FCC EVALUATION REPORT FOR CERTIFICATION

Applicant : OHSUNG ELECTRONICS CO., LTD.
#181 Gongdan-dong, Gumi-si, Gyeongbuk,
Republic of Korea
Attn: Mr. Hak-Ki Kim / General Manager

Date of Issue : April 13, 2011
Order Number: GETEC-C1-11-078
Test Report Number: GETEC-E3-11-029
Test Site: Gumi College EMC Center
FCC Registration Number: (100749, 443957)

FCC ID. : OZ5URCTKP2000

Applicant : OHSUNG ELECTRONICS CO., LTD.

Rule Part(s)	**: FCC Part 15 Subpart B**
Equipment Class	**: Class B computing device peripheral (JBP)**
EUT Type	**: Network Keypad**
Type of Authority	**: Certification**
Model Name	**: TKP-2000**
Trade Name	**: UNIVERSAL Remote Control**

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,

Soon Hoon

Soon-Hoon Jeong, Associate Engineer
GUMI College EMC center

Reviewed by,

Jae-Hoon Jeong, Senior Engineer
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

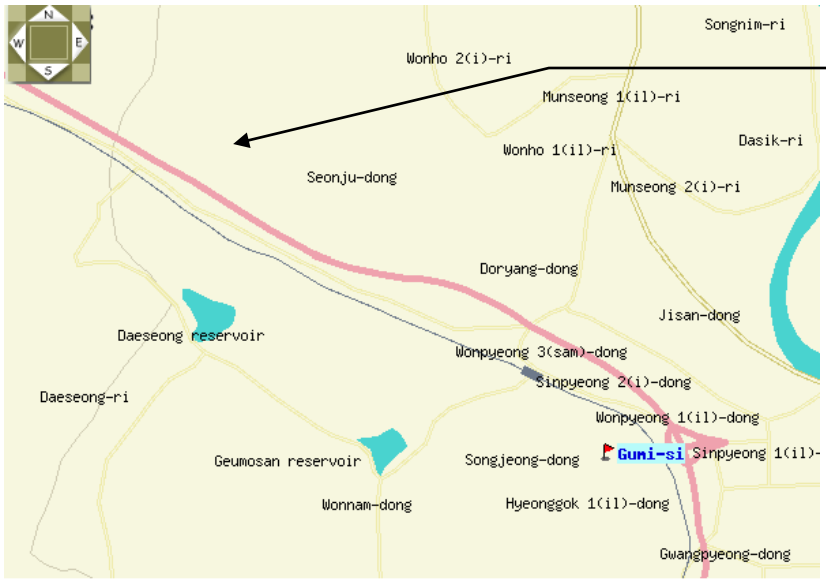
Applicant: OHSUNG ELECTRONICS CO., LTD.
Applicant Address: #181 Gongdan-dong, Gumi-si, Gyeongbuk, Republic of Korea
Manufacturer: OHSUNG ELECTRONICS CO., LTD.
Manufacturer Address: #181 Gongdan-dong, Gumi-si, Gyeongbuk, Republic of Korea
Contact Person: Mr. Hak-Ki Kim / General Manager
Tel. Number: +82-54-468-7281 Fax Number: +82-54-461-8368

- **FCC ID.** OZ5URCTKP2000
- **EUT Type** Network Keypad
- **Model Name** TKP-2000
- **Trade Name** UNIVERSAL Remote Control
- **Serial Number** Prototype
- **Rule Part(s)** FCC Part 15 Subpart B
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.4 (2003)
- **Dates of Test** April 6 ~ 7, 2011
- **Place of Test** **Gumi College EMC Center** (FCC Registration Number: 100749, 443957) 407, Bugok-dong, Gumi-si, Gyeongbuk, Korea.
- **Test Report Number** GETEC-E3-11-029
- **Dates of Issue** April 13, 2011

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 **OHSUNG ELECTRONICS CO., LTD. Network Keypad (Model Name: TKP-2000)**

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)



GUMI COLLEGE EMC CENTER
407, Bugok-dong, Gumi-si,
Gyeongbuk 730-711, Korea.
Tel: +82-54-440-1195
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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 **OHSUNG ELECTRONICS CO., LTD. Network Keypad (Model Name: TKP-2000) FCC ID.: OZ5URCTKP2000**

