GUMI COLLEGE
EMC CENTER

407, Bugok-Dong, Gumi-Si, Gyeongsangbuk-Do, Korea
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FCC EVALUATION REPORT FOR CERTIFICATION

Manufacturer : Kubong Information Technology Co., Ltd.

#1812, Sankyuk-2dong, Buk-Gu, Daegu, Korea.

Attn: Moo-Hee Park , President

Date of Issue : November 22, 2006

Test Report No. : GETEC-E3-06-069

Test Site : Gumi College EMC Center (Registration No.: 100749)

FCC ID.: RGTKBHP-01

Applicant : Kubong Information Technology Co., Ltd.

Rule Part(s)	**: FCC Part 15 Subpart B**
Equipment Class	**: Class B computing device peripheral (JBP)**
EUT Type	**: Hanaro Plus** (Computing device peripheral with Mic, Speaker, USB Hubs, and Memories)
Type of Authority	**: Certification**
Model No.	**: KBHP-01**

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

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 vest 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,

Dong-Hun Kang, Associate Engineer
GUMI College EMC center

Reviewed by,

Tae-Sig Park, Technical Manager
GUMI College EMC center

CONTENTS

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: Kubong Information Technology Co., Ltd.
Applicant Address: #1812,Sankyuk-2dong, Buk-Gu, Daegu Korea
Manufacturer: Kubong Information Technology Co., Ltd.
Manufacturer Address: #1812,Sankyuk-2dong, Buk-Gu, Daegu Korea
Contact Person: Moo-Hee Park , President
Tel. & Fax No.: Tel No.: +82-53-382-3803~5 Fax No.: +82-53-382-3807

- **EUT Type** Hanaro Plus
- **Model No.** KBHP-01
- **Serial No.** Proto type
- **Rule Part(s)** FCC Part 15 Subpart B
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.4 (2003)
- **Dates of Test** November 17~ 20, 2006
- **Place of Test** **Gumi College EMC Center** (FCC Registration No.: 100749)
  407, Bugok-Dong, Gumi-si, Gyeongsangbuk-Do, Korea
- **Test Report No.** GETEC-E3-06-069
- **Dates of Issue** November 22, 2006

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 9kHz to 40GHz (ASNI C63.4-2003) was used in determining radiated and conducted emissions emanating from **Kubong Information Technology Co., Ltd. Hanaro Plus (Model No.: KBHP-01)**

These measurement tests were conducted at **Gumi College EMC Center**.
The site address is 407, Bugok-Dong, Gumi-si, Gyeongsangbuk-Do, Korea
This test site is one of the highest point of Gumi 1 college at about 200 kilometers away from Seoul city and 40 kilometers away from Daege 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 on October 19, 1992

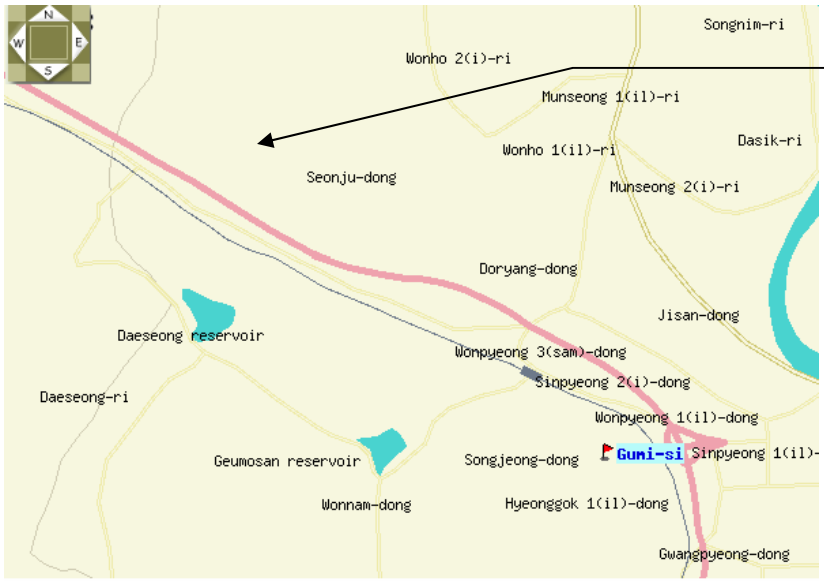

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Fig 1. The map above shows the Gumi College in vicinity area.

