



FCC CFR47 PART 15 DIGITAL DEVICE

TEST REPORT

FOR

LASER PRINTER

MODEL: ML4500

FCC ID: A3LML4500

REPORT NUMBER: 00U0297-1

ISSUE DATE: JUNE 15, 2000

Prepared for

**SAMSUNG ELECTRONICS CO., LTD
416 MAETAN DONG, PALDAL GU
SUWON SHI
KOREA**

Prepared by

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LAB CODE:200065-0

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1. VERIFICATION OF COMPLIANCE

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD
416 MAETAN DONG, PALDAL GU
SUWON SHI
KOREA



CONTACT PERSON: WALLACE OH / MANAGER



TELEPHONE NO: 408-828-8833

MODEL NO/NAME: ML4500

SERIAL NO: N/A

DATE TESTED: JUNE 15, 2000

TYPE OF EQUIPMENT:	INFORMATION TECHNOLOGY EQUIPMENT (ITE)
MEASUREMENT DISTANCE:	(X) 3 METER () 10 METER
TECHNICAL LIMIT:	CLASS B
FCC RULES:	PART 15
MEASUREMENT PROCEDURE	ANSI C63.4/ 1992
EQUIPMENT AUTHORIZATION PROCEDURE	CERTIFICATION
MODIFICATIONS MADE ON EUT	☐ YES ☒ NO
DEVIATIONS FROM MEASUREMENT PROCEDURE	☐ YES (refer to section 20 for comments) ☒ NO
RADIATED EMISSION TEST RESULT	-4.72dB@70MHz/VERTICAL
CONDUCTED EMISSION TEST RESULT	-3.18dB@4.48MHz/L2

The above equipment was tested by Compliance Certification Services for compliance with the requirements set forth in the FCC CFR 47, PART 15. The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties. **Warning** : This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification will constitute fraud and shall nullify the document.

Approved By

Acknowledged By

T. N. COKENIAS/ ENG. DIRECTOR
COMPLIANCE CERTIFICATION SERVICES

WALLACE OH/ MANAGER
SAMSUNG ELECTRONICS CO.-3

2. PRODUCT DESCRIPTION

CHASSIS TYPE	PLASTIC
LIST OF EACH OSC. OR XTAL. FREQ. (FREQ.>=1 MHz)	20.0, 28.748 & 35.0 MHz
CHIPSET BRAND AND PART NO.	SAMSUNG /KS32C65100 - 01
POWER SUPPLY/NAME/MODEL/S.N.	DONGYANG INSTRUMENT/ APOLLO -V1
REV.	1.1
NUMBER OF PCB LAYERS	4
LINE FILTER NAME AND MODEL	BUILT-IN
POWER REQUIREMENTS	115VAC/60Hz
NO. OF EXTERNAL I/O CONNECTORS	1

3. TESTED SYSTEM DETAILS

The Model names for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Device Type	Manufacturer	Model Number	Serial No.	FCC ID / DoC
MONITOR	IBM	G54	00764	DOC
PC TOWER	SAMSUNG	M4310	382092DK500187	DOC
KEYBOARD	COMPAQ	RT6656TW	62051025	AQ6-MTN4XZ15
MODEM	TEAM TECHNOLOGY	103/212A	A038329	EF56A5103/212A
MOUSE	COMPAQ	MUS9J	B01920H67E40LUI	EMJMUSSJ
PRINTER(EU T)	SAMSUNG	ML-4500	N/A	A3LML4500

4. TEST FACILITY

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are

constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5. ACCREDITATION AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code:200065-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT(1300F2))

6. MEASUREMENT INSTRUMENTATION

Radiated emissions were measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, ridged waveguide, liner horn. EMI receivers were used for line conducted readings, spectrum analyzers with pre-selectors and quasi-peak detectors were used to perform radiated measurements. Receiving equipment (i.e., receiver, analyzer, quasi-peak adapter, pre-selector) and LISNs conform to CISPR specification for "Radio Interference Measuring Apparatus and Measurement Methods," Publication 16.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

7. MEASURING INSTRUMENT CALIBRATION

The measuring equipment which was utilized in performing the tests documented herein has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment which is traceable to recognized national standards.

