# *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 : December 9, 2008**
**Test Report S/N : GETEC-E3-08-053**
**Test Site : Gumi College EMC Center**
**FCC Registration No.: (100749)**

| | |
|---|---|
| **FCC ID** | **OZ5URCMX6000I** |
| **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** |
| **Model Name** | **: MX-6000i** |
| **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 Manger**
**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. Kwang-Jae Ok / Team Leader Q.C**
**Tel Number: +82-54-468- 0831 Fax Number: +82-54- 461- 8368**

- **FCC ID.** OZ5URCMX6000I
- **Equipment Class** Remote Control Transmitter (DSC)
- **EUT Type** RF Remote Controller
- **Power Source** AC 120 V/ 60 Hz, DC 3.7V Li-ion Rechargeable Battery
- **Model Name** MX-6000i
- **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** December 2, 2008
- **Place of Test** **Gumi College EMC Center** ( FCC Registration No.: 100749)
  407, Bugok-Dong, Gumi-si, Gyeongsangbuk-Do, Korea
- **Test Report Number** GETEC-E3-08-053
- **Dates of Issue** December 9, 2008

## 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-6000i)**

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 §2.948 according to ANSI C63.4 on October 19, 1992

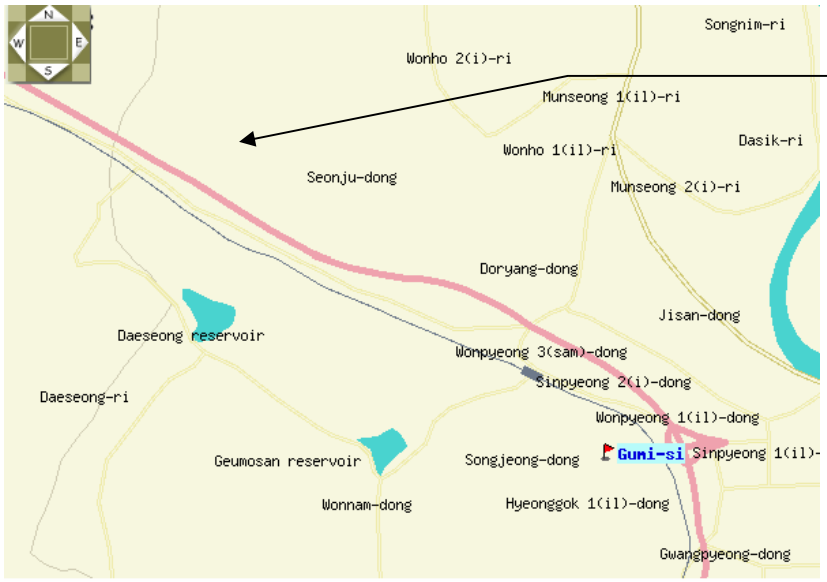


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Fig 1. The map above shows the Gumi College in vicinity area.

## 3. Product Information

### 3.1 Description of EUT

The equipment under test (EUT) is the **OHSUNG ELECTRONICS CO., LTD. RF Remote Controller (Model Name: MX-6000i) FCC ID.: OZ5URCMX6000I**
The RF Remote Controller has 2 type of RF module.
One is 433.92 MHz ASK module and the other is 2-way WiFi.
This Report is for 433.92 MHz ASK module the next report (No. GETEC-E3-08-055) is for WiFi module.

| | |
|---|---|
| **Used AC/DC Adapter** | : KSAD0600200W1US(UNIVERSAL remote control)<br>Input: AC (100-240) V, (50/60) Hz, 0.4 A<br>Output: DC 6 V, 2.0 A |
| **RF Frequency** | : 433.92 MHz, 2.4 GHz |
| **External Connector** | : USB, DC in, Stereo Jack, SD card |
| **Crystal & Clock Frequency** | : 533 MHz,48 MHz, 12 MHz,32.768 kHz,8 MHz on Main board B'D<br>13.0625 MHz on RF MODULE B'D,<br>26 MHz on WiFi module B'D |
| **Number of Layer** | : 6 Layer |

Microprocessor: 533MHz ARM9
RAM: 128Mbyte Mobile DDR
NAND: 64Mbyte
LCD: 4.3 Inch Wide Screen (480 by 272)
LCD Backlighting by LED
Sound: 2 x 1 watt
USB: 2.0
Devices - Supports up to 255 Devices with text, less with heavy graphics usage
Pages - Supports up to 255 Pages on each Device with text, less with heavy graphics usage
Learning Capability - Standard frequencies (15kHz to 455kHz)
Macro Capability - Up to 255 steps each, however nesting is allowed