-. Crystal & Clock Frequency	: 32.768 kHz, CPU X-TAL (12 MHz), Ethernet chip (25 MHz) on main board
-. Number of Layer	: Main board: 6 layer Sub board: 2 layer
-. Microprocessor	: 190 MHz RISC
-. Memory	: 128 MB Flash
-. Devices	: Supports up to 255 devices
-. Pages	: Supports up to 255 pages on each device
-. Macro Capability	: Up to 255 steps
-. LCD	: 3.5 inch
-. Weight	: 9.84 oz
-. Size	: 5.75” × 4.7” × 1.8”
-. Power	: Standard PoE Injector or PoE switch (Purchased separately)

3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID.
Switching hub	OHSUNG ELECTRONICS CO., LTD.	MFSPOE-8	S/N: N/A FCC ID.: OZ5URCMFSPOE8

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
LAN cable	Connected to the EUT and switching hub	2.00 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 switching hub)
- Test Mode(s): Connected to the Network via switching hub

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

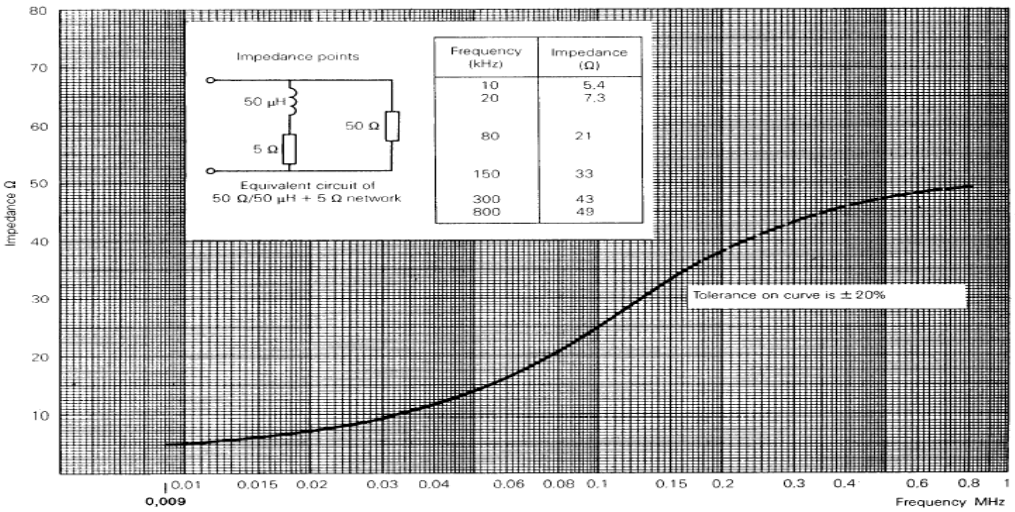


Fig 2. Impedance of LISN

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

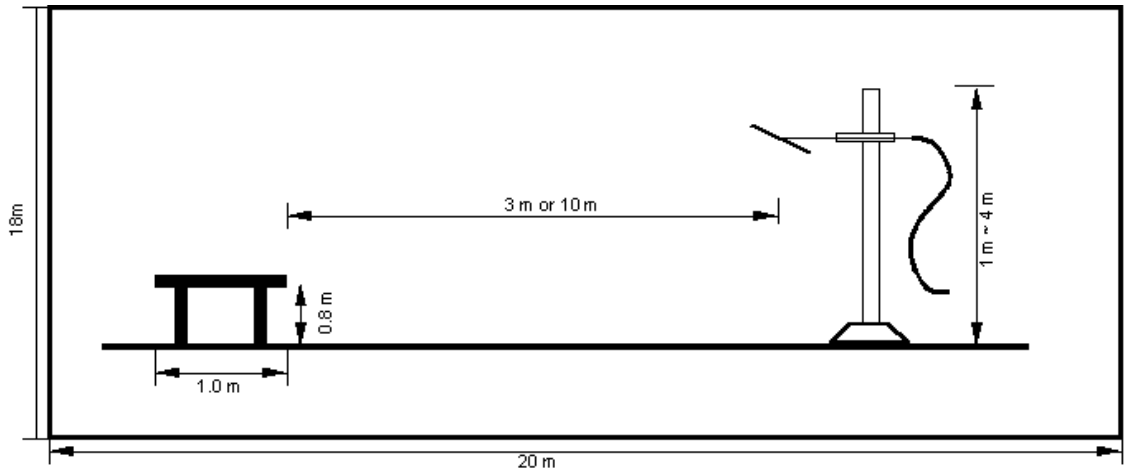


Fig 3. Dimensions of test site.

