FCC Test Report

Report No.:	FV190815D12
Test Model:	SPC-4600
Series Model:	SPC-4 XXXXXXXXXXXXX (“X” can be 0-9, A-Z or blank for marketing purpose)
Received Date:	Aug. 15, 2019
Test Date:	Aug. 22 to 29, 2019
Issued Date:	Oct. 7, 2019
Applicant:	Vecow Co., Ltd.
Address:	3F., No.10, Jiankang Rd., Zhonghe Dist., New Taipei City 23586, Taiwan
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
FCC Registration/ Designation Number:	418586 / TW1078

Testing Laboratory 2021

ACCREDITED Certificate #4327.01

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Release Control Record

Issue No.	Description	Date Issued
FV190815D12	Original release.	Oct. 7, 2019

1 Certificate of Conformity

Product:	SPC-4600 series
Brand:	Vecow
Test Model:	SPC-4600
Series Model:	SPC-4 XXXXXXXXXXXXX (“X” can be 0-9, A-Z or blank for marketing purpose)
Sample Status:	Engineering sample
Applicant:	Vecow Co., Ltd.
Test Date:	Aug. 22 to 29, 2019
Standards:	47 CFR FCC Part 15, Subpart B, Class A ICES-003: 2016 Issue 6, updated Apr. 2019 Class A ANSI C63.4:2014

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:** Oct. 7, 2019

Vivian Chen / Specialist

Approved by : _____ , **Date:** Oct. 7, 2019

Jim Hsiang / Associate Technical Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart B / ICES-003: 2016 Issue 6, updated Apr. 2019 Class A ANSI C63.4:2014				
FCC Clause	ICES-003 Clause	Test Item	Result/Remarks	Verdict
15.107	6.1	AC Power Line Conducted Emissions	Minimum passing Class A margin is -7.88 dB at 9.10938 MHz	Pass
15.109	6.2.1	Radiated Emissions up to 1 GHz	Minimum passing Class A margin is -3.47 dB at 924.86 MHz	Pass
	6.2.2	Radiated Emissions above 1 GHz	Minimum passing Class A margin is -11.77 dB at 1386.03 MHz	Pass

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.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.79 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	4.02 dB
Radiated Emissions above 1 GHz	Above 1GHz	5.18 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 Description of EUT

Product	SPC-4600 series
Brand	Vecow
Test Model	SPC-4600
Series Model	SPC-4 XXXXXXXXXXXX (“X” can be 0-9, A-Z or blank for marketing purpose)
Model Difference	Marketing Differentiation
Sample Status	Engineering sample
Operating Software	Windows 10
Power Supply Rating	DC 9V to 36V from adapter
Accessory Device	Adapter
Data Cable Supplied	N/A

Note:

1. The EUT is a SPC-4600 series with following interfaces:

- ✧ COM *4 (RS-232/422/485)
- ✧ USB 3.0*4
- ✧ Isolated DIO
- ✧ Display (resolution up to 4096 x 2160 @ 60Hz)
- ✧ DVI-I (resolution up to 3840 x 2160 @ 60Hz)
- ✧ PoE LAN*2 (10/100Mbps)
- ✧ Audio out
- ✧ IGN
- ✧ DC input

2. The EUT uses following adapter.

Brand	MEAN WELL
Model	GST160A24
Input Power	100-240Vac, 50/60Hz, 2.0A
Output Power	24V, 6.67A, 160W
Power Line	Non-shielded DC (1.2m) with one ferrite core

3.2 Features of EUT

1. 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.

2. The EUT was configured with the following key components:

Processor	Intel Atom® x7-E3950 Processor (Apollo Lake-I)
BIOS	AMI
SIO	IT8786E
Memory	1 DDR3L 1866MHz SO-DIMM, up to 8GB
OS	Windows 10, Linux

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

1. The EUT is designed with AC power of rating 100-240Vac, 50/60Hz.
   For radiated emission evaluation, 230Vac/ 50Hz (EN 50121-3-2), 120Vac/ 60Hz (for FCC Part 15) had been covered during the pre-test. The worst data was found at **120Vac/ 60Hz** and recorded in the applied test report.
2. Test modes are presented in the report as below.

Mode	Test Condition	Input Power
Conducted emission & Radiated emission tests		
1	Full system, Display (3480 x 2160 @ 60Hz) <Note>+ DVI (1920 x 1200 @ 60Hz)<Note>	120Vac/ 60Hz

Note: The general maximum resolution of the external display monitor is 1920x 1200 @ 60Hz. (for DVI) and 3480 x 2160 @ 60Hz (for Display).

