

EMC TEST REPORT

Project No.	LBE20112456	Issue No.	1
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	April 19, 2011	
EUT	Type of device	Class B personal computers and peripherals	
	Equipment authorization	☐ Declaration of Conformity ☒ Certification ☐ Verification	
	FCC ID	A3LML2545	
	Kind of product	Mono Laser Printer	
	Model No.	ML-2545	
	Variant Model No.	ML-2540	
	Manufacturer	1) Samsung Electronics Co., Ltd. 259, Gongdan-Dong, Gumi-City, Gyeongsangbuk-Do, Korea 730-030 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 4) 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 C63.4-2009	
Test Period		April 20, 2011 ~ April 21, 2011	
Issue date		May 19, 2011	

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



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416 Maetan 3-Dong, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, 443-742 Korea
 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 (Mains Port)	FCC Part 15 Subpart B / ANSI C63.4-2009	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 / DoC
Mono Laser Printer	ML-2545	–	SAMSUNG	EUT
Laptop PC	NT-RV511	ZZDN93CZB00036R	SAMSUNG	DoC
Adapter	A10-090P1A	CNBA4400215ADON43AB01380	Chicony	DoC
USB mouse	SC-1000	328447928	Primax electronics Ltd.,	DoC
Head set	Microsoft	–	Plantronics	–

3.2 EUT operating mode

To achieve compliance with the applied standards and/or specifications, the following mode(s) were considered and tested.

Operating Mode 1	Standby
Operating Mode 2	USB Printing(Duplex)

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 laptop PC
USB	1.8	Yes	From laptop PC to EUT
USB	1.5	Yes	From laptop PC to Mouse
Audio	1.8	No	From Notebook PC to Headphones

3.5 EUT Description

The following features describe EUT represented by this report:

Item	Specification and Description
Processor	TEMUJIN (300 MHz)
Standard System memory	Embedded SDRAM core of ESMT with 8 MB size
Resolution	True 1 200 x 1 200 dpi
Copy Quality mode	N/A
Paper Handling	Cassette Type, 250 Sheets
Power Rating	[110 ~ 127] VAC, 5 A, 50/60 Hz
Power Consumption	Power save mode : Less than 6.5 Watts Printing mode: MAX. 400 Watts
Printer Language	GDI
PC Interfaces	USB 2.0
OS compatibility	Windows 2000, XP, Vista, Windows7, 2003 Server, 2008 Sever, Various Linux OS, and 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 Clock	12	Video Clock	22.344 7
CPU Internal Clock	300	USB Device Clock	12

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.

The EUT was measured all testing with toner cartridge.

Power source for the EUT operating was supplied by CVCF made by the Voltech Corp.

- 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	2.90 dB
Radiated Disturbance (30 MHz ~ 1 GHz)	Horizontal	4.61 dB
	Vertical	4.68 dB
Radiated Disturbance (1 GHz ~ 6 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 B ITE

Frequency range Limits MHz	Resolution Bandwidth	Limits dB μ V	
		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	ESIB26	R&S	100147	2010-08-17	12
Artificial mains network	ENV216	R&S	100117	2010-11-16	12
Artificial mains network	ESH3-Z5	R&S	831887/004	2010-07-07	12
Test software	EP5CE	TOYO	Ver 4.7.10	N/A	N/A

4.1.2 Temperature and humidity condition

Test date	April 20, 2011	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)

