

## ***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 : August 18, 2009**

**Order Number: GETEC-C1-09-177**

**Test Report Number: GETEC-E3-09-101**

**Test Site: Gumi College EMC Center**

**FCC Registration Number: (100749, 443957)**

**FCC ID.: OZ5URCMX-350N**

**Applicant: OHSUNG ELECTRONICS CO., LTD.**

<b>Rule Part(s)</b>	<b>: FCC Part 15 Subpart C-Intentional Radiator § 15.231</b>
<b>Equipment Class</b>	<b>: Remote Control Transmitter (DSC)</b>
<b>EUT Type</b>	<b>: RF Remote Controller</b>
<b>Type of Authority</b>	<b>: Certification</b>
<b>Model Name</b>	<b>: MX-350-N, MX-350, MX-350EPS</b>
<b>Trade Name</b>	<b>: UNIVERSAL remote control</b>

**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 Manager**  
**GUMI College EMC center**



## CONTENTS

1. GENERAL INFORMATION .....	4
2. INTRODUCTION .....	5
3. PRODUCT INFORMATION .....	6
3.1 DESCRIPTION OF EUT.....	6
3.2 SUPPORT EQUIPMENT / CABLES USED .....	7
3.3 MODIFICATION ITEM(S) .....	7
4. ANTENNA REQUIREMENT - §15.203 .....	7
4.1 DESCRIPTION OF ANTENNA.....	7
5. DESCRIPTION OF TESTS.....	8
5.1 TEST CONDITION.....	8
5.2 RADIATED EMISSION.....	9
5.3 CONDUCTED EMISSION .....	10
5.4 DUTY CYCLE CORRECTION .....	10
5.5 OCCUPIED BANDWIDTH.....	10
6. DUTY CYCLE CORRECTION.....	11
6.1 OPERATING ENVIRONMENT .....	11
6.2 TEST SET-UP .....	11
6.3 TEST EQUIPMENT USED.....	11
6.4 TEST RESULT OF DUTY CYCLE.....	11
7. RADIATED EMISSION .....	12
7.1 OPERATING ENVIRONMENT .....	12
7.2 TEST SET-UP.....	12
7.3 MEASUREMENT UNCERTAINTY .....	12
7.4 LIMIT .....	13
7.5 TEST EQUIPMENT USED .....	13
7.6 RADIATED EMISSION TEST DATA .....	14
8. OCCUPIED BANDWIDTH MEASUREMENT.....	17
8.1 OPERATING ENVIRONMENT .....	17
8.2 TEST SET-UP .....	17
8.3 LIMIT .....	17
8.4 TEST EQUIPMENT USED.....	17
8.5 TEST RESULT OF OCCUPIED BANDWIDTH.....	17
9. SAMPLE CALCULATIONS.....	18
9.1 EXAMPLE 1 : .....	18
9.2 EXAMPLE 2 : .....	18
10. RECOMMENDATION & CONCLUSION.....	19

APPENDIX A – ATTESTATION STATEMENT

APPENDIX B – TEST PLOTS

APPENDIX C – ID SAMPLE LABEL & LOCATION

APPENDIX D – BLOCK DIAGRAM

APPENDIX E – SCHEMATIC DIAGRAM

APPENDIX F – TEST SET-UP PHOTOGRAPHS



**APPENDIX G – EXTERNAL PHOTOGRAPHS**

**APPENDIX H –INTERNAL PHOTOGRAPHS**

**APPENDIX I – USER’S MANUAL**

**APPENDIX J – OPERATIONAL DESCRIPTION FOR 418 MHz**



*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-350N
- **Equipment Class** Remote Control Transmitter (DSC)
- **EUT Type** RF Remote Controller
- **Power Source** DC 6V supplied from four AAA size batteries
- **Model Name** MX-350-N, MX-350, MX-350EPS
- **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** August 13, 2009
- **Place of Test** **Gumi College EMC Center** ( FCC Registration No.: 100749, 443957)  
407, Bugok-Dong, Gumi-si, Gyeongsangbuk-Do, Korea.
- **Test Report Number** GETEC-E3-09-101
- **Dates of Issue** August 18, 2009

**EUT Type: RF Remote Controller**

**FCC ID.: OZ5URCMX-350N**



## 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-350-N)**

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).



