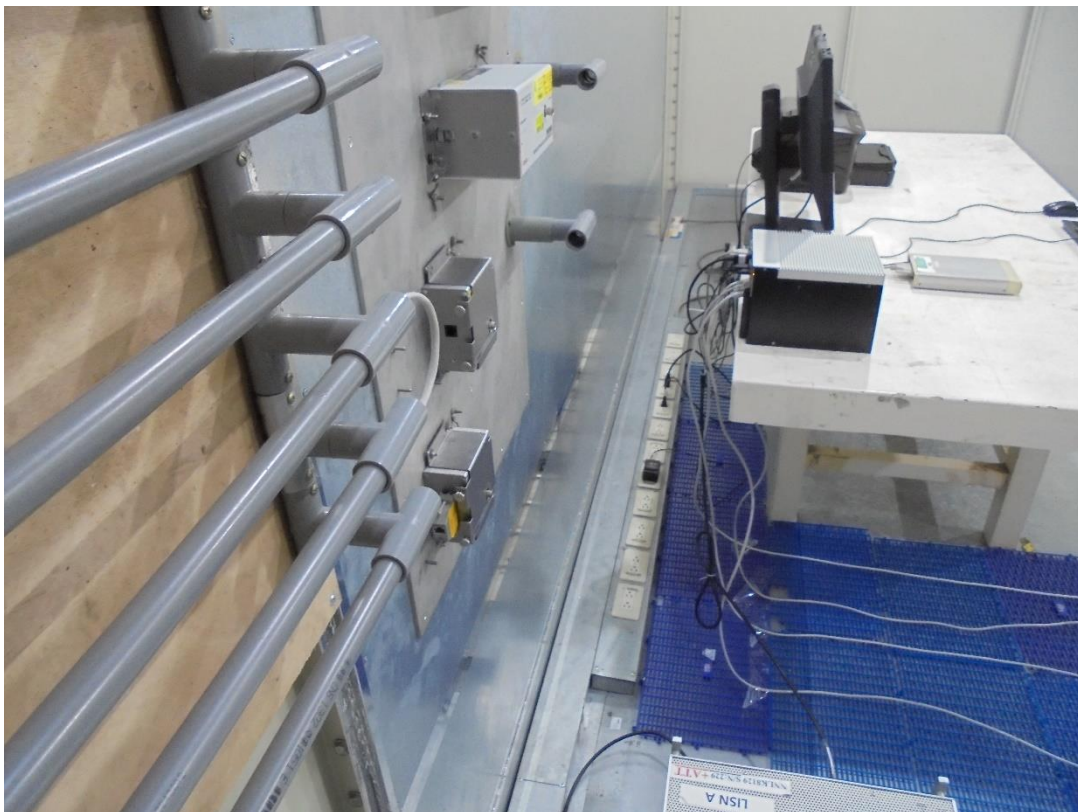
Input Power	36Vdc (System)	Tested by	Thomas Cheng
Environmental Conditions	23 °C, 68% RH	Test mode	Mode 1

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

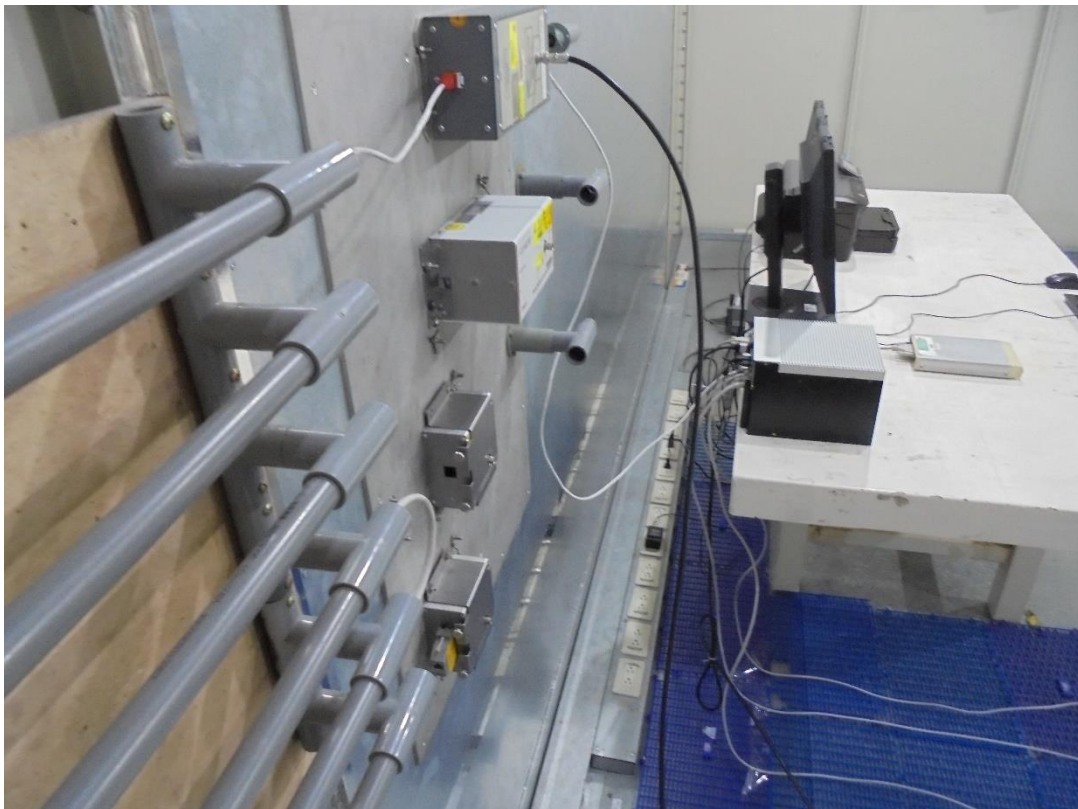
Note: The EUT function was correct during the test.

