EMC TEST REPORT

Project No.	LBE072425	**Revision No.**	None
Applicant	**Name of organization**	**Samsung Electronics Co., Ltd.**	
	Address	416 Maetan 3-Dong, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do 443-742 Korea	
	Date of application	2007.07.26	
EUT Equipment Under Test	**Type of device**	Class B personal computers and peripherals	
	Equipment authorization	☐ Declaration of Conformity ☒ Certification ☐ Verification	
	FCC ID	A3LML2851ND ☐ Not applicable	
	Kind of product	PRINTER	
	Model No.	ML-2851ND	
		Variant Model No.	ML-2850D
	Manufacturer	1) **Samsung Electronics Co., Ltd.** 259, Gongdan-Dong, Gumi-City, Gyeongsangbuk-Do, 730-030, Korea 2) **Samsung Electronics (Shandong) Digital Printing Co., Ltd.** 264209, Samsung Road, Weihai Hi-Tech. IDZ, Shandong Province, P.R.China 3) **Weihai Shin Heung Digital Electronics Co., Ltd.** 98, Samsung Road, Weihai Hi-Tech. IDZ, Shandong Province, P.R.China	
Applied Standards		FCC Part 15, Subpart B / ANSI C63.4-2003	
Issue date		2007.08.20	

Test result : **Complied**

The equipment under test has found to be compliant with the applied standards.
(Refer to the attached test result for more detail.)

Tested by : Young Hun, Cheong

Reviewed by : No Cheon, Park

This report is the test result about the sphere accredited by KOLAS which signed the Mutual Recognition Arrangement of International Laboratory Accreditation Cooperation.
The test results in this report only apply to the tested sample. This report must not be reproduced, except in full, without written permission from SEC EMC Laboratory.

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Tel: 82 31 277 7752, Fax: 82 31 277 7753

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1. Summary of test results

1.1 Emission

The EUT has been tested according to the following specifications:

Applied	Test type	Applied standard	Result	Remarks
☒	Conducted Disturbance	FCC Part 15 Subpart B	Complied	Meets Class B Limit Minimum margin is 12.9 dB at 0.15 MHz
☒	Radiated Disturbance		Complied	Meets Class B Limit Minimum margin is 7.5 dB at 500.959 MHz

2. General Information

2.1 Test facility

The SEC EMC Laboratory is located on Samsung Electronics Co., Ltd. at 416 Maetan 3-Dong, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, South Korea.
All testing are performed in Semi-anechoic chambers conforming to the site attenuation Characteristics defined by ANSI C63.4, CISPR 22, 16-1 and 16-2. and Shielded rooms.

The SEC EMC Laboratory is operated as testing laboratory in accordance with the requirements of ISO/IEC 17025:1995.

2.2 Accreditation and listing

Laboratory Qualifications		Remarks
	KOLAS(Korea Laboratory Accreditation Scheme)	Accredited : 124
	Radio Research Laboratory	Accredited : KR0004
	FCC(Federal Communications Commission)	Accredited : KR0004
	National Voluntary Laboratory Accreditation Program	Lab Code: 200623-0
	Norges Elektriske Materiellkontroll	Accredited : ELA 195
	VCCI (Voluntary Control Council for Interference by Information Technology Equipment)	C-2421,R-2224
	China Quality Certification Center	5-053, 5-054
	TUV Rhineland	H9354285
	GOST(GOSTSTANDART)	ROSTEST
	Elektrotechnicky Zkusebni Ustav	Reg. No.: 001
	IC(Industry Canada)	Assigned Code: 5871

3. Test Setup configuration

3.1 Test Peripherals

The following is a listing of the EUT and peripherals utilized during the performance of EMC test:

Description	Model No.	Serial No.	Manufacturer	FCC ID
PRINTER	ML-2851ND	-	Samsung	A3LML2851ND
Note PC	NT-SP29	674E93AYC00024E	Samsung	A3LNPSP29
AC Adapter	AD-9019S	CNBA4400215AD2VH6BL1084	Li Shin	-
USB Mouse	M-UV69	HCA50702112	Logitech	Doc
Serial Mouse	M-CU15	L1345000091	Logitech	DZLMCCU15
Headset	-	-	COSY	-

3.2 EUT operating mode

To achieve compliance applied standard specification, the following mode(s) were made during compliance testing:

Operating Mode 1	Stand-by
Operating Mode 2	USB Printing

3.3 Details of Sampling

Customer selected, single unit.

3.4 Used cable description

The EUT is configured, installed, arranged and operated in a manner consistent with typical applications. Interface cables/loads/devices are connected to at least one of each type of interface port of the EUT, and where practical, each cable shall be terminated in a device typical of actual usage. The type(s) of interconnecting cables to be used and the interface port (of the EUT) to which these were connected;

Connected cable	Length [m]	Shielded [Y/N]	Note
Power	1.8	No	For EUT
Power	1.8	No	For note PC
USB	1.8	Yes	From EUT to PC
Serial	1.8	Yes	From EUT to PC
Headset	2.0	No	From EUT to PC
Power	1.8	No	For EUT

3.5 EUT Description

The following features describe EUT represented by this report:

