

# FCC CERTIFICATION TEST REPORT

**REPORT NO.:** FC150416C26 R1

**MODEL NO.:** GPLB200K

**FCC ID:** QLEGPLB200K

**RECEIVED:** Apr. 16, 2015

**TESTED:** May 03 ~ May 06, 2015

**ISSUED:** Jul. 21, 2015

**APPLICANT:** ATEN Technology, Inc., dba IOGEAR

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**ISSUED BY:** Bureau Veritas Consumer Products Services (H.K.)  
Ltd., Taoyuan Branch

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Dist., Taoyuan City 33383, TAIWAN (R.O.C.)



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## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
FC150416C26	Original release.	May 13, 2015
FC150416C26 R1	Modify FCC ID.	Jul. 21, 2015

## 1 CERTIFICATION

**PRODUCT:** Powerline Nano Ethernet Bridge  
**MODEL NO.:** GPLB200K  
**BRAND:** IOGEAR  
**APPLICANT:** ATEN Technology, Inc., dba IOGEAR  
**TESTED:** May 03 ~ May 06, 2015  
**TEST SAMPLE:** ENGINEERING SAMPLE  
**STANDARD:** **FCC Part 15, Subpart B, Class B** (Carrier Current Systems & Digital Systems)  
**ICES-003:2012 Issue 5, Class B**  
**ICES-006:2009 Issue 2**  
ANSI C63.4:2009

The above equipment (Model: GPLB200K) 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 :** Sunt Lee , **DATE :** Jul. 21, 2015  
Sunt Lee / Specialist

**APPROVED BY :** Ken Liu , **DATE :** Jul. 21, 2015  
Ken Liu / Senior Manager

## 2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications.

FCC Part 15, Subpart B, Class B			
Standard Section	Test Type	Result	Remarks
FCC 15.107(a) ICES-003, 6.1	Conducted Emissions (Carrier Current Off)	PASS	Meets Class B Limit. Minimum passing margin is -23.66dB at 0.17737MHz
FCC 15.107(c)(2) ICES-006, 5.1	Conducted Emissions (Carrier Current On)	PASS	Meets Class B Limit. Minimum passing margin is -26.16dB at 0.56055MHz
ICES-006, 5.2	Permissible Carrier Current Output Voltages	PASS	Fundamental frequencies not falling within 0-535kHz
FCC 15.109(a) ICES-003, 6.2	Radiated Emissions (Carrier Current Off, Device Operating Frequency: 30MHz to 1000MHz) – <i>see Note</i>	PASS	Meets Class B Limit. Minimum passing margin is -11.17dB at 895.67MHz
FCC 15.109(a) ICES-003, 6.2	Radiated Emissions (Carrier Current On, Device Operating Frequency: 30MHz to 1000MHz) – <i>see Note</i>	PASS	Meets Class B Limit. Minimum passing margin is -6.53dB at 875.01MHz
FCC 15.109(e) ICES-006, 5.3	Radiated Emissions (Carrier Current On, Device Operating Frequency: 9kHz to 30MHz)	PASS	Meets Class B Limit. Minimum passing margin is -7.88dB at 125.02MHz

Note: The report shows compliance with “Digital” emissions and also shows compliance with “Carrier Current” emissions from the EUT.

## 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:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

Measurement	Frequency	Uncertainty
Conducted emissions	150kHz ~ 30MHz	2.44 dB
Radiated emissions	30MHz ~ 1GHz	4.70 dB

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.

### 3 GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>PRODUCT</b>	Powerline Nano Ethernet Bridge
<b>MODEL NO.</b>	GPLB200K
<b>OPERATING SOFTWARE</b>	NA
<b>POWER SUPPLY</b>	100-240Vac, 0.1A, 50-60Hz
<b>DATA CABLE</b>	NA
<b>ACCESSORY DEVICE</b>	NA

**NOTE:**

1. The EUT's highest operating frequency is 28MHz, therefore the radiated emission is tested up to 1GHz.
2. The above EUT information is declared by manufacturer and for more detailed feature description, please refer to the manufacturer's specifications or user's manual.



### 3.2 DESCRIPTION OF TEST MODES

The EUT consumes AC power of rating 100-240Vac, 50/60Hz.

EUT has been pre-tested under the following test modes. The worst radiated emissions data were found at test mode 1.

Test Mode	Test Condition
1	LAN 100Mbps
2	LAN 10Mbps

Test modes are presented in the report as below.

Test Mode	Test Condition
<b>Conducted Emission (Carrier current off)</b>	
-	LAN 100Mbps
<b>Conducted Emission (Carrier current on)</b>	
-	LAN 100Mbps
<b>Radiated Emission (Carrier current off)</b>	
-	LAN 100Mbps
<b>Radiated Emission (Carrier current on)</b>	
-	LAN 100Mbps

### **3.3 DESCRIPTION OF APPLIED STANDARD**

The EUT is a kind of power line communication apparatus, which uses house wiring to transmit Ethernet data between computers. According to the specification of the EUT declared by the manufacturer, it must comply with the requirements of the following standards.

**ICES-003:2012 Issue 5, Class B**

**ICES-006:2009 Issue 2**

**FCC Part 15, Subpart B, Class B** Section 15.107(a), 15.107(c) (2), 15.109(a) and 15.109(e) with measurement guidelines based on:

**ANSI C63.4:2009**

**FCC 11-160 Appendix D item 1 & 3**

All tests have been performed and recorded as per the above standards.

### 3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Extension Socket	NA	NA	NA	NA	-
B.	Home Plug	IOGEAR	GPLB200K	NA	NA	Provided by manufacturer
C.	Notebook	DELL	E6440	G4QPM32	FCC DoC Approved	-
D.	Notebook	Lenovo	S430	MP-2DBFW	PD92230BNHU	-

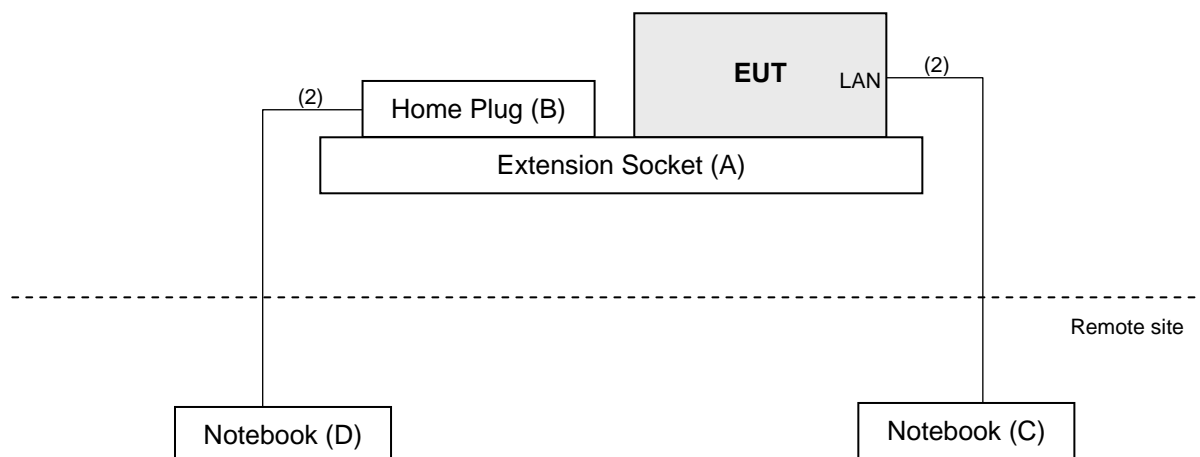
Note:

