

FCC EVALUATION REPORT FOR CERTIFICATION

Applicant : LG Electronics Inc.

19-1, Cheongho-ri, Jinwi-myeon,

Pyeongteak-si, Gyeonggi-do, Korea.

Attn: Mr. Do-Hyung Kim, Chief research engineer

Date of Issue : February 9, 2011

Order Number: GETEC-C1-11-016

Test Report Number: GETEC-E3-11-006

Test Site: Gumi College EMC Center

FCC Registration Number: (100749, 443957)

FCC ID. : BEJ22LV2500UA

Applicant : LG Electronics Inc.

Rule Part(s)	: FCC Part 15 Subpart B
Equipment Class	: Class B computing device peripheral (JBP)
EUT Type	: LED LCD TV/Monitor
Type of Authority	: Certification
Model Name	: 22LV2500-UA
Trade Name	: LG

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2003 / Canadian standard ICES-003

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the vest 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,

Reviewed by,


Soon-Hoon Jeong, Engineer
GUMI College EMC center


Jae-Hoon Jeong, Senior Engineer
GUMI College EMC center



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Scope: Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and / or unintentional radiators for compliance with technical rules and regulations of the Federal Communications Commission.

1. General Information

Applicant: LG Electronics Inc.

Applicant Address: 19-1, Cheongho-ri, Jinwi-myeon, Pyeongteak-si, Gyeonggi-do, Korea.

Manufacturer: LG Electronics Inc.

Manufacturer Address: 19-1, Cheongho-ri, Jinwi-myeon, Pyeongteak-si, Gyeonggi-do, Korea.

Contact Person: Mr. Do-Hyung Kim, Chief research engineer

Tel Number: +82-31-610-9623

- **FCC ID.** BEJ22LV2500UA
- **EUT Type** LED LCD TV/Monitor
- **Model Name** 22LV2500-UA
- **Trade Name** LG
- **Serial Number** Prototype
- **Rule Part(s)** FCC Part 15 Subpart B
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.4 (2003) / Canadian standard ICES-003
- **Dates of Test** January 28 ~ 31, 2011
- **Place of Test** **Gumi College EMC Center** (FCC Registration Number: 100749, 443957)
407, Bugok-dong, Gumi-si, Gyeongbuk, Korea.
- **Test Report Number** GETEC-E3-11-006
- **Dates of Issue** February 9, 2011



2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Nose Emissions From Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ASNI C63.4-2003) was used in determining radiated and conducted emissions emanating from **LG Electronics Inc. LED LCD TV/Monitor (Model Name: 22LV2500-UA)**

These measurement tests were conducted at **Gumi College EMC Center**.

The site address is 407, Bugok-dong, Gumi-si, Gyeongbuk, Korea.

This test site is one of the highest point of Gumi 1 college at about 200 km away from Seoul city and 40 km away from Daegu city. 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 (2003)



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Fig 1. The map above shows the Gumi College in vicinity area.



3. Product Information

3.1 Description of EUT

The Equipment under Test (EUT) is the **LG Electronics Inc. LED LCD TV/Monitor (Model Name: 22LV2500-UA) FCC ID.: BEJ22LV2500UA**

MODELS		19LV2500 (19LV2500-UA)	22LV2500 (22LV2500-UA)
Dimensions (W x H x D)	With stand	455.2 mm x 355.0 mm x 145.0 mm (17.9 inch x 13.9 inch x 5.7 inch)	471.2 mm x 365.9 mm x 155.4 mm (18.5 inch x 14.4 inch x 6.1 inch)
	Without stand	455.2 mm x 313.1 mm x 40.9 mm (17.9 inch x 12.3 inch x 1.6 inch)	471.2 mm x 315.5 mm x 34.4 mm (18.5 inch x 12.4 inch x 1.3 inch)
Weight	With stand	2.7 kg (5.9 lbs)	3.4 kg (7.4 lbs)
	Without stand	2.5 kg (5.5 lbs)	3.2 kg (7.0 lbs)
Power requirement		AC100 - 240 V - 50/60 Hz	
Television System		NTSC-M, ATSC, 64 & 256 QAM	
Program Coverage		VHF 2-13, UHF 14-69, CATV 1-135, DTV 2-69, CADTV 1-135	
External Antenna Impedance		75 Ω	
Environment condition	Operating Temperature	0 - 40 °C	
	Operating Humidity	Less than 80 %	
	Storage Temperature	-20 - 60 °C	
	Storage Humidity	Less than 85 %	

-. Maximum Frequency Range : 667 MHz



3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID.
PC	Hewlett Packard	D530	S/N: CNG34800PY FCC ID.: DoC
Video card	ATI	ATI RV360(9600)	S/N: SN0402017176 FCC ID.: DoC
PS2 Key board	COMPAQ	166516-AD6	S/N: B13BBOR391006D FCC ID.: AQ6-23K15
PS2 mouse	LOGITECH	M-S69	S/N: 334684-108 FCC ID.: JNZ211443
Joy stick	MICROSOFT	X05-92626	S/N: 9262600296169 FCC ID.: DoC
DVD player	LG Electronics Inc.	LC-954	S/N: 3850R-Z674K FCC ID.: DoC
Headset	PHILIPS	SBC HL140	S/N: N/A FCC ID.: N/A
USB memory stick	LG Electronics Inc.	UM5 2GB	S/N: 003RLRZN37758 FCC ID.: N/A
TV signal generator	FLUKE	54200M01	S/N: 831011 FCC ID.: DoC

See “Appendix D – Test Setup Photographs” for actual system test set-up

3.2.2 System configuration

Description	Manufacturer	Model Name	S/N & FCC ID.
AC/DC adapter ¹⁾	LITE-ON TECHNOLOGY CORPORATION	PA-1061-61	S/N: OAD4E622898010470 FCC ID.: N/A

1) Input ratings: AC (100 – 240) V~, (50 – 60) Hz, 1.5 A / Output ratings: DC 24 V, 2.5 A



3.2.3 Used Cable(s)

Cable Name	Condition	Description
Power cable	Connected to the adapter	1.80 m unshielded
DC in cable	Connected to the EUT and adapter	1.50 m shielded with a ferrite core
RGB(Analog) in cable	Connected to the EUT and PC	1.80 m shielded with two ferrite cores
HDMI/DVI(Digital) in cable	Connected to the EUT and PC	2.00 m shielded
Audio(RGB/DVI) in cable	Connected to the EUT and PC	1.80 m shielded
RS-232C(control & service) in cable	Connected to the EUT and PC	1.80 m shielded
AV in cable	Connected to the EUT and DVD player	3.00 m shielded
Component cable	Connected to the EUT and DVD player	3.00 m shielded
Headset cable	Connected to the EUT and headset	1.20 m shielded
Antenna cable	Connected to the EUT and TV signal generator	10.00 m shielded

3.3 Modification Item(s)

- None



4. Description of tests

4.1 Test Condition

The EUT was installed, arranged and operated in a manner that is most representative of equipment as typically used. The measurements were carried out while varying operating modes and cable positions within typically arrangement to determine maximum emission level.

The representative and worst test mode(s) were noted in the test report.

- Test Voltage / Frequency : AC 120 V / 60 Hz
- Test Mode(s)

-. Monitor mode

Radiated emission: 1 920 × 1 080 / 60 Hz (RGB: Analog, HDMI/DVI: Digital)

Conducted emission: 1 920 × 1 080 / 60 Hz (RGB: Analog, HDMI/DVI: Digital)

1 024 × 768 / 60 Hz (RGB: Analog), 640 × 480 / 60 Hz (RGB: Analog)

◆ Operating test pattern

- . “H” character scrolling mode (Font size: 10)
- . Black background white character
- . Brightness and contrast was adjusted as maximum level
- . Continuous playback mode of 1 kHz audio file with winamp player
- . USB memory stick was connected to the USB port

“The verification report for TV/AV mode would be issued by LG Electronics Inc.”



4.2 Conducted Emission

The Line conducted emission test facility is inside a 4 m × 8 m × 2.5 m shielded enclosure. (FCC Registration No.: 100749)

The EUT was placed on a non-conducting 1.0 m by 1.5 m table, which is 0.8 m in height and 0.4 m away from the vertical wall of the shielded enclosure.

The EUT is powered from the Rohde & Schwarz LISN (ESH2-Z5) and the support equipment is powered from the Rohde & Schwarz LISN (ESH3-Z5). Powers to the LISN are filtered by high-current high insertion loss power line filter.

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 EMI test receiver (Rohde & Schwarz, ESCS30).

The EMI test receiver was scanned from 150 kHz to 30 MHz with 20 ms sweep time to determine the frequency producing the maximum EME from the EUT. The frequency producing the maximum level was re-examined using Quasi-Peak mode of the EMI test receiver.