Item	Specification
Printing speed	Up to 28 ppm in A4 (30 ppm in Letter) Duplex: 14 ipm in A4 (14.5 ipm in Letter)
Resolution	Up to 1200 x 1200 dpi effective output
Warm-up time	Less than 15 seconds
First print out time	8.5 seconds (From Ready) Sleep mode: 23.5 seconds
Power rating	AC 110-127V, 6.4A, 50/60 Hz
Power consumption	Average : 400 W Power save mode: Less than 11 W
Noise Level	Standby mode: Less than 26 dBA Printing mode: Less than 50 dBA
Toner cartridge life	Standard Yield: Average cartridge yield 2,000 standard pages. High Yield: Average cartridge yield 5,000 standard pages. (Ships with 2,000 pages Starter/Standard Toner Cartridge)
Duty cycle	Monthly: 30,000 pages
Weight	11.9 Kg (including consumables)
Package weight	Paper: 2.4 Kg, Plastic: 0.3 Kg
External dimensions (W x D x H)	364 X 369 X 210 mm (14.3 x 14.5 x 8.2 inches)
Operating environment	Temperature : 10℃ to 32℃ (50˚F to 90 ˚F) Humidity : 20% to 80% RH
Printer Language	PCL6, IBM ProPrinter, EPSON, PostScrpript3, SPL
Fonts	1 bitmap, 45 scalable, 136 PostScript fonts
Memory	32MB (Max. 160MB) 128MB optional memory available. Use only the Samsung-approved DIMM.
Interface	- USB 2.0: Hi-Speed USB 2.0 - Ethernet 10/100 Base TX wired LAN (ML-2851ND only)
OS compatibility	- Windows 2000/ 2003 Server/ XP(32/64bit)/ Vista - Various Linux OS - Mac 10.3 or 8.6 ~ 9.2/ 10.1 ~ 10.4
Options	250-sheet tray

3.6 Clock Frequencies

Kind of Clocks	Frequency[MHz]
Main Source Clock	12 MHz
Video Clock	12 MHz
CPU Clock	400 MHz
SDRAM	100 MHz
USB	12 MHz
Network Device	25 MHz

3.7 Operating mode condition

The system was configured for testing in typical fashion use. Cable were attached to each of the available I/O port. Where applicable, peripherals were attached to the I/O cables.
This EUT is supporting the USB and Network(LAN) printing.
In each test mode, finally we found worst case emission that is above configuration with the Worst case components(in the above table). So, the data of the maximum EUT operation, USB printing was reported.

- Test Voltage : AC 120 V, 60 Hz

3.8 Measurement uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus: (According to CISPR 16-4 and UKAS Lab 34.)

Test type		**Measurement uncertainty (C.L. 95 %, k = 2)**
Conducted disturbance	Mains Port	± 2.8 dB
Radiated disturbance	Horizontal	± 5.1 dB
	Vertical	± 5.09 dB

4. Results of individual test

4.1 Conducted disturbance

Both conducted lines are measured in Quasi-Peak and Average mode, including the worst-case data points for each tested configuration.
The EUT measured in accordance with the methods described in standards.

Limits for conducted disturbance at mains ports of class A

Frequency range Limits MHz	Limits dB(μV)	
	Quasi-peak	Average
0,15 to 0,50	79	66
0,50 to 30	73	60
Note 1: 1 μV is regarded as 0 dB. Note 2: If the average limit is met in the measurement with quasi-peak detector, the measurement with average detector at the same frequency is unnecessary. Note 3: The lower limit shall apply at the transition frequency.		

Limits for conducted disturbance at the mains ports of class B

Frequency range Limits MHz	Limits dB(μV)	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50
Note 1: 1 μV is regarded as 0 dB. Note 2: The limits shall decreases linearly with the logarithm of the frequency in the range 150 - 500 kHz. Note 3: If the average limit is met in the measurement with quasi-peak detector, the measurement with average detector is unnecessary. Note 4: The lower limit shall apply at the transition frequency.		

4.1.1 Test instrumentation

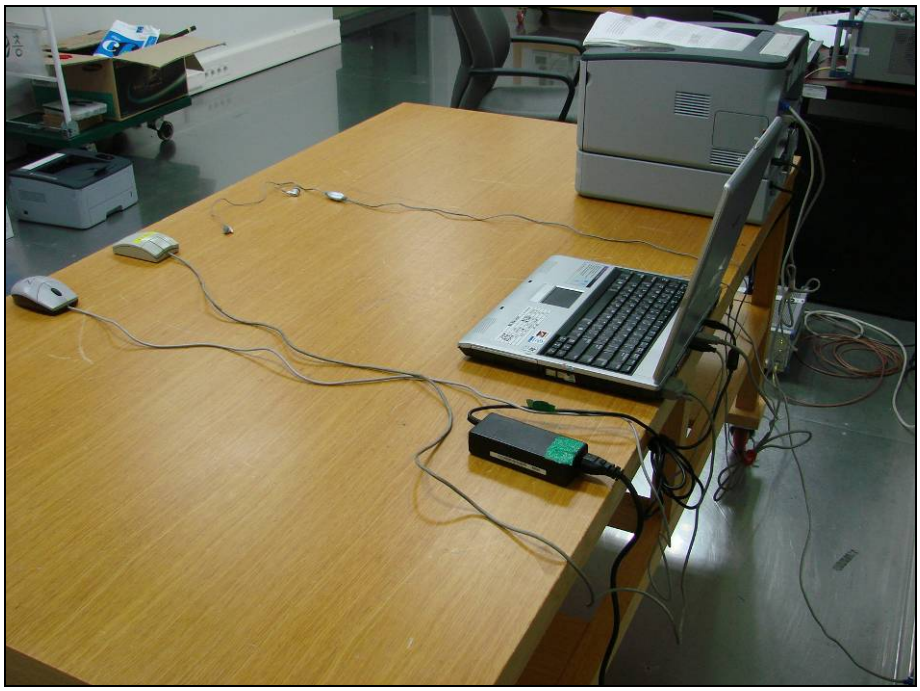
Test instrumentation used in the Conducted disturbance test was as follows:

