

CE EMC Test Report

Report No.: CE190611D12

Test Model: SMX-200

Series Model: SMX-2XXXXXXXXXXXXXXXXXX
(“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
Lin Kou Laboratories

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Release Control Record


Issue No.	Description	Date Issued
CE190611D12	Original release.	Aug. 28, 2019

1 Certificate of Conformity

Product: Mini PCIe 4-port Isolated RS-232/422/485 Serial Card
Brand: Vecow
Test Model: SMX-200
Series Model: SMX-2XXXXXXXXXXXXXXXXX
("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 (Not applicable)
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 (Not applicable)
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
Vivian Chen / 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 -13.09 dB at 14.68359 MHz	Pass
	Asymmetric mode conducted emission at telecommunication ports	Without telecom port of the EUT	N/A
	Radiated emission 30-1000 MHz	Minimum passing Class A margin is -4.86 dB at 174.91 MHz	Pass
	Radiated emission above 1GHz	EUT's highest frequency is below 108 MHz	N/A
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)	EUT's cable length is not greater than 3m and EUT consumes DC power	N/A
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)	EUT's cable length is not greater than 3m and EUT consumes DC power	N/A
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	Test not applicable because port does not exist.	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_{cispr})
Radiated emission, 30MHz ~ 1GHz	4.01 dB	6.3 dB (U_{cispr})

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 Description of EUT

Product	Mini PCIe 4-port Isolated RS-232/422/485 Serial Card
Brand	Vecow
Test Model	SMX-200
Series Model	SMX-2XXXXXXXXXXXXXXXXXX (“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 Mini PCIe 4-port Isolated RS-232/422/485 Serial Card and installed in IPC during the test.
2. The EUT maximum data rate is 921.6kbps.

3.2 Features of EUT

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

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

The EUT was pre-tested under operating and standby condition and the worst emission level was found under **operating condition**.

3.4 Test Program Used and Operation Descriptions

Emission tests (Harmonics & Flicker 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. 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.

Harmonics, Flicker, Immunity tests (RS 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. IPC sent “H” messages to monitor then displayed “H” messages on its screen.
- f. Steps d-e were repeated.

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. IPC sent “H” messages to monitor (kept in a remote area) then displayed “H” messages on its screen.
- f. Steps d-e were repeated.

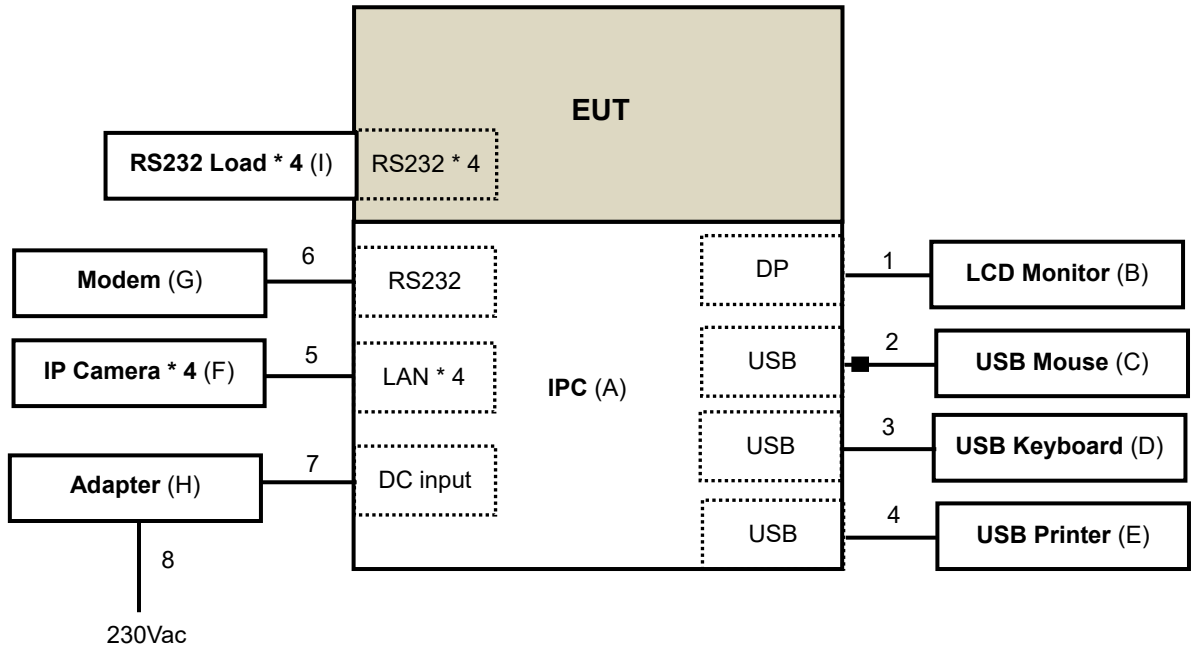
3.5 Primary Clock Frequencies of Internal Source

The highest frequency generated or used within the EUT or on which the EUT operates or tunes is 921.6kbps, provided by Vecow Co., Ltd., for detailed internal source, please refer to the manufacturer's specifications.

