

## ***FCC EVALUATION REPORT FOR CERTIFICATION***

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

**Date of Issue : May 28, 2010**

**#181 Gongdan-dong, Gumi-si, Gyeongbuk,**

**Order Number: GETEC-C1-10-122**

**Republic of Korea.**

**Test Report Number: GETEC-E3-10-062**

**Attn : Mr. Kwang-Jae Ok / Team Leader of Q.C**

**Test Site: Gumi College EMC Center**

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

**FCC ID. : OZ5URCMX5000I**

**Applicant : OH SUNG 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> (WI-FI built in RF remote controller)
<b>Type of Authority</b>	<b>: Certification</b>
<b>Model Name</b>	<b>: MX-5000i</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,**

**Reviewed by,**

  
**Soon-Hoon Jeong, Engineer**  
**GUMI College EMC center**

  
**Jae-Hoon Jeong, Senior Engineer**  
**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, 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.** OZ5URCMX5000I
- **Equipment Class** Remote Control Transmitter (DSC)
- **EUT Type** RF remote controller
- **Power Source** AC 120 V / 60 Hz  
(Rechargeable LITHUM POLYMER Battery 3.7 V , 2 400 mAh)
- **Model Name** MX-5000i
- **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** May 6 ~ 13 , 2010
- **Place of Test** **Gumi College EMC Center** ( FCC Registration No.: 100749, 443957)  
407, Bugok-Dong, Gumi-si, Gyeongsangbuk-Do, Korea.
- **Test Report Number** GETEC-E3-10-062
- **Dates of Issue** May 28, 2010

**EUT Type: RF remote controller**

**FCC ID.: OZ5URCMX5000I**



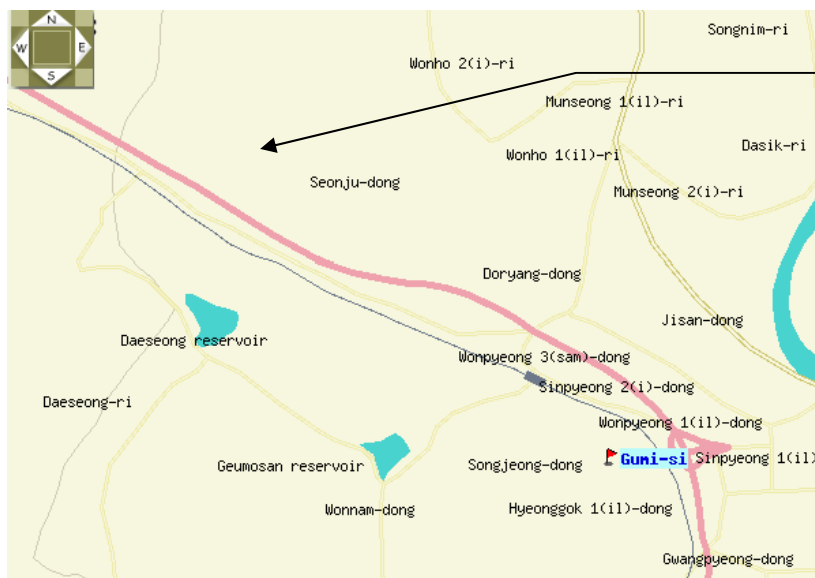
## 2. Introduction

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 ELECTRONCIS CO., LTD. RF remote controller (Model Name: MX-5000i)**

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 ELECTRONCIS CO., LTD. RF remote controller (Model Name: MX-5000i) FCC ID.: OZ5URCMX5000I**

The RF Remote Controller has 2 type of RF module.

One is 418 MHz ASK module and the other is 2-way Wi-Fi.

This Report is for 418 MHz ASK module the next report (No. GETEC-E3-10-063) is for Wi-Fi module.

