FCC EVALUATION REPORT FOR CERTIFICATION

FCC (Class II Permissive Change)

Manufacturer: OHSUNG ELECTRONICS CO., LTD.
#181 Gongdan-dong, Gumi-si, Gyeongbuk
Republic of Korea.
Attn : Mr. Hak-Ki Kim / General Manager

Date of Issue: November 15, 2012
Order Number: GETEC-C1-12- 298
Test Report Number: GETEC-E3-12-122
Test Site: GUMI COLLEGE EMC CENTER
FCC Registration Number: (100749, 443957)

FCC ID. : OZ5URC-MX900

Applicant : OHSUNG ELECTRONICS CO., LTD.

Rule Part(s)	**: FCC Part 15 Subpart C-Intentional Radiator § 15.231**
Equipment Class	**: Remote Control Transmitter (DSC)**
EUT Type	**: RF REMOTE CONTROLLER**
Type of Authority	**: Certification**
Model Name	**: MX-900**
Trade Name	**: UNIVERSAL Remote Control**
Class II Change(s)	**: With alternate main board**

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 (2009)

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,

Seung-Chul Lee, Associate Engineer
GUMI COLLEGE EMC CENTER

Reviewed by,

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. Hak-Ki Kim / General Manager

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- **FCC ID.** OZ5URC-MX900
- **Equipment Class** Remote Control Transmitter (DSC)
- **EUT Type** RF REMOTE CONTROLLER
- **Model Name** MX-900
- **Trade Name** UNIVERSAL Remote Control
- **Serial Number** Prototype
- **Rule Part(s)** FCC Part 15 Subpart C
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.4 (2009)
- **Dates of Test** October 17, 2012
- **Place of Test** **GUMI COLLEGE EMC CENTER** (FCC Registration No.: 100749, 443957)
  37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea
- **Test Report Number** GETEC-E3-12-122
- **Dates of Issue** November 15, 2012
- **Class II Change(s)** With alternate main board

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 (ANSI C63.4-2009) was used in determining radiated and conducted emissions emanating from **OHSUNG ELECTRONICS CO., LTD. RF REMOTE CONTROLLER (Model Name: MX-900) FCC ID.: OZ5URC-MX900**

These measurement tests were conducted at **GUMI COLLEGE EMC CENTER**.
The site address is 37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea.
This test site is one of the highest point of Gumi 1 college at about 200 km away from Seoul city and 40 km 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 (2009)

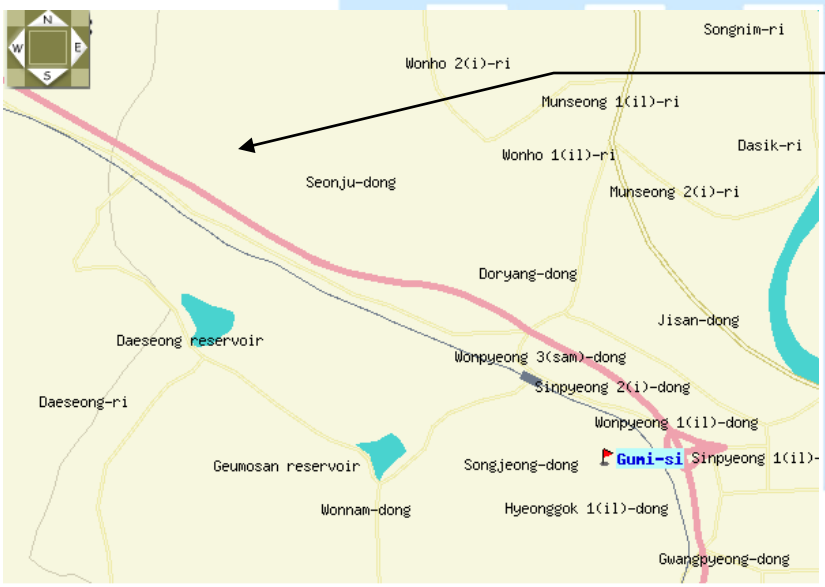

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Fig 1. The map above shows the Gumi College in vicinity area.