3. Product Information

3.1 Description of EUT

The Equipment Under Test (EUT) is the **Kubong Information Technology Co., Ltd. Hanaro Plus (Model No.: KBHP-01)**

Components	Spec
MIC Type : condenser	- Directional Pattern : Uni Directional 10db(180° ±45°) - Sensitivity : -47dB (±4dB) - Consuming Power : 0.75W below - S/N Ratio :60dB
Speaker Dimension : 2" 57¢	- Output : 5W Stereo - Impedance : 150ohm - Power : DC 5V - R.M.S : Satellite : 3W x 2 (THD10%/4Ohm) - S/N Ratio : 65dB - Frequency Response : 150Hz~ 20Khz
USB Hub	Port : A type USB port x 2 Interface : 2 port high-speed USB 2.0 Transmit Speed : 1.5 / 12 / 480Mbps Function : Computer Plug &Play Operational Temperature : 0~55 °c Operational Humidity : 10 ~ 90%
Flash Memory Port	Compatibleness : SD, CF Card

3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

Description	Manufacturer	Model No.	S/N & FCC ID
PC	Hewlett Packard	D530	S/N: CNG34800PY FCC ID: DoC
Video card	ATI	ATI RV360(9600)	S/N: SN0402017176 FCC ID: DoC
Printer	Hewlett Packard	970CXI	S/N: MY9B01F1FG FCC ID: DoC
Serial Mouse	LOGITECH	M-S69	S/N: 334684-108 FCC ID: JNZ211443
Key-board	COMPAQ	166516-AD6	S/N: B13BBOR391006D FCC ID: AQ6-23K15
Headset	GOWOONSORI	GW-500M	S/N: N/A FCC ID: DoC
USB Memory	TUV	E-D900-02-4570	S/N: N/A FCC ID: DoC
CF SD Memory	MP master	N/A	S/N: N/A FCC ID: DoC
Flash Memory	SAMSUNG	N/A	S/N: N/A FCC ID: DoC

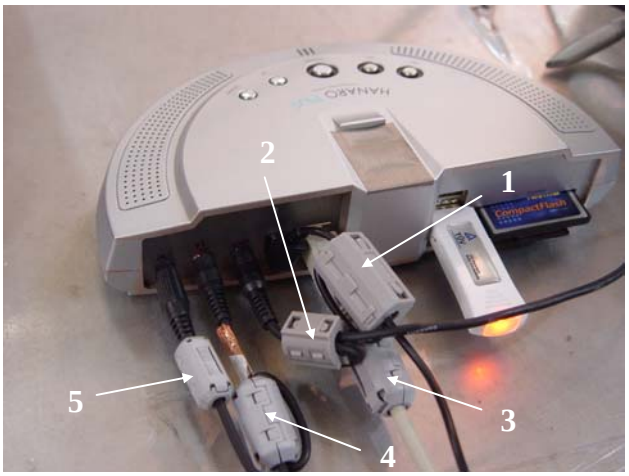
See "Appendix E – Test Setup Photographs" for actual system test set-up

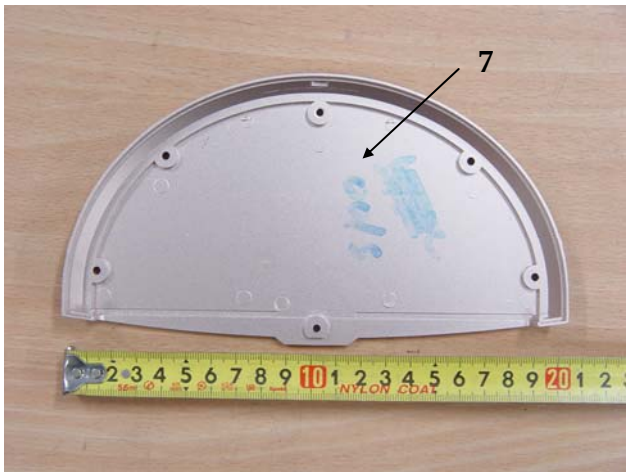
3.2.2 Used Cable(s)