3.4 Test Program Used and Operation Descriptions

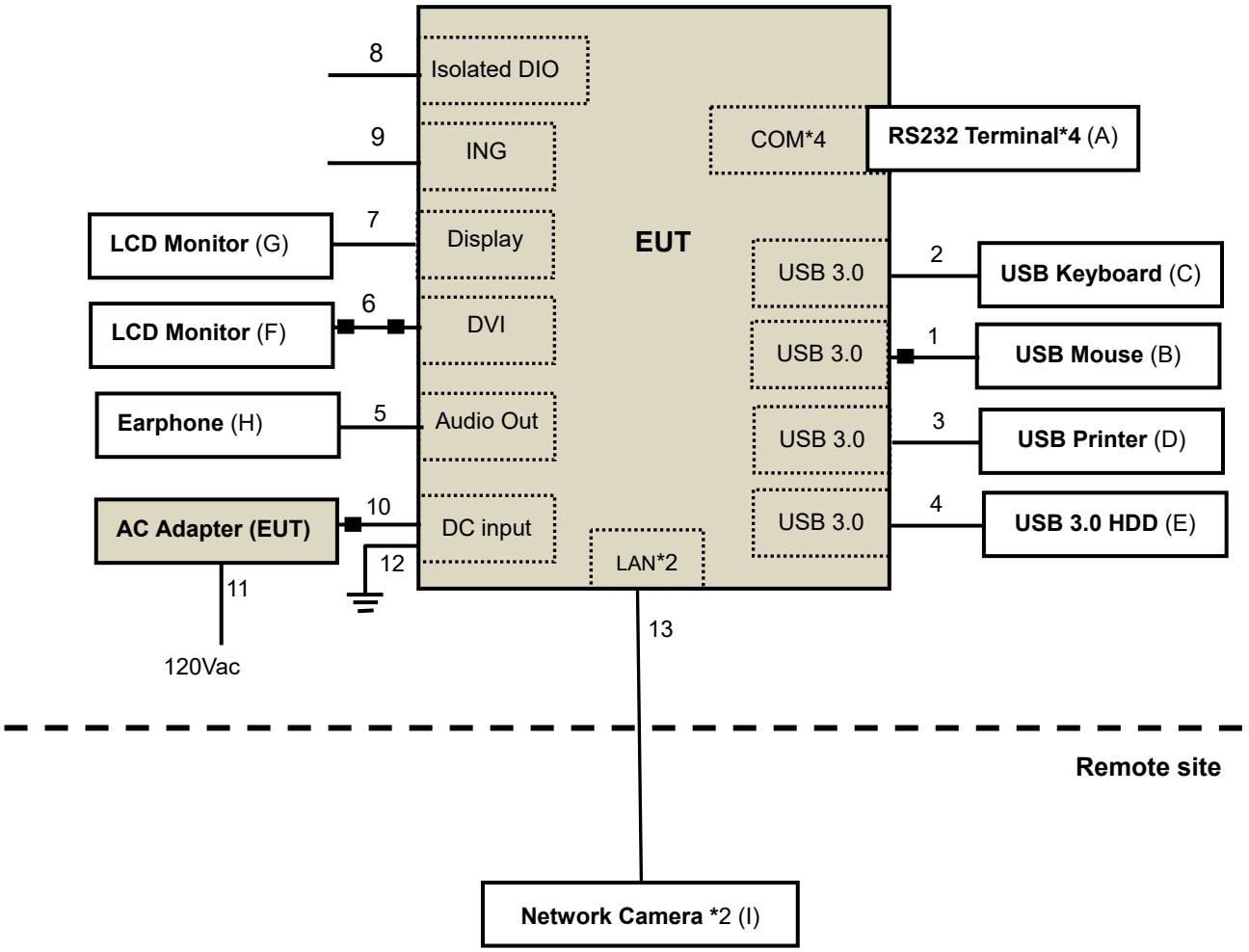
a. Turned on the power of all equipment.
b. EUT ran a test program to enable all functions.
c. EUT read and wrote messages from/to SSD and ext. HDD.
d. Network Cameras (kept in a remote area) captured messages to EUT via two STP LAN cables (each 10m).
e. EUT sent “H” messages to ext. LCD Monitors. Then they displayed “H” messages on their screens simultaneously.
f. EUT sent 1kHz audio signal to earphone.
g. EUT sent messages to printer and printer printed them out.
h. Steps c-g 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 1600MHz, 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



4.2 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	RS232 Terminal*4	N/A	N/A	N/A	N/A	Supplied by client
B.	USB Mouse	Microsoft	1113	9170528318308	FCC DoC Approved	Provided by Lab
C.	USB KEYBOARD	Dell	KB216t	CN-0W33XP-LO300-7CL-190A	FCC DoC Approved	Provided by Lab
D.	Printer	HP	Officejet pro 251dw	CN55FCV012	B94SDGOB1191	Provided by Lab
E.	USB-C Hard Disk	G-DRIVE	0G04878	620XJ6RW	FCC DoC Approved	Provided by Lab
F.	24" LCD MONITOR	DELL	U2410	CN082WXD728720CC0UHL	FCC DoC Approved	Provided by Lab
G.	LCD Monitor	ASUS	MG28UQ	H8LMTF147978	FCC DoC Approved	Provided by Lab
H.	EARPHONE	PHILIPS	SBC HL145	N/A	N/A	Provided by Lab
I.	Network Camera*2	3MP	A301RZ-0309P	T42211286/278	N/A	Supplied by client

Note:

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

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB cable	1	1.8	Y	1	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.	USB cable	1	0.5	Y	0	Provided by Lab
5.	Audio cable	1	1.2	N	0	Provided by Lab
6.	DVI cable	1	1.8	Y	2	Provided by Lab
7.	Display cable	1	1.8	Y	0	Provided by Lab
8.	DIO cable	1	0.9	N	0	Supplied by client
9.	Signal cable	1	1.8	N	0	Supplied by client
10.	DC power power	1	1.2	N	1	Supplied by client
11.	AC power cord	1	1.8	N	0	Provided by Lab
12.	GND cable	1	2.0	N	0	Supplied by client
13.	LAN cable	2	10	Y	0	Provided by Lab (RJ45, Cat.5e)

