GUMI COLLEGE
EMC CENTER

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FCC EVALUATION REPORT FOR CERTIFICATION

FCC Class B (Class II Permissive Change)

Manufacturer : OHSUNG ELECTRONICS CO., LTD
#181 Gongdan-Dong, Gumi, GyeongBuk
Republic of Korea
Attn : Mr. Kwang-Jae Ok / Team Leader of Q.C

Date of Issue : August 7, 2007
Test Report S/N : GETEC-E3-07-063
Test Site : Gumi College EMC Center

FCC ID	**OZ5URCMX900**
APPLICANT	**OHSUNG ELECTRONICS CO., LTD**

Rule Part(s)	**: FCC Part 15 Subpart C**
Equipment Class	**: Remote Control Transmitter (DSC)**
EUT Type	**: RF Transmitter Universal Remote**
Type of Authority	**: Certification**
Model No.	**: MX-900**
Trade name	**: UNIVERSAL remote control**
Class II Change(s)	**: Changed the component values inside of RF module(OTMF-A513TYPE)**

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,

Jae-Hoon Jeong, Senior Engineer
GUMI College EMC center

Reviewed by,

Tae-Sig Park, Technical Manger
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: OHSUNG ELECTRONICS CO., LTD.

Applicant Address: #181 Gongdan-Dong, Gumi-Si, Gyeongsangbuk-do, Korea

Manufacturer: OHSUNG ELECTRONICS CO., LTD

Manufacturer Address: #181 Gongdan-Dong, Gumi-Si, Gyeongsangbuk-do, Korea

Contact Person: Mr. Kwang-Jae Ok / Team Leader Q.C

Tel. & Fax No.: Tel No.: +82-54-468- 0831 Fax No.: +82-54- 461- 8368

- **FCC ID.** OZ5URCMX900
- **Equipment Class** Remote Control Transmitter (DSC)
- **EUT Type** Remote Controller
- **Power Source** DC 6V supplied from four AAA size batteries
- **Model No.** MX-900
- **Rule Part(s)** FCC Part 15 Subpart C
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.4 (2003)
- **Dates of Test** July 19, 2007
- **Place of Test** **Gumi College EMC Center** (FCC Registration No.: 100749)
  407, Bugok-Dong, Gumi-si, Gyeongsangbuk-Do, Korea
- **Test Report No.** GETEC-E3-07-063
- **Class II Change(s)** Changed the component values inside of RF module(OTMF-A513TYPE)

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 **OHSUNG ELECTRONICS CO., LTD. RF Remote Controller (Model No.: MX-900)**

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

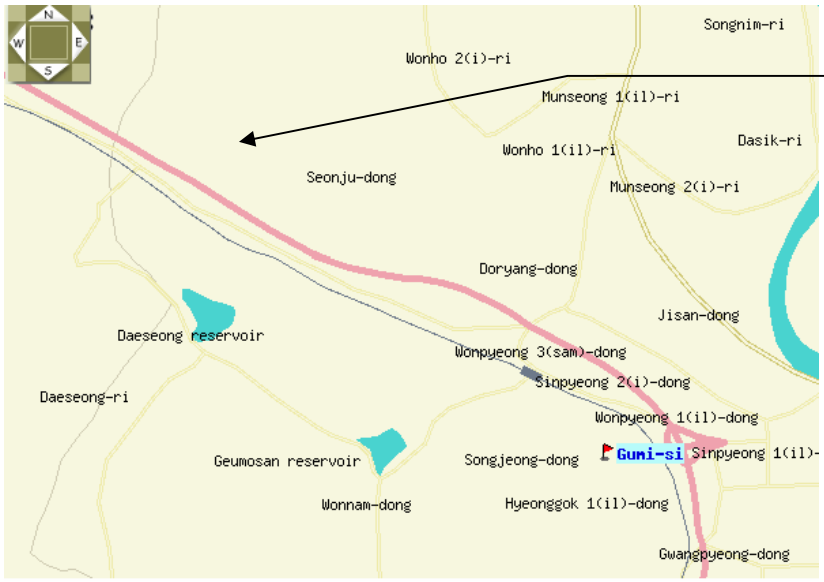

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Fig 1. The map above shows the Gumi College in vicinity area.

