

FCC TEST REPORT

Order No. : G-44-2016-01712
 Applicant Name : Sony Corporation
 Equipment Under Test (EUT) :
 Product Name : Mobile Projector
 Model Name : MP-CL1A
 FCC Authorization Type : Certification
 Applied Standards : FCC Part 15 Subpart B, Class B
 ANSI C63.4 : 2014
 Date of Receipt : June 9, 2016
 Date of Test : July 11, 2016 ~ July 12, 2016
 Date of Issue : July 20, 2016
 Test Results : Complied

<p>Tested by :</p> <p>Technical Manager :</p>	<p>:</p>	<div style="text-align: center;">  ----- Noah Jeon </div> <div style="text-align: center;">  ----- Julia Choi </div>
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1. General Information

1.1 Client Information

Applicant : Sony Corporation
 Address : 1-7-1 Konan Minato-ku, Tokyo, 108-0075, Japan

 Manufacturer : Sony Electronics of Korea Co., Ltd.
 Address : 76 Jayumyeok 2-gil, Masanhoewon-Gu, Changwon-Si, Gyeongsangnam-Do, Korea

1.2 Test Laboratory

Name and Address : SGS Korea Co., Ltd.
 - Giheung 1 Lab : 35, Giheungdanji-ro 121beon-gil, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea, 17086
 - Giheung 2 Lab : 23, Giheungdanji-ro 24beon-gil, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea, 17086

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1.3 General Information of E.U.T.

Classification	Description
Model Name	MP-CL1A
Product Name	Mobile Projector
EMI Classification	Class B
FCC ID	AK8MP-CL1A
Operating temperature	-10 ℃ ~ 50 ℃
Output resolution	1 920 x 720
Input Power	5 Vd.c., 1.5 A
Output Power	5 Vd.c., 1.5 A(USB)
Li-ion Battery	3.8 Vd.c.(3400 mAh)
Applicant	Sony Corporation
Manufacturer / Country	Sony Electronics of Korea Co., Ltd. / Korea
Dimensions	Approx. 77.0 mm x 149.5 mm x 13.0 mm
Weight	Approx. 210 g
Screen size	Max. 120 inches
Aspect ratio	16:9
Port	Micro USB, HDMI/MHL IN, Audio, USB Output(DC Output)
Function	It can output audio and video data by using screen mirroring, MHL connection or HDMI connection and include battery pack function

1.4 Operating Modes and Conditions

Operating mode	Operating condition
1) HDMI	The EUT is connected by HDMI with Personal Computer and it is outputting video and sound. Also The Mobile Phone has been connected by USB port and it is charging the phone.
2) MHL	The EUT is connected by MHL with Tablet PC and it is outputting video and sound. Also The Mobile Phone has been connected by USB port and it is charging the phone.

1.5 Auxiliary Equipments

Description	Model	Serial No.	Manufacturer
HDTV Adapter	ET-H10FAU	RT2G311AS E	Samsung Electronics Co., Ltd.
Earphone	-	-	-
Travel Adapter	EP-TA10KWK	SE1DC19AS/B-E	Dongguan Samsung Electro-mechanics Co., Ltd.
Tablet PC	SM-P605S	0020187	Samsung Electronics Co., Ltd.
Mobile Phone	SHV-E210K	0079009	Samsung Electronics Co., Ltd.
Personal Computer	DM500T4Z	JMQ598EG1BZ00NK	Samsung Electronics Co., Ltd.

