



FCC Verification Test Report

Report No.: FV150723C22

Test Model: IVH-7700-QRD

Series Model: Vecow IVH Series, IVH-7700-QRDM, IVH-XXXXXXXXXXXXXXXXXXXXX
("X" can be 0-9, A-Z or blank for marketing purpose)

Received Date: Jul. 23, 2015

Test Date: Aug. 04 ~ Aug. 07, 2015

Issued Date: Aug. 10, 2015

Applicant: Vecow Co.,Ltd.

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LAB CODE: 200837-0



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A D T

Release Control Record

Issue No.	Description	Date Issued
FV150723C22	Original release.	Aug. 10, 2015



1 Certificate of Conformity

Product: High Performance Fanless In-Vehicle System

Brand: Vecow

Test Model: IVH-7700-QRD

Series Model: Vecow IVH Series, IVH-7700-QRDM, IVH-XXXXXXXXXXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)

Sample Status: Engineering sample

Applicant: Vecow Co.,Ltd.

Test Date: Aug. 04 ~ Aug. 07, 2015

Standards: 47 CFR FCC Part 15, Subpart B, Class A
ICES-003:2012 Issue 5, Class A
ANSI C63.4:2009

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 : Suntee Liu , Date: Aug. 10, 2015
Suntee Liu / Specialist

Approved by : Ken Liu , Date: Aug. 10, 2015
Ken Liu / Senior Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart B / ICES-003:2012 Issue 5, Class A

ANSI C63.4:2009

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 -8.99 dB at 0.15802 MHz	Pass
15.109	6.2.1	Radiated Emissions up to 1 GHz	Minimum passing Class A margin is -4.42 dB at 85.83 MHz	Pass
	6.2.2	Radiated Emissions above 1 GHz	Minimum passing Class A margin is -20.75 dB at 2999.96 MHz	Pass

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

2.1 Measurement Uncertainty

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

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Frequency	Expanded Uncertainty (k=2) (\pm)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.44 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	4.70 dB
Radiated Emissions above 1 GHz	Above 1GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 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.

3.2 General Description of EUT

Product	High Performance Fanless In-Vehicle System
Brand	Vecow
Test Model	IVH-7700-QRD
Series Model	Vecow IVH Series, IVH-7700-QRDM, IVH-XXXXXXXXXXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)
Model Difference	Refer to Note
Sample Status	Engineering sample
Operating Software	Win 7
Power Supply Rating	24Vdc (adapter)
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. All models are listed as below. Model IVH-7700-QRD is the representative for final test.

Brand	Model	Difference
Vecow	Vecow IVH Series	All models are electrically identical, different model names are for marketing purpose.
	IVH-7700-QRD	
	IVH-7700-QRDM	
	IVH-XXXXXXXXXXXXXXXXXXXXX ("X" can be 0-9, A-Z or blank for marketing purpose)	

2. The EUT tested with following adapter (support unit).

Brand	MW
Model	GS160A24
Input Power	100-240Vac, 50/60Hz, 2.0A
Output Power	24Vdc, 6.67Am, 160W MAX.
Power Line	1.15m DC cable with 1 core attached on adapter

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

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

For radiated emission up to 1GHz evaluation, 230Vac/50Hz (for EN 55022) & 120Vac/60Hz (for FCC Part 15) had been covered during the pre-test. The worst data was recorded in the applied test report.

EUT has been pre-tested under following modes, and mode 6 was the worst case for final test.

Mode	Test Condition
1	LAN 1~2 1Gbps, LAN 3~6 with camera, DVI 1920*1200, DP 1920*1200, 230Vac/50Hz
2	LAN 1~2 1Gbps, LAN 3~6 with camera, DVI 1280*1024, DP 1280*1024, 230Vac/50Hz
3	LAN 1~2 1Gbps, LAN 3~6 with camera, DVI 800*600, DP 800*600, 230Vac/50Hz
4	LAN 1~2 100Mbps, LAN 3~6 with camera, DVI 1920*1200, DP 1920*1200, 230Vac/50Hz
5	LAN 1~2 10Mbps, LAN 3~6 with camera, DVI 1920*1200, DP 1920*1200, 230Vac/50Hz
6	LAN 1~2 1Gbps, LAN 3~6 with camera, DVI 1920*1200, DP 1920*1200, 120Vac/60Hz

Test modes are presented in the report as below.

Mode	Test Condition
Conducted emission test	
-	LAN 1~2 1Gbps, LAN 3~6 with camera, DVI 1920*1200, DP 1920*1200
Radiated emission test	
-	LAN 1~2 1Gbps, LAN 3~6 with camera, DVI 1920*1200, DP 1920*1200

3.4 Test Program Used and Operation Descriptions

- EUT sent "H" patterns to monitors and monitors displayed them.
- EUT sent "H" patterns to modems.
- EUT read and wrote date with HDDs.
- EUT sent audio signal to earphone.
- EUT sent data to notebooks and cameras through LAN by command PING.

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 3.3 GHz, provided by Vecow Co.,Ltd., for detailed internal source, please refer to the manufacturer's specifications.

3.6 Miscellaneous

Labelling Requirements for Part 15 Devices:

➤ Verification

The specific labelling requirements for a device subject to the Verification procedure are contained in Section 15.19(a). These labelling requirements are:

If the device is subject only to Verification, include a label bearing a unique identifier (Section 2.954) and one of three compliance statements specified in Section 15.19(a). If the labeling area for the device is so small, and/or it is not practical to place the compliance statement on the device, then the statement can be placed in the user manual or product packaging (Section 15.19(a)(5)). However, the device must still be labelled with the unique identifier (Verification). Generally, devices smaller than the palm of the hand are considered too small for the compliance statement.

