

FCC EVALUATION REPORT FOR CERTIFICATION

Applicant: Seahyun Korea Co., Ltd.
204 Byuksan Technopia, Sangdaewon-Dong,
Joongwon-Gu, Seongnam-Si, Kyonggi-Do, Korea
Attn: Mr. Sun-Jong, Jin / Director

Date of Issue: December 6, 2011
Order Number: GETEC-C1-11-274
Test Report Number: GETEC-E3-11-130
Test Site: Gumi College EMC Center
FCC Registration Number: (100749, 443957)

FCC ID. : A4UUSB100

Applicant : Seahyun Korea Co., Ltd.


Rule Part(s)	: FCC Part 15 Subpart B
Equipment Class	: Class B computing device peripheral (JBP)
EUT Type	: POF USB to Ethernet Dongle
Type of Authority	: Certification
Model Name	: GAIAGRID USB-100
Trade Name	: Gaiagrid

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2003 / Canadian standard ICES-003

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested by,

Reviewed by,


Hyun Kim, Engineer
GUMI College EMC center


Jae-Hoon Jeong, Senior Engineer
GUMI College EMC center



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Scope: Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and / or unintentional radiators for compliance with technical rules and regulations of the Federal Communications Commission.

1. General Information

Applicant: Seahyun Korea Co., Ltd.

**Applicant Address: 204 Byuksan Technopia, Sangdaewon-Dong, Joongwon-Gu, Seongnam-Si,
Kyonggi-Do, Korea**

Manufacturer: Seahyun Korea Co., Ltd.

**Manufacturer Address: 204 Byuksan Technopia, Sangdaewon-Dong, Joongwon-Gu, Seongnam-Si,
Kyonggi-Do, Korea**

Contact Person: Mr. Sun-Jong, Jin / Director

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- **FCC ID.** A4UUSB100
- **EUT Type** POF USB to Ethernet Dongle
- **Model Name** GAIAGRID USB-100
- **Trade Name** Gaiagrid
- **Serial Number** Prototype
- **Rule Part(s)** FCC Part 15 Subpart B
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.4 (2003) / Canadian standard ICES-003
- **Dates of Test** November 25 ~ 29, 2011
- **Place of Test** **Gumi College EMC Center** (FCC Registration Number: 100749, 443957)
407, Bugok-dong, Gumi-si, Gyeongbuk, Korea.
- **Test Report Number** GETEC-E3-11-130
- **Dates of Issue** December 6, 2011

EUT Type: POF USB to Ethernet Dongle

FCC ID.: A4UUSB100



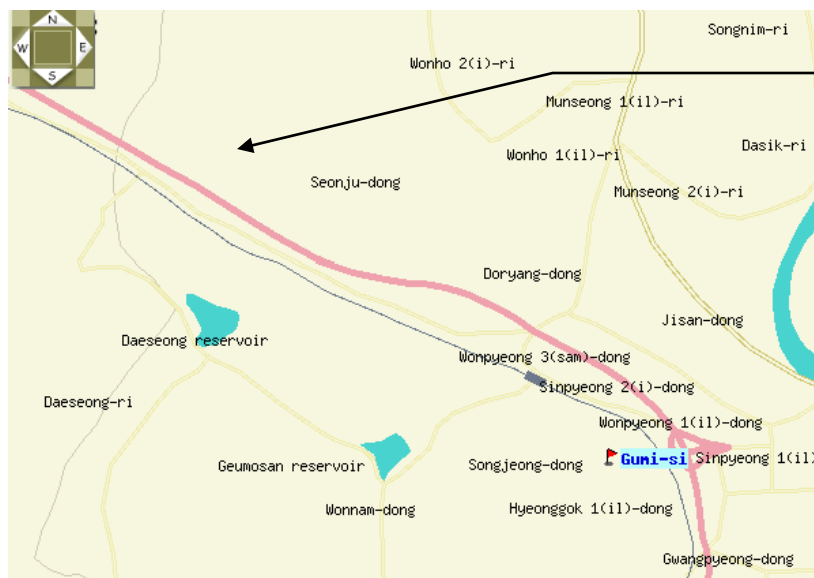
2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Nose Emissions From Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ASNI C63.4-2003) was used in determining radiated and conducted emissions emanating from **Seahyun Korea Co., Ltd. POF USB to Ethernet Dongle (Model Name: GAIAGRID USB-100)**

These measurement tests were conducted at **Gumi College EMC Center**.

