

Nemko Korea CO., Ltd.

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

TEL:+82 31 322 2333

FAX:+82 31 322 2332

FCC EVALUATION REPORT FOR CERTIFICATION

Manufacturer:

Samsung Electro-Mechanics Co., Ltd.

314, Maetan3-dong, Paldal-gu, Suwon-shi

Kyunggi-do, 442-743, Korea

Attn : Mr. Junhwan Lim

Dates of Issue : August 13, 2001

Test Report No. : NK2BE494

Test Site : Nemko Korea Co., Ltd.

EMC site, Korea

FCC ID

E2XSDR3000K

Brand Name

SAMSUNG

CONTACT PERSON

**Samsung Electro-Mechanics Co., Ltd.
314, Maetan3-dong, Paldal-gu, Suwon-shi
Kyunggi-do, 442-743, Korea
Mr. Junhwan Lim
Telephone No. : +82 32 210 6497**

FCC Rule Part(s):

Part 15 & 2

Classification :

FCC Class B Device

EUT Type:

2.4GHz Wireless Internet Keyboard

The device bearing the trade name and model 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.

Back Sung-hyun

**Tested By : S. H. Baek
Engineer**

H.H. Kim

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

TABLE OF CONTENTS

SCOPE	3
INTRODUCTION (Site Description)	4
GENERAL TEST CONDITION	5
DESCRIPTION OF TEST (Radiated Emissions)	6
§ 15.203 Antenna Requirement	7
Applied Modulation	7
TEST DATA (Radiated Emissions)	8
PLOT OF EMISSION	12
SAMPLE CALCULATIONS	13
ACCURACY of MEASUREMENT	14
TEST EQUIPMENT	15
RECOMMENDATION/CONCLUSION	16
APPENDIX A - LABELLING REQUIREMENTS	17
APPENDIX B - CIRCUIT DIAGRAM	18
APPENDIX C - PHOTOGRAPHS of TEST SET-UP	19
APPENDIX D - EUT PHOTOGRAPHS	20
APPENDIX E - USER'S MANUAL	25
APPENDIX F - SCHEMATIC DIAGRAM	26

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 verification.

Responsible Party* : Samsung Electro-Mechanics Co., Ltd.

Contact Person : Mr. Junhwan Lim

Manufacturer : Samsung Electro-Mechanics Co., Ltd.

314, Maetan3-dong, Paldal-gu, Suwon-shi, Kyunggi-do
442-743, Korea

Tel : +82 32 210 6497/Fax : +82 32 210 3324

- FCC ID: E2XSDR3000K
- Model: SDR3000K
- Brand Name: SAMSUNG
- EUT Type: 2.4GHz Wireless Internet Keyboard

- Classification: FCC Class B
- Rule Part(s): FCC Part 15 & Part 2
- Test Procedure(s): ANSI C63.4 (1992)
- Dates of Test: August 06, 2001 to August 10, 2001
- Place of Tests: Nemko Korea Co., Ltd. EMC Site
- Test Report No.: NK2BE494

** NOTE: Please refer to the duties and responsibilities of the Responsible Party attached.*

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 : **E2XSDR3000K, 2.4GHz Wireless Internet Keyboard.**

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 50 kilometers (30 miles) southeast and Seoul International Airport (Kimpo 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.



Nemko Korea Co., Ltd.
 OPEN AREA TEST SITE
 300-2, Osan-Ri, Mohyun-Myun, Yongin-
 City Kyungki-Do, KOREA 449-852
 Tel)+82-31-322-2333
 Fax)+82-31-322-2332

Fig. 1. The map above shows the Seoul in Korea vicinity area.

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

TEST CONDITIONS & EUT INFORMATION

Operating During Test

The EUT was set to each channel.

Support Equipment

PC	Sotec, Model: N/A 1.8m unshielded AC power cable	S/N: N/A
Monitor	Hansol, FCC ID: 103055 1.8m unshielded AC power cord 1.2m shielded D-sub cable	S/N: N/A
RF Receiver	Samsung, FCC ID: E2XSDR3000R 1.05m shield Din cable	S/N: N/A
Keyboard(EUT)	Samsung, FCC ID: E2XSDR3000K	S/N: N/A
Mouse	Samsung, FCC ID: E2XSDR3000M	S/N: N/A
Printer	HP, Model No: C4562K 1.8m unshielded AC power cord 1.2m Shield D-sub cable	S/N: SG74T1C206

EUT Information

Clock:	4MHz(X1)
Chipset:	KS86C0104(U3)
No. of Channel:	16
Operating distance:	Over 5m
Frequency:	2,474MHz – 2,474.75MHz
Power Supply:	Two AA alkaline

DESCRIPTION OF TESTS

Radiated Emissions

Preliminary measurement were made indoors at 1 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.