8. UNITS OF MEASUREMENT

Measurements of radiated interference are reported in terms of dB(uV/m) at a specified distance. The indicated readings on the spectrum analyzer were converted to dB(uV/m) by use of appropriate conversion factors. Measurements of conducted interference are reported in terms of dB(uV).

The field strength is calculated by adding the Antenna Factor and Cable Factors, then by subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain

Assume a receiver reading of 52.5 dBuV is obtained. The Antenna Factor of 7.4dB/m and a Cable Factor of 1.1dB is added. The Amplifier Gain of 29 dB is subtracted, giving a field strength of 32 dBuV/m. The 32 dBuV/m value was mathematically converted to its corresponding level in uV/m.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dBuV/m}$$

$$\text{Level in uV/m} = \text{Common Antilogarithm} [(32 \text{ dBuV/m})/20] = 39.8 \text{ uV/m}$$

9. ANTENNAS

The calibrated antennas used to sample the radiated field strength are mounted on a non-conductive, motorized antenna mast 3 meters from the leading edge of the turntable.

10. CLASSIFICATION OF DIGITAL DEVICE

Class A includes digital devices that are marketed for use in commercial, industrial or business environments, excluding devices which are marketed for use by the general public or are intended to be used in the home.

Class B includes digital devices that are marketed for use in residential environments, notwithstanding use in commercial, business and industrial environments.

Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as Class B device, and in fact is encouraged to do so provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

11. RADIATED EMISSION LIMITS

FCC PART 15 CLASS A

MEASURING DISTANCE OF 10 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	90	39.1
88-216	150	43.5
216-960	210	46.4
Above 960	300	49.5

FCC PART 15 CLASS B

MEASURING DISTANCE OF 3 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

**FCC RADIATED EMISSION ALTERNATIVE METHOD
(CISPR 22/EN55022)**

Limits for radiated disturbance of Class A ITE at
measuring distance of 10 m

Frequency range MHz	Quasi-peak limits dB(uV/m)
30 to 230	40
230 to 1000	47
NOTES 1. The lower limit shall apply at the transition frequency. 2. Additional provisions may be required for cases where interference occurs.	

Limits for radiated disturbance of Class B ITE at
measuring distance of 10 m

Frequency range MHz	Quasi-peak limits dB(uV/m)
30 to 230	30
230 to 1000	37
NOTES 1. The lower limit shall apply at the transition frequency. 2. Additional provisions may be required for cases where interference occurs.	

12. CONDUCTED EMISSION LIMITS

FCC CLASS A

FREQUENCY RANGE	FIELD STRENGTH (Microvolts)	FIELD STRENGTH (dBuV)/QP
450kHz-1.705MHz	1000	60
1.705MHz - 30MHz	3000	69.54

FCC CLASS B

FREQUENCY RANGE	FIELD STRENGTH (Microvolts)	FIELD STRENGTH (dBuV)/QP
450kHz-30MHz	250	48

**FCC CONDUCTED EMISSION ALTERNATIVE METHOD
(CISPR 22/EN55022)**

Limits for conducted disturbance at the mains ports of
Class A ITE

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	79	66
0.5 to 30	73	60
Note- The lower limit shall apply at the transition frequency.		

Limits of Conducted disturbance at the mains ports
of Class B ITE

Frequency range MHz	Limits dB(uV)	
	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.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

13. CONDUCTED EMISSION TEST PROCEDURE

The EUT is located so that the distance between the boundary of the EUT and the closest surface to the LISN is 0.8m.

EUT test configuration is according to Section 7 of ANSI C63.4/1992.

Conducted disturbance shall be measured between the phase lead and the ground, and between the neutral lead and the ground. The frequency 0.450 - 30 MHz (or 0.150 - 30 MHz in case of CISPR 22/EN55022 method) shall be investigated.

Set the EMI receiver to PEAK detector setting and sweep continuously over the frequency range to be investigated. Set resolution bandwidth to 9kHz minimum. Connect EMI receiver input cable to LINE 1 RF measurement connection on the LISN. Connect a 50ohm terminator to the unused RF connection on the LISN. For each mode of EUT operation, maximize emissions readings by manipulating cable and wire positions. Record the configuration for each EUT power cord which produces emissions closest to the limit. Repeat the same procedure for LINE 2 of each EUT power cord.