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

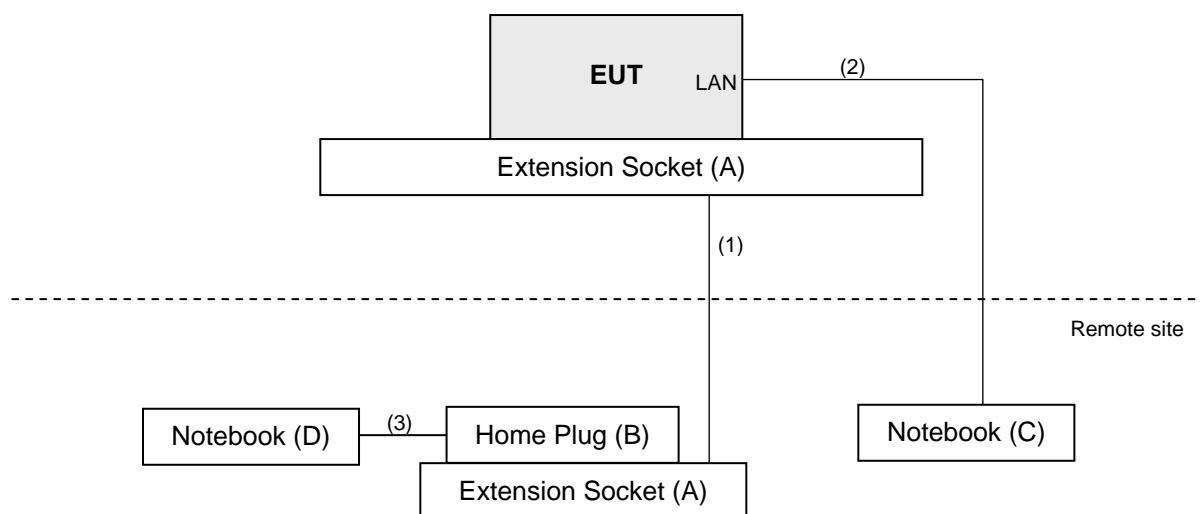
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Power	1	10	Y	0	-
2.	RJ45, Cat5e	2	10	N	0	-
3.	RJ45, Cat5e	1	1.8	N	0	-

### 3.5 CONFIGURATION OF SYSTEM UNDER TEST

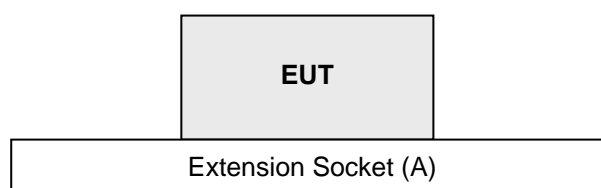
#### Conducted emission (Carrier current on) test



#### Radiated Emission (Link mode) test



#### Conducted emission (Carrier current off), Radiated Emission (Idle mode) tests



## 4 EMISSION TESTS

### 4.1 CONDUCTED EMISSION MEASUREMENT (CARRIER CURRENT OFF)

#### 4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT (CARRIER CURRENT OFF)

FCC Part 15 Subpart B (Section 15.107(a)) & ICES-003 (Clause 6.1) is applied for Class B device operating below 30MHz of unintentional radiators.

Frequency (MHz)	Conducted Emissions Limit	
	Quasi-peak (dB $\mu$ V)	Average (dB $\mu$ V)
0.15-0.5	66-56	56-46
0.50-5.0	56	46
5.0-30.0	60	50

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
  2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
  3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

#### 4.1.2 TEST INSTRUMENT

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	Mar. 02, 2015	Mar. 01, 2016
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 21, 2014	Jul. 20, 2015
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.

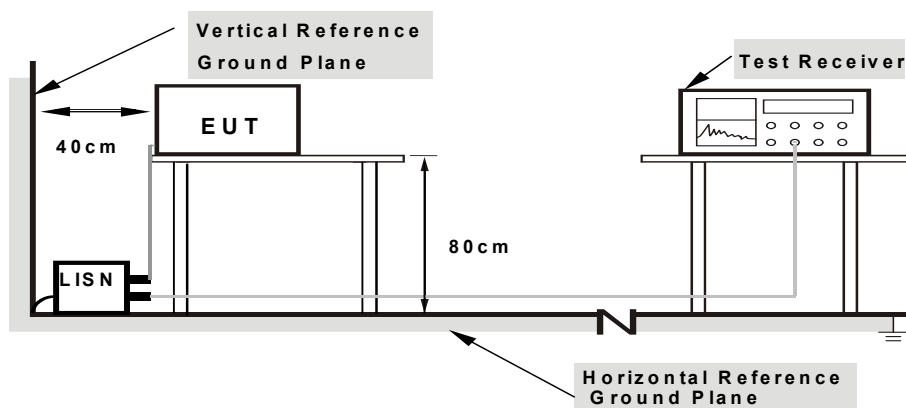
### 4.1.3 TEST PROCEDURE

- 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 frequency range from 150kHz to 30MHz was searched. Emissions levels under Limit - 20dB were not recorded.

### 4.1.4 DEVIATION FROM TEST STANDARD

No deviation.

### 4.1.5 TEST SETUP



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

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

### 4.1.6 EUT OPERATING CONDITIONS

- EUT was tested with PLC function inactive.
- EUT linked with notebooks through LAN in idle condition.

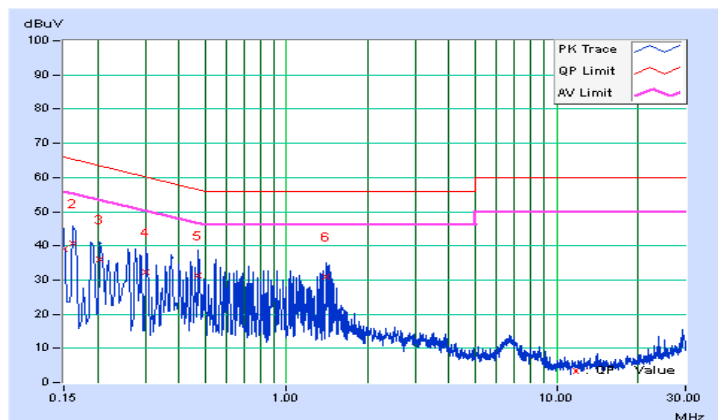
## 4.1.7 TEST RESULTS

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	20°C, 60%RH
Tested by	Pon Tsai	Test Date	2015/5/5

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	0.07	39.14	24.19	39.21	24.26	66.00	56.00	-26.79	-31.74
2	0.16181	0.09	40.55	21.19	40.64	21.28	65.37	55.37	-24.73	-34.09
3	0.20474	0.15	35.78	19.32	35.93	19.47	63.42	53.42	-27.49	-33.95
4	0.30249	0.11	32.21	15.02	32.32	15.13	60.17	50.17	-27.85	-35.04
5	0.47062	0.09	31.08	16.13	31.17	16.22	56.50	46.50	-25.33	-30.28
6	1.40511	0.20	30.76	12.40	30.96	12.60	56.00	46.00	-25.04	-33.40

### 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

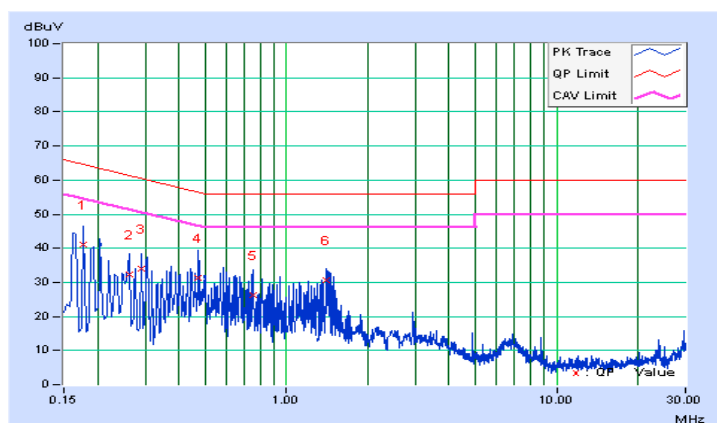


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	20°C, 60%RH
Tested by	Pon Tsai	Test Date	2015/5/5

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	0.17737	0.19	40.76	21.63	40.95	21.82	64.61	54.61	-23.66	-32.79
2	0.26339	0.22	32.21	19.09	32.43	19.31	61.32	51.32	-28.89	-32.01
3	0.29076	0.21	33.93	16.78	34.14	16.99	60.50	50.50	-26.36	-33.51
4	0.47062	0.17	31.11	18.42	31.28	18.59	56.50	46.50	-25.22	-27.91
5	0.75214	0.18	26.23	12.89	26.41	13.07	56.00	46.00	-29.59	-32.93
6	1.39729	0.19	30.39	13.12	30.58	13.31	56.00	46.00	-25.42	-32.69

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





## 4.2 CONDUCTED EMISSION MEASUREMENT (CARRIER CURRENT ON)

### 4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT (CARRIER CURRENT ON)

FCC Part 15 Subpart B (Section 15.107(c)(2)) & ICES-006 (Clause 5.1) is applied for device operating below 30 MHz of unintentional carrier current radiators.

