FCC EVALUATION REPORT FOR CERTIFICATION

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

Date of Issue : October 12, 2009
Order Number: GETEC-C1-09-179
Test Report Number: GETEC-E3-09-091
Test Site: Gumi College EMC Center
FCC Registration Number: (443957)

FCC ID.: OZ5URCMX-900

Applicant: OHSUNG ELECTRONICS CO., LTD.

Rule Part(s)	**: FCC Part 15 Subpart C-Intentional Radiator § 15.231**
Equipment Class	**: Remote Control Transmitter (DSC)**
EUT Type	**: RF Remote Controller**
Type of Authority	**: Certification**
Model Name	**: MX-900**
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,

Hyoung seop Kim Associate Engineer
GUMI College EMC center

Reviewed by,

Tae-Sig Park, Technical Manager
GUMI College EMC center

This test report only contains the result of a specific sample supplied for the examination.
It is not allowed to copy this report even partly without the approval of EMC center

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APPENDIX G – EXTERNAL PHOTOGRAPHS
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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, Gyeongbuk, Republic of Korea.

Manufacturer: OHSUNG ELECTRONICS CO., LTD.

Manufacturer Address: #181 Gongdan-dong, Gumi-si, Gyeongbuk, Republic of Korea.

Contact Person: Mr. Kwang-Jae Ok / Team Leader Q.C
Tel Number: +82-54-468- 0831 Fax Number: +82-54- 461- 8368

- **FCC ID.** OZ5URCMX-900
- **Equipment Class** Remote Control Transmitter (DSC)
- **EUT Type** RF Remote Controller
- **Power Source** DC 6.0 V supplied from four “AAA” size batteries
- **Model Name** MX-900
- **Trade Name** UNIVERSAL remote control
- **Rule Part(s)** FCC Part 15, Subpart C-Intentional Radiator § 15.231
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.4 (2003)
- **Dates of Test** September 09, 2009
- **Place of Test** **Gumi College EMC Center** (FCC Registration No.: 443957)
  407, Bugok-Dong, Gumi-si, Gyeongsangbuk-Do, Korea.
- **Test Report Number** GETEC-E3-09-091
- **Dates of Issue** October 12, 2009

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. RF Remote Controller (Model Name: 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 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 FCC §2.948 according to ANSI C63.4 (2003).

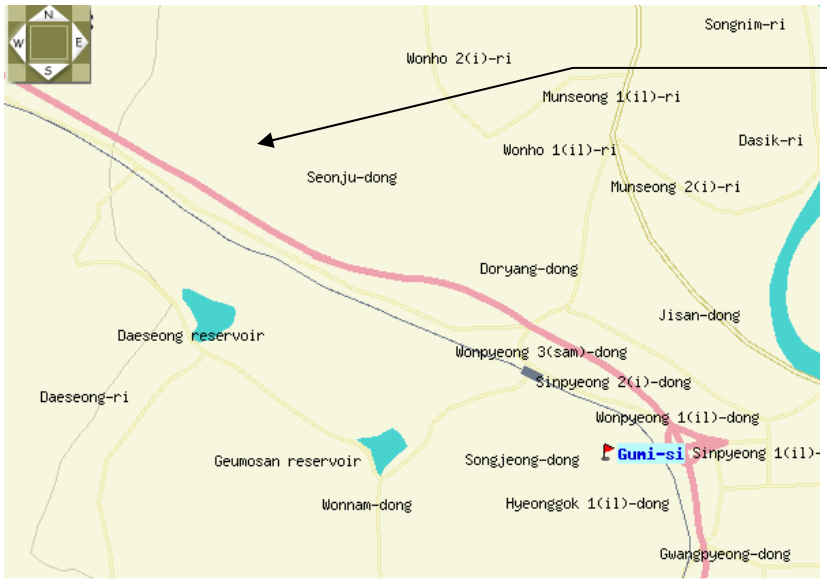

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Fig 1. The map above shows the Gumi College in vicinity area.