- **Used AC/DC Adapter** : Model Name: KSAD0600200W1US  
Manufacturer: UNIVERSAL remote control  
Input rating: AC (100-240) V, (50/60) Hz, 0.4 A  
Output rating: DC 6 V, 2.0 A  
Serial Number: R1808
- **Battery** : Rechargeable LITHUM POLYMER BATTERY(DC 3.7 V, 2 400 mAh)
- **RF Frequency** : 433.92 MHz, 2.4 GHz
- **External Connector** : DC in, Charger Signal, USB
- **Crystal & Clock Frequency** :133 MHz, 48 MHz, 12 MHz, 32.768 kHz, 8 MHz, 13.560 MHz on Main B'D,
- **Number of Layer** : 6 Layers
- **Antenna** : Built-in internal looped antenna on-board

Microprocessor: 533MHz ARM9  
RAM: 128Mbyte Mobile DDR  
NAND: 64Mbyte  
LCD: 2.8 Inch Screen (240 by 320)  
LCD Backlighting by LED  
Sound: mono 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 fre-  
quencies (20kHz to 455kHz)  
Macro Capability - Up to 255 steps  
each, however nesting is allowed

IR Range (Line of Sight via Infrared):  
30-50 feet, depending on the environ-  
ment  
RF Frequency: 433.92MHz  
RF Range (radio frequency): 50 to 100  
feet, depending upon the environment  
Wi-Fi: IEEE 802.11 B (11Mbps), G  
(54Mbps)  
Battery: Lithium Ion, 2400mAh  
Battery Capacity: 4 hours continuous  
use, 9 days standby  
Battery Charging Time: 5 Hours  
Dimensions: 8.8" Height x 2.3" Wide  
x 0.9 Thick  
Battery Warranty : 1 Year  
Weight (without AC Adapter): 7.8 oz



### 3.2 Support Equipment / Cables used

#### 3.2.1 Used Support Equipment

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

#### 3.2.2 System configuration

Description	Manufacturer	Model Name	S/N & FCC ID.
Charging Cradle	OH SUNG ELECTRONICS CO., LTD.	MX-5000i	S/N: N/A FCC ID.:-

#### 3.2.3 Used Cable(s)

Cable Name	Condition	Description
Adaptor(power) cable	Connected to the EUT(charging cradle)	1.86 m unshielded

*See “Appendix E – 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.