The site address is 407, Bugok-dong, Gumi-si, Gyeongbuk, Korea.

This test site is one of the highest point of Gumi 1 college at about 200 km away from Seoul city and 40 km away from Daegu city. It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures. The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.4 (2003)



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Fig 1. The map above shows the Gumi College in vicinity area.



3. Product Information

3.1 Description of EUT

The Equipment under Test (EUT) is the **Seahyun Korea Co., Ltd. POF USB to Ethernet Dongle (Model Name: GAIAGRID USB-100) FCC ID.: A4UUSB100**

Parameter	GAIAGRID USB-100
Standard Compatibility	1. IEEE 802.3 Fast Ethernet 2. IEEE 802.3 Full Duplex Flow Control
Date Rate	100Mbps
Transmitting Length	50M at POF interface
Interface connector	Optolock POF transceiver
Equipped Cable	POF
LED Indication	Power status , FX link / active status
Operating Environment	Temperature : 0-50°C Humidity : 10-90%
Storage Environment	Temperature : -40-70°C Humidity : 10-90% (Non-condensing)
Dimension (W*D*H)	60*25*19mm
Total Weight	80g



3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID.
Notebook PC	SAMSUNG	NT-Q45	S/N: BR2693DQ300059J FCC ID.: DoC
POF media converter	Seahyun Korea Co., Ltd.	None.	S/N: None. FCCC ID.: N/A

See "Appendix D – Test Setup Photographs" for actual system test set-up

3.2.2 System configuration

Description	Manufacturer	Model Name	S/N & FCC ID.
None.	-	-	S/N: - FCC ID.: -

3.2.3 Used Cable(s)

Cable Name	Condition	Description
Optical cable	Connected to the EUT and POF media converter	1.20 m unshielded

3.3 Modification Item(s)

- None



4. Description of tests

4.1 Test Condition

The EUT was installed, arranged and operated in a manner that is most representative of equipment as typically used. The measurements were carried out while varying operating modes and cable positions within typically arrangement to determine maximum emission level.

The representative and worst test mode(s) were noted in the test report.

- Test Voltage / Frequency : AC 120 V / 60 Hz (DC 5 V supplied from the notebook PC)
- Test Mode(s): Network connecting mode



4.2 Conducted Emission

The Line conducted emission test facility is inside a 4 m × 8 m × 2.5 m shielded enclosure. (FCC Registration No.: 100749)

The EUT was placed on a non-conducting 1.0 m by 1.5 m table, which is 0.8 m in height and 0.4 m away from the vertical wall of the shielded enclosure.

The EUT is powered from the Rohde & Schwarz LISN (ESH2-Z5) and the support equipment is powered from the Rohde & Schwarz LISN (ESH3-Z5). Powers to the LISN are filtered by high-current high insertion loss power line filter.

Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

The RF output of the LISN was connected to the EMI test receiver (Rohde & Schwarz, ESCS30).

The EMI test receiver was scanned from 150 kHz to 30 MHz with 20 ms sweep time to determine the frequency producing the maximum EME from the EUT. The frequency producing the maximum level was re-examined using Quasi-Peak mode of the EMI test receiver.

The bandwidth of Quasi-peak mode was set to 9 kHz. Each emission was maximized consistent with typical applications by varying the configuration of the test sample. Interface cables were connected to the available interface ports of the test unit. The effect of varying the position of cables was investigated to find the configuration that produces maximum diagram emission. Excess cable lengths were bundled at center with 30 cm ~ 40 cm.