The bandwidth of Quasi-peak mode was set to 9 kHz. Each emission was maximized consistent with typical applications by varying the configuration of the test sample. Interface cables were connected to the available interface ports of the test unit. The effect of varying the position of cables was investigated to find the configuration that produces maximum diagram emission. Excess cable lengths were bundled at center with 30 cm ~ 40 cm.

Each EME reported was calibrated using the R/S signal generator

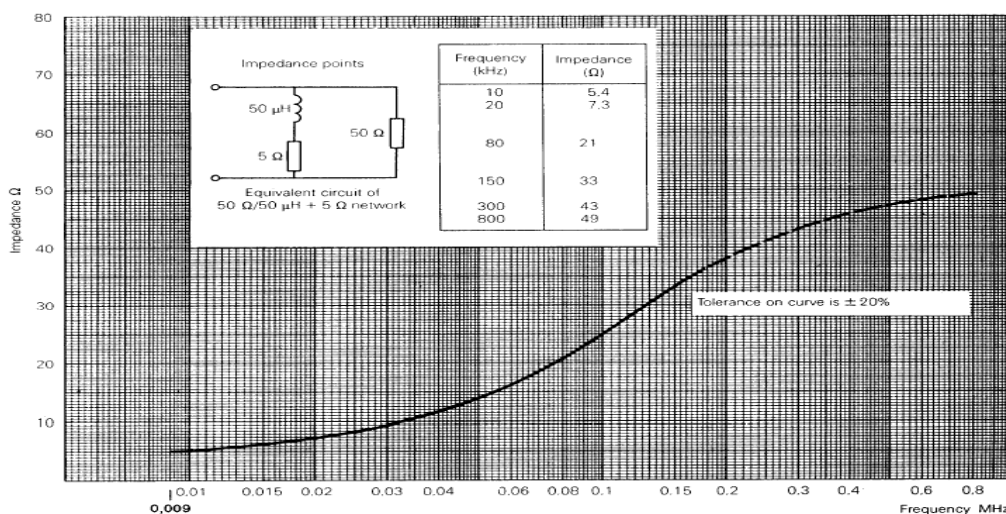


Fig 2. Impedance of LISN



4.3 Radiated Emission

Preliminary measurements were conducted 3 m semi anechoic chamber using broadband antennas 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, mode of operation and turntable azimuth with respect to antenna was note for each frequency found.

Final measurements were made 3 m chamber (FCC registration No.: 443957) and/or 10 m OATS (FCC registration No.: 100749).

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 re-examined and investigated using EMI test receiver. The detector function was set to CISPR quasi-peak mode average mode and the bandwidth of the receiver was set to 120 kHz or 1 MHz depending on the frequency or type of signal.

The EUT, support equipment and interconnecting cables were reconfigured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8 m high non-metallic 1.0 m × 1.5 m table.

The turntable containing the test sample was rotated; the antenna height was varied 1 to 4 meter and stopped at the azimuth or height producing the maximum emission.

Each EME reported was calibrated using the R/S signal generator

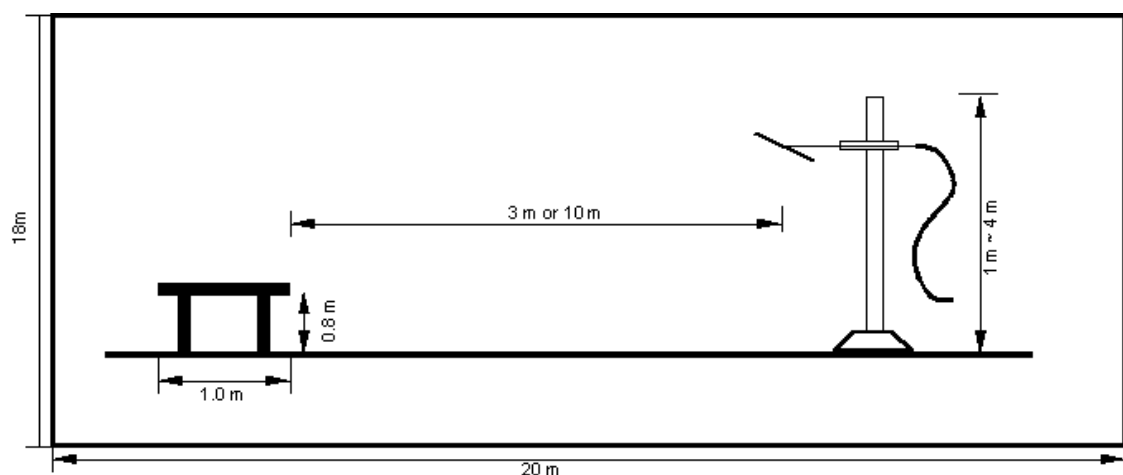


Fig 3. Dimensions of test site.



5. Conducted Emission

5.1 Operating Environment

Temperature : 26
Relative Humidity : 40 % R.H.

5.2 Test Set-up

The conducted emission measurements were performed in the shielded room.

The EUT was placed on wooden table, 0.8 m heights above the floor, 0.4 m from the reference ground plane (GRP) wall and 0.8 m from AMN & ISN.

AMN is bonded on horizontal reference ground plane.

The ground plane, which was electrically bonded to the shield room, ground system and all power lines entering the shield room, were filtered.

5.3 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO "Guide to the expression of uncertainty in measurement."

The measurement uncertainty was given with a confidence of 95 %.

Test Items	Uncertainty	Remark
Conducted emission (9 kHz ~ 150 kHz)	± 2.71 dB	Confidence levels of 95 % ($k = 2$)
Conducted emission (150 kHz ~ 30 MHz)	± 3.34 dB	Confidence levels of 95 % ($k = 2$)



5.4 Limit

RFI Conducted	FCC Limit(dB μ V/m) Class B	
Freq. Range	Quasi-Peak	Average
150 kHz ~ 0.5 MHz	66 ~ 56*	56 ~ 46*
0.5 MHz ~ 5 MHz	56	46
5 MHz ~ 30 MHz	60	50
*Limits decreases linearly with the logarithm of frequency.		

5.5 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESCS30	Rohde & Schwarz	EMI Test Receiver	839809/003	12. 10. 2011
■ - ESH3-Z5	Rohde & Schwarz	LISN	838979/020	12. 10. 2011
■ - ESH2-Z5	Rohde & Schwarz	LISN	829991/009	12. 10. 2011
□ - ISN T8	TESEQ. GmbH	Impedance Network	24568	11. 09. 2011

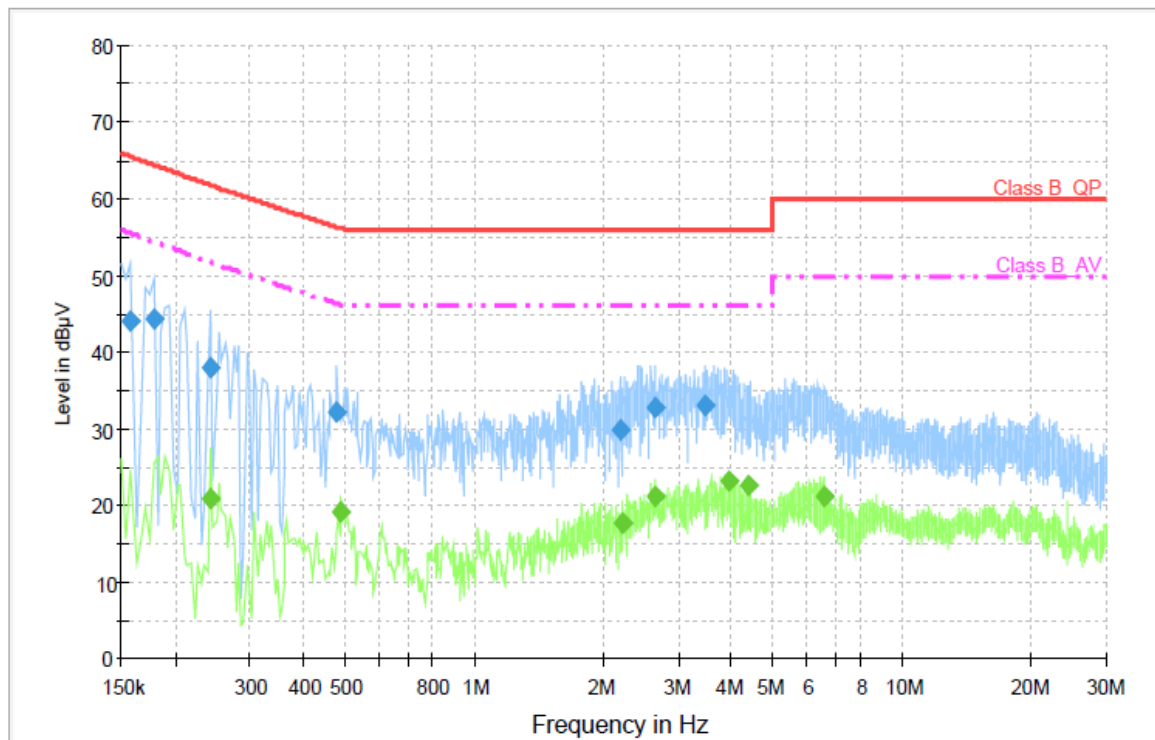
5.6 Test data for Conducted Emission

-. Test Date : January 28, 2011
-. Resolution Bandwidth : 9 kHz
-. Frequency Range : 0.15 MHz ~ 30 MHz