15 Pictures of Test Arrangements

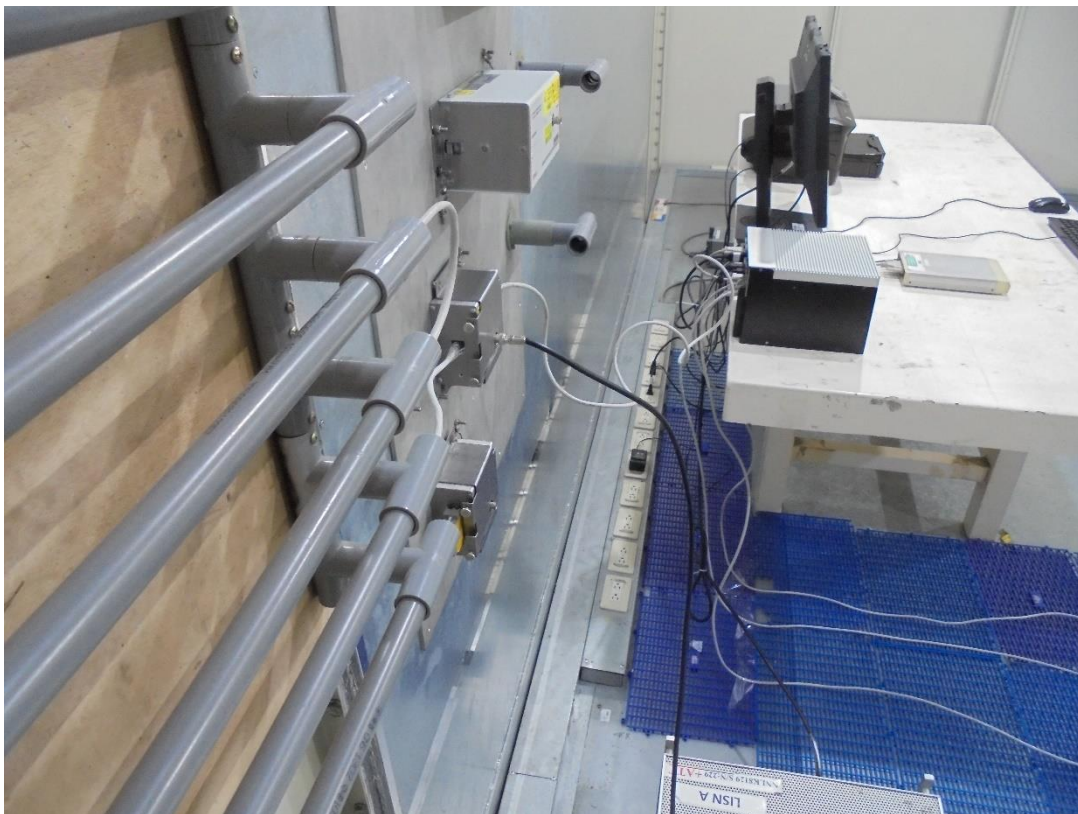
15.1 Conducted Emission from the Mains Power Port