Each EME reported was calibrated using the R/S signal generator

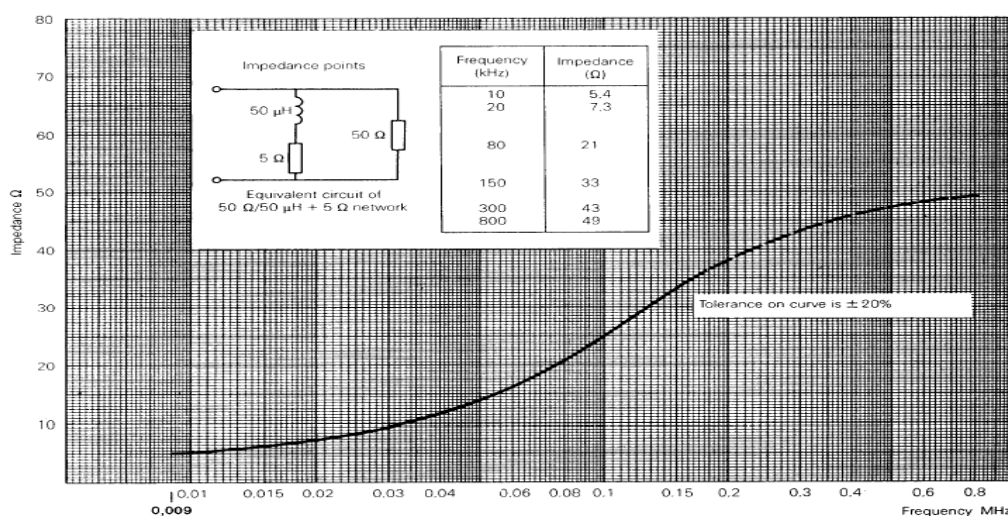


Fig 2. Impedance of LISN



4.3 Radiated Emission

Preliminary measurements were conducted 3 m semi anechoic chamber using broadband antennas to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The technology configuration, mode of operation and turntable azimuth with respect to antenna was note for each frequency found.

Final measurements were made 3 m chamber (FCC registration No.: 443957) and/or 10 m OATS (FCC registration No.: 100749).

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

Each frequency found during pre-scan measurements was re-examined and investigated using EMI test receiver. The detector function was set to CISPR quasi-peak mode average mode and the bandwidth of the receiver was set to 120 kHz or 1 MHz depending on the frequency or type of signal.

The EUT, support equipment and interconnecting cables were reconfigured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8 m high non-metallic 1.0 m × 1.5 m table.

The turntable containing the test sample was rotated; the antenna height was varied 1 to 4 meter and stopped at the azimuth or height producing the maximum emission.

Each EME reported was calibrated using the R/S signal generator

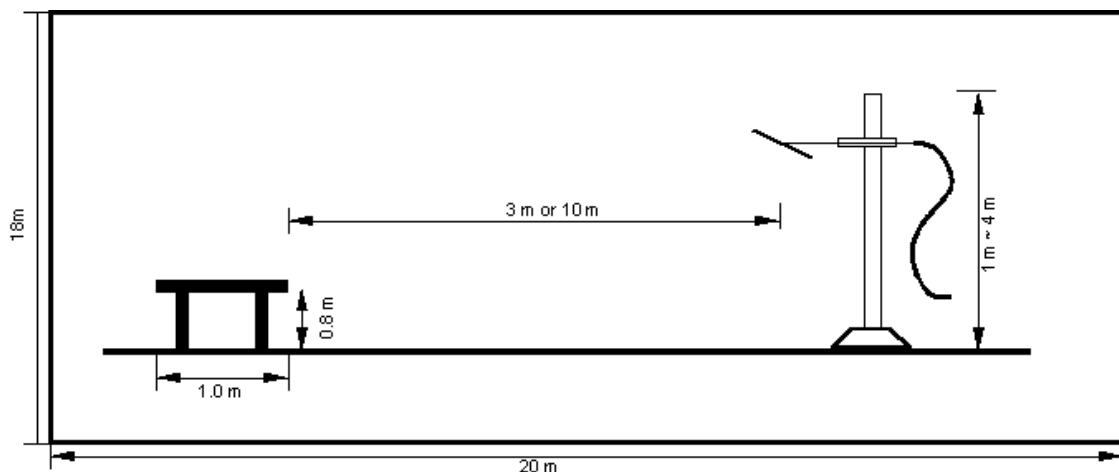


Fig 3. Dimensions of test site



5. Conducted Emission

5.1 Operating Environment

Temperature : 23.0 °C
Relative Humidity : 41.0 % R.H.

5.2 Test Set-up

The conducted emission measurements were performed in the shielded room.

The EUT was placed on wooden table, 0.8 m heights above the floor, 0.4 m from the reference ground plane (GRP) wall and 0.8 m from AMN & ISN.

AMN is bonded on horizontal reference ground plane.

