GUMI COLLEGE
EMC CENTER

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# *FCC EVALUATION REPORT FOR CERTIFICATION*

**Manufacturer : OHSUNG ELECTRONICS CO., LTD**
**#181 Gongdan-Dong, Gumi-City**
**Gyeongsangbuk-Do, Korea**
**Attn : Mr. Kwang-jae Ok / Team Leader Q.C**

**Date of Issue : April 25, 2006**
**Test Report S/N : GETEC-E3-06-020**
**Test Site : Gumi College EMC Center**

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

| | |
|---|---|
| **Rule Part(s)** | **: FCC Part 15 Subpart B, C** |
| **Equipment Class** | **: Remote Control Transmitter (DSC)** |
| **Frequency Range** | **: 417.5~418.5 MHz** |
| **EUT Type** | **: Remote Controller** |
| **Model No.** | **: MX-900** |

**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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## 1. 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.*

**Responsible Party : OHSUNG ELECTRONICS CO., LTD.**

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

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

**#181 Gongdan-Dong, Gumi-city, Gyeongsangbuk-do, Korea**

- **FCC ID.** OZ5URCMX900
- **Equipment Class** Remote Control Transmitter (DSC)
- **EUT Type** Remote Controller
- **Model No.** MX-900
- **Rule Part(s)** FCC Part 15 Subpart B, C
- **Test Procedure(s)** ANSI C63.4 (2003)
- **Dates of Test** March 23, 2006
- **Place of Test** Gumi College EMC Center
- **Test Report No.** GETEC-E3-06-020

## 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. Remote Controller (Model No.: MX-900)**

These measurement tests were conducted at **Gumi College EMC Center**.
The site address is 407, Bugok-Dong, Gumi-City, 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

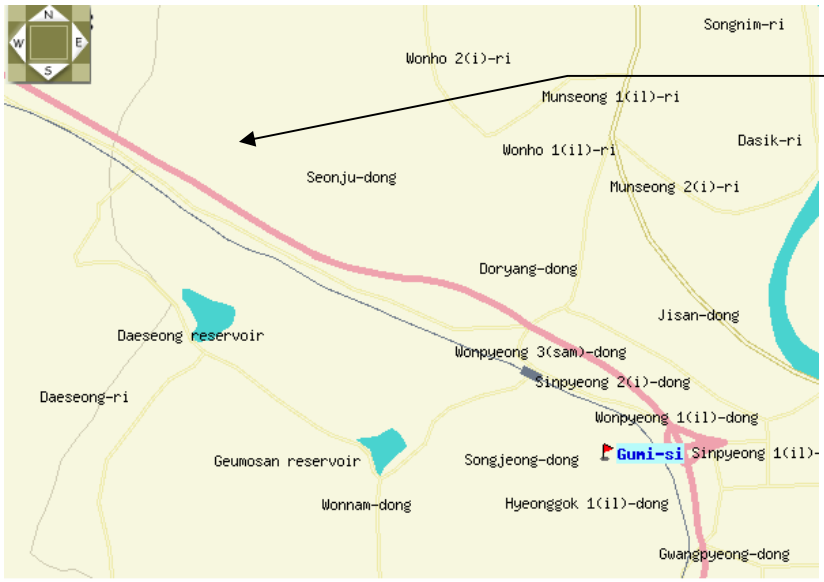


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Fig 1. The map above shows the Gumi College in vicinity area.

## 3. Test Conditions & EUT Information

### 3.1 Description of EUT

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

It can transmit pulse trains to RF Receiver Model No.: SRC-S401RF/B

| | |
|---|---|
| **Frequency Range** | 417.5~418.5MHz |
| **Oscillator(s)** | 418MHz |
| **Power Supply** | DC 6V supplied from four AAA size batteries |
| **Antenna** | Built-in internal looped antenna on-board |
| **Test Mode** | Download mode<br>IR mode<br>RF mode |
| **Cable(s)** | 1.8m USB cable<br>Connected to the EUT and PC |