5. Conducted Emission

5.1 Operating Environment

Temperature : 23 ℃
Relative Humidity : 37 % 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 μV/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.		

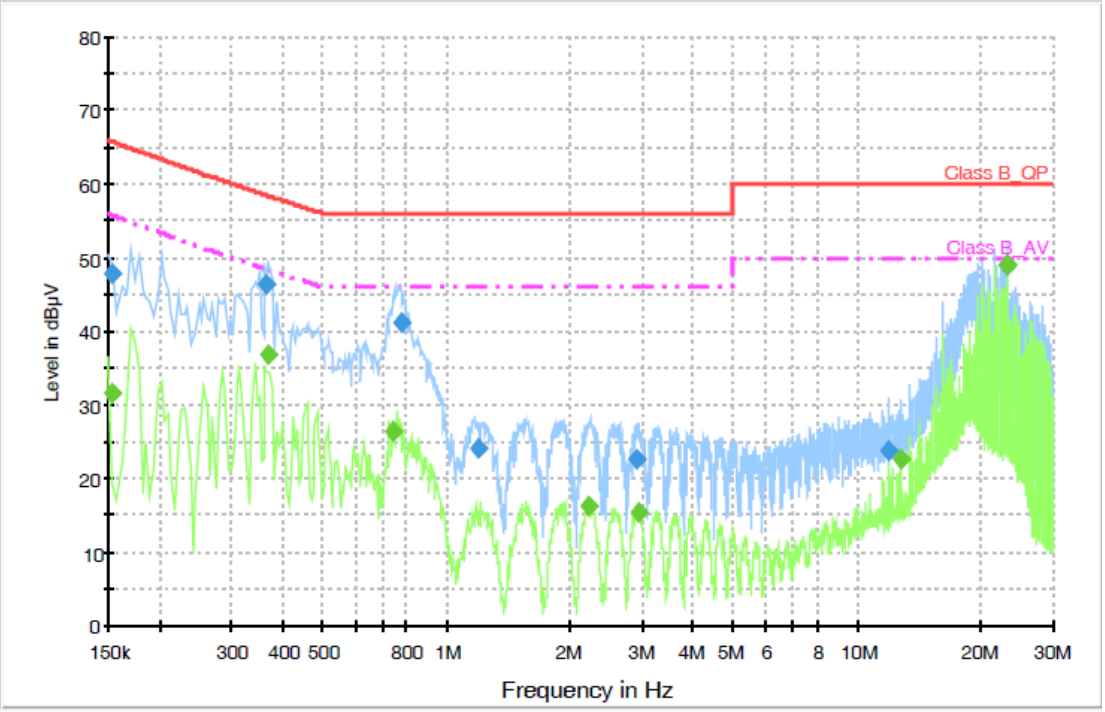
5.5 Test Equipment used

	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
■ -	ISN T8	TESEQ. GmbH	Impedance Network	24568	11. 09. 2011

5.6 Test data for Conducted Emission

-. Test Date : April 7, 2011
-. Resolution Bandwidth : 9 kHz
-. Frequency Range : 0.15 MHz ~ 30 MHz