The ground plane, which was electrically bonded to the shield room, ground system and all power lines entering the shield room, were filtered.

5.3 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement.”

The measurement uncertainty was given with a confidence of 95 %.

Test Items	Uncertainty	Remark
Conducted emission (9 kHz ~ 150 kHz)	± 2.71 dB	Confidence levels of 95 % ($k = 2$)
Conducted emission (150 kHz ~ 30 MHz)	± 3.34 dB	Confidence levels of 95 % ($k = 2$)



5.4 Limit

RFI Conducted	FCC Limit(dB μ V/m) Class B	
Freq. Range	Quasi-Peak	Average
150 kHz ~ 0.5 MHz	66 ~ 56*	56 ~ 46*
0.5 MHz ~ 5 MHz	56	46
5 MHz ~ 30 MHz	60	50
*Limits decreases linearly with the logarithm of frequency.		

5.5 Test Equipment used

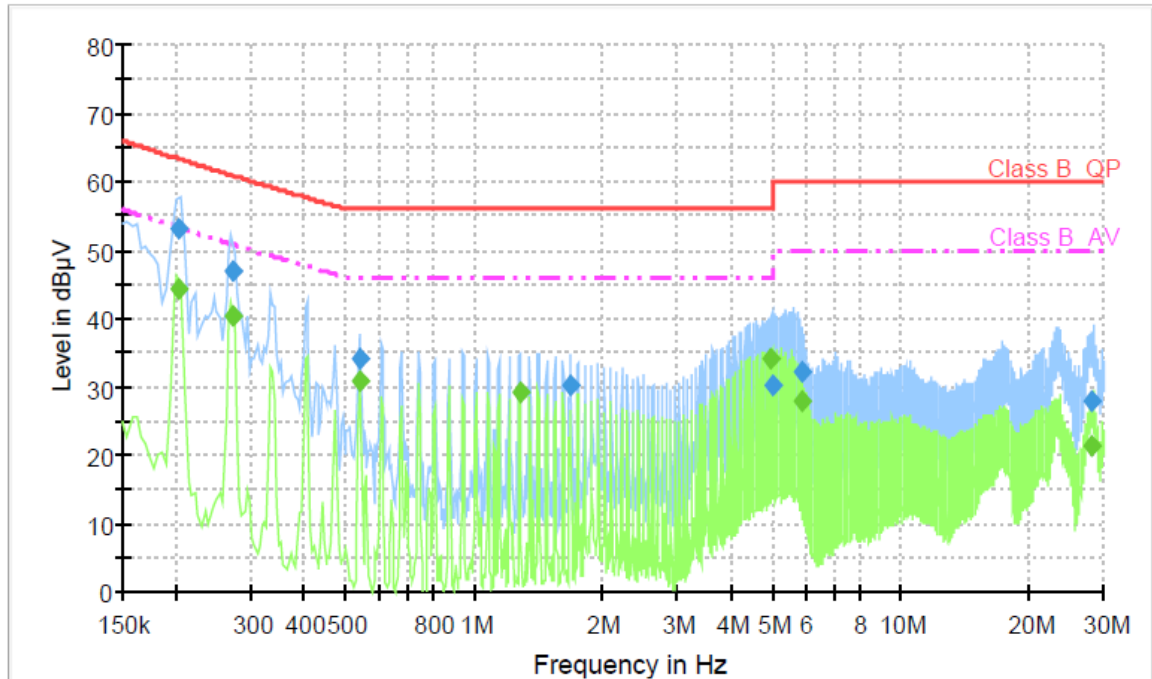
Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESCS30	Rohde & Schwarz	EMI Test Receiver	839809/003	12. 10. 2011
□ - ESH3-Z5	Rohde & Schwarz	LISN	838979/020	12. 10. 2011
■ - ESH2-Z5	Rohde & Schwarz	LISN	829991/009	12. 10. 2011
□ - ENY81-CA6	Rohde & Schwarz	ISN	101573	10. 19. 2012

5.6 Test data for Conducted Emission

- . Test Date : November 29, 2011
- . Resolution Bandwidth : 9 kHz
- . Frequency Range : 0.15 MHz ~ 30 MHz