### 3.2 Support Equipment used

| | |
|---|---|
| **PC** | COMPAQ D530<br>S/N: CNG34800PY<br>FCC ID: DoC |
| **Serial mouse** | LOGITECH M-S69<br>S/N: 334684-108<br>FCC ID: JNZ211443 |
| **Key board** | COMPAQ 166516-AD6<br>S/N: B13BBOR391006D<br>FCC ID: AQ6-23K15 |
| **Printer** | Hewlett Packard 970CXI<br>S/N: MY9B01F1FG<br>FCC ID: DoC |
| **Joy stick** | MICROSOFT X05-92626<br>S/N: 9262600296169<br>FCC ID: DoC |
| **Monitor** | LG Electronics 1800FP<br>S/N: N/A<br>FCC ID: DoC |

## 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 Remote Controller comply with the requirement of §15.203 with a built-in looped antenna permanently attached to the transmitter.

## 5. Description of tests

### 5.1 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 biconical antenna (R&S, HK116) and log-periodic antenna (R&S, HL223).

Above 1GHz, calibrated double ridged horn antennas(Schwarzbeck, BBHA 9120D) were used.

Final measurements were made outdoors at 3 m-test range using biconical antenna (R&S, HK116) , log-periodic antenna (R&S, HL223)and calibrated double ridged horn antennas(Schwarzbeck, BBHA 9120D).

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. (ESI)

The detector function was set to peak mode, the bandwidth of the receiver was set to 120kHz and 1MHz.

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

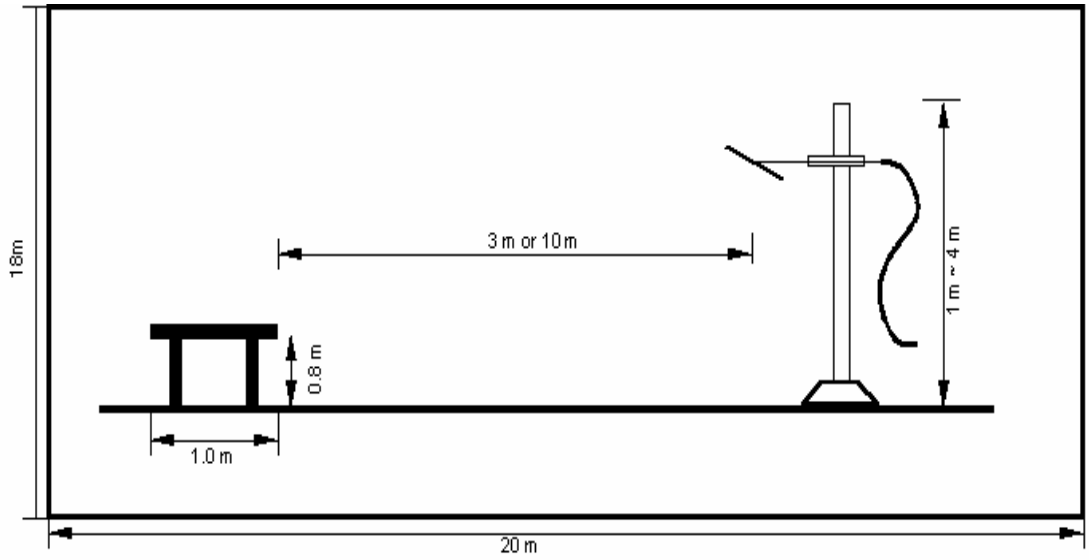



Fig 2. Dimensions of Open Site Test Area

### 5.2 Conducted Emission

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

### 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 : 5℃
Relative humidity : 35 %

### 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 | Calibrated Date |
|---|---|---|---|---|---|
| ■ - | ESI | Rohde & Schwarz | EMI test receiver | 830482/010 | 12. 2. 2005 |
| ■ - | HL223 | Rohde & Schwarz | Log-periodic antenna | 829228/011 | 12. 2. 2005 |

### 6.4 Test result of Duty Cycle

-. Test Date : March 23, 2006
-. Reference standard : Part 15 Subpart C, Sec. 15.35
-. Operating condition : Continuous transmitter (Maximum pulse train)
-. Spectrum resolution bandwidth(6dB) : 30 kHz
-. Power Source : Four AAA size Batteries