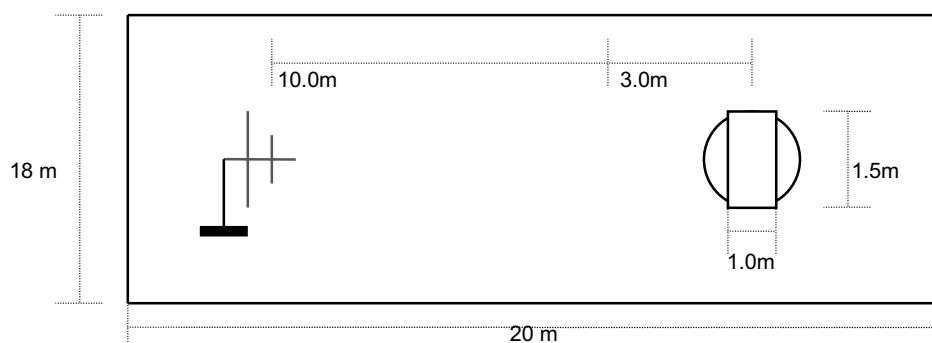


Fig. 2. Dimensions of Outdoor Test Site

§ 15.203 Antenna Requirement

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.

Conclusion

The SDR3000K, wireless keyboard complies with the requirement of § 15.203 with an omni-directional antenna uniquely coupled to the transmitter.

Applied Modulation

The modulation used was the test procedure specified in ANSI C63.4-1992. For modulation, various keys were used to determine the worst-case modulation. The worst-case modulation that produces the widest bandwidth was used during final testing.

TEST DATA

Radiated Emissions; general requirements

FCC ID : E2XSDR3000K

Test Mode : set to each channel

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)
131.16	31.5	H	-15.6	15.9	43.5	27.6
139.47	36.6	H	-14.3	22.3	43.5	21.2
341.79	32.4	V	-10.2	22.2	46.0	23.8
483.13	33.8	V	-6.7	27.1	46.0	18.9
660.50	31.0	V	-2.0	29.0	46.0	17.0
825.40	28.8	V	2.2	31.0	46.0	15.0

Table 1. Radiated Measurements at 3meters

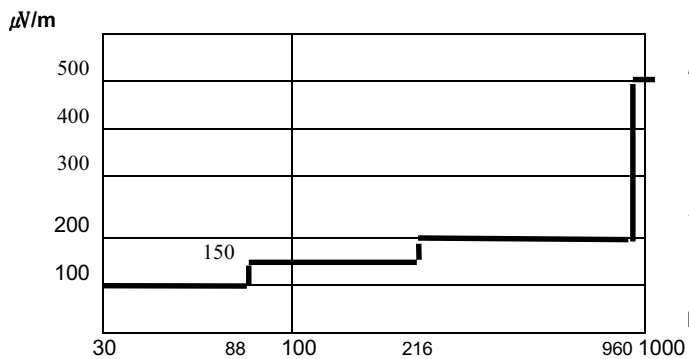


Fig. 3. Limits at 3 meters

NOTES:

1. All modes of operation were investigated the worst-case emission are reported.
2. The radiated limits are shown on Figure 4.

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. Measurements using CISPR quasi-peak mode. Above 1GHz, peak detector function mode is used using a resolution bandwidth of 1MHz and a video bandwidth of 1MHz. The peak level complies with the average limit. Peak mode is used with linearly polarized horn antenna and low-loss microwave cable.