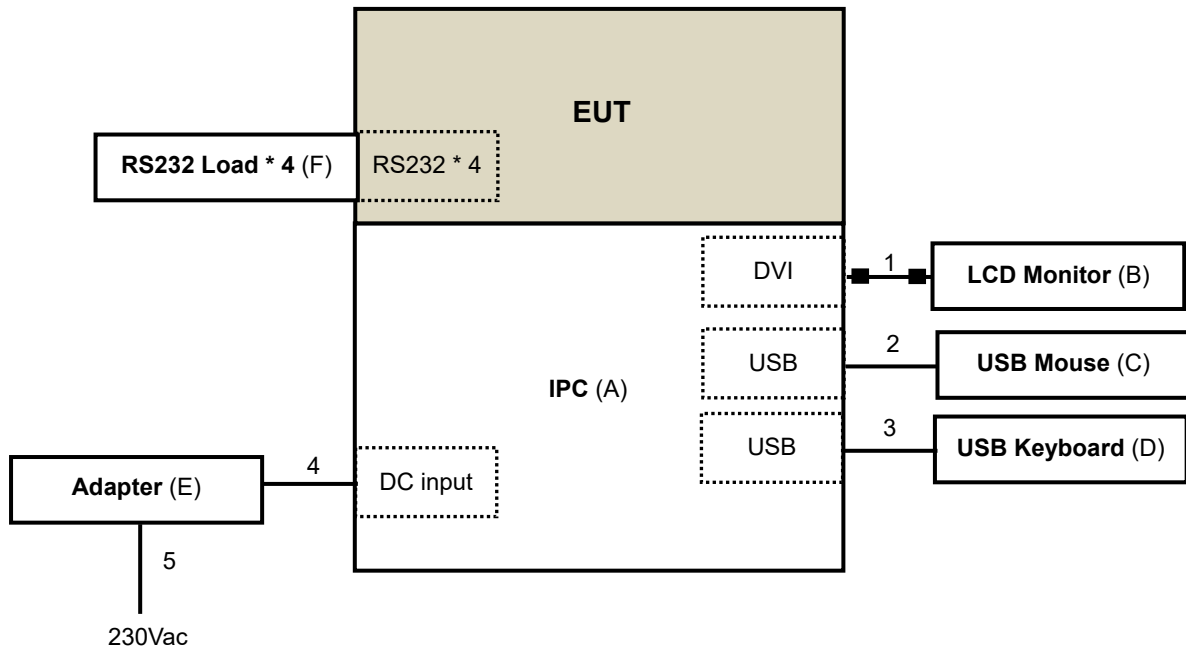
4 Configuration and Connections with EUT