◆ Operating condition: 1 920 × 1 080 / 60 Hz (RGB: Analog)

Voltage with 4-Line-LISN_L1



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.158000	44.2	1000.000	9.000	GND	L1	10.1	21.3	65.5	
0.178000	44.2	1000.000	9.000	GND	L1	10.1	20.3	64.5	
0.242000	37.9	1000.000	9.000	GND	L1	10.1	23.9	61.8	
0.478000	32.1	1000.000	9.000	GND	L1	10.1	24.2	56.3	
2.194000	30.0	1000.000	9.000	GND	L1	10.2	26.0	56.0	
2.658000	32.9	1000.000	9.000	GND	L1	10.2	23.1	56.0	
3.482000	33.0	1000.000	9.000	GND	L1	10.3	23.0	56.0	

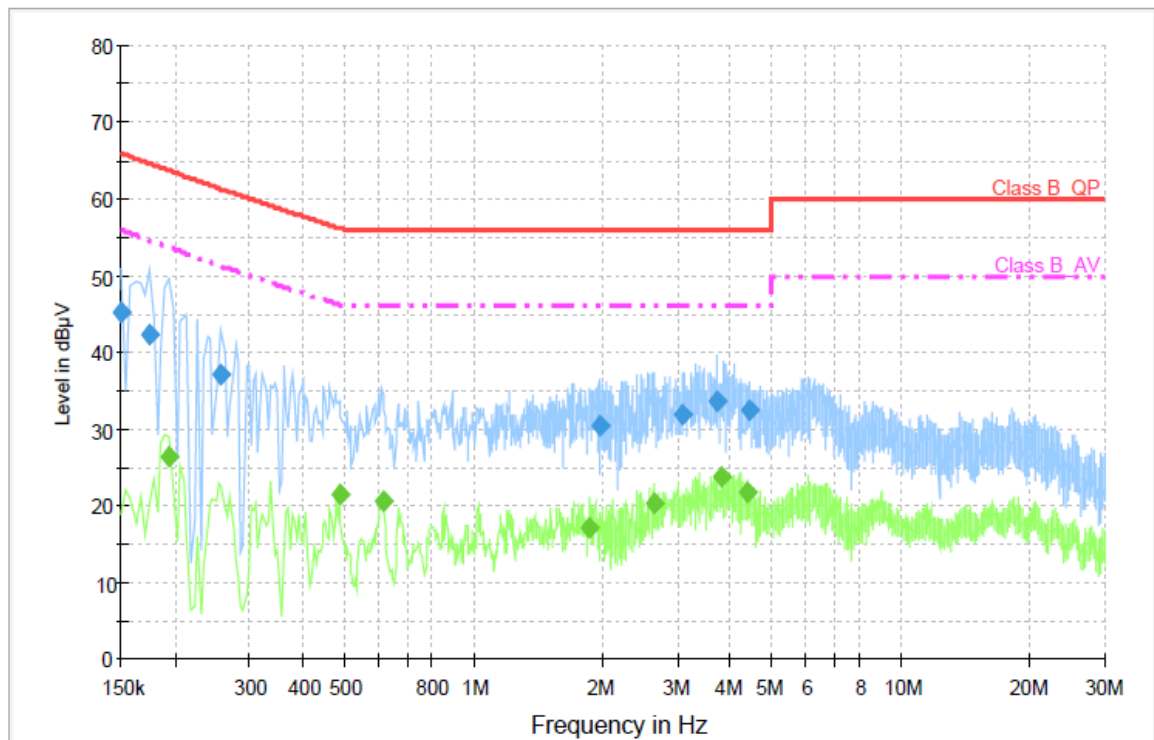
Final Measurement Detector 2

Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.242000	20.9	1000.000	9.000	GND	L1	10.1	30.9	51.8	
0.490000	19.1	1000.000	9.000	GND	L1	10.1	27.1	46.2	
2.214000	17.8	1000.000	9.000	GND	L1	10.2	28.2	46.0	
2.658000	21.1	1000.000	9.000	GND	L1	10.2	24.9	46.0	
3.938000	23.1	1000.000	9.000	GND	L1	10.3	22.9	46.0	
4.382000	22.5	1000.000	9.000	GND	L1	10.3	23.5	46.0	
6.542000	21.2	1000.000	9.000	GND	L1	10.4	28.8	50.0	

< Fig 4. Conducted emission result (Live line) >



Voltage with 4-Line-LISN_N



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.150000	45.3	1000.000	9.000	GND	N	10.1	20.7	66.0	
0.174000	42.3	1000.000	9.000	GND	N	10.1	22.4	64.7	
0.258000	37.1	1000.000	9.000	GND	N	10.1	24.2	61.3	
1.978000	30.5	1000.000	9.000	GND	N	10.2	25.5	56.0	
3.070000	31.9	1000.000	9.000	GND	N	10.2	24.1	56.0	
3.718000	33.6	1000.000	9.000	GND	N	10.3	22.4	56.0	
4.414000	32.4	1000.000	9.000	GND	N	10.3	23.6	56.0	

Final Measurement Detector 2

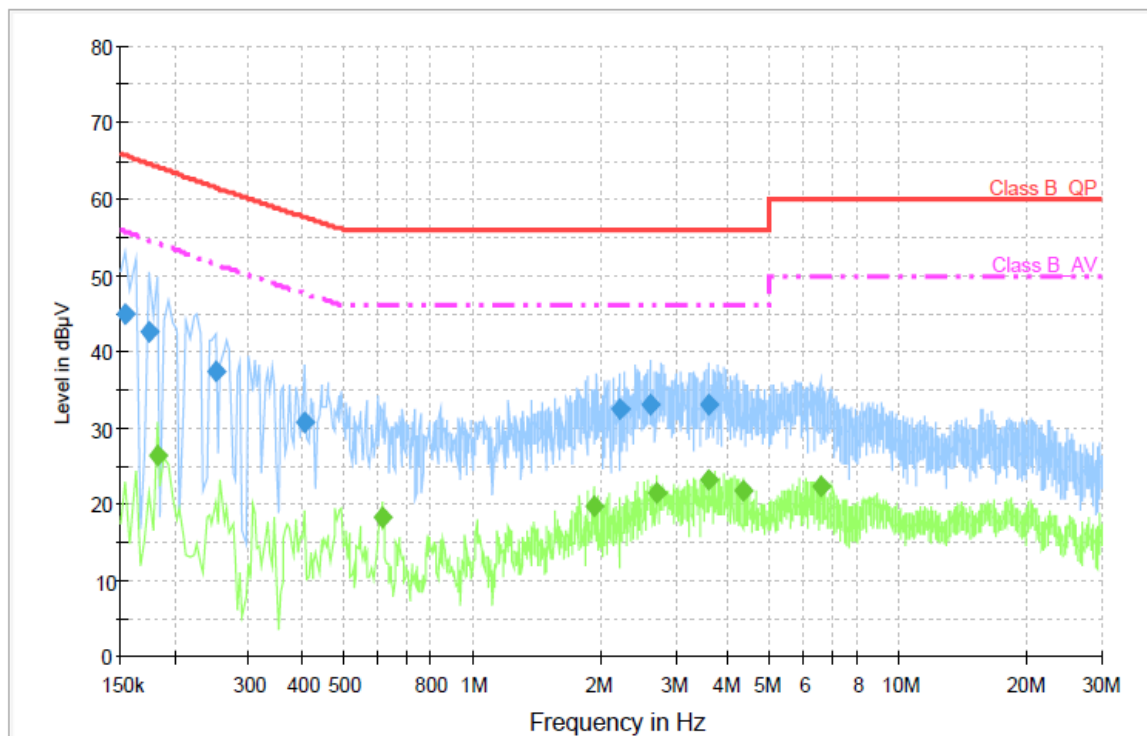
Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.194000	26.4	1000.000	9.000	GND	N	10.1	27.3	53.7	
0.486000	21.4	1000.000	9.000	GND	N	10.1	24.8	46.2	
0.614000	20.5	1000.000	9.000	GND	N	10.1	25.5	46.0	
1.874000	17.2	1000.000	9.000	GND	N	10.2	28.8	46.0	
2.654000	20.3	1000.000	9.000	GND	N	10.2	25.7	46.0	
3.786000	23.6	1000.000	9.000	GND	N	10.3	22.4	46.0	
4.390000	21.7	1000.000	9.000	GND	N	10.3	24.3	46.0	

