

EMC TEST REPORT

Project No.	LBE20100662	Issue No.	2
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	August 20, 2010	
EUT	Type of device	Class B digital devices, peripherals	
	Equipment authorization	☐ Declaration of Conformity ☒ Certification ☐ Verification	
	FCC ID	A3LML1860	
	Kind of product	MONO LASER PRINTER	
	Model No.	ML-1860	
		Variant Model No.	ML- 1861, ML-1865, ML-1866, ML-1867
	Manufacturer	Samsung Electronics Co., Ltd. 259, Gongdan-Dong, Gumi-City, Gyeongsangbuk-Do, Korea 730-030 Samsung Electronics (Shandong) Digital Printing Co.Ltd (264209) SAMSUNG ROAD HI-TECH IDZ, WEIHAI, CHINA Weihai Shin Heung Digital Electronics Co., Ltd. 98, Samsung Road, Weihai Hi-Tech. IDZ, Shandong Province, P.R.China Intops : Intops (Weihai) Electronics Co., Ltd. Keji Road-268-1 , Weihai Hi-Tech, Industries Development Zone , Shandong Province , CHINA	
Applied Standards	FCC Part 15, Subpart B / ANSI C63.4-2003		
Test Period	August 30, 2010 ~ October 12, 2010		
Issue date	October 12, 2010		

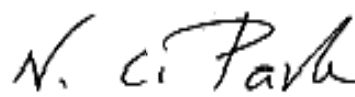
Test result : Complied

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

Tested by : Sung Jin Sim



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.



416 Maetan 3-Dong, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, 443-742 Korea
Tel: 82 31 277 7752, Fax: 82 31 277 7753

Table of contents

1. Summary of test results

1.1 Emission

2. General Information

2.1 Test facility

3. Test configuration

3.1 Test Peripherals

3.2 EUT operating mode

3.3 Details of Sampling

3.4 Used cable description

3.5 EUT Description

3.6 Clock Frequencies

3.7 Test configuration and condition

3.8 Measurement uncertainty

4. Result of individual tests

4.1 Conducted disturbance

4.2 Radiated disturbance

Appendix – EUT photography

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 (Mains Port)	FCC Part 15 Subpart B	Complied	Meets Class B Limit
☒	Radiated Disturbance		Complied	Meets Class B Limit

2. General Information

2.1 Test facility

The CS & Environment center 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 CS & Environment center is operated as testing laboratory in accordance with the requirements of ISO/IEC 17025:2005.

3. Test Setup configuration

3.1 Test Peripherals

The cables used for these peripherals are either permanently attached by the peripheral manufacturer or coupled with an assigned cable as defined below.

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 and/or DoC
Mono Laser Printer	ML-1860	–	SAMSUNG	A3LML1860
PC	PP18L	29359007709	DELL	DoC
Adapter	PA-12	CN-0YD637-71615-83C-0280	DELL	DoC
USB MOUSE	MOARUO	0740007850	Primax Electronics	DoC
Headset	–	–	Labtec	–

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	1.5	No	-
USB	1.8	Yes	From EUT to PC
USB	1.5	Yes	From PC to Mouse
Headset	1.6	No	From PC to Headset

3.5 EUT Description

The following features describe EUT represented by this report:

Item	Specification and Description
Processor	TEMUJIN(300Mhz)
Standard System memory	Embedded SDRAM 8MB size
Resolution	1200x1200dpi
Copy Quality mode	N.A
Paper Handling	Paper Tray(BIN Type) 150 Sheets
Power Rating	110~127 VAC, 4A, 50/60 Hz
Power Consumption	Power save mode : 2.8 Watts Printing mode: MAX. 270 Watts
Printer Language	SPL
PC Interfaces	Hi-Speed USB 2.0
OS compatibility	Windows 2000/XP(32/64bits)/Vista(32/64bits)/Win7(32/64bits)/2003 Server(32/64bits)/2008 Server(32/64bits)/2008 Server R2 Various Linux OS including RedHat Enterprise Linux WS 4, 5 (32/64bit), Fedora 4~12 (32/64bit), SuSE Linux 10.0, 10.1 (32bit), OpenSuSE 10.2, 10.3, 11.0, 11.1, 11.2 (32/64bit), Mandriva 2005, 2006, 2007, 2008, 2009, 2009.1 (32/64bit), Ubuntu 5.04, 5.10, 6.06, 6.10, 7.04, 7.10, 8.04 8.10, 9.04, 9.10 (32/64bit), SuSE Linux Enterprise Desktop 10, 11 (32/64bit), Debian 4.0, 5.0 (32/64bit) Mac OS X 10.3~10.6
Modes of Operation	USB Printing
Intended Class for Emissions	Class B

3.6 Clock Frequencies

Kind of Clocks	Frequency[MHz]	Kind of Clocks	Frequency[MHz]
Main Source	12	Video	21.75
CPU Internal	300	USB Device	12
CPU Bus Clock	100		

3.7 Test configuration and condition

The system was configured for testing in typical fashion use. Cables were attached to each of the available I/O Ports. Where applicable, peripherals were attached to the I/O cables. The mode of operation utilized for testing was selected to best simulate typical EUT use. Power source for the EUT operating was supplied by CVCF made by the Voltech Corp.

The EUT was measured all testing with toner cartridge.

- 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.)