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

5 Conducted Emissions at Mains Ports

5.1 Limits

Frequency (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56	56 - 46
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

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

5.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCS 30	100290	Dec. 18, 2018	Dec. 17, 2019
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ENV216	101197	Jun. 5, 2019	Jun. 4, 2020
LISN With Adapter (for EUT)	101197	NA	Jun. 5, 2019	Jun. 4, 2020
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	100218	Nov. 30, 2018	Nov. 29, 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-C10.01	Feb. 13, 2019	Feb. 12, 2020
LYNICS Terminator (For ROHDE & SCHWARZ LISN)	0900510	E1-011484	May 13, 2019	May 12, 2020
ROHDE & SCHWARZ Artificial Mains Network (For TV EUT)	ENV216	101196	Apr. 16, 2019	Apr. 15, 2020
LISN With Adapter (for TV EUT)	101196	NA	Apr. 16, 2019	Apr. 15, 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. 10.
3. The VCCI Site Registration No. C-11852.
4. Tested Date: Aug. 22, 2019

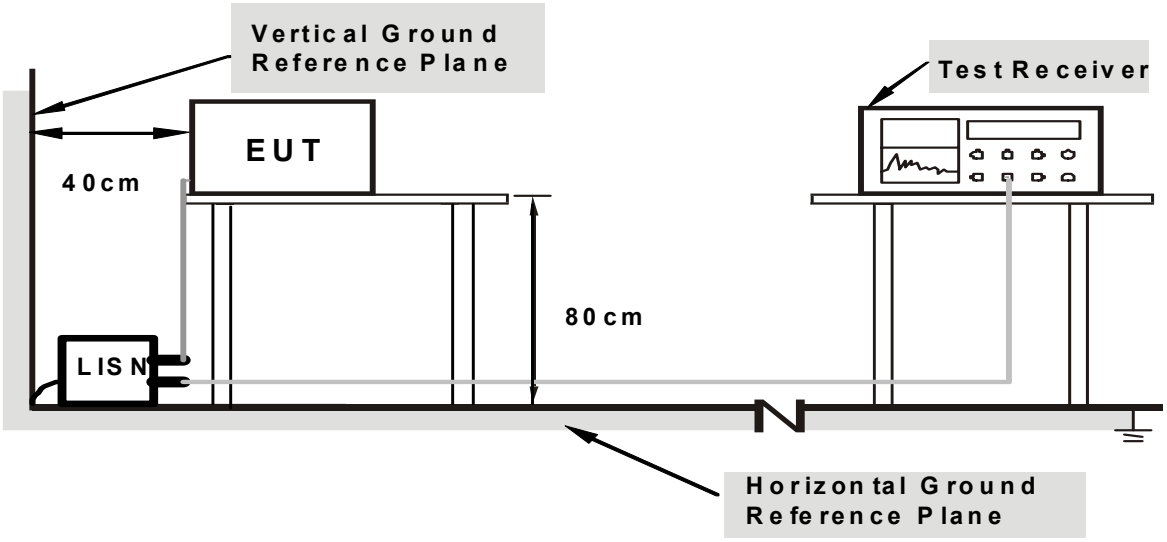
5.3 Test Arrangement

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c. 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 LISN.

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

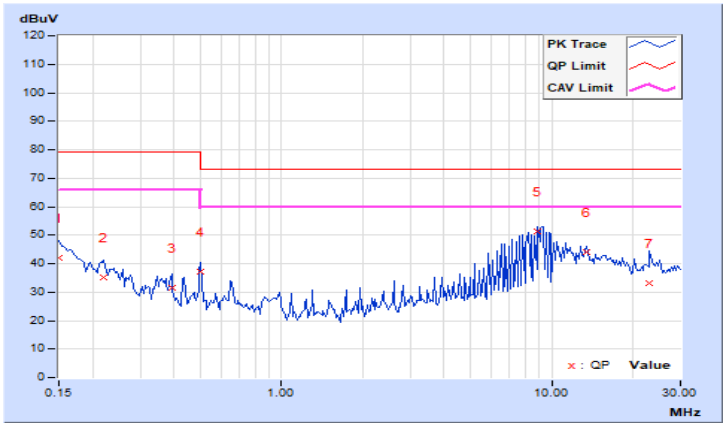
5.4 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25℃, 75%RH
Tested by	Vincent Lin		
Test Mode	Mode 1		

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.63	32.49	24.02	42.12	33.65	79.00	66.00	-36.88	-32.35
2	0.22031	9.65	25.64	23.48	35.29	33.13	79.00	66.00	-43.71	-32.87
3	0.39219	9.67	21.76	21.28	31.43	30.95	79.00	66.00	-47.57	-35.05
4	0.50156	9.68	27.65	26.99	37.33	36.67	73.00	60.00	-35.67	-23.33
5	8.89063	9.91	41.25	40.73	51.16	50.64	73.00	60.00	-21.84	-9.36
6	13.40625	9.96	34.18	33.35	44.14	43.31	73.00	60.00	-28.86	-16.69
7	23.08984	10.07	23.20	15.53	33.27	25.60	73.00	60.00	-39.73	-34.40