IR Learning: 20-455 kHz
IR Range (Line of Sight via Infrared): 30-50 feet, depending on the environment
RF Frequency: 433.92MHz
RF Range (radio frequency): 50 to 100 feet, depending upon the environment
WiFi: IEEE 802.11 B (11Mps), G (54Mps)
Battery: Lithium Ion, 4800 mA hours
Battery Capacity: 4 hours continuous use, 9 days standby
Battery Charging Time: 7 Hours
Dimensions: 7.5″Wide x 5.1″Deep x 1.3″Height
Weight (without AC Adapter): 15 oz

### 3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

| Description | Manufacturer | Model Name | S/N & FCC ID |
|---|---|---|---|
| None | - | - | |

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

3.2.2 Used Cable(s)

| Cable Name | Condition | Description |
|---|---|---|
| Adapter cable | Connected to the EUT | 1.84 m unshielded |

### 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.

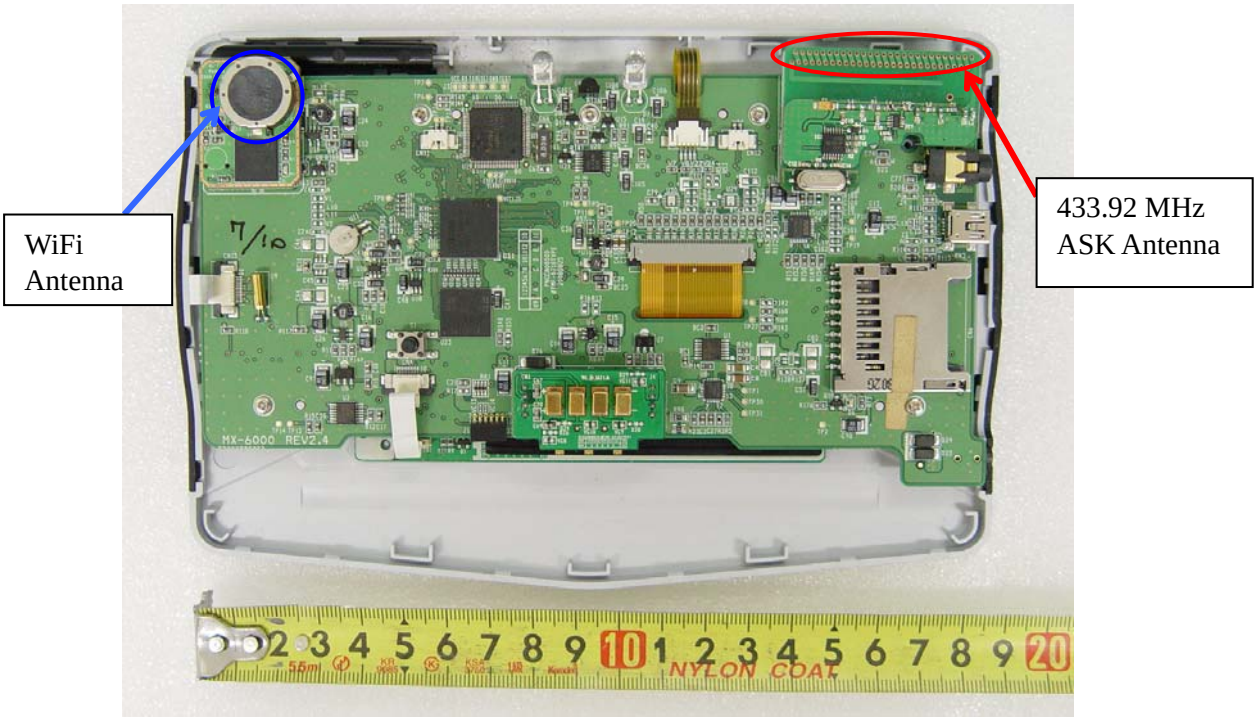
### 4.1 Description of Antenna

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. Intermodulation Compliance Statement

The two transmitters can be operated simultaneously but, do not share a common antenna.

Therefore, according to the "EMC Co-locatin Testing Poilcy", Intermodulation test does not be required.
Although the test could be skipped, we conducted intermodulation test and there was no distortion observed.