Voltage with 4-Line-LISN_L1



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.204000	53.2	1000.000	9.000	GND	L1	10.1	10.1	63.3	
0.272000	46.9	1000.000	9.000	GND	L1	10.1	14.0	60.9	
0.540000	34.0	1000.000	9.000	GND	L1	10.1	22.0	56.0	
1.692000	30.2	1000.000	9.000	GND	L1	10.1	25.8	56.0	
4.996000	30.3	1000.000	9.000	GND	L1	10.3	25.7	56.0	
5.884000	32.1	1000.000	9.000	GND	L1	10.4	27.9	60.0	
28.180000	27.8	1000.000	9.000	GND	L1	11.2	32.2	60.0	

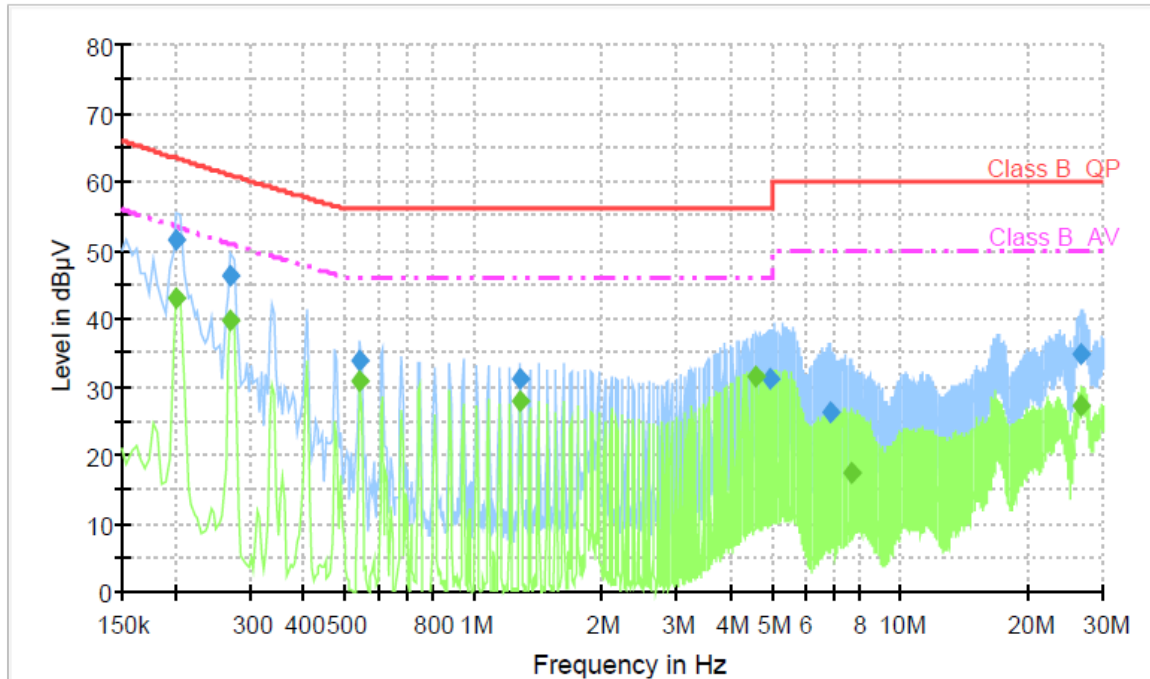
Final Measurement Detector 2

Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.204000	44.3	1000.000	9.000	GND	L1	10.1	9.0	53.3	
0.272000	40.3	1000.000	9.000	GND	L1	10.1	10.5	50.8	
0.540000	30.7	1000.000	9.000	GND	L1	10.1	15.3	46.0	
1.284000	29.3	1000.000	9.000	GND	L1	10.1	16.7	46.0	
4.940000	34.0	1000.000	9.000	GND	L1	10.3	12.0	46.0	
5.884000	27.9	1000.000	9.000	GND	L1	10.4	22.1	50.0	
28.196000	21.3	1000.000	9.000	GND	L1	11.2	28.7	50.0	

< Fig 4. Conducted emission result (Live line) >



Voltage with 4-Line-LISN_N



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.202000	51.6	1000.000	9.000	GND	N	10.1	11.8	63.4	
0.270000	46.4	1000.000	9.000	GND	N	10.1	14.5	60.9	
0.542000	33.9	1000.000	9.000	GND	N	10.1	22.1	56.0	
1.286000	31.1	1000.000	9.000	GND	N	10.1	24.9	56.0	
4.942000	31.2	1000.000	9.000	GND	N	10.3	24.8	56.0	
6.838000	26.1	1000.000	9.000	GND	N	10.4	33.9	60.0	
26.562000	34.8	1000.000	9.000	GND	N	10.7	25.2	60.0	

