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

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. : NK2DE394
Test Site : Nemko Korea Co., Ltd.
EMC site, Korea

FCC ID	***E2XOMW4CL-R***
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 B : 2000
Classification : FCC Class B Device
EUT Type: Wireless Optical Wheel Mouse Receiver

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

TABLE OF CONTENTS

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.

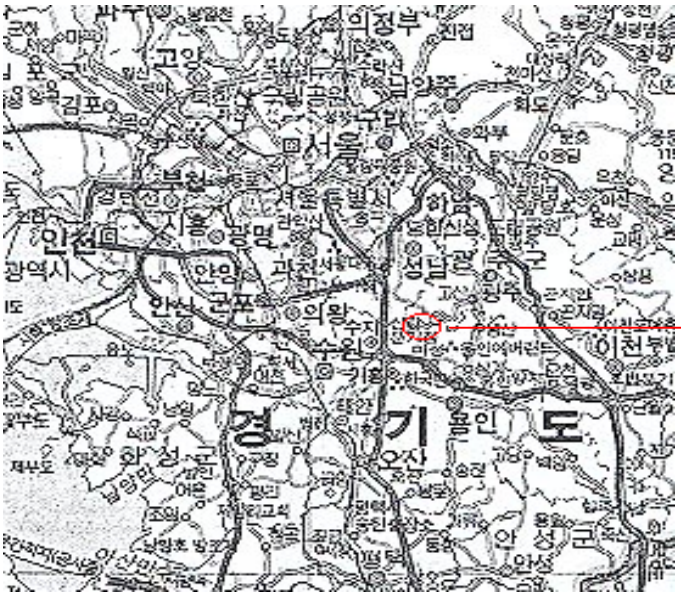
Responsible Party* :	Samsung Electro-Mechanics Co., Ltd.
Contact Person :	Mr. Junhwan Lim
Manufacturer :	Samsung Electro-Mechanics Co., Ltd. 314, Maetan3-dong, Paldal-gu, Suwon-shi, Kyunggi-do, Korea , 442-743.
Factory :	1. Chic Technology Corp. Xiwang Industrial Park, Tian Tang Wei, Feng Gang, Dongguan, 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-R
- Model: OMW4CL-R
- Brand Name: SAMSUNG
- EUT Type: Wireless Optical Wheel Mouse Receiver
- Classification: FCC Class B
- Applied Standard: FCC 47 CFR Part 15 , Subpart B
- 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.: NK2DE394

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-R, Wireless Optical Wheel Mouse Receiver.**

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.



Nemko Korea Co., Ltd.
EMC Lab.
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 Incheon Airport.

TEST CONDITIONS & EUT INFORMATION

Operating During Test

The EUT was connected to PC and set channel switch to mouse channel.

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 (EUT)	Samsung, FCC ID: E2XOMW4CL-R 1.2m Shielded USB cable	S/N: N/A
Mouse	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:	6MHz(XT1) , 26.59MHz(XT2)
Chipset:	S3P9658(U1) , S1T3361D(U2)
Interface Method:	USB
Current Dissipation:	100mA Max.
Power Supply:	4.5 ~5.5V DC

SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

Name of Test	Paragraph No.	Result	Remark
Conducted Emission	15.107	Complies	
Radiated Emission	15.109	Complies	

RECOMMENDATION/CONCLUSION

The data collected shows that the **Samsung Electro-Mechanics Co., Ltd.**
FCC ID : **E2XOMW4CL-R, Wireless Optical Wheel Mouse Receiver.**
The highest emission observed was at **0.28 MHz** for conducted emissions with a Q.P margin of **6.4 dB,** at **48.43 MHz** for radiated emissions with a margin of **11.9 dB.**

SAMPLE CALCULATION

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

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

EX. 1.

@57.7 MHz Class B limit = 100 μN/m = 40.0 dB μN/m

Reading = 19.1 dB μN(calibrated level)
Antenna factor + Cable Loss = 10.12 dB
Total = 29.22 dB μN/m
Margin = 40.0 - 29.22 = 10.78
10.78 dB below the limit