- Operating Mode 1 : Standby Mode

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

Subrange 1

Frequency Range: 150 kHz – 30 MHz

Receiver: ESIB 26

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

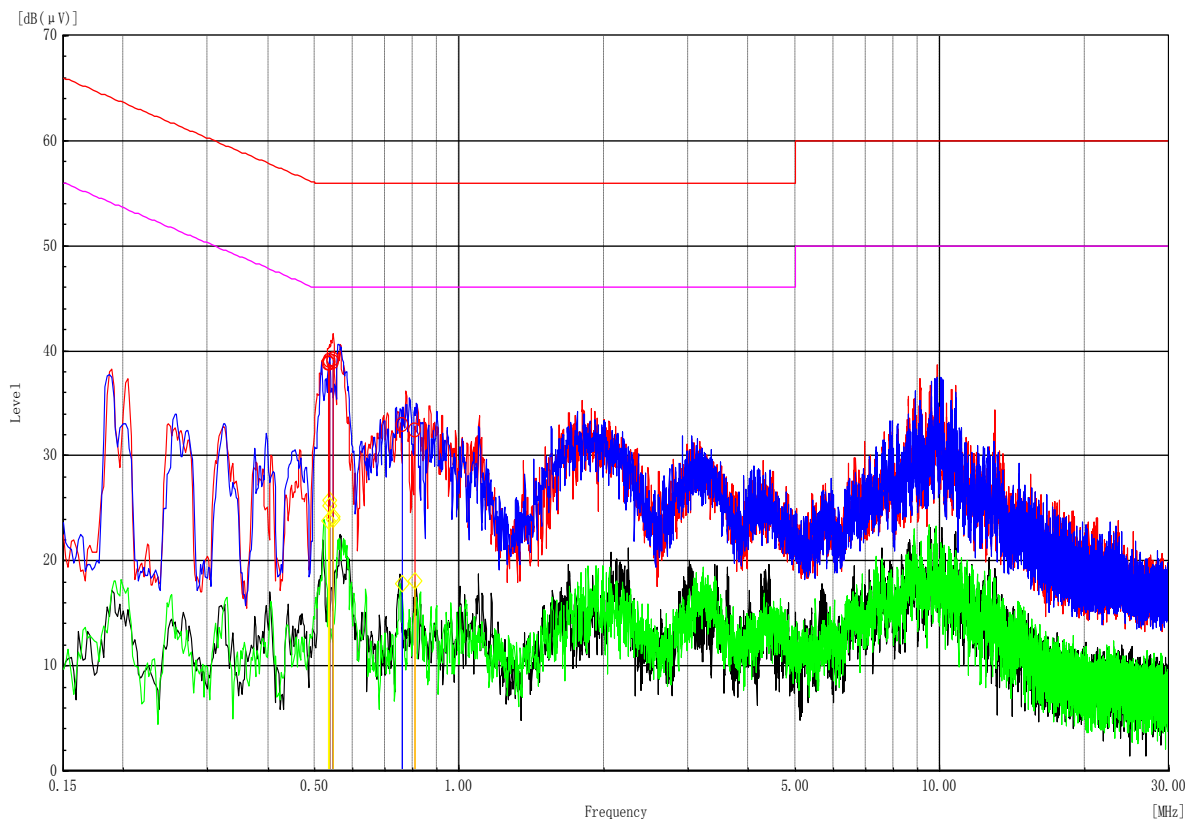
Scan Setup: K 00022_B_ENV 2-Line-LISN fin [EMI conducted]

Hardware Setup: Voltage with ENV 2-Line-LISN

Level Unit: dB μ V

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
150 kHz – 30 MHz	QuasiPeak; Average	9 kHz	15 s	ESIB 26

Test 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)
0.535	38.8	L1	10.1	17.2	56
0.547	38.9	L1	10.1	17.1	56
0.536	39.0	N	10.1	17.0	56
0.536	38.8	L1	10.1	17.2	56
0.547	39.1	N	10.1	16.9	56
0.759	33.0	N	10.0	23.0	56
0.807	32.4	L1	10.0	23.6	56

Average final measurement results table

Frequency (MHz)	Average (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.535	23.8	L1	10.1	22.2	46
0.547	24.2	L1	10.1	21.8	46
0.536	25.7	N	10.1	20.3	46
0.536	25.3	L1	10.1	20.7	46
0.547	24.0	N	10.1	22.0	46
0.759	17.8	N	10.0	28.2	46
0.807	18.0	L1	10.0	28.0	46

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)