Frequency (MHz)	Conducted Emissions Limit	
	Quasi-peak ( $\mu\text{V}$ )	Quasi-peak ( $\text{dB}\mu\text{V}$ )
0.535-1.705	1000	60

### 4.2.2 TEST INSTRUMENT

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	Mar. 02, 2015	Mar. 01, 2016
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 21, 2014	Jul. 20, 2015
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

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

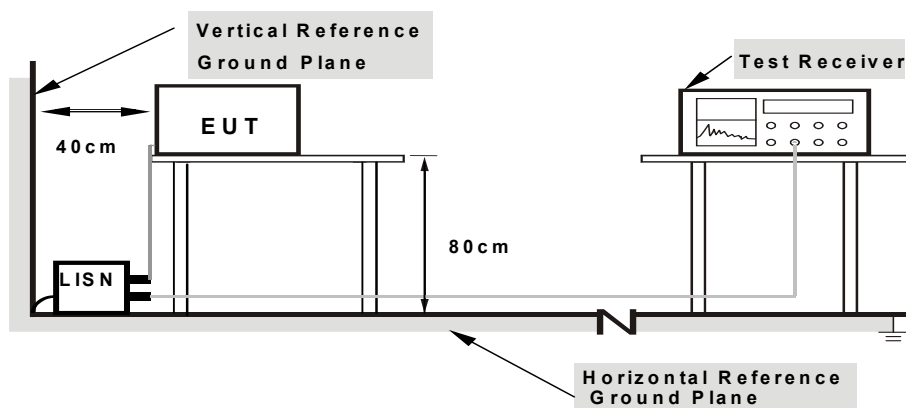
### 4.2.3 TEST PROCEDURE

- 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 50Ohm/ 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 frequency range from 535kHz to 1705kHz was searched. Emission levels under (Limit - 20dB) were not recorded.

### 4.2.4 DEVIATION FROM TEST STANDARD

No deviation.

### 4.2.5 TEST SETUP



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

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

### 4.2.6 EUT OPERATING CONDITIONS

- EUT was tested with PLC function active.
- EUT linked with notebooks through LAN by command PING.

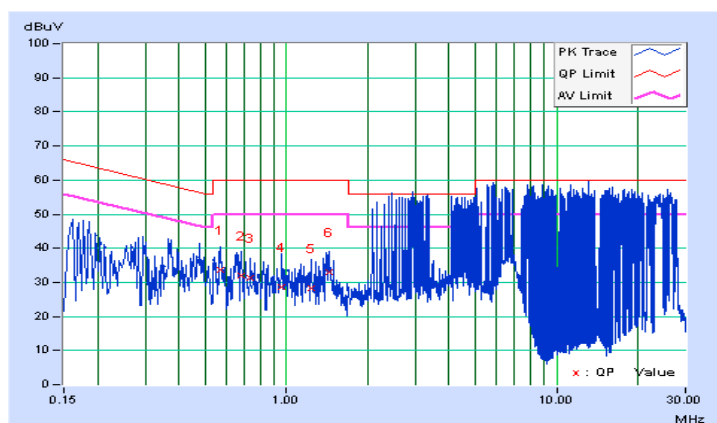
## 4.2.7 TEST RESULTS

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	20°C, 60%RH
Tested by	Pon Tsai	Test Date	2015/5/5

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	0.56837	0.11	33.67	19.90	33.78	20.01	60.00	50.00	-26.22	-29.99
2	0.68176	0.13	31.69	19.95	31.82	20.08	60.00	50.00	-28.18	-29.92
3	0.73259	0.14	31.34	19.40	31.48	19.54	60.00	50.00	-28.52	-30.46
4	0.96328	0.17	28.42	16.53	28.59	16.70	60.00	50.00	-31.41	-33.30
5	1.22916	0.19	28.08	17.52	28.27	17.71	60.00	50.00	-31.73	-32.29
6	1.43639	0.20	32.75	19.11	32.95	19.31	60.00	50.00	-27.05	-30.69

### 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

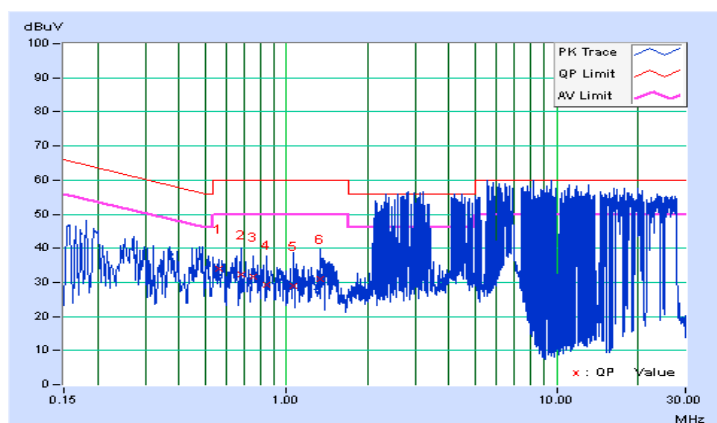


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	20°C, 60%RH
Tested by	Pon Tsai	Test Date	2015/5/5

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	0.56055	0.17	33.67	19.12	33.84	19.29	60.00	50.00	-26.16	-30.71
2	0.67785	0.17	32.30	19.70	32.47	19.87	60.00	50.00	-27.53	-30.13
3	0.75605	0.18	31.51	19.47	31.69	19.65	60.00	50.00	-28.31	-30.35
4	0.84598	0.18	29.10	17.90	29.28	18.08	60.00	50.00	-30.72	-31.92
5	1.06494	0.18	28.88	18.09	29.06	18.27	60.00	50.00	-30.94	-31.73
6	1.33082	0.19	30.83	18.04	31.02	18.23	60.00	50.00	-28.98	-31.77

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



## 4.3 PERMISSIBLE CARRIER CURRENT OUTPUT VOLTAGES

### 4.3.1 PERMISSIBLE CARRIER CURRENT OUTPUT VOLTAGES FOR INSTALLATION IN RESIDENTIAL AND OFFICE BUILDINGS

For 0-535 kHz, carrier current devices intended for residential and office buildings are permitted the output voltages listed in table below when measured, in turn, with 5 ohms and 50 ohms resistive loads. If the duty cycle is not determined by the manufacturer of the device (i.e. duty cycle is system-dependent), then the user manual shall provide clear instructions to the system designer about how to compute the permissible output voltage of the device, based on table below.

Frequency Range	Permissible Carrier Current Output Voltages
Below 9 kHz	No limits
9 to 95 kHz <sup>[2]</sup>	15.0 volts pk-pk (or 5.3 volts rms)
105 to 185 kHz <sup>[2]</sup>	15.0 volts pk-pk (or 5.3 volts rms)
185-535 kHz	0.45(B/D) <sup>1/2</sup> volts pk-pk for devices intended for connection to 120 VAC lines and 0.90(B/D) <sup>1/2</sup> volts pk-pk for devices intended for connection to 240 VAC lines, or 15 volts pk-pk, whichever is the lesser voltage. B = bandwidth in kHz (-6 dB points, i.e. when the spectral density has decreased by 6 dB). D = duty cycle, e.g. D = 1.0 for continuous transmission. When B is less than 4.8 kHz, B = 4.8 may be used

Note: The frequency table above does not include 100 kHz because it is a restricted frequency; it is the LORAN C radio navigation frequency. Carrier current devices that use the band 95-105 kHz, or spread spectrum systems that include this band, may do so, but must cease operation if found to cause interference. It should be noted that the voltage limits in Table 1 are not to be measured across an LISN connected to the AC wiring; these voltages are to be measured at the factory with 5 ohm and 50 ohm dummy loads. If the aggregate interference in any area or city is found to cause unacceptable interference to the authorized users, Industry Canada may revise the permissible voltage levels. Therefore, manufacturers should limit the duty cycle (transmission on-time) of their devices wherever possible.