4.1 Connection Diagram of EUT and Peripheral Devices

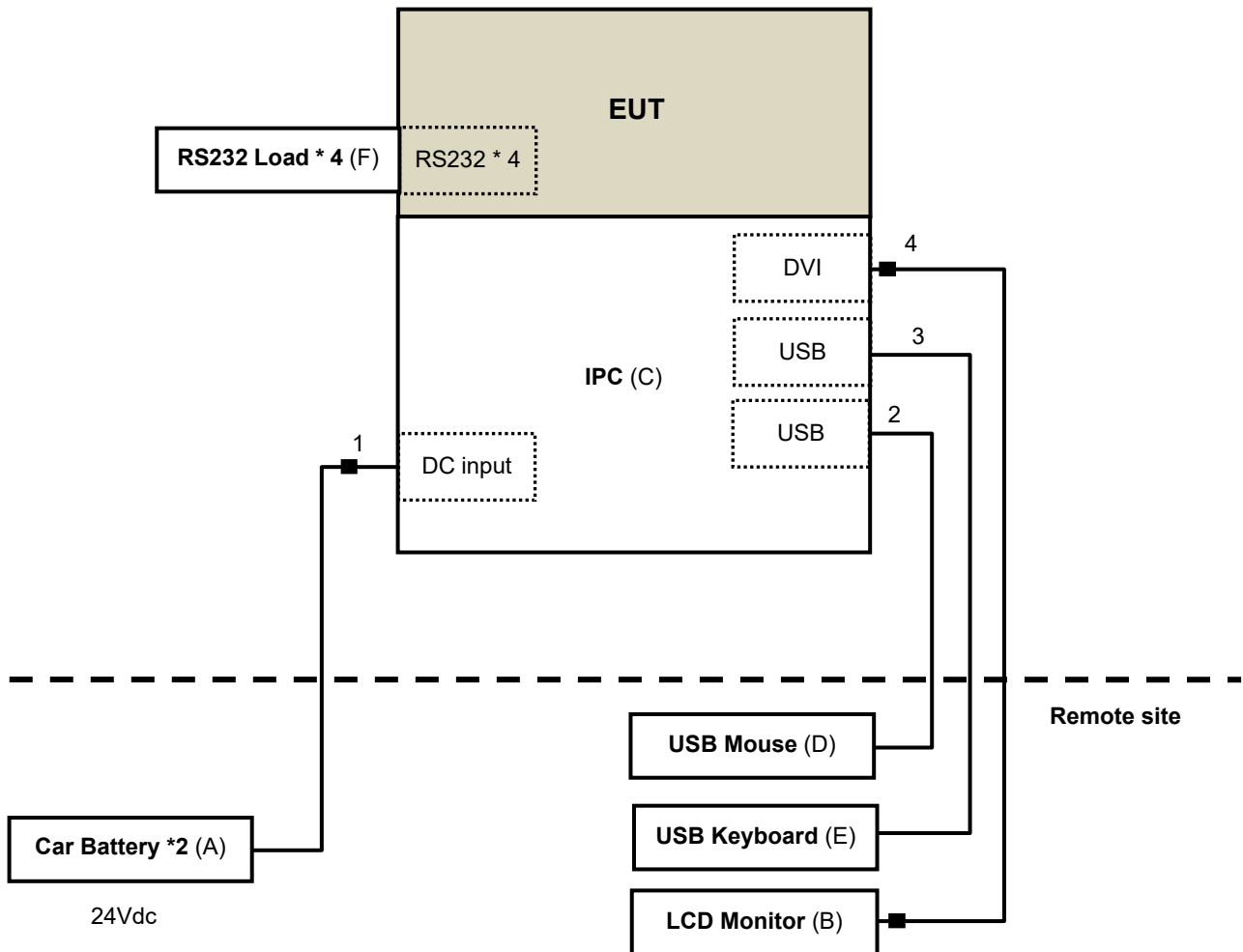
Emission tests (Harmonics & Flicker excluded):



Harmonics, Flicker, Immunity tests (RS excluded):



Immunity tests (Only for RS test):



4.2 Configuration of Peripheral Devices and Cable Connections

Emission tests (Harmonics & Flicker excluded):

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	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	Supplied by client

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	1	1.0	N	0	Supplied by client
8.	AC power cord	1	1.8	N	0	Provided by Lab

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

Harmonics, Flicker, Immunity tests (RS 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	CN082WXD728720C C0KDL	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.	Adapter	Seasonic	SSA-1201-24	N/A	N/A	Supplied by client
F.	RS232 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. 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.	DC power	1	1.0	N	0	Supplied by client
5.	AC power cord	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-74261-8 74-22KS-A00	N/A	Provided by Lab
C.	IPC	Vecow	RCS-9000	N/A	N/A	Supplied by client
D.	USB Mouse	Dell	MS111-L	N/A	FCC DoC Approved	Provided by Lab
E.	USB Keyboard	Dell	SK-8115	N/A	FCC DoC Approved	Provided by Lab
F.	RS232 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 A-B, D-E acted as communication partners to transfer data.

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

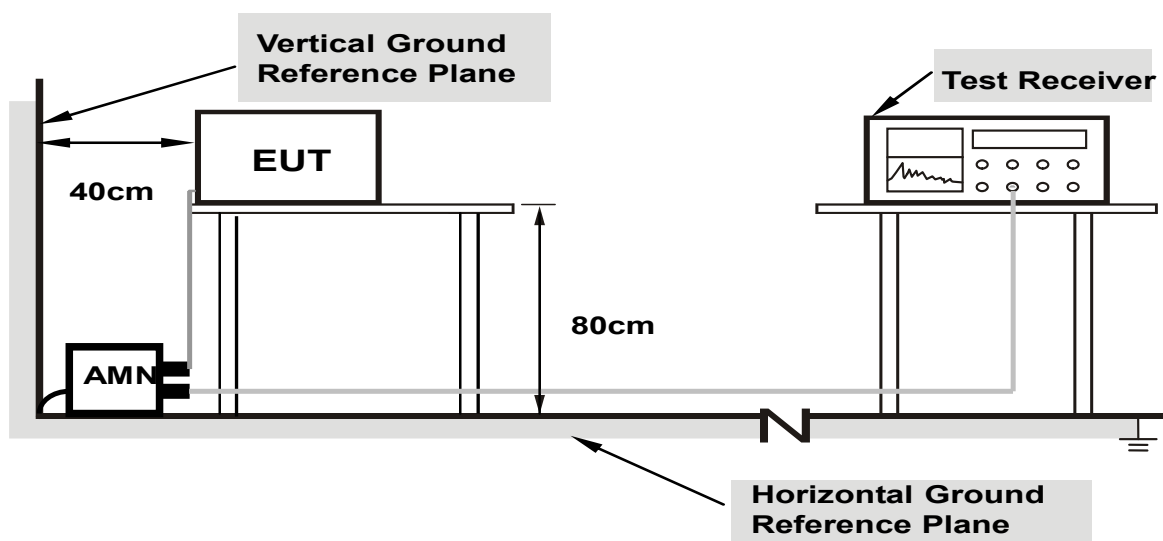
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCS 30	838251/021	Nov. 1, 2018	Oct. 31, 2019
ROHDE & SCHWARZ Artificial Mains Network (For EUT)	ENV216	101195	May 9, 2019	May 8, 2020
LISN With Adapter(for EUT)	101195	N/A	May 9, 2019	May 8, 2020
EMCO L.I.S.N. (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:**
- 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.