Voltage with 4-Line-LISN_L1



Final Measurement Detector 1

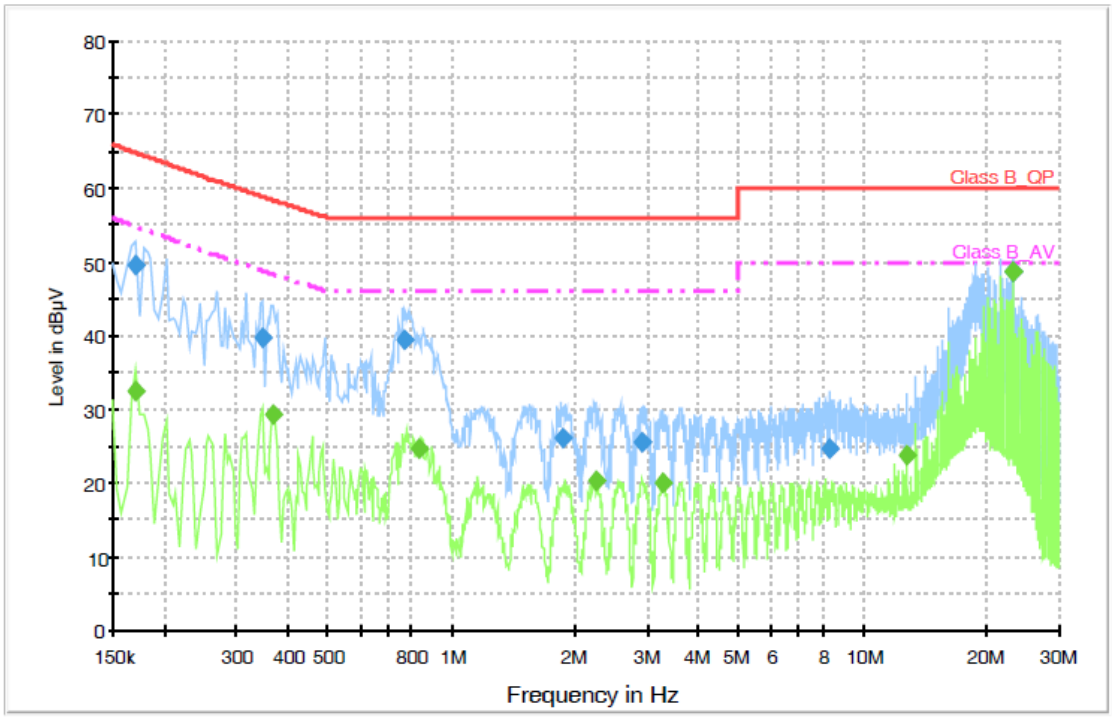
Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.154000	47.8	1000.000	9.000	GND	L1	10.1	18.0	65.8	
0.366000	46.5	1000.000	9.000	GND	L1	10.1	11.9	58.4	
0.778000	41.2	1000.000	9.000	GND	L1	10.1	14.8	56.0	
1.202000	23.9	1000.000	9.000	GND	L1	10.1	32.1	56.0	
2.918000	22.5	1000.000	9.000	GND	L1	10.2	33.5	56.0	
11.954000	23.6	1000.000	9.000	GND	L1	10.7	36.4	60.0	
23.126000	49.0	1000.000	9.000	GND	L1	11.2	11.0	60.0	

Final Measurement Detector 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.154000	31.6	1000.000	9.000	GND	L1	10.1	24.2	55.8	
0.370000	36.9	1000.000	9.000	GND	L1	10.1	11.4	48.3	
0.746000	26.3	1000.000	9.000	GND	L1	10.1	19.7	46.0	
2.230000	16.2	1000.000	9.000	GND	L1	10.2	29.8	46.0	
2.950000	15.5	1000.000	9.000	GND	L1	10.2	30.5	46.0	
12.806000	22.6	1000.000	9.000	GND	L1	10.8	27.4	50.0	
23.126000	48.9	1000.000	9.000	GND	L1	11.2	1.1	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
0.170000	49.6	1000.000	9.000	GND	N	10.1	15.3	64.9	
0.346000	39.7	1000.000	9.000	GND	N	10.1	19.2	58.9	
0.766000	39.5	1000.000	9.000	GND	N	10.1	16.5	56.0	
1.874000	26.2	1000.000	9.000	GND	N	10.2	29.8	56.0	
2.902000	25.4	1000.000	9.000	GND	N	10.2	30.6	56.0	
8.354000	24.7	1000.000	9.000	GND	N	10.5	35.3	60.0	
23.126000	48.8	1000.000	9.000	GND	N	10.8	11.2	60.0	

Final Measurement Detector 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.170000	32.5	1000.000	9.000	GND	N	10.1	22.4	54.9	
0.370000	29.2	1000.000	9.000	GND	N	10.1	19.1	48.3	
0.834000	24.5	1000.000	9.000	GND	N	10.1	21.5	46.0	
2.238000	20.2	1000.000	9.000	GND	N	10.2	25.8	46.0	
3.266000	19.9	1000.000	9.000	GND	N	10.3	26.1	46.0	
12.806000	23.8	1000.000	9.000	GND	N	10.7	26.2	50.0	
23.126000	48.6	1000.000	9.000	GND	N	10.8	1.4	50.0	

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

6. Radiated Emission

6.1 Operating Environment

Temperature : 24 ℃
Relative Humidity : 40 % 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 μV/m	CISPR Limit @ 10 m. 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 ~ 1 000	54.0	37.0
> 1 000	54.0	No Specified limit

