

## ***Nemko Korea CO., Ltd.***

300-2, Osan-Ri, Mohyun-Myun, Yongin-City, Kyungki-Do, KOREA

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

**Applicant :****Samsung Electro-Mechanics Co., Ltd.****314, Maetan3-dong, Paldal-gu, Suwon-shi****Kyunggi-do, Korea, (Post code : 442-743)****Attn. : Mr. Junhwan Lim****Dates of Issue : September 16, 2003****Test Report No. : NK2DE396****Test Site : Nemko Korea Co., Ltd.****EMC site, Korea****FCC ID*****E2XOMW4CL-M*****Brand Name*****SAMSUNG*****CONTACT PERSON****Samsung Electro-Mechanics Co., Ltd.  
314, Maetan3-dong, Paldal-gu, Suwon-shi  
Kyunggi-do, Korea , 442-743.  
Mr. Junhwan Lim  
Telephone No. : +82 32 210 6497**

Applied Standard:

FCC 47 CFR Part 15, Subpart C : 2000

Classification :

FCC Class B Device

EUT Type:

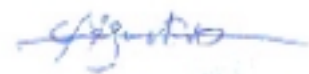
Wireless Optical Wheel Mouse

The device bearing the brand name and FCC ID specified above has been shown to comply 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 and 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 : T. H. Ryu**  
**Senior Engineer**



**Reviewed By : H.H. Kim**  
**Manager & Chief Engineer**

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## SCOPE

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Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 15.

<b>Responsible Party* :</b>	Samsung Electro-Mechanics Co., Ltd.
<b>Contact Person :</b>	Mr. Junhwan Lim
<b>Manufacturer :</b>	Samsung Electro-Mechanics Co., Ltd. 314, Maetan3-dong, Paldal-gu, Suwon-shi, Kyunggi-do, Korea , 442-743.
<b>Factory :</b>	1. Chic Technology Corp. Xiwang Industrial Park, Tian Tang Wei, Feng Gang, Dongguan, China 2. Dongguan Samsung Electro-Mechanics Co.,Ltd. Quan-Tang Village,Liao-Bu Town, Dong-Guan City, Guang-Dong Province P.R CHINA, 523425

● FCC ID:	E2XOMW4CL-M
● Model:	OMW4CL-M
● Brand Name:	SAMSUNG
● EUT Type:	Wireless Optical Wheel Mouse
● Classification:	FCC Class B
● Applied Standard:	FCC 47 CFR Part 15 , Subpart C
● Test Procedure(s):	ANSI C63.4 (1992)
● Dates of Test:	September 03, 2003 to September 15, 2003
● Place of Tests:	Nemko Korea Co., Ltd. EMC Site
● Test Report No.:	NK2DE396

## INTRODUCTION

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-1992) was used in determining radiated and conducted emissions emanating from **Samsung Electro-Mechanics Co., Ltd.**

FCC ID : **E2XOMW4CL-M, Wireless Optical Wheel Mouse.**

These measurement tests were conducted at **Nemko Korea Co., Ltd. EMC Laboratory**.

The site address is 300-2, Osan-Ri, Mohyun-Myun, Yongin-City, Kyungki-Do, KOREA

The area of Nemko Korea Corporation LTD. EMC Test Site is located in a mountain area at 80 kilometers (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 kilometers (18miles) south-southeast from central Seoul.

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 Seoul in Korea vicinity area.

The map also shows Nemko Korea Corporation Ltd. EMC Lab. and Incheon Airport.

## TEST CONDITIONS & EUT INFORMATION

### Operating During Test

The EUT is part of transmitter and transmitted specific frequency(27.045MHz) continuously.

