



FCC EVALUATION REPORT FOR CERTIFICATION

FCC Class B(Class II Permissive Change)

Manufacturer : OHSUNG ELECTRONICS CO., LTD

Date of Issue : October 01, 2004

#181 Gongdan-Dong, Gumi-City

Test Report S/N : GETEC-E3-04-047

Gyeongsangbuk-Do, Korea

Test Site : Gumi College EMC Center

Attn : Mr. Kwang-jae Ok / Manager

FCC ID

OZ5URC200

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 Transmitter Universal Remote Control

Frequency Range : 417.5~418.5 MHz

Trade Name : Universal Remote Control

Model No. : MX-350

Class II Change : Added a current stabilization circuit at main PCB and changed the shape and location of internal antenna.

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 C63.4-1992.

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 best 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,

Jea-Woon Choi, Chief engineer
GUMI College EMC center

Tae-Sig Park, Technical manager
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 / Manager
Manufacturer	: OHSUNG ELECTRONICS CO., LTD #181 Gongdan-Dong, Gumi-city, Gyeongsangbuk-do, Korea

- **Equipment Class** Remote Control Transmitter (DSC)
- **EUT Type** RF Transmitter Universal Remote Control
- **Power Source** DC 6V supplied from four AAA size batteries
- **Model No.** MX-350
- **Rule Part(s)** FCC Part 15, Subpart C-Intentional Radiator § 15.231
- **Test Procedure(s)** ANSI C63.4 (1992)
- **Dates of Test** October 01, 2004
- **Place of Test** Gumi College EMC Center
- **Test Report No.** GETEC-E3-04-047

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 C63.4-1992) was used in determining radiated and conducted emissions emanating from **OHSUNG ELECTRONICS CO., LTD. RF Transmitter Universal Remote Control, Model No.: MX-350**

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 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



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. RF Transmitter Universal Remote Control, Model No.: MX-350**

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

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 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 100KHz 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

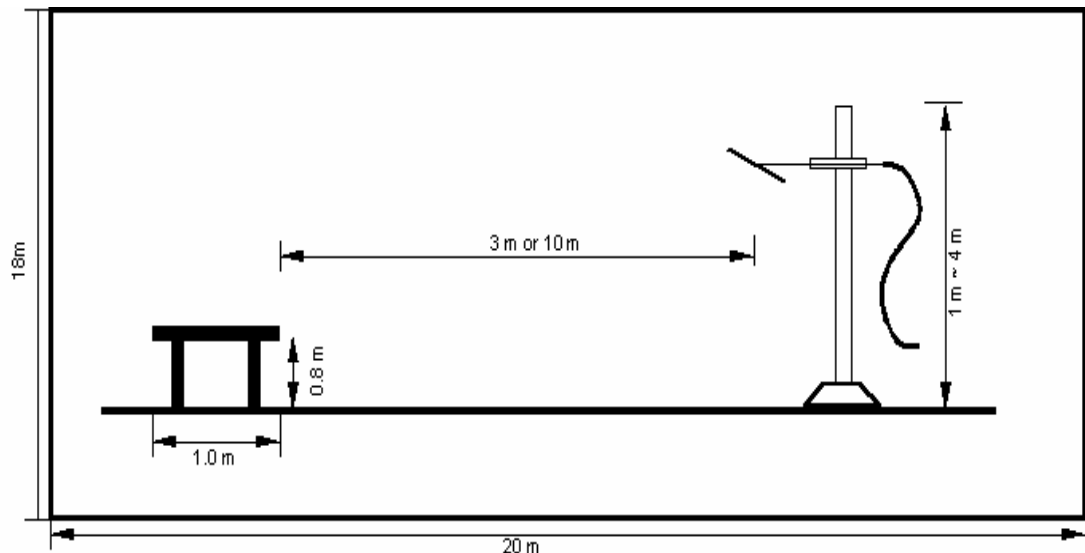


Fig 2. Dimensions of Open Site Test Area

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

Duty Cycle = On time/100 millisecond.