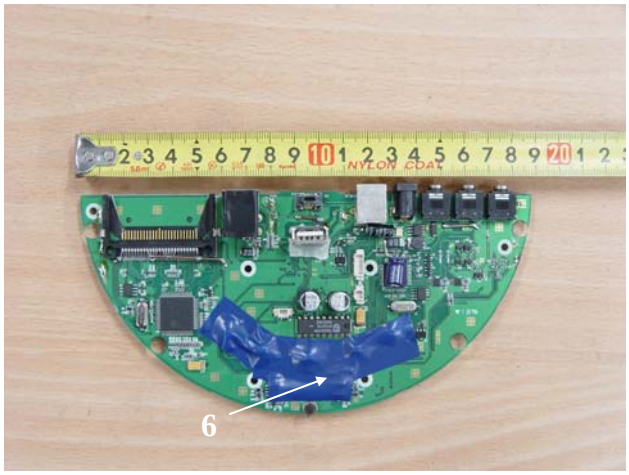
Cable No.	Condition	Description
Adapter cable	Connected to the Adapter	1.9m unshielded with 2 ferrite cores
USB power cable	Connected to the EUT and PC	1.8m shielded with a ferrite core
Earphone cable	Connected to the EUT	2.85m shielded with a ferrite core
Speaker cable	Connected to the EUT and PC	1.8m shielded with a ferrite core
Microphone cable	Connected to the EUT	1.8m shielded with a ferrite core
Power cable	Connected to the EUT	1.2m unshielded

3.3 Modification Item(s)

1) Added a clamp type ferrite core (Feelux:BNF-14)on the Adapter cable with one turn.
2) Added a clamp type ferrite core (Feelux:BNF-12) on the Earphone cable with one turn.
3) Added a clamp type ferrite core (TDK:ZCAT1730-0730) on the USB cable
4) Added a clamp type ferrite core (TDK:ZCAT1730-0730) Speaker cable with one turn
5) Added a clamp type ferrite core (TDK:ZCAT13250530) on the microphone cable with one turn.
6) Attached a isolation tape on the main board.
7) Sprinkled the inside of the case with EMI paint.







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 120V / 60Hz

- Test Mode(s)
  - The below operating modes were conducted at the same time
    1. Operated data downloading- erasing at USB memory, CF SD memory and Flash memory with an EMC software simultaneously.
    2. Played sound with movie player software.

4.2 Conducted Emission

The Line conducted emission test facility is inside a 4×8×2.5 meter shielded enclosure.
The EUT was placed on a non-conducting 1.0 by 1.5 meter table, which is 0.8 meters in height and 0.4 meters 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 150kHz to 30MHz with 20msec 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 9kHz. 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 – 40 centi-meters.
Each EME reported was calibrated using the R/S signal generator

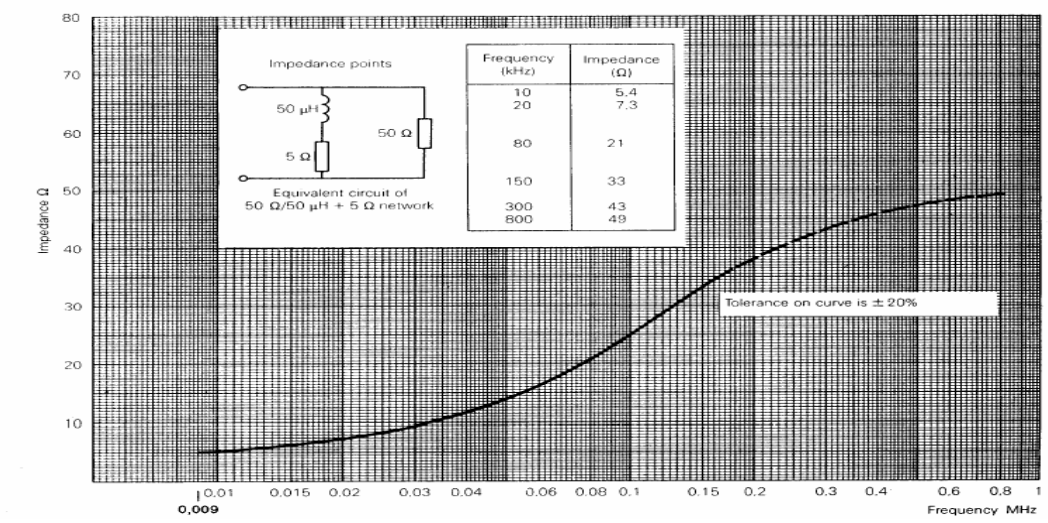


Fig 2. Impedance of LISN

4.3 Radiated Emission

Preliminary measurements were conducted 3m 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.