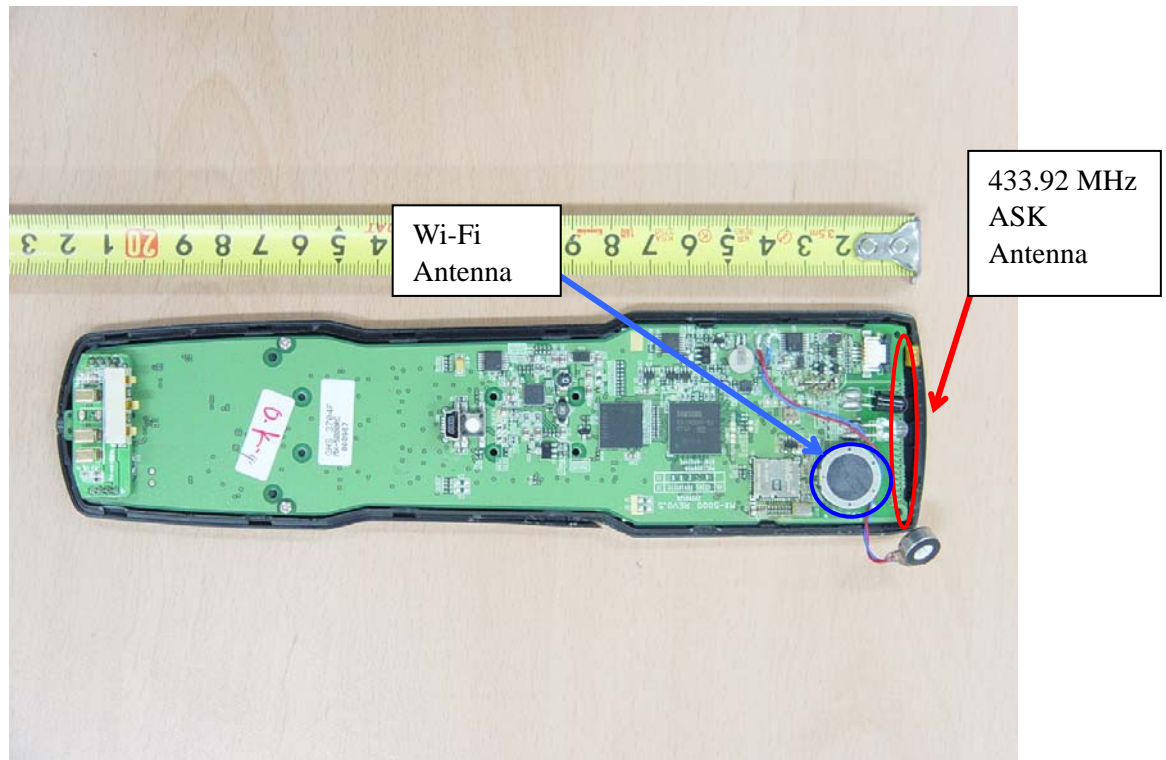
### 4.1 Description of Antenna

The **OHSUNG ELECTRONCIS 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. Inter modulation Compliance Statement

The two transmitters can be operated simultaneously but, do not share a common antenna.  
Therefore, according to the “EMC Co-location Testing Policy”, 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 (Rechargeable LITHIUM POLYMER Battery 3.7 V, 2 400 mAh)

- Test Mode(s)  
-. 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. (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

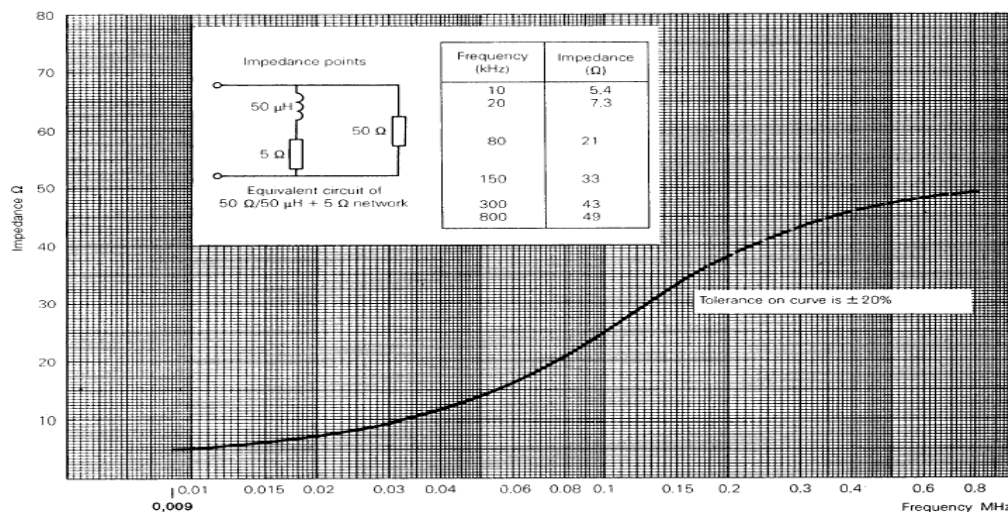


Fig 2. Impedance of LISN



### 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.

Final measurements were made 3 m chamber (FCC registration No.: 443957) and/or 10 m OATS (FCC registration No.: 100749).

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

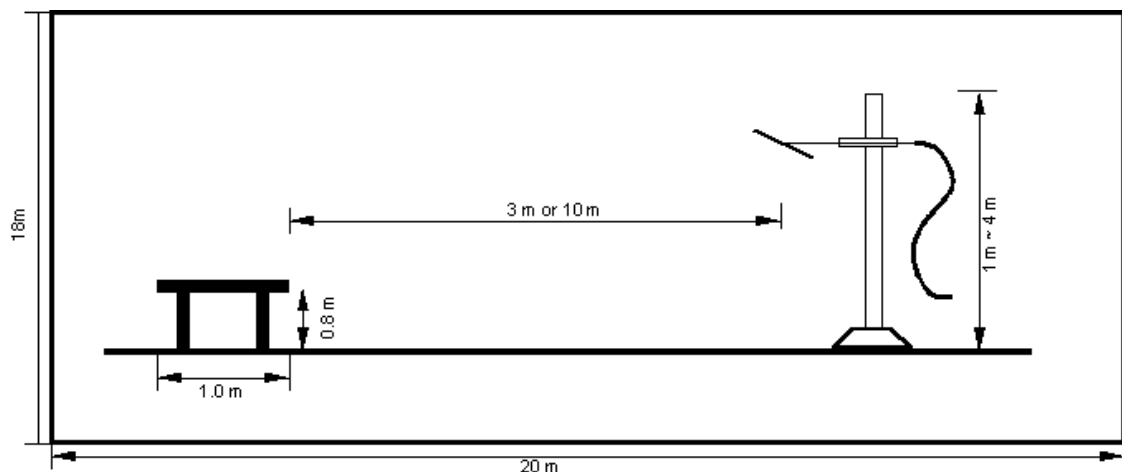


Fig 3. Dimensions of test site.