Define of duty cycle
-. Number of Code groups per 100ms = 1
-. Number of Wide Pulse = 1
-. Width of Pulses = 8.93ms
-. Number of Narrow Pulse = 693
-. Width of Pulses =0.019ms
Calculation of duty cycle
-. Total width of pulse train : 1x 8.93ms + 693 x 0.019ms = 22.10ms
-. Duty Cycle (%) : 22.10ms / 100ms = 22.10%
-. Duty Cycle (dB) : -13.11dB

| Fundamental Frequency | Total width of ON-Time | Duty Cycle (%) | Duty Cycle (dB) |
|---|---|---|---|
| 417.58 MHz | 22.10 ms | 22.10% | -13.11dB |

Refer to APPENDIX B: Test Plots of occupied bandwidth

## 7. Radiated emission test

### 7.1 Operating environment

Temperature : 5℃
Relative humidity : 35 %

### 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<br>Receiver VRC : Γl= 0.09<br>Antenna VRC : Γg= 0.43 (Bi) 0.23 (Lp)<br>Uncertainty limits 20log(1± Γl Γg) | U-shaped | 0.33<br>-0.35 | 0.33<br>-0.35 | 0.33<br>-0.18 | 0.33<br>-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<br>-1.05 | 1.45<br>-1.45 | 1.78<br>-1.77 | 1.80<br>-1.78 |
| Extended uncertainty U | Normal (k=2) | 2.11<br>-2.11 | 2.90<br>-2.90 | 3.55<br>-3.53 | 3.59<br>-3.57 |

### 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 | 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 | Calibrated Date |
|---|---|---|---|---|---|
| ■ - | ESI | Rohde & Schwarz | EMI test receiver | 830482/010 | 12. 2. 2005 |
| ■ - | HK116 | Rohde & Schwarz | Biconical antenna | 826861/018 | 12. 2. 2005 |
| ■ - | HL223 | Rohde & Schwarz | Log-periodic antenna | 829228/011 | 12. 2. 2005 |
| ■ - | BBHA 9120D | Schwarzbeck | Double ridged broadband horn antenna | 207 | 11. 26. 2005 |
| ■ - | HD100 | HD GmbH | Position Controller | 100/692/01 | NCR |
| ■ - | DS415S | HD GmbH | Turntable | 415/657/01 | NCR |
| ■ - | MA240 | HD GmbH | Antenna Mast | 240/565/01 | NCR |

**7.6 Radiated emission test data**

-. Test Date : March 22, 2006
-. Reference standard : Part 15 Subpart C, Sec. 15.231
-. Operating condition : Continuous transmitting
-. 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 (m) | Azimuth (Deg) | AFCL (dB/m) | Peak (dBuV/m) | Duty Cycle Correction (dB) | Average (dBuV/m) | Limits (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 418.02 | H | 124 | 99 | 21.18 | 89.13 | -13.11 | 76.02 | 80.29 | 4.27 |

Note: “H”: Horizontal, “V”: Vertical

**Field Strength at the Harmonic frequencies**

| Frequency (MHz) | Ant. Pol. (H/V) | ANT Height (m) | Azimuth (Deg) | AFCL (dB/m) | Peak (dBuV/m) | Duty Cycle Correction (dB) | Average (dBuV/m) | Limits (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 836.04 | H | 135 | 100 | 28.64 | 56.35 | -13.11 | 43.24 | 61.94 | 18.70 |
| 1254.00 | V | 152 | 142 | -11.83 | 46.70 | -13.11 | 33.59 | 61.94 | 28.35 |
| 1672.00 | V | 175 | 220 | -9.20 | 52.60 | -13.11 | 39.49 | 54.00 | 14.51 |
| 2090.00 | H | 204 | 185 | -6.95 | 52.47 | -13.11 | 39.36 | 61.94 | 22.58 |
| 2508.00 | V | 136 | 301 | -4.95 | 54.04 | -13.11 | 40.93 | 61.94 | 21.01 |
| 2926.00 | V | 210 | 175 | -3.22 | 50.76 | -13.11 | 37.65 | 61.94 | 24.29 |
| 3344.00 | V | 100 | 90 | -1.95 | 50.92 | -13.11 | 37.81 | 61.94 | 24.13 |
| 3762.00 | H | 180 | 185 | -0.76 | 50.11 | -13.11 | 37.00 | 54.00 | 17.00 |
| 4180.00 | V | 120 | 120 | 1.42 | 50.82 | -13.11 | 37.71 | 54.00 | 16.29 |
| 4598.00 | V | 134 | 62 | 1.71 | 54.82 | -13.11 | 41.71 | 54.00 | 12.29 |