< Fig 5. Conducted emission result (Neutral line) >



◆ Operating condition: 1 024 × 768 / 60 Hz (RGB: Analog)

Voltage with 4-Line-LISN_L1



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.154000	45.0	1000.000	9.000	GND	L1	10.1	20.8	65.8	
0.174000	42.5	1000.000	9.000	GND	L1	10.1	22.2	64.7	
0.250000	37.3	1000.000	9.000	GND	L1	10.1	24.3	61.6	
0.406000	30.7	1000.000	9.000	GND	L1	10.1	26.9	57.6	
2.226000	32.4	1000.000	9.000	GND	L1	10.2	23.6	56.0	
2.614000	33.1	1000.000	9.000	GND	L1	10.2	22.9	56.0	
3.574000	33.1	1000.000	9.000	GND	L1	10.3	22.9	56.0	

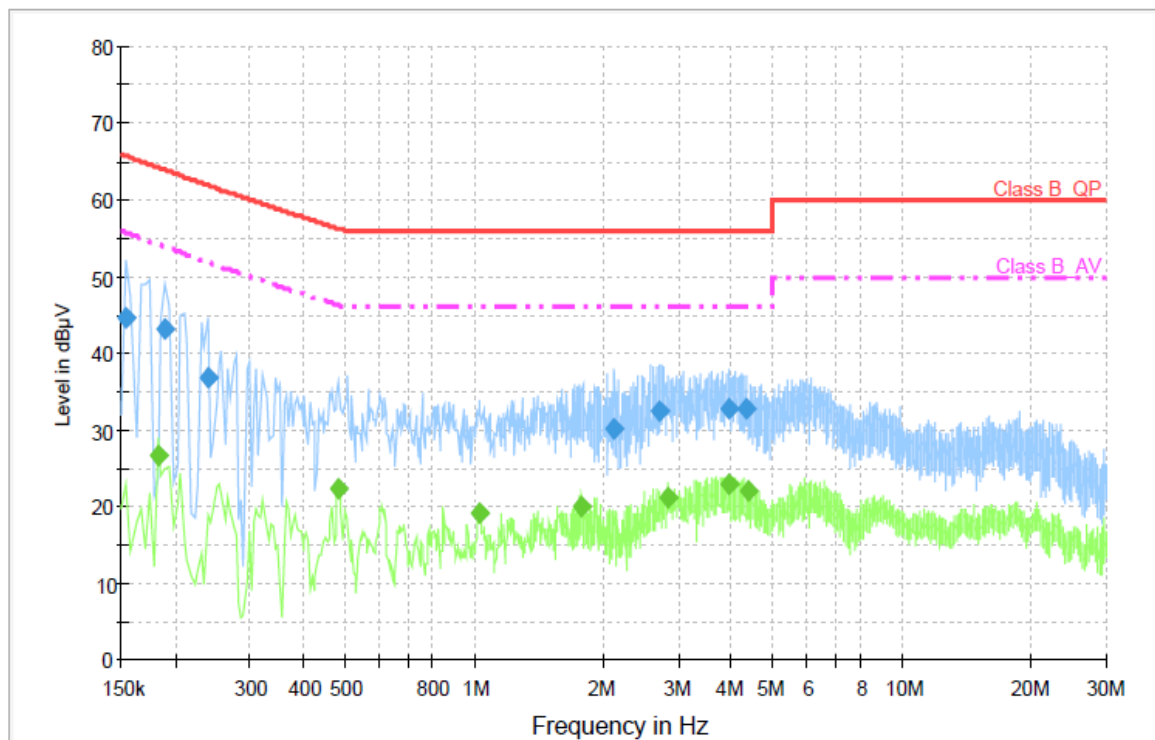
Final Measurement Detector 2

Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.182000	26.4	1000.000	9.000	GND	L1	10.1	27.9	54.3	
0.614000	18.3	1000.000	9.000	GND	L1	10.1	27.7	46.0	
1.922000	19.6	1000.000	9.000	GND	L1	10.2	26.4	46.0	
2.710000	21.3	1000.000	9.000	GND	L1	10.2	24.7	46.0	
3.574000	23.1	1000.000	9.000	GND	L1	10.3	22.9	46.0	
4.322000	21.8	1000.000	9.000	GND	L1	10.3	24.2	46.0	
6.602000	22.4	1000.000	9.000	GND	L1	10.4	27.6	50.0	

< Fig 6. Conducted emission result (Live line) >



Voltage with 4-Line-LISN_N



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.154000	44.6	1000.000	9.000	GND	N	10.1	21.2	65.8	
0.190000	43.2	1000.000	9.000	GND	N	10.1	20.7	63.9	
0.238000	36.8	1000.000	9.000	GND	N	10.1	25.2	62.0	
2.130000	30.2	1000.000	9.000	GND	N	10.2	25.8	56.0	
2.706000	32.6	1000.000	9.000	GND	N	10.2	23.4	56.0	
3.922000	32.8	1000.000	9.000	GND	N	10.3	23.2	56.0	
4.330000	32.6	1000.000	9.000	GND	N	10.3	23.4	56.0	

Final Measurement Detector 2

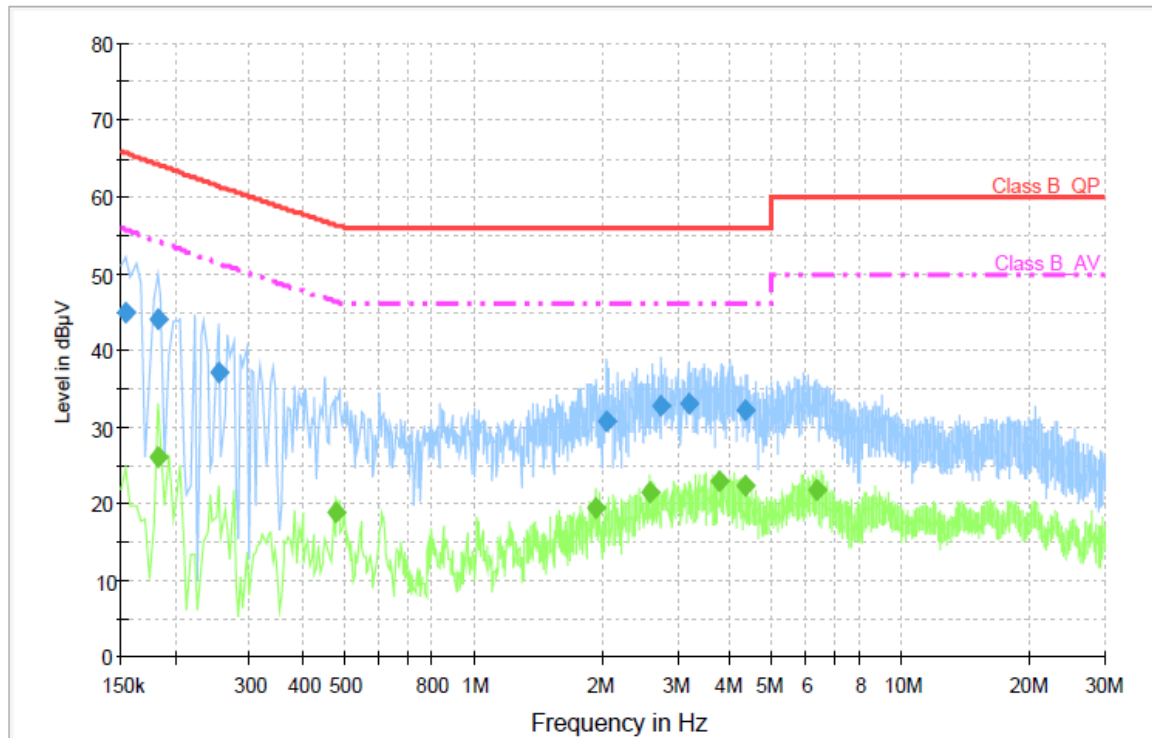
Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.182000	26.7	1000.000	9.000	GND	N	10.1	27.6	54.3	
0.482000	22.3	1000.000	9.000	GND	N	10.1	24.0	46.3	
1.034000	19.1	1000.000	9.000	GND	N	10.1	26.9	46.0	
1.790000	20.0	1000.000	9.000	GND	N	10.2	26.0	46.0	
2.846000	21.1	1000.000	9.000	GND	N	10.2	24.9	46.0	
3.950000	23.0	1000.000	9.000	GND	N	10.3	23.0	46.0	
4.394000	22.0	1000.000	9.000	GND	N	10.3	24.0	46.0	

< Fig 7. Conducted emission result (Neutral line) >



◆ Operating condition: 640 × 480 / 60 Hz (RGB: Analog)