14. RADIATED EMISSION TEST PROCEDURE

The EUT and all other support equipment are placed on a wooden table 80 cm above the ground screen. Antenna to EUT distance is either 3 meters or 10 meters (Class B or Class A). During the test, the table is rotated 360 degrees to maximize emissions and the antenna is positioned from 1 to 4 meters above the ground screen to further maximize emissions. The antenna is polarized in both vertical and horizontal positions.

EUT test configuration is according to Section 8 of ANSI C63.4/1992.

Monitor the frequency range of interest at a fixed antenna height and EUT azimuth. Frequency span should be small enough to easily differentiate between broadcast stations and intermittent ambients. Rotate EUT 360 degrees to maximize emissions received from EUT. If emission increases by more than 1 dB, or if another emission appears that is greater by 1 dB, return to azimuth where maximum occurred and perform additional cable manipulation to further maximize received emission.

Move antenna up and down to further maximize suspected highest amplitude signal. If emission increased by 1 dB or more, or if another emission appears that is greater by 1dB or more, return to antenna height where maximum signal was observed and manipulate cables to produce highest emissions, noting frequency and amplitude.

15. AMBIENT CONDITIONS

The ambient conditions at the time of final tests were as follows:

	Radiated Emission	Conducted Emission
Temperature	37 °C	27 °C
Humidity	54%	62%

16. SYSTEM TEST CONFIGURATION

The equipment under test was configured and operated in a manner which tended to maximize its emission characteristics in a typical application. Power and signal distribution, ground, interconnecting cabling and physical placement of equipment simulated the typical application and usage insofar as practicable.

SOFTWARE USED DURING THE TESTS	
File Name	GDI EMI TEST PROGRAM
Program Sequence	ACTIVATE EUT BY PRINTING H PATTERN CONTINUOUSLY.

17. EQUIPMENT MODIFICATIONS

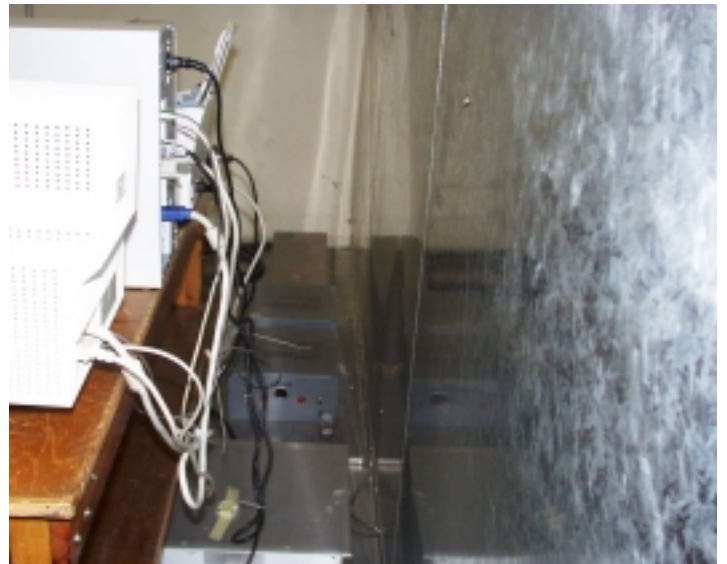
To achieve compliance to CLASS B levels, the following change(s) were made during compliance testing:

N/A

18. EUT SETUP PHOTOS



Radiated Emission Setup Photos (Worst Emission Position)



Conducted Emission Setup Photos (Worst Emission Position)