## 6. Description of tests

### 6.1 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 3.7 V Li-ion Rechargeable Battery

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

## 6.2 Conducted Emission

The Line conducted emission test facility is inside a 4 m × 8 m × 2.5 m shielded enclosure.
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

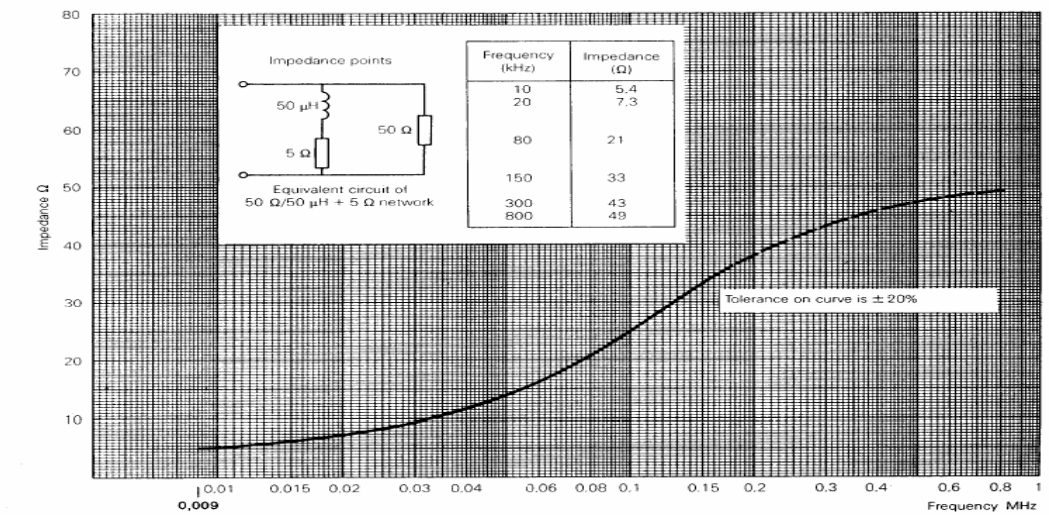



Fig 2. Impedance of LISN

### 6.3 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.

The spectrum was scanned from 30 MHz to 1 000 MHz using bicornical log antenna (Schwarzbeck, VULB9160). Above 1 GHz, horn antenna (Schwarzbeck, BBHA9120D) was used.

Final measurements were made outdoors at 3 m /10 m 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 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

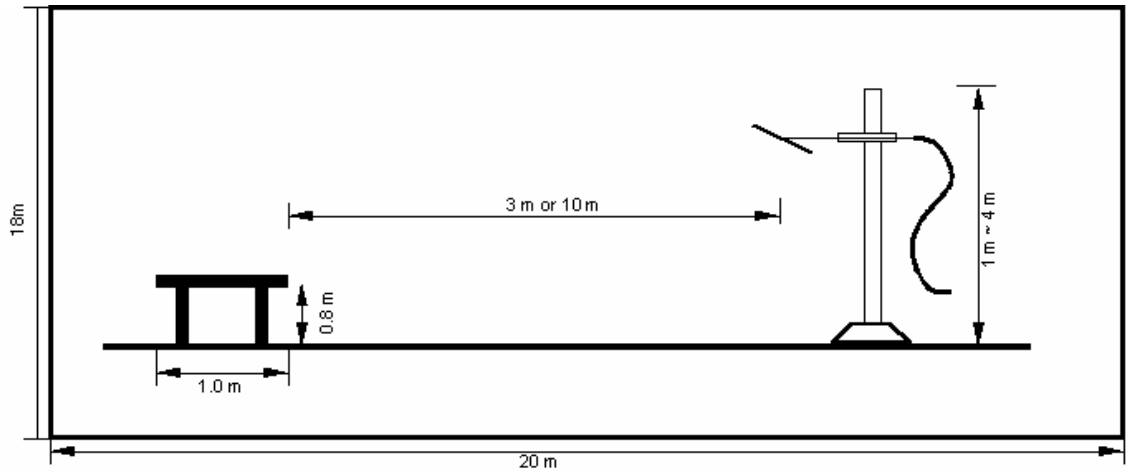



Fig 3. Dimensions of Open Site Test Area

### 6.4 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**.

### 6.5 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.

## 7. Conducted Emission

### 7.1 Operating environment

Temperature : 25 ℃
Relative humidity : 40 % R.H.