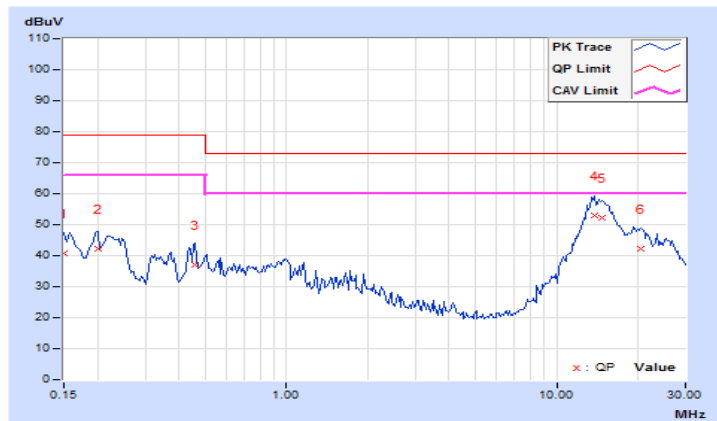
5.4 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power (System)	230Vac, 50Hz	Environmental Conditions	25°C, 71%RH, 1001mbar
Tested by	John Liao		
Test Mode	With System		

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	0.15000	9.62	31.07	22.60	40.69	32.22	79.00	66.00	-38.31	-33.78
2	0.20078	9.61	32.65	19.96	42.26	29.57	79.00	66.00	-36.74	-36.43
3	0.45860	9.63	27.30	16.12	36.93	25.75	79.00	66.00	-42.07	-40.25
4	13.75391	9.89	43.19	37.01	53.08	46.90	73.00	60.00	-19.92	-13.10
5	14.68359	9.90	42.29	37.01	52.19	46.91	73.00	60.00	-20.81	-13.09
6	20.54297	9.93	32.27	24.59	42.20	34.52	73.00	60.00	-30.80	-25.48

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

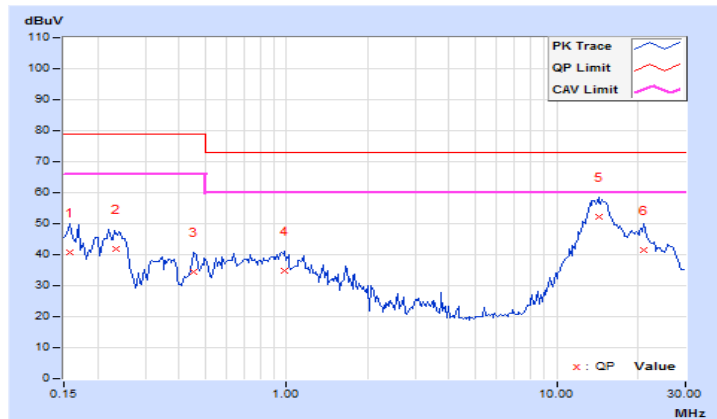


Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power (System)	230Vac, 50Hz	Environmental Conditions	25°C, 71%RH, 1001mbar
Tested by	John Liao		
Test Mode	With System		

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	0.15781	9.60	31.17	20.58	40.77	30.18	79.00	66.00	-38.23	-35.82
2	0.23331	9.60	32.31	22.14	41.91	31.74	79.00	66.00	-37.09	-34.26
3	0.45469	9.61	24.72	15.96	34.33	25.57	79.00	66.00	-44.67	-40.43
4	0.98594	9.66	25.08	18.03	34.74	27.69	73.00	60.00	-38.26	-32.31
5	14.27734	9.91	42.21	36.60	52.12	46.51	73.00	60.00	-20.88	-13.49
6	20.99609	9.98	31.44	23.32	41.42	33.30	73.00	60.00	-31.58	-26.70

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 Radiated Emission at Frequencies up to 1GHz