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

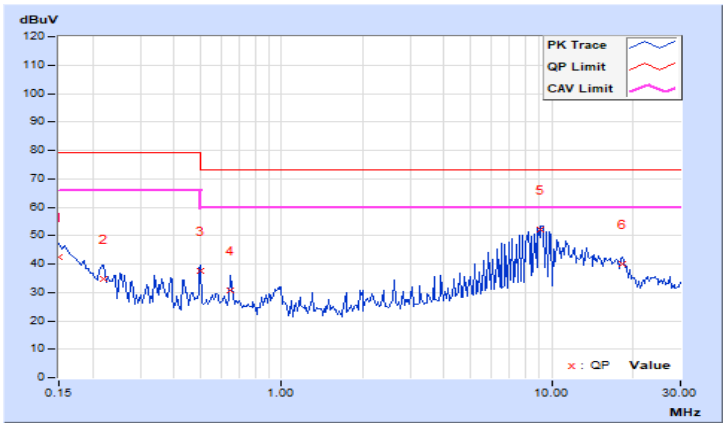


Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	**Environmental Conditions**	25℃, 75%RH
Tested by	Vincent Lin		
Test Mode	Mode 1		

Phase Of Power : Neutral (N)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.15000	9.66	32.66	25.44	42.32	35.10	79.00	66.00	-36.68	-30.90
2	0.22031	9.67	25.25	22.75	34.92	32.42	79.00	66.00	-44.08	-33.58
3	0.50156	9.71	27.88	27.13	37.59	36.84	73.00	60.00	-35.41	-23.16
4	0.65000	9.73	20.88	20.15	30.61	29.88	73.00	60.00	-42.39	-30.12
5	**9.10938**	**9.95**	**42.32**	**42.17**	**52.27**	**52.12**	**73.00**	**60.00**	**-20.73**	**-7.88**
6	18.22266	10.06	29.80	28.02	39.86	38.08	73.00	60.00	-33.14	-21.92

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 Emissions up to 1 GHz

6.1 Limits

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

Radiated Emissions Limits at 10 meters (dBμV/m)				
Frequencies (MHz)	FCC 15B / ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
30-88	39	29.5	40	30
88-216	43.5	33.1		
216-230	46.4	35.6		
230-960			47	37
960-1000	49.5	43.5		

Radiated Emissions Limits at 3 meters (dBμV/m)				
Frequencies (MHz)	FCC 15B / ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
30-88	49.5	40	50.5	40.5
88-216	54	43.5		
216-230	56.9	46		
230-960			57.5	47.5
960-1000	60	54		

Notes: 1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. QP detector shall be applied if not specified.

6.2 Test Instruments

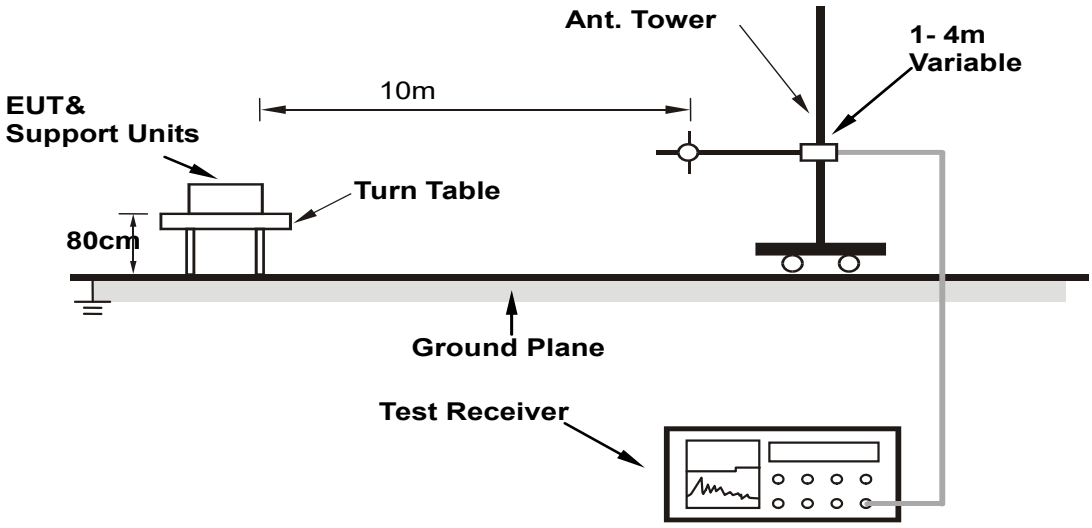
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCS 30	100027	May 13, 2019	May 12, 2020
Schwarzbeck Bilog Antenna	VULB9168	9168-303	Nov. 22, 2018	Nov. 21, 2019
Agilent Preamplifier	8447D	2944A08119	Feb. 20, 2019	Feb. 19, 2020
ADT. Turn Table	TT100	0205	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. 25, 2018	Oct. 24, 2019
Pacific RF cable With 5dB PAD	8D	CABLE-ST2-01	Oct. 25, 2018	Oct. 24, 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 Open Site No. 2.
3. The VCCI Site Registration No. R-237.
4. Tested Date: Aug. 28, 2019

6.3 Test Arrangement

a. 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.
b. The EUT was set 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. 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.
d. 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.
e. 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.