3. Product Information

3.1 Description of EUT

The Equipment under Test (EUT) is the **OHSUNG ELECTRONICS CO., LTD.**
RF REMOTE CONTROLLER (Model Name: MX-900) FCC ID.: OZ5URC-MX900

-. Memory	: 4 Mbit of flash memory (for user configuration)
-. Devices	: Flexible, typically can support up to 40 devices
-. Pages	: Flexible, typically can support up to 40 pages on each device
-. Learning Capability	: Up to 255 steps each, however nesting is allowed
-. IR Range (Line of Sight via Infrared)	: (30 – 50) feet, depending on the environment
-. RF Range (Radio Frequency)	: (50 – 100) feet, depending upon the environment
-. RF Frequency	: 418 MHz
-. Weight	: 14 ounces (with batteries)
-. Size	: 8.00 inch (H) × 2.25 inch (W) × 1.25 inch (D)
-. Crystal & Clock Frequency	: Main board: 18.432 MHz (CPU X-TAL), 8 MHz (MICOM X-TAL) RF board: 13.062 5 MHz
-. I/O Port	: USB port

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: -

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

3.2.2 System configuration

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

3.2.3 Used Cable(s)

Cable Name	Condition	Description
None.	-	-

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

- Test Voltage / Frequency : DC 6 V supplied from the four AAA size batteries

(The EUT power is fed from battery (Not supported USB power). Therefore, the conducted emission test was skipped.)

- Test Mode(s): Continuous RF transmitting mode

5.2 Conducted Emission

The Line conducted emission test facility is inside a 4 m × 8 m × 2.5 m shielded enclosure. (FCC Registration No.: 100749)
The EUT was placed on a non-conducting 1.0 m by 1.5 m table, which is 0.8 m in height and 0.4 m away from the vertical wall of the shielded enclosure.
The EUT is powered from the Rohde & Schwarz LISN (ESH2-Z5) and the support equipment is powered from the Rohde & Schwarz LISN (ESH3-Z5). Powers to the LISN are filtered by high-current high insertion loss power line filter.
Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.
The RF output of the LISN was connected to the EMI test receiver (Rohde & Schwarz, ESCS30).
Exploratory measurements were conducted to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.
Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Exploratory measurements were scanned using Peak mode of EMI Test receiver from 150 kHz to 30 MHz with 20 ms sweep time. The final measurements were measured with Quasi-Peak and Average mode.
The bandwidth of EMI Test Receiver was set to 9 kHz. Interface cables were connected to the available interface ports of the test unit. Excess cable lengths were bundled at center with 30 cm ~ 40 cm.