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Test Software	EMC 32	R&S	Ver 5.20.2	N/A	N/A
Measuring receiver	ESCI	R&S	100368	2007-06-01	12
Artificial mains network	ENV216	R&S	100116	2006-09-01	12
Artificial mains network	ESH3-Z5	R&S	100262	2006-08-23	12

4.1.2 Photograph of the test Configuration

(Front)

(Rear)



4.1.3 Test results

Operating condition	USB Printing, Standby			
Test date	2007-08-04	**Test engineer**	Young Hun, Cheong	
Climate condition	**Ambient temperature**	24.9 ℃	**Relative humidity**	56 %
	Atmospheric pressure	100.2 kPa		
Test place	Shielded room #1			
Note	* QP : Quasi-peak, AV: Average * Level (QP or AV) = Meter Reading(QP or AV) + Corr.(LISN Insertion loss + Cable loss) * Margin = Limit - Level			

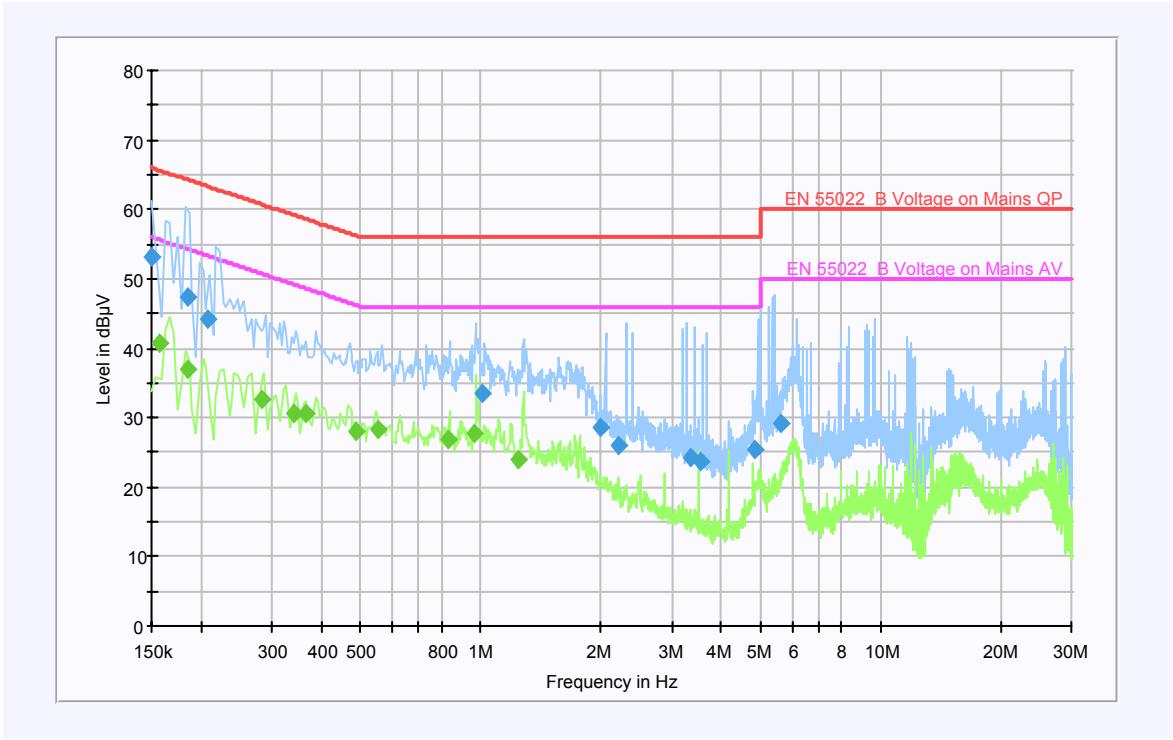
Scan Setup: EN55022_B_ENV 2-Line-LISN fin [EMI conducted]

Hardware Setup: Voltage with ENV 2-Line-LISN
Level Unit: dBµV

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
150kHz - 30MHz	QuasiPeak; Average	9kHz	15s	ESCS 30

EN55022_B with ENV 2-Line-LISN

[USB Printing Mode]