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-350-N) FCC ID.: OZ5URCMX-350N**

<b>Power Supply</b>	DC 6V supplied from four AAA size batteries
<b>RF Frequency</b>	418 MHz
<b>Crystal, Clock Frequency</b>	12 MHz on Main B'D 13.0625 MHz on RF module B'D
<b>Number of Layer</b>	Main B'D 2 Layer RF Module B'D 2 Layer
<b>Antenna</b>	Built-in internal looped antenna on-board

Learning Capability - 784 IR commands at standard frequencies (15KHz to 455 KHz)

Macro Capability - 472 Macros of up to 190 steps each

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: 8 oz. (with batteries)

Size: 8.5" x 2 7/16" x 1"

Batteries: Four AAA Alkaline batteries included

LCD Size: approximately 7/8" x 1-7/8"



### **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 6V supplied from four AAA size batteries

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





## 5.2 Radiated Emission

The measurements were conducted in a 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 noted for each frequency found.

The spectrum was scanned from 30 to 1000 MHz, using a biconical log antenna (Schwarzbeck, VULB9160).

Above 1 GHz, a 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 an 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 from 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.

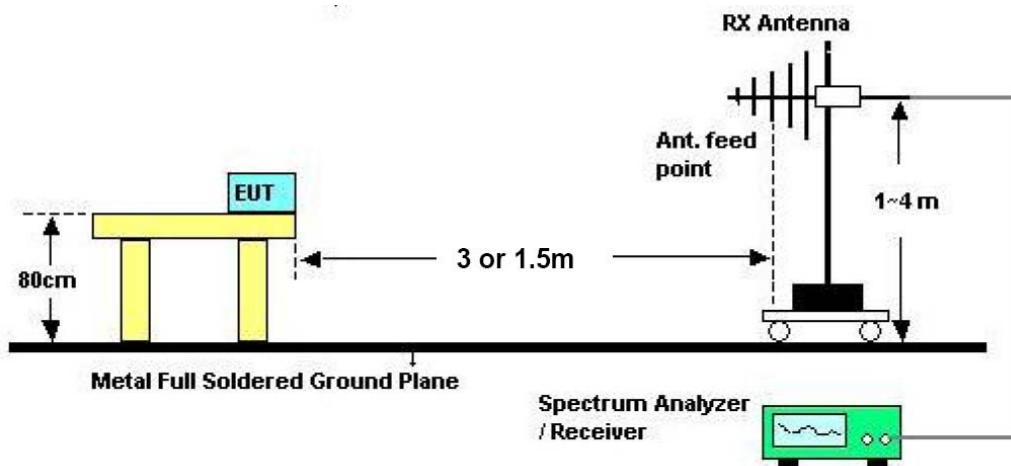


Fig 2. Dimensions of test site.



### 5.3 Conducted Emission

This equipment is supplied DC power from the batteries. Therefore, no conducted limits apply for this equipment.

### 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 =  $N_1L_1 + N_2L_2 + \dots + N_nL_n$ , where  $N_1$  is number of type 1 pulses,  $L_1$  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 °C  
 Relative humidity : 48.0 %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 : August 13, 2009
- Reference standard : Part 15 Subpart C, Sec. 15.35
- Operating condition : RF transmitting mode
- Spectrum resolution bandwidth(6dB) : 100 kHz
- Power Source : DC 6V 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:  $335 \times 0.006 \text{ ms} + 693 \times 0.006 \mu\text{s} = 6.17 \text{ ms}$
- Duty Cycle (%):  $6.17 \text{ ms} / 100 \text{ ms} = 6.17 \%$
- 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

Refer to APPENDIX B: Test Plots of complete Pulse Train



## 7. Radiated Emission

### 7.1 Operating environment

Temperature : 21.0 °C  
Relative humidity : 48.0 % 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)



#### 7.4 Limit

Fundamental Frequency (MHZ)	Field strength of Fundamental			Field strength of Spurious Emission	
	uV/m	dBuV/m	uV/m	uV/m	dBuV/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

#### 7.5 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



### 7.6 Radiated emission test data

- Test Date : August 13, 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 6V supplied from four AAA size batteries
- Note : 1.Through three orthogonal axes were investigated and the worst case is reported.