The spectrum was scanned from 30 to 1000MHz using bicornical log antenna (Schwarzbeck, VULB9160). Above 1GHz, horn antenna (Schwarzbeck, BBHA9120D) was used.

Final measurements were made outdoors at 3m/10m-test range.

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 120kHz or 1MHz 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 0.8m high non-metallic 1.0×1.5 meter 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

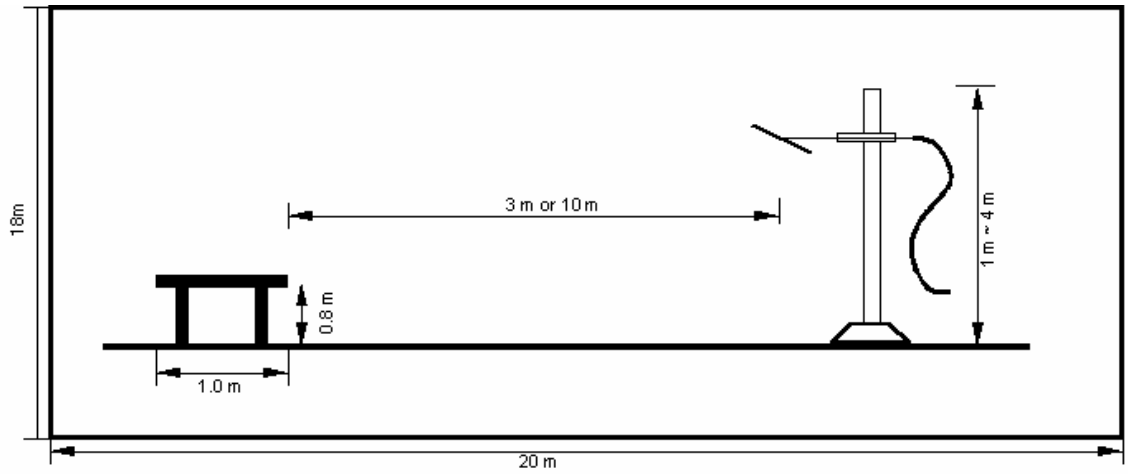


Fig 3. Dimensions of Open Site Test Area

5. Conducted Emission

5.1 Operating environment

Temperature : 21℃
Relative humidity : 39 %

5.2 Test set-up

The conducted emission measurements were performed in the shielded room.
The EUT was placed on wooden table, 0.8m heights above the floor, 0.4m from the reference ground plane (GRP) wall and 0.8m from AMN.
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%.

Contribution	Probability Distribution	Uncertainty (±dB)	
		Power Port	Communication port
Receiver specification	Rectangular	0.50	0.50
LISN coupling specification	Rectangular	1.50	
ISN coupling specification	Rectangular		1.50
Mismatch LISN VRC : Γl= 0.20 ISN VRC : Γl= 0.20 ATT VRC(IN) : Γg= 0.03 Uncertainty limits 20log(1± Γl Γg)	U-shaped	0.05 -0.05	0.05 -0.05
Mismatch Receiver VRC : Γl= 0.09 ATT VRC : Γg= 0.11 Uncertainty limits 20log(1± Γl Γg)	U-shaped	0.09 -0.09	0.09 -0.09
System repeatability	Std Deviation	0.55	0.55
Cable and input attenuator calibration	Normal (k=2)	0.08	0.08
Repeatability of EUT			
Combined standard uncertainty Uc(y)	Normal	1.07 -1.07	1.07 -1.07
Extended uncertainty U	Normal (k=2)	2.15 -2.15	2.15 -2.15

5.4 Limit

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

5.5 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due to calibration
■ -	ESCS30	Rohde & Schwarz	EMI test receiver	839809/003	12. 14. 2006
■ -	ESH3-Z5	Rohde & Schwarz	Artificial mains network	838979/020	12. 16. 2006
■ -	ESH2-Z5	Rohde & Schwarz	Artificial mains network	829991/009	12. 16. 2006

5.6 Test data for power line conducted emission

-. Test Date : November 17, 2006
-. Resolution bandwidth : 9kHz
-. Frequency range : 0.15MHz ~ 30MHz