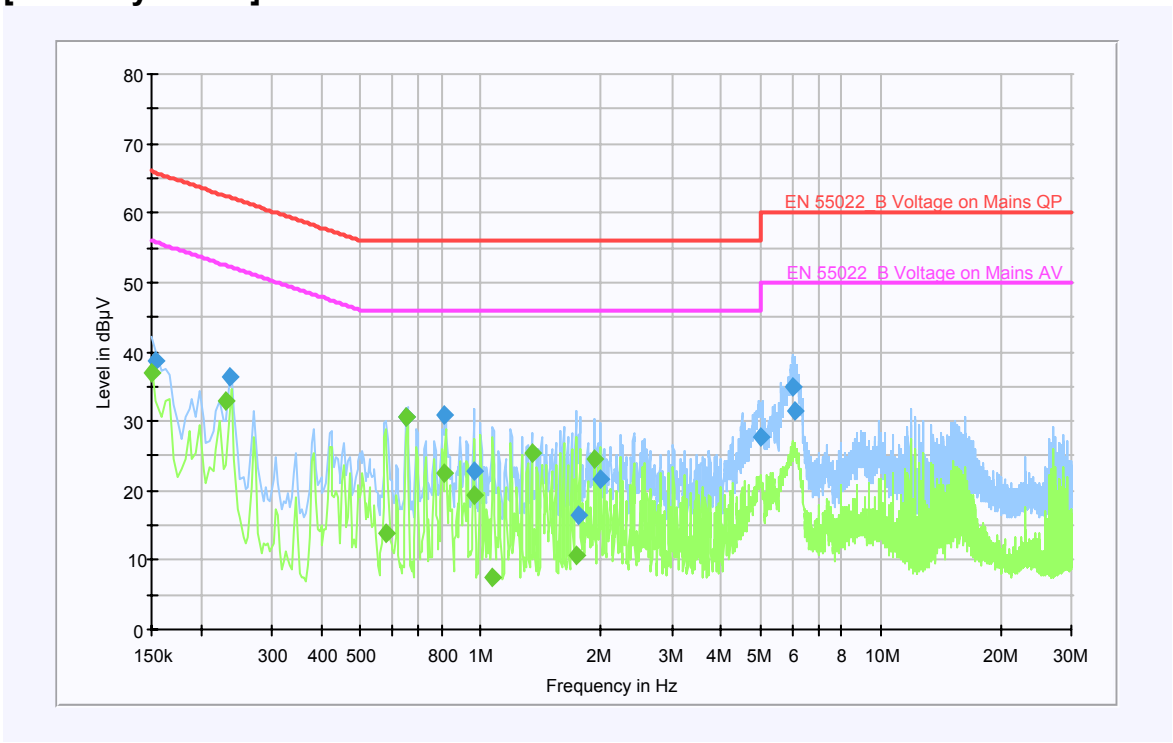
Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150 000	53.1	N	9.6	12.9	66.0
0.184 900	47.5	N	9.6	16.8	64.3
0.207 100	44.3	N	9.6	19.0	63.3
1.009 500	33.6	N	9.6	22.4	56.0
1.989 400	28.5	N	9.7	27.5	56.0
2.196 400	25.9	N	9.7	30.1	56.0
3.352 400	24.2	L1	9.7	31.8	56.0
3.564 200	23.7	L1	9.7	32.3	56.0
4.857 600	25.5	N	9.8	30.5	56.0
5.649 200	29.0	N	9.8	31.0	60.0

Final Measurement Detector 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.157 700	40.7	L1	9.6	14.9	55.6
0.184 900	37.1	N	9.6	17.2	54.3
0.283 700	32.5	L1	9.6	18.2	50.7
0.341 700	30.5	L1	9.6	18.7	49.2
0.366 700	30.6	L1	9.6	18.0	48.6
0.486 700	28.0	L1	9.6	18.2	46.2
0.550 700	28.4	L1	9.6	17.6	46.0
0.824 300	26.8	L1	9.6	19.2	46.0
0.961 300	27.7	N	9.6	18.3	46.0
1.236 000	24.1	N	9.6	21.9	46.0

[Standby Mode]



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.154 000	38.8	L1	9.6	27.0	65.8
0.234 100	36.3	L1	9.6	26.0	62.3
0.653 300	30.7	L1	9.6	25.3	56.0
0.805 300	31.0	L1	9.6	25.0	56.0
0.961 900	22.9	L1	9.6	33.1	56.0
1.757 600	16.5	N	9.7	39.5	56.0
1.991 800	21.6	N	9.7	34.4	56.0
4.996 200	27.7	L1	9.8	28.3	56.0
6.046 400	35.1	N	9.8	24.9	60.0
6.091 600	31.6	L1	9.8	28.4	60.0

Final Measurement Detector 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150 000	37.0	L1	9.6	19.0	56.0
0.230 100	32.9	L1	9.6	19.5	52.4
0.581 100	13.9	N	9.6	32.1	46.0
0.653 300	30.6	L1	9.6	15.4	46.0
0.813 300	22.4	L1	9.6	23.6	46.0
0.960 100	19.3	L1	9.6	26.7	46.0
1.070 400	7.6	L1	9.6	38.4	46.0
1.341 000	25.5	L1	9.7	20.5	46.0
1.725 600	10.6	N	9.7	35.4	46.0
1.920 200	24.4	N	9.7	21.6	46.0

4.2 Radiated disturbance

Of those disturbances above (*L* - 20dB), where *L* is the limit level in logarithmic units, record at least the disturbance levels and the frequencies of the six highest disturbances.
The following data lists the significant emission frequencies, measured levels, correction factors (for antenna and cables), orientation of table, polarization and height of antenna, the corrected reading, the limit, and the amount of margin. All measurements were taken utilizing quasi-peak detection unless stated otherwise. Measurements were performed at an antenna to EUT distance of 10 meters and elevated between 1 and 4 meters. Both vertical and horizontal antenna polarizations were measured.

Limits for radiated disturbance of ITE at a measuring distance of 10 m

Frequency range Limits MHz	Quasi-peak Limits dB dB(μV/m)	
	Class A	Class B
30 to 230	40	30
230 to 1000	47	37
Note 1: The lower limit shall apply at the transition frequency. Note 2: Additional provisions may be required for cases where interference occurs. Note 3: 1 μV/m is regarded as 0 dB.		