3.8.1 Emission

Test type		Measurement uncertainty (C.L. 95 %, k = 2)
Conducted disturbance	Main terminal	3.00 dB
Radiated Disturbance (Below 1 GHz)	Horizontal	4.95 dB
	Vertical	4.99 dB
Radiated Disturbance (Above 1 GHz)	Horizontal	3.32 dB
	Vertical	3.32 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 the mains ports of class A ITE

Frequency range Limits MHz	Resolution Bandwidth	Limits dB(μV)	
		Quasi-peak	Average
0,15 to 0,50	9 kHz	79	66
0,50 to 30	9 kHz	73	60
NOTE The lower limit shall apply at the transition frequency			

Limits for conducted disturbance at the mains ports of class B ITE

Frequency range Limits MHz	Resolution Bandwidth	Limits dB(μV)	
		Quasi-peak	Average
0,15 to 0,50	9 kHz	66 to 56	56 to 46
0,50 to 5	9 kHz	56	46
5 to 30	9 kHz	60	50
NOTE 1 The lower limit shall apply at the transition frequency			
NOTE 2 The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.			

4.1.1 Test instrumentation

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Measuring receiver	ESCI	R&S	100086	2009-11-19	12
Artificial mains network	ENV216	R&S	100117	2009-11-11	12
Artificial mains network	ESH3-Z5	R&S	831887/004	2010-07-06	12
Test software	EMC32	R&S	Ver 4.40.	N/A	N/A

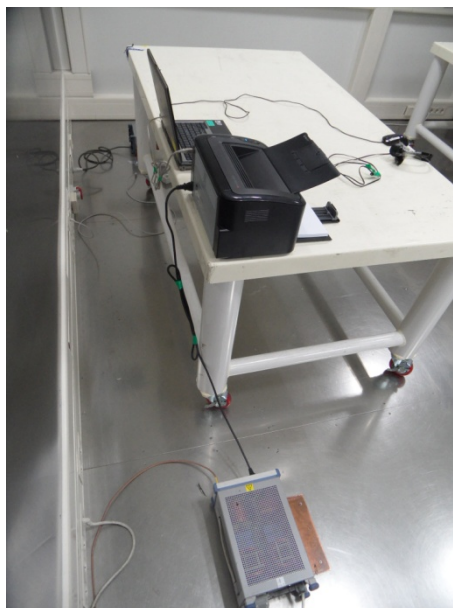
4.1.2 Temperature and humidity condition

Test date	October 12, 2010	Test engineer	Sung Jin Sim
Test place	Shielded Room #1		

4.1.3 Photograph of Test Setup



Front



Rear

4.1.4 Test results (mains port)

- Configuration 1 : Stand-by Mode

Hardware Setup: Voltage with ENV 2-Line-LISN - [EMI conducted]

Subrange 1

Frequency Range: 150kHz - 30MHz

Receiver: ESCI 3

Transducer: ENV216 / Receiver-2-Line-LISN ENV216

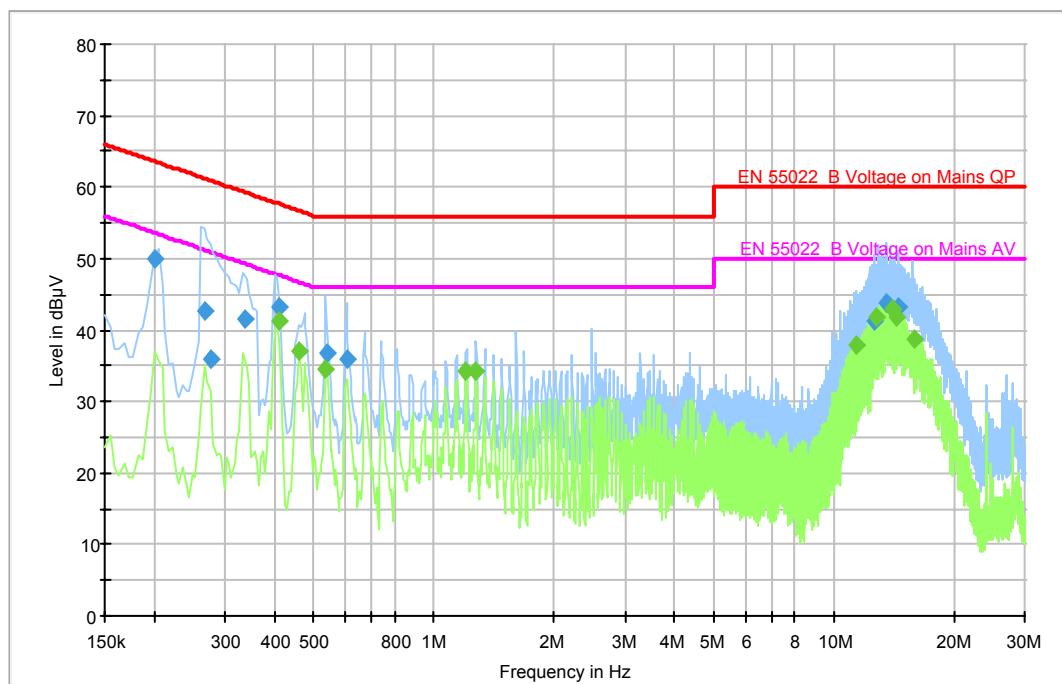
Scan Setup: EN55022_B_ENV 2-Line-LISN fin [EMI conducted]

Hardware Setup: Voltage with ENV 2-Line-LISN

Level Unit: dB μ V

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
150kHz - 30MHz	QuasiPeak; Average	9kHz	15s	ESCI 3

Test Graph



Note) Two graphs measured for both Live(L1) and Neutral(N) of the LISN are combined into one graph.