3. Product Information

3.1 Description of EUT

The equipment under test (EUT) is the **OHSUNG ELECTRONICS CO., LTD. RF Remote Controller (Model Name: MX-900) FCC ID.: OZ5URCMX-900**

RF Frequency	418 MHz
Crystal, Clock Frequency	CPU X-TAL(18.432 MHz) , MICOM X-TAL(8 MHz) On Main B'D 13.0625 MHz on RF Module B'D
Number of Layer	Main B'D 2 Layer RF Module B'D 2 Layer
External Connector	USB
Antenna	Built-in internal looped antenna on-board

Memory - 4 Megabits of Flash Memory (for User Configuration)
Devices - Flexible, typically can support up to 40 Devices
Pages - Flexible, typically can support up to 40 Pages on each Device
Learning Capability - Standard frequencies (15kHz to 460kHz)
Macro Capability - Up to 255 steps each, however nesting is allowed
IR Range (Line of Sight via Infrared): 30-50 feet, depending on the environment
RF Range (radio frequency): 50 to 100 feet, depending upon the environment
RF Frequency: 418MHz
Weight: 14 ounces (with batteries)
Size: 8″ H x 2.25″ W x 1.25″ D
Batteries: 4 AAA Batteries

3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment
-. None

3.2.2 Used Cable(s)
-. None

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

3.3 Modification Item(s)
-. None

4. 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.

4.1 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. Description of tests

5.1 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 6.0 V supplied from four “AAA” size batteries
(The EUT used battery power. So, the conducted emission test was skip)

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

5.2 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

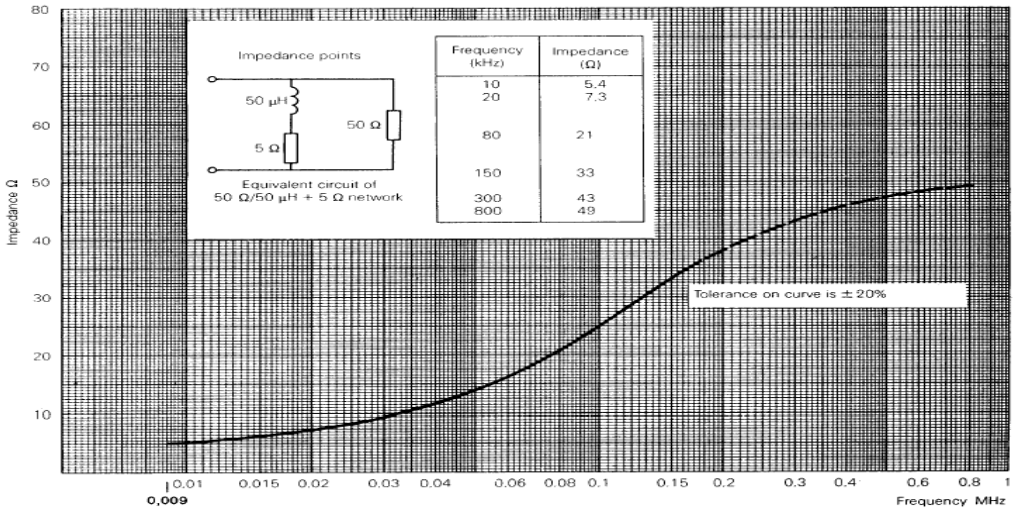


Fig 2. Impedance of LISN

5.3 Radiated Emission

The measurements were conducted 3 m anechoic chamber (FCC Registration No.: 443957) 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 1000 MHz, using bicornical log antenna (Schwarzbeck, VULB9160).

Above 1 GHz, horn antenna (Schwarzbeck, BBHA9120D / EMCO 3160) was used.

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 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 0.8 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 m to 4 m and stopped at the azimuth or height producing the maximum emission.