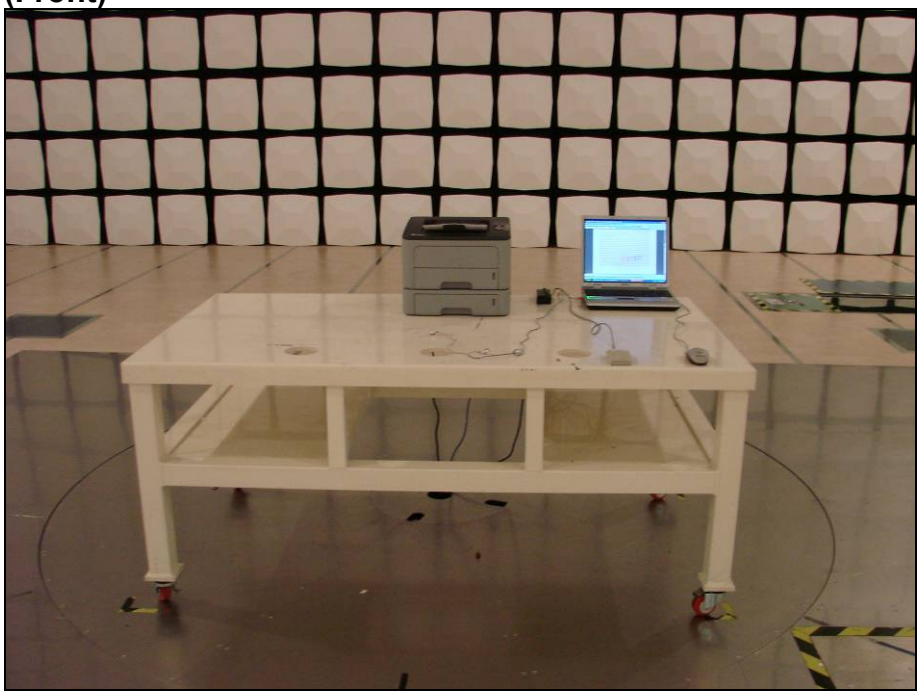
4.2.1 Test instrumentation

Test instrumentation used in the Radiated disturbance was as follows:

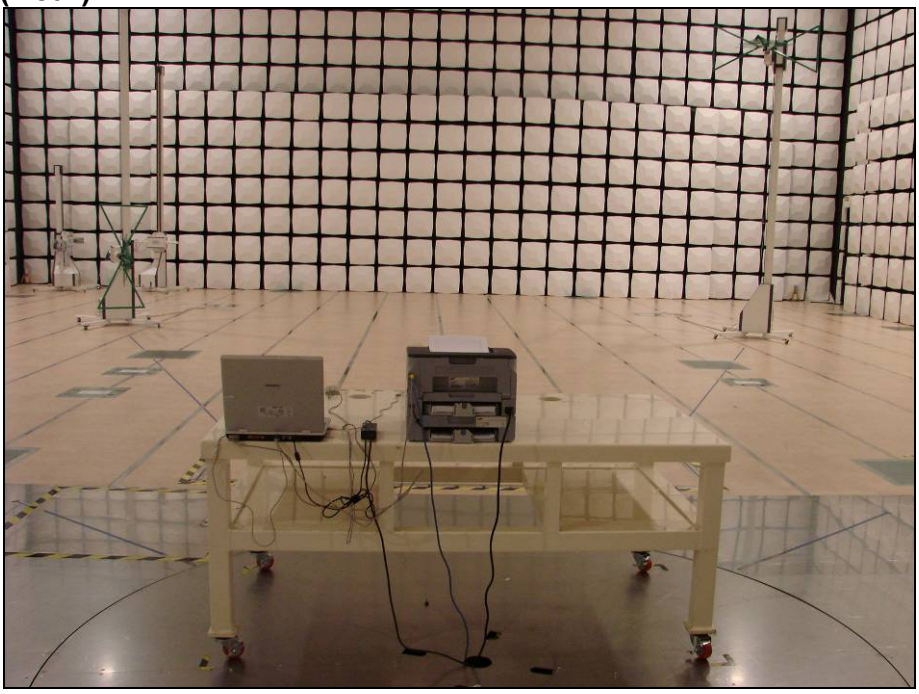
Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Bi-con Antenna	CBL6112D	SCHAFFNER	22602	2006-06-26	24
Bi-con Antenna	CBL6112D	SCHAFFNER	22601	2007-04-02	24
EMI Receiver	ESIB-26	R&S	100289	2007-03-22	12
EMI Receiver	ESIB-26	R&S	100287	2007-04-10	12
AMPLIFIER	310N	SONOMA	186467	2007-03-17	12
AMPLIFIER	310N	SONOMA	251673	2007-03-17	12
Ant Mast	MA4000	INN CO	-	N/A	N/A
Ant Mast	MA4000	INN CO	-	N/A	N/A
Mast Controller	CO2000	INN CO	-	N/A	N/A
Test software	EP5/RE	TOYO	VER 3.1.20	N/A	N/A
RF Selector	NS4900	TOYO	-	N/A	N/A

4.2.2 Photograph of the test Configuration

(Front)