Note: “H”: Horizontal, “V”: Vertical

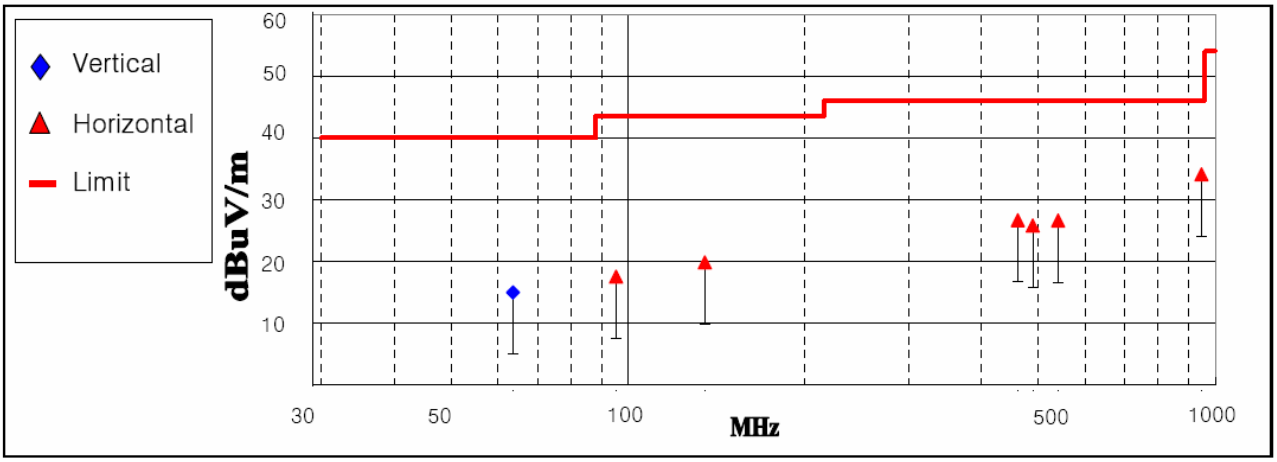
**Field Strength of the spurious emission**

| Frequency (MHz) | Reading (dBuV/m) | Ant. Pol. (H/V) | Ant. Factor(dB) | Cable Loss | Emission Level(dBuV/m) | Limits (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| All Frequency | - | - | - | - | - | - | << |
| | | | | | | | |

Note: “<<” The margin is more than 20dB

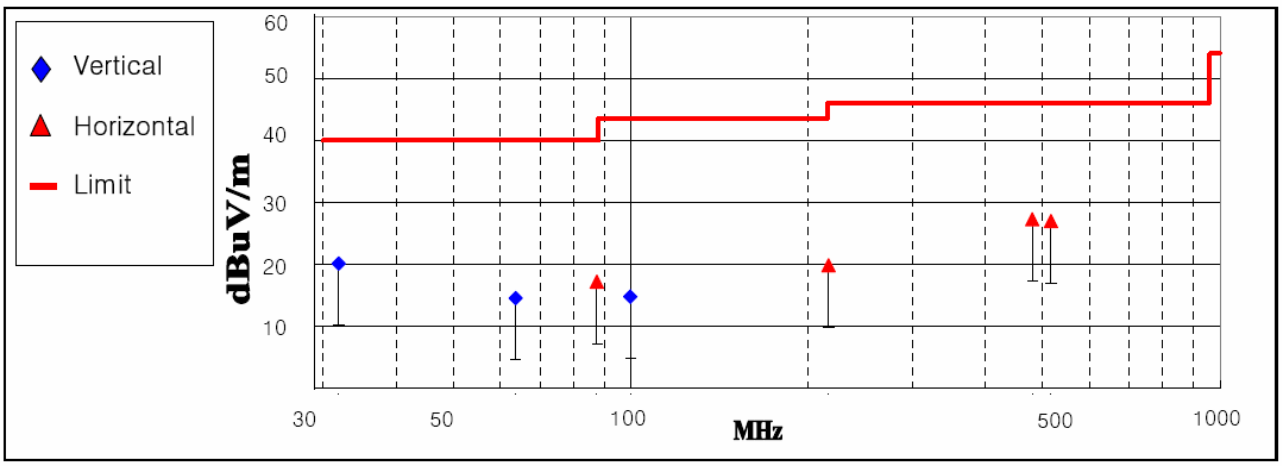
-. Test Date : March 22, 2006
-. Reference standard : Part 15 Subpart B
-. Operating condition : IR Mode (Continuous transmitter)
-. Measuring Distance : 3m
-. Detector mode : Quasi-peak detector mode
-. Power Source : DC 6V supplied from four AAA size batteries