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

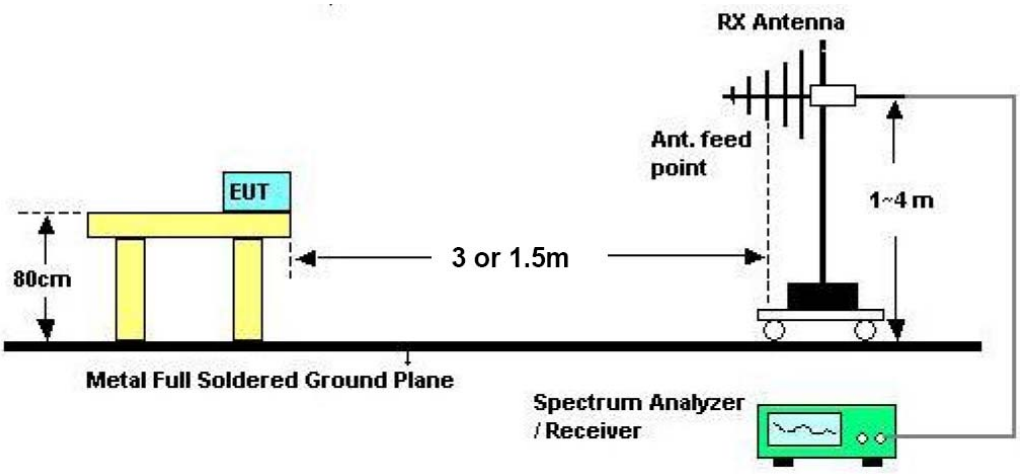


Fig 3. Dimensions of test site.

5.4 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.

5.5 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 70 MHz and below 900 MHz. For device operating above 900 MHz, the emission shall be no wider than 0.5 % of the center frequency. The bandwidth is determined at the points 20 dB down from the modulated carrier.

6. Duty Cycle Correction

6.1 Operating Environment

Temperature : 21.0 ℃
Relative humidity : 47.0 % R.H.

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 Name	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 14. 2009
■ -	VULB9160	Schwarzbeck	Bi-log antenna	3193	12. 11. 2009

6.4 Test result of Duty Cycle

-. Test Date : September 09, 2009
-. Reference standard : Part 15 Subpart C, Sec. 15.35
-. Operating condition : RF transmitting mode
-. Spectrum resolution bandwidth(6dB) : 100 kHz
-. Power Source : DC 6.0 V supplied from four “AAA” size batteries

6.4.1 Test Frequency: 418 MHz

Define of duty cycle
-. Number of Code groups per 100 ms = 1
-. Number of Wide Pulse = 335
-. Width of Pulses = 0.006 ms
-. Number of Narrow Pulse = 693
-. Width of Pulses =0.006 μs
Calculation of duty cycle
-. Total width of pulse train: 335 x 0.006 ms + 693 x 0.006 μs = 6.17 ms
-. Duty Cycle (%): 6.17 ms / 100 ms = 6.17 %
-. Duty Cycle (dB): -24.20 dB

Fundamental Frequency	Total width of ON-Time	Duty Cycle (%)	Duty Cycle (dB)
418 MHz	6.17 ms	6.17 %	- 24.20 dB

7. Radiated Emission

7.1 Operating environment

Temperature : 21.0 ℃
Relative humidity : 47.0 % R.H.

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 3 m distance open area test site.
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.

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 %.

Test items	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical)	± 3.54 dB	Confidence levels of 95 % (k=2)
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	± 3.49 dB	Confidence levels of 95 % (k=2)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	± 3.85 dB	Confidence levels of 95 % (k=2)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	± 3.76 dB	Confidence levels of 95 % (k=2)
Radiated emission (30 MHz ~ 300 MHz, 10 m, Vertical)	± 3.21 dB	Confidence levels of 95 % (k=2)
Radiated emission (30 MHz ~ 300 MHz, 10 m, Horizontal)	± 3.32 dB	Confidence levels of 95 % (k=2)
Radiated emission (300 MHz ~ 1 000 MHz, 10 m, Vertical)	± 3.77 dB	Confidence levels of 95 % (k=2)
Radiated emission (300 MHz ~ 1 000 MHz, 10 m, Horizontal)	± 3.84 dB	Confidence levels of 95 % (k=2)

8.4 Limit

Fundamental Frequency (MHZ)	Field strength of Fundamental			Field strength of Spurious Emission	
	μV/m	dBμV/m	μV/m	μV/m	dBμV/m
40.66~40.7	2 250	67.04		225	47.04
70~130	1 250	61.94		125	41.94
130~174	1 250 to 3 750	61.94 to 71.48	56.81818(F)-6136.3636	125 to 375	41.94 to 51.48
174~260	3 750	71.48		375	51.48
260~470	3 750 to 12 500	71.48 to 81.94	41.6667(F)-7083.3333	375 to 1250	51.48 to 61.94
Above 470	12 500	81.94		1250	61.94
Restricted Band	N/A			500	54.0