#### 7.6.1 Operating condition: RF mode (418 MHz)

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

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	77.06	22.14	-24.20	99.20	75.00	100.28	80.28	1.08	5.28	H	100	270
Spurious												
836.00	28.9	30.30	-24.20	59.20	35.00	80.28	60.28	21.08	25.28	H	100	123
1254.00	88.1	-15.01	-24.20	73.10	48.90	80.28	60.28	7.18	11.38	V	100	90
1672.00	76.8	-13.59	-24.20	63.20	39.00	74.00	54.00	10.80	15.00	V	150	270
2090.00	72.3	-12.16	-24.20	60.10	35.90	80.28	60.28	20.18	24.38	V	120	90
2508.00	62.4	-10.33	-24.20	52.10	27.90	80.28	60.28	28.18	32.38	V	120	180
2926.00	67.5	-8.78	-24.20	58.70	34.50	80.28	60.28	21.58	25.78	H	130	270
3344.00				<<								
3762.00				<<								
4180.00				<<								

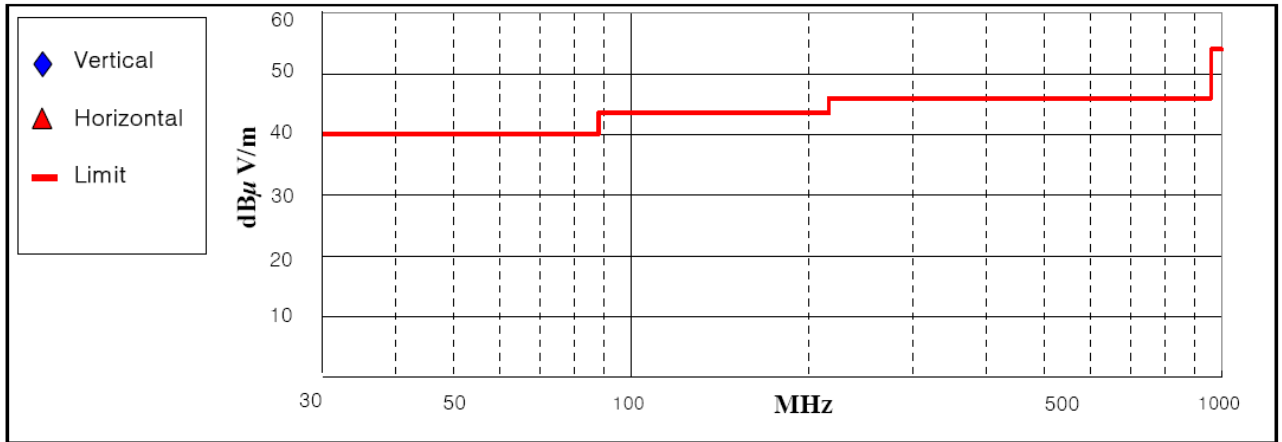
\*Comment ; below 1GHz : Tranduce = ANT factor + cable loss  
 above 1GHz : Tranduce = ANT factor + cable loss + AMP gain

Note: "H": Horizontal, "V": Vertical



◆ Field Strength of the spurious emission except the harmonic frequencies

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)	(°)
All frequency	-	-	-	<<		-	-	-	

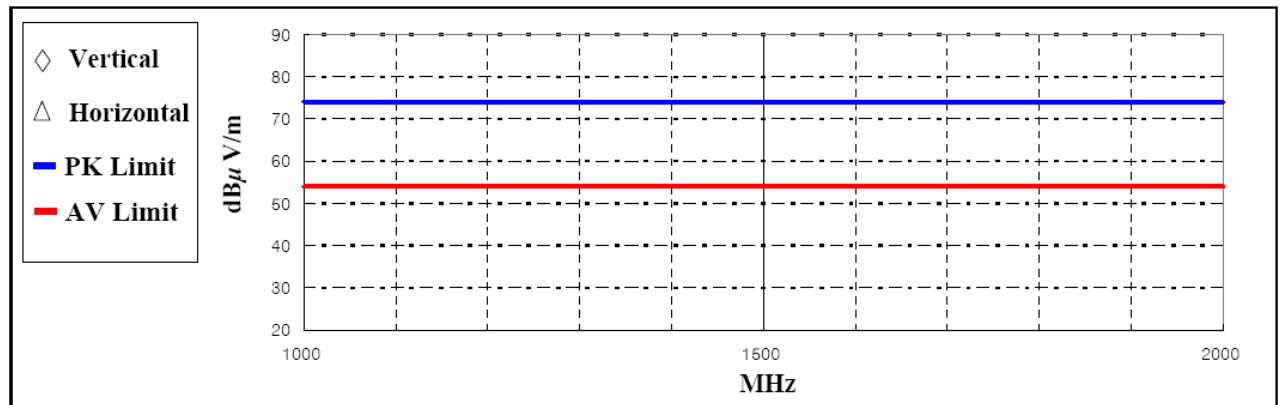


<< : The margin is more than 30 dB

< Fig 3. 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)		Peak	Average	Peak	Average	Pol. (H/V)	Height (cm)	Angle (°)
	Peak	Average	(dB/m)	(dB)	Peak	Average							
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