#### 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 =  $N_1L_1 + N_2L_2 + \dots + N_nL_n$ , where  $N_1$  is number of type 1 pulses,  $L_1$  is length of type 1 pulses, etc.

**Duty Cycle = on time/100 millisecond.**

#### 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 °C  
Relative humidity : 41 % 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 & ISN.

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)	$\pm 2.69$ dB	Confidence levels of 95 % ( $k = 2$ )
Conducted emission (150 kHz ~ 30 MHz)	$\pm 4.16$ dB	Confidence levels of 95 % ( $k = 2$ )



#### 7.4 Limit

RFI Conducted	FCC Limit(dB) Class B	
	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. 10. 2010
□ - ESH3-Z5	Rohde & Schwarz	LISN	838979/020	12. 10. 2010
■ - ESH2-Z5	Rohde & Schwarz	LISN	829991/009	12. 10. 2010
□ - ISN T8	TESEQ. GmbH	Impedance Network	24568	10. 16. 2010

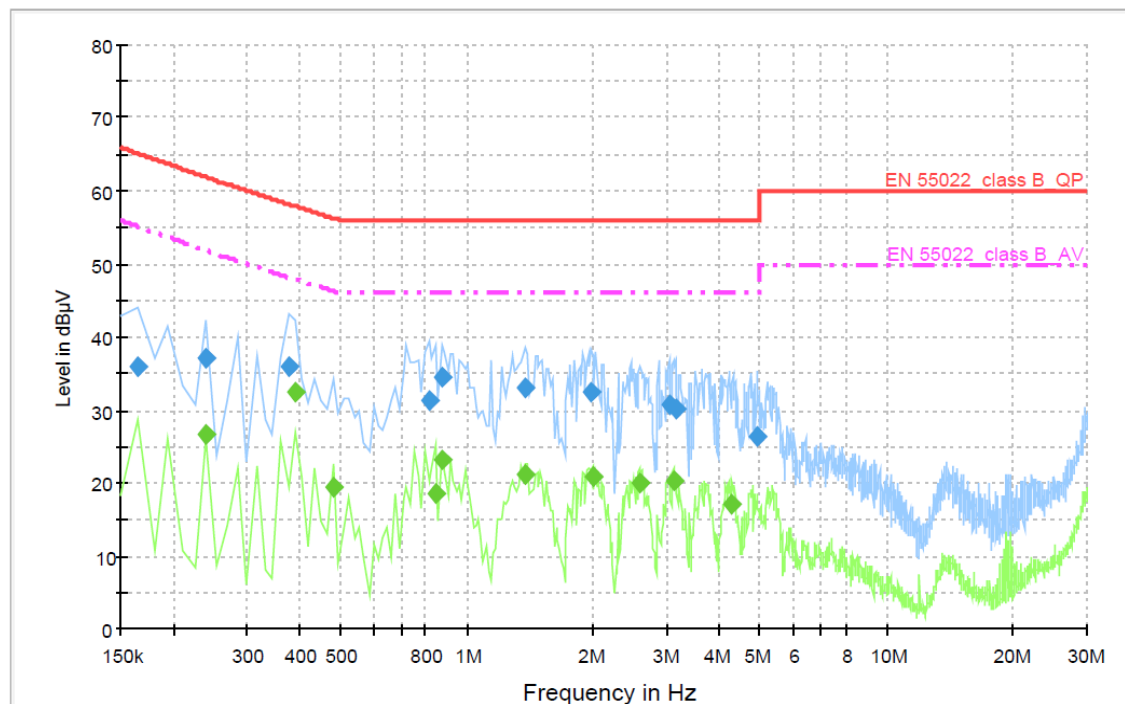
#### 7.6 Test data for power line conducted emission

##### 7.6.1 Test mode: RF transmitting mode.

- Test Date : May 6, 2010  
- Resolution Bandwidth : 9 kHz  
- Frequency Range : 0.15 MHz ~ 30 MHz