Voltage with 4-Line-LISN_L1



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.154000	44.9	1000.000	9.000	GND	L1	10.1	20.9	65.8	
0.182000	44.0	1000.000	9.000	GND	L1	10.1	20.3	64.3	
0.254000	37.0	1000.000	9.000	GND	L1	10.1	24.4	61.4	
2.058000	30.7	1000.000	9.000	GND	L1	10.2	25.3	56.0	
2.758000	32.9	1000.000	9.000	GND	L1	10.2	23.1	56.0	
3.174000	32.9	1000.000	9.000	GND	L1	10.2	23.1	56.0	
4.330000	32.2	1000.000	9.000	GND	L1	10.3	23.8	56.0	

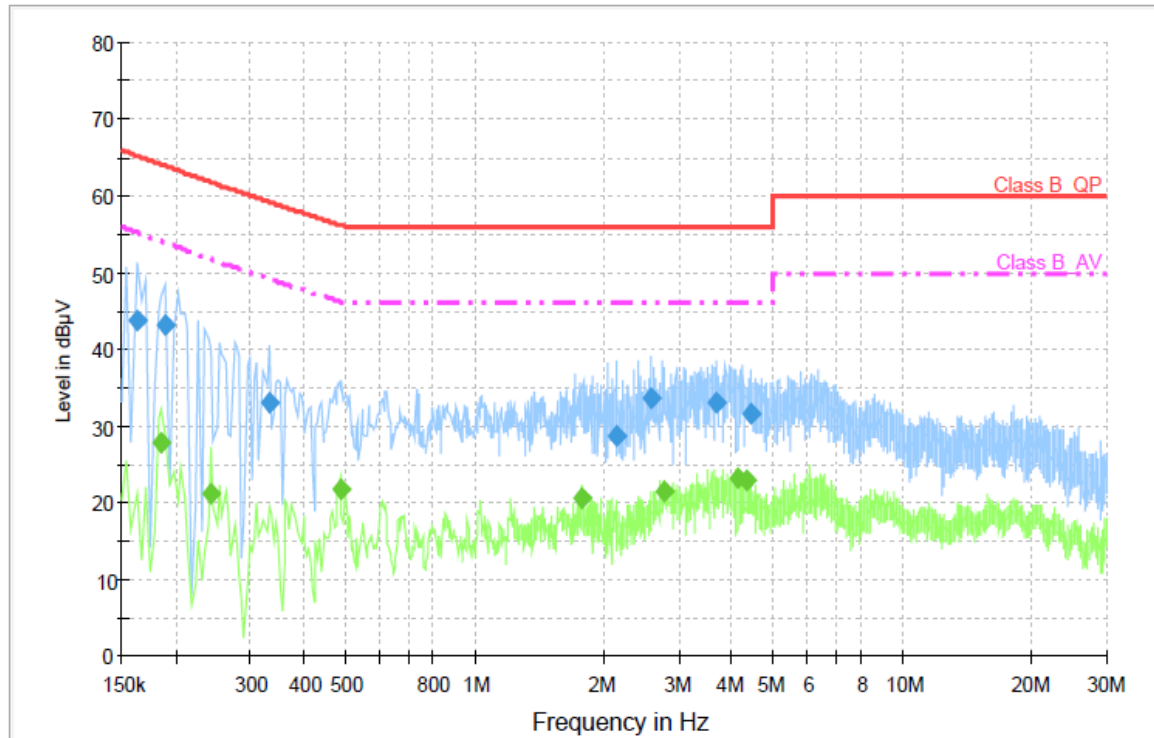
Final Measurement Detector 2

Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.182000	26.2	1000.000	9.000	GND	L1	10.1	28.1	54.3	
0.478000	18.9	1000.000	9.000	GND	L1	10.1	27.4	46.3	
1.922000	19.4	1000.000	9.000	GND	L1	10.2	26.6	46.0	
2.582000	21.3	1000.000	9.000	GND	L1	10.2	24.7	46.0	
3.778000	22.8	1000.000	9.000	GND	L1	10.3	23.2	46.0	
4.330000	22.3	1000.000	9.000	GND	L1	10.3	23.7	46.0	
6.354000	21.6	1000.000	9.000	GND	L1	10.4	28.4	50.0	

< Fig 8. Conducted emission result (Live line) >



Voltage with 4-Line-LISN_N



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.162000	43.9	1000.000	9.000	GND	N	10.1	21.4	65.3	
0.190000	43.2	1000.000	9.000	GND	N	10.1	20.7	63.9	
0.330000	33.1	1000.000	9.000	GND	N	10.1	26.2	59.3	
2.142000	28.8	1000.000	9.000	GND	N	10.2	27.2	56.0	
2.586000	33.7	1000.000	9.000	GND	N	10.2	22.3	56.0	
3.654000	32.9	1000.000	9.000	GND	N	10.3	23.1	56.0	
4.446000	31.7	1000.000	9.000	GND	N	10.3	24.3	56.0	

Final Measurement Detector 2

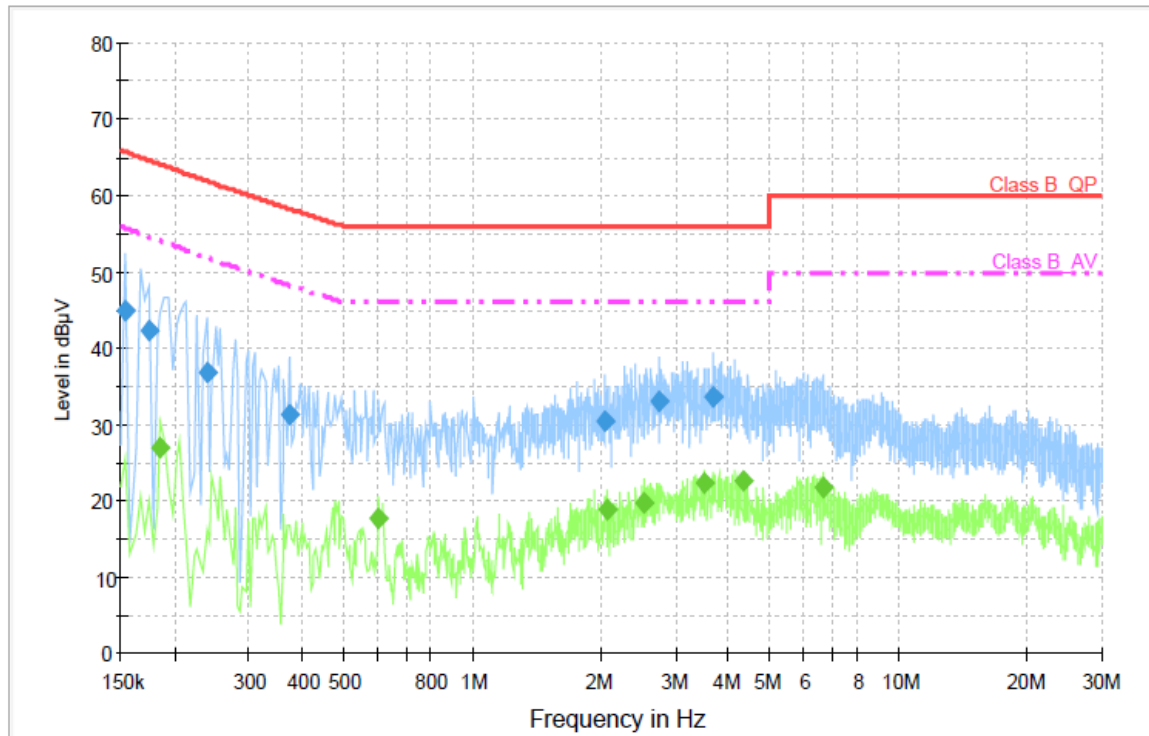
Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.186000	27.7	1000.000	9.000	GND	N	10.1	26.4	54.1	
0.242000	21.3	1000.000	9.000	GND	N	10.1	30.5	51.8	
0.486000	21.6	1000.000	9.000	GND	N	10.1	24.6	46.2	
1.790000	20.5	1000.000	9.000	GND	N	10.2	25.5	46.0	
2.766000	21.5	1000.000	9.000	GND	N	10.2	24.5	46.0	
4.130000	23.2	1000.000	9.000	GND	N	10.3	22.8	46.0	
4.330000	22.8	1000.000	9.000	GND	N	10.3	23.2	46.0	

< Fig 9. Conducted emission result (Neutral line) >



◆ Operating condition: 1 920 × 1 080 / 60 Hz (HDMI/DVI: Digital)

Voltage with 4-Line-LISN_L1



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.154000	44.9	1000.000	9.000	GND	L1	10.1	20.9	65.8	
0.174000	42.4	1000.000	9.000	GND	L1	10.1	22.3	64.7	
0.238000	36.9	1000.000	9.000	GND	L1	10.1	25.1	62.0	
0.374000	31.4	1000.000	9.000	GND	L1	10.1	26.9	58.3	
2.050000	30.6	1000.000	9.000	GND	L1	10.2	25.4	56.0	
2.754000	32.9	1000.000	9.000	GND	L1	10.2	23.1	56.0	
3.654000	33.7	1000.000	9.000	GND	L1	10.3	22.3	56.0	