### Support Equipment

Notebook PC	Dell Asia Pacific Sdn., Model: PPT(Latitude D400)	S/N: 7WV381S
Notebook PC (Adaptor)	Lite-On Technology Corp., Model No: PA-1900-02D 1.0m unshielded AC power cord	S/N: N/A
17" LCD Monitor	Hansol LCD Inc., Model : B17DF 1.5m unshielded AC power cable 1.8m shielded D-sub cable	S/N: N/A
RF Receiver	Samsung, FCC ID: E2XOMW4CL-R 1.2m Shielded USB cable	S/N: N/A
Mouse (EUT)	Samsung, FCC ID: E2XOMW4CL-M	S/N: N/A
Printer	HP, Model No: C5870A 1.8m unshielded AC power cord 1.2m Shielded D-sub cable	S/N: SG88R131GW
Printer (Adaptor)	YOKOGAWA, Model: C4557-60104 1.8m unshielded AC power cable 1.2m unshielded DC power cable	S/N: N/A
Keyboard	BTC Info & Comm. , M/N:5900 1.8m Shielded D-sub cable	S/N: KI5100342
Serial Mouse	ALLSPIRIT, M/N: WS-V1-400 1.2m Unshielded D-sub cable	S/N: B050402
PS/2 Mouse	Logitech, M/N: M-S48a 1.5m Shielded Din cable	S/N: N/A

### EUT Information

Clock:	*) Main Board : 6MHz(Y1), 13.5225MHz(Y2)
	*) Sensor Board : 18.43MHz(Y2)
Chipset:	ADNS-2030(U2)
Working Frequency:	27.045MHz (1 CH)
Modulation:	FSK
RF output power:	-18dBm@conduction
Current Dissipation	27mA Max. (Active Mode)
Power Supply:	3.0V , AA size Battery 2 pcs

## SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

Name of Test	Paragraph No.	Result	Remark
Power line Conducted Emission	15.207	N/A	EUT is operated by 3V batteries
Radiated Emission ( Fundamental )	15.227	Complies	
Radiated Emission ( Spurious )	15.209	Complies	

## RECOMMENDATION/CONCLUSION

The data collected shows that the **Samsung Electro-Mechanics Co., Ltd.**

FCC ID : **E2XOMW4CL-M, Wireless Optical Wheel Mouse.**

The highest emission observed was at **48.43 MHz** for radiated emissions with a margin of **11.9 dB**.

## SAMPLE CALCULATION

$$\text{dB } \mu\text{V} = 20 \log_{10} (\mu\text{V}/\text{m})$$

$$\mu\text{V} = 10^{(\text{dB } \mu\text{V}/20)}$$

### EX. 1.

@57.7 MHz

Class B limit = 100  $\mu\text{V}/\text{m}$  = 40.0 dB  $\mu\text{V}/\text{m}$

Reading = 19.1 dB  $\mu\text{V}$  (calibrated level)

Antenna factor + Cable Loss = 10.12 dB

Total = 29.22 dB  $\mu\text{V}/\text{m}$

Margin = 40.0 - 29.22 = 10.78

10.78 dB below the limit

## DESCRIPTION OF TEST

### Radiated Emissions

Preliminary measurement were made indoors at 3 meter using broad band antennas, broadband amplifier, and spectrum analyzer 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, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna was note for each frequency found.

The spectrum was scanned from 30 to 1000MHz using Biconical log Antenna(ARA, LPB-2520/A). Above 1GHz, log periodic antenna (Rohde Schwarz HL025:upto 18GHz) was used.

Final Measurements were made outdoors at 3 or 10m test range using Logbicon Super Antenna(Schwarzbeck, VULB9166) or log periodic antenna.( Rohde Schwarz HL025)

The test equipment was placed on a wooden table.

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 reexamined and investigated using EMI test receiver.(ESCS30)

The detector function was set to CISPR quasi-peak mode or Average mode and the bandwidth of the receiver was set to 120KHz or 1MHz depending on the frequency or type of signal.

The half wave dipole antenna was tuned to the frequency found during preliminary radiated measurements.

The EUT support equipment and interconnecting cables were re configured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8m high non- metallic 1.0X 1.5 meter table.

The EUT, support equipment and interconnecting cables were re-arranged and manipulated to maximize each EME emission.

The turn table containing the Technology was rotated; the antenna height was varied 1 to 4meter and stopped at the azimuth or height producing the maximum emission Each emission was maximized by : switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; which ever determined the worst case emission.