Frequency (MHz)	Insertion Loss	Cable Loss	Pol.	Quasi-Peak[dBuV]			Average[dBuV]			Margin[dBuV]	
				Limit	Reading	Result	Limit	Reading	Result	Quasi	Average
0.150	0.07	-0.14	L1	66.00	46.3	46.23	56.00	41.6	41.53	19.77	14.47
0.250	0.12	-0.20	L1	61.76	39.1	39.02	51.76	36.4	36.32	22.74	15.44
0.355	0.12	-0.14	N	58.84	26.3	26.27	48.84	25.0	24.97	32.57	23.87
0.700	0.15	-0.23	L1	56.00	32.5	32.42	46.00	33.1	33.02	23.58	12.98
1.100	0.14	-0.24	N	56.00	32.1	32.01	46.00	32.3	32.21	24.00	13.80
1.545	0.16	-0.28	N	56.00	32.2	32.08	46.00	32.0	31.88	23.92	14.12
4.240	0.25	-0.14	N	56.00	33.9	34.01	46.00	33.9	34.01	21.99	11.99
5.540	0.30	-0.17	N	60.00	35.3	35.43	50.00	35.3	35.43	24.57	14.57
22.120	0.64	0.12	N	60.00	31.5	32.26	50.00	31.3	32.06	27.74	17.94

*Comment : Pol : H (Live), N(Neut)
Insertion Loss : Insertion Loss of LISN
Cable Loss : Cable Loss + Pulse Limiter Insertion loss value

6. Radiated Emission

6.1 Operating environment

Temperature : 15℃
Relative humidity : 36 %

6.2 Test set-up

A preliminary scan with peak mode was performed in the semi anechoic chamber and found frequency for open area test site.
The formal radiated emission was measured at 3m/10m-distance open area test site.
The EUT was placed on a non-conductive turntable approximately 0.8 meters above the ground plane.
The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 and 4.0 meters 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%.

Contribution	Probability Distribution	Uncertainty (dB)			
		Biconical Ant.		Log-periodic Ant.	
		3m	10m	3m	10m
Ambient signal					
Antenna factor calibration	Normal (k=2)	0.50	0.50	0.50	0.50
Receiver specification	Rectangular	0.50	0.50	0.50	0.50
Antenna directivity	Rectangular	0.25	0.00	1.50	0.25
Antenna phase center variation	Rectangular	0.00	0.00	1.00	0.20
Antenna factor frequency interpolation	Rectangular	0.25	0.25	0.25	0.25
Measure distance variation	Rectangular	0.60	0.40	0.60	0.40
Site imperfections	Rectangular	-2.00	-2.40	2.50	2.40
Mismatch Receiver VRC : Γl= 0.09 Antenna VRC : Γg= 0.43 (Bi) 0.23 (Lp) Uncertainty limits 20log(1± Γl Γg)	U-shaped	0.33 -0.35	0.33 -0.35	0.18 -0.18	0.18 -0.18
System repeatability	Std Deviation	0.82	0.82	0.79	0.79
Cable loss calibration	Normal (k=2)	0.09	0.09	0.09	0.09
Combined standard uncertainty Uc(y)	Normal	1.54 -1.54	1.70 -1.70	2.03 -2.03	1.68 -1.68
Extended uncertainty U	Normal (k=2)	3.09 -3.09	3.39 -3.40	4.05 -4.05	3.36 -3.36

6.4 Limit

Frequency (MHz)	FCC Limit @ 3m. dB μV/m	CISPR Limit @ 10m. dB μV/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 – 1000	54.0	37.0