6.5 Test Equipment used

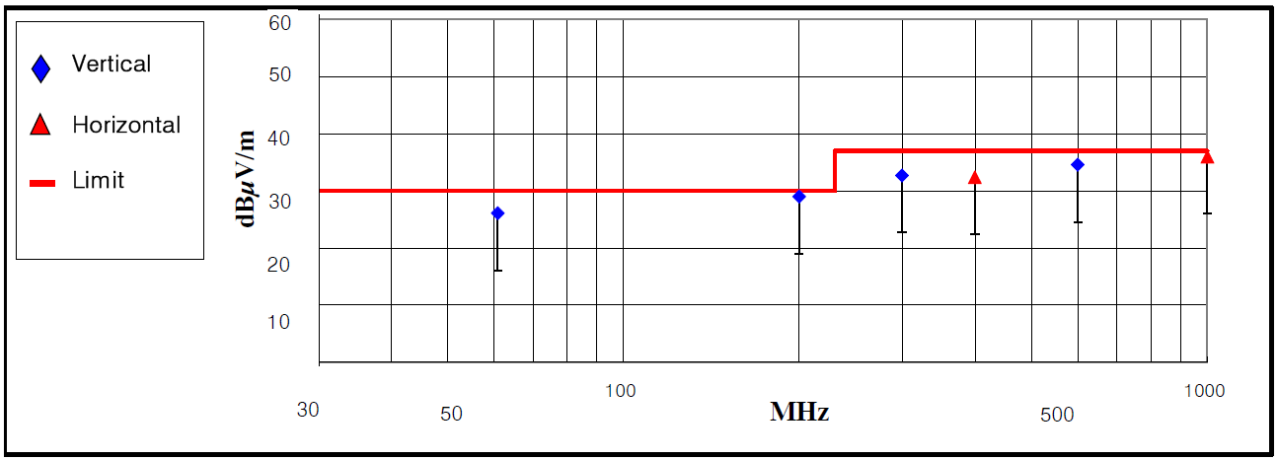
	Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESCS30	Rohde & Schwarz	EMI Test Receiver	839809/003	12. 10. 2011
■ -	HK116	Rohde & Schwarz	Biconical Antenna	832639/007	03. 15. 2012
■ -	HL223	Rohde & Schwarz	Log Periodic Antenna	835998/004	03. 15. 2012
■ -	HD100	HD GmbH	Position 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
☐ -	ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 10. 2011
☐ -	VULB9160	Schwarzbeck	Broadband Test Antenna	3193	03. 15. 2012
☐ -	BBHA9120D	Schwarzbeck	Horn Antenna	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. 2011

6.6 Test data for Radiated Emission

-. Test Date : April 6, 2011
-. Resolution Bandwidth : 120 kHz
-. Frequency Range : 30 MHz ~ 1 000 MHz
-. Measurement Distance : 10 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

♦ Detector mode: Quasi-peak detector mode

Frequency (MHz)	Measurement Level				Limit (dBμV/m)	Margin (dB)	Positioning System		
	Reading Value(dBμV)	Antenna Factor(dB/m)	Cable Loss(dB)	Test Result (dBμV/m)			Pol. (H/V)	Height (cm)	Angle (°)
60.90	16.08	8.10	1.92	26.10	30.00	3.90	V	100	311
199.97	10.72	14.51	3.77	29.00	30.00	1.00	V	100	86
300.00	15.06	12.92	4.72	32.70	37.00	4.30	V	100	351
399.96	10.68	16.21	5.53	32.42	37.00	4.58	H	110	228
600.00	8.55	19.01	7.02	34.58	37.00	2.42	V	108	180
999.97	2.64	23.72	9.64	36.00	37.00	1.00	H	100	138



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

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 = 39.2 dBμV

$10^{(39.2dB\mu V/20)}$ = 91.2 μV

Margin = 48 dBμV - 39.2 dBμV

= 8.8 dB

7.2 Example 2 :

■ **66.7 MHz**

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

Reading = 31.0 dBμV

Antenna Factor + Cable Loss = 5.8 dB

Total = 36.8 dBμV/m

Margin = 40.0 dBμV/m – 36.8 dBμV/m

= 3.2 dB

8. Recommendation & Conclusion

The data collected shows that the **OHSUNG ELECTRONICS CO., LTD. Network Keypad (Model Name: TKP-2000)** was complies with §15.107 and 15.109 of the FCC Rules.