➤ Certification

If the device is subject to Certification: (1) Section 2.925 contains information on identification of the equipment; (2) include a label bearing an FCC Identifier (FCC ID) (Section 2.926) and (3) include the appropriate compliance statement in Section 15.19(a). If the device is considered too small and therefore it is impractical (smaller than the palm of the hand) to display the compliance statement, then the statement may be placed in the user manual or product packaging. However, the device must still be labelled with the FCC ID. If the device is unquestionably too small for the FCC ID to be readable (smaller than 4-6 points), the FCC ID may be placed in the user manual. However, it must be determined that the device itself is too small – the label area allocated to the FCC ID may not be reduced because of over crowded identification of other product and regulatory information.

An electronic display of the FCC ID (see 9. Electronic Labelling below) may be used for Certification of Section 15.212 modular transmitters and software defined radios (Section 2.944).

➤ Declaration of Conformity (DoC):

The labelling requirements for a device subject to the DoC procedure are specified in Section 15.19(b). The label should include the FCC logo along with the Trade Name and Model Number, which satisfies the unique identifier requirement of Section 2.1074 if it represents the identical equipment tested for DoC compliance. For personal computers assembled from authorized components, the following additional text must also be included: “Assembled from tested components,” “Complete system not tested.” When the device is so small and/or when it is not practical to place the required additional text on the device, the text may be placed in the user manual or pamphlet supplied to the user. However, the FCC logo, Trade Name, and Model Number must still be displayed on the device (Section 15.19(b)(3)).



Part 15 Declaration of Conformity (DoC) Label Examples

Equipment certified as software defined radio may use a means that readily displays the FCC ID on an electronic display screen, instead of labelling the device (Section 2.925 (e)).

Further information may refer to FCC KDB:784748 D01 Labelling Part 15 &18 Guidelines

Labelling Requirements for ICES-003 Devices:

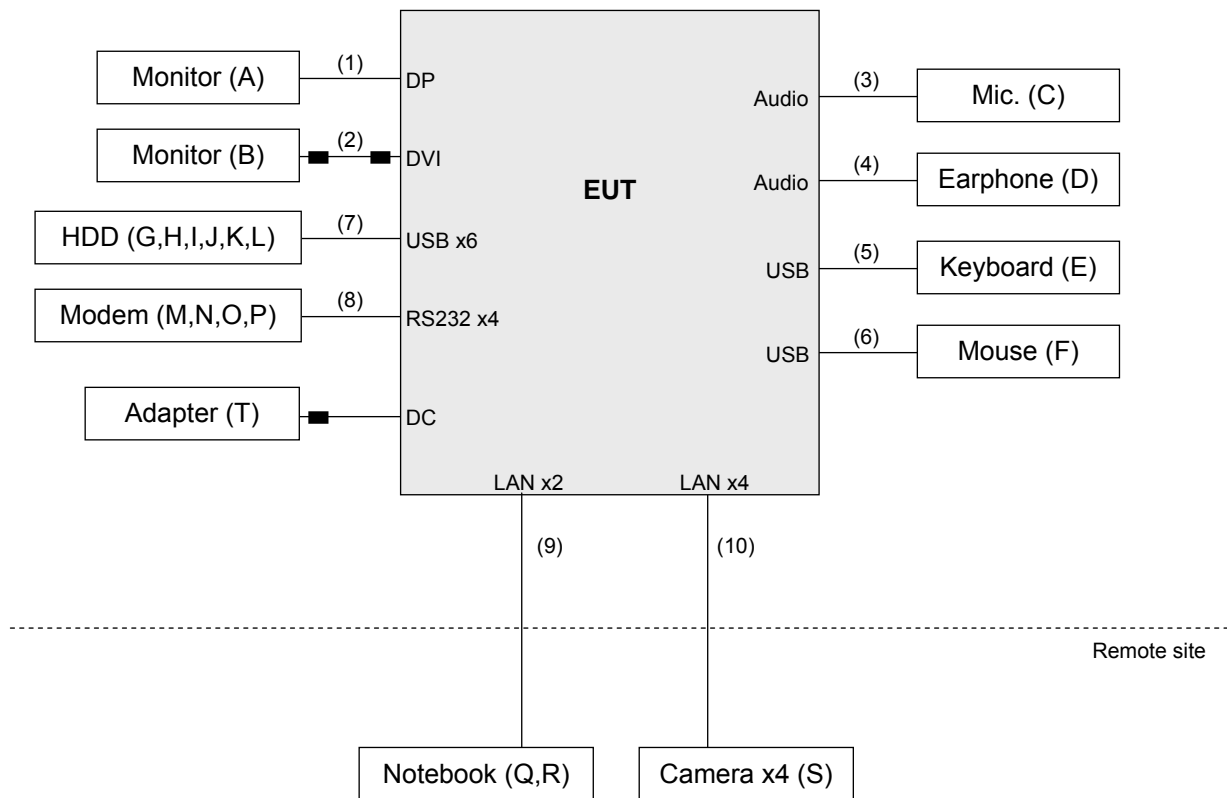
➤ Industry Canada ICES-003 Compliance Label:

CAN ICES-3 ()/NMB-3(*)*

* Insert either “A” or “B” but not both to identify the applicable Class of ITE.

