

Nemko Korea CO., Ltd.

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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 : August 30, 2003

Test Report No. : NK2DE532

Test Site : Nemko Korea Co., Ltd.

EMC site, Korea

FCC ID

E2XSDR5000M

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:

27MHz Wireless Optical 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 : S. K. Lee
Senior Engineer



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

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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 the technical rules and regulations of the Federal Communications Commission under FCC part 15.

Responsible Party* :	Samsung Electro-Mechanics Co., Ltd.
Contact Person :	Mr. Junhwan Lim
Manufacturer :	1. Samsung Electro-Mechanics Co., Ltd. 314, Maetan3-dong, Paldal-gu, Suwon-shi, Kyunggi-do, Korea , 442-743. 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: E2XSDR5000M
- Model: SDR5000M
- Brand Name: SAMSUNG
- EUT Type: 27MHz Wireless Optical Mouse
- Classification: FCC Class B
- Applied Standard: FCC 47 CFR Part 15 , Subpart C
- Test Procedure(s): ANSI C63.4 (1992)
- Dates of Test: August 14, 2003 to August 19, 2003
- Place of Tests: Nemko Korea Co., Ltd. EMC Site
- Test Report No.: NK2DE532

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 : **E2XSDR5000M, 27MHz Wireless Optical 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(27.245MHz) continuously.

Support Equipment

PC	Dell computer, FCC DoC Model: Dimension 4600 1.8m Unshielded AC power cable	S/N: B56481S
Monitor	Hansol, FCC ID: MSAB17DF 1.8m unshielded AC power cord 1.2m Shielded D-sub cable	S/N: N/A
RF Receiver	Samsung, FCC ID: E2XSDR5000R 1.2m Shielded Din cable	S/N: N/A
Keyboard	Samsung, FCC ID: E2XSDR5000K	S/N: N/A
Mouse (EUT)	Samsung, FCC ID: E2XSDR5000M	S/N: N/A
Printer	HP, Model No: C4562K , FCC DoC 1.8m unshielded AC power cord 1.2m Shielded D-sub cable	S/N: SG74T1C206
Joystick	Logitech , M/N:J-ZA10, FCC DoC 1.8m Shielded D-sub cable	S/N: YED20300268
Serial Mouse	IO Tec , M/N: Laser mouse 1.2m Unshielded D-sub cable	S/N: N/A
USB Mouse	Immanuel . M/N: Magicsecure3100 1.5m Shielded D-sub cable	S/N: N/A

EUT Information

Clock:	6MHz(X2) , 13.6225MHz(Y1) , 18.43MHz(Y2)
Chipset:	A2030(U2) , M238(U1)
Working Frequency:	27.245MHz (1 CH)
Modulation:	FSK
RF output power:	> -10dBm
Current Dissipation	< 35mA
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 : **E2XSDR5000M**, **27MHz Wireless Optical Mouse**.

The highest emission observed was at **40.88 MHz** for radiated emissions with a margin of **7.7 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 μV (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.

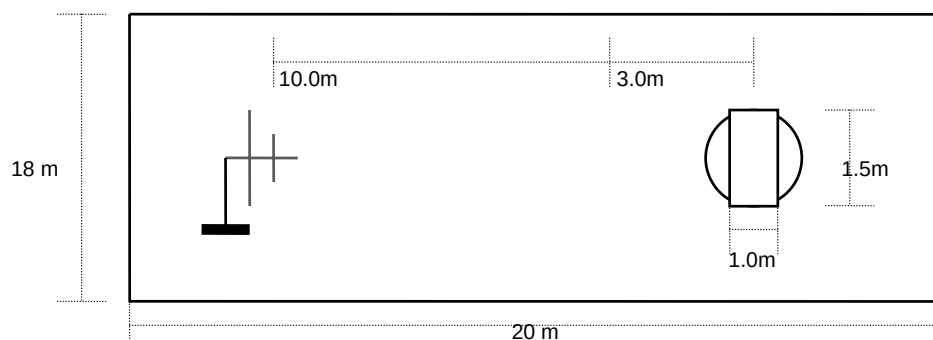


Fig. 2. Dimensions of Outdoor Test Site

TEST DATA

Radiated Emissions; general requirements (15.209)

FCC ID : E2XSDR5000M

Working Frequency : 27.245MHz

Frequency (MHz)	Reading (dB μ V)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
40.88	53.4	V	-21.1	32.3	40.0	7.7
81.75*	46.2	V	-20.4	25.8	40.0	14.2
108.98*	42.4	H	-17.3	25.1	43.5	18.4
122.61	39.9	H	-16.9	23.0	43.5	20.5
136.23*	33.4	H	-14.8	18.6	43.5	24.9
351.57	36.3	H	-10.6	25.7	46.0	20.3

* : Harmonics of the highest fundamental frequency.

Table 1. Radiated Measurements at 3meters

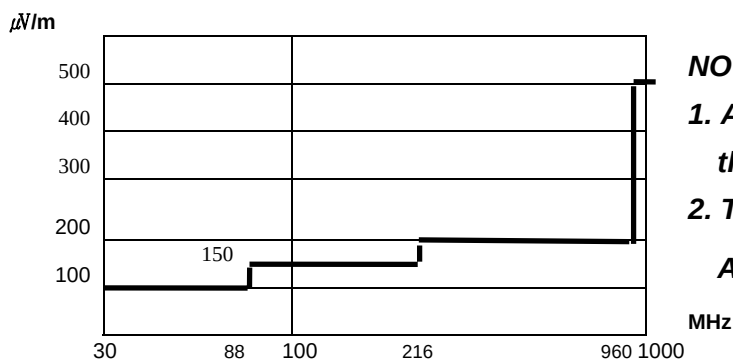


Fig. 3. Limits at 3 meters

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 μ V/m.