- Operating Mode 2 : USB Printing

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

Subrange 1

Frequency Range: 150 kHz – 30 MHz

Receiver: ESIB 26

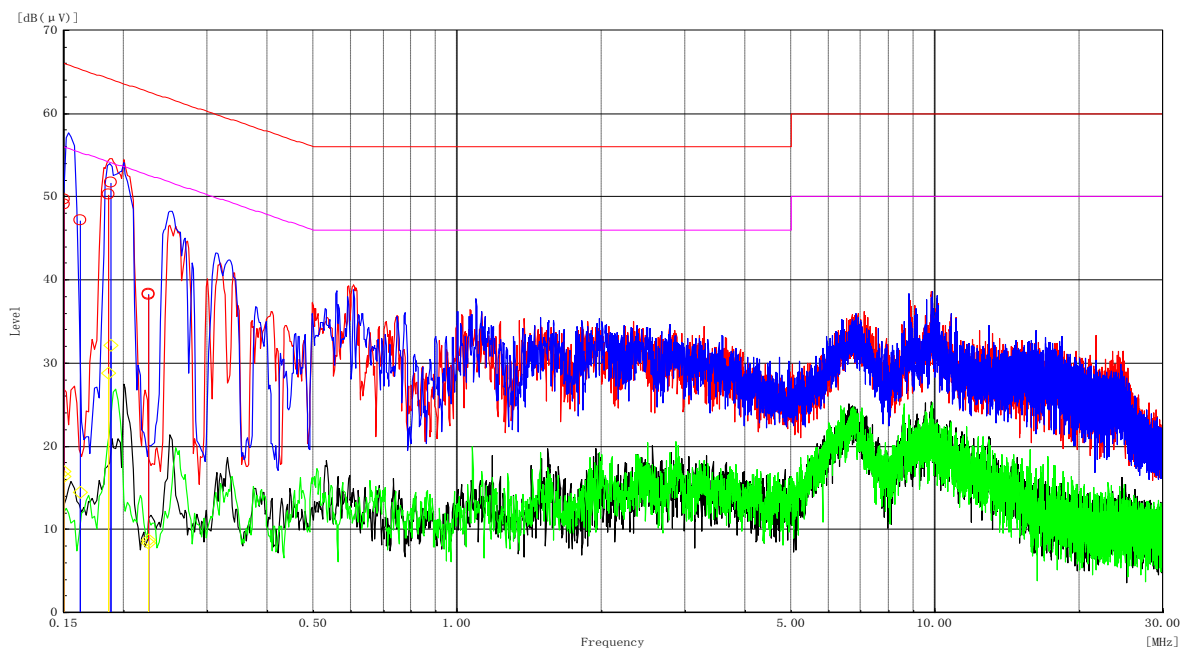
Transducer: ENV216 / Receiver-2-Line-LISN ENV216

Scan Setup: K 00022_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
150 kHz – 30 MHz	QuasiPeak; Average	9 kHz	15 s	ESIB 26

Test 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)
0.150	49.7	L1	10.2	16.3	66.0
0.151	49.1	N	10.0	16.9	66.0
0.162	47.2	N	10.2	18.2	65.4
0.185	50.3	L1	10.1	13.9	64.2
0.188	51.7	N	10.1	12.4	64.1
0.225	38.2	L1	10.1	24.4	62.6
0.226	38.4	N	9.9	24.2	62.6

Average final measurement results table

Frequency (MHz)	Average (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.150	17.0	L1	10.2	39.0	56.0
0.151	16.4	N	10.0	39.6	56.0
0.162	14.4	N	10.2	41.0	55.4
0.185	28.8	L1	10.1	25.4	54.2
0.188	32.2	N	10.1	21.9	54.1
0.225	8.7	L1	10.1	43.9	52.6
0.226	8.4	N	9.9	44.2	52.6

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 ($L - 20$ 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 m and elevated between 1 m and 4 m.

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 μ V/m
		Class B
30 to 230	120 kHz	30
230 to 1000	120 kHz	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 1 GHz to 40 GHz or 5th in accordance with internal maximum operating frequency at a measurement distance of 3 m for the following antenna and turntable arrangements:

Antenna Height (cm)	Antenna Polarisation	Turntable position (degrees)
100 ~ 400	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
B	74	54
Average limit 500, $20 \log 500 = 53.979 \text{ dB} \approx 54 \text{ dB}$		

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
Horn Antenna	HF907	R&S	100016	2010-04-28	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	Sonoma	185861	2011-04-07	12
Preamplifier	SCU_F018	R&S	10001	2011-04-22	12
Antenna 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