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

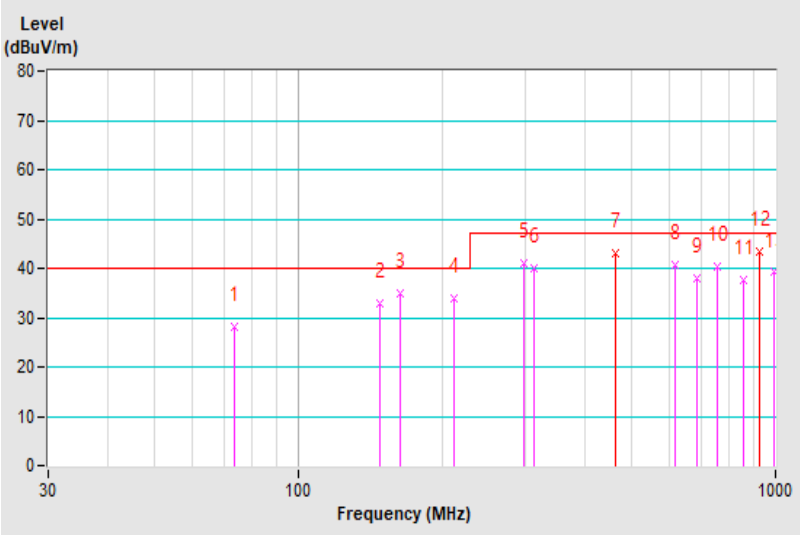
6.4 Test Results

Frequency Range	30MHz ~ 1GHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP), 120kHz
Tested by	Vhenson Huang	Environmental Conditions	30℃, 55%RH
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	73.79	28.22 QP	40.00	-11.78	4.00 H	180	41.98	-13.76
2	148.62	32.93 QP	40.00	-7.07	4.00 H	111	43.12	-10.19
3	163.66	34.75 QP	40.00	-5.25	4.00 H	114	44.90	-10.15
4	212.75	34.02 QP	40.00	-5.98	4.00 H	198	46.48	-12.46
5	296.46	40.91 QP	47.00	-6.09	3.07 H	111	50.09	-9.18
6	312.01	40.03 QP	47.00	-6.97	2.72 H	297	48.69	-8.66
7	462.44	43.05 QP	47.00	-3.95	2.26 H	316	48.77	-5.72
8	616.59	40.58 QP	47.00	-6.42	1.83 H	319	42.62	-2.04
9	685.07	38.09 QP	47.00	-8.91	1.50 H	38	38.97	-0.88
10	752.93	40.40 QP	47.00	-6.60	1.50 H	7	39.50	0.90
11	856.75	37.64 QP	47.00	-9.36	1.00 H	263	34.95	2.69
12	**924.86**	**43.53 QP**	**47.00**	**-3.47**	**1.00 H**	**130**	**39.17**	**4.36**
13	993.33	39.15 QP	47.00	-7.85	1.00 H	144	33.99	5.16

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

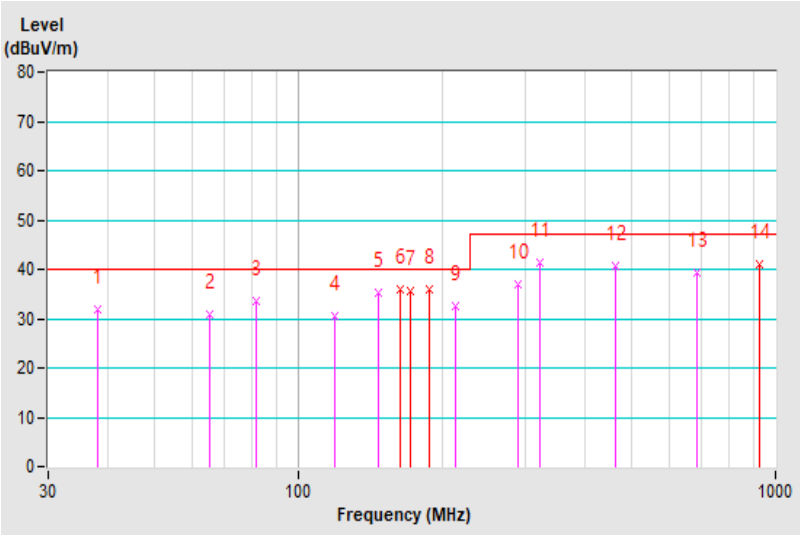


Frequency Range	30MHz ~ 1GHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP), 120kHz
Tested by	Vhenson Huang	Environmental Conditions	30℃, 55%RH
Test Mode	Mode 1		

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	38.01	31.74 QP	40.00	-8.26	1.70 V	132	42.77	-11.03
2	65.54	30.78 QP	40.00	-9.22	1.88 V	153	42.73	-11.95
3	81.85	33.72 QP	40.00	-6.28	1.00 V	72	49.23	-15.51
4	119.48	30.55 QP	40.00	-9.45	1.00 V	308	42.86	-12.31
5	147.37	35.18 QP	40.00	-4.82	1.00 V	139	45.40	-10.22
6	163.75	35.97 QP	40.00	-4.03	1.00 V	12	46.12	-10.15
7	171.93	35.69 QP	40.00	-4.31	1.00 V	14	46.24	-10.55
8	188.34	35.79 QP	40.00	-4.21	1.00 V	351	48.22	-12.43
9	213.09	32.54 QP	40.00	-7.46	1.00 V	98	45.00	-12.46
10	288.64	37.04 QP	47.00	-9.96	1.00 V	172	46.38	-9.34
11	321.50	41.45 QP	47.00	-5.55	1.00 V	53	49.84	-8.39
12	462.41	40.80 QP	47.00	-6.20	2.69 V	168	46.52	-5.72
13	685.06	39.30 QP	47.00	-7.70	2.61 V	149	40.18	-0.88
14	924.86	41.05 QP	47.00	-5.95	2.57 V	104	36.69	4.36