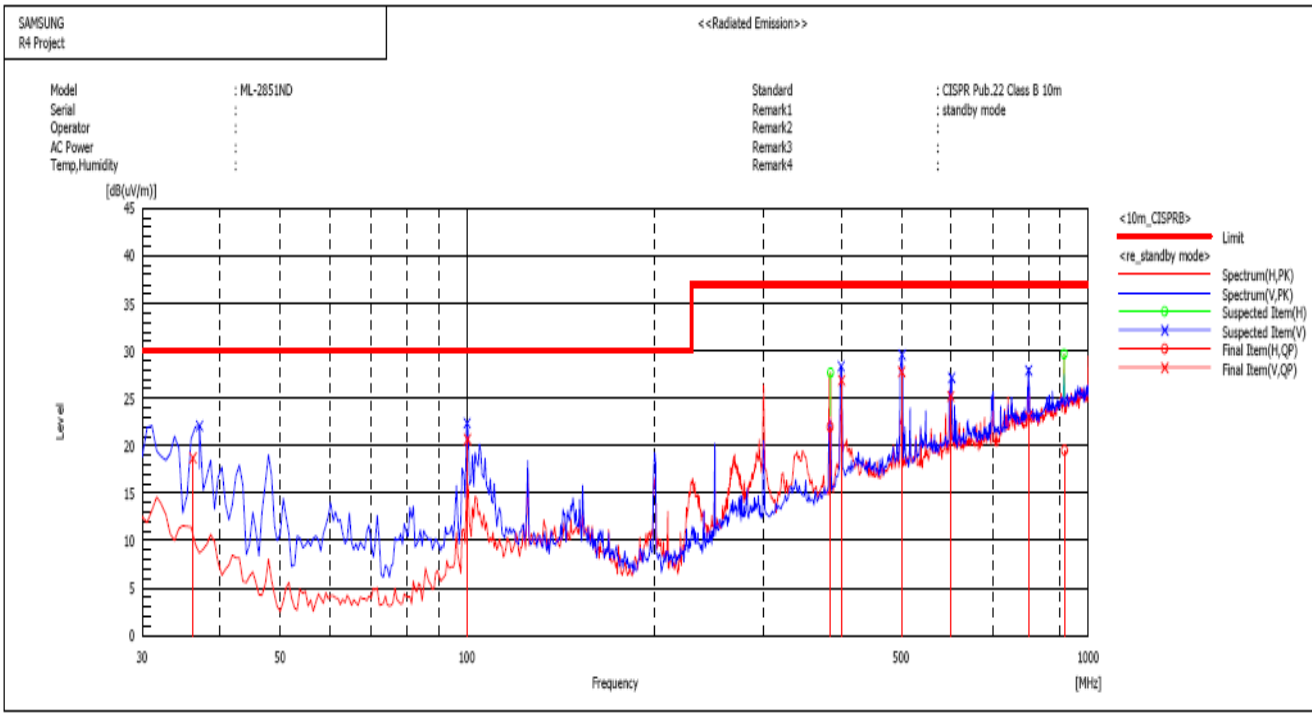
(Rear)



4.2.3 Test results (30MHz ~ 1GHz)

Operating condition	USB Printing, Standby			
Test date	2007-07-26	**Test engineer**	Young Hun, Cheong	
Climate condition	**Ambient temperature**	21.2 ℃	**Relative humidity**	48 %
	Atmospheric pressure	100.0 kPa		
Test place	10m Semi-Anechoic Chamber #1			
Note	* Receiving antenna mode : Horizontal, Vertical * Test distance : 10 m (RF Semi Anechoic Chamber) * Result = Reading + c.f (Antenna factor + Cable loss- Amp Gain) * Margin = Limit – Result			

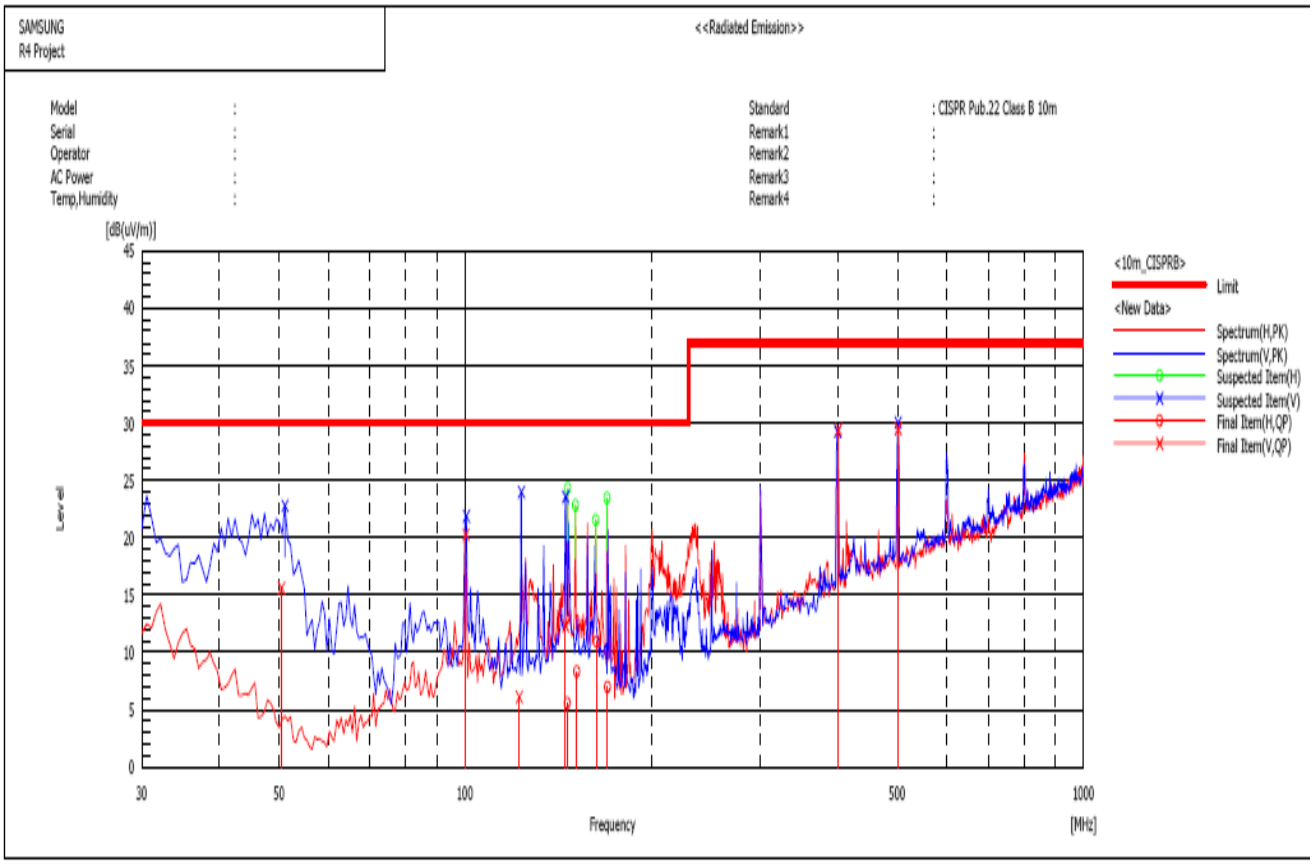
[Stand-by Mode]