### 7.2 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.
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.

### 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 |
|---|---|---|
| Conducted emission (9 kHz ~ 150 kHz) | ± 2.97 dB | Confidence levels of 95 % (k=2) |
| Conducted emission (150 kHz ~ 30 MHz) | ± 4.05 dB | Confidence levels of 95 % (k=2) |

**7.4 Limit**

| RFI Conducted | FCC Limit(dB) 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. | | |

**7.5 Test equipment used**

| | Model Name | Manufacturer | Description | Serial Number | Due to Calibration |
|---|---|---|---|---|---|
| ■ - | ESCS30 | Rohde & Schwarz | EMI test receiver | 839809/003 | 12. 14. 2008 |
| □ - | ESH3-Z5 | Rohde & Schwarz | LISN | 838979/020 | 12. 13. 2008 |
| ■ - | ESH2-Z5 | Rohde & Schwarz | LISN | 829991/009 | 12. 13. 2008 |
| □ - | ISN T8 | TESEQ.GmbH | ISN | 24568 | 10. 16. 2009 |

### 7.6 Test data for power line conducted emission

#### 7.6.1 Test mode: RF transmitting mode

-. Test Date : December 2, 2008
-. Resolution bandwidth : 9 kHz
-. Frequency range : 0.15 MHz ~ 30 MHz

| Frequency (MHz) | Insertion Loss | Cable Loss | Line | Q.P[dBμV] | | | A.V[dBμV] | | | Margin[dB] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Limit | Reading | Result | Limit | Reading | Result | Q.P | A.V |
| 0.154 | 0.10 | -0.15 | L1 | 65.78 | 57.25 | 57.20 | 55.78 | 36.15 | 36.10 | 8.58 | 19.68 |
| 0.214 | 0.12 | -0.22 | L1 | 63.04 | 52.20 | 52.10 | 53.04 | 30.60 | 30.50 | 10.94 | 22.54 |
| 0.310 | 0.14 | -0.17 | N | 59.97 | 46.00 | 45.97 | 49.97 | 30.83 | 30.80 | 14.00 | 19.17 |
| 0.478 | 0.17 | -0.16 | N | 56.37 | 39.90 | 39.91 | 46.37 | 23.79 | 23.80 | 16.46 | 22.57 |
| 0.682 | 0.15 | -0.23 | N | 56.00 | 36.80 | 36.72 | 46.00 | 20.98 | 20.90 | 19.28 | 25.10 |
| 0.754 | 0.15 | -0.23 | N | 56.00 | 36.50 | 36.42 | 46.00 | 18.58 | 18.50 | 19.58 | 27.50 |
| 0.894 | 0.15 | -0.23 | N | 56.00 | 34.50 | 34.42 | 46.00 | 18.68 | 18.60 | 21.58 | 27.40 |
| 1.020 | 0.15 | -0.23 | L1 | 56.00 | 32.80 | 32.72 | 46.00 | 19.88 | 19.80 | 23.28 | 26.20 |
| 1.726 | 0.17 | -0.30 | L1 | 56.00 | 28.30 | 28.17 | 46.00 | 16.93 | 16.80 | 27.83 | 29.20 |
| 2.170 | 0.18 | -0.29 | L1 | 56.00 | 29.30 | 29.19 | 46.00 | 16.31 | 16.20 | 26.81 | 29.80 |
| 3.562 | 0.22 | -0.14 | L1 | 56.00 | 28.90 | 28.98 | 46.00 | 14.22 | 14.30 | 27.02 | 31.70 |
| 4.590 | 0.25 | -0.15 | L1 | 56.00 | 29.10 | 29.20 | 46.00 | 14.60 | 14.70 | 26.80 | 31.30 |
| 5.386 | 0.27 | -0.17 | L1 | 60.00 | 30.60 | 30.70 | 50.00 | 17.70 | 17.80 | 29.30 | 32.20 |
| 13.386 | 0.53 | 0.08 | L1 | 60.00 | 26.20 | 26.81 | 50.00 | 17.79 | 18.40 | 33.19 | 31.60 |
| 22.430 | 0.90 | 0.10 | N | 60.00 | 27.30 | 28.30 | 50.00 | 19.70 | 20.70 | 31.70 | 29.30 |

*Comment : Line : L1(line 1), L2(line2), L3(line 3), N(neutral)
Q.P:Quasi-peak, A.V : Average
Insertion Loss : Insertion Loss of LISN
Cable Loss : Cable Loss + Pulse Limiter Insertion loss value
"<<" : The margin is more than 30 dB

## 8. Duty Cycle Correction

### 8.1 Operating environment

Temperature : 12 ℃
Relative humidity : 44 %R.H.