15.2 Asymmetric Mode Conducted Emission at Telecommunication Ports and Tuner Ports For PoE



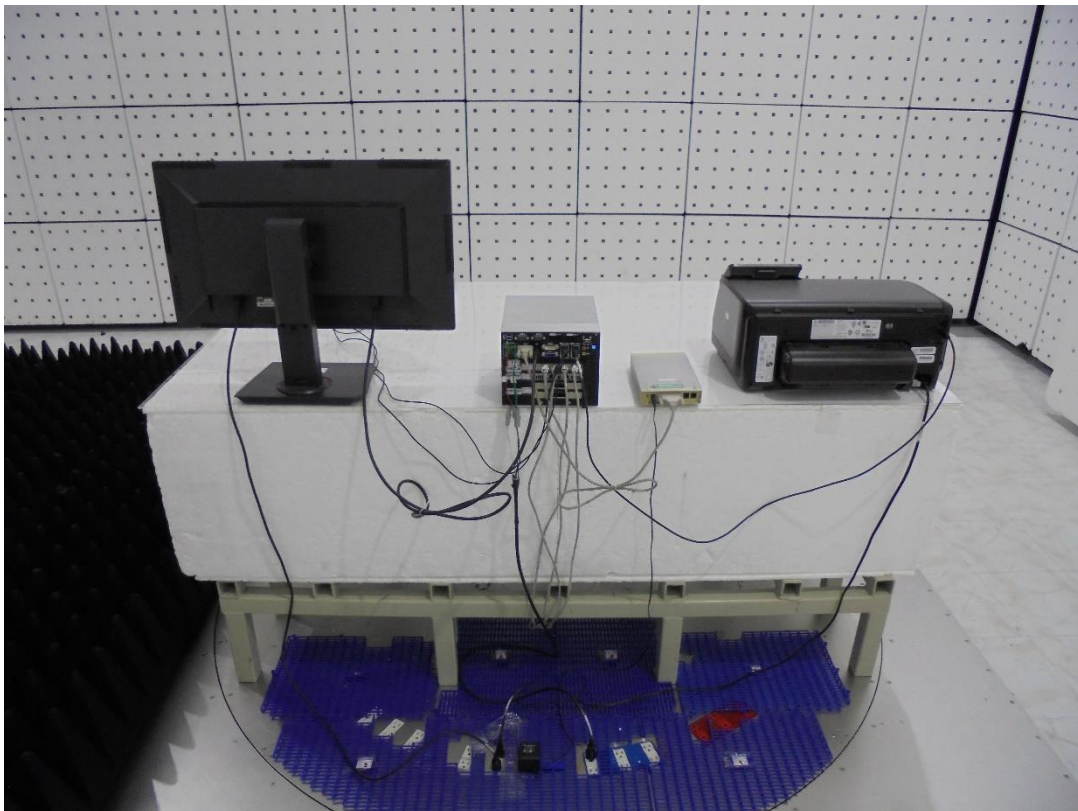
For LAN



15.3 Radiated Emission at Frequencies up to 1GHz



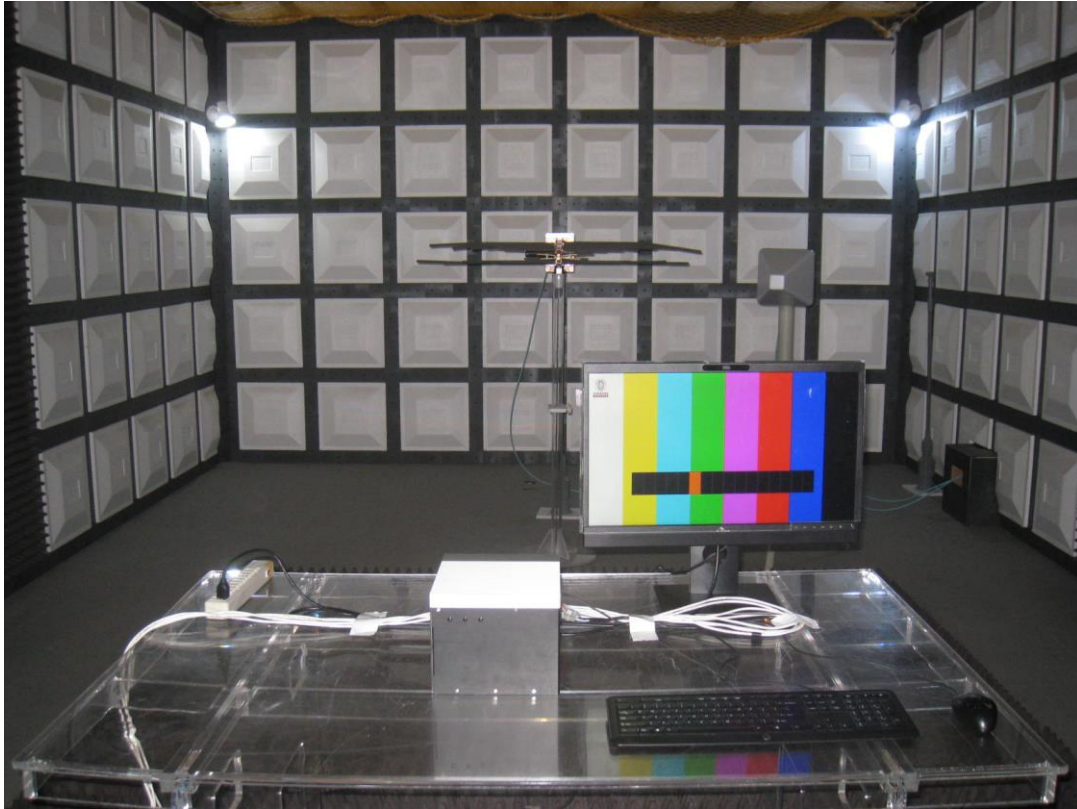
15.4 Radiated Emission at Frequencies above 1GHz