3. Product Information

3.1 Description of EUT

The Equipment Under Test (EUT) is the **OHSUNG ELECTRONICS CO., LTD. RF Remote Controller (Model No.: MX-900) FCC ID.:OZ5URCMX900**

Rate of Power supply	: DC 6V supplied from four AAA size batteries
RF Frequency	: 418MHz ± 0.5 MHz
External Connector	: USB
Crystal & Clock Frequency	: 6MHz & 8MHz on Main B' D 13.560MHz on RF Module B'D
Number of Layer	: 2 Layer

3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

Description	Manufacturer	Model No.	S/N & FCC ID
None	-	-	-

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

3.2.2 Used Cable(s)

Cable No.	Condition	Description
None	-	-

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: DC 6V supplied from four AAA size batteries

- Test Mode(s)
  -. RF mode: RF transmitting mode

5. Antenna Requirement - §15.203

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the applicant can be used with the device. The use of permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.

5.1 Description of Antenna

The **OHSUNG ELECTRONICS CO., LTD RF Transmitter Universal Remote Control** comply with the requirement of §15.203 with a built-in looped antenna permanently attached to the transmitter.

5.2 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

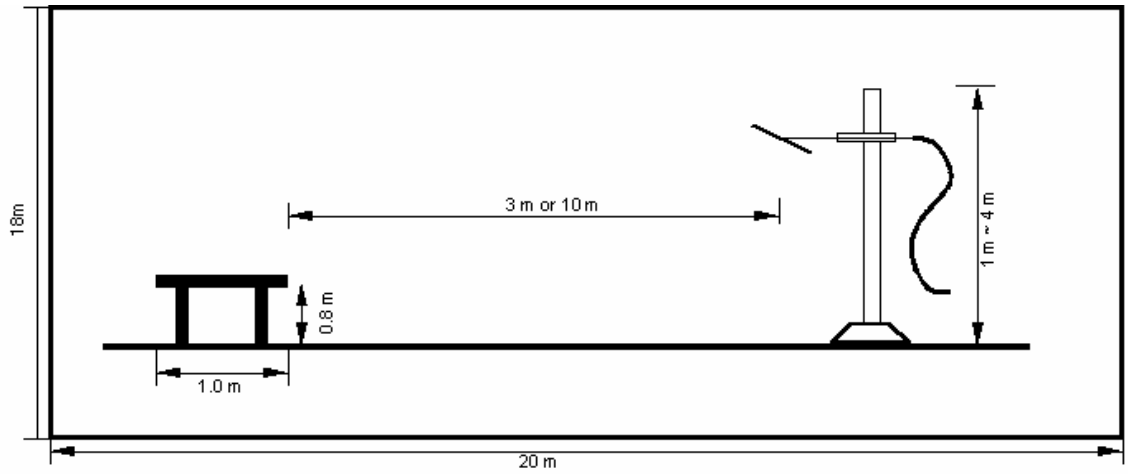


Fig 3. Dimensions of Open Site Test Area

5.3 Duty Cycle Correction

Measurements may be adjusted where pulsed RF is utilized to find the average level associated with a quantity.
This calculation is applied to limits for pulsed licensed and unlicensed devices.
For unlicensed intentional radiator under 47CFR Part 15 §15.35, all duty cycle measurements are compared to a 100 millisecond period.

On time = N1L1+N2L2+…+NnLn, where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc.
Duty Cycle = On time/100 millisecond.

5.4 Occupied Bandwidth

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer.
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for device operating above 70MHz and below 900MHz.For device operating above 900MHz, the emission shall be no wider than 0.5% of the center frequency. The bandwidth is determined at the points 20dB down from the modulated carrier.

6. Duty Cycle Correction

6.1 Operating environment

Temperature : 27℃
Relative humidity : 50 %

6.2 Test set-up

The spectrum analyzer was set to Zero span and the video triggered to collect the pulse train of the modulation. Calculations of the duty cycle correction factor were obtained from time data provided by the plots.