DESCRIPTION OF TESTS

Conducted Emissions

The Line conducted emission test facility is located inside a 4 X 7 X 2.5 meter shielded enclosure.
It is manufactured by EM engineering. The shielding effectiveness of the shielded room is in accordance with MIL-STD-285 or NSA 65-6.
A 1m X 1.5m wooden table 0.8m height is placed 0.4m away from the vertical wall and 1.5m away from the side of wall of the shielded room
Rohde & Schwarz (ESH3-Z5) and Kyoritsu (KNW-408) of the 50ohm/50uH Line Impedance Stabilization Network(LISN) are bonded to the shielded room.
The EUT is powered from the Rohde & Schwarz LISN and the support equipment is powered from the Kyoritsu LISN. Power to the LISN s are filtered by high-current high insertion loss Power line filters. The purpose of filter is to attenuate ambient signal interference and this filter is also bonded to shielded enclosure. All electrical cables are shielded by tinned copper zipper tubing with inner diameter of 1/2".
If DC power device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the LISNs,
All interconnecting cables more than 1 meter were shortened by non inductive bundling (serpentine fashion) to a 1 meter length.
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 spectrum analyzer to determine the frequency producing the maximum EME from the EUT.
The spectrum was scanned from 150kHz to 30MHz with 20msec sweep time.
The frequency producing the maximum level was re-examined using the EMI test receiver. (Rohde & Schwarz ESCS30).
The detector function were set to CISPR quasi-peak mode & average mode.
The bandwidth of receiver was set to 9KHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME 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.

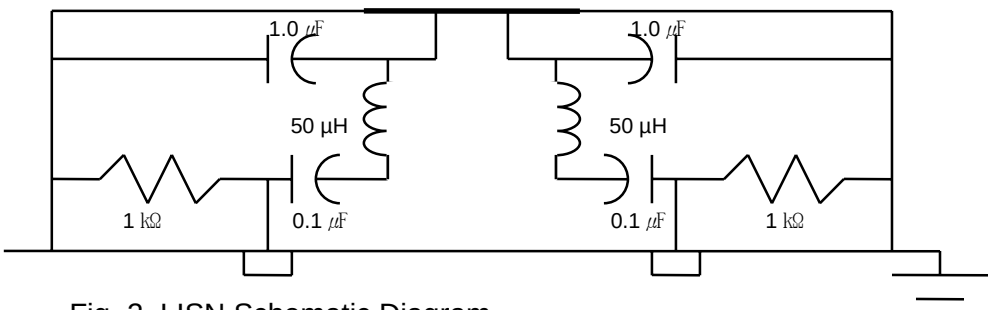


Fig. 2. LISN Schematic Diagram

DESCRIPTION OF TESTS

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.

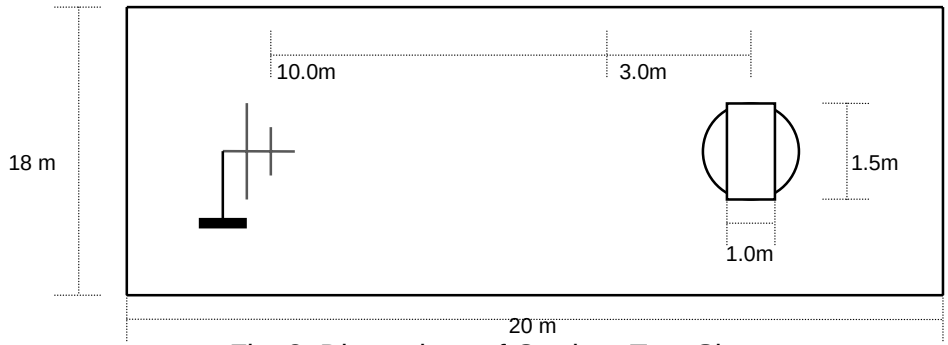


Fig. 3. Dimensions of Outdoor Test Site

TEST DATA

Conducted Emissions

FCC ID : E2XOMW4CL-R
Test Mode : set channel switch to mouse channel.

Frequency (MHz)	Level(dBμV)		Line	Limit(dBμV)		Margin(dBuV)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.16	55.8	47.3	N	65.5	55.5	9.7	8.2
0.18	55.0	51.2	L	64.5	54.5	9.5	3.3
0.28	54.4	44.6	N	60.8	50.8	6.4	6.2
0.29	54.1	39.0	N	60.5	50.5	6.4	11.5
0.55	48.4	34.1	N	56.0	46.0	7.6	11.9
0.56	47.9	34.5	N	56.0	46.0	8.1	11.5

Table 1. Line Conducted Emissions Tabulated Data

NOTES:
1. Measurements using CISPR quasi-peak mode & average mode.
2. All modes of operation were investigated and the worst -case emission are reported. See attached Plots.
3.The limit for Class B device is on the FCC Part section 15.107(a).
4.Line L = Line Line N = Neutral

*Tested by **T. H. Ryu***

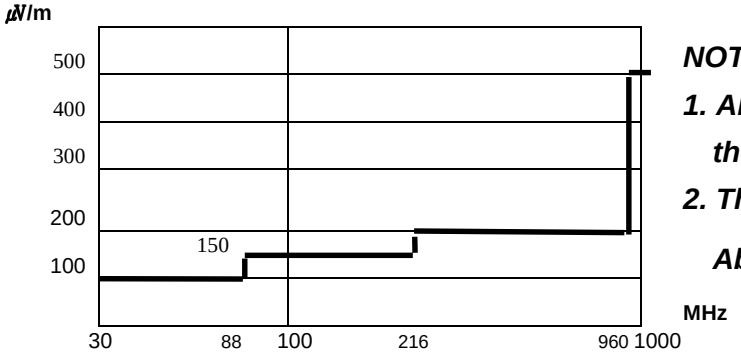
TEST DATA

Radiated Emissions

FCC ID : E2XOMW4CL-R
Test Mode : set channel switch to mouse channel.