### 4.3.2 TEST RESULTS

The EUT has no fundamental frequencies falling within 0-535kHz and found compliance with this requirement.

## 4.4 RADIATED EMISSION MEASUREMENT

### 4.4.1 LIMITS OF RADIATED EMISSION MEASUREMENT

#### TEST STANDARD:

FCC Part 15, Subpart B (section: 15.109)

ICES-003:2012 Issue 5 (section: 6.2)

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				
960-1000	49.5	43.5	47	37
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 (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				
960-1000	60	54	57.5	47.5
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

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
  2. Emission level (dB $\mu$ V/m) = 20 log Emission level ( $\mu$ V/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.
  4. QP detector shall be applied if not specified.

**FREQUENCY RANGE OF RADIATED MEASUREMENT (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

#### 4.4.2 TEST INSTRUMENT

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 (Below 1GHz)	8447D	2944A10629	Oct. 18, 2014	Oct. 17, 2015
RF signal cable HUBER+SUHNER	SUCOFLEX 104	MWX322+MWX22113 08S0295	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

- 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 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.



#### 4.4.3 TEST PROCEDURE

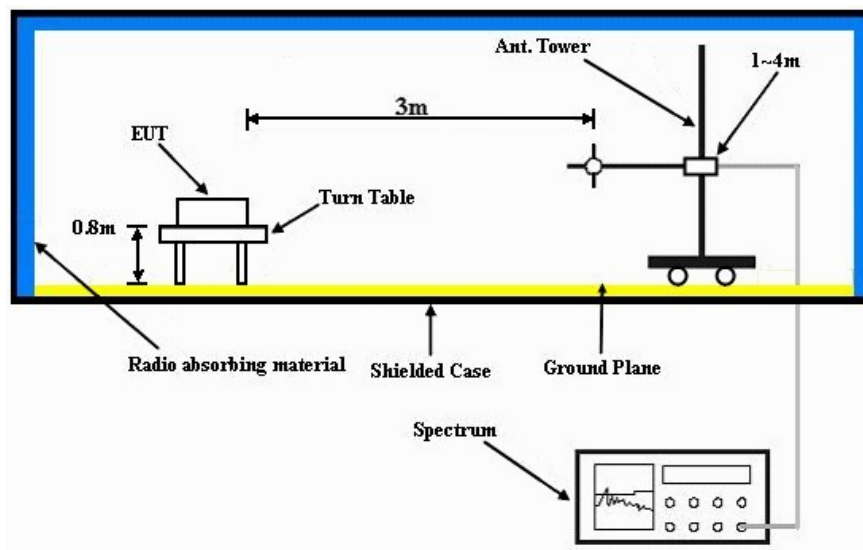
- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from 1 meter to 4 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 below 1GHz.

**NOTE:** The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-Peak (QP) detection at frequency below 1GHz.

#### 4.4.4 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.4.5 TEST SETUP



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

#### 4.4.6 EUT OPERATING CONDITIONS

##### Idle mode

- a. EUT was tested with PLC function inactive.

##### Link mode

- a. EUT was tested with PLC function active.
- b. EUT linked with notebooks through LAN by command PING.

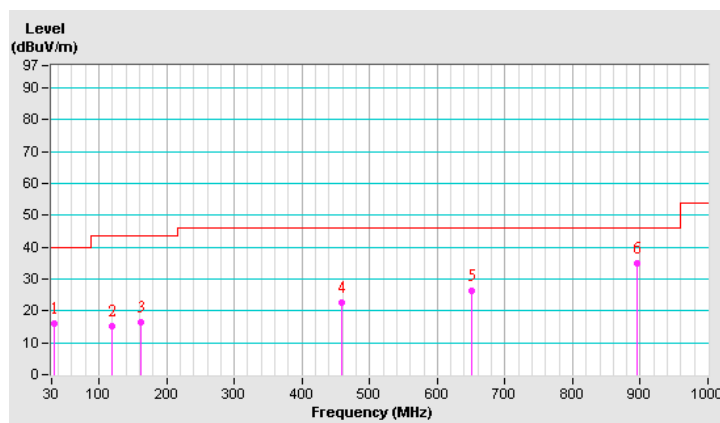
#### 4.4.7 TEST RESULTS

Frequency Range	30MHz ~ 1GHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP), 120kHz
Input Power	120Vac , 60Hz	Environmental Conditions	21℃ , 58%RH
Tested by	Rolan Zheng	Test Date	2015/5/6
Test Mode	Idle mode		

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	34.46	16.14 QP	40.00	-23.86	2.50 H	296	30.68	-14.54
2	119.97	15.03 QP	43.50	-28.47	1.00 H	74	30.13	-15.10
3	162.46	16.39 QP	43.50	-27.11	1.50 H	105	29.00	-12.61
4	459.34	22.44 QP	46.00	-23.56	4.00 H	360	29.59	-7.15
5	649.86	26.16 QP	46.00	-19.84	3.00 H	351	28.76	-2.60
6	895.67	34.83 QP	46.00	-11.17	2.00 H	38	32.53	2.30

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

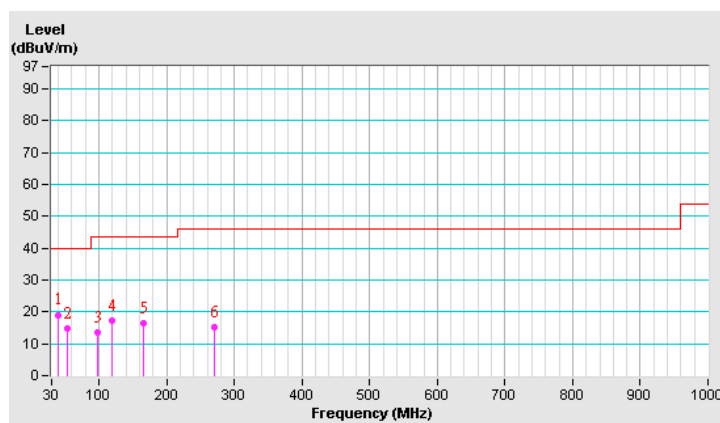


Frequency Range	30MHz ~ 1GHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP), 120kHz
Input Power	120Vac , 60Hz	Environmental Conditions	21℃, 58%RH
Tested by	Rolan Zheng	Test Date	2015/5/6
Test Mode	Idle mode		

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	39.36	19.08 QP	40.00	-20.92	3.00 V	360	33.25	-14.17
2	53.77	14.81 QP	40.00	-25.19	3.00 V	6	28.17	-13.36
3	98.53	13.61 QP	43.50	-29.89	1.50 V	360	31.53	-17.92
4	119.97	17.32 QP	43.50	-26.18	1.00 V	76	32.42	-15.10
5	165.61	16.53 QP	43.50	-26.97	2.50 V	88	29.33	-12.80
6	270.52	15.17 QP	46.00	-30.83	2.00 V	95	27.17	-12.00

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

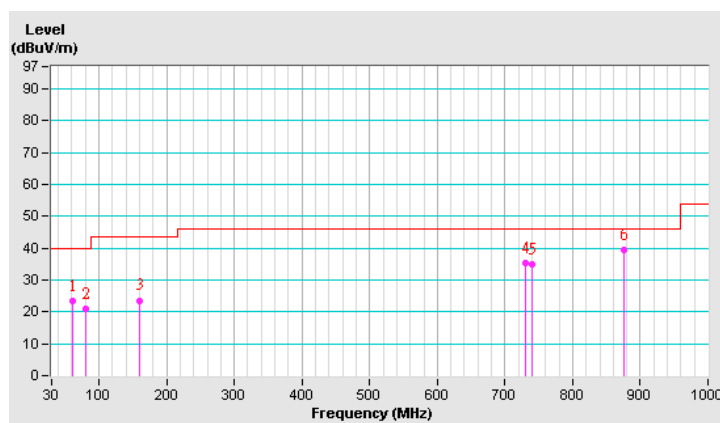


Frequency Range	30MHz ~ 1GHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP), 120kHz
Input Power	120Vac , 60Hz	Environmental Conditions	21℃ , 58%RH
Tested by	Rolan Zheng	Test Date	2015/5/6
Test Mode	Link mode		