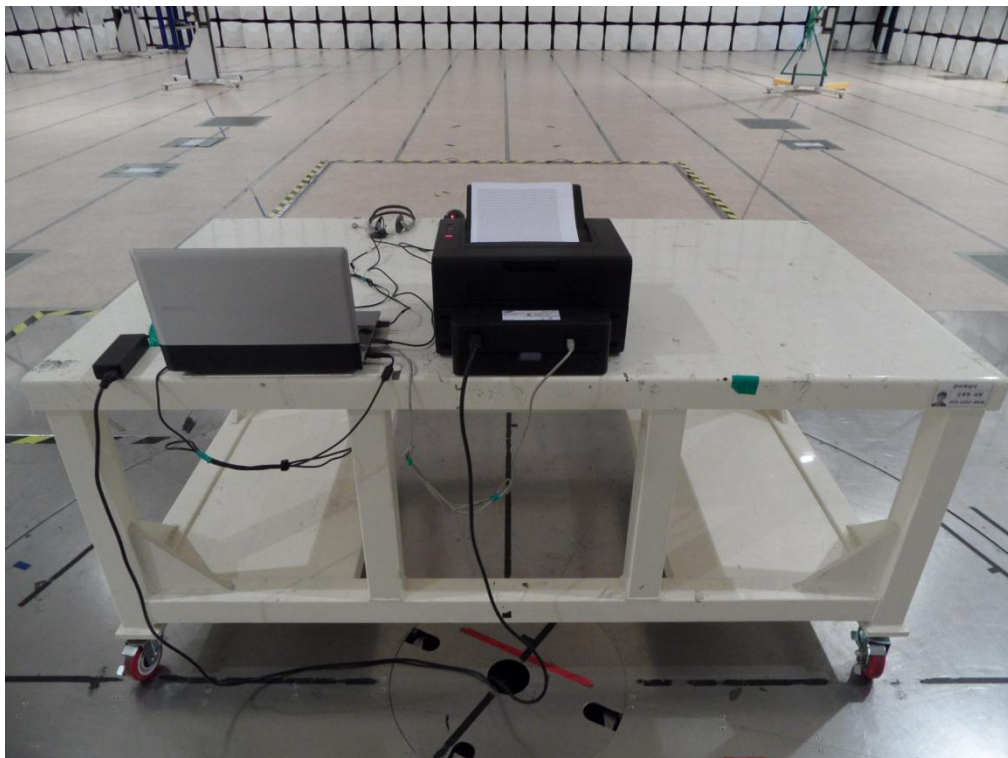
4.2.2 Temperature and humidity condition

Test date	April 21, 2011	Test engineer	Sung Jin Sim
Test place	Semi-Anechoic Chamber		

4.2.3 Photograph of Test Setup



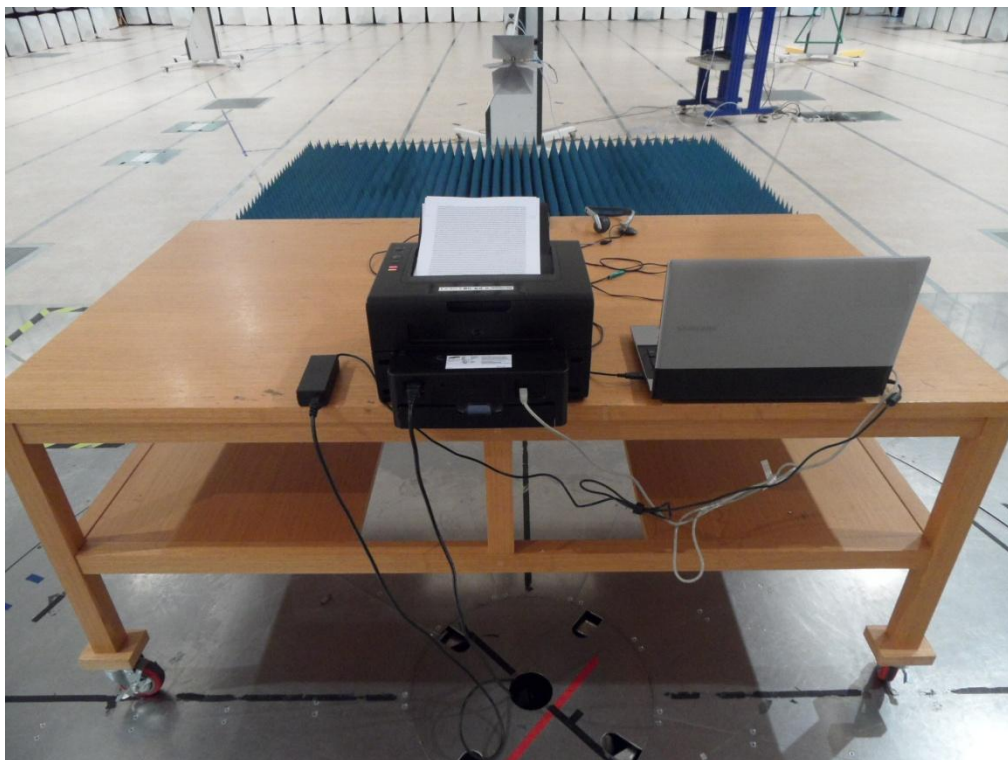
Front (below 1 GHz)