19. TEST EQUIPMENT LIST

Equipment	Manufacturer	Model No.	Serial No.	Site	Cal Date	Due Date
RF Preselector (20Hz-2GHz)	H.P.	85685A	2817A00756	A	11/1999	11/2000
Antenna	Chase	CBL6112	2049	A/F	03/2000	03/2001
Antenna	EMCO	3110	8908-1079	A/F	03/2000	03/2001
Antenna	EMCO	3146	NSN=X100	A/F	03/2000	03/2001
Pre-Amp	H.P.(P1)	8447D	2944A06833	A	10/1999	10/2000
Pre-Amp	H.P.(P2)	8447D	2944A06265	F	09/1999	09/2000
Spectrum Analyzer	H.P.	8566B	3014A06685	F	07/1999	07/2000
Spectrum Display	H.P.	85662A	3026A19146	F	07/1999	07/2000
Quasi-peak Detector	H.P.	85650A	3145A01654	F	07/1999	07/2000
Spectrum Analyzer	H.P.	8568A	2314A02604	B	02/2000	02/2001
Spectrum Display	H.P.	85662A	2314A04793	B	02/2000	02/2001
Quasi-peak Detector	H.P.	85650A	2521A01038	B	02/2000	02/2001
Pre-Amp	H.P.(P8)	8447D	2944A06589	B	08/1999	08/2000
Antenna	Eaton	94455-1	1197	B	08/1999	08/2000
Antenna	Emco	3146	2120	B	08/1999	08/2000
Spectrum Analyzer	H.P.	8568B	2732A03661	C	11/1999	11/2000
Spectrum Display	H.P.	85662A	2811A015728	C	11/1999	11/2000
Quasi-peak Detector	H.P.	85650A	2811A01335	C	11/1999	11/2000
Pre-Amp	H.P.(P5)	8447D	2944A06550	C	08/1999	08/2000
Antenna	Eaton	94455-1	1214	C	08/1999	08/2000
Antenna	EMCO	3146	9107-3163	C	08/1999	08/2000
LISN	Fischer	LISN2 CISPR adapter	00710 00711	Cond	03/2000	03/2001
EMI Receiver	Rohde Schwarz	ESHS20	827129/006	Cond	03/2000	03/2001
LISN	Fischer	FCCLISN 50/250-25-2	114	Cond	08/1999	08/2000

20. TEST RESULT SUMMARY

Preliminary Radiated Emission Tests were performed at the 3 meter open area test site. CCS test procedure no: CCSUE2001B and the procedure listed in ANSI C63.4 /1992 section 8.3.1.1 were used. The following preliminary tests were conducted to determine the worst mode of operation and configuration.

Preliminary Radiated Emission Test			
Frequency Range Investigated		30 MHz TO 1000 MHz	
Mode of operation	Date	Data Report No.	Worst Mode
PRINTING H's	06/15/00	000615A1	☒

Final Radiated Emission Test was conducted by operating the worst mode as indicated above.

OATS No: A-SITE		Data Report No. 000615A1		Date 06/15/00		Tested By: KERWIN CORPUZ	
Six Highest Radiated Emission Readings							
Frequency Range Investigated				30 MHz TO 1000 MHz			
Freq (MHz)	Meter Reading (dBuV)	C.F. (dB/m)	Corrected Reading (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Reading Type (P/Q/A)	Polar (H/V)
70	55.4	-20.12	35.28	40	-4.72	P	V
490	47.7	-7.59	40.11	46	-5.89	P	V
35	43.6	-10.39	33.21	40	-6.79	P	V
630	44.6	-5.78	38.82	46	-7.18	P	V
100	50.6	-14.72	35.88	43.5	-7.62	P	V
595	43.6	-6.02	37.58	46	-8.42	P	V

C.F.(Correction Factor) = Antenna Factor + Cable Loss - Amplifier Gain

Corrected Reading = Metering Reading + C.F.

Margin = Corrected Reading - Limits

P = Peak Reading

H = Horizontal Polarization/Antenna

Q = Quasi-peak

V = Vertical Polarization/Antenna

A = Average Reading

Comments:

N/A

Preliminary Conducted Emission Tests were performed according to CCS test procedure no: CCSUE2002B and ANSI C63.4/1992 section 7.2.3. The following preliminary tests were conducted to determine the worst mode of operation.

Preliminary Conducted Emission Test			
Frequency Range Investigated		450 kHz TO 30 MHz	
Mode of operation	Date	Data Report/Plot No.	Worst Mode
PRINTING H's	06/15/00	00U0297-1	☒

Final Conducted Emission Test was conducted by operating the worst mode as indicated above.