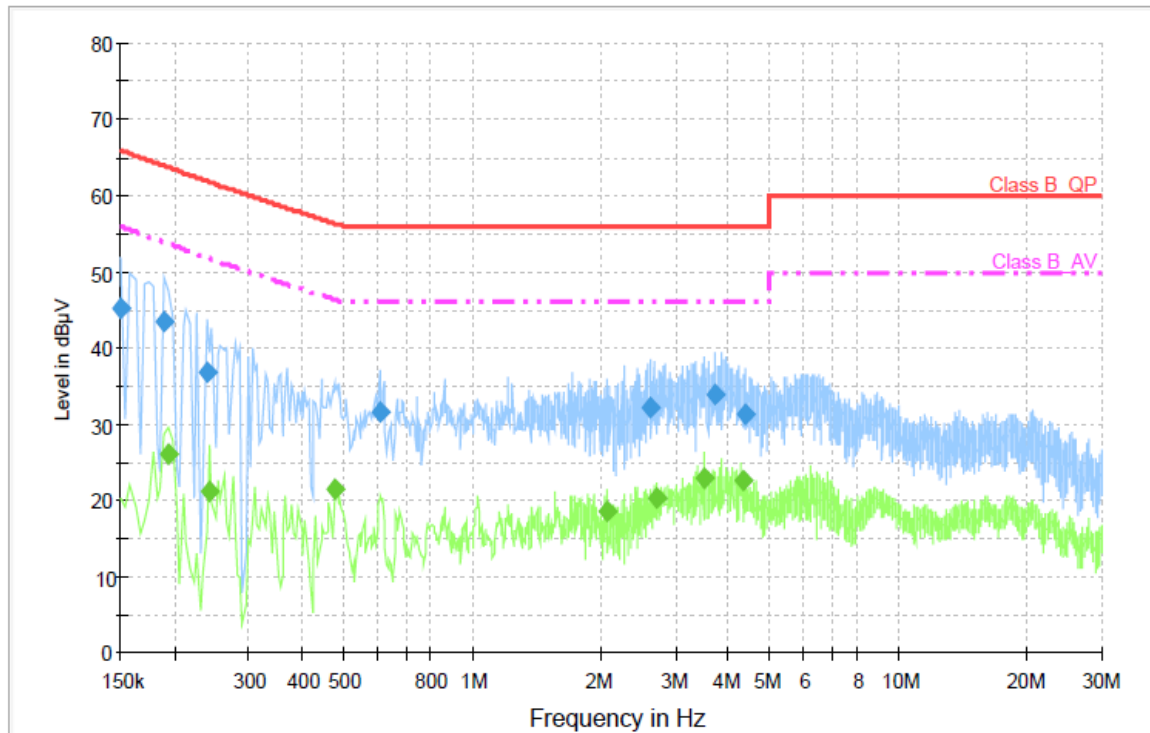
Final Measurement Detector 2

Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.186000	27.0	1000.000	9.000	GND	L1	10.1	27.1	54.1	
0.602000	17.7	1000.000	9.000	GND	L1	10.1	28.3	46.0	
2.062000	18.9	1000.000	9.000	GND	L1	10.2	27.1	46.0	
2.530000	19.6	1000.000	9.000	GND	L1	10.2	26.4	46.0	
3.522000	22.4	1000.000	9.000	GND	L1	10.3	23.6	46.0	
4.330000	22.5	1000.000	9.000	GND	L1	10.3	23.5	46.0	
6.682000	21.9	1000.000	9.000	GND	L1	10.4	28.1	50.0	

< Fig 10. Conducted emission result (Live line) >



Voltage with 4-Line-LISN_N



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.150000	45.4	1000.000	9.000	GND	N	10.1	20.6	66.0	
0.190000	43.4	1000.000	9.000	GND	N	10.1	20.5	63.9	
0.238000	36.8	1000.000	9.000	GND	N	10.1	25.2	62.0	
0.606000	31.6	1000.000	9.000	GND	N	10.1	24.4	56.0	
2.606000	32.1	1000.000	9.000	GND	N	10.2	23.9	56.0	
3.722000	33.8	1000.000	9.000	GND	N	10.3	22.2	56.0	
4.386000	31.3	1000.000	9.000	GND	N	10.3	24.7	56.0	

Final Measurement Detector 2

Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.194000	26.1	1000.000	9.000	GND	N	10.1	27.6	53.7	
0.242000	21.1	1000.000	9.000	GND	N	10.1	30.7	51.8	
0.478000	21.4	1000.000	9.000	GND	N	10.1	24.9	46.3	
2.066000	18.4	1000.000	9.000	GND	N	10.2	27.6	46.0	
2.714000	20.3	1000.000	9.000	GND	N	10.2	25.7	46.0	
3.510000	22.8	1000.000	9.000	GND	N	10.3	23.2	46.0	
4.338000	22.5	1000.000	9.000	GND	N	10.3	23.5	46.0	

< Fig 11. Conducted emission result (Neutral line) >



6. Radiated Emission

6.1 Operating Environment

Temperature : 23
Relative Humidity : 42 % R.H.

6.2 Test Set-up

A preliminary and final measurement was at 3 m anechoic chamber.

The EUT was placed on a non-conductive turntable approximately 0.8 m above the ground plane.

The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels.

This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

6.3 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”.

The measurement uncertainty was given with a confidence of 95 %.

Test Items(Anechoic Chamber)	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical)	± 4.32 dB	Confidence levels of 95 % ($k = 2$)
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	± 4.21 dB	Confidence levels of 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	± 3.96 dB	Confidence levels of 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	± 3.97 dB	Confidence levels of 95 % ($k = 2$)



6.4 Limit

Frequency (MHz)	FCC Limit @ 3 m. dB μ V/m	CISPR Limit @ 10 m. dB μ V/m
30 ~ 88	40.0	30.0
88 ~ 216	43.5	30.0
216 ~ 230	46.0	30.0
230 ~ 960	46.0	37.0
960 ~ 1 000	54.0	37.0
> 1 000	54.0	No Specified limit

6.5 Test Equipment used

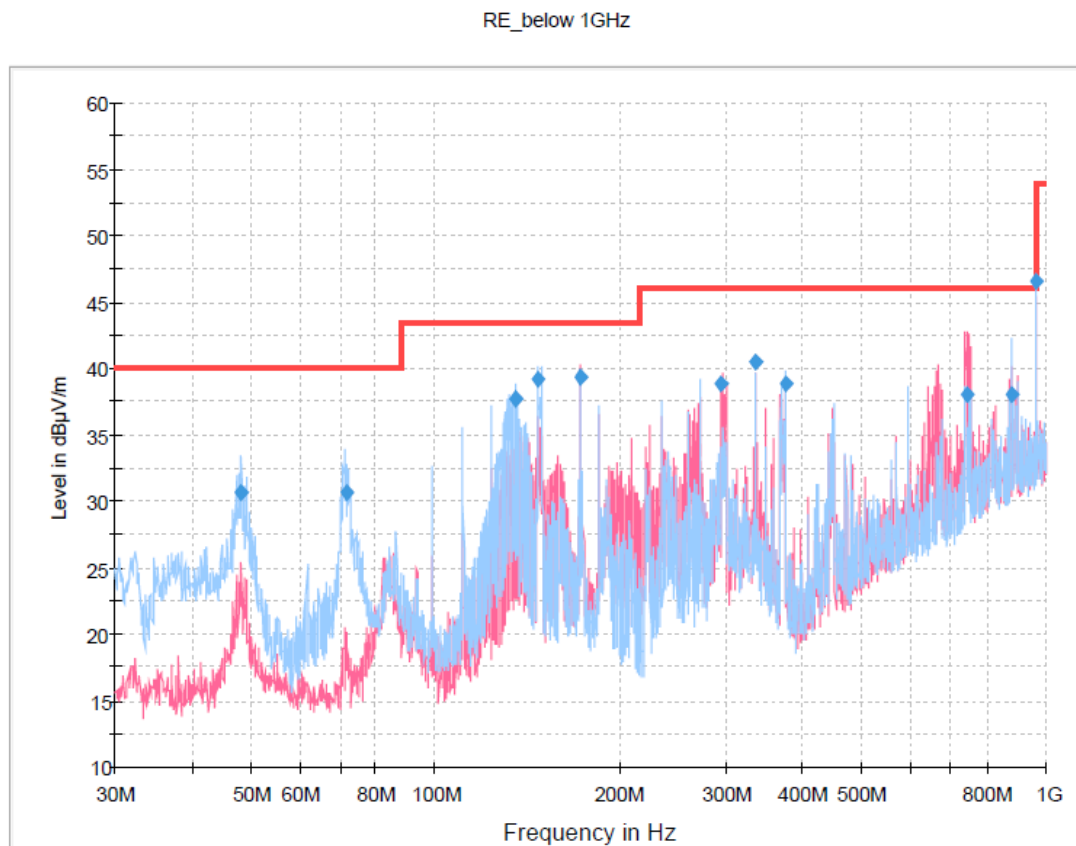
Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 11. 2011
■ - VULB9160	Schwarzbeck	Broadband Test Antenna	3193	03. 15. 2012
■ - BBHA9120D	Schwarzbeck	Horn ANT	207	12. 22. 2011
■ - MCU066	maturo GmbH	Position Controller	1390306	N/A
■ - TT2.5SI	maturo GmbH	Turntable	1390307	N/A
■ - AM 4.0	maturo GmbH	Antenna Mast	1390308	N/A
■ - AFS 44 00101800-25-10P-44	MITEQ	Preamplifier	1258943	11. 12. 2011