## Voltage with 4-Line-LISN\_L1



### Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.165000	36.0	1000.000	9.000	GND	L1	10.0	29.1	65.1	
0.240000	37.2	1000.000	9.000	GND	L1	10.0	24.7	61.9	
0.375000	35.8	1000.000	9.000	GND	L1	10.0	22.4	58.2	
0.810000	31.3	1000.000	9.000	GND	L1	10.0	24.7	56.0	
0.870000	34.5	1000.000	9.000	GND	L1	10.0	21.5	56.0	
1.380000	33.1	1000.000	9.000	GND	L1	10.1	22.9	56.0	
1.980000	32.3	1000.000	9.000	GND	L1	10.1	23.7	56.0	
3.030000	30.8	1000.000	9.000	GND	L1	10.1	25.2	56.0	
3.150000	30.0	1000.000	9.000	GND	L1	10.1	26.0	56.0	
4.920000	26.3	1000.000	9.000	GND	L1	10.2	29.7	56.0	

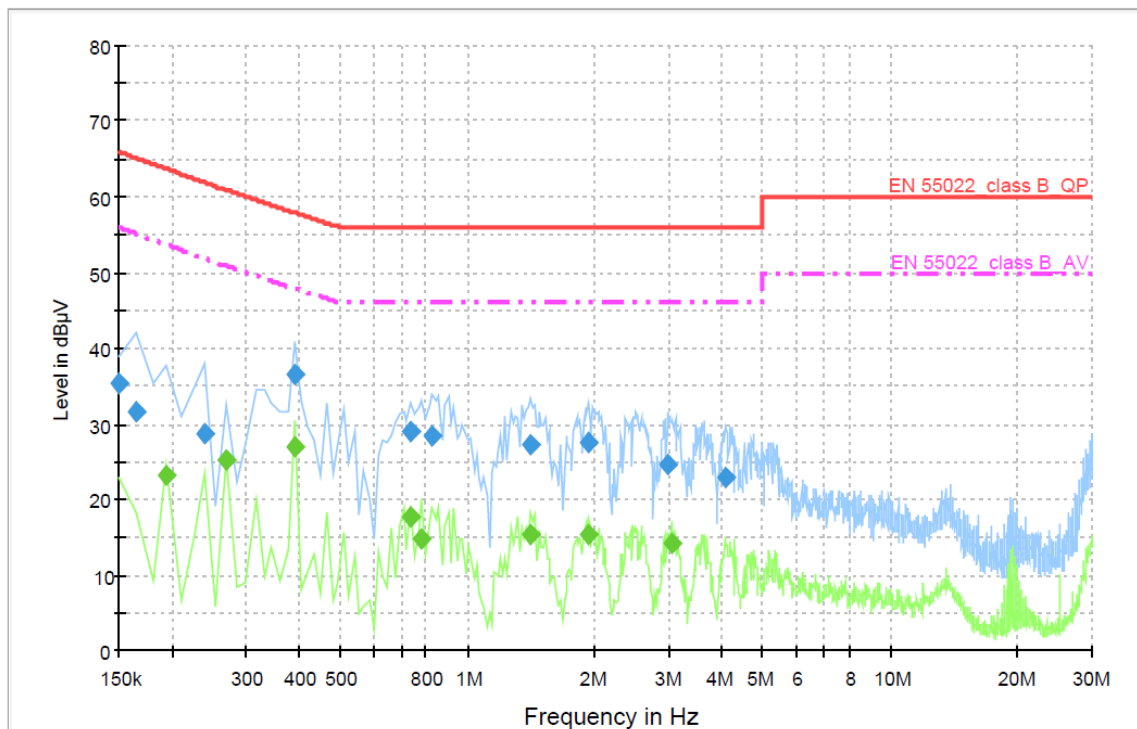
### Final Measurement Detector 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.240000	26.8	1000.000	9.000	GND	L1	10.0	25.1	51.9	
0.390000	32.4	1000.000	9.000	GND	L1	10.0	15.5	47.9	
0.480000	19.5	1000.000	9.000	GND	L1	10.0	26.8	46.3	
0.840000	18.5	1000.000	9.000	GND	L1	10.0	27.5	46.0	
0.870000	23.1	1000.000	9.000	GND	L1	10.0	22.9	46.0	
1.380000	21.1	1000.000	9.000	GND	L1	10.1	24.9	46.0	
1.995000	20.8	1000.000	9.000	GND	L1	10.1	25.2	46.0	
2.580000	20.0	1000.000	9.000	GND	L1	10.1	26.0	46.0	
3.105000	20.2	1000.000	9.000	GND	L1	10.1	25.8	46.0	
4.290000	17.2	1000.000	9.000	GND	L1	10.2	28.8	46.0	