NOTES:

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

S.K. Lee

Tested by **S. K. Lee**

TEST DATA

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

FCC ID : E2XSDR5000M

Working Frequency : 27.245MHz

Channel	Frequency	*)Pol.	Reading(dB μ V)		**)A.F	**)C.L+Amp	Result(dB μ V/m)		Limit(dB μ V/m)	
	(MHz)	(H/V)	AV	PK	(dB)	(dB)	AV	PK	AV	PK
1	27.245	H	13.7	14.3	5.0	30.7	49.4	50.0	80.0	100.0
	27.245	V	14.4	14.9	5.0	30.7	50.1	50.6	80.0	100.0

Table 2. Radiated Measurements at 3meters

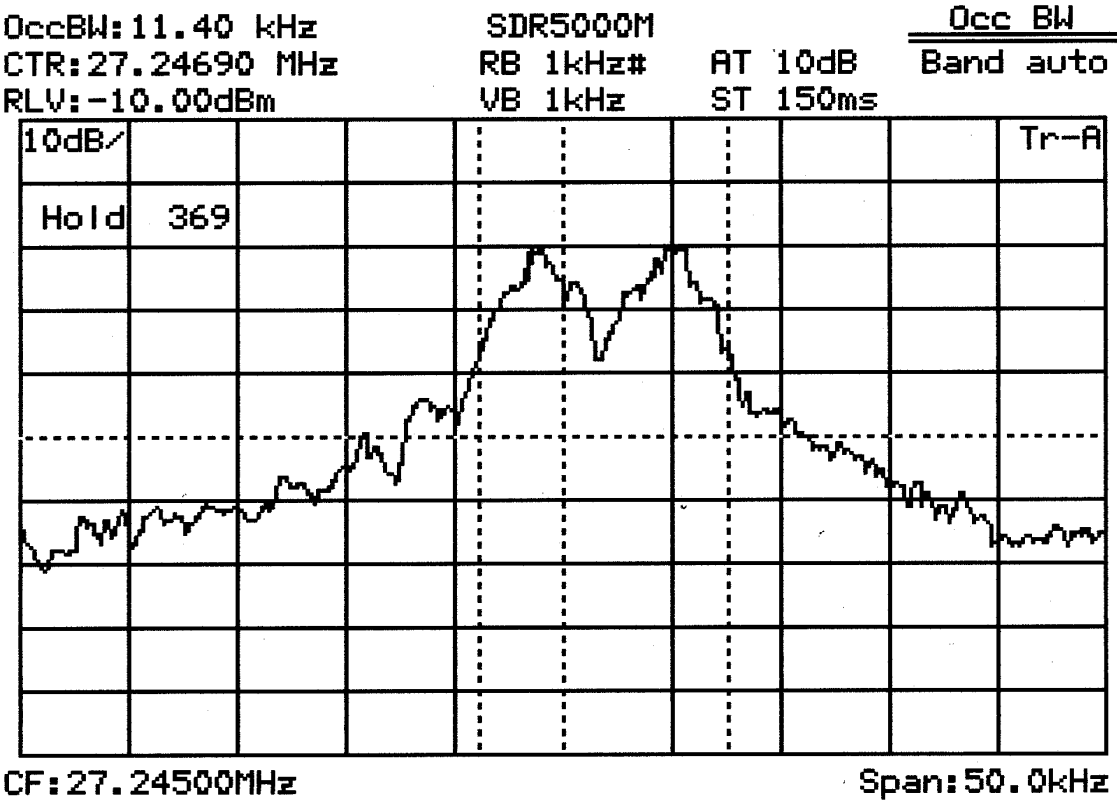
NOTES:

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 **S. K. Lee**

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

Contribution	Probability Distribution	Uncertainty(+/-dB)
Antenna Factor	Normal (k=2)	± 0.5
Cable Loss	Normal (k=2)	± 0.04
Receiver Specification	Rectangular	± 2.0
Antenna directivity	Rectangular	± 1.0
Antenna Factor variation with Height		
Antenna Phase Center Variation		
Antenna Factor Frequency Interpolation		
Measurement Distance Variation		
Site Imperfections	Rectangular	± 2.0
Mismatch:Receiver VRC ri=0.3 Antenna VRC rR=0.1(Bi)0.4(Lp) Uncertainty Limits 20Log(1+/-ri rR)	U-Shaped	+ 0.25 / - 0.26
System Repeatibility	Std.deviation	± 0.05
Repeatability of EUT	-	-
Combined Standard Uncertainty	Normal	± 1.77
Expended Uncertainty U	Normal (k=2)	± 3.5

2. Conducted Uncertainty Calculation

Contribution	Probability Distribution	Uncertainty(+/-dB)
Receiver Specification	Normal (k=2)	± 2.0
LISN coupling spec.	Normal (k=2)	± 0.4
Cable and input attenuator cal.	Rectangular	± 0.4
Mismatch:Receiver VRC ri=0.3 LISN vrc rg=0.1 Uncertainty Limits 20Log(1+/-ri rR)	U-Shaped	± 0.26
System Repeatibility	Std.deviation	± 0.68
Repeatability of EUT	-	-
Combined Standard Uncertainty	Normal	± 1.18
Expended Uncertainty U	Normal (k=2)	± 2.4

TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Calibration Date
1	*Test Receiver	R & S	ESCS 30	2002.09
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	R4136	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	2002.09
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