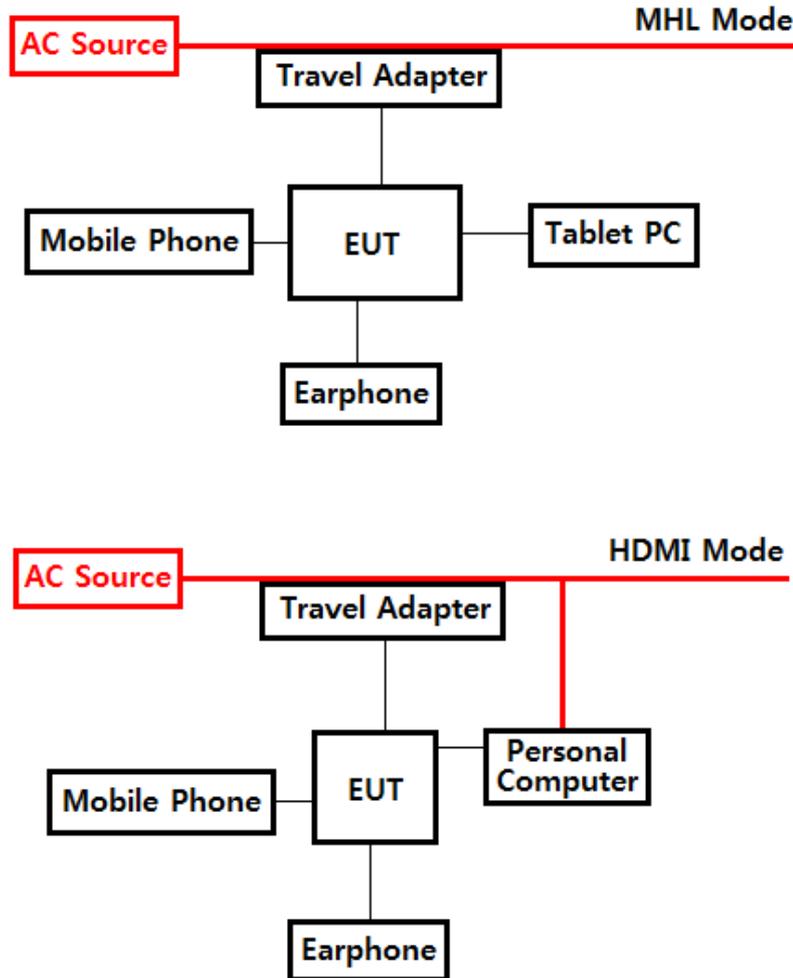
1.6 Cable List

Start		END		Cable Spec.		Used core
Name	I/O Port	Name	I/O Port	Length	Shield	
MHL Mode						
EUT	HDMI/MHL IN	HDTV Adapter	HDMI	1.5	Shield	No
	USB Output	Mobile Phone	Micro USB	1.3	Unshield	No
	Micro USB	Travel Adapter	USB	0.6	Unshield	No
	Audio OUT	Earphone	-	1.2	Unshield	No
HDTV Adapter	Micro USB	Tablet PC	Micro USB	0.1	Unshield	No
Travel Adapter	AC IN	AC Source	-	-	-	-
HDMI Mode						
EUT	HDMI/MHL IN	Personal Computer	HDMI	1.5	Shield	No
	USB Output	Mobile Phone	Micro USB	1.3	Unshield	No
	Micro USB	Travel Adapter	USB	0.6	Unshield	No
	Audio OUT	Earphone	-	1.2	Unshield	No
Personal Computer	AC IN	AC Source	-	1.6	Unshield	No
Travel Adapter	AC IN	AC Source	-	-	-	-

1.7 System Configurations

Description	Model	Serial No.	Manufacturer
Battery	LIS1BB1SEK(KR3)	0-MPA-005-01	-
Main Board	MP-CL1A MAIN. PWB	1-MPA-002-01	SONY
Sub Board	PJM-1102 EP GW	1-894-933-11	-

1.8 Test System Layout



1.9 Modifications

- There was no modified item during the test.

1.10 Applicable Standards for Testing

Standards	Status	Deviation
FCC Part 15 : Subpart B	Applicable	No Deviation

1.11 Summary of Test Results

Test Item	Standards	Results
Conducted Emission	FCC Part 15 Subpart B Section 15.107	Complied
Radiated Emission	FCC Part 15 Subpart B Section 15.109	Complied

Note : Test methods of all test items are performed according to the basic standards in this table.