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	System	Remark
1	36.149	V	35.2	-16.5	18.7	30.0	11.3	100.0	0.3	2	
2	100.062	V	39.9	-19.2	20.7	30.0	9.3	100.0	0.3	2	
3	383.979	H	33.7	-11.8	21.9	37.0	15.1	300.0	0.3	1	
4	400.308	V	37.8	-10.9	26.9	37.0	10.1	400.0	70.0	2	
5	500.328	V	36.6	-8.8	27.8	37.0	9.2	300.0	4.3	2	
6	600.025	V	32.4	-7.2	25.2	37.0	11.8	200.0	36.4	2	
7	800.177	V	27.6	-4.5	23.1	37.0	13.9	200.0	11.8	2	
8	915.278	H	22.4	-2.9	19.5	37.0	17.5	100.0	0.3	1	

[USB Printing Mode]

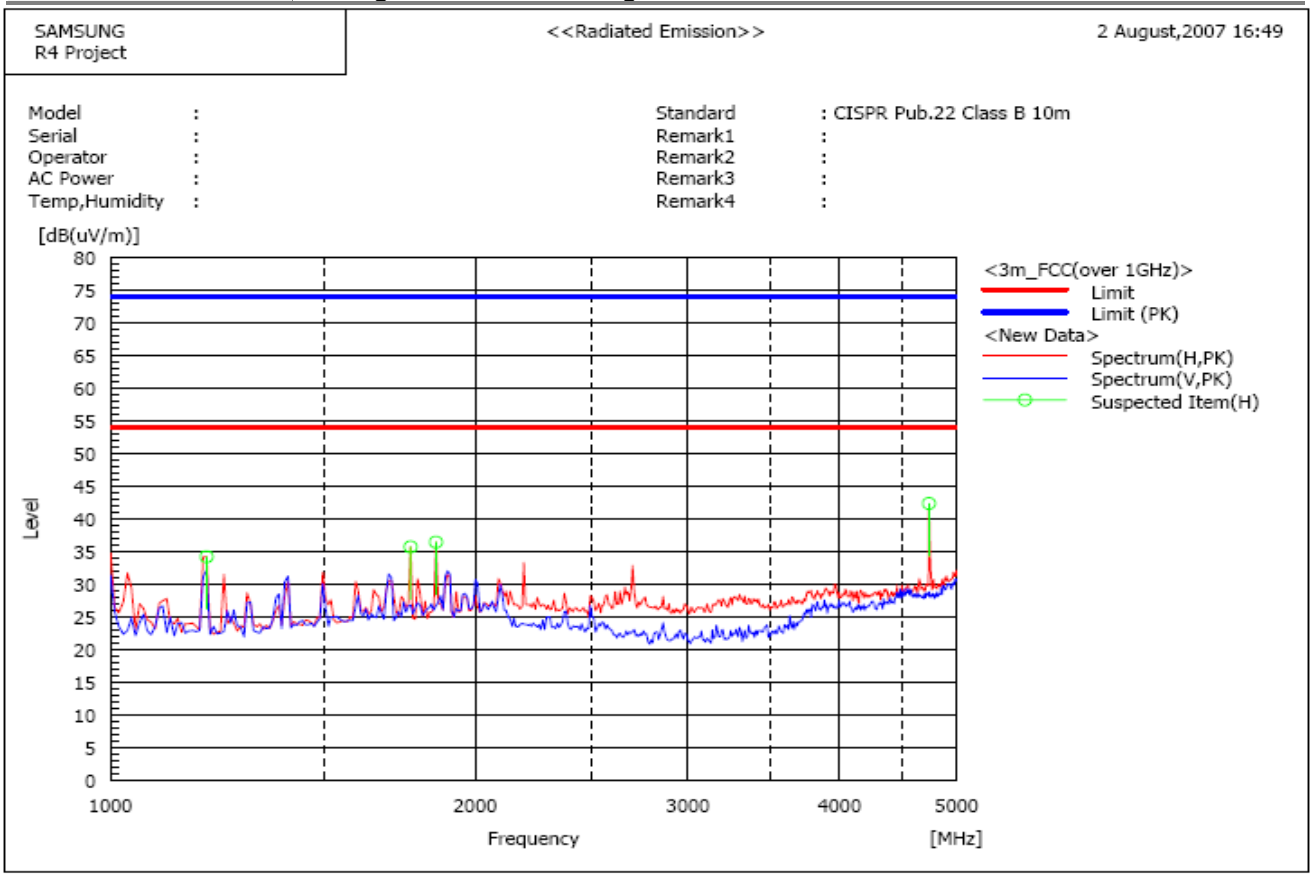


Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c,f [dB(1/m)]	Result QP [dB(uV/m)]	Limit [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	System	Remark
1	50.423	V	39.1	-23.5	15.6	30.0	14.4	211.0	0.7	2	
2	100.122	V	39.5	-19.2	20.3	30.0	9.7	100.0	31.5	2	
3	122.084	V	24.0	-17.9	6.1	30.0	23.9	108.0	330.5	2	
4	145.275	V	31.0	-18.7	12.3	30.0	17.7	154.0	330.4	2	
5	146.206	H	24.1	-18.5	5.6	30.0	24.4	400.0	13.6	1	
6	151.400	H	27.1	-18.8	8.3	30.0	21.7	345.0	53.7	1	
7	163.033	H	30.1	-19.2	10.9	30.0	19.1	400.0	354.3	1	
8	169.672	H	26.4	-19.4	7.0	30.0	23.0	380.0	349.0	1	