Final Measurement Detector 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.202000	42.8	1000.000	9.000	GND	N	10.1	10.5	53.3	
0.270000	39.8	1000.000	9.000	GND	N	10.1	11.1	50.9	
0.542000	30.7	1000.000	9.000	GND	N	10.1	15.3	46.0	
1.286000	27.8	1000.000	9.000	GND	N	10.1	18.2	46.0	
4.606000	31.6	1000.000	9.000	GND	N	10.3	14.4	46.0	
7.650000	17.4	1000.000	9.000	GND	N	10.4	32.6	50.0	
26.626000	27.4	1000.000	9.000	GND	N	10.7	22.6	50.0	

< Fig 5. Conducted emission result (Neutral line) >



6. Radiated Emission

6.1 Operating Environment

Temperature : 10.0 °C
Relative Humidity : 53.0 % R.H.

6.2 Test Set-up

A preliminary scan with peak mode was performed in the semi anechoic chamber and found frequency for test site. The formal radiated emission was measured at 10 m distance open area test site and 3 m distance anechoic chamber. The EUT was placed on a non-conductive turntable approximately 0.8 m above the ground plane. The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

6.3 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”.

The measurement uncertainty was given with a confidence of 95 %.

Test Items(Open area test site)	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 10 m, Vertical)	± 4.03 dB	Confidence levels of 95 % ($k = 2$)
Radiated emission (30 MHz ~ 300 MHz, 10 m, Horizontal)	± 3.96 dB	Confidence levels of 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 10 m, Vertical)	± 4.01 dB	Confidence levels of 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 10 m, Horizontal)	± 3.88 dB	Confidence levels of 95 % ($k = 2$)



6.4 Limit

Frequency (MHz)	FCC Limit @ 3 m. dB μ V/m	CISPR Limit @ 10 m. dB μ V/m
30 ~ 88	40.0	30.0
88 ~ 216	43.5	30.0
216 ~ 230	46.0	30.0
230 ~ 960	46.0	37.0
960 ~ 1 000	54.0	37.0
> 1 000	54.0	No Specified limit

6.5 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 11. 2011
■ - VULB9160	Schwarzbeck	Broadband Test Antenna	3193	03. 15. 2012
□ - BBHA9120D	Schwarzbeck	Horn ANT	207	12. 22. 2011
■ - MCU066	maturo GmbH	Position Controller	1390306	N/A
■ - TT2.5SI	maturo GmbH	Turntable	1390307	N/A
■ - AM 4.0	maturo GmbH	Antenna Mast	1390308	N/A
□ - AFS 44 00101800-25-10P-44	MITEQ	Preamplifier	1258943	11. 12. 2012

6.6 Test data for Radiated Emission

- . Test Date : November 25, 2011
 - . Measurement Distance : 3 m
 - . Note : The highest frequency of the internal source of the EUT is less than 108 MHz
 The measurement was made up to 1 000 MHz