*Back sampling*Tested by **S. H. Baek**

TEST DATA**Radiated Emissions ; within the bands 2400-2483.5MHz****FCC ID : E2XSDR3000K****Test Mode : set to channel 1**

Channel	Frequency	*)Pol.	Reading($\text{dB}\mu\text{V}$)		**)A.F	**)C.L+Amp	Result($\text{dB}\mu\text{V}/\text{m}$)		Limit($\text{dB}\mu\text{V}/\text{m}$)	
	(GHz)	(H/V)	AV	PK	(dB)	(dB)	AV	PK	AV	PK
1	2.474	H	21.4	28.6	33.0	-3.4	51.0	58.2	94.0	114.0
	4.948	H	4.5	7.0	35.0	-3.0	36.5	39.0	54.0	74.0

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 50,000uV/m @3m, using Average detector. The harmonic limit is 500uV/m @3m.
4. The emissions radiated outside of the specified frequency band, except harmonics, are attenuated by at least 50dBc or to the limits in § 15.209, whichever is lesser.
5. The Antenna is manipulated through typical positions and length during the tests.
6. The emissions are maximized by changing polarity of the antenna.
7. Up to the 10th harmonics were investigated according to § 15.33 and the worst -case is reported.
8. The 3 of frequencies(1 near top, 1 near middle , 1 near bottom) was operated and reported according to § 15.31.

*S. H. Baek*Tested by **S. H. Baek**

TEST DATA**Radiated Emissions ; within the bands 2400-2483.5MHz****FCC ID : E2XSDR3000K****Test Mode : set to channel 8**

Channel	Frequency	*)Pol. (H/V)	Reading(dB μ V)		**)A.F (dB)	**)C.L+Amp (dB)	Result(dB μ V/m)		Limit(dB μ V/m)	
	(GHz)		AV	PK			AV	PK	AV	PK
8	2.47435	H	17.2	29.0	33.0	-3.4	46.8	58.6	94.0	114.0
	4.94870	H	4.2	6.4	35.0	-3.0	36.2	38.4	54.0	74.0

Table 3. 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 50,000uV/m @3m, using Average detector. The harmonic limit is 500uV/m @3m.
4. The emissions radiated outside of the specified frequency band, except harmonics, are attenuated by at least 50dBc or to the limits in § 15.209, whichever is lesser.
5. The Antenna is manipulated through typical positions and length during the tests.
6. The emissions are maximized by changing polarity of the antenna.
7. Up to the 10th harmonics were investigated according to § 15.33 and the worst –case is reported.
8. The 3 of frequencies(1 near top, 1 near middle , 1 near bottom) was operated and reported according to § 15.31.

*S. H. Baek*Tested by **S. H. Baek**

TEST DATA**Radiated Emissions ; within the bands 2400-2483.5MHz****FCC ID : E2XSDR3000K****Test Mode : set to channel 16**

Channel	Frequency	*Pol.	Reading($\text{dB}\mu\text{V}$)		**A.F	**C.L+Amp	Result($\text{dB}\mu\text{V}/\text{m}$)		Limit($\text{dB}\mu\text{V}/\text{m}$)	
	(GHz)	(H/V)	AV	PK	(dB)	(dB)	AV	PK	AV	PK
16	2.47475	H	13.8	26.1	33.0	-3.4	43.4	55.7	94.0	114.0
	4.94870	H	3.6	8.1	35.0	-3.0	35.6	40.1	54.0	74.0

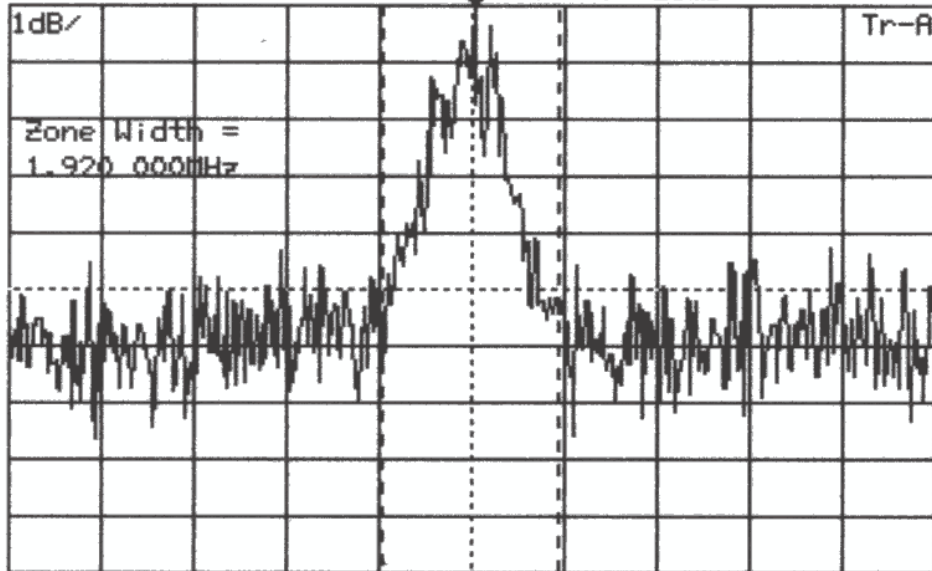
Table 4. Radiated Measurements at 3meters**NOTES:**