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.	24" LCD MONITOR	DELL	U2410	CN-0J257M-72872-0A 6-02NL	FCC DoC Approved	-
B.	24" LCD MONITOR	DELL	U2410	CN-0J257M-72872-0A 6-08JL	FCC DoC Approved	-
C.	MICROPHONE	Labtec	LVA7313	NA	NA	-
D.	EARPHONE	PHILIPS	SBC HL150	NA	NA	-
E.	Keyboard	DELL	SK-8115	MY-0DJ325-71619-68 U-1757	FCC DoC Approved	-
F.	MOUSE	DELL	M056U0	349003901	FCC DoC Approved	-
G.	External Hard Disk	WD	WDBACY5000ABL	WX81E71WXC27	FCC DoC Approved	-
H.	External Hard Disk	WD	WDBACY5000ABL -01	WXS1CC1D3606	FCC DoC Approved	-
I.	External Hard Disk	WD	WDBACY5000ABL	WX81E71TTS16	FCC DoC Approved	-
J.	External Hard Disk	TOSHIBA	V63700-B	53E2CFNUTSX4	FCC DoC Approved	-
K.	External Hard Disk	TOSHIBA	V63700-B	43J4T0EFTTS9	FCC DoC Approved	-
L.	External Hard Disk	TOSHIBA	V63700-B	53ERP61GTSX4	FCC DoC Approved	-
M.	MODEM	ACEEX	1414V/3	0401008246	IFAXDM1414	-
N.	MODEM	ACEEX	1414V/3	0401008268	IFAXDM1414	-
O.	MODEM	ACEEX	1414V/3	0401008244	IFAXDM1414	-
P.	MODEM	ACEEX	1414V/3	0401008263	IFAXDM1414	-
Q.	Notebook	DELL	V3560D	HGZ5RX1	FCC DoC Approved	-
R.	Notebook	lenovo	20AYA00MTW	MP042EKY	FCC DoC Approved	-
S.	Camera x4	NA	NA	NA	NA	Provided by manufacturer
T.	Adapter	MW	GS160A24	NA	NA	Provided by manufacturer

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Display	1	1.8	Y	0	-
2.	DVI	1	1.8	Y	2	-
3.	Microphone	1	2.2	N	0	-
4.	Earphone	1	1.2	N	0	-
5.	USB	1	1.8	Y	0	-
6.	USB	1	1.8	Y	0	-
7.	USB	6	0.5	Y	0	-
8.	RS232	4	1.2	Y	0	-
9.	RJ45, Cat5e	2	10	N	0	-
10.	RJ45, Cat5e	4	10	N	0	-

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

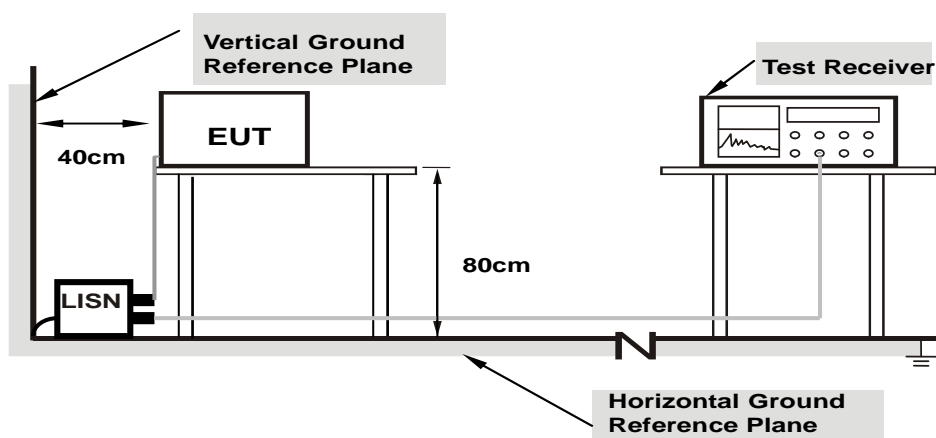
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Nov. 11, 2014	Nov. 10, 2015
RF signal cable Woken	5D-FB	Cable-HYC01-01	Dec. 26, 2014	Dec. 25, 2015
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Feb. 26, 2015	Feb. 25, 2016
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 24, 2015	Jul. 23, 2016
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in HwaYa Shielded Room 1.
 3. The VCCI Site Registration No. is C-2040.

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 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.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The test results of conducted emissions at mains ports are recorded of six worst margins for quasi-peak (mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.

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



Note: 1.Support units were connected to second LISN.

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

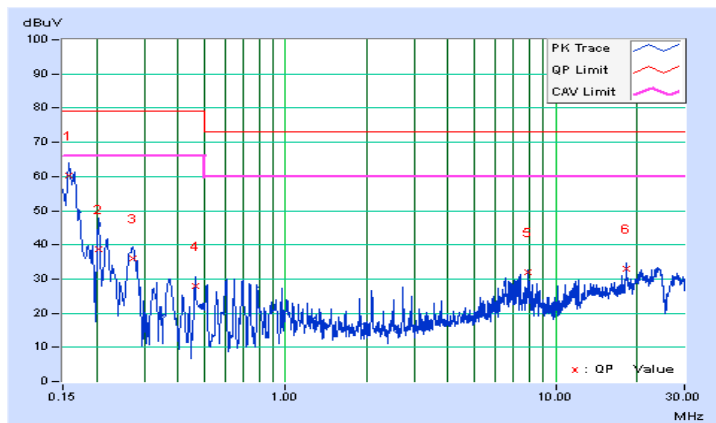
5.4 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120 Vac, 60 Hz (System)	Environmental Conditions	20°C, 60%RH
Tested by	Pon Tsai	Test Date	2015/8/4