| 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) |
| 63.60 | 4.9 | 7.91 | 2.14 | 15.0 | 40.0 | 25.0 | V | 125 | 95 |
| 95.34 | 5.6 | 9.27 | 2.65 | 17.5 | 43.5 | 26.0 | H | 385 | 124 |
| 135.06 | 5.1 | 11.59 | 3.16 | 19.8 | 43.5 | 23.7 | H | 300 | 263 |
| 460.80 | 3.4 | 16.84 | 6.40 | 26.6 | 46.0 | 19.4 | H | 342 | 215 |
| 488.64 | 2.1 | 17.15 | 6.54 | 25.8 | 46.0 | 20.2 | H | 306 | 180 |
| 540.24 | 1.5 | 18.16 | 6.92 | 26.6 | 46.0 | 19.4 | H | 390 | 20 |
| 947.22 | 2.3 | 22.36 | 9.43 | 34.1 | 46.0 | 11.9 | H | 350 | 350 |



-. Test Date : March 22, 2006
-. Reference standard : Part 15 Subpart B
-. Operating condition : Download Mode (PC communication mode)
-. Measuring Distance : 3m
-. Detector mode : Quasi-peak detector mode
-. Power Source : DC 6V supplied from four AAA size batteries

| 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) |
| 31.86 | 5.3 | 13.16 | 1.67 | 20.1 | 40.0 | 19.9 | V | 120 | 22 |
| 63.66 | 4.5 | 7.91 | 2.14 | 14.5 | 40.0 | 25.5 | V | 186 | 352 |
| 87.42 | 6.1 | 8.52 | 2.55 | 17.2 | 40.0 | 22.8 | H | 326 | 175 |
| 99.60 | 2.3 | 9.75 | 2.70 | 14.8 | 43.5 | 28.7 | V | 180 | 165 |
| 216.40 | 1.2 | 14.53 | 4.10 | 19.8 | 46.0 | 26.2 | H | 325 | 245 |
| 480.06 | 3.7 | 17.05 | 6.50 | 27.3 | 46.0 | 18.7 | H | 390 | 290 |
| 516.25 | 2.6 | 17.63 | 6.73 | 27.0 | 46.0 | 19.0 | H | 350 | 20 |



## 8. Occupied Bandwidth Measurement

### 8.1 Operating environment

Temperature : 6℃
Relative humidity : 38 %

### 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, 10kHz 6dB 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 | Calibrated Date |
|---|---|---|---|---|---|
| ■ - | ESI | Rohde & Schwarz | EMI test receiver | 830482/010 | 12. 2. 2005 |
| ■ - | HL223 | Rohde & Schwarz | Log-periodic antenna | 829228/011 | 12. 2. 2005 |

### 8.5 Test result of occupied bandwidth

-. Test Date : March 22, 2006
-. Reference standard : Part 15 Subpart C, Sec. 15.231
-. Operating condition : Continuous transmitting
-. Spectrum resolution bandwidth(6dB) : 30 kHz
-. Power Source : DC 6V supplied from four AAA size batteries

Allowed Bandwidth : 417.58 x 0.0025 = 1.043 MHz

| Fundamental Frequency | Bandwidth | Allowed Bandwidth | Result |
|---|---|---|---|
| 417.58 MHz | 934kHz | 1.043 MHz | PASS |

Refer to APPENDIX B: Test Plots of occupied bandwidth

## 9. Recommendation & conclusion

The data collected shows that the Gumi College EMC Center.
**OHSUNG ELECTRONICS CO., LTD. Remote Controller (Model No.: MX-900)** was complies with §15.109 and §15.231 of the FCC Rules.