Rear (below 1 GHz)



Front (above 1 GHz)



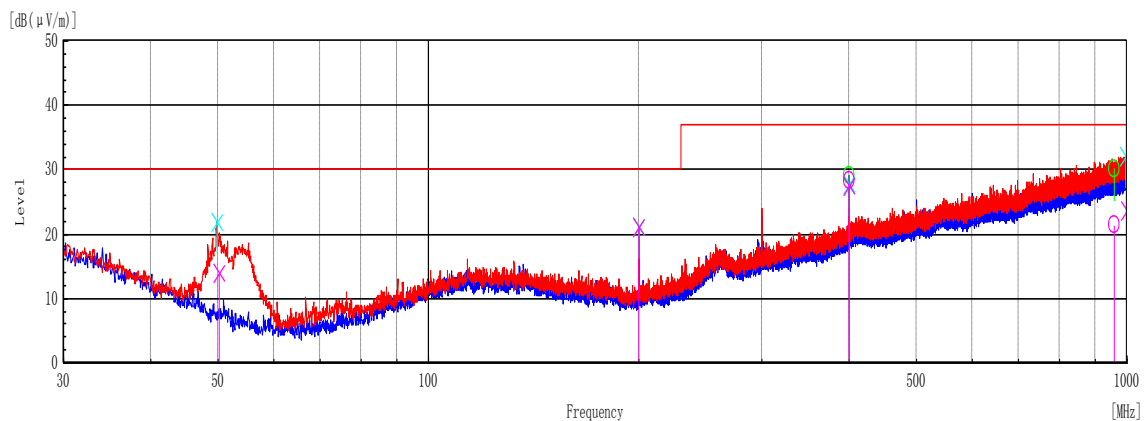
Rear (above 1 GHz)

4.2.4 Test results

4.2.4.1 30 MHz to 1GHz test results

- Operating Mode 1 : Standby

Test Graph and Results



Frequency [MHz]	Pol.	Reading QP [dBμV/m]	Factor [dB(1/m)]	Level QP [dBμV /m]	Limit [dBμV /m]	Margin QP [dB]	Height [cm]	Angle [deg]
50.066	V	33.6	-19.5	14.1	30	15.9	338	283.4
200.025	V	37.7	-16.6	21.1	30	8.9	101	135.5
400.005	H	36.6	-8.2	28.4	37	8.6	295	269.4
400.019	V	34.8	-7.2	27.6	37	9.4	370	214.3
958.628	H	21.1	0.4	21.5	37	15.5	113	329.2
998.267	V	20.4	3.4	23.8	37	13.2	200	304.9

Note) Receiving antenna polarization : Horizontal and/or Vertical

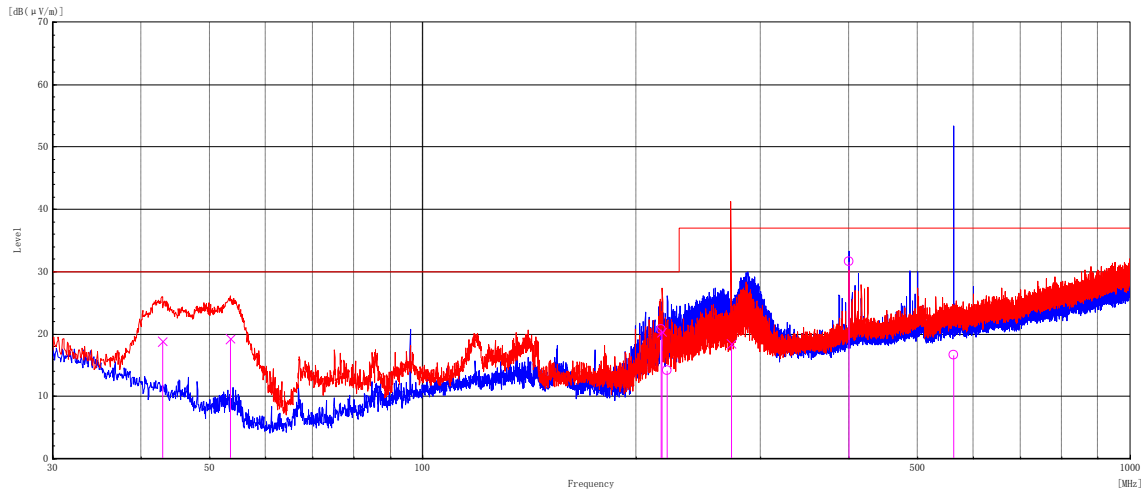
Test Distance : 10 m, Antenna Height : 1 m to 4 m