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	0.15782	0.05	60.20	55.40	60.25	55.45	79.00	66.00	-18.75	-10.55
2	0.20474	0.06	38.61	17.59	38.67	17.65	79.00	66.00	-40.33	-48.35
3	0.27120	0.06	35.97	31.14	36.03	31.20	79.00	66.00	-42.97	-34.80
4	0.46280	0.06	27.93	20.87	27.99	20.93	79.00	66.00	-51.01	-45.07
5	7.92308	0.36	31.78	29.76	32.14	30.12	73.00	60.00	-40.86	-29.88
6	18.24157	0.82	32.12	28.43	32.94	29.25	73.00	60.00	-40.06	-30.75

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

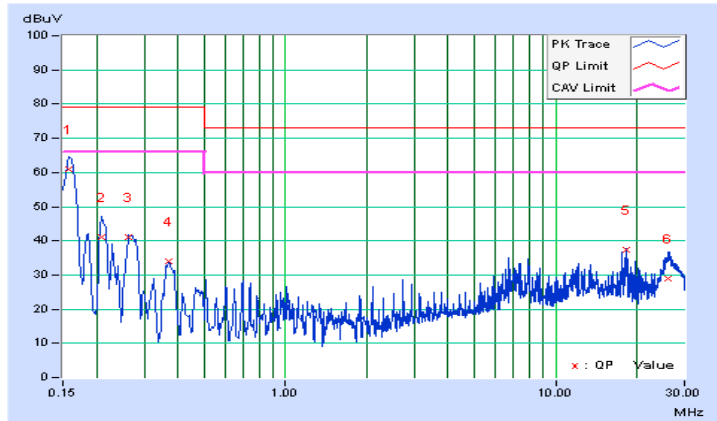


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120 Vac, 60 Hz (System)	Environmental Conditions	20°C, 60%RH
Tested by	Pon Tsai	Test Date	2015/8/4

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	0.15802	0.05	60.78	56.96	60.83	57.01	79.00	66.00	-18.17	-8.99
2	0.20893	0.05	41.07	24.41	41.12	24.46	79.00	66.00	-37.88	-41.54
3	0.26346	0.05	40.95	36.20	41.00	36.25	79.00	66.00	-38.00	-29.75
4	0.36913	0.06	33.79	28.25	33.85	28.31	79.00	66.00	-45.15	-37.69
5	18.30413	0.68	36.64	34.54	37.32	35.22	73.00	60.00	-35.68	-24.78
6	26.20624	0.82	27.97	21.57	28.79	22.39	73.00	60.00	-44.21	-37.61

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 (dB μ V/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 (dB μ V/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 (dB μ V/m) = 20 log Emission level (uV/m).
 3. QP detector shall be applied if not specified.

6.2 Test Instruments

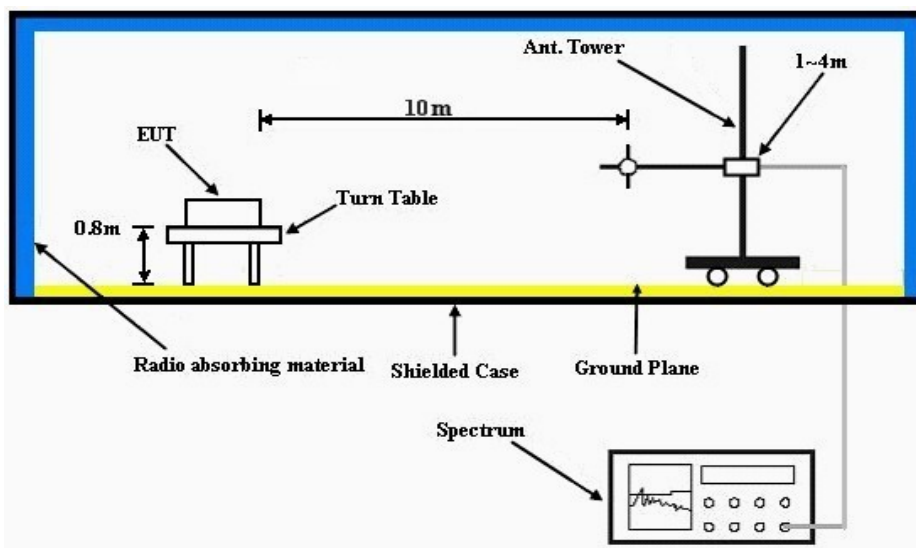
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ (V)	ESR	101240	Sep. 29, 2014	Sep. 28, 2015
Test Receiver ROHDE & SCHWARZ (H)	ESR	101264	Dec. 04, 2014	Dec. 03, 2015
BILOG Antenna SCHWARZBECK (V)	VULB9168	9168-149	Feb. 03, 2015	Feb. 02, 2016
BILOG Antenna SCHWARZBECK (H)	VULB9168	9168-154	Feb. 03, 2015	Feb. 02, 2016
Preamplifier Agilent (V)	8447D	2944A10636	Oct. 18, 2014	Oct. 17, 2015
Preamplifier Agilent (H)	8447D	2944A10637	Oct. 18, 2014	Oct. 17, 2015
Preamplifier Agilent	8449B	3008A01959	Oct. 17, 2015	Oct. 17, 2015
RF signal cable Woken (V)	8D-FB	Cable-CH(V)-01	Oct. 24, 2015	Oct. 24, 2015
RF signal cable Woken (H)	8D-FB	Cable-CH(H)-01	Oct. 24, 2015	Oct. 24, 2015
Software BV ADT	BV ADT_Radiated_ V 8.7.07	NA	NA	NA
Antenna Tower (V)	MFA-440	9707	NA	NA
Antenna Tower (H)	MFA-440	970705	NA	NA
Turn Table	DS430	50303	NA	NA
Controller (V)	MF7802	074	NA	NA
Controller (H)	MF7802	08093	NA	NA

- 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 HwaYa Chamber 1.
 3. The FCC Site Registration No. is 477732.
 4. The IC Site Registration No. is IC 7450F-1.
 5. The VCCI Site Registration No. is R-1893.