5.4 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 : 23 °C
Relative humidity : 57 %

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. 17. 2003
■ -	HL223	Rohde & Schwarz	Log-periodic antenna	829228/011	11. 21. 2003

6.4 Test result of Duty Cycle

- Test Date : September 22, 2004
- Reference standard : Part 15 Subpart C, Sec. 15.35
- Operating condition : Transmit a pulse train
- Spectrum resolution bandwidth(6dB) : 100 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 = 8.42ms
- Number of Narrow Pulse = 340
- Width of Pulses = 24.0µs

Calculation of duty cycle

- Total width of pulse train : $1 \times 8.42\text{ms} + 340 \times 24\mu\text{s} = 16.58\text{ms}$
- Duty Cycle (%) : $16.58\text{ms} / 100\text{ms} = 16.58\%$
- Duty Cycle (dB) : -15.61dB

Fundamental Frequency	Total width of ON-Time	Duty Cycle (%)	Duty Cycle (dB)
417.6 MHz	16.58 ms	16.58%	-15.61dB

Refer to APPENDIX B: Test Plots of occupied bandwidth

7. Radiated emission test

7.1 Operating environment

Temperature : 23 °C
Relative humidity : 57 %

7.2 Test set-up

A preliminary scan with peak mode was performed in the semi anechoic chamber using the procedure in ANSI C63.4/1992 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)	1.00	1.00	1.00	1.00
Receiver specification	Rectangular	1.00	1.00	1.00	1.00
Antenna directivity	Rectangular	0.50	0.00	3.00	0.50
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	2.83	-2.94	-1.96	-2.96
Mismatch Receiver VRC : $\Gamma_l = 0.09$ Antenna VRC : $\Gamma_g = 0.43$ (Bi) 0.23 (Lp) Uncertainty limits $20\log(1 \pm \Gamma_l \Gamma_g)$	U-shaped	0.33 -0.35	0.33 -0.35	0.33 -0.18	0.33 -0.18
System repeatability	Std Deviation	0.07	0.05	0.06	0.10
Cable loss calibration	Normal (k=2)	0.20	0.20	0.20	0.20
Combined standard uncertainty $U_c(y)$	Normal	1.88 -1.88	1.90 -1.90	2.33 -2.32	1.94 -1.93
Extended uncertainty U	Normal (k=2)	3.77 -3.77	3.80 -3.80	4.65 -4.63	3.87 -3.85

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. 17. 2003
■ - HK116	Rohde & Schwarz	Biconical antenna	826861/018	11. 21. 2003
■ - HL223	Rohde & Schwarz	Log-periodic antenna	829228/011	11. 21. 2003
■ - BBHA 9120D	Schwarzbeck	Double ridged broadband 207 horn antenna		11. 21. 2003
■ - 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 : September 22, 2004
- Reference standard : Part 15 Subpart C, Sec. 15.231
- Operating condition : Continuous transmitting
- Measuring Distance : 3m
- Spectrum resolution bandwidth (6dB) : 100kHz
- Detector mode : Peak detector mode
- Power Source : DC 6V supplied from four AAA size 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)
417.6	H	100	122	22.71	91.81	-15.61	76.20	80.27	4.07

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)
835.16	H	100	331	29.82	67.62	-15.61	52.01	61.94	9.93
1253	H	145	188	25.48	73.08	-15.61	57.47	61.94	4.47
1670	H	100	0	27.77	62.37	-15.61	46.76	54.0	7.24
2088	H	127	199	29.99	72.19	-15.61	56.58	61.94	5.36
2505	H	100	142	31.88	73.38	-15.61	57.77	61.94	4.17
2923	H	100	165	33.77	72.07	-15.61	56.46	61.94	5.48
3340	V	100	179	34.98	66.58	-15.61	50.97	61.94	10.97
4176	H	100	244	37.06	65.16	-15.61	49.55	54.0	4.45
4594	H	100	219	38.03	63.83	-15.61	48.22	54.0	5.78

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)
277.8	11.6	V	17.21	4.28	33.1	46.0	12.9
92.94	13.3	V	14.82	4.47	32.6	46.0	13.4

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

[Quasi- peak detector mode]

8. Occupied Bandwidth Measurement

8.1 Operating environment

Temperature : 23°C
Relative humidity : 57 %

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 86.8kHz/division frequency span, 100kHz 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. 17. 2003
■ - HL223	Rohde & Schwarz	Log-periodic antenna	829228/011	11. 21. 2003

8.5 Test result of occupied bandwidth

- Test Date : September 22, 2004
 - Reference standard : Part 15 Subpart C, Sec. 15.231
 - Operating condition : Continuous transmitting
 - Spectrum resolution bandwidth(6dB) : 100 kHz
 - Power Source : DC 6V supplied from four AAA size batteries

Allowed Bandwidth : $417.6 \times 0.0025 = 1.044$ MHz

Fundamental Frequency	Bandwidth	Allowed Bandwidth	Result
417.6 MHz	507.01 MHz	1.044 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. RF Transmitter Universal Remote Control, Model No.: MX-350 was complies with §15.231 of the FCC Rules.

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