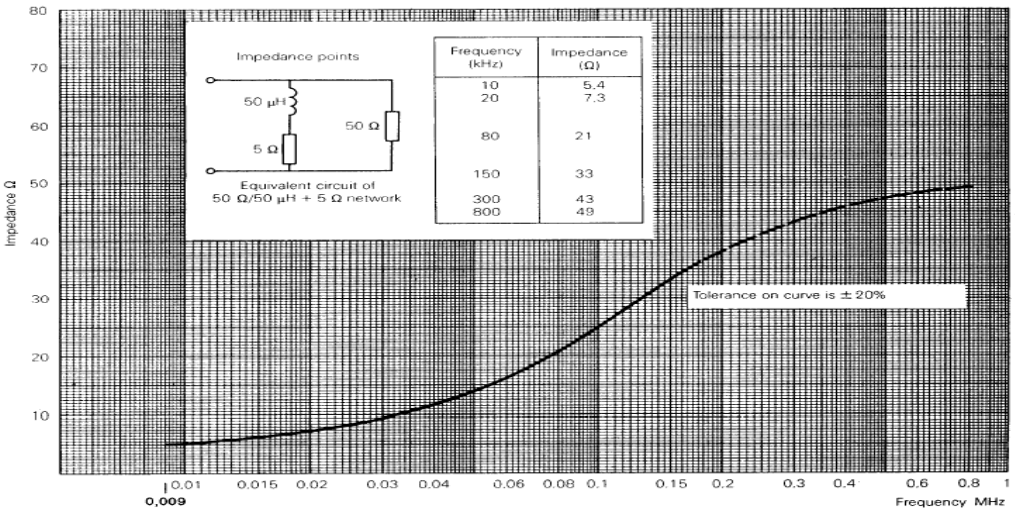


Fig 2. Impedance of LISN

5.3 Radiated Emission

Exploratory Radiated measurements were conducted at the 3m semi anechoic chamber in order to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.
Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Final measurements of below 1GHz were made at 3m Chamber (FCC Registration No.: 443957) or Open area test site (FCC Registration No.: 100749) that complies with CISPR 16/ANSI C63.4.
Above 1GHz final measurements were conducted at the 3m Chamber (FCC Registration No.: 443957) only.

For measurements above 1GHz, the bottom side of 3m chamber was installed with absorbers in order to meet SVSWR Limit.
Exploratory measurements were scanned using Peak mode of EMI Test receiver and final measurements were measured with Quasi-Peak mode (Below 1GHz) and Peak & Average mode (Above 1GHz).

The measurements were performed by rotating the EUT 360° and adjusting the receive antenna height from 1.0 m to 4.0 m. All frequencies were investigated in both horizontal and vertical antenna polarity.

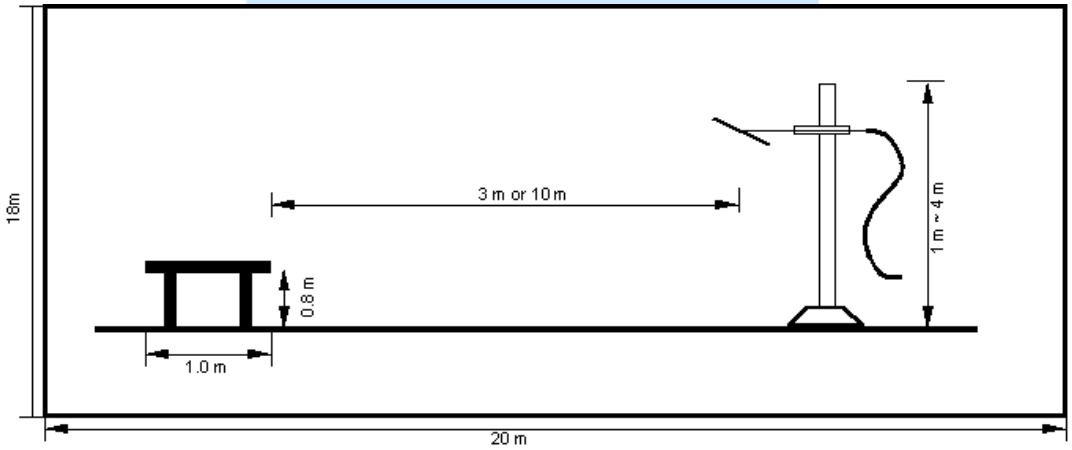


Fig 3. Dimensions of test site (Below 1GHz)