8.5 Test equipment used

	Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 14. 2009
■ -	VULB9160	Schwarzbeck	Bi-log antenna	3193	12. 11. 2009
■ -	BBHA9120D	Schwarzbeck	Horn antenna	207	12. 26. 2009
■ -	MCU066	Maturo GmbH	Position Controller	1390306	N/A
■ -	AM4.0	Maturo GmbH	Antenna Mast	1390308	N/A
■ -	TT2.5SI	Maturo GmbH	Turntable	1390307	N/A
■ -	AFS 44 00101800-25-10P-44	MITEQ	Preamplifier	1258943	11. 11. 2009

8.6 Radiated emission test data

-. Test Date : September 09, 2009
-. Reference standard : Part 15 Subpart C, Sec.15.231
-. Measuring Distance : 3 m
-. Spectrum resolution bandwidth (6 dB): 120 kHz/ 1 MHz
-. Detector mode : Peak detector mode / Average detector mode
-. Power Source : DC 6.0 V supplied from four “AAA” size batteries
-. Note : 1.Through three orthogonal axes were investigated and the worst case is reported.

8.6.1 Operating condition: RF mode (418 MHz)

♦ **Field Strength of the Fundamental & harmonic frequencies emission.**

Frequency (MHz)	Measurement Level					Limit		Margin		Positioning System		
	Reading (dBuV/m)	Tranduce (dB/m)	Duty cycle (dB)	Peak (dBuV/m)	Average (dBuV/m)	Peak (dBuV/m)	Aveage (dBuV/m)	Peak (dB)	Average (dB)	Pol. (H/V)	Height (cm)	Angle (deg)
Fundamental												
418.00	76.42	22.14	-24.20	98.56	74.36	100.28	80.28	1.72	5.92	H	200	270
Spurious												
836.00	31.4	30.30	-24.20	61.70	37.50	80.28	60.28	18.58	22.78	H	100	0
1254.00	81.1	-15.01	-24.20	66.10	41.90	80.28	60.28	14.18	18.38	V	100	0
1672.00	76.5	-13.59	-24.20	62.90	38.70	74.00	54.00	11.10	15.30	H	100	0
2090.00	71.3	-12.16	-24.20	59.10	34.90	80.28	60.28	21.18	25.38	V	150	90
2508.00	70.0	-10.33	-24.20	59.70	35.50	80.28	60.28	20.58	24.78	H	200	90
2926.00	55.8	-8.78	-24.20	47.00	22.80	80.28	60.28	33.28	37.48	V	100	185
3344.00	61.6	-7.58	-24.20	54.00	29.80	80.28	60.28	26.28	30.48	V	100	210
3762.00				<<								
4180.00				<<								

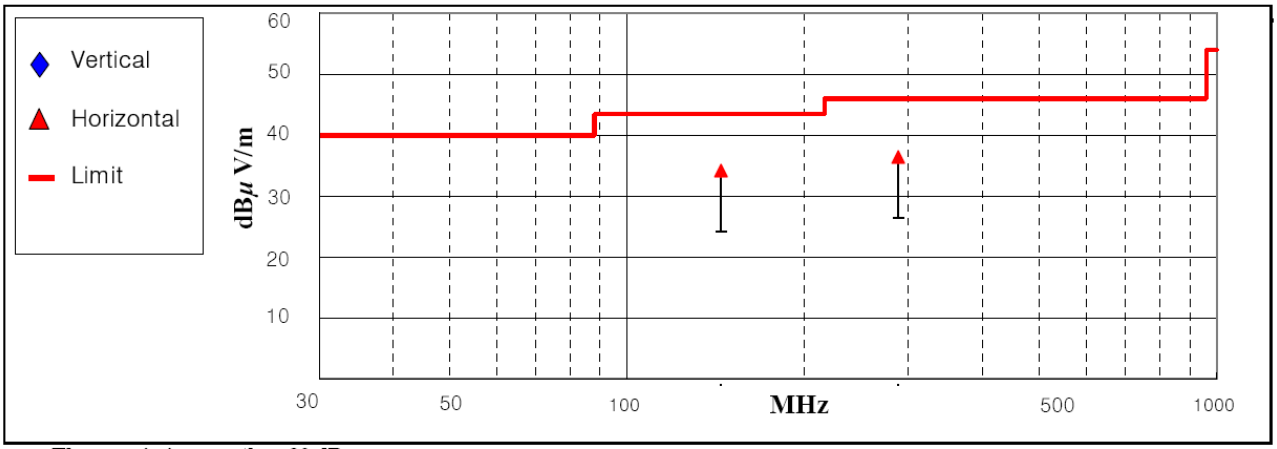
*Commant ; below 1GHz : Tranduce = ANT factor + cable loss
above 1GHz : Tranduce = ANT factor + cable loss + AMP gain