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	60.17	23.32 QP	40.00	-16.68	2.00 H	148	36.87	-13.55
2	81.17	20.84 QP	40.00	-19.16	3.50 H	3	38.51	-17.67
3	160.91	23.57 QP	43.50	-19.93	3.50 H	284	36.11	-12.54
4	729.45	35.46 QP	46.00	-10.54	1.00 H	283	36.21	-0.75
5	739.83	34.97 QP	46.00	-11.03	1.00 H	283	35.38	-0.41
6	875.01	39.47 QP	46.00	-6.53	1.00 H	268	37.41	2.06

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

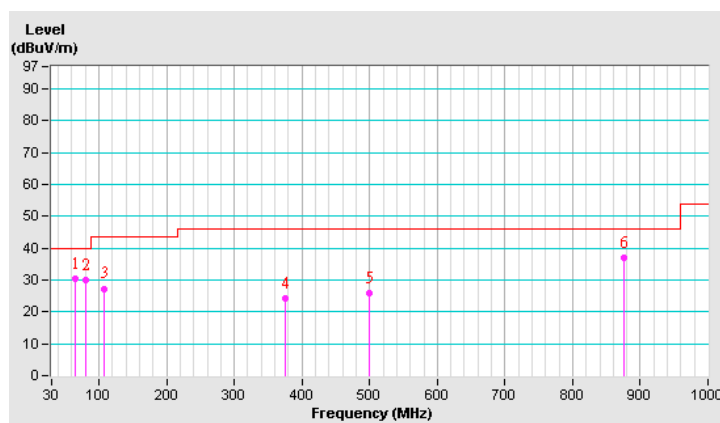


Frequency Range	30MHz ~ 1GHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP), 120kHz
Input Power	120Vac , 60Hz	Environmental Conditions	21℃ , 58%RH
Tested by	Rolan Zheng	Test Date	2015/5/6
Test Mode	Link mode		

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	64.78	30.41 QP	40.00	-9.59	1.00 V	360	44.59	-14.18
2	81.17	29.90 QP	40.00	-10.10	1.00 V	239	47.57	-17.67
3	106.68	27.33 QP	43.50	-16.17	1.50 V	234	43.70	-16.37
4	375.00	24.36 QP	46.00	-21.64	1.50 V	15	33.51	-9.15
5	499.99	26.03 QP	46.00	-19.97	1.00 V	265	32.40	-6.37
6	875.01	36.91 QP	46.00	-9.09	1.00 V	116	34.85	2.06

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



## 4.5 RADIATED EMISSION MEASUREMENT (CARRIER CURRENT ON)

### 4.5.1 LIMITS OF RADIATED EMISSION MEASUREMENT (CARRIER CURRENT ON)

According to FCC Part 15 Subpart B (Section 15.109(e)) & ICES-006 (Clause 5.3) for the Class B device of unintentional Carrier current radiators shall comply with the radiated emission limits for intentional radiators provided in 15.109(e) for frequency range of 9KHz to 30MHz.

Frequency (MHz)	Radiated Emission Limit	
	Field Strength (Microvolts / Meter)	Measurement Distance (Meter)
0.009-0.490	2400 / F(kHz)	300
0.490-1.705	24000 / F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

**NOTE:** 1. The lower limit shall apply at the transition frequencies.  
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

### FREQUENCY RANGE OF RADIATED MEASUREMENT (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
1.705-10	400
10-30	500

## 4.5.2 TEST INSTRUMENT

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer Agilent	R3132	140701958	May 21, 2014	May 20, 2015
TEST RECEIVER ROHDE & SCHWARZ	ESCS30	100289	Dec. 01, 2014	Nov. 30, 2015
Pre-Amplifier Agilent	8447D	2944A10636	Oct. 18, 2014	Oct. 17, 2015
Bilog Antenna Schwarbeck	VULB9168	9168-154	Feb. 03, 2015	Feb. 02, 2016
LOOP ANTENNA ROHDE & SCHWARZ	HFH2-Z2	100070	Mar. 06, 2014	Mar. 05, 2016

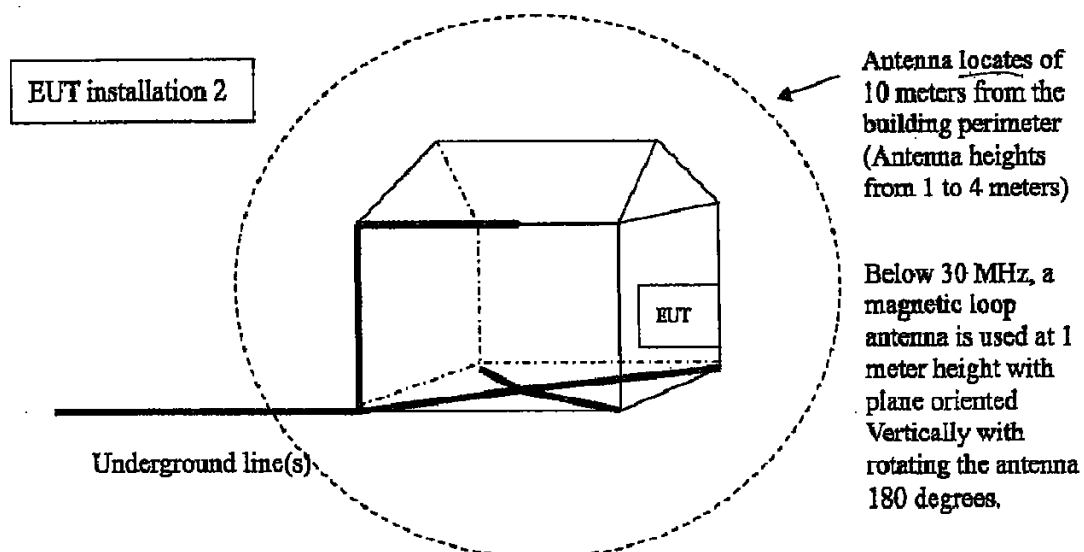
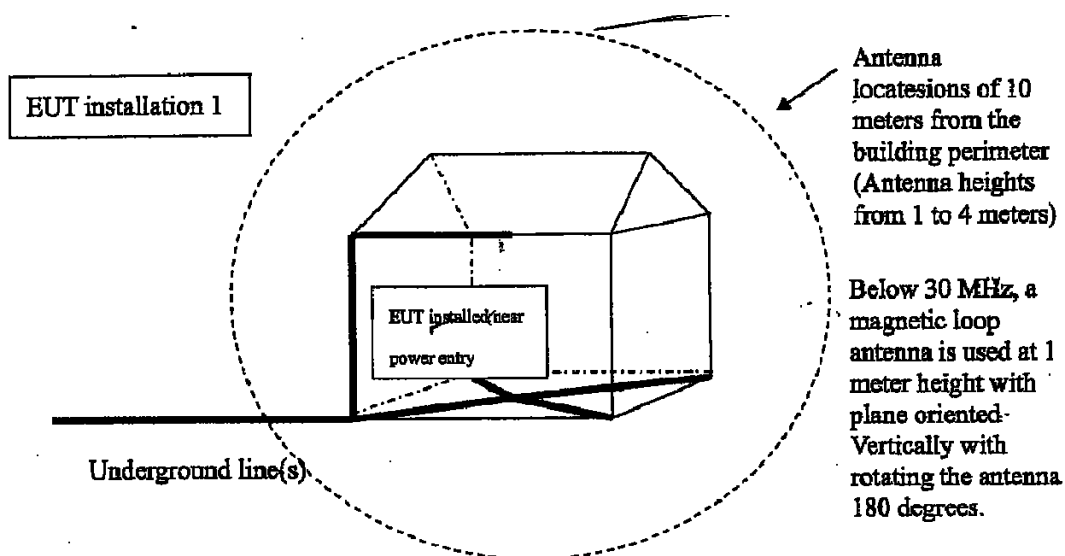