Test Results (Quasi-Peak and Average)

Quasi-peak final measurement results table

Frequency (MHz)	Quasi-Peak (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.201	50.0	N	9.7	13.6	63.6
0.269	42.6	L1	9.7	18.5	61.2
0.278	35.9	L1	9.7	25.0	60.9
0.336	41.5	L1	9.7	17.9	59.3
0.408	43.2	L1	9.7	14.5	57.7
0.539	36.7	L1	9.7	19.3	56.0
0.606	36.1	N	9.7	19.9	56.0
12.603	41.3	L1	9.9	18.7	60.0
13.534	43.7	L1	9.9	16.3	60.0
14.475	43.1	N	9.9	16.9	60.0

Average final measurement results table

Frequency (MHz)	Average (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.408	41.2	L1	9.7	6.5	47.7
0.462	36.9	L1	9.7	9.7	46.7
0.534	34.5	N	9.7	11.5	46.0
1.204	34.4	L1	9.7	11.6	46.0
1.272	34.4	L1	9.7	11.6	46.0
11.383	37.9	L1	9.9	12.1	50.0
12.724	41.9	L1	9.9	8.1	50.0
13.930	42.9	L1	9.9	7.1	50.0
14.331	41.9	N	9.9	8.1	50.0
15.973	38.7	N	9.9	11.3	50.0

Note) Level (Quasi-Peak and/or Average) = Meter Reading (Quasi-Peak and/or Average) +
Factor (LISN Insertion Loss + Cable Loss)

Margin = Limit – Level (Quasi-Peak and/or Average)

- Configuration 1 : USB printing Mode

Hardware Setup: Voltage with ENV 2-Line-LISN - [EMI conducted]

Subrange 1

Frequency Range: 150kHz - 30MHz

Receiver: ESCI 3

Transducer: ENV216 / Receiver-2-Line-LISN ENV216

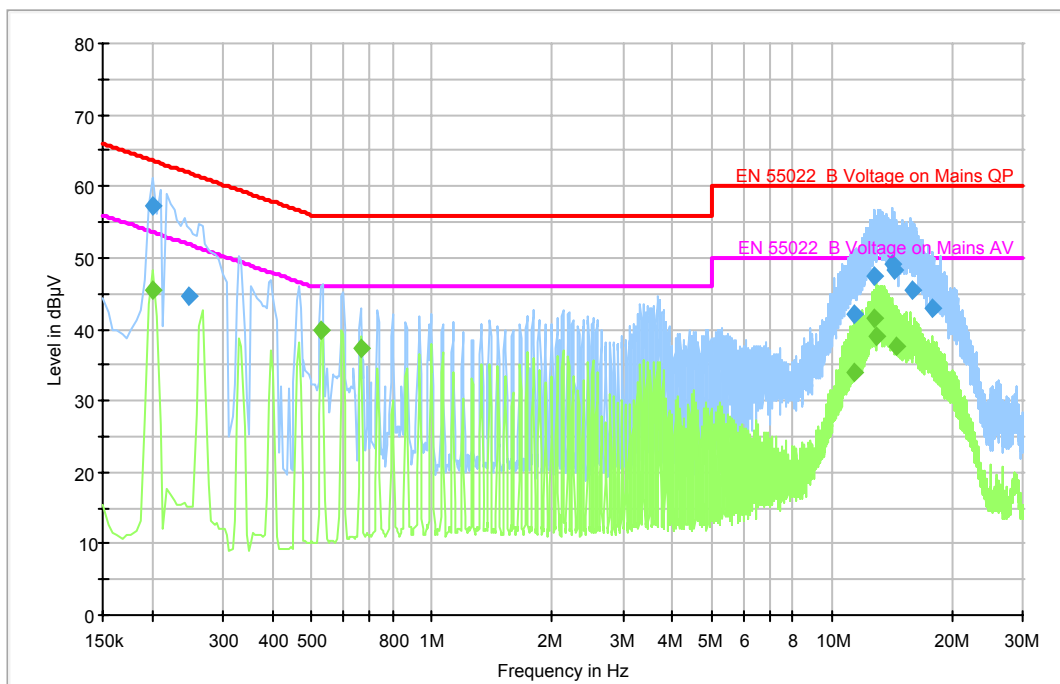
Scan Setup: EN55022_B_ENV 2-Line-LISN fin [EMI conducted]

Hardware Setup: Voltage with ENV 2-Line-LISN

Level Unit: dB μ V

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
150kHz - 30MHz	QuasiPeak; Average	9kHz	15s	ESCI 3

Test Graph



Note) Two graphs measured for both Live(L1) and Neutral(N) of the LISN are combined into one graph.