15.5 Electrostatic Discharge Immunity Test (ESD)



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



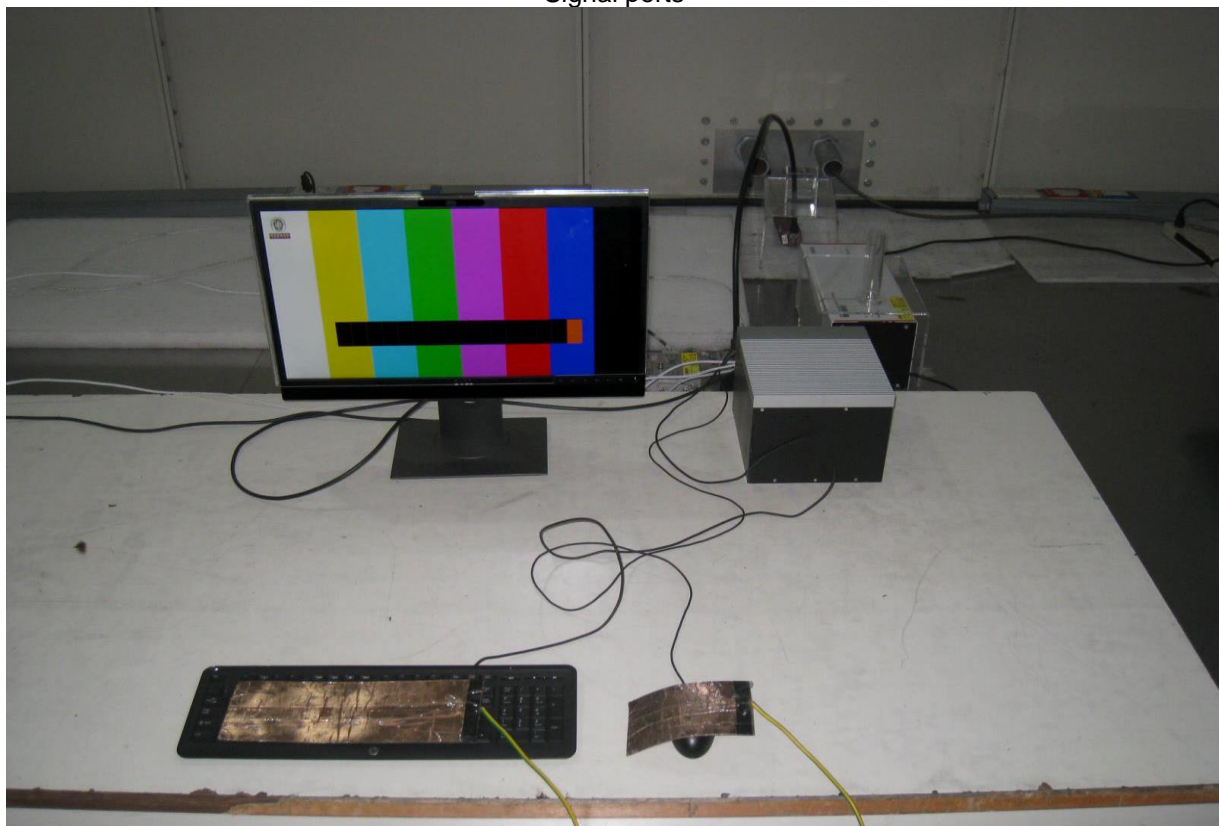
15.7 Electrical Fast Transient/Burst Immunity Test (EFT)

Signal ports



15.8 Conducted Disturbances Induced by RF Fields (CS)

Signal ports



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.

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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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