Remarks:

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



7 Radiated Emissions above 1 GHz

7.1 Limits

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

Radiated Emissions Limits at 10 meters (dBμV/m)				
Frequencies (MHz)	FCC 15B / ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
1000-3000	Avg: 49.5 Peak: 69.5	Avg: 43.5 Peak: 63.5	Not defined	Not defined
Above 3000			Not defined	Not defined

Radiated Emissions Limits at 3 meters (dBμV/m)				
Frequencies (MHz)	FCC 15B / ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
1000-3000	Avg: 60 Peak: 80	Avg: 54 Peak: 74	Avg: 56 Peak: 76	Avg: 50 Peak: 70
Above 3000			Avg: 60 Peak: 80	Avg: 54 Peak: 74

Notes: 1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

Frequency Range (For unintentional radiators)

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5th harmonic of the highest frequency or 40GHz, whichever is lower

7.2 Test Instruments

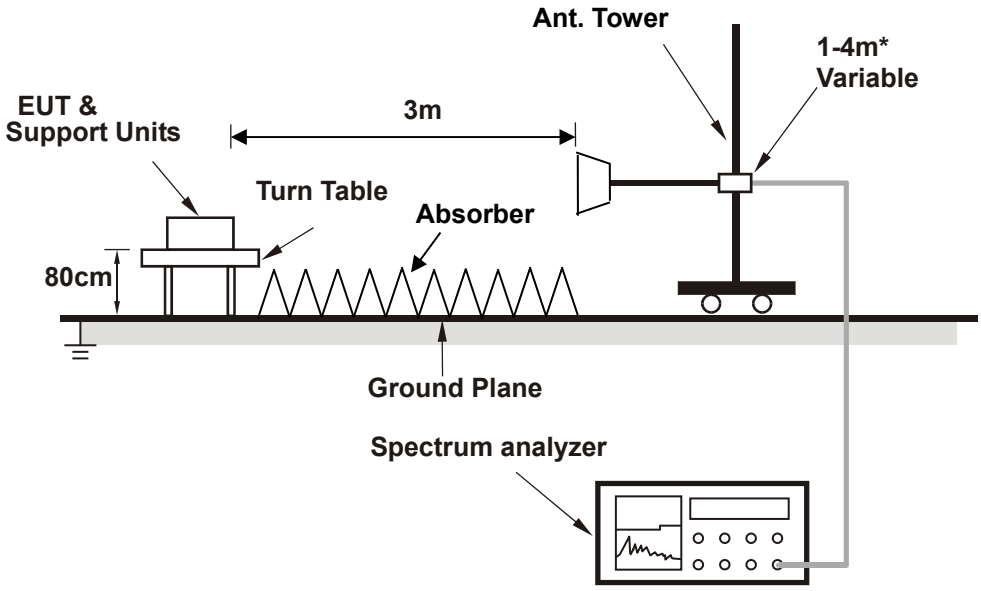
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Agilent Spectrum	E4446A	MY51100009	Jun. 6, 2019	Jun. 5, 2020
Agilent Test Receiver	N9038A	MY50010135	May 29, 2019	May 28, 2020
Agilent Preamplifier	8449B	3008A01924	Feb. 21, 2019	Feb. 20, 2020
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Feb. 21, 2019	Feb. 20, 2020
EMCI Preamplifier	EMC184045B	980235	Feb. 21, 2019	Feb. 20, 2020
ETS Preamplifier	3117-PA	00215857	Nov. 25, 2018	Nov. 24, 2019
Schwarzbeck Horn Antenna	BBHA-9170	212	Nov. 25, 2018	Nov. 24, 2019
EMCO Horn Antenna	3115	9312-4192	Nov. 25, 2018	Nov. 24, 2019
Max Full. Turn Table & Tower	MF7802	MF780208103	NA	NA
Software	Radiated_V8.7.08	NA	NA	NA
SUHNER RF cable With 3/4dB PAD	SF102	Cable-CH7-3.6m	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 test was performed in Chamber No. 7.
3. The VCCI Site Registration No. G-10039
4. Tested Date: Aug. 29, 2019

7.3 Test Arrangement

a. 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.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. 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.
d. 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.
e. 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.



* :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.