6.5 Test equipment used

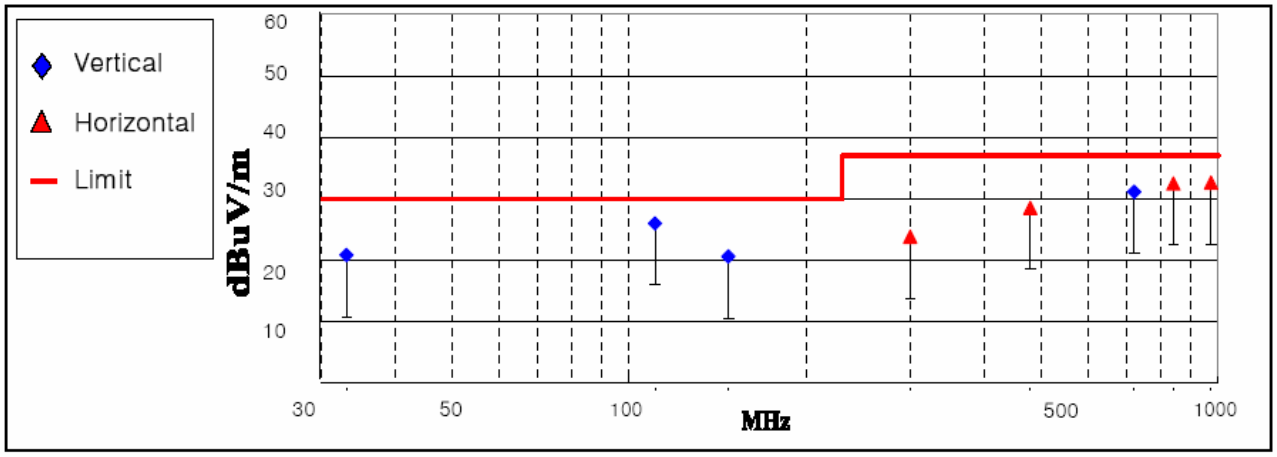
	Model Number	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 02. 2006
■ -	ESCS30	Rohde & Schwarz	EMI test receiver	839809/003	12. 14. 2006
■ -	HK116	Rohde & Schwarz	Biconical ANT	826861/018	12. 02. 2006
■ -	HL223	Rohde & Schwarz	Log-periodic antenna	829228/011	12. 02. 2006
■ -	HD100	HD GmbH	Position Controller	100/692/01	N/A
■ -	DS415S	HD GmbH	Turntable	415/657/01	N/A
■ -	MA240	HD GmbH	Antenna Mast	240/565/01	N/A
■ -	BBHA9120D	Schwarzbeck	Horn ANT	207	11.26.2006
■	87405A	Agilent	Preamplifier	MY39500777	N/A

6.6 Test data for radiated emission

-. Test Date : November 20, 2006
-. Resolution bandwidth : 120kHz
-. Frequency range : 30MHz ~ 1000MHz
-. Measurement distance : 10m

♦ Operating Condition: Normal operating mode
Detector mode: Quasi- peak detector mode

Frequency (MHz)	Measurement Level				Limit (dBuV/m)	Margin (dBuV/m)	Positioning System		
	Reading Value(dBuV)	Antenna Factor(dB)	Cable Loss(dB)	Test Result (dBuV/m)			Pol. (H/V)	Height (cm)	Angle (deg)
33.12	6.3	12.76	1.72	20.8	30.0	9.2	V	185	12
110.61	12.8	10.34	2.81	25.9	30.0	4.1	V	210	326
147.48	5.1	12.10	3.34	20.5	30.0	9.5	V	145	185
300.06	6.3	12.34	5.10	23.7	37.0	13.3	H	230	252
480.06	4.9	17.05	6.50	28.5	37.0	8.5	H	395	270
720.55	2.3	20.76	8.02	31.1	37.0	5.9	V	190	190
840.12	1.5	22.18	8.74	32.4	37.0	4.6	H	300	100
972.12	0.2	22.78	9.60	32.6	37.0	4.4	H	228	90



< Fig 4. Radiated emission result (30MHz ~ 1000MHz)>

7. Sample Calculations

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

7.1 Example 1 :

■ **20.3 MHz**

Class B Limit = **250 μV** = **48 dBμV**

Reading = **- 67.8 dBm(Calibrated level)**

Convert to dBμV = **- 67.8 dBm + 107** = **39.2 dBμV**

$10^{(39.2dB\mu V/20)}$ = **91.2 μV**

Margin = **39.2 – 48** = **-8.8**

= **8.8 dB below Limit**

7.2 Example 2 :

■ **66.7 MHz**

Class B Limit = **100 μV/m** = **40.0 dBμV/m**

Reading = **- 76.0 dBm(Calibrated level)**

Convert to dBμV/m = **- 67.8 dBm + 107** = **31.0 dBμV/m**

Antenna Factor + Cable Loss = **5.8 dB**

Total = **36.8 dBμV/m**

Margin = **36.8 – 40.0** = **-3.2**

= **3.2 dB below Limit**

8. Recommendation & conclusion

The data collected shows that the **Kubong Information Technology Co., Ltd. Hanaro Plus (Model No.: KBHP-01)** was complies with §15.107 and 15.109 of the FCC Rules.