Test Results (Quasi-Peak and Average)

Quasi-peak final measurement results table

Frequency (MHz)	Quasi-Peak (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.201	57.3	L1	9.7	6.3	63.6
0.248	44.6	L1	9.7	17.2	61.8
11.437	42.0	L1	9.9	18.0	60.0
12.828	47.5	L1	9.9	12.5	60.0
14.160	49.2	L1	9.9	10.8	60.0
14.371	48.4	L1	9.9	11.6	60.0
15.969	45.5	L1	10.0	14.5	60.0
17.908	42.8	L1	10.0	17.2	60.0

Average final measurement results table

Frequency (MHz)	Average (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.201	45.4	N	9.7	8.1	53.6
0.530	40.0	L1	9.7	6.0	46.0
0.665	37.4	L1	9.7	8.6	46.0
11.437	33.9	L1	9.9	16.1	50.0
12.828	41.4	L1	9.9	8.6	50.0
12.967	38.9	L1	9.9	11.1	50.0
14.484	37.6	L1	9.9	12.4	50.0

Note) Level (Quasi-Peak and/or Average) = Meter Reading (Quasi-Peak and/or Average) +
Factor (LISN Insertion Loss + Cable Loss)

Margin = Limit – Level (Quasi-Peak and/or Average)

4.2 Radiated disturbance

Of those disturbances above ($L - 20\text{dB}$), 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	Resolution Bandwidth	Quasi-peak Limits dB($\mu\text{V}/\text{m}$)	
		Class A	Class B
30 to 230	120 kHz	40	30
230 to 1000	120 kHz	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.			

Peak measurements were made over the changeable frequency range 1GHz to 40GHz or 5th in accordance with internal maximum operating frequency at a measurement distance of 3m for the following antenna and turntable arrangements:

Antenna Height (Cm)	Antenna Polarisation	Turntable position (degrees)
100	Horizontal, Vertical	Continuous

Limits for above 1GHz radiated disturbance of ITE at a measuring distance of 3 m

Class	Limits - dB(μV/m)	
	Peak	Average
A	80	60
B	74	54
Average limit 500, $20 \log 500 = 53.979 \text{ dB} \approx 54 \text{ dB}$		

Antenna height was adjusted to 100 cm to be parallel from EUT to antenna centre.
Measurements within 20 dB of the limit were then maximized by adjusting turntable position.
Final measurements were made using a average detector.

Results checked manually; and points close to the limit line were re-measured.

4.2.1 Test instrumentation

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Bi-con Antenna	CBL6112D	Schaffner	22602	2010-04-21	24
Bi-con Antenna	CBL6112D	Schaffner	22604	2010-04-21	24
Horn Antenna	R&S	HF907	100016	2009-04-27	24
EMI Receiver	ESIB-26	R&S	100288	2010-06-04	12
EMI Receiver	ESIB-26	R&S	100147	2010-08-17	12
Amplifier	310N	Agilent	185861	2010-01-28	12
Amplifier	310N	Agilent	251676	2010-01-28	12
Preamplifier	R&S	SCU_F018_G35_ ASF42_CNN(F)	10001	2010-04-19	12
Antenna Mast	MA4000	INN CO	-	N/A	N/A
Antenna Mast	MA4000	INN CO	-	N/A	N/A
Antenna Mast	MA2000	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

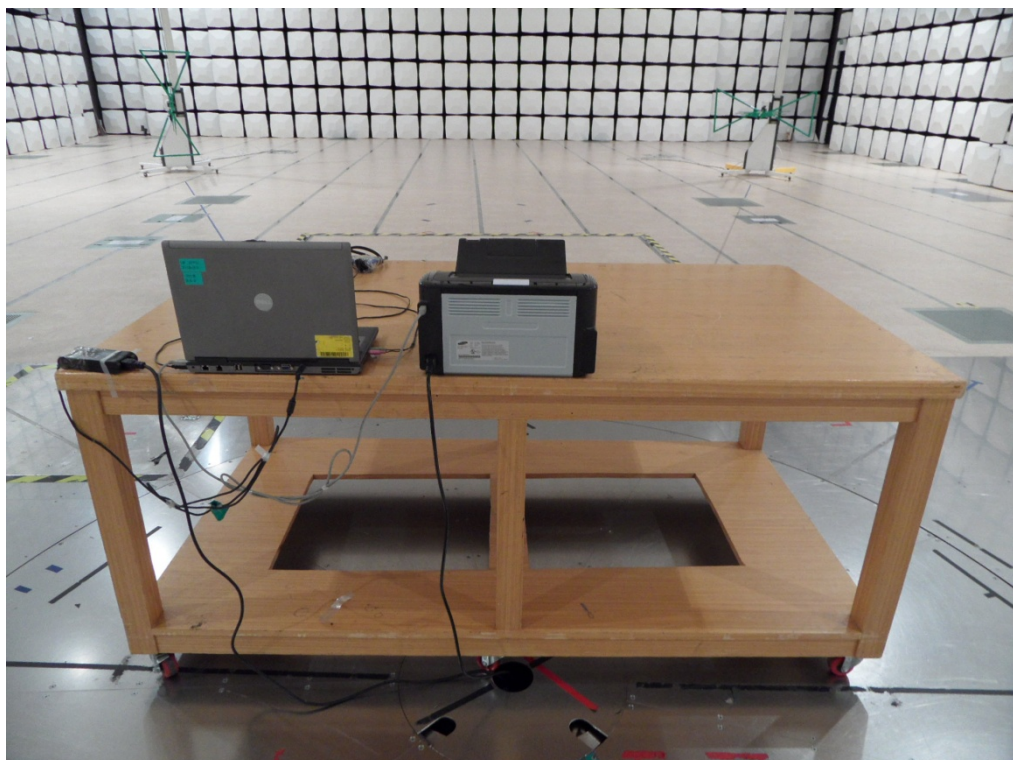
4.2.2 Temperature and humidity condition