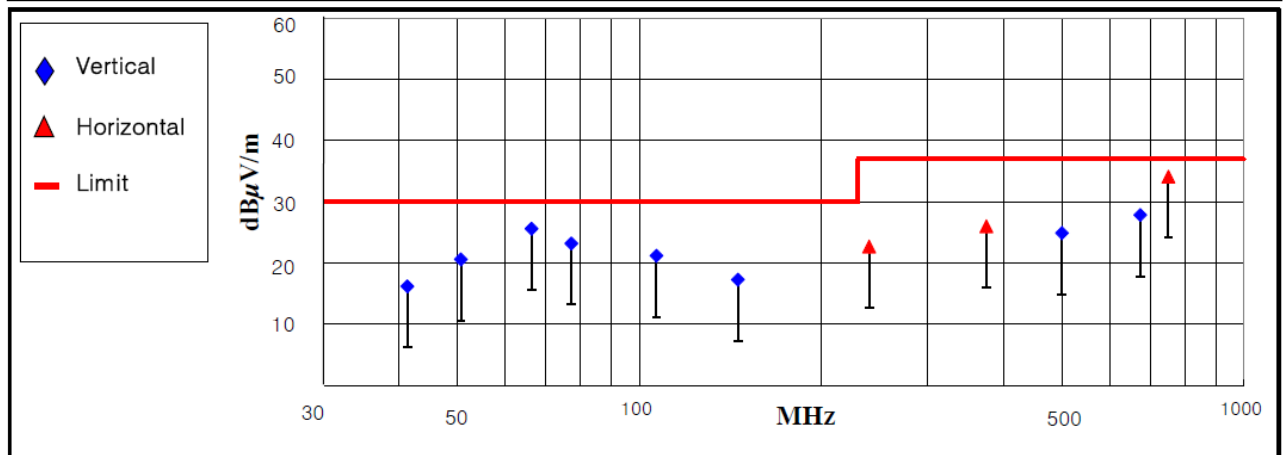
- . Measurement

Frequency range	30 MHz ~ 1 GHz	Above 1 GHz
Detector type	Quasi peak	Peak / Average
IF bandwidth	120 kHz	1 MHz



◆ Detector mode: Quasi-peak detector mode

Frequency (MHz)	Measurement Level				Limit (dBμ V/m)	Margin (dB)	Positioning System		
	Reading	Antenna	Cable	Test Result			Pol.	Height	Angle
	Value(dBμ V)	Factor(dB/m)	Loss(dB)	(dBμ V/m)			(H/V)	(cm)	(°)
41.32	3.53	11.12	1.55	16.20	30.00	13.80	V	100	95
50.67	9.62	9.25	1.73	20.60	30.00	9.40	V	102	154
66.31	15.13	8.46	2.01	25.60	30.00	4.40	V	100	180
77.19	12.48	8.52	2.20	23.20	30.00	6.80	V	165	245
106.73	8.51	10.07	2.62	21.20	30.00	8.80	V	143	200
145.55	2.28	11.91	3.11	17.30	30.00	12.70	V	132	100
239.99	4.97	13.57	4.16	22.70	37.00	14.30	H	195	196
375.05	5.27	15.39	5.34	26.00	37.00	11.00	H	250	124
500.10	1.06	17.53	6.31	24.90	37.00	12.10	V	145	10
673.89	0.42	19.89	7.54	27.85	37.00	9.15	V	100	90
750.18	5.29	20.76	8.05	34.10	37.00	2.90	H	100	36



< Fig 6. Radiated emission result (30 MHz ~ 1 000 MHz) >



7. Sample Calculations

$$\begin{aligned}\text{dB}\mu\text{V} &= 20 \text{ Log}_{10}(\mu\text{V}/\text{m}) \\ \text{dB}\mu\text{V} &= \text{dBm} + 107 \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)}\end{aligned}$$

7.1 Example 1 :

■ 20.3 MHz

$$\begin{aligned}\text{Class B Limit} &= 250 \mu\text{V} = 48 \text{ dB}\mu\text{V} \\ \text{Reading} &= 39.2 \text{ dB}\mu\text{V} \\ 10^{(39.2\text{dB}\mu\text{V}/20)} &= 91.2 \mu\text{V} \\ \text{Margin} &= 48 \text{ dB}\mu\text{V} - 39.2 \text{ dB}\mu\text{V} \\ &= 8.8 \text{ dB}\end{aligned}$$

7.2 Example 2 :

■ 66.7 MHz

$$\begin{aligned}\text{Class B Limit} &= 100 \mu\text{V}/\text{m} = 40.0 \text{ dB}\mu\text{V}/\text{m} \\ \text{Reading} &= 31.0 \text{ dB}\mu\text{V} \\ \text{Antenna Factor} + \text{Cable Loss} &= 5.8 \text{ dB} \\ \text{Total} &= 36.8 \text{ dB}\mu\text{V}/\text{m} \\ \text{Margin} &= 40.0 \text{ dB}\mu\text{V}/\text{m} - 36.8 \text{ dB}\mu\text{V}/\text{m} \\ &= 3.2 \text{ dB}\end{aligned}$$



8. Recommendation & Conclusion

The data collected shows that the **Seahyun Korea Co., Ltd. POF USB to Ethernet Dongle (Model Name: GAIAGRID USB-100)** complies with §15.107 and 15.109 of the FCC Rules.