6.1 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

6.2 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

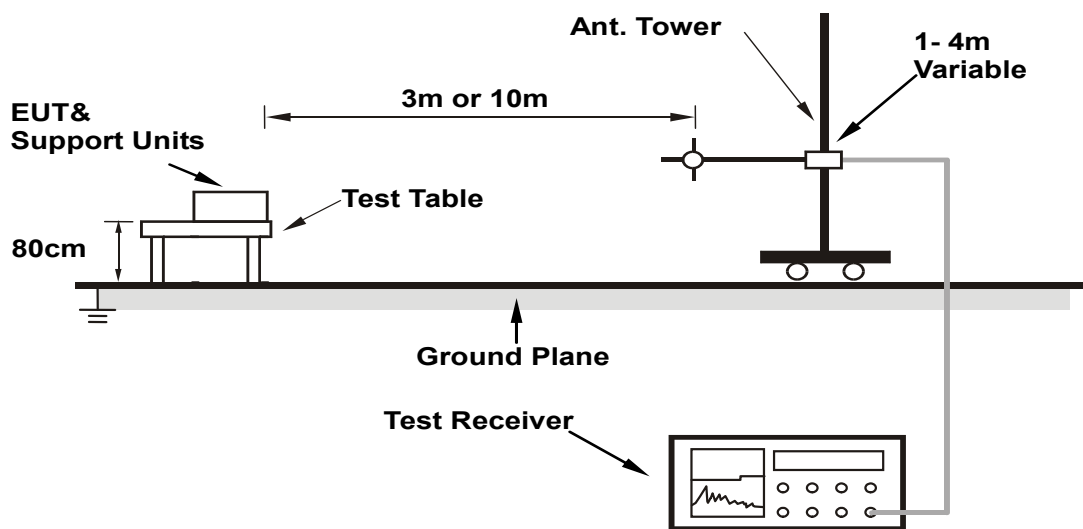
- Note:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in Open Site No. 4.
 3. The VCCI Site Registration No. R-11038.
 4. Tested Date: Jun. 18, 2019

6.3 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.

6.4 Test Results

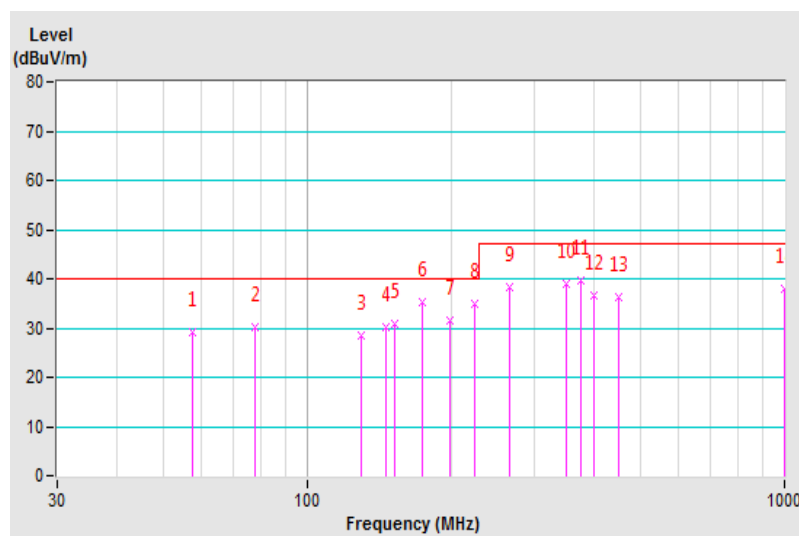
Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Input Power (System)	230Vac, 50Hz	Environmental Conditions	30°C, 61%RH, 1000mbar
Tested by	Adam Chen		
Test Mode	With System		

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
6	174.91	35.14 QP	40.00	-4.86	4.00 H	142	50.60	-15.46
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

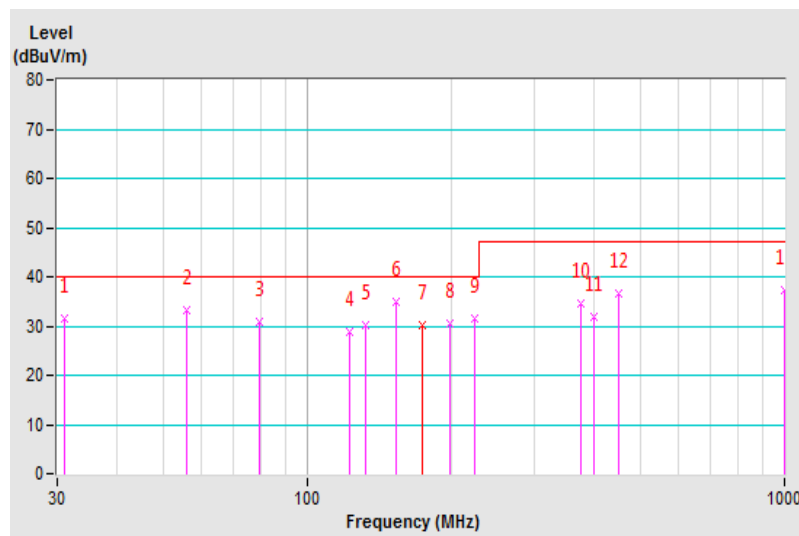


Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Input Power (System)	230Vac, 50Hz	Environmental Conditions	30°C, 61%RH, 1000mbar
Tested by	Adam Chen		
Test Mode	With System		

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



7 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
4.2.4	EN/IEC 61000-4-8 PFMF	1.1	Enclosure port: 50 or 60 Hz, 1A/m	A

7.1 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.