Test date	August 30, 2010 ~ August 31, 2010	Test engineer	Sung Jin Sim
Test place	Semi-Anechoic Chamber		

4.2.3 Photograph of Test Setup



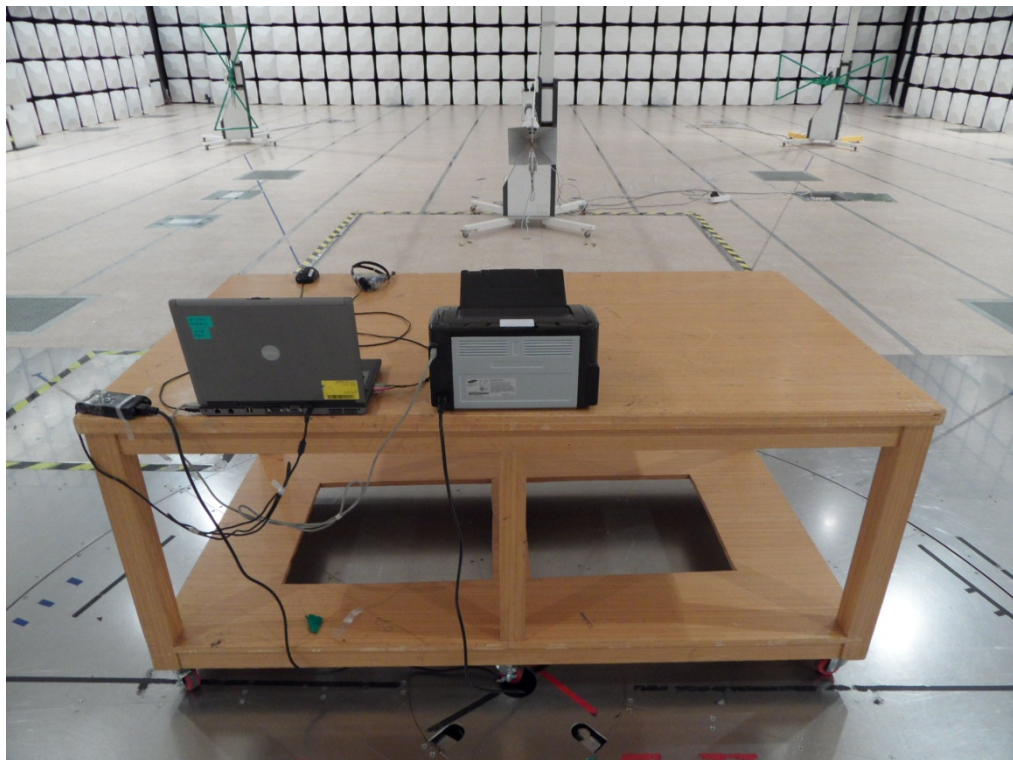
Front



Rear



Front (above 1GHz)



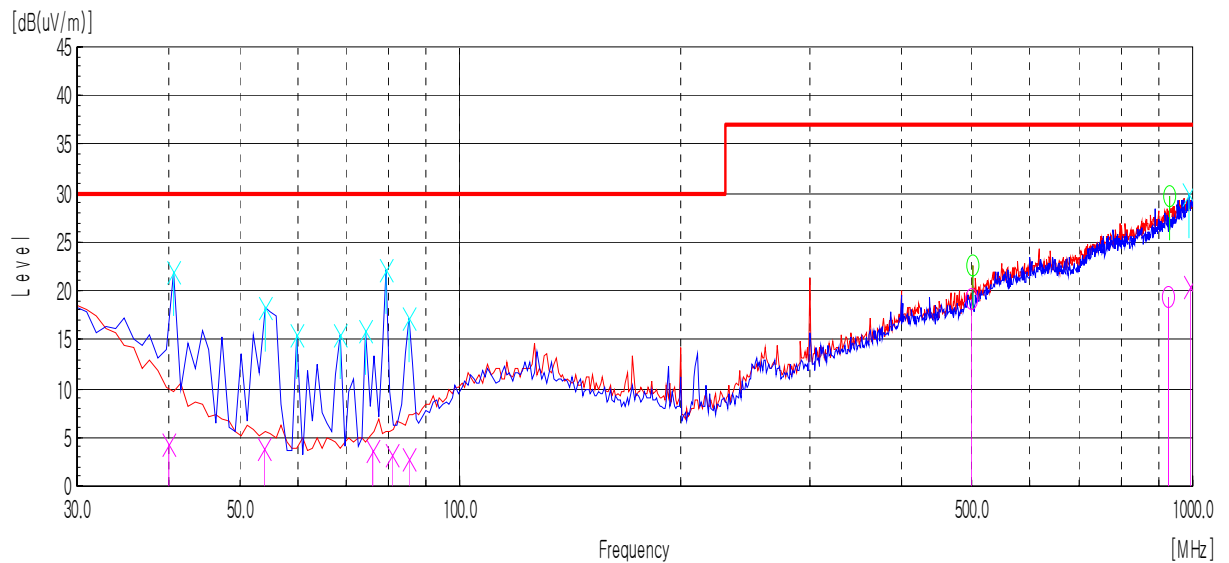
Rear (above 1GHz)