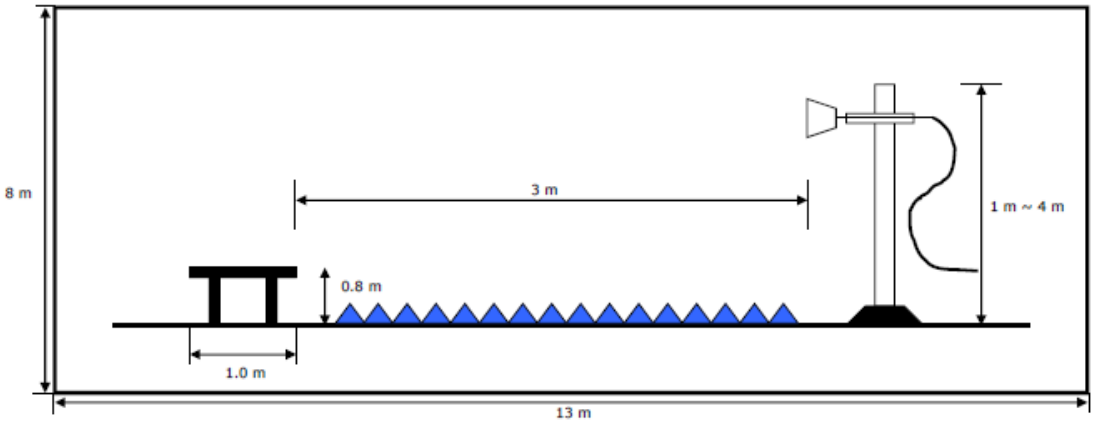


Fig 4. Dimensions of test site (Above 1GHz)

5.4 Duty Cycle Correction

Measurements may be adjusted where pulsed RF is utilized to find the average level associated with a quantity.
This calculation is applied to limits for pulsed licensed and unlicensed devices.
For unlicensed intentional radiator under 47CFR Part 15 §15.35, all duty cycle measurements are compared to a 100 millisecond period.

On time = N1L1+N2L2+…+NnLn, where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc.
Duty Cycle = On time/100 millisecond.

5.5 Occupied Bandwidth

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer.
The bandwidth of the emission shall be no wider than 0.25 % of the center frequency for device operating above 70 MHz and below 900 MHz. For device operating above 900 MHz, the emission shall be no wider than 0.5 % of the center frequency. The bandwidth is determined at the points 20 dB down from the modulated carrier.

6. Radiated Emission

6.1 Operating environment

Temperature : 21.0 ℃
Relative humidity : 42.0 % R.H.

6.2 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.

6.3 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, 3 m, Vertical)	± 4.35 dB	Confidence level of approximately 95 % (k = 2)
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	± 4.29 dB	Confidence level of approximately 95 % (k = 2)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	± 4.43 dB	Confidence level of approximately 95 % (k = 2)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	± 4.21 dB	Confidence level of approximately 95 % (k = 2)

6.4 Limit

Fundamental Frequency (MHz)	Field strength of Fundamental			Field strength of Spurious Emission	
	µV/m	dBµV/m	µV/m	µV/m	dBµV/m
40.66 ~ 40.7	2 250	67.04		225	47.04
70 ~ 130	1 250	61.94		125	41.94
130 ~ 174	1 250 to 3 750	61.94 to 71.48	56.818 18(F)-6136.363 6	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	41.666 7(F)-7083.333 3	375 to 1 250	51.48 to 61.94
Above 470	12 500	81.94		1 250	61.94
Restricted Band	N/A			500	54.0

6.5 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	05. 23. 2013
■ - VULB9160	Schwarzbeck	Broadband Test Antenna	3193	03. 14. 2013
□ - BBHA9120D	Schwarzbeck	Horn Antenna	597	01. 23. 2013
■ - 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. 2012

6.6 Test data for Radiated Emission

-. Test Date : October 17, 2012
-. Reference Standard : Part 15 Subpart C, Sec.15.231
-. Measuring Distance : 3 m
-. Note : 1. Through three orthogonal axes were investigated and the worst case is reported.
2. The signal bandwidth was measured around 40kHz and it less than 100 kHz. Therefore, PDCF is not required the fundamental signal peak result.

-. Measurement

Frequency range	30 MHz ~ 1 GHz	Above 1 GHz
Detector mode	Quasi peak	Peak / Average
Resolution bandwidth	120 kHz	1 MHz

6.6.1 Operating condition: Continuous RF transmitting mode (418 MHz)

♦ Field Strength of the fundamental & harmonic frequencies.