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/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

Table 2. Radiated Measurements at 3meters



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 μV/m.

Fig. 4. Limits at 3 meters

NOTES:

1. *Pol. H =Horizontal V=Vertical

2. **AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.

3.The limit for Class B device is on the FCC Part section 15.109(a)

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*Tested by **T. H. Ryu***

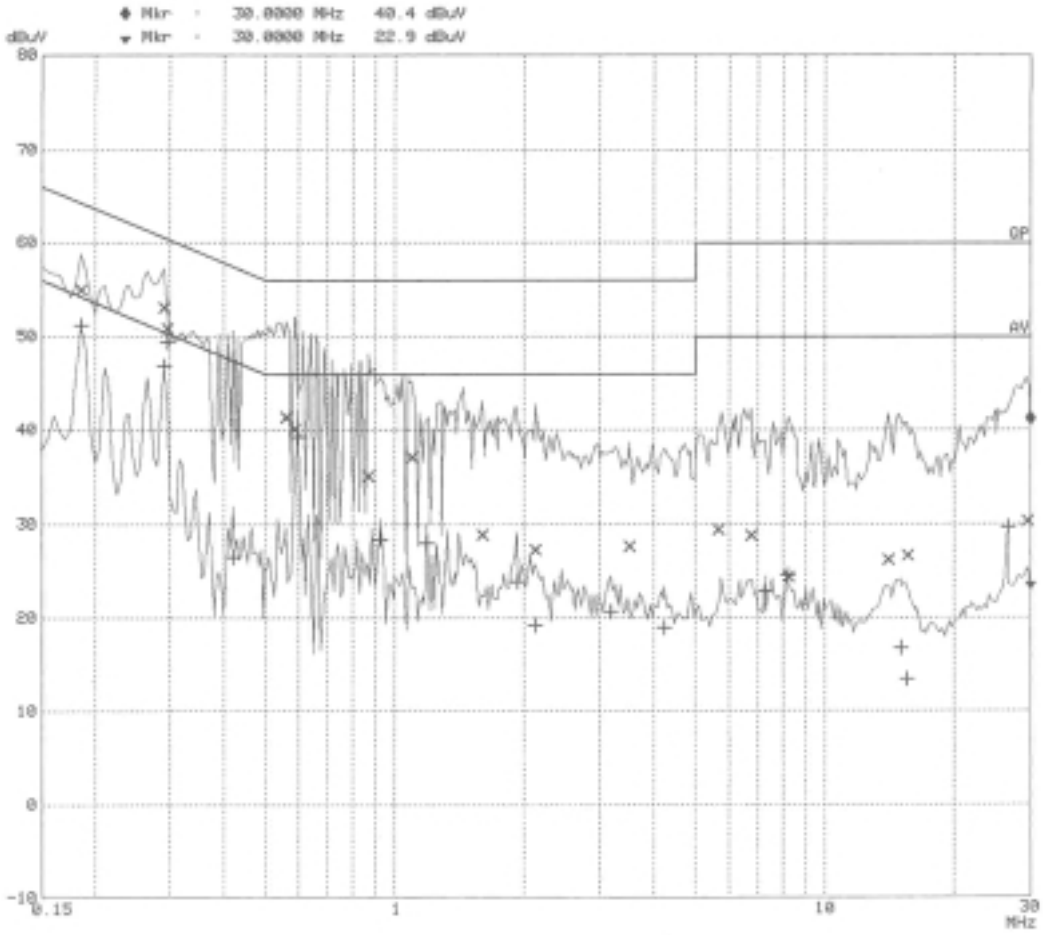
PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Line)***

```
Scan Settings (1 Range)
|--------- Frequencies -----------||--------- Receiver Settings ---------|
   Start        Stop         Step      IF BW  Detector  M-Time  Atten Preamp
 150k          30M           5k          9k     PK+AV     20ms AUTO LN   OFF

Transducer No. Start       Stop       Name
           20   150k        30M      LISN_RS

Final Measurement: x QP / + AV
                   Meas Time:   200 ms
                   Subranges:    16
                   Acc Margin:   40dB
```