8 Electrostatic Discharge Immunity Test (ESD)

8.1 Test Specification

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

8.2 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. 22, 2019

8.3 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.

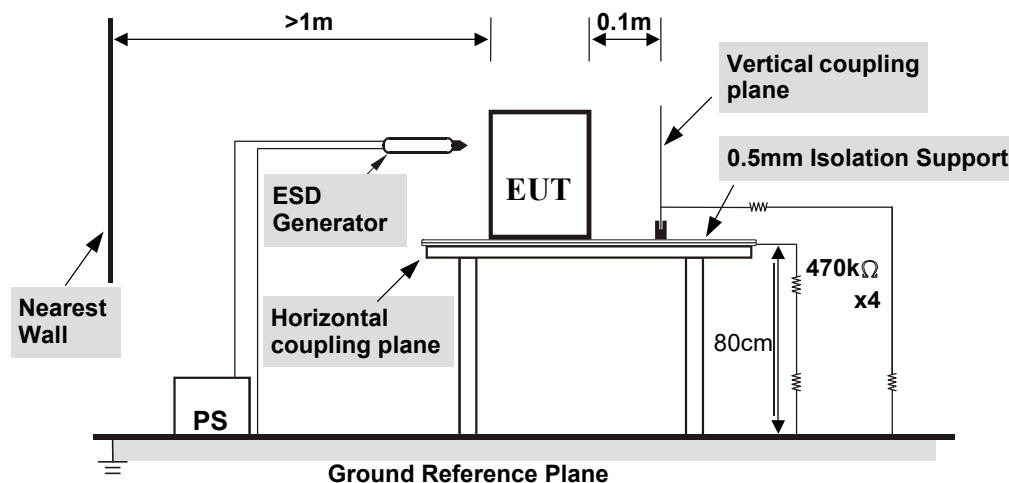


TABLE-TOP EQUIPMENT

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.

8.4 Test Results

Input Power (System)	230 Vac, 50 Hz	Tested by	Todd Chang
Environmental Conditions	25 °C, 39% RH 1001 mbar	Test mode	With System

Test Results of Direct Application

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

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

Test Results of Indirect Application

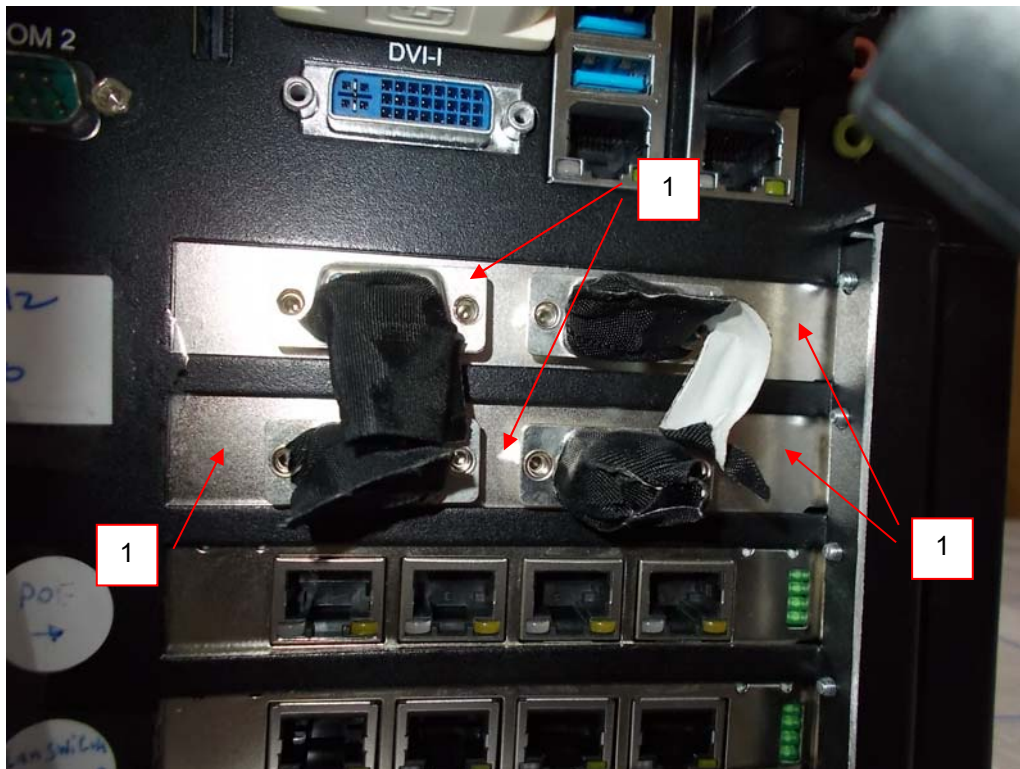
Discharge Level (kV)	Polarity (+/-)	Test Point	Horizontal Coupling Plane	Vertical Coupling Plane	Performance Criterion
2, 4	+/-	Four Sides	Note	Note	A