1. *Pol. H =Horizontal V=Vertical
2. **CL+Amp. = Cable Loss + Amplifier. A.F= Antenna Factor
3. The limit at fundamental frequency is 50,000uV/m @3m, using Average detector. The harmonic limit is 500uV/m @3m.
4. The emissions radiated outside of the specified frequency band, except harmonics, are attenuated by at least 50dBc or to the limits in § 15.209, whichever is lesser.
5. The Antenna is manipulated through typical positions and length during the tests.
6. The emissions are maximized by changing polarity of the antenna.
7. Up to the 10th harmonics were investigated according to § 15.33 and the worst –case is reported.
8. The 3 of frequencies(1 near top, 1 near middle , 1 near bottom) was operated and reported according to § 15.31.

*Baek Sungblum*Tested by **S. H. Baek**

PLOTS OF EMISSIONS

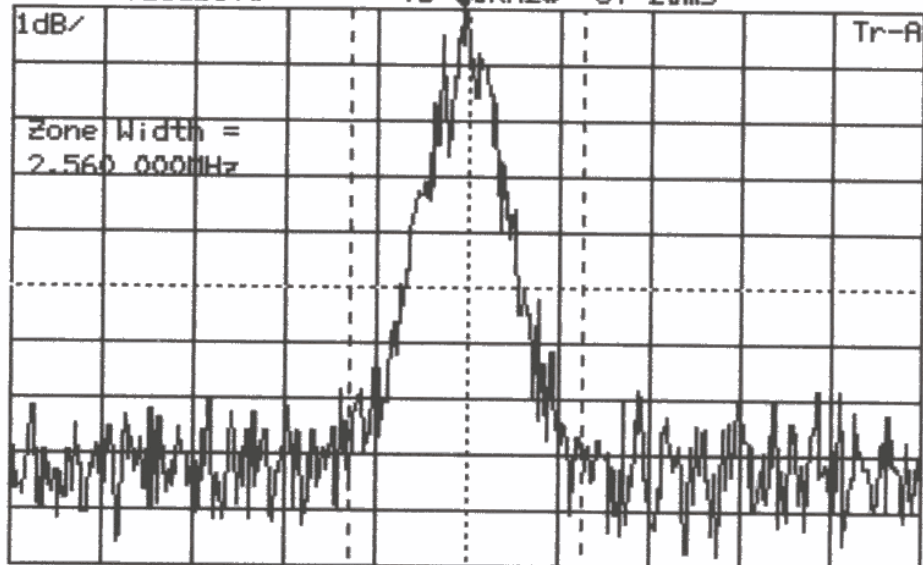
MKR: 2.47490GHz CH16, KEYBOARD, PEAK Zone Width
55.59dBuV RB 1MHz# AT 0dB# Band auto
RLV: 55.70dBuV# VB 30kHz# ST 20ms



CF: 2.47484GHz

Span: 10.0MHz

MKR: 2.47404GHz CH1, KEYBOARD, PEAK Zone Width
58.15dBuV RB 1MHz# AT 0dB# Band auto
RLV: 58.20dBuV# VB 30kHz# ST 20ms



CF: 2.47408GHz

Span: 10.0MHz

SAMPLE CALCULATIONS

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

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

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

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)	± 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 $r_i=0.3$ Antenna VRC $r_R=0.1(B_i)0.4(L_p)$ Uncertainty Limits $20\log(1+/-r_i r_R)$	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