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 below 1 GHz.

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



6.4 Test Results

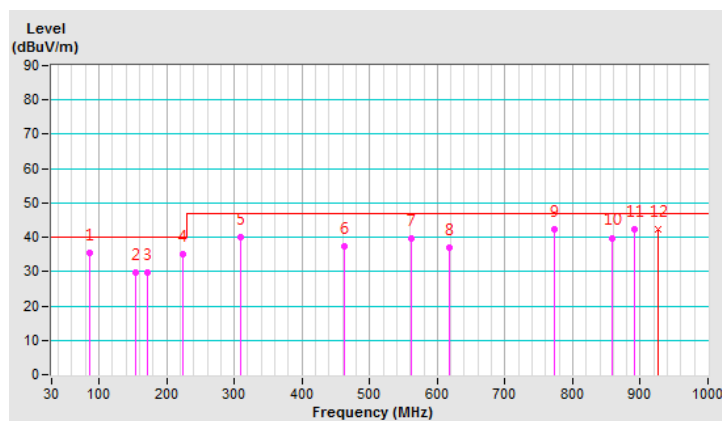
Frequency Range	30MHz ~ 1GHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP), 120kHz
Environmental Conditions	20°C, 61%RH	Tested by	Rolan Zheng
Test Date	2015/8/7		

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	85.83	35.58 QP	40.00	-4.42	4.00 H	199	55.01	-19.43
2	154.51	29.76 QP	40.00	-10.24	4.00 H	53	43.13	-13.37
3	172.02	29.68 QP	40.00	-10.32	3.50 H	130	43.74	-14.06
4	223.19	35.10 QP	40.00	-4.90	3.50 H	81	50.83	-15.73
5	309.03	39.89 QP	47.00	-7.11	4.00 H	260	51.27	-11.38
6	463.51	37.25 QP	47.00	-9.75	2.00 H	178	45.25	-8.00
7	562.51	39.62 QP	47.00	-7.38	2.00 H	315	45.76	-6.14
8	618.04	37.08 QP	47.00	-9.92	1.50 H	66	41.53	-4.45
9	772.57	42.33 QP	47.00	-4.67	1.00 H	259	43.88	-1.55
10	858.42	39.83 QP	47.00	-7.17	3.50 H	148	40.05	-0.22
11	890.63	42.23 QP	47.00	-4.77	1.00 H	28	41.79	0.44
12	927.09	42.45 QP	47.00	-4.55	1.00 H	245	41.24	1.21

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

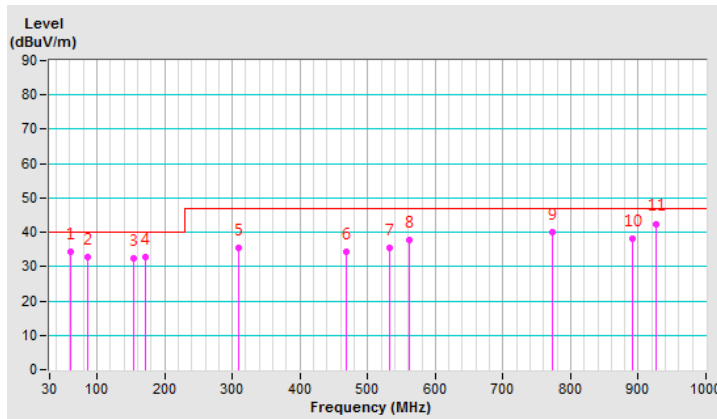


Frequency Range	30MHz ~ 1GHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP), 120kHz
Environmental Conditions	20°C, 61%RH	Tested by	Rolan Zheng
Test Date	2015/8/7		

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	60.07	34.23 QP	40.00	-5.77	2.00 V	48	48.21	-13.98
2	85.83	32.71 QP	40.00	-7.29	2.00 V	340	51.85	-19.14
3	154.51	32.47 QP	40.00	-7.53	2.50 V	325	45.18	-12.71
4	172.02	32.78 QP	40.00	-7.22	2.00 V	344	46.23	-13.45
5	309.03	35.47 QP	47.00	-11.53	4.00 V	124	46.21	-10.74
6	468.75	34.40 QP	47.00	-12.60	1.00 V	309	41.70	-7.30
7	532.19	35.59 QP	47.00	-11.41	1.00 V	319	41.59	-6.00
8	562.51	37.57 QP	47.00	-9.43	3.50 V	325	43.02	-5.45
9	772.57	40.15 QP	47.00	-6.85	4.00 V	262	40.52	-0.37
10	890.63	38.23 QP	47.00	-8.77	3.50 V	164	36.83	1.40
11	927.10	42.48 QP	47.00	-4.52	2.50 V	245	39.93	2.55

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 (dB μ V/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	Avg: 43.5	Not defined	Not defined
Above 3000	Peak: 69.5	Peak: 63.5	Not defined	Not defined