### 8.2 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.

### 8.3 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Due to Calibration |
|---|---|---|---|---|---|
| ■ - | ESI | Rohde & Schwarz | EMI test receiver | 830482/010 | 12. 14. 2008 |
| ■ - | HL223 | Rohde & Schwarz | Log-periodic antenna | 835998/004 | 12. 28. 2009 |

### 8.4 Test result of Duty Cycle

-. Test Date : December 2, 2008
-. Reference standard : Part 15 Subpart C, Sec. 15.35
-. Operating condition : RF transmitting mode
-. Spectrum resolution bandwidth(6dB) : 100 kHz
-. Power Source : AC 120 V/ 60 Hz, DC 3.7 V Li-ion Rechargeable battery

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 =0.006$\mu$s
Calculation of duty cycle
-. Total width of pulse train: 335 x 0.006 ms + 693 x 0.006 $\mu$s = 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) |
|---|---|---|---|
| 433.92 MHz | 6.17 ms | 6.17 % | - 24.20 dB |

Refer to APPENDIX B: Test Plots of complete Pulse Train

## 9. Radiated Emission

### 9.1 Operating environment

Temperature : 12 ℃
Relative humidity : 44 % R.H.

### 9.2 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.

### 9.3 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) |

**9.4 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 |

**9.5 Test equipment used**

| | Model Number | Manufacturer | Description | Serial Number | Due to Calibration |
|---|---|---|---|---|---|
| ■ - | ESCS30 | Rohde & Schwarz | EMI test receiver | 839809/003 | 12. 14. 2008 |
| ■ - | ESI | Rohde & Schwarz | EMI test receiver | 830482/010 | 12. 14. 2008 |
| ■ - | HK116 | Rohde & Schwarz | Biconical ANT | 832639/007 | 12. 28. 2009 |
| ■ - | HL223 | Rohde & Schwarz | Log-periodic antenna | 835998/004 | 12. 28. 2009 |
| ■ - | 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 | 597 | 04.01.2009 |
| ■ - | AFS44-00101800-25-10P-44 | MITEQ | Preamplifier | 1258943 | N/A |

### 9.6 Radiated emission test data

-. Test Date : December 2, 2008
-. Reference standard : Part 15 Subpart C, Sec.15.231
-. Operating condition : RF transmitting mode
-. Measuring Distance : 3 m
-. Spectrum resolution bandwidth (6 dB) : 120 kHz / 1 MHz
-. Detector mode : Peak detector mode / Average detector mode
-. Power Source : AC 120 V/ 60 Hz, DC 3.7 V Li-ion Rechargeable battery
-. 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 and 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 | | | | | | | | | | | | |
| 433.92 | 77.57 | 22.55 | -24.20 | 100.12 | 75.92 | 100.83 | 80.83 | 0.71 | 4.90 | H | 100 | 315 |
| Spurious | | | | | | | | | | | | |
| 867.84 | 24.4 | 30.79 | -24.20 | 55.23 | 31.03 | 80.83 | 60.83 | 25.60 | 29.79 | H | 123 | 300 |
| 1301.76 | 51.2 | -10.11 | -24.20 | 41.10 | 16.90 | 74.00 | 54.00 | 32.90 | 37.10 | H | 133 | 0 |
| 1735.68 | 64.2 | -8.40 | -24.20 | 55.80 | 31.60 | 80.83 | 60.83 | 25.03 | 29.22 | H | 139 | 138 |
| 2169.60 | 67.7 | -6.72 | -24.20 | 61.00 | 36.80 | 80.83 | 60.83 | 19.83 | 24.02 | V | 124 | 216 |
| 2603.52 | 70.6 | -4.89 | -24.20 | 65.70 | 41.50 | 80.83 | 60.83 | 15.13 | 19.32 | H | 200 | 270 |
| 3037.44 | 65.2 | -3.56 | -24.20 | 61.60 | 37.40 | 80.83 | 60.83 | 19.23 | 23.42 | H | 167 | 297 |
| 3471.36 | 58.2 | -3.01 | -24.20 | 55.20 | 31.00 | 80.83 | 60.83 | 25.63 | 29.82 | H | 114 | 60 |
| 3905.28 | 51.5 | -1.92 | -24.20 | 49.60 | 25.40 | 74.00 | 54.00 | 24.40 | 28.60 | H | 109 | 249 |
| 4339.20 | 51.7 | -0.66 | -24.20 | 51.00 | 26.80 | 74.00 | 54.00 | 23.00 | 27.20 | V | 121 | 250 |