<i>Contribution</i>	<i>Probability Distribution</i>	<i>Uncertainty(+/-dB)</i>
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 $r_i=0.3$ LISN vrc $r_g=0.1$ Uncertainty Limits $20\log(1+/-r_i r_R)$	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	2001.02
2	Test Receiver	PMM	PMM9000	2001.06
3	*Amplifier	HP	8447F	2001.05
4	*Amplifier	HP	8447F	2001.05
5	Spectrum Analyzer	Advantest	R4136	2000.12
6	*Spectrum Analyzer	ANRITSU	MS2668C	2001.02
7	*Logbicon Super Antenna	Schwarzbeck	VULB9166	2001.02
8	*Log-Periodic Antenna	R & S	HL025	2001.01
9	Dipole Antenna	R & S	VHA9103	2001.05
10	Dipole Antenna	R & S	UHA9105	2001.05
11	Biconical Log Antenna	ARA	LPB-2520/A	2001.01
12	Absorbing Clamp	R & S	MDS21	2001.01
13	High Voltage Probe	R & S	ESH2-Z3	2001.02
14	Signal Generator	R & S	SMP02	2001.01
15	Matching Pad	R & S	RAM358.5414.02	2001.05
16	LISN	R & S	ESH3-Z5	2001.04
17	LISN	PMM	L3-9103	2001.04
18	*Position Controller	EM Eng.	N/A	N/A
19	*Turn Table	EM Eng.	N/A	N/A
20	*Antenna Mast	EM Eng.	N/A	N/A
21	*Anechoic Chamber	EM Eng.	N/A	N/A
22	*Shielded Room	EM Eng.	N/A	N/A

*) Test equipment used during the test

RECOMMENDATION/CONCLUSION

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

FCC ID : **E2XSDR3000K, 2.4GHz Wireless Internet Keyboard.** complies with § 15.209, 15.249 of the FCC Rules.

The highest emission observed was at **825.40 MHz** for radiated emissions with a margin of **15.0 dB**.

APPENDIX A – SAMPLE LABEL

Labelling Requirements

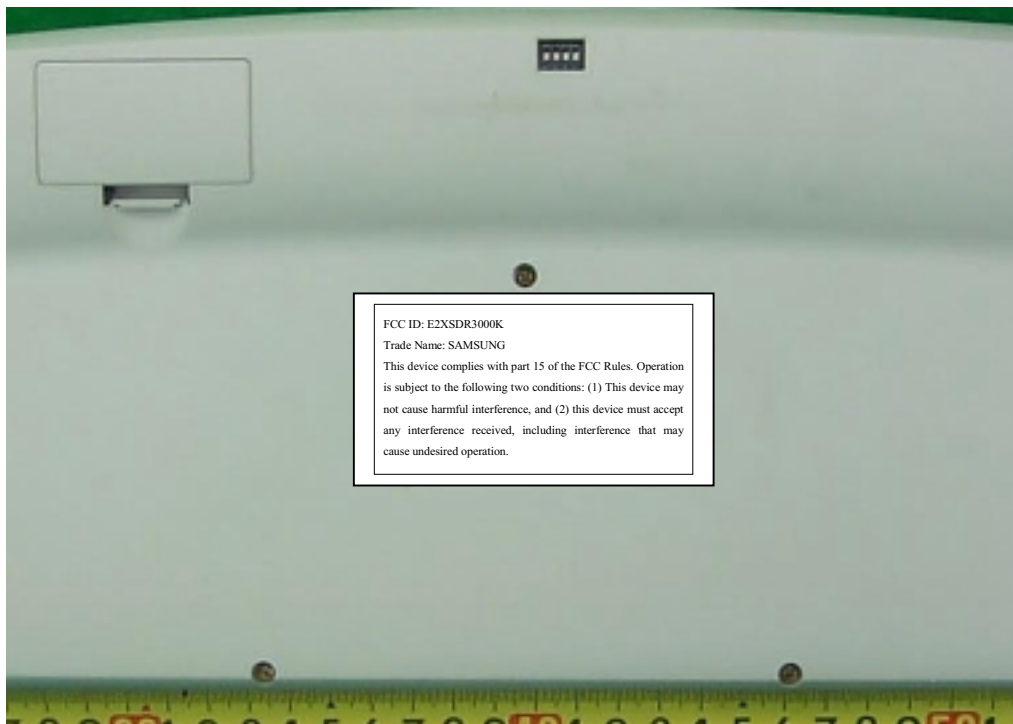
The sample label shown shall be *permanently affixed* at a conspicuous location on the device and be readily visible to the user at the time of purchase.

FCC ID: E2XSDR3000K

Trade 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

APPENDIX E – USER’S MANUAL

APPENDIX F – Schematic Diagrams