<< : The margin is more than 30 dB

Note: “H”: Horizontal, “V”: Vertical

♦ **Field Strength of the spurious emission except the harmonic frequencies**

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 (°)
144.16	19.53	11.38	3.30	34.21	43.50	9.29	H	200	270
288.32	13.84	17.65	4.97	36.46	46.00	9.54	H	100	263
Other frequency	-	-	-	<<	-	-	-	-	0

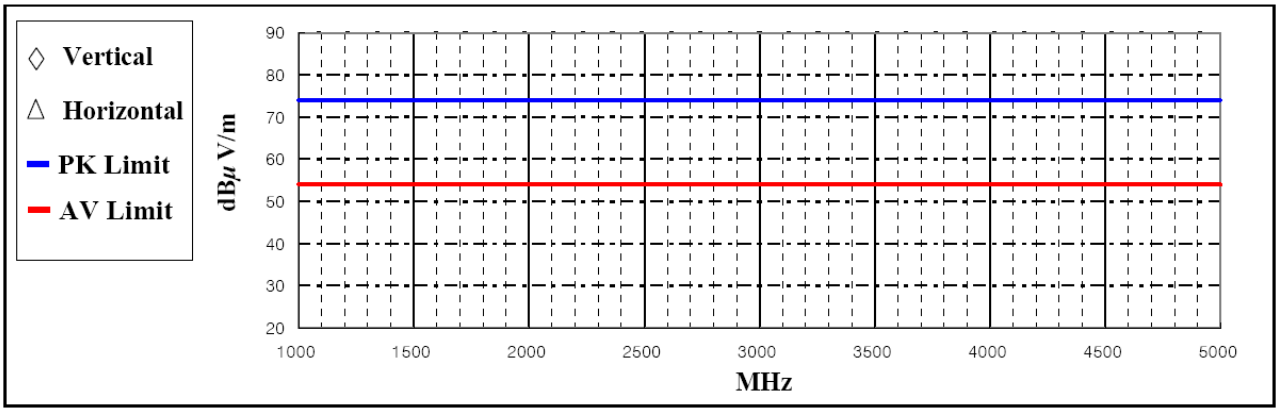


<< : The margin is more than 30 dB

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

♦ **Field Strength of the spurious emission except the harmonic frequencies**

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



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

<< : The margin is more than 30 dB

<Fig 7. Radiated Emission result (1 GHz ~ 5 GHz) >

8. Occupied Bandwidth Measurement

8.1 Operating Environment

Temperature : 21.0 ℃
Relative humidity : 47.0 % R.H.

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 200 kHz/division frequency span, 100 kHz 3 dB resolution bandwidth and 5 dB/division logarithmic displays 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 Name	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 14. 2009
■ -	VULB9160	Schwarzbeck	Bi-log antenna	3193	12. 11. 2009

8.5 Test result of occupied bandwidth

-. Test Date : September 09, 2009
-. Reference standard : Part 15 Subpart C, Sec. 15.231
-. Operating condition : RF transmitting mode
-. Spectrum resolution bandwidth(3dB) : 100 kHz
-. Power Source : DC 6.0 V supplied from four “AAA” size batteries

8.5.1 Test Frequency: 418 MHz

Allowed Bandwidth: 418 × 0.0025 = 1 045 kHz

Fundamental Frequency	Bandwidth	Allowed Bandwidth	Result
418 MHz	993.988 kHz	1 045 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	**= 39.2 dBμV**
$10^{(39.2dB\mu V/20)}$	**= 91.2 μV**
Margin	**= 48 dBμV - 39.2 dBμV**
	= 8.8 dB

9.2 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

10. Recommendation & conclusion

The data collected shows that the Gumi College EMC Center.
OH SUNG ELECTRONICS CO., LTD. RF Remote Controller (Model Name: MX-900) was complies with §15.231 of the FCC Rules.