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

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

- Operating Mode 2 : USB Printing

Test Graph and Results



Frequency [MHz]	Pol.	Reading QP [dBμV/m]	Factor [dB(1/m)]	Level QP [dBμV /m]	Limit [dBμV /m]	Margin QP [dB]	Height [cm]	Angle [deg]
42.833	V	35.2	-16.4	18.8	30	11.2	105	251.1
53.520	V	39.9	-20.6	19.3	30	10.7	295	220.5
217.173	H	37.5	-16.8	20.7	30	9.3	400	83.8
217.821	V	36.0	-15.7	20.3	30	9.7	100	152.0
221.684	H	30.5	-16.4	14.1	30	15.9	302	109.5
272.802	V	30.3	-11.9	18.4	37	18.6	197	221.3
400.012	H	39.8	-8.2	31.6	37	5.4	203	216.3
562.840	H	21.6	-5.0	16.6	37	20.4	361	141.1

Note) Receiving antenna polarization : Horizontal and/or Vertical

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

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

- Operating Mode 1 : Standby

The EUT was measured up to 2 GHz because the internal maximum frequency is 300 MHz, below 500MHz

Test Results

Peak Measurement

Frequency [MHz]	(P)	Reading PK [dBuV/m]	Factor [dB(1/m)]	Level PK [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]
1014.058	H	59.8	-16.5	43.3	74	30.7	100	359.7
1016.997	V	58.7	-16.5	42.2	74	31.8	100	71.7
1495.195	V	58.1	-16.3	41.8	74	32.2	100	357.6
1496.981	H	55.6	-16.3	39.3	74	34.7	100	260.5
1697.183	V	50.7	-14.6	36.1	74	37.9	100	175.0
1993.327	V	57.6	-13.7	43.9	74	30.1	100	307.4

Average Measurement

Frequency [MHz]	(P)	Reading AV [dBuV/m]	Factor [dB(1/m)]	Level AV [dBuV/m]	Limit [dBuV/m]	Margin AV [dB]	Height [cm]	Angle [deg]
1014.058	H	40.2	-16.5	23.7	54	30.3	100	359.7
1016.997	V	41.0	-13.7	27.3	54	26.7	100	307.4
1495.195	V	42.9	-16.3	26.6	54	27.4	100	357.6
1496.981	H	39.4	-16.5	22.9	54	31.1	100	71.7
1697.183	V	40.8	-16.3	24.5	54	29.5	100	260.5
1993.327	V	36.9	-14.6	22.3	54	31.7	100	175.0

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 PK(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)

- Operating Mode 2 : USB Printing

Test Results

Peak Measurement

Frequency [MHz]	(P)	Reading PK [dBuV/m]	Factor [dB(1/m)]	Level PK [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]
1010.272	H	59.6	-16.4	43.2	74	30.8	100	356.8
1496.003	V	57.9	-16.3	41.6	74	32.4	100	354.1
1498.398	H	58.1	-16.3	41.8	74	32.2	100	284.9
1668.099	V	67.7	-14.9	52.8	74	21.2	100	177.2
1697.116	V	61.3	-14.6	46.7	74	27.3	100	348.4
1995.682	V	57.8	-13.7	44.1	74	29.9	100	297.4

Average Measurement

Frequency [MHz]	(P)	Reading AV [dBuV/m]	Factor [dB(1/m)]	Level AV [dBuV/m]	Limit [dBuV/m]	Margin AV [dB]	Height [cm]	Angle [deg]
1010.272	H	39.7	-16.4	23.3	54	30.7	100	356.8
1496.003	V	42.7	-16.3	26.4	54	27.6	100	354.1
1498.398	H	44.6	-16.3	28.3	54	25.7	100	284.9
1668.099	V	39.9	-14.9	25.0	54	29.0	100	177.2
1697.116	V	41.5	-14.6	26.9	54	27.1	100	348.4
1995.682	V	39.5	-13.7	25.8	54	28.2	100	297.4