4.2.4 Test results

4.2.4.1 30 MHz to 1GHz test results

- Configuration 1 : Stand-by

Test Graph and Results



Frequency [MHz]	Pol.	Reading QP [dB(μV)]	Factor [dB(1/m)]	Level QP [dB(μV /m)]	Limit [dB(μV /m)]	Margin QP [dB]	Height [cm]	Angle [deg]
39.993	V	22.9	-18.5	4.4	30	25.6	234	185.6
54.076	V	28.1	-24.2	3.9	30	26.1	384	231.4
75.993	V	27.9	-24.2	3.7	30	26.3	210	233.6
80.823	V	26.3	-23.1	3.2	30	26.8	247	217.8
85.169	V	25.0	-22.1	2.9	30	27.1	137	201.7
500.018	H	27.8	-8.6	19.2	37	17.8	153	352.3
928.419	H	21.0	-1.5	19.5	37	17.5	149	68.4
991.106	V	20.8	-0.3	20.5	37	16.5	149	316.1

Note) Receiving antenna polarization : Horizontal and/or Vertical

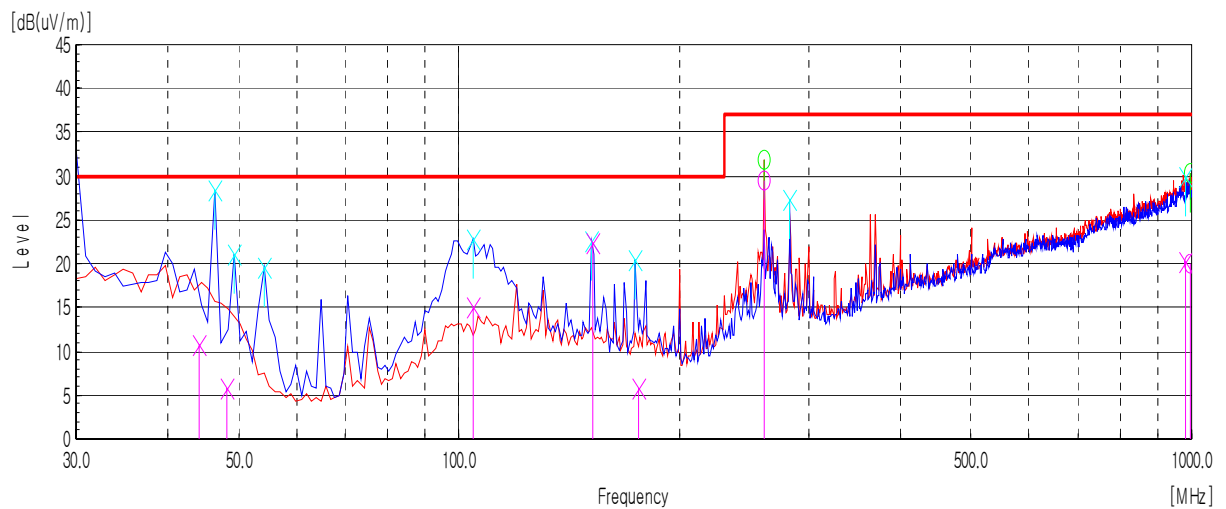
Test Distance : 10m, Antenna Height : 1 to 4 meters

Level QP (Quasi-Peak) = Reading QP + Factor (Antenna Factor + Cable Loss - Amp. Gain)

Margin QP (Quasi-Peak) = Limit – Level QP

- Configuration 1 : USB printing Mode

Test Graph and Results



Frequency [MHz]	Pol.	Reading QP [dB(μV)]	Factor [dB(1/m)]	Level QP [dB(μV /m)]	Limit [dB(μV /m)]	Margin QP [dB]	Height [cm]	Angle [deg]
30.000	V	30.7	-11.2	19.5	30	10.5	135	38.2
44.156	V	31.3	-20.6	10.7	30	19.3	249	280.1
48.242	V	28.3	-22.5	5.8	30	24.2	251	280.1
104.401	V	33.5	-18.4	15.1	30	14.9	151	53.4
152.253	V	41.7	-19.3	22.4	30	7.6	151	344.7
175.706	V	25.6	-19.7	5.9	30	24.1	151	358.8
260.998	H	44.1	-14.5	29.6	37	7.4	349	355.1
979.527	V	21.0	-0.8	20.2	37	16.8	351	0.8

Note) Receiving antenna polarization : Horizontal and/or Vertical

Test Distance : 10m, Antenna Height : 1 to 4 meters

Level QP (Quasi-Peak) = Reading QP + Factor (Antenna Factor + Cable Loss - Amp. Gain)

Margin QP (Quasi-Peak) = Limit – Level QP

4.2.4.2 1 GHz to 2 GHz test results

- Configuration 1 : Stand-by Mode

Test Results

Peak Measurement

Frequency [MHz]	POL	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level PK [dB(uV/m)]	Limit [dB(uV/m)]	Margin PK [dB]	Height [cm]	Angle [deg]
1328.657	V	48.2	-12.6	35.6	74	38.4	100	174.6
1665.331	V	46.1	-9.5	36.6	74	37.4	100	94.0
1989.980	V	46.9	-6.8	40.1	74	33.9	100	15.5
2198.397	V	43.9	-5.1	38.8	74	35.2	100	174.6
2875.752	V	39.0	-0.4	38.6	74	35.4	100	221.9

Note1) Representative operating modes were selected by customer and any emissions that do NOT exceed Average limit were not tested with average detector mode.