6.6 Test data for Radiated Emission

- Test Date : January 28 ~ 31, 2011
- Resolution Bandwidth : 120 kHz/1 MHz
- Frequency Range : 30 MHz ~ 5 000 MHz
- Measurement Distance : 3 m
- Note : The highest frequency of the internal source of the EUT is between 500 MHz and 1 000 MHz (667 MHz). The measurement was made up to 5 000 MHz



- ◆ Operating Condition: 1 920 × 1 080 / 60 Hz (RGB: Analog)
Red trace: Vertical polarization, Blue trace: Horizontal polarization



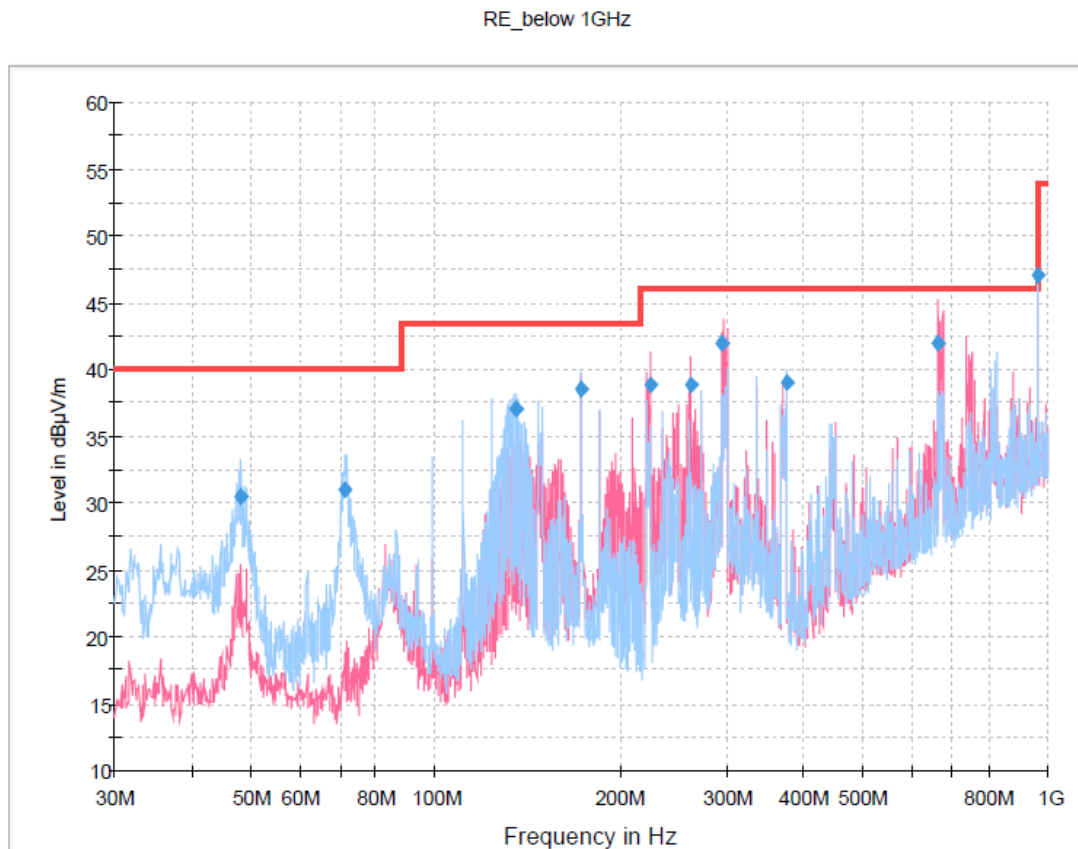
Final Result 1

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
48.328750	30.7	1000.0	120.000	110.0	H	183.0	13.0	9.30	40.00
71.686250	30.7	1000.0	120.000	113.0	H	315.0	11.1	9.30	40.00
135.346250	37.7	1000.0	120.000	100.0	H	64.0	14.2	5.80	43.50
147.388750	39.2	1000.0	120.000	100.0	H	195.0	14.8	4.30	43.50
173.297500	39.3	1000.0	120.000	150.0	V	285.0	14.0	4.20	43.50
294.592500	38.9	1000.0	120.000	100.0	V	198.0	16.6	7.10	46.00
334.196250	40.5	1000.0	120.000	100.0	V	307.0	17.3	5.50	46.00
375.093750	38.8	1000.0	120.000	130.0	H	230.0	17.6	7.20	46.00
743.385000	38.1	1000.0	120.000	100.0	V	141.0	27.6	7.90	46.00
880.953750	38.0	1000.0	120.000	113.0	H	150.0	29.6	8.00	46.00
960.048750	46.6	1000.0	120.000	100.0	H	195.0	30.9	7.40	54.00

< Fig 14. Radiated emission result (30 MHz ~ 1 000 MHz) >



- ◆ Operating Condition: 1 920 × 1 080 / 60 Hz (HDMI/DVI: Digital)
Red trace: Vertical polarization, Blue trace: Horizontal polarization



Final Result 1

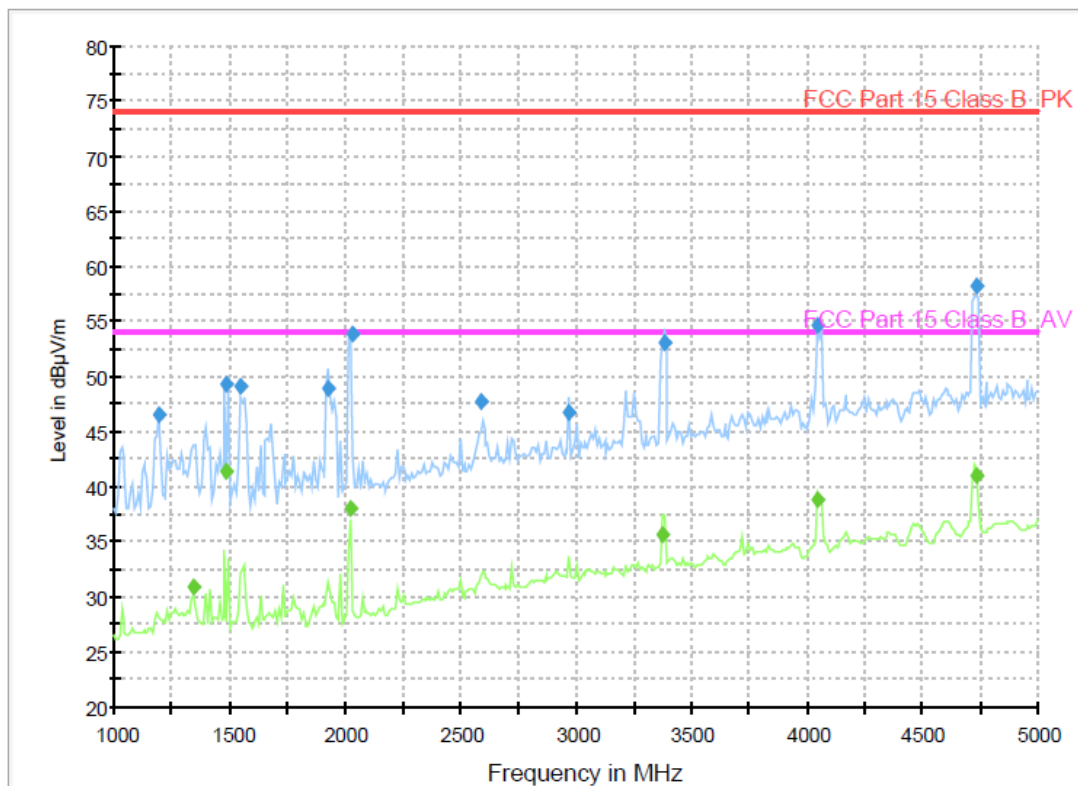
Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
48.328750	30.5	1000.0	120.000	100.0	H	138.0	13.0	9.50	40.00
71.527500	31.1	1000.0	120.000	100.0	H	341.0	11.1	8.90	40.00
135.856250	37.1	1000.0	120.000	100.0	H	20.0	14.2	6.40	43.50
173.297500	38.6	1000.0	120.000	112.0	H	328.0	14.0	4.90	43.50
224.990000	38.9	1000.0	120.000	150.0	V	217.0	13.1	7.10	46.00
262.497500	38.8	1000.0	120.000	100.0	V	183.0	15.0	7.20	46.00
294.473750	41.9	1000.0	120.000	100.0	V	194.0	16.6	4.10	46.00
375.093750	39.1	1000.0	120.000	129.0	H	223.0	17.6	6.90	46.00
662.538750	42.0	1000.0	120.000	113.0	V	206.0	25.9	4.00	46.00
960.048750	47.0	1000.0	120.000	100.0	H	195.0	30.9	7.00	54.00