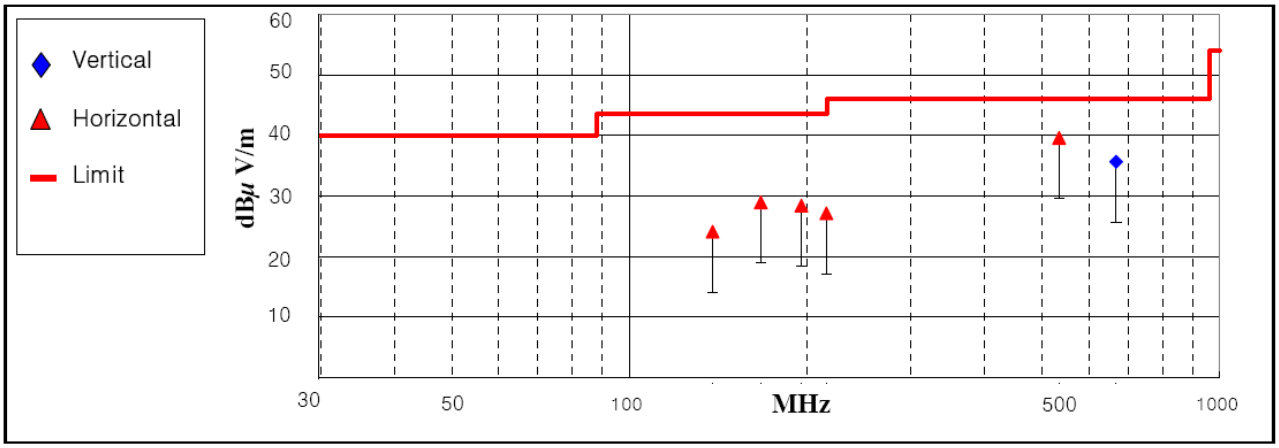
**Commant ; below 1GHz : Tranduce = ANT factor + cable loss*
*above 1GHz : Tranduce = ANT factor + cable loss + AMP gain*

**"The margin is more than 30 dBuV/m"**

Note: “H”: Horizontal, “V”: Vertical

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

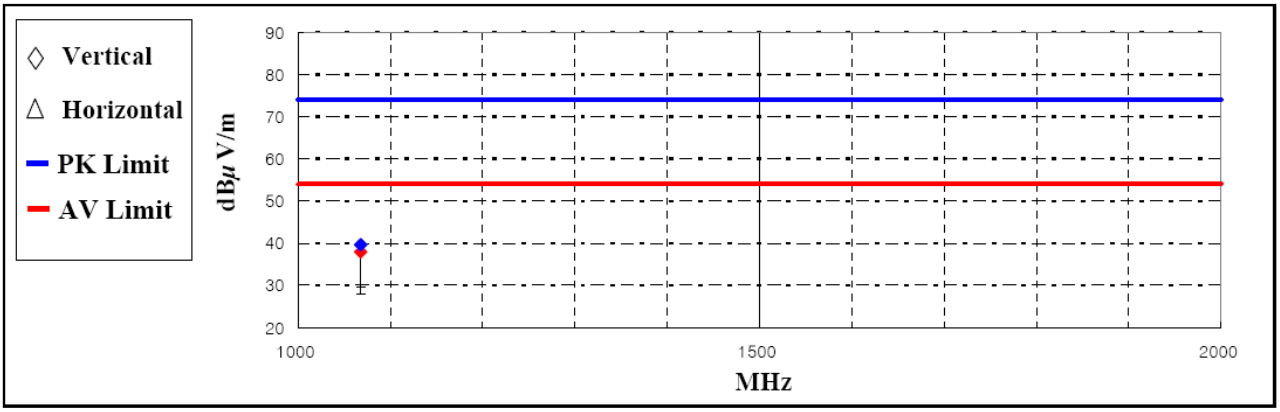
| Frequency (MHz) | Measurement Level | | | | Limit (dBμ V/m) | Margin (dB) | Positioning System | | |
|---|---|---|---|---|---|---|---|---|---|
| | Reading Value(dBμ V) | Antenna Factor(dB/m) | Cable Loss(dB) | Test Result (dBμ V/m) | | | Pol. (H/V) | Height (cm) | Angle (°) |
| 138.25 | 9.72 | 11.16 | 3.22 | 24.10 | 43.50 | 19.40 | H | 200 | 83 |
| 166.92 | 13.08 | 12.29 | 3.53 | 28.90 | 43.50 | 14.60 | H | 215 | 80 |
| 195.53 | 11.15 | 13.42 | 3.83 | 28.40 | 43.50 | 15.10 | H | 216 | 260 |
| 215.53 | 8.90 | 14.14 | 4.09 | 27.13 | 43.50 | 16.37 | H | 300 | 211 |
| 534.23 | 15.28 | 17.41 | 6.87 | 39.56 | 46.00 | 6.44 | H | 228 | 215 |
| 667.85 | 8.18 | 19.78 | 7.66 | 35.62 | 46.00 | 10.38 | V | 165 | 90 |