Radiated Emissions Limits at 3 meters (dB μ V/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	Avg: 54	Avg: 56 Peak: 76	Avg: 50 Peak: 70
Above 3000	Peak: 80	Peak: 74	Avg: 60 Peak: 80	Avg: 54 Peak: 74

- Notes:
1. The lower limit shall apply at the transition frequencies.
 2. Emission level (dB μ V/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

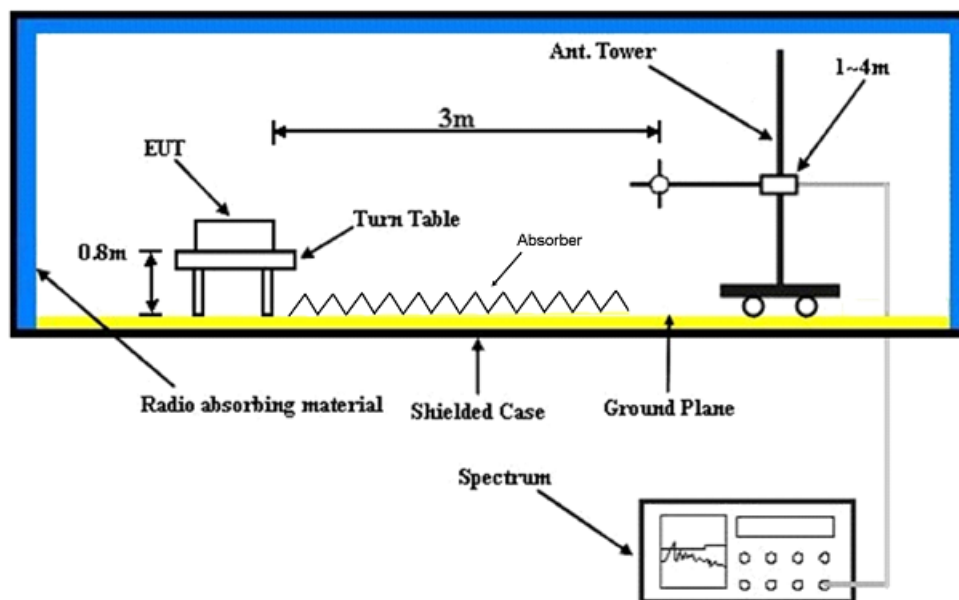
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESR7	101471	Feb. 09, 2015	Feb. 08, 2016
Spectrum Analyzer Agilent	E4446A	MY51100039	Aug. 18, 2014	Aug. 17, 2015
BILOG Antenna SCHWARZBECK	VULB9168	9168-157	Feb. 03, 2015	Feb. 02, 2016
RF signal cable Woken	8D-FB	NA	Mar. 22, 2015	Mar. 21, 2016
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-405	Feb. 06, 2015	Feb. 05, 2016
Preamplifier Agilent (Above 1GHz)	8449B	3008A01961	Oct. 18, 2014	Oct. 17, 2015
RF signal cable HUBER+SUHNER	SUCOFLEX 104	MWX322+MWX2211308 S0295	Nov. 06, 2014	Nov. 05, 2015
Software BV ADT	BV ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Controller BV ADT	SC100	SC93021702	NA	NA
HORN Antenna SCHWARZBECK	BBHA 9170	148	Feb. 09, 2015	Feb. 08, 2016
RF signal cable) HUBER+SUHNER	SUCOFLEX 102	38218/2+37433/2	Oct. 25, 2014	Oct. 24, 2015
Fix tool for Boresight antenna tower	BAF-01	2	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 HwaYa Chamber 2.
3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 686814.
5. The IC Site Registration No. is IC 7450F-2.
6. The VCCI Site Registration No. is G-18.

7.3 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.



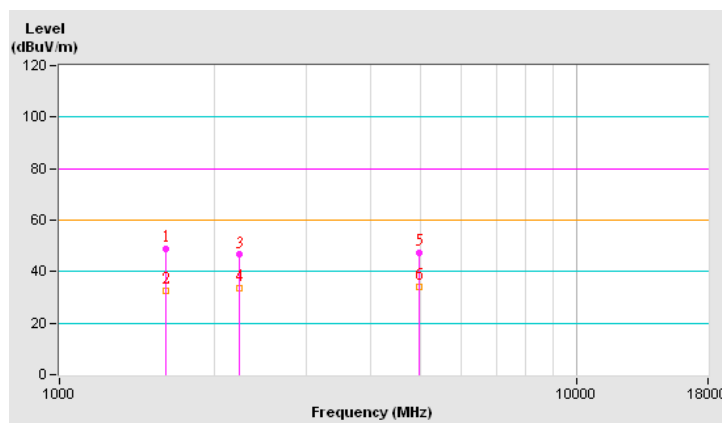
7.4 Test Results

Frequency Range	1GHz ~ 18GHz	Detector Function & Resolution Bandwidth	Peak (PK) / Average (AV), 1MHz
Input Power	120 Vac, 60 Hz (System)	Environmental Conditions	26°C, 66%RH
Tested by	Scott Yang	Test Date	2015/8/6

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	1609.95	49.03 PK	80.00	-30.97	1.00 H	169	56.15	-7.12
2	1609.95	32.69 AV	60.00	-27.31	1.00 H	169	39.81	-7.12
3	2230.05	46.57 PK	80.00	-33.43	1.54 H	160	52.34	-5.77
4	2230.05	33.62 AV	60.00	-26.38	1.54 H	160	39.39	-5.77
5	4980.13	47.28 PK	80.00	-32.72	2.00 H	60	45.00	2.28
6	4980.13	34.13 AV	60.00	-25.87	2.00 H	60	31.85	2.28