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



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

9.1 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

9.2 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

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

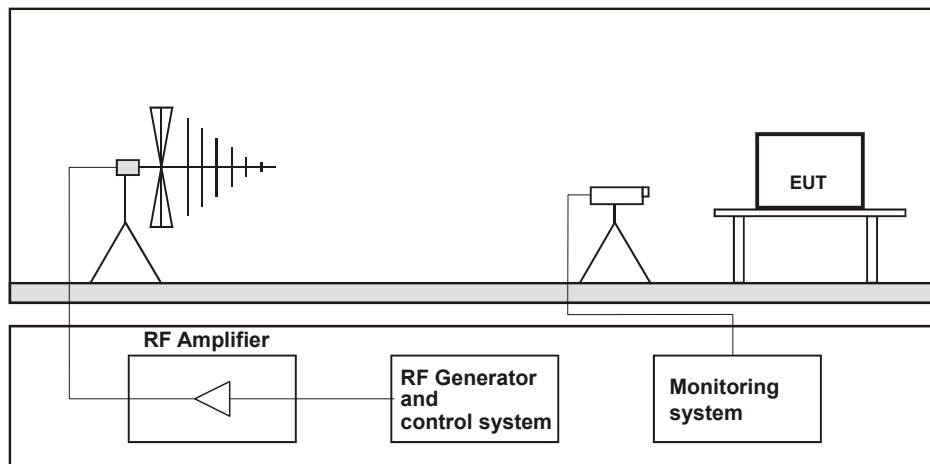


Table-top Equipment

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.

9.4 Test Results

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

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.

10 Power Frequency Magnetic Field Immunity Test

10.1 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

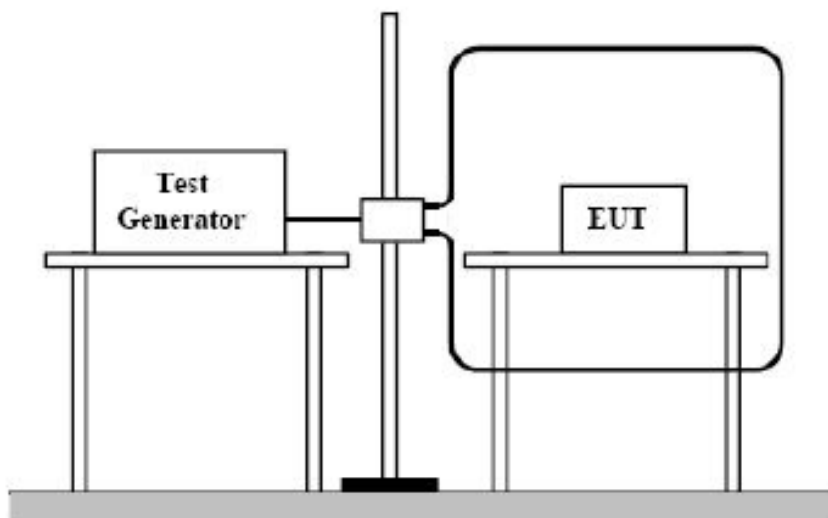
10.2 Test Instruments

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

10.3 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.