< Fig 4. Conducted emission result (Live line)>



## Voltage with 4-Line-LISN\_N



### Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.150000	35.3	1000.000	9.000	GND	N	10.0	30.7	66.0	
0.165000	31.5	1000.000	9.000	GND	N	10.0	33.6	65.1	
0.240000	28.6	1000.000	9.000	GND	N	10.0	33.3	61.9	
0.390000	36.6	1000.000	9.000	GND	N	10.0	21.3	57.9	
0.735000	29.0	1000.000	9.000	GND	N	10.0	27.0	56.0	
0.825000	28.3	1000.000	9.000	GND	N	10.0	27.7	56.0	
1.410000	27.4	1000.000	9.000	GND	N	10.1	28.6	56.0	
1.935000	27.7	1000.000	9.000	GND	N	10.1	28.3	56.0	
2.985000	24.6	1000.000	9.000	GND	N	10.1	31.4	56.0	
4.095000	22.8	1000.000	9.000	GND	N	10.2	33.2	56.0	

### Final Measurement Detector 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.195000	23.3	1000.000	9.000	GND	N	10.0	30.4	53.7	
0.270000	25.1	1000.000	9.000	GND	N	10.0	25.8	50.9	
0.390000	27.1	1000.000	9.000	GND	N	10.0	20.8	47.9	
0.735000	17.7	1000.000	9.000	GND	N	10.0	28.3	46.0	
0.780000	14.9	1000.000	9.000	GND	N	10.0	31.1	46.0	
1.410000	15.3	1000.000	9.000	GND	N	10.1	30.8	46.0	
1.935000	15.5	1000.000	9.000	GND	N	10.1	30.5	46.0	
3.045000	14.2	1000.000	9.000	GND	N	10.1	31.8	46.0	

< Fig 5. Conducted emission result (Neutral line)>



## 8. Duty Cycle Correction

### 8.1 Operating Environment

Temperature : 23 °C  
Relative humidity : 38 % 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 Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI test receiver	830482/010	12. 11 2010
■ - VULB9160	Schwarzbeck	Bi-log antenna	3193	03. 15 2012

### 8.4 Test result of Duty Cycle

- Test Date : May 13, 2010  
- 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  
(Rechargeable LITHIUM POLYMER Battery 3.7 V , 2 400 mAh)

#### 8.4.1 Test Frequency: 433.92 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)
433.92 MHz	6.17 ms	6.17 %	- 24.20 dB



## 9. Radiated Emission

### 9.1 Operating environment

Temperature : 23 °C  
Relative humidity : 38 % R.H.

### 9.2 Test set-up

A preliminary and final measurement was at 3 m anechoic chamber.

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(Anechoic Chamber)	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 3m, Vertical)	± 4.32 dB	Confidence levels of 95 % ( $k = 2$ )
Radiated emission (30 MHz ~ 300 MHz, 3m, Horizontal)	± 4.21 dB	Confidence levels of 95 % ( $k = 2$ )
Radiated emission (300 MHz ~ 1 000 MHz, 3m, Vertical)	± 3.96 dB	Confidence levels of 95 % ( $k = 2$ )
Radiated emission (300 MHz ~ 1 000 MHz, 3m, Horizontal)	± 3.97 dB	Confidence levels of 95 % ( $k = 2$ )



#### 9.4 Limit

Fundamental Frequency (MHZ)	Field strength of Fundamental			Field strength of Spurious Emission	
	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$	$\mu\text{V/m}$	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$
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 Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 11. 2010
■ - VULB9160	Schwarzbeck	Broadband Test Antenna	3193	03. 15. 2012
■ - BBHA9120D	Schwarzbeck	Horn ANT	207	12. 22. 2011
■ - MCU066	maturo GmbH	Position Controller	1390306	N/A
■ - TT2.5SI	maturo GmbH	Turntable	1390307	N/A
■ - AM 4.0	maturo GmbH	Antenna Mast	1390308	N/A
■ - AFS 44 00101800-25-10P-44	MITEQ	Preamplifier	1258943	11. 12. 2010



## 9.6 Radiated emission test data

- Test Date : May 13, 2010  
- 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 : AC 120 V/ 60 Hz  
(Rechargeable LITHIUM POLYMER Battery 3.7 V, 2 400 mAh)  
- Note 1. Through three orthogonal axes were investigated and the worst case is reported.