< Fig 15. Radiated emission result (30 MHz ~ 1 000 MHz) >



- ◆ Operating Condition: 1 920 × 1 080 / 60 Hz (RGB: Analog)
Green trace: Average detector, Blue trace: Peak detector

Radiated Emission_above 1 GHz



Final Result 1

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1190.584770	46.5	100.0	1000.000	100.0	H	203.0	-13.7	27.5	74.0
1484.761924	49.4	100.0	1000.000	100.0	V	221.0	-13.1	24.6	74.0
1548.090180	49.2	100.0	1000.000	247.0	V	186.0	-12.8	24.8	74.0
1930.459720	48.9	100.0	1000.000	114.0	H	129.0	-12.0	25.2	74.0
2029.852104	53.8	100.0	1000.000	100.0	H	40.0	-11.5	20.2	74.0
2592.590381	47.8	100.0	1000.000	100.0	V	139.0	-9.0	26.2	74.0
2973.343888	46.7	100.0	1000.000	100.0	V	153.0	-7.5	27.3	74.0
3380.961523	53.1	100.0	1000.000	113.0	V	200.0	-5.9	20.9	74.0
4045.092184	54.7	100.0	1000.000	113.0	H	211.0	-3.2	19.3	74.0
4733.670942	58.2	100.0	1000.000	100.0	H	232.0	-1.8	15.8	74.0

Final Result 2

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1348.489379	30.9	100.0	1000.000	100.0	H	114.0	-13.3	23.1	54.0
1484.761924	41.4	100.0	1000.000	100.0	V	221.0	-13.1	12.6	54.0
2028.652104	38.1	100.0	1000.000	100.0	H	40.0	-11.5	15.9	54.0
3371.345491	35.5	100.0	1000.000	183.0	H	88.0	-6.0	18.5	54.0
4045.492184	38.8	100.0	1000.000	114.0	H	211.0	-3.2	15.2	54.0
4732.454910	41.1	100.0	1000.000	100.0	H	232.0	-1.8	12.9	54.0

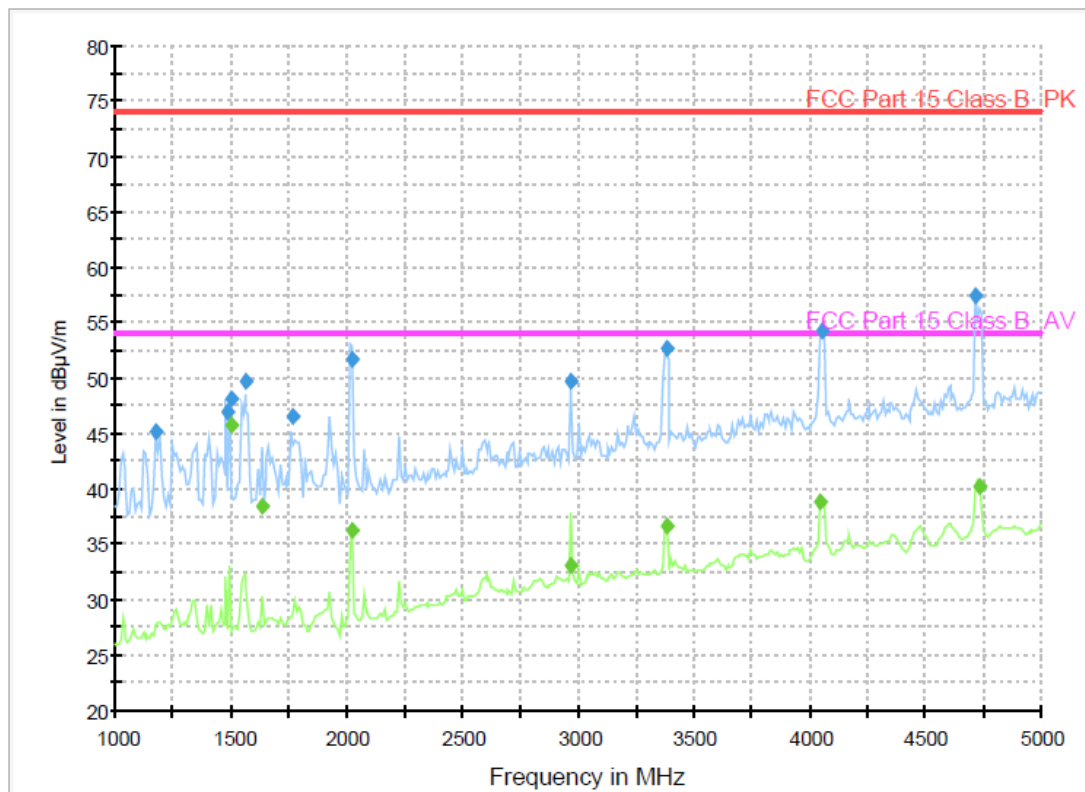
< Fig 17. Radiated emission result (1 000 MHz ~ 5 000 MHz) >



- ◆ Operating Condition: 1 920 × 1 080 / 60 Hz (HDMI/DVI: Digital)

Green trace: Average detector, Blue trace: Peak detector

Radiated Emission_above 1 GHz



Final Result 1

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1180.152706	45.1	100.0	1000.000	100.0	H	205.0	-13.8	28.9	74.0
1484.761924	46.9	100.0	1000.000	100.0	V	244.0	-13.1	27.1	74.0
1500.393988	48.1	100.0	1000.000	100.0	V	0.0	-13.0	25.9	74.0
1566.122245	49.8	100.0	1000.000	236.0	V	193.0	-12.8	24.2	74.0
1765.723046	46.6	100.0	1000.000	100.0	H	157.0	-12.3	27.4	74.0
2021.036072	51.6	100.0	1000.000	100.0	V	236.0	-11.6	22.4	74.0
2972.143888	49.6	100.0	1000.000	279.0	V	275.0	-7.5	24.4	74.0
3383.761523	52.6	100.0	1000.000	100.0	V	196.0	-5.9	21.4	74.0
4057.108216	54.2	100.0	1000.000	118.0	H	247.0	-3.2	19.8	74.0
4720.038878	57.5	100.0	1000.000	100.0	H	233.0	-1.8	16.5	74.0

Final Result 2

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1500.393988	45.8	100.0	1000.000	100.0	V	0.0	-13.0	8.2	54.0
1633.466533	38.3	100.0	1000.000	100.0	V	189.0	-12.6	15.7	54.0
2022.652104	36.3	100.0	1000.000	100.0	V	236.0	-11.5	17.7	54.0
2971.743888	33.1	100.0	1000.000	100.0	V	275.0	-7.5	20.9	54.0
3381.361523	36.6	100.0	1000.000	100.0	V	196.0	-5.9	17.4	54.0
4045.492184	38.8	100.0	1000.000	113.0	H	247.0	-3.2	15.2	54.0
4732.454910	40.2	100.0	1000.000	100.0	H	233.0	-1.8	13.8	54.0

< Fig 18. Radiated emission result (1 000 MHz ~ 5 000 MHz) >



7. Sample Calculations

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \text{ Log}_{10}(\mu\text{V}/\text{m}) \\ \text{dB}\mu\text{V} &= \text{dBm} + 107 \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)} \end{aligned}$$

7.1 Example 1 :

■ 20.3 MHz

Class B Limit	= 250 μV = 48 dB μV
Reading	= 39.2 dB μV
$10^{(39.2\text{dB}\mu\text{V}/20)}$	= 91.2 μV
Margin	= 48 dB μV - 39.2 dB μV = 8.8 dB

7.2 Example 2 :

■ 66.7 MHz

Class B Limit	= 100 $\mu\text{V}/\text{m}$ = 40.0 dB $\mu\text{V}/\text{m}$
Reading	= 31.0 dB μV
Antenna Factor + Cable Loss = 5.8 dB	
Total	= 36.8 dB $\mu\text{V}/\text{m}$
Margin	= 40.0 dB $\mu\text{V}/\text{m}$ – 36.8 dB $\mu\text{V}/\text{m}$ = 3.2 dB



8. Recommendation & Conclusion

The data collected shows that the **LG Electronics Inc. LED LCD TV/Monitor (Model Name: 22LV2500-UA)** was complies with §15.107 and 15.109 of the FCC Rules.