6.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 14. 2007
■ -	HL223	Rohde & Schwarz	Log-periodic antenna	829228/011	11. 27. 2007

6.4 Test result of Duty Cycle

-. Test Date : July 19, 2007
-. Reference standard : Part 15 Subpart C, Sec. 15.35
-. Operating condition : RF transmitting mode
-. Spectrum resolution bandwidth(6dB) : 100 kHz
-. Power Source : AC 120V, 60Hz

Define of duty cycle
-. Number of Code groups per 100ms = 1
-. Number of Wide Pulse = 335
-. Width of Pulses = 0.006ms
-. Number of Narrow Pulse = 693
-. Width of Pulses =0.006μs
Calculation of duty cycle
-. Total width of pulse train : 335x 0.006ms + 693 x 0.006μs = 6.17ms
-. Duty Cycle (%) : 6.17ms / 100ms = 6.17%
-. Duty Cycle (dB) : -24.19dB

Fundamental Frequency	Total width of ON-Time	Duty Cycle (%)	Duty Cycle (dB)
418 MHz	6.17 ms	6.17%	-24.19dB

Refer to APPENDIX B: Test Plots of complete Pulse Train

7. Radiated Emission

7.1 Operating environment

Temperature : 27℃
Relative humidity : 50 %

7.2 Test set-up

A preliminary scan with peak mode was performed in the semi anechoic chamber using the procedure in ANSI C63.4/2003 13.1.4.1 and found frequency for open area test site.
The formal radiated emission was measured at 3m-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.

7.3 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	1.46	-2.32	2.26	2.94
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	0.33 -0.18	0.33 -0.18
System repeatability	Std Deviation	0.18	0.18	0.17	0.17
Cable loss calibration	Normal (k=2)	0.05	0.05	0.05	0.05
Combined standard uncertainty Uc(y)	Normal	1.05 -1.05	1.45 -1.45	1.78 -1.77	1.80 -1.78
Extended uncertainty U	Normal (k=2)	2.11 -2.11	2.90 -2.90	3.55 -3.53	3.59 -3.57

7.4 Limit

Fundamental	Field strength of Fundamental			Field strength of Spurious Emission	
Frequency (MHZ)	uV/m	dBuV/m	uV/m	uV/m	dBuV/m
40.66~40.7	2250	67.04		225	47.04
70~130	1250	61.94		125	41.94
130~174	1250 to 3750	61.94 to 71.48	56.81818(F)-6136.3636	125 to 375	41.94 to 51.48
174~260	3750	71.48		375	51.48
260~470	3750 to 12500	71.48 to 81.94	41.6667(F)-7083.3333	375 to 1250	51.48 to 61.94
Above 470	12500	81.94		1250	61.94
Restricted Band	N/A			500	54.0

7.5 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESCS30	Rohde & Schwarz	EMI test receiver	839809/003	11. 27. 2007
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 14. 2007
■ -	HK116	Rohde & Schwarz	Biconical ANT	826861/018	11. 27. 2007
■ -	HL223	Rohde & Schwarz	Log-periodic antenna	829228/011	11. 27. 2007
■ -	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	11.20.2007
■ -	AFS44-00101800-25-10P-44	MITEQ	Preamplifier	1258943	N/A

7.6 Radiated emission test data

-. Test Date : July 19, 2007
-. Reference standard : Part 15 Subpart C, Sec.15.231
-. Operating condition : RF transmitting mode
-. Measuring Distance : 3m
-. Spectrum resolution bandwidth (6dB) : 120kHz / 1MHz
-. Detector mode : Peak detector mode / Average detector mode
-. Power Source : DC 6V supplied from four AAA size batteries
-. Note : 1. Through three orthogonal axes were investigated and the worst case is reported.
2. The EUT was tested with new batteries.