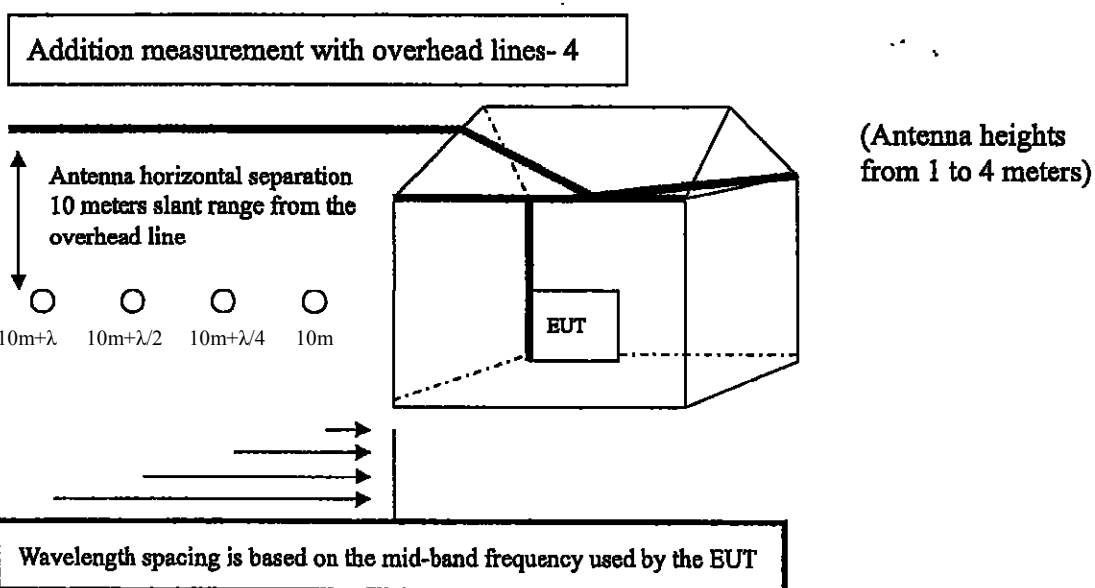
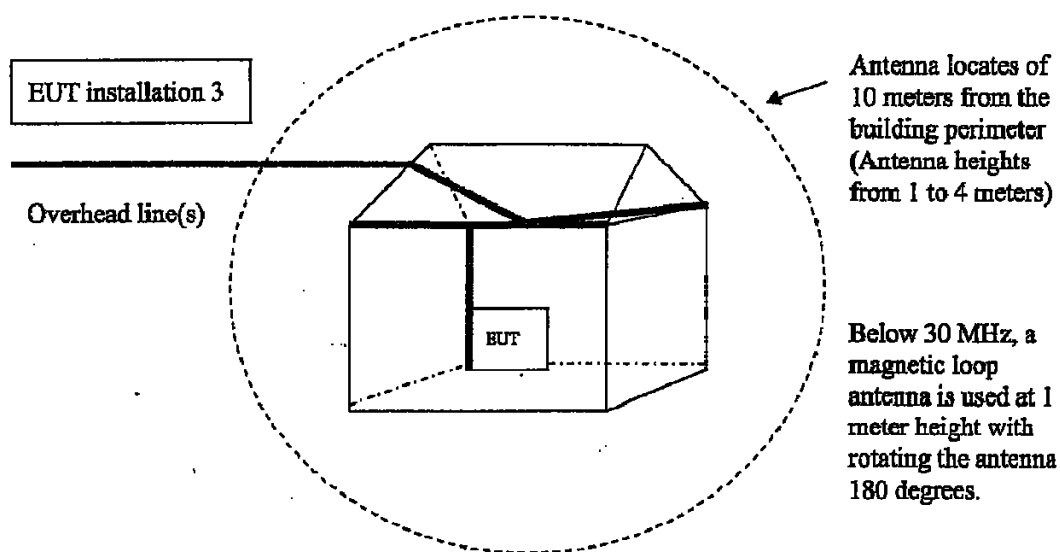
#### 4.5.3 TEST PROCEDURE

- 1) Testing shall be performed with the power settings of the Equipment Under Test (EUT) set at the maximum level.
- 2) Testing shall be performed using the maximum RF injection duty factor (burst rate). Test modes or test software may be used for uplink and downlink transmissions.
- 3) Measurements should be made at a test site where the ambient signal level is 6 dB below the applicable limit. (See ANSI C63.4-2009, section 5.1.2 for alternatives, if this test condition cannot be achieved.)
- 4) If the data communications burst rate is at least 20 burst per second, quasi-peak measurements shall be employed. If the data communications burst rate is 20 bursts per second or less, measurements shall be made using a peak detector.
- 5) For frequencies above 30 MHz, The signal shall be maximized for antenna heights from 1 to 4 meters, for both horizontal and vertical polarizations, in accordance to ANSI C63.4-2009 procedures.
- 6) For frequencies below 30 MHz, an active magnetic loop is used. The magnetic loop antenna was at 1 meter height with its plane oriented vertically and the emission maximized by rotating the antenna 180 degrees about its vertical axis.
- 7) The six highest radiated emissions relative to the limit and independent of antenna polarization were reported.

#### In-situ Radiated Emission Measurement environment.

- The three installations shall include a combination of buildings with overhead-line(s) and underground line(s).
- The buildings shall not have aluminum or other metal siding, or shielding wiring (e.g.: wiring installed through conduit or BX electric cable).
- Measurement shall be made at a minimum of 16 radial angles surrounding the EUT (building perimeter).
- Measurement distance is 10 meters. If necessary, due to ambient emissions, measurement may be performed a distance of 3 meters using distance corrections in accordance with 15.31(f).





#### 4.5.4 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.5.5 TEST SETUP LOCATION

The measurements were performed at three installations that were representative of typical installations. For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

Installation 1	
Address	Room 852, Holland Village, Pu-Xin Pasture, Gaorong Village, Yangmei Township, Taoyuan County 326, Taiwan
General description	It is a three floors concerted building and room 852 is located at first floor.
Source of power lines	Underground lines

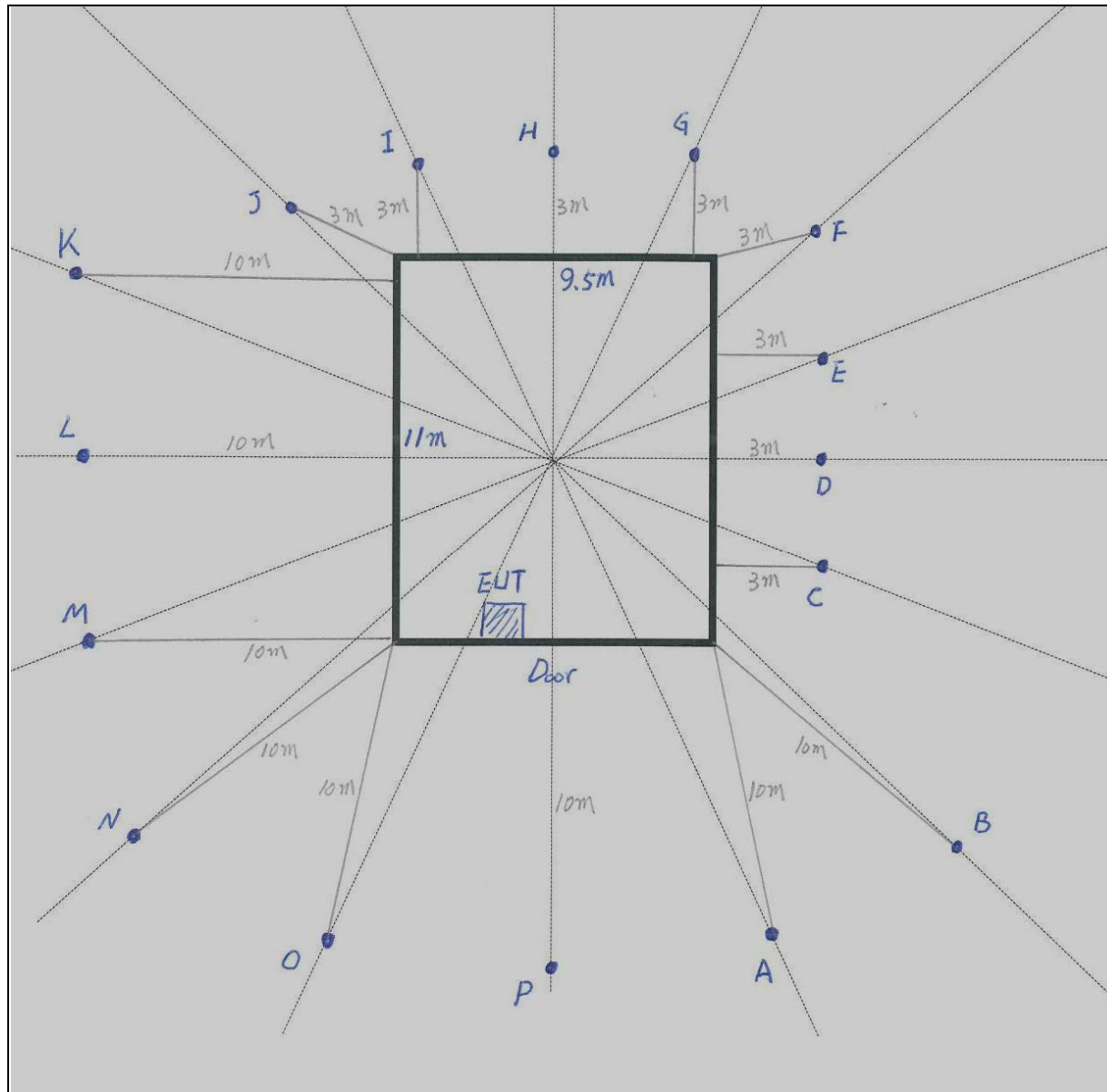
Installation 2	
Address	Room 862, Holland Village, Pu-Xin Pasture, Gaorong Village, Yangmei Township, Taoyuan County 326, Taiwan
General description	It is a two floors concerted building and room 802 is located at first floor.
Source of power lines	Underground lines