### 9.6.1 Operating condition: RF mode (433.92 MHz)

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

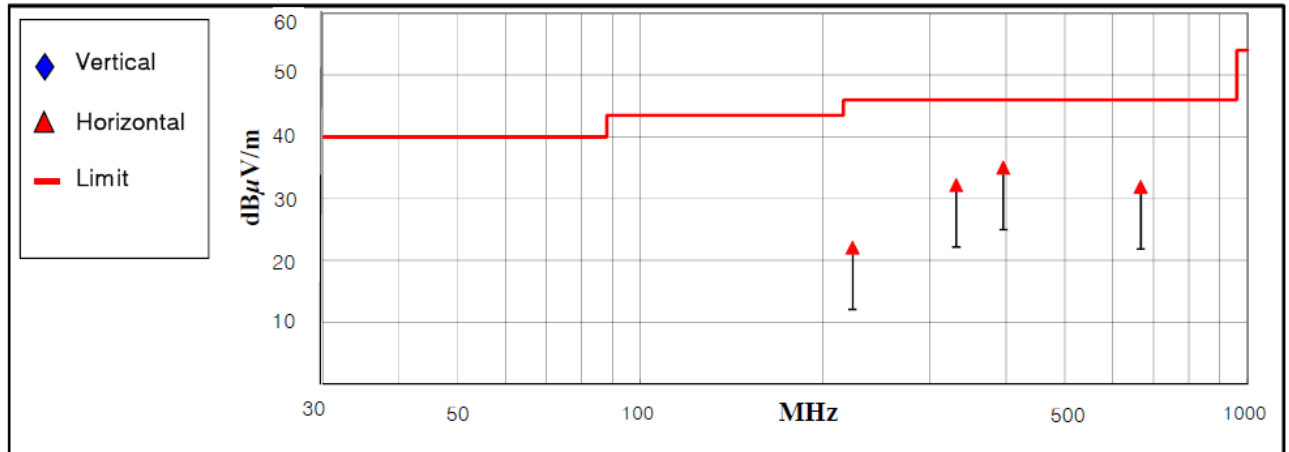
Frequency (MHz)	Measurement Level					Limit		Margin		Positioning System		
	Reading (dBuV)	Tranduce (dB/m)	Duty cycle (dB)	Peak (dBuV/m)	Average (dBuV/m)	Peak (dBuV/m)	Average (dBuV/m)	Peak (dBuV/m)	Average (dBuV/m)	Pol. (H/V)	Height (cm)	Angle (deg)
Fundamental												
433.92	79.03	20.07	-24.20	99.10	74.90	100.83	80.83	1.73	5.92	H	100	120
Spurious												
867.84	31.04	27.66	-24.20	58.70	34.50	80.83	60.83	22.13	26.32	H	100	7
1301.76	76.39	-14.79	-24.20	61.60	37.40	74.00	54.00	12.40	16.60	V	100	5
1735.68	68.98	-13.48	-24.20	55.50	31.30	80.83	60.83	25.33	29.52	H	192	75
2169.60	68.06	-11.96	-24.20	56.10	31.90	80.83	60.83	24.73	28.92	H	100	0
2603.52	68.32	-10.12	-24.20	58.20	34.00	80.83	60.83	22.63	26.82	H	114	16
3037.44	66.79	-8.29	-24.20	58.50	34.30	80.83	60.83	22.33	26.52	H	125	4
3471.36	64.33	-6.63	-24.20	57.70	33.50	80.83	60.83	23.13	27.32	H	100	323
3905.28	61.98	-4.98	-24.20	57.00	32.80	74.00	54.00	17.00	21.20	H	100	43
4339.20	56.26	-3.96	-24.20	52.30	28.10	74.00	54.00	21.70	25.90	H	100	354.0