Note2) Receiving antenna polarization : Horizontal and Vertical

Level P K(Peak) = Reading PK(Peak) + Factor(Antenna Factor + Cable Loss - Amp. Gain)

Level AV (Average) = Reading AV (Average) + Factor(Antenna Factor + Cable Loss - Amp. Gain)

Margin PK (Peak) = Limit – Level PK (Peak)

Margin AV (Average) = Limit – Level AV (Average)

- Configuration 1 : USB printing Mode

Test Results

Peak Measurement

Frequency [MHz]	POL	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level PK [dB(uV/m)]	Limit [dB(uV/m)]	Margin PK [dB]	Height [cm]	Angle [deg]
1156.313	V	63.5	-14.1	49.4	74	24.6	100	194.7
1993.988	V	51.8	-6.8	45.0	74	29.0	100	129.7
2014.028	V	53.9	-6.6	47.3	74	26.7	100	337.3
2266.533	V	51.5	-4.5	47.0	74	27.0	100	337.3
2735.471	V	49.1	-1.3	47.8	74	26.2	100	15.8

Average Measurement

Frequency [MHz]	POL	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level PK [dB(uV/m)]	Limit [dB(uV/m)]	Margin PK [dB]	Height [cm]	Angle [deg]
1164.089	V	21.1	-14.0	7.1	54	46.9	100	166.6
1995.592	V	25.1	-6.8	18.3	54	35.7	100	112.3
2023.908	V	14.2	-6.5	7.7	54	46.3	100	81.5
2271.563	V	13.3	-4.5	8.8	54	45.2	100	140.7
2741.744	V	11.0	-1.2	9.8	54	44.2	100	65.4

Note1) Representative operating modes were selected by customer and any emissions that do NOT exceed Average limit were not tested with average detector mode.

Note2) Receiving antenna polarization : Horizontal and Vertical

Level P K(Peak) = Reading PK(Peak) + Factor(Antenna Factor + Cable Loss - Amp. Gain)

Level AV (Average) = Reading AV (Average) + Factor(Antenna Factor + Cable Loss - Amp. Gain)

Margin PK (Peak) = Limit – Level PK (Peak)

Margin AV (Average) = Limit – Level AV (Average)