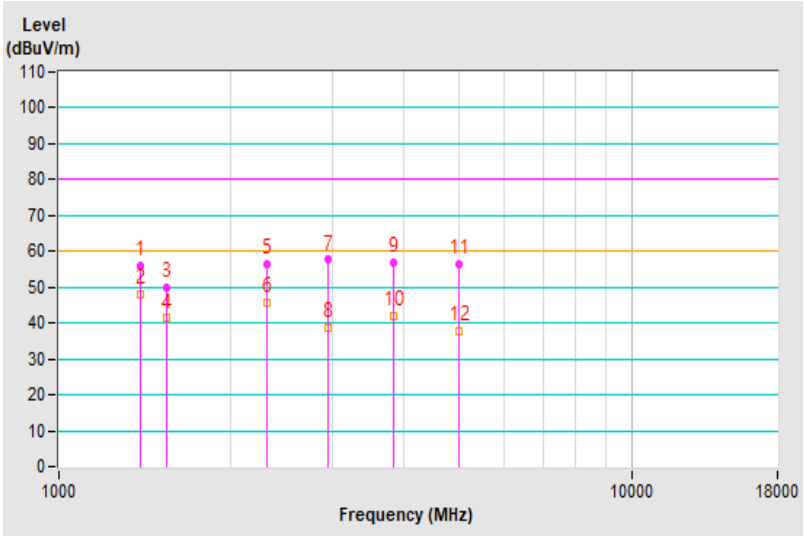
7.4 Test Results

Frequency Range	1GHz ~ 8GHz	Detector Function & Resolution Bandwidth	Peak (PK) / Average (AV), 1MHz
Tested by	Chin-Wen Wang	Environmental Conditions	22℃, 68%RH
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	1386.03	56.12 PK	80.00	-23.88	1.87 H	133	58.99	-2.87
2	**1386.03**	**48.23 AV**	**60.00**	**-11.77**	**1.87 H**	**133**	**51.10**	**-2.87**
3	1539.94	49.96 PK	80.00	-30.04	1.29 H	360	52.25	-2.29
4	1539.94	41.34 AV	60.00	-18.66	1.29 H	360	43.63	-2.29
5	2309.93	56.36 PK	80.00	-23.64	1.32 H	148	55.04	1.32
6	2309.93	45.73 AV	60.00	-14.27	1.32 H	148	44.41	1.32
7	2957.88	57.62 PK	80.00	-22.38	1.41 H	133	54.21	3.41
8	2957.88	38.76 AV	60.00	-21.24	1.41 H	133	35.35	3.41
9	3849.76	56.81 PK	80.00	-23.19	1.73 H	63	52.08	4.73
10	3849.76	42.09 AV	60.00	-17.91	1.73 H	63	37.36	4.73
11	4995.24	56.59 PK	80.00	-23.41	1.94 H	284	49.65	6.94
12	4995.24	37.79 AV	60.00	-22.21	1.94 H	284	30.85	6.94

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

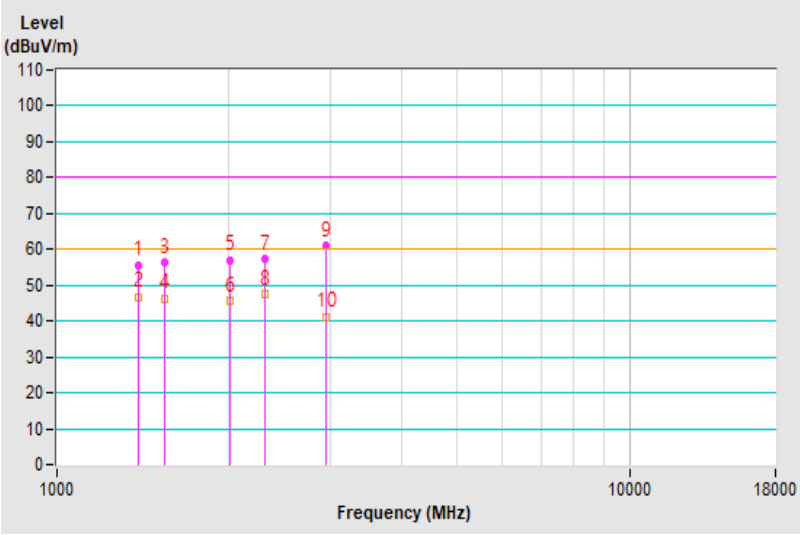


Frequency Range	1GHz ~ 8GHz	Detector Function & Resolution Bandwidth	Peak (PK) / Average (AV), 1MHz
Tested by	Chin-Wen Wang	Environmental Conditions	22℃, 68%RH
Test Mode	Mode 1		

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	1386.03	55.54 PK	80.00	-24.46	1.87 V	132	58.41	-2.87
2	1386.03	46.61 AV	60.00	-13.39	1.87 V	132	49.48	-2.87
3	1539.90	56.21 PK	80.00	-23.79	2.29 V	104	58.50	-2.29
4	1539.90	46.32 AV	60.00	-13.68	2.29 V	104	48.61	-2.29
5	2001.94	56.83 PK	80.00	-23.17	1.90 V	166	55.93	0.90
6	2001.94	45.55 AV	60.00	-14.45	1.90 V	166	44.65	0.90
7	2309.88	57.21 PK	80.00	-22.79	1.32 V	147	55.89	1.32
8	2309.88	47.32 AV	60.00	-12.68	1.32 V	147	46.00	1.32
9	2944.70	60.84 PK	80.00	-19.16	1.33 V	166	57.51	3.33
10	2944.70	41.19 AV	60.00	-18.81	1.33 V	166	37.86	3.33