Installation 3	
Address	Playground in the seafront by the sea, Houlong, Dashan Village, Houlong Township, Miaoli County 356, Taiwan
General description	It is a two floors wood building.
Source of power lines	Overhead lines

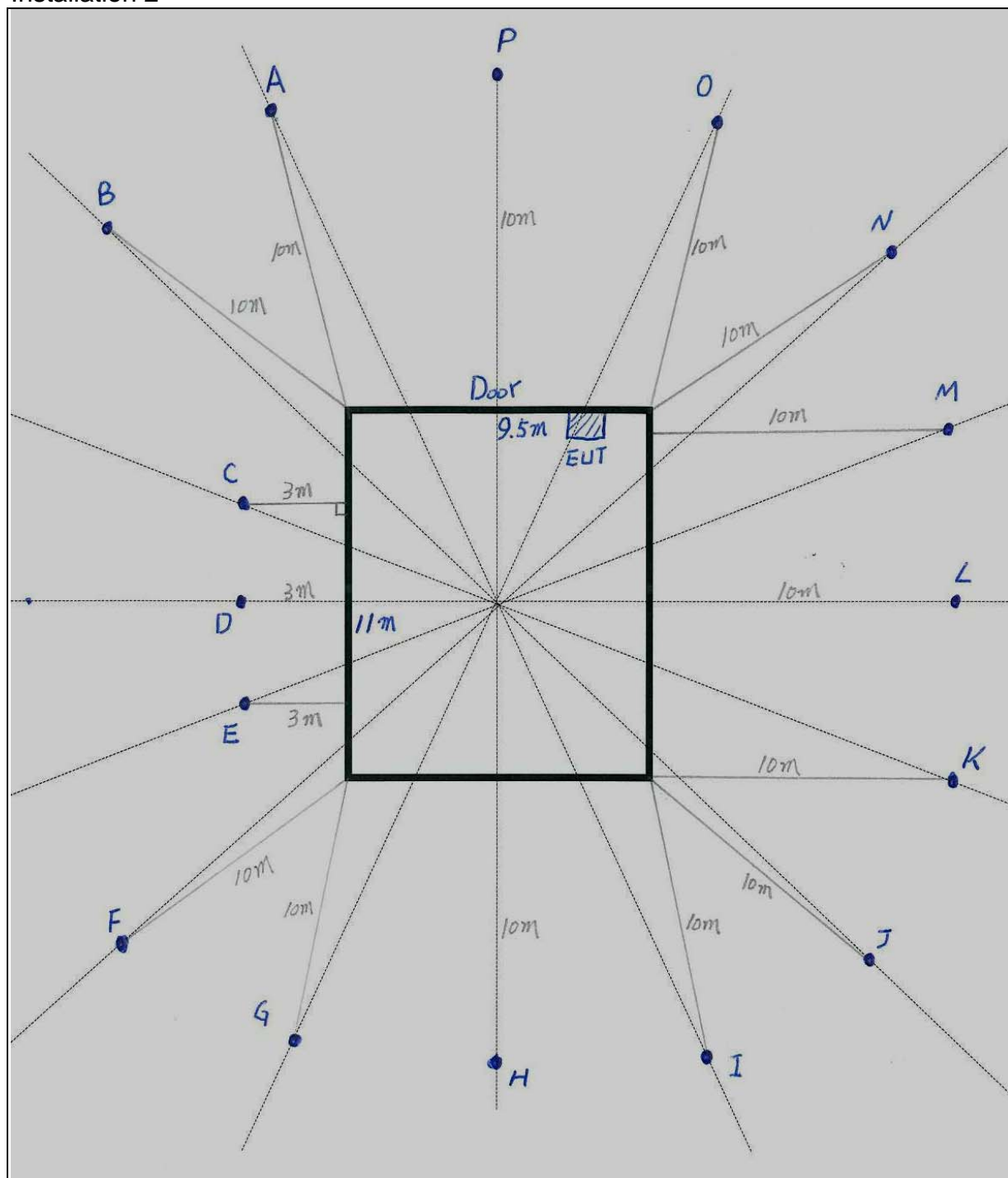
Addition measurement with overhead lines-4	
Address	Playground by the sea, Houlong, Dashan Village, Houlong Township, Miaoli County 356, Taiwan
General description	It is a two floors wood building.
Source of power lines	Overhead lines