Field Strength at the Fundamental frequency

Frequency (MHz)	Ant. Pol. (H/V)	ANT Height (cm)	Azimuth (Deg)	AFCL (dB/m)	Peak (dBuV/m)	Duty Cycle Correction (dB)	Average (dBuV/m)	Limits (dBuV/m)	Margin (dB)
418.00	H	320	98	22.21	102.00	-24.19	77.81	80.28	2.47

Note: “H”: Horizontal, “V”: Vertical

Field Strength at the Harmonic frequencies

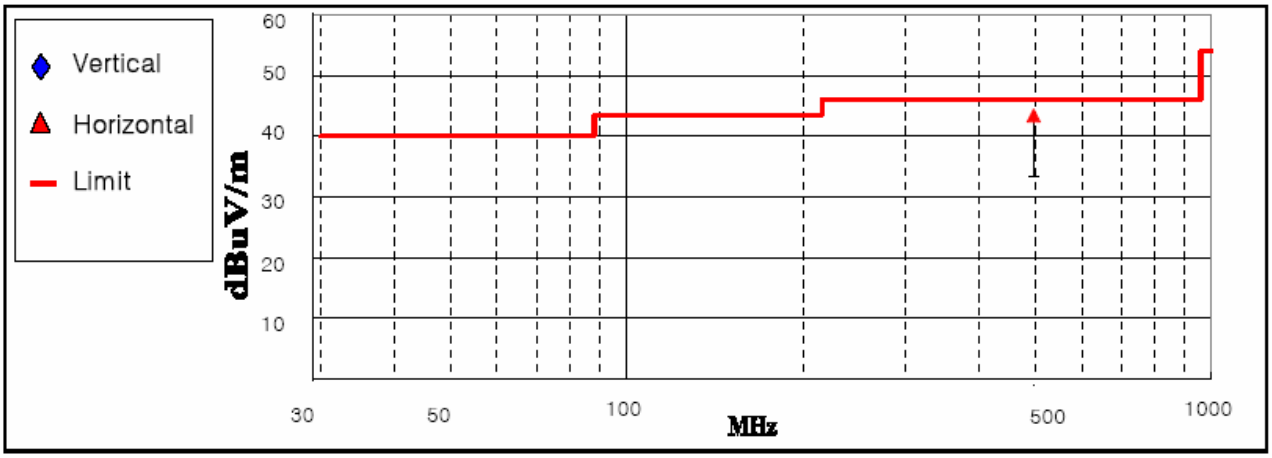
Frequency (MHz)	Ant. Pol. (H/V)	ANT Height (cm)	Azimuth (Deg)	AFCL (dB/m)	Peak (dBuV/m)	Duty Cycle Correction (dB)	Average (dBuV/m)	Limits (dBuV/m)	Margin (dB)
836.00	H	285	269	30.91	62.46	-24.19	38.27	61.94	23.67
1254.00	H	386	185	-10.09	59.90	-24.19	35.71	61.94	26.23
1672.00	V	207	290	-8.32	56.90	-24.19	32.71	54.00	21.29
2090.00	H	295	100	-6.88	60.60	-24.19	36.41	61.94	25.53
2508.00	H	227	187	-4.87	60.00	-24.19	35.81	61.94	26.13
2926.00	H	316	158	-3.85	62.00	-24.19	37.81	61.94	24.13
3344.00	V	108	90	-3.02	63.00	-24.19	38.81	61.94	23.13
3762.00	V	100	270	-1.95	55.80	-24.19	31.61	54.00	22.39
4180.00	V	120	270	-0.88	54.20	-24.19	30.01	54.00	23.99

Note: “H”: Horizontal, “V”: Vertical

Comment: below 1GHz: Transducer = ANT factor + cable loss
above 1GHz: Transducer = ANT factor + cable loss + AMP gain

♦ **Field Strength of the spurious emission except the harmonic frequencies (30MHz ~ 1GHz)**

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)
496.38	19.6	17.24	6.58	43.4	46.0	2.6	H	350	95
	-	-	-	-	-	<<	-	-	-