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

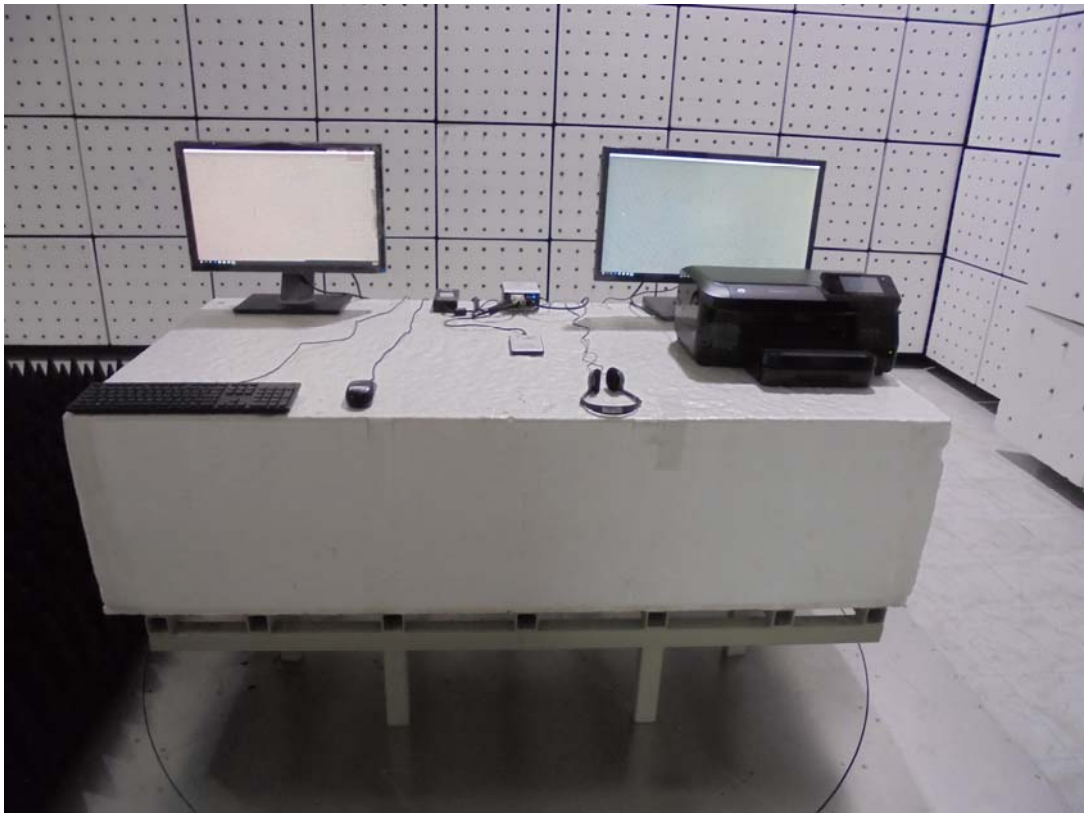


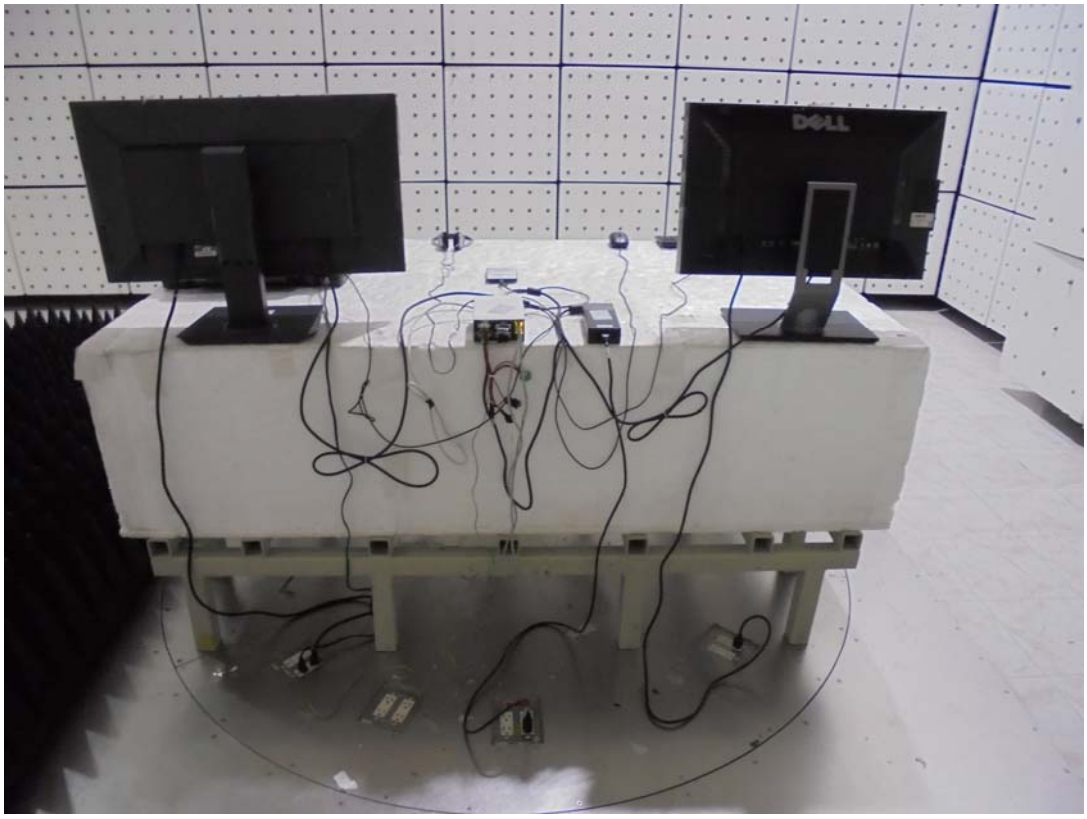
8 Pictures of Test Arrangements

8.1 Conducted Emissions at Mains Ports

8.2 Radiated Emissions up to 1 GHz

8.3 Radiated Emissions above 1 GHz





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 FCC recognized accredited test firms and accredited 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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