Each EME reported was calibrated using the R/S signal generator.

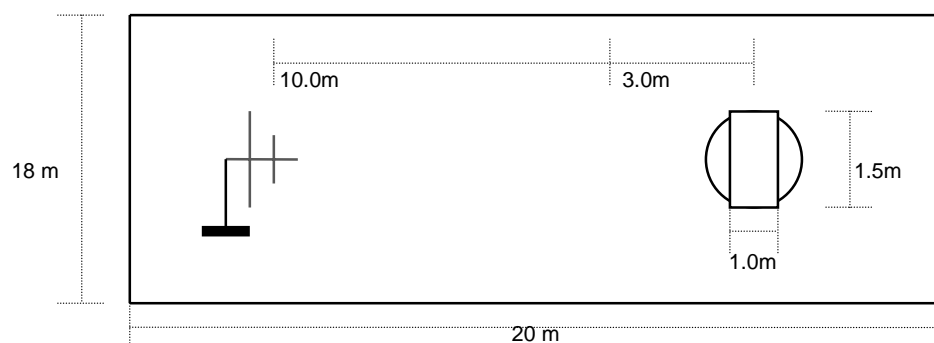


Fig. 2. Dimensions of Outdoor Test Site

# TEST DATA

## Radiated Emissions; general requirements (15.209)

FCC ID : E2XOMW4CL-M

Working Frequency : 27.045MHz

Frequency (MHz)	Reading (dB $\mu$ V)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
48.43	49.6	V	-21.4	28.2	40.0	11.9
125.06	44.9	V	-16.5	28.4	43.5	15.2
214.30	40.2	V	-13.4	26.9	43.5	16.7
317.12	40.6	H	-10.9	29.8	46.0	16.3
499.48	33.6	V	-6.3	27.3	46.0	18.8
624.61	35.4	V	-2.9	32.5	46.0	13.6

\*) The field strength of fundamental frequencies were under 20dB below limit.

Table 1. Radiated Measurements at 3meters

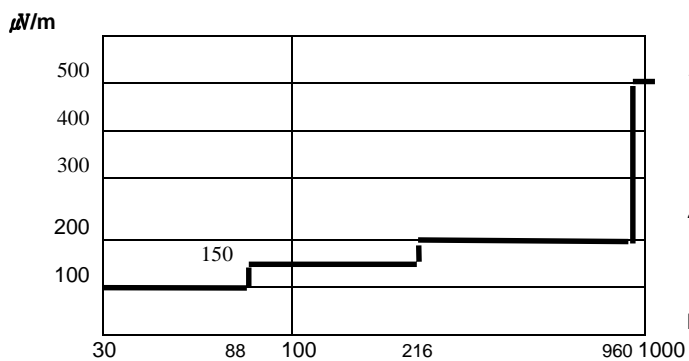


Fig. 3. Limits at 3 meters

### NOTES:

1. All modes of operation were investigated the worst-case emission are reported.
2. The radiated limits are shown on Figure 3.

Above 1GHz the limit is 500  $\mu$ V/m.

### NOTES:

1. \*Pol. H=Horizontal V=Vertical
2. \*\*AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.
3. Up to the 10<sup>th</sup> harmonics were investigated according to § 15.33 and the worst -case is reported.

*T. H. Ryu*

Tested by **T. H. Ryu**



## TEST DATA

### Radiated Emissions ; within the band 26.96-27.28MHz (15.227)

FCC ID : E2XOMW4CL-M

Working Frequency : 27.045MHz

Channel	Frequency	*)Pol. (H/V)	Reading(dB $\mu$ V)		**)A.F (dB)	**)C.L+Amp (dB)	Result(dB $\mu$ V/m)		Limit(dB $\mu$ V/m)	
	(MHz)		AV	PK			AV	PK	AV	PK
1	27.045	H	7.1	8.3	5.0	30.7	42.8	44.0	80.0	100.0
	27.045	V	3.0	4.3	5.0	30.7	38.7	40.0	80.0	100.0