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



♦ Field Strength of the spurious emission except the harmonic frequencies

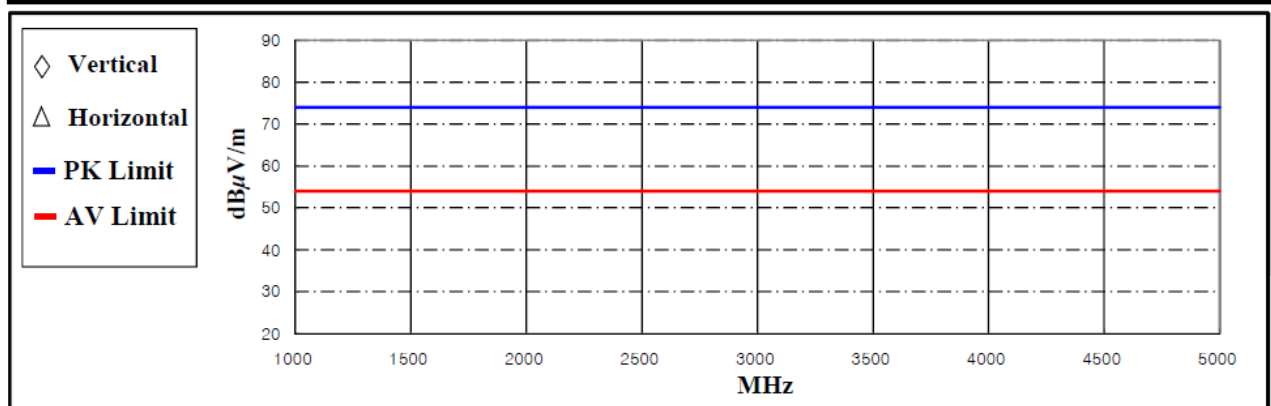
Frequency (MHz)	Measurement Level				Limit (dB $\mu$ V/m)	Margin (dB)	Positioning System		
	Reading	Antenna	Cable	Test Result			Pol.	Height	Angle
	Value(dB $\mu$ V)	Factor(dB/m)	Loss(dB)	(dB $\mu$ V/m)			(H/V)	(cm)	(°)
223.50	9.56	9.99	2.55	22.10	46.00	23.90	H	150	120
331.19	14.79	14.27	3.14	32.20	46.00	13.80	H	100	273
395.87	15.61	15.95	3.44	35.00	46.00	11.00	H	100	85
666.62	7.24	20.18	4.48	31.90	46.00	14.10	H	100	302



< 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 (dB $\mu$ V/m)		Margin (dB)		Positioning System		
	Reading Value (dB $\mu$ V/m)		AF	AMP / CL	Test Result (dB $\mu$ V/m)					Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	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 (1 000 MHz ~ 5 000 MHz)>



## 10. Occupied Bandwidth Measurement

### 10.1 Operating Environment

Temperature : 23 °C  
Relative humidity : 38 % 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 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)

### 10.3 Limit

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

### 10.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI test receiver	830482/010	12. 11 2010
■ - VULB9160	Schwarzbeck	Bi-log antenna	3193	03. 15 2012

### 10.5 Test result of occupied bandwidth

- . Test Date : May 13, 2010  
- . Reference standard : Part 15 subpart C, Sec. 15.231  
- . Operating condition : RF transmitting mode  
- . Spectrum resolution bandwidth(3dB) : 100 kHz  
- . Power Source : AC 120 V/ 60 Hz  
(Rechargeable LITHUM POLYMER Battery 3.7 V, 2 400 mAh)

#### 10.5.1 Test Frequency: 433.92 MHz

Allowed Bandwidth:  $433.92 \times 0.0025 = 1.085 \text{ kHz}$

Fundamental Frequency	Bandwidth	Allowed Bandwidth	Result
433.92 MHz	936.000 kHz	1.085 kHz	PASS

*“Refer to APPENDIX L: Test Plots of occupied bandwidth”*



## 11. Sample Calculations

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

### 11.1 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

### 11.2 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



## 12. Recommendation & conclusion

The data collected shows that the Gumi College EMC Center.

**OHSUNG ELECTRONICS CO., LTD. RF remote controller (Model Name: MX-5000i)** was complies with §15.231 of the FCC Rules.