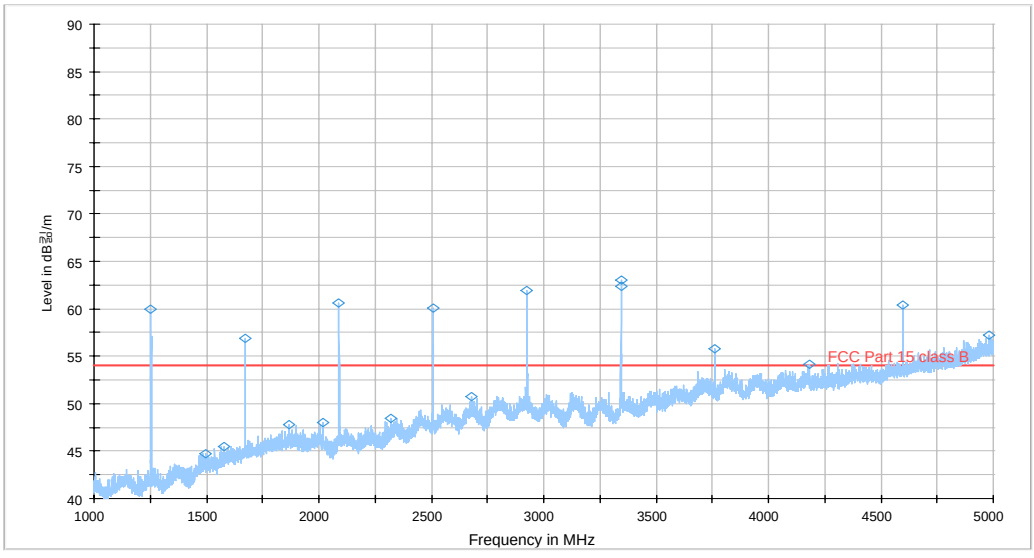


"<<" The margin is more than 30dB

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

♦ **Field Strength of the spurious emission except the harmonic frequencies (1GHz ~ 5GHz)**

Frequency (MHz)	Measurement Level						AV Limit (dBuV/m)	Margin (dBuV/m)	Positioning System		
	Reading Value(dBuV)		AF	AMP / CL	Test Result (dBuV/m)				Pol. (H/V)	Height (cm)	Angle (deg)
	Peak	Average	(dB)	(dB)	Peak	Average					
All frequency	-	-	-	-	<<	<<	-	-	-	-	-



< Fig 5. Radiated Emission result (1000MHz ~ 5000MHz)>

8. Occupied Bandwidth Measurement

8.1 Operating environment

Temperature : 27℃
Relative humidity : 50 %

8.2 Test set-up

This measurement is performed with the antenna located close enough to give a full-scale deflection of the modulated carrier on the spectrum analyzer. The plot is taken at 200kHz/division frequency span, 100kHz 3dB resolution bandwidth and 5dB/division logarithmic display from an ESI spectrum analyzer.
The measuring bandwidth shall be set to a value greater than 5% of the allowed bandwidth(ANSI C63.4-1992 I6)

8.3 Limit

Frequency Range(MHz)	Occupied Bandwidth Limit
70 ~ 900 MHz	0.25%
>900 MHz	0.5%

8.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 14. 2007
■ -	HL223	Rohde & Schwarz	Log-periodic antenna	829228/011	11. 27. 2007

8.5 Test result of occupied bandwidth

-. Test Date : July 19, 2007
-. Reference standard : Part 15 Subpart C, Sec. 15.231
-. Operating condition : RF transmitting mode
-. Spectrum resolution bandwidth(3dB) : 100 kHz
-. Power Source : DC 6V supplied from four AAA size batteries

Allowed Bandwidth : 418x 0.0025 = 1045 kHz

Fundamental Frequency	Bandwidth(Measured)	Allowed Bandwidth	Result
418 MHz	900 kHz	1045 kHz	PASS

Refer to APPENDIX B: Test Plots of occupied bandwidth

9. Sample Calculations

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

9.1 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**

9.2 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**

10. Recommendation & conclusion

The data collected shows that the Gumi College EMC Center.
OH SUNG ELECTRONICS CO., LTD. RF Remote Controller (Model No.: MX-900) was complies with §15.231 of the FCC Rules.