**Table 2. Radiated Measurements at 3meters**

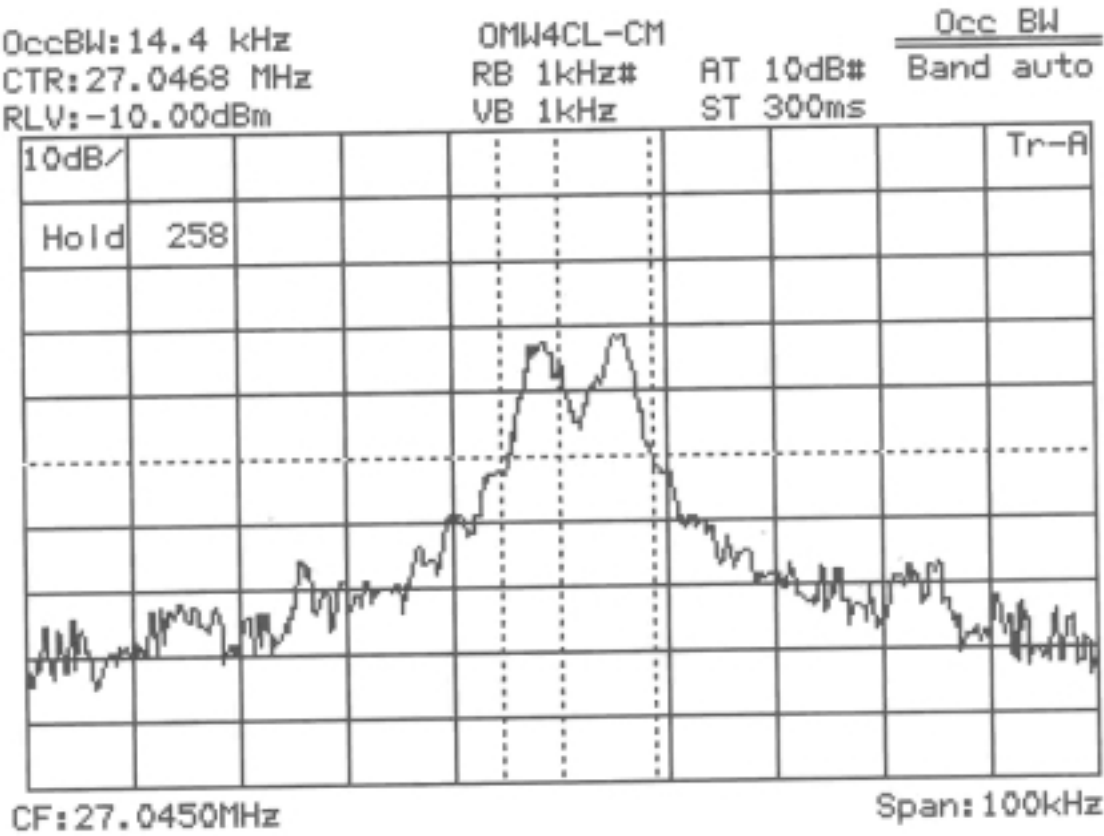
#### NOTES:

1. \*Pol. H=Horizontal V=Vertical
2. \*\*CL+Amp. = Cable Loss + Amplifier. A.F= Antenna Factor
3. The limit at fundamental frequency is 10,000uV/m @3m, using Average detector.
4. The emissions radiated outside of this band shall not exceed the general radiated emission limit in § 15.209.
5. The emissions are maximized by changing polarity of the antenna.