9	400.743	V	40.3	-10.9	29.4	37.0	7.6	100.0	30.1	2	
10	500.959	V	38.2	-8.7	29.5	37.0	7.5	327.0	38.4	2	

4.2.4 Test results (1GHz ~ 5GHz)

Operating condition	USB Printing			
Test date	2007-07-26	**Test engineer**	Young Hun, Cheong	
Climate condition	**Ambient temperature**	21.2 ℃	**Relative humidity**	48 %
	Atmospheric pressure	100.0 kPa		
Test place	10m Semi-Anechoic Chamber #1			
Note	* Receiving antenna mode : Horizontal, Vertical * Test distance : 3 m (Semi Anechoic Chamber) * Result = Reading + c.f (Antenna factor + Cable loss- Amp Gain) * Margin = Limit – Reading			



Spectrum Selection

--- Horizontal Polarization ---

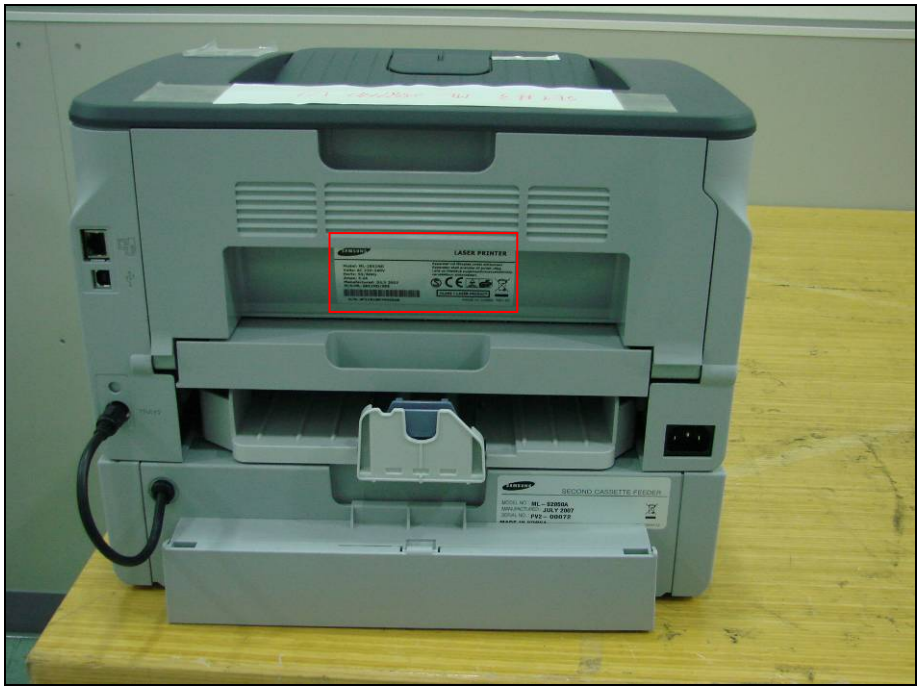
No.	Frequency [MHz]	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit [dB(uV/m)]	Margin [dB]	Remark
1	4743.487	40.5	1.8	42.3	54.0	11.7	
2	1857.715	44.7	-8.3	36.4	54.0	17.6	
3	1769.539	44.5	-8.8	35.7	54.0	18.3	
4	1200.401	45.7	-11.6	34.1	54.0	19.9	

Appendix – EUT photography

Front View

Rear View

Label location



Label

Samsung Electronics (Shandong) Digital Printing Co., Ltd.

Samsung Electronics Co., Ltd.

Weihai Shin Heung Digital Electronics Co., Ltd.