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

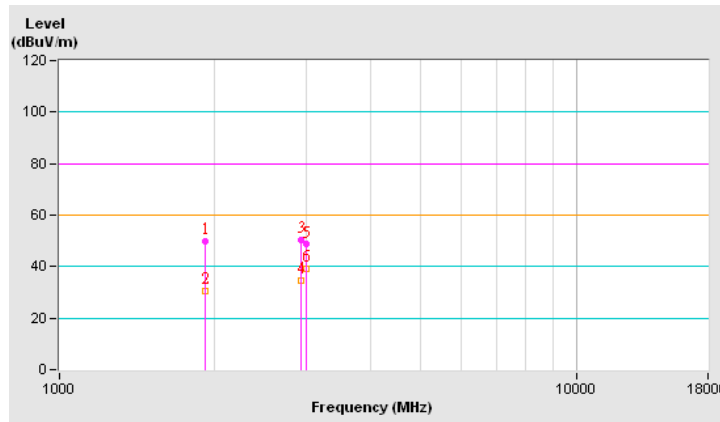


Frequency Range	1GHz ~ 18GHz	Detector Function & Resolution Bandwidth	Peak (PK) / Average (AV), 1MHz
Input Power	120 Vac, 60 Hz (System)	Environmental Conditions	26°C, 66%RH
Tested by	Scott Yang	Test Date	2015/8/6

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	1920.03	50.02 PK	80.00	-29.98	1.23 V	70	56.74	-6.72
2	1920.03	30.51 AV	60.00	-29.49	1.23 V	70	37.23	-6.72
3	2932.51	50.30 PK	80.00	-29.70	1.10 V	235	53.69	-3.39
4	2932.51	34.78 AV	60.00	-25.22	1.10 V	235	38.17	-3.39
5	2999.96	48.56 PK	80.00	-31.44	1.00 V	11	51.77	-3.21
6	2999.96	39.25 AV	60.00	-20.75	1.00 V	11	42.46	-3.21