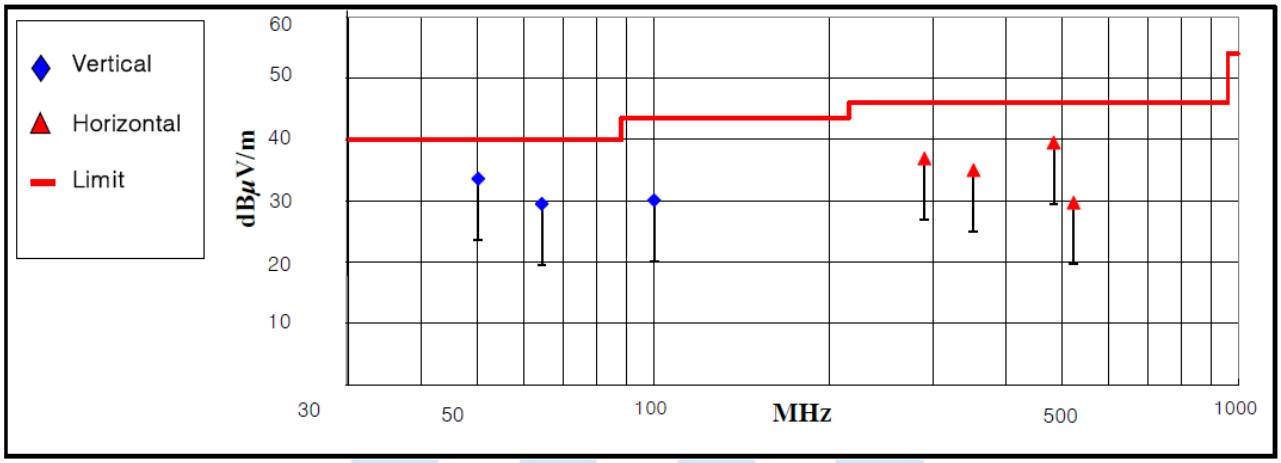
Frequency (MHz)	Measurement Level					Limit		Margin		Positioning System		
	Reading	Tranduce	Duty cycle	Peak	Average	Peak	Aveage	Peak	Average	Pol.	Height	Angle
	(dBuV)	(dB/m)	(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/	(H/V)	(cm)	(deg)
Fundamental												
418.00	79.74	20.06	-24.20	99.80	75.60	100.28	80.28	0.48	4.68	H	100	258
Spurious												
836.00	36.40	27.90	-24.20	64.30	40.10	80.28	60.28	15.98	20.18	H	100	93
1254.00	78.22	-13.72	-24.20	64.50	40.30	80.28	60.28	15.78	19.98	V	101	270
1672.00	76.06	-12.56	-24.20	63.50	39.30	74.00	54.00	10.50	14.70	H	106	135
2090.00	70.76	-11.26	-24.20	59.50	35.30	80.28	60.28	20.78	24.98	H	100	94
2508.00	79.48	-9.48	-24.20	70.00	45.80	80.28	60.28	10.28	14.48	H	100	5
2926.00	72.19	-7.69	-24.20	64.50	40.30	80.28	60.28	15.78	19.98	H	100	320
3344.00	72.98	-5.98	-24.20	67.00	42.80	80.28	60.28	13.28	17.48	H	103	324
3762.00	69.80	-4.30	-24.20	65.50	41.30	74.00	54.00	8.50	12.70	V	100	118
4180.00	66.64	-2.94	-24.20	63.70	39.50	74.00	54.00	10.30	14.50	H	100	350
4598.00	65.52	-2.02	-24.20	63.50	39.30	74.00	54.00	10.50	14.70	H	100	356