**< Fig 4. Radiated emission result (30 MHz ~ 1 000 MHz) >**

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

| Frequency (MHz) | Measurement Level | | | | | | Limit (dBμV/m) | | Margin (dB) | | Positioning System | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Reading Value (dBμV/m) | | AF | AMP / CL | Test Result (dBμV/m) | | | | | | Pol. | Height | Angle |
| | Peak | Average | (dB/m) | (dB) | Peak | Average | Peak | Average | Peak | Average | (H/V) | (cm) | (°) |
| 1067.965 | 55.55 | 53.87 | 24.98 | -40.90 | 39.63 | 37.95 | 74.00 | 54.00 | 34.37 | 16.05 | V | 153.00 | 168.00 |




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

**"The margin is more than 30 dBuV/m"**

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

## 10. Occupied Bandwidth Measurement

### 10.1 Operating environment

Temperature : 12 ℃
Relative humidity : 44 %R.H.

### 10.2 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)

### 10.3 Limit

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

### 10.4 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Due to Calibration |
|---|---|---|---|---|---|
| ■ - | ESI | Rohde & Schwarz | EMI test receiver | 830482/010 | 12. 14. 2008 |
| ■ - | HL223 | Rohde & Schwarz | Log-periodic antenna | 835998/004 | 12. 28. 2009 |

### 10.5 Test result of occupied bandwidth

-. Test Date : December 2, 2008
-. Reference standard : Part 15 Subpart C, Sec. 15.231
-. Operating condition : RF transmitting mode
-. Spectrum resolution bandwidth(3dB) : 30 kHz
-. Power Source : AC 120 V/ 60 Hz, DC 3.7 V Li-ion Rechargeable battery

Allowed Bandwidth : 433.92 x 0.0025 = 1 084.8 kHz

| Fundamental Frequency | Bandwidth | Allowed Bandwidth | Result |
|---|---|---|---|
| 433.92 MHz | 988 kHz | 1 084.8 kHz | PASS |

Refer to APPENDIX B: Test Plots of occupied bandwidth

## 11. Sample Calculations

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

### 11.1 Example 1 :

■ **20.3 MHz**

**Class B Limit** = **250 $\mu$V** = **48 dB$\mu$V**

**Reading** = **- 67.8 dBm(Calibrated level)**

**Convert to dB$\mu$V** = **- 67.8 dBm + 107** = **39.2 dB$\mu$V**

$10^{(39.2dB\mu V/20)}$ = **91.2 $\mu$V**

**Margin** = **39.2 – 48** = **-8.8**

= **8.8 dB below Limit**

### 11.2 Example 2 :

■ **66.7 MHz**

**Class B Limit** = **100 $\mu$V/m** = **40.0 dB$\mu$V/m**

**Reading** = **- 76.0 dBm(Calibrated level)**

**Convert to dB$\mu$V/m** = **- 67.8 dBm + 107** = **31.0 dB$\mu$V/m**

**Antenna Factor + Cable Loss** = **5.8 dB**

**Total** = **36.8 dB$\mu$V/m**

**Margin** = **36.8 – 40.0** = **-3.2**

= **3.2 dB below Limit**

## 12. Recommendation & conclusion

The data collected shows that the Gumi College EMC Center.
**OH SUNG ELECTRONICS CO., LTD. RF Remote Controller (Model Name: MX-6000i)** was complies with §15.231 of the FCC Rules.