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

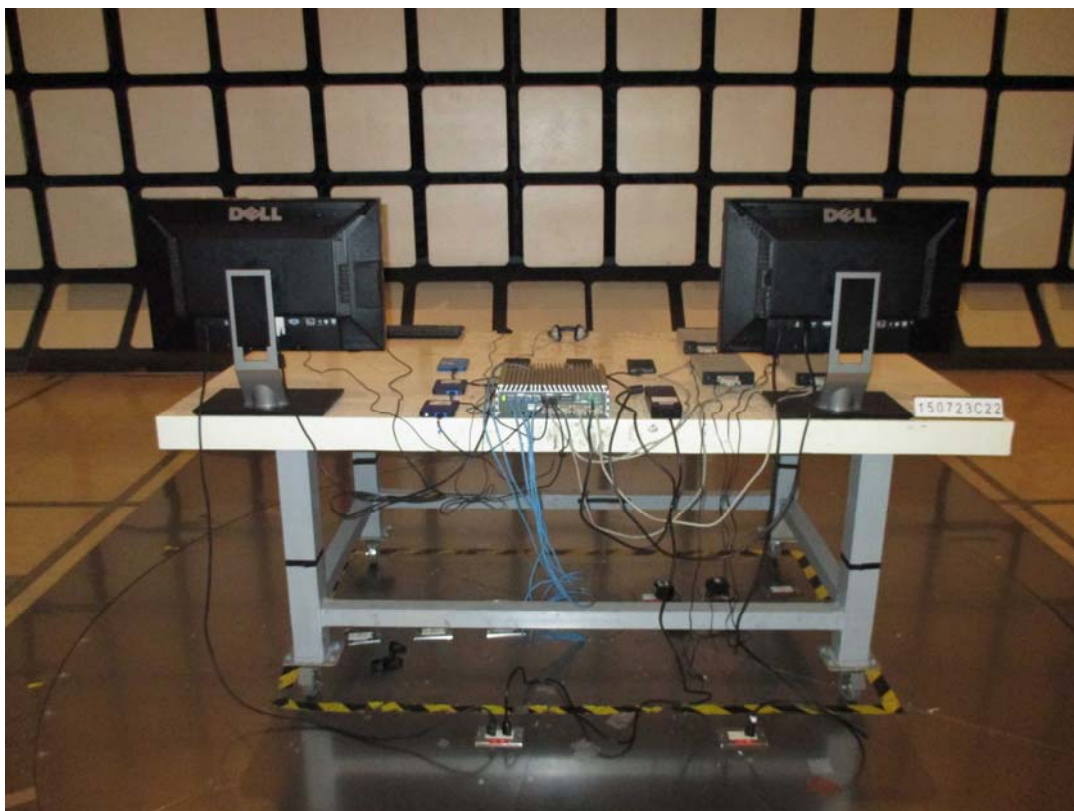


8 Pictures of Test Arrangements

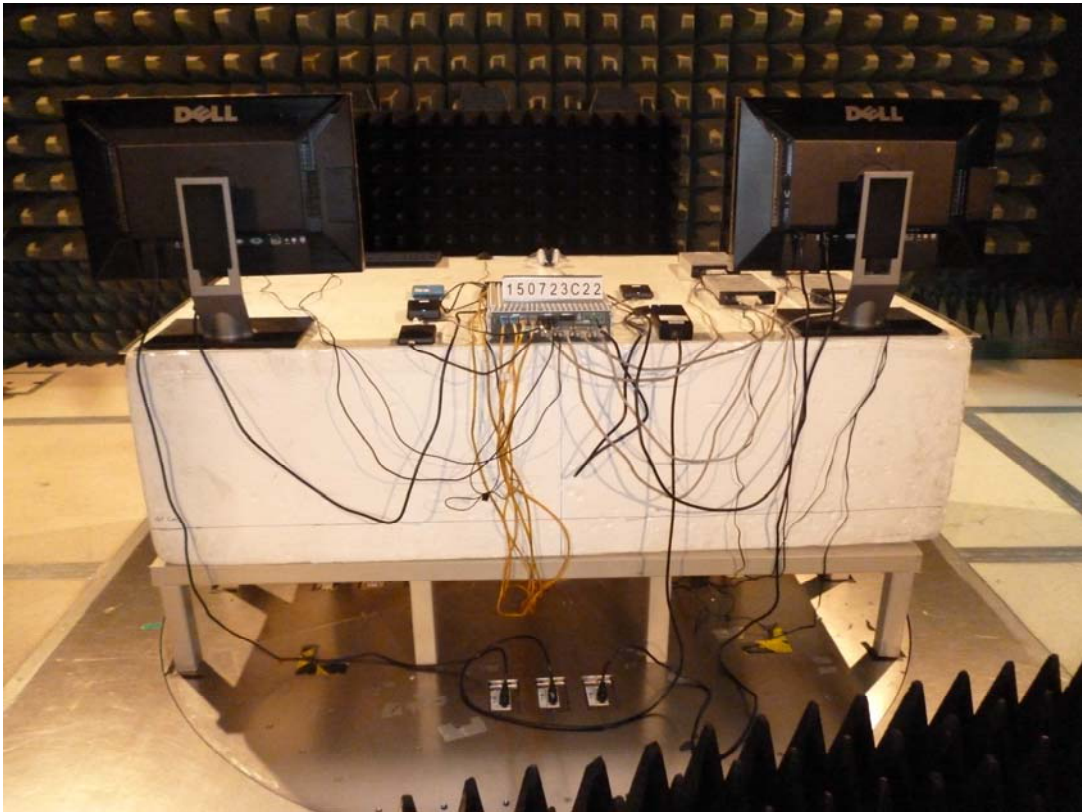
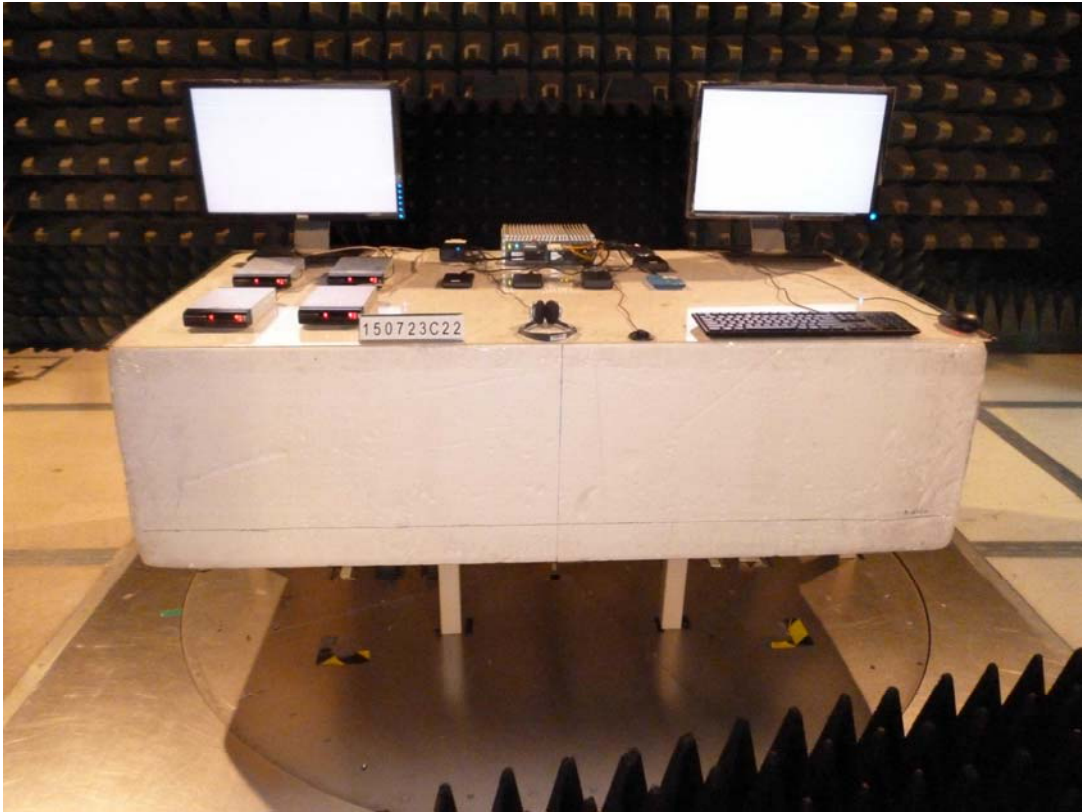
8.1 Conducted Emissions at Mains Ports



8.2 Radiated Emissions up to 1 GHz



8.3 Radiated Emissions above 1 GHz





Appendix – Information on the Testing Laboratories

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

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

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Web Site: www.bureauveritas-adt.com

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

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