*Commant ; 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

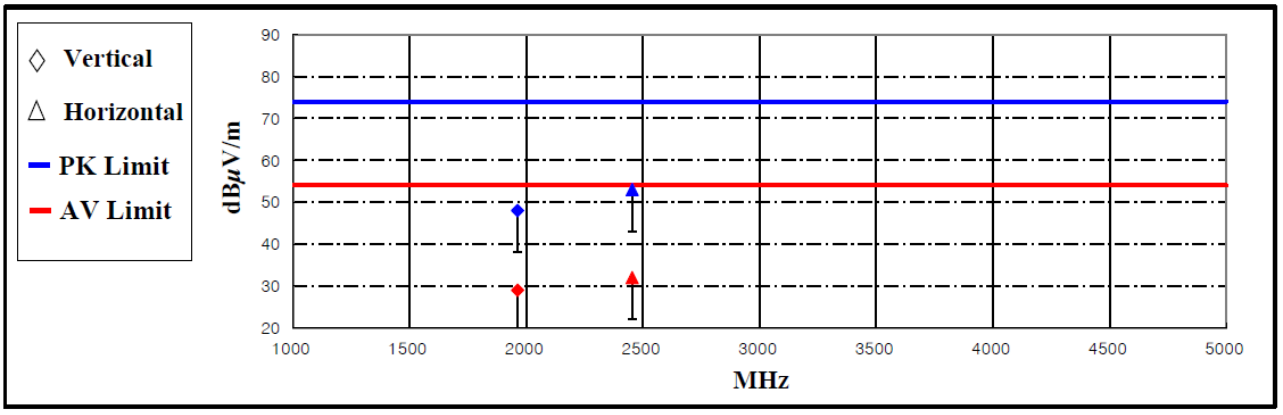
Frequency (MHz)	Measurement Level				Limit (dBμV/m)	Margin (dB)	Positioning System		
	Reading Value(dBμV)	Antenna Factor(dB/m)	Cable Loss(dB)	Test Result (dBμV/m)			Pol. (H/V)	Height (cm)	Angle (°)
50.13	20.07	12.00	1.53	33.60	40.00	6.40	V	100	76
64.38	17.16	10.77	1.57	29.50	40.00	10.50	V	116	188
100.20	18.87	9.41	1.82	30.10	43.50	13.40	V	105	32
290.50	20.69	13.06	3.15	36.90	46.00	9.10	H	100	100
352.43	16.72	14.82	3.46	35.00	46.00	11.00	H	157	65
483.26	18.33	17.08	4.09	39.50	46.00	6.50	H	209	273
522.81	7.65	17.79	4.26	29.70	46.00	16.30	H	181	260



< Fig 7. 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)	(°)
1962.11	59.54	40.54	26.19	-37.73	48.00	29.00	74.00	54.00	26.00	25.00	V	100	20
2453.50	62.19	41.19	27.64	-36.83	53.00	32.00	74.00	54.00	21.00	22.00	H	154	330



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

< Fig 8. Radiated emission result (1 GHz ~ 5 GHz) >

7. Sample Calculations

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

7.1 Example 1 :

■ **20.3 MHz**

Class B Limit = 250 µV = 48 dBµV

Reading = 39.2 dBµV

$10^{(39.2dB\mu V/20)}$ = 91.2 µV

Margin = 48 dBµV - 39.2 dBµV

= 8.8 dB

7.2 Example 2 :

■ **66.7 MHz**

Class B Limit = 100 µV/m = 40.0 dBµV/m

Reading = 31.0 dBµV

Antenna Factor + Cable Loss = 5.8 dB

Total = 36.8 dBµV/m

Margin = 40.0 dBµV/m – 36.8 dBµV/m

= 3.2 dB

8. Recommendation & Conclusion

The data collected shows that the **OHSUNG ELECTRONICS CO., LTD. RF REMOTE CONTROLLER (Model Name: MX-900)** was complies with §15.231 of the FCC Rules.

- The end -