10.4 Test Results

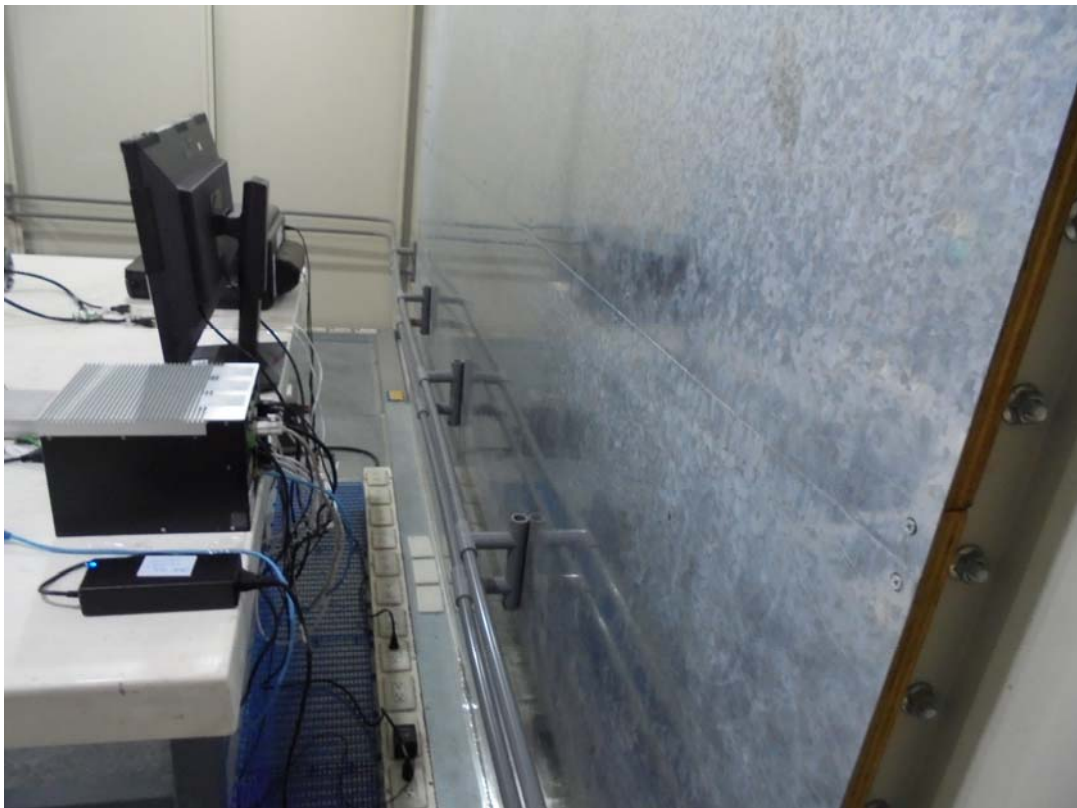
Input Power (System)	230 Vac, 50 Hz	Tested by	Xun Lee
Environmental Conditions	25 °C, 70% RH	Test mode	With System

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.

11 Pictures of Test Arrangements

11.1 Conducted Emission from the AC Mains Power Port



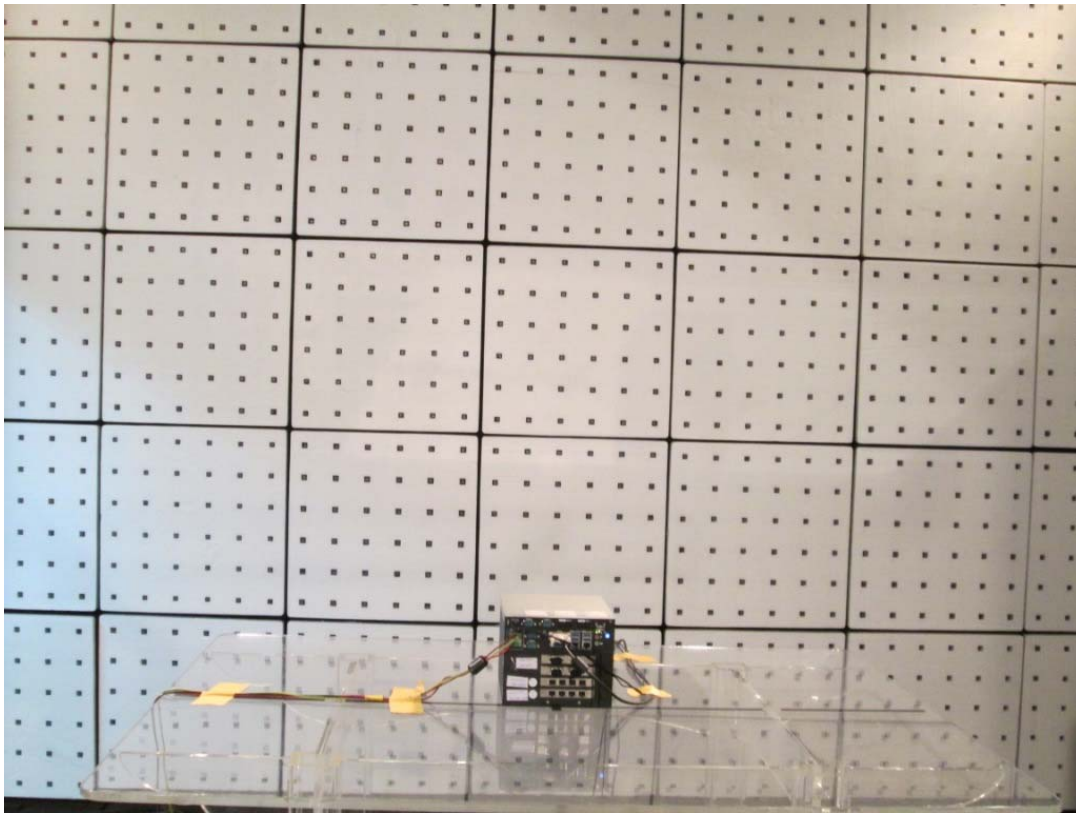
11.2 Radiated Emission at Frequencies up to 1GHz



11.3 Electrostatic Discharge Immunity Test (ESD)



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



11.5 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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