Appendix – EUT photography



Front View



Rear View & Label position



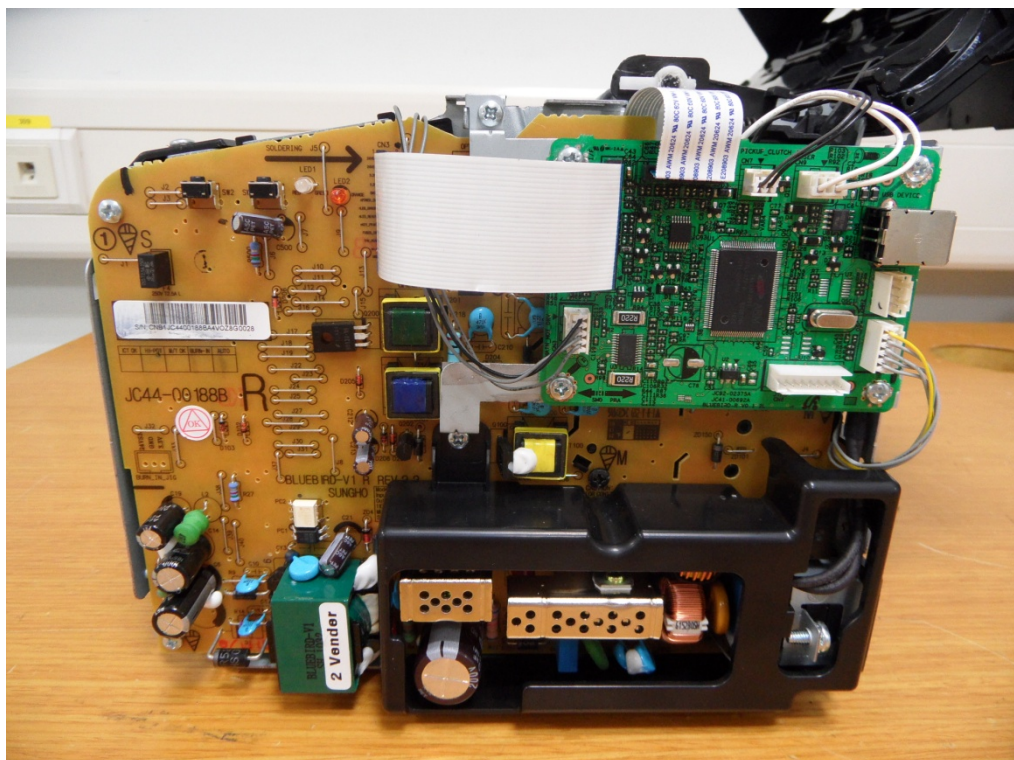
Left View



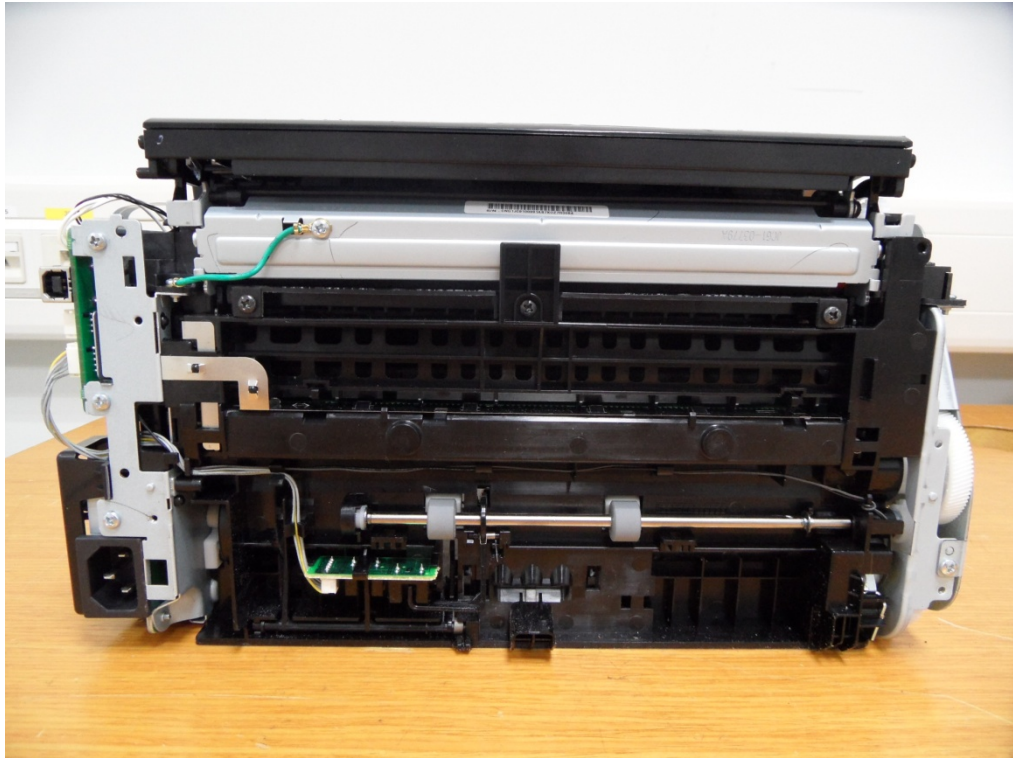
Right View



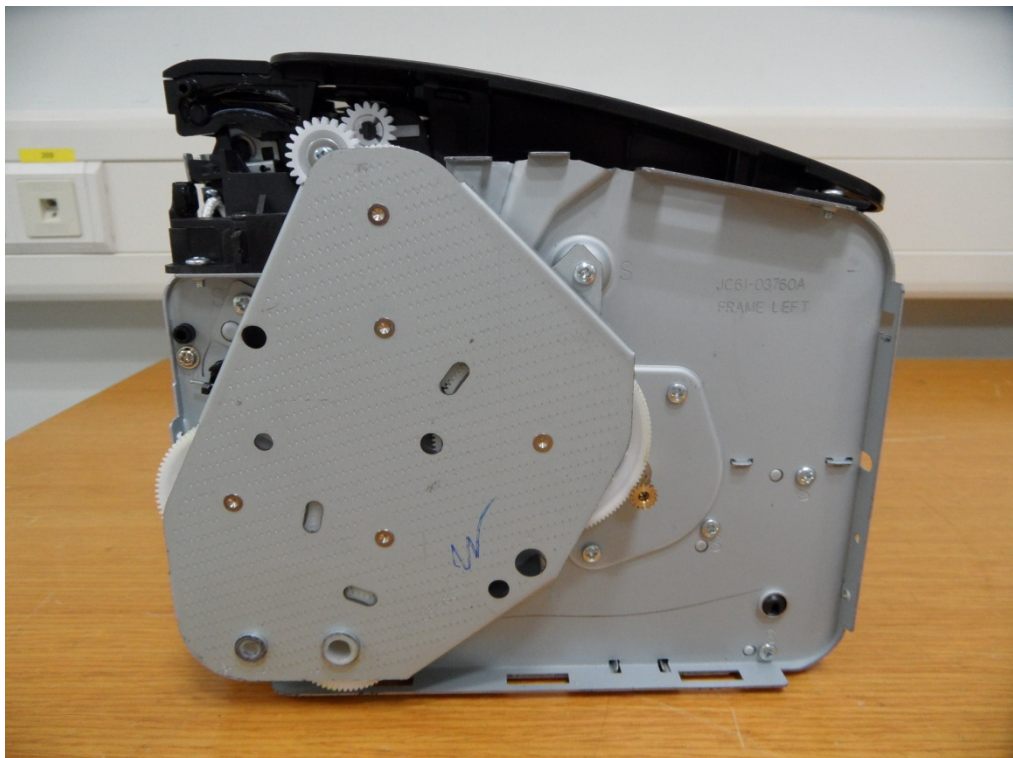
Front inside View



Left inside View



Rear inside View



Right inside View



Label