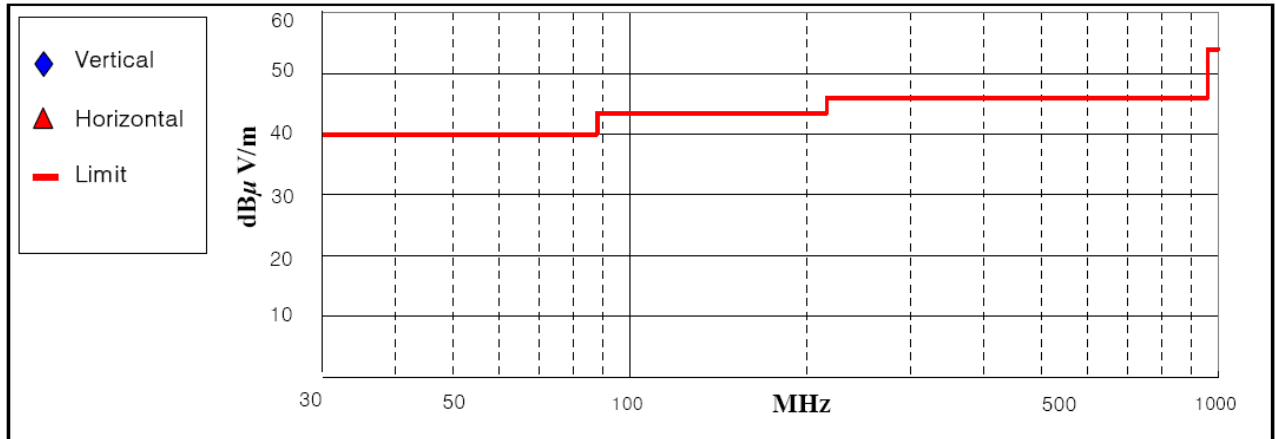
<Fig 4. Radiated Emission result (1 GHz ~ 5 GHz) >



**7.6.2 Operating condition: IR mode**

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

Frequency (MHz)	Measurement Level				Limit (dB $\mu$ V/m)	Margin (dB)	Positioning System		
	Reading	Antenna	Cable	Test Result			Pol. (H/V)	Height (cm)	Angle (°)
	Value(dB $\mu$ V)	Factor(dB/m)	Loss(dB)	(dB $\mu$ V/m)					
447.46	2.40	16.56	6.34	25.30	46.00	20.70	V	103	96
other frequency				<<					



<< : The margin is more than 30 dB

< Fig 5. Radiated emission result (30 MHz ~ 1 000 MHz) >





## 8. Occupied Bandwidth Measurement

### 8.1 Operating Environment

Temperature : 21.0 °C  
Relative humidity : 48.0 %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 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 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 : August 13, 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 V supplied from four AAA size batteries

#### 8.5.1 Test Frequency: 418 MHz

Allowed Bandwidth:  $418 \times 0.0025 = 1\ 045\ \text{kHz}$

Fundamental Frequency	Bandwidth	Allowed Bandwidth	Result
418 MHz	907 kHz	1 045 kHz	PASS

Refer to APPENDIX B: Test Plots of occupied bandwidth



## 9. Sample Calculations

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

### 9.1 Example 1 :

#### ■ 20.3 MHz

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

### 9.2 Example 2 :

#### ■ 66.7 MHz

Class B Limit	= 100 $\mu\text{V}/\text{m}$ = 40.0 dB $\mu\text{V}/\text{m}$
Reading	= 31.0 dB $\mu\text{V}$
Antenna Factor + Cable Loss	= 5.8 dB
Total	= 36.8 dB $\mu\text{V}/\text{m}$
Margin	= 40.0 dB $\mu\text{V}/\text{m}$ - 36.8 dB $\mu\text{V}/\text{m}$
	= 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-350-N)** was complies with §15.231 of the FCC Rules.