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 PK(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



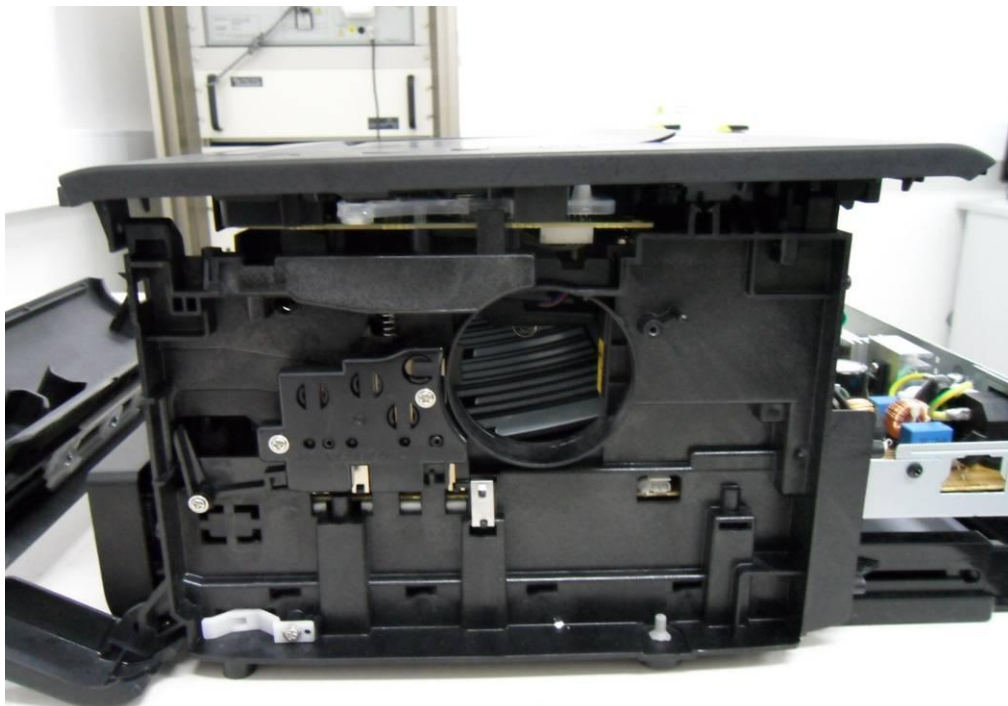
Front View



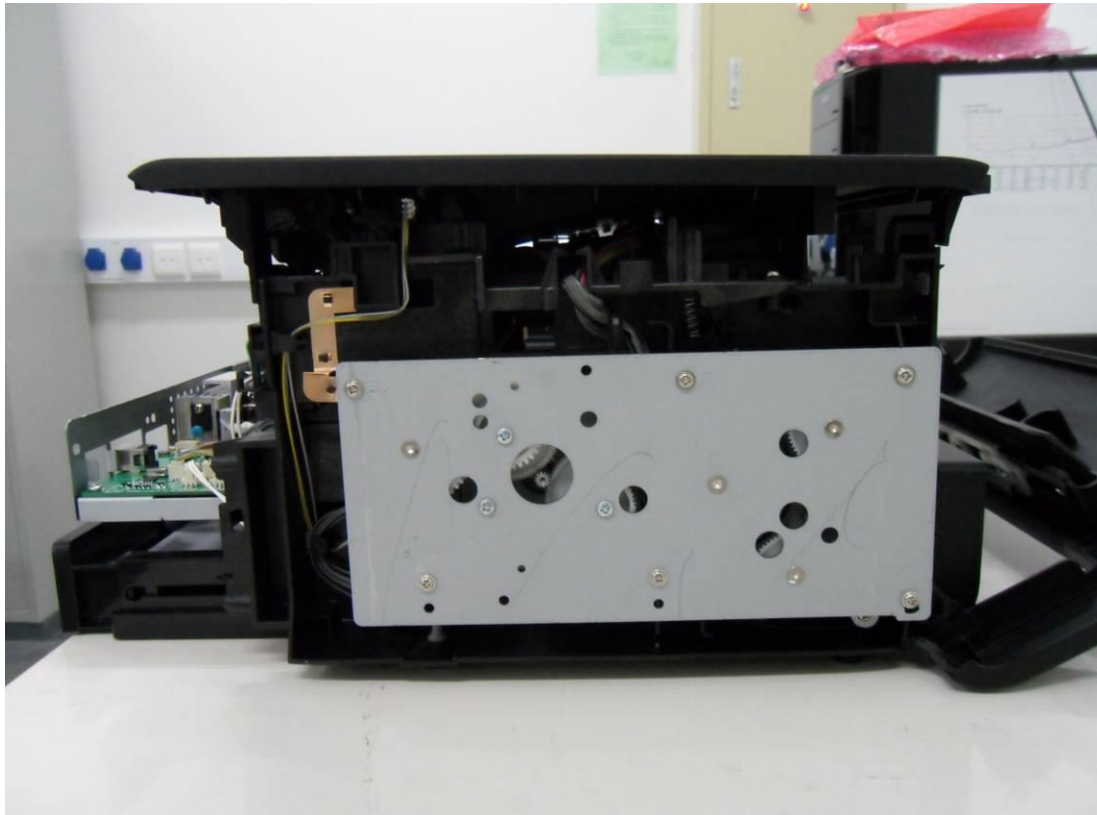
Rear View & Label location



Internal View(front)



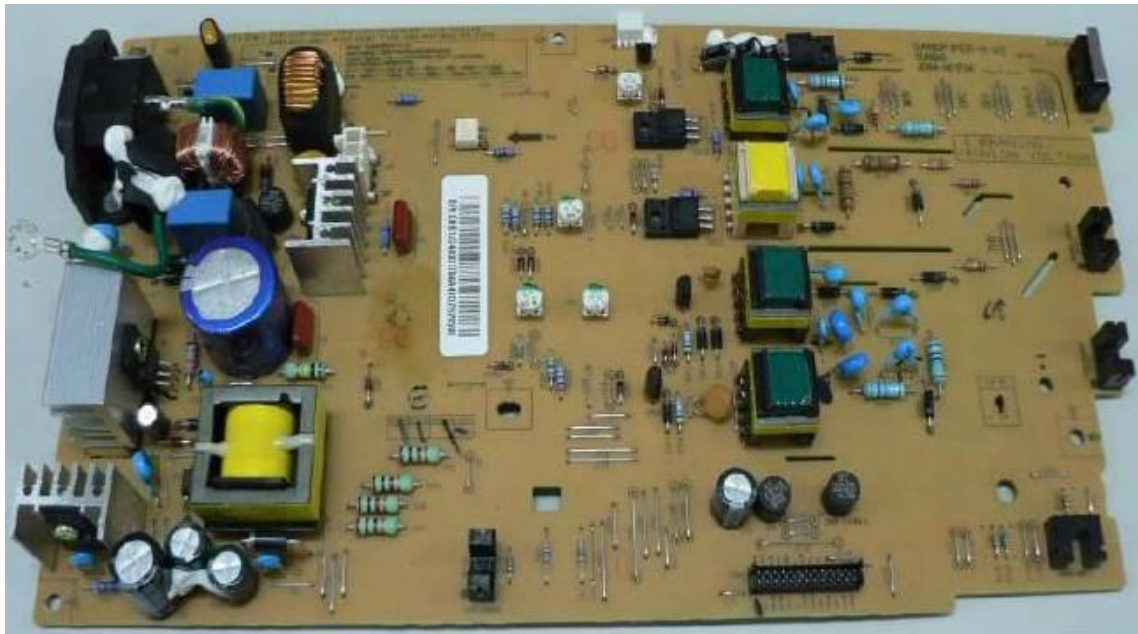
Internal View(left)



Internal View(right)



Internal View(rear)



SMPS

 Samsung Electronics Co., Ltd. Suwon, Korea, 443-742 Place: M098	Model: ML-2545 Volts: AC 110-127V Hertz: 50/60Hz Amps: 5A Manufactured:	FCC ID: A3LML2545 This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: i) This device may not cause harmful interference, and ii) This device must accept any interference received, including interference that may cause undesired operation. This Class B digital apparatus complies with Canadian ICES-003 Cet appareil numérique de la classe B est Conforme à la norme NMB-003 du Canada. This product complies with 21 CFR Chapter 1, subchapter J.
	 3UU7 E337632 I.T.E.	
Serial No.	Made in China Fabriqu� en Chine REV.00	

Label Rating