Conducted Room		Plot No. 00U0297-1		Date 06/15/00		Tested By: KERWIN CORPUZ	
Six Highest Conducted Emission Readings							
Frequency Range Investigated				4 50 kHz TO 30 MHz			
Freq (MHz)	Meter Reading (dBuV)	C.F. (dB)	Corrected Reading (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Reading Type (P/Q/A)	Line (L1/L2)
0.81	41.28	0	41.28	48	-6.72	P	L1
4.48	44.82	0	44.82	48	-3.18	P	L1
4.69	44	0	44	48	-4	P	L1
4.48	44.48	0	44.48	48	-3.52	P	L2
9.03	38.60	0	38.60	48	-9.40	P	L2
12.01	41.08	0	41.08	48	-6.92	P	L2

C.F.(Correction Factor) = Insertion Loss + Cable Loss

Corrected Reading = Metering Reading + C.F.

Margin = Corrected Reading - Limits

P = Peak Reading

L1 = Hot

Q = Quasi-peak

L2 = Neutral

A = Average Reading

Comments:

N/A

APPENDICES

EXTERNAL I/O CABLE CONSTRUCTION DESCRIPTION

CONFIGURATION BLOCK DIAGRAM

CONDUCTED EMISSION PLOT

RADIATED EMISSION DATA

EUT PHOTOGRAPHS

External I/O Cable Construction Description

CABLE NO: 1	
I/O Port: VGA	Number of I/O ports of this type: 1
Number of Conductors: 14	Connector Type: D-SUB 15
Capture Type: SCREW-IN	Type of Cable used: SHIELDED
Cable Connector Type: MOLDING HOOD	Cable Length: 1.5M
Bundled During Test: YES	Data Traffic Generated: YES
Remark: 1 TORROID ON EACH END	

CABLE NO: 2	
I/O Port: Keyboard	Number of I/O ports of this type: 1
Number of Conductors: 6	Connector Type: PS/2
Capture Type: SNAP-IN	Type of Cable used: SHIELDED
Cable Connector Type: MOLDING HOOD	Cable Length: 1.8M
Bundled During Test: NO	Data Traffic Generated: YES
Remark: N/A	

CABLE NO: 3	
I/O Port: MOUSE	Number of I/O ports of this type: 1
Number of Conductors: 6	Connector Type: PS/2
Capture Type: SNAP-IN	Type of Cable used: DRAIN WIRE
Cable Connector Type: MOLDING HOOD	Cable Length: 1.9M
Bundled During Test: NO	Data Traffic Generated: YES
Remark: N/A	

CABLE NO: 4	
I/O Port: RS232	Number of I/O ports of this type: 1
Number of Conductors: 9	Connector Type: DB9
Capture Type: SCREW-IN	Type of Cable used: SHIELDED
Cable Connector Type: METAL	Cable Length: 1M
Bundled During Test: NO	Data Traffic Generated: YES
Remark: N/A	

CABLE NO: 5	
I/O Port: PARALLEL	Number of I/O ports of this type: 1
Number of Conductors: 25	Connector Type: DB25
Capture Type: SCREW-IN	Type of Cable used: SHIELDED
Cable Connector Type: METAL	Cable Length: 2M
Bundled During Test: YES	Data Traffic Generated: YES
Remark: N/A	

CABLE NO: 6 & 7	
I/O Port: AC POWER	Number of I/O ports of this type: 1
Number of Conductors: 3	Connector Type: USA
Capture Type: PUSH-IN	Type of Cable used: UNSHIELDED
Cable Connector Type: MOLDING	Cable Length: 1.8M
Bundled During Test: NO	Data Traffic Generated: NO
Remark: N/A	

CABLE NO: 8	
I/O Port: AC POWER	Number of I/O ports of this type: 1
Number of Conductors: 3	Connector Type: USA
Capture Type: PUSH-IN	Type of Cable used: UNSHIELDED
Cable Connector Type: MOLDING	Cable Length: 1.8M
Bundled During Test: NO-RAD, YES-LC	Data Traffic Generated: NO
Remark: N/A	

CABLE NO: 9	
I/O Port: AC POWER ADAPTOR	Number of I/O ports of this type: 1
Number of Conductors: 2	Connector Type: USA
Capture Type: PUSH-IN	Type of Cable used: UNSHIELDED
Cable Connector Type: MOLDING	Cable Length: 2.0M
Bundled During Test: NO	Data Traffic Generated: NO
Remark: N/A	

Configuration Block Diagram