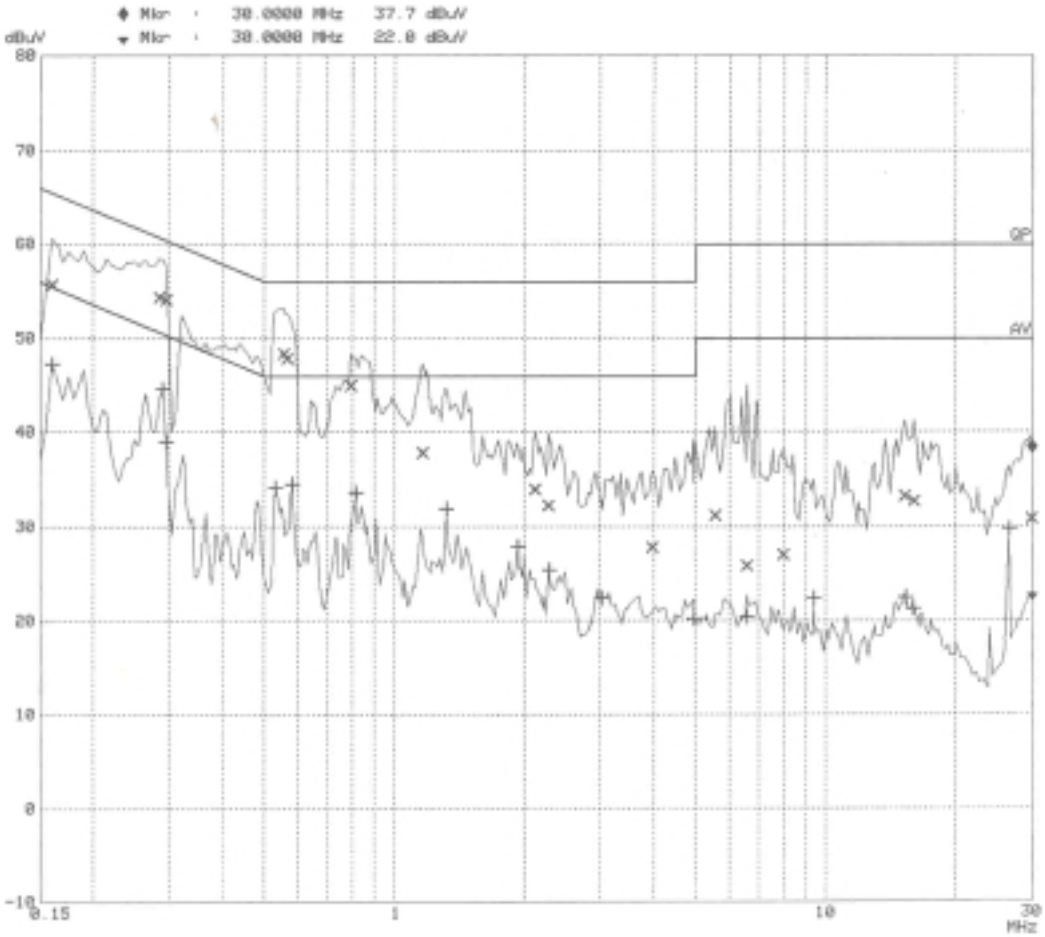
PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Neutral)***

```
Scan Settings (1 Range)
---------- Frequencies ----------;;--------- Receiver Settings ---------;
   Start        Stop         Step      IF BW  Detector  M-Time  Atten Preamp
 150k          30M           5k          9k     PK+AV     20ms AUTO LN   OFF

Transducer No. Start       Stop       Name
           20   150k        30M      LISN_RS

Final Measurement: x QP / + AV
                   Meas Time:  200 ms
                   Subranges:   16
                   Acc Margin:  40dB
```



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 Inperfections	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 Repeatibilty	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 Repeatibilty	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	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	R4136	2003.03
7	Spectrum Analyzer	H.P	8566B	2003.03
8	*Logbicon Super Antenna	Schwarzbeck	VULB9166	2003.05
9	Log-Periodic Antenna	R & S	HL025	2003.01
10	Dipole Antenna	R & S	VHA9103	2003.05
11	Dipole Antenna	R & S	UHA9105	2003.05
12	*Biconical Log Antenna	ARA	LPB-2520/A	2003.05
13	Asorbing Clamp	R & S	MDS21	2003.06
14	High Voltage Probe	R & S	ESH2-Z3	2002.10
15	Signal Generater	R & S	SMP02	2002.12
16	Matching Pad	R & S	RAM358.5414.02	2003.05
17	*LISN	R & S	ESH3-Z5	2002.10
18	*LISN	Kyoritsu	KNW-408	2002.12
19	LISN	Kyoritsu	KNW-407	2003.04
20	*Position Controller	EM Eng.	N/A	N/A
21	*Turn Table	EM Eng.	N/A	N/A
22	*Antenna Mast	EM Eng.	N/A	N/A
23	*Anechoic Chamber	EM Eng.	N/A	N/A
24	*Shielded Room	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-R
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

APPENDIX E – USER'S MANUAL

APPENDIX F – SCHEMATIC DIAGRAM