## 4.5.6 TEST SETUP DIAGRAM

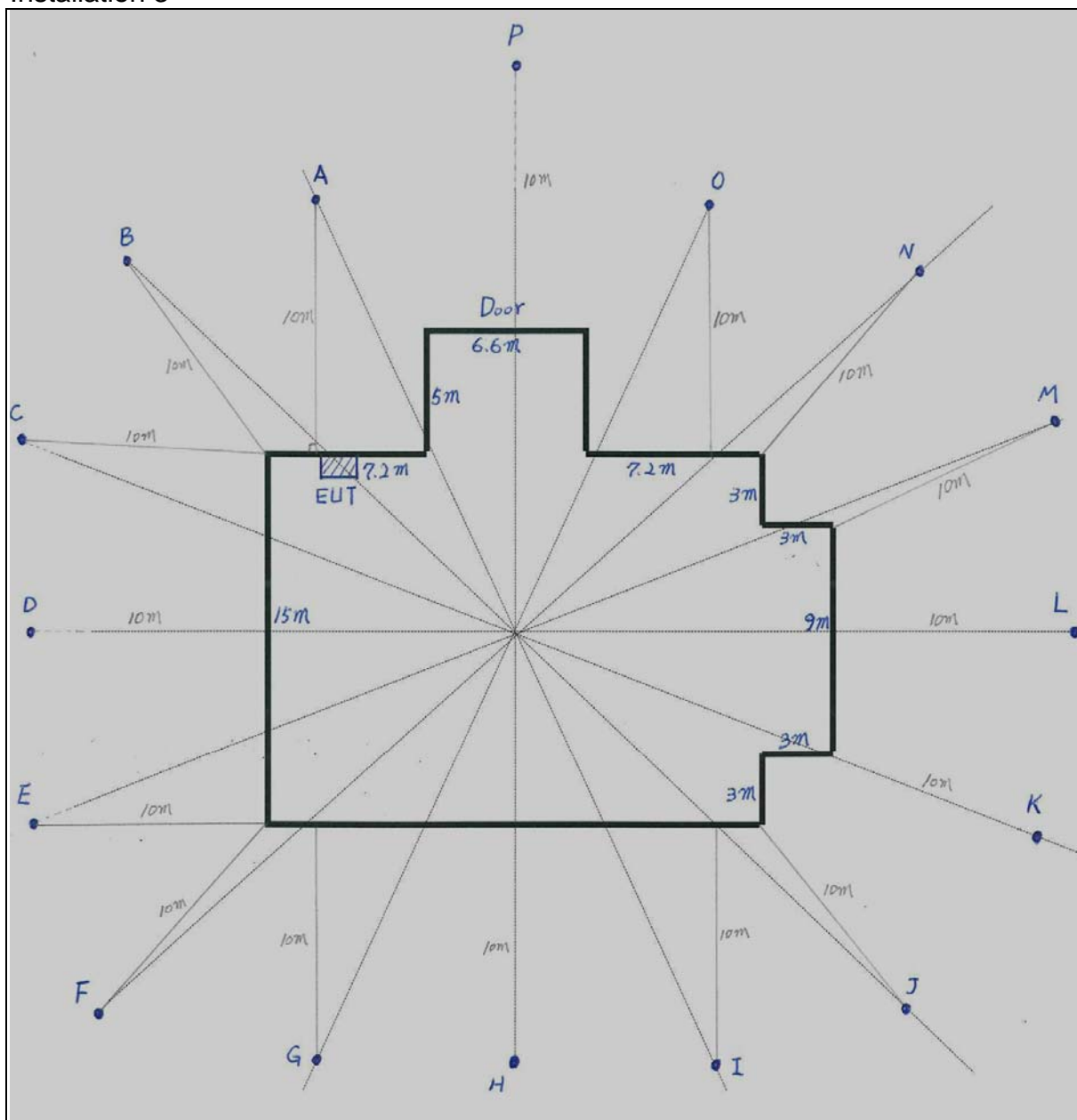
### Installation 1



## Installation 2



## Installation 3



### 4.5.7 EUT OPERATING CONDITIONS

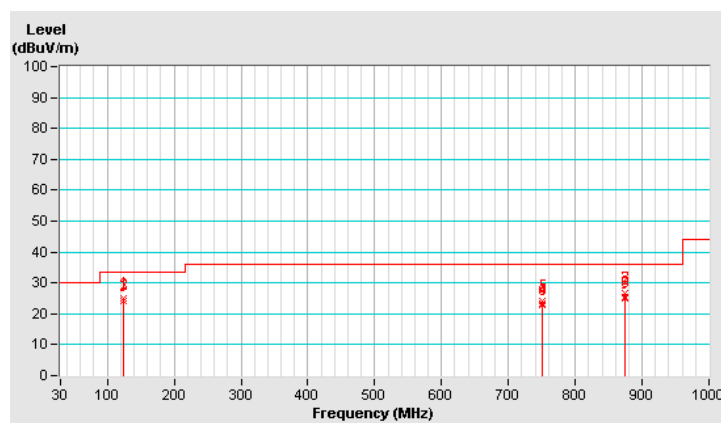
Same as 4.2.6.

## 4.5.8 TEST RESULTS

Frequency Range	9kHz ~ 1000MHz	Detector Function & Bandwidth	Quasi-Peak , 120 kHz
Input Power	120Vac, 60Hz	Environmental Conditions	23°C , 60%RH
Tested by	Rolan Zheng	Test Date	2015/5/3

Antenna Polarity & Test Distance : Horizontal at 10 m										
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)	Installation	Point
1	125.02	25.18 QP	33.06	-7.88	3.50 H	N/A	40.02	-14.84	1	A
2	125.05	24.79 QP	33.06	-8.27	3.00 H	N/A	39.63	-14.84	2	B
3	125.08	24.28 QP	33.06	-8.78	3.00 H	N/A	39.13	-14.85	3	O
4	750.04	23.17 QP	35.56	-12.39	2.50 H	N/A	23.34	-0.17	1	K
5	750.04	24.29 QP	35.56	-11.27	2.00 H	N/A	24.46	-0.17	2	J
6	750.05	22.79 QP	35.56	-12.77	3.00 H	N/A	22.96	-0.17	3	I
7	875.00	26.87 QP	35.56	-8.69	2.50 H	N/A	24.81	2.06	1	N
8	875.05	25.38 QP	35.56	-10.18	1.50 H	N/A	23.32	2.06	2	H
9	875.06	25.17 QP	35.56	-10.39	2.00 H	N/A	23.11	2.06	3	G

- 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)
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value – Pre-Amplifier Factor(dB)
  5. Refer to item 4.5.5 and 4.5.6 for installation information.
  6. Only worst emission levels were recorded among the three installations.
  7. The emission from 9kHz to 30MHz was very low, therefore there's no data was shown on the report in the frequency range.

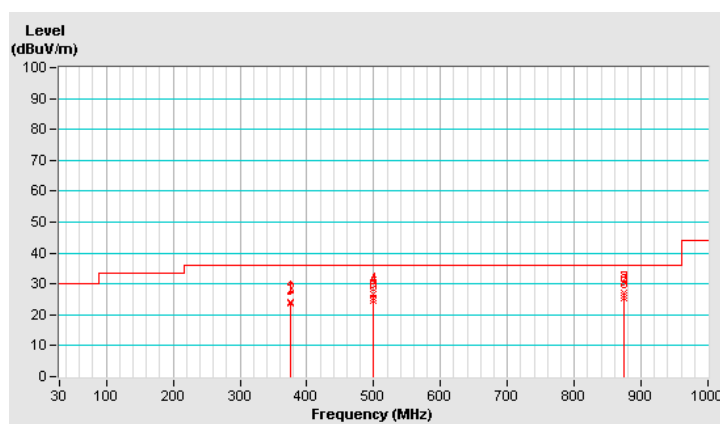




Frequency Range	9kHz ~ 1000MHz	Detector Function & Bandwidth	Quasi-Peak , 120 kHz
Input Power	120Vac, 60Hz	Environmental Conditions	23°C , 60%RH
Tested by	Rolan Zheng	Test Date	2015/5/3

Antenna Polarity & Test Distance : Vertical at 10 m										
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)	Installation	Point
1	375.02	24.15 QP	35.56	-11.41	1.25 V	N/A	33.29	-9.14	1	B
2	375.06	23.87 QP	35.56	-11.69	1.00 V	N/A	33.01	-9.14	2	F
3	375.10	23.54 QP	35.56	-12.02	1.50 V	N/A	32.68	-9.14	3	G
4	500.01	26.82 QP	35.56	-8.74	1.45 V	N/A	33.19	-6.37	1	M
5	500.05	25.38 QP	35.56	-10.18	1.30 V	N/A	31.75	-6.37	2	P
6	500.10	24.77 QP	35.56	-10.79	1.60 V	N/A	31.14	-6.37	3	E
7	875.02	27.18 QP	35.56	-8.38	1.40 V	N/A	25.12	2.06	1	N
8	875.06	25.46 QP	35.56	-10.10	1.55 V	N/A	23.40	2.06	2	L
9	875.15	26.33 QP	35.56	-9.23	1.30 V	N/A	24.27	2.06	3	D

- 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)
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value – Pre-Amplifier Factor(dB)
  5. Refer to item 4.5.5 and 4.5.6 for installation information.
  6. Only worst emission levels were recorded among the three installations.
  7. The emission from 9kHz to 30MHz was very low, therefore there's no data was shown on the report in the frequency range.



## 5 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).

## 6 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:

**Linko EMC/RF Lab**

Tel: 886-2-26052180

Fax: 886-2-26051924

**Hsin Chu EMC/RF/Telecom Lab**

Tel: 886-3-5935343

Fax: 886-3-5935342

**Hwa Ya EMC/RF/Safety Lab**

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

## **7 APPENDIX-A MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BYE THE LAB**

No modifications were made to the EUT by the lab during the test.

**--- END ---**