Tested by **T. H. Ryu**

PLOTS OF EMISSION



## ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 with the confidence level of 95%

### 1. Radiation Uncertainty Calculation

<i>Contribution</i>	<i>Probability Distribution</i>	<i>Uncertainty(+/-dB)</i>
Antenna Factor	Normal (k=2)	$\pm 0.5$
Cable Loss	Normal (k=2)	$\pm 0.04$
Receiver Specification	Rectangular	$\pm 2.0$
Antenna directivity	Rectangular	$\pm 1.0$
Antenna Factor variation with Height		
Antenna Phase Center Variation		
Antenna Factor Frequency Interpolation		
Measurement Distance Variation		
Site Imperfections	Rectangular	$\pm 2.0$
Mismatch:Receiver VRC $r_i=0.3$ Antenna VRC $r_R=0.1(B_i)0.4(L_p)$ Uncertainty Limits $20\text{Log}(1+\pm r_i r_R)$	U-Shaped	$+ 0.25 / - 0.26$
System Repeatibility	Std.deviation	$\pm 0.05$
Repeatability of EUT	-	-
Combined Standard Uncertainty	Normal	$\pm 1.77$
Expended Uncertainty U	Normal (k=2)	$\pm 3.5$

### 2. Conducted Uncertainty Calculation

<i>Contribution</i>	<i>Probability Distribution</i>	<i>Uncertainty(+/-dB)</i>
Receiver Specification	Normal (k=2)	$\pm 2.0$
LISN coupling spec.	Normal (k=2)	$\pm 0.4$
Cable and input attenuator cal.	Rectangular	$\pm 0.4$
Mismatch:Receiver VRC $r_i=0.3$ LISN vrc $r_g=0.1$ Uncertainty Limits $20\text{Log}(1+\pm r_i r_R)$	U-Shaped	$\pm 0.26$
System Repeatibility	Std.deviation	$\pm 0.68$
Repeatability of EUT	-	-
Combined Standard Uncertainty	Normal	$\pm 1.18$
Expended Uncertainty U	Normal (k=2)	$\pm 2.4$

## TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Calibration Date
1	*Test Receiver	R & S	ESCS 30	2003.09
2	Test Receiver	PMM	PMM9000	2003.06
3	Amplifier	HP	8447F	2003.07
4	*Amplifier	HP	8447F	2002.11
5	*Amplifier	HP	8447F	2003.01
6	*Spectrum Analyzer	Advantest	R3265A	2003.03
7	Spectrum Analyzer	H.P	8566B	2003.03
8	*Spectrum Analyzer	Anritsu	MS2668C	2002.12
9	*Logbicon Super Antenna	Schwarzbeck	VULB9166	2003.05
10	Log-Periodic Antenna	R & S	HL025	2003.01
11	Dipole Antenna	R & S	VHA9103	2003.05
12	Dipole Antenna	R & S	UHA9105	2003.05
13	*Biconical Log Antenna	ARA	LPB-2520/A	2003.05
14	Absorbing Clamp	R & S	MDS21	2003.06
15	High Voltage Probe	R & S	ESH2-Z3	2002.10
16	Signal Generator	R & S	SMP02	2002.12
17	Matching Pad	R & S	RAM358.5414.02	2003.05
18	LISN	R & S	ESH3-Z5	2002.10
19	LISN	Kyoritsu	KNW-408	2002.12
20	LISN	Kyoritsu	KNW-407	2003.04
21	*Position Controller	EM Eng.	N/A	N/A
22	*Turn Table	EM Eng.	N/A	N/A
23	*Antenna Mast	EM Eng.	N/A	N/A
24	*Anechoic Chamber	EM Eng.	N/A	N/A

\*) Test equipment used during the test

## APPENDIX A – LABELLING REQUIREMENTS

### Labelling Requirements

The sample label shown shall be *permanently affixed* at a conspicuous location on the device and be readily visible to the user at the time of purchase.

FCC ID: E2XOMW4CL-M

Bland Name: SAMSUNG

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

#### ● FCC ID Location of EUT



## ***APPENDIX B – CIRCUIT DIAGRAM***

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## ***APPENDIX E – USER’S MANUAL***

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## ***APPENDIX F – SCHEMATIC DIAGRAM***

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## ***APPENDIX G - OPERATING DESCRIPTION***

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The EUT is part of transmitter that it is powered by 3V batteries.

The receiver connected to the USB port of the PC and the EUT communicates with the receiver wirelessly.

The EUT uses FSK to modulate commands and uses the transmit frequency 27MHz.