EMISSION

2.1 Test Results

Test Items	Standards	Test Results
Conducted Emission	FCC Part 15 Subpart B Section 15.107	Complied
Radiated Emission	FCC Part 15 Subpart B Section 15.109	Complied

2.2 Test Method and Limits

2.2.1 Test Method

Test Items	Measuring Frequency Range	RBW	Measuring Distance
Conducted Emission	0.15 MHz ~ 30 MHz	9 kHz	-
Radiated Emission	30 MHz ~ 1 GHz	120 kHz	10 m & 3 m
	Above 1 GHz	1 MHz	3 m

Note : 10 m method of radiated emission measurement is only applied to Class A equipment over the frequency range of 30 MHz ~ 1 GHz. Except this, 3 m method is applied to Class B equipment over the frequency range of 30 MHz ~ 1 GHz and Class A and Class B equipment above 1 GHz.

2.2.2 Test Limits

-Conducted Emission Limits

Frequency Range	Limits(dB μ V)		Class
	Quasi-peak	Average	
0.15 MHz ~ 0.5 MHz	79	66	Class A
0.5 MHz ~ 30 MHz	73	60	
0.15 MHz ~ 0.5 MHz	66 to 56	56 to 46	Class B
0.5 MHz ~ 5 MHz	56	46	
5 MHz ~ 30 MHz	60	50	

Note : The lower limit shall apply at the transition frequencies. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

-Radiated Emission Limits below 1 GHz

Frequency Range	Limits(dB μ V/m)		Class
	Quasi-peak		
30 MHz ~ 88 MHz	39.1		Class A (10 m method)
88 MHz ~ 216 MHz	43.5		
216 MHz ~ 960 MHz	46.4		
960 MHz ~ 1 GHz	49.5		
30 MHz ~ 88 MHz	40.0		Class B (3 m method)
88 MHz ~ 216 MHz	43.5		
216 MHz ~ 960 MHz	46.0		
960 MHz ~ 1 GHz	54.0		

-Radiated Emission Limits above 1 GHz (3 m method)

Frequency Range	Limits(dB μ V/m)		Class
	Average	Peak	
Above 1 GHz	59.5	79.5	Class A
Above 1 GHz	54.0	74.0	Class B

Note : The limits of class A equipment is extrapolated using an extrapolation factor of 20 dB/decade because it was measured at 3 m distance not 10 m distance.

2.3 Conducted Emission

The initial preliminary exploratory scans were performed over the measuring frequency range (0.15 MHz to 30 MHz) using a max hold mode incorporating a Peak detector and Average detector and using the software of EMC32 (Version V8.53 from R&S). The final test data was measured using a Quasi-Peak detector and an Average detector.

2.3.1 Test Equipments

Equipment	Model	Manufacturer	Serial No	Cal Due. Date
EMI TEST RECEIVER	ESU8	R&S	100128	2017.01.08
2-LINE V-NETWORK	ENV216	R&S	101120	2017.01.07
PULSE LIMITER	ESH3-Z2	R&S	100850	2016.11.18
Shield Room	-	Will Tech	-	-

2.3.2 Test Site

Shield Room in Giheung 2 Laboratory

2.3.3 Environment Conditions

Temperature : (minimum 23.6, maximum 24.7) °C

Humidity : (minimum 56.0, maximum 57.0) %R.H.

Atmospheric Pressure : (99.8) kPa

Test Date : July 12, 2016

2.3.4 Test Results

[Test Mode : HDMI]

Freq. (MHz)	Line (H/N)	Level (dB μ V)		LISN (dB)	CL (dB)	P/L (dB)	Result (dB μ V)		Limit (dB μ V)		Margin (dB)	
		Q/P	A/V				Q/P	A/V	Q/P	A/V	Q/P	A/V
0.17	H	27.11	11.55	9.71	0.00	9.86	46.68	31.12	64.86	54.86	18.18	23.74
0.26	H	18.52	7.20	9.60	0.00	9.85	37.97	26.65	61.43	51.43	23.46	24.78
0.77	H	15.34	4.83	9.73	0.00	9.85	34.92	24.41	56.00	46.00	21.08	21.59
0.88	H	12.05	2.60	9.70	0.00	9.85	31.60	22.15	56.00	46.00	24.40	23.85
2.08	H	9.37	2.91	9.60	0.04	9.86	28.87	22.41	56.00	46.00	27.13	23.59
4.74	H	16.98	7.60	9.60	0.10	9.86	36.54	27.16	56.00	46.00	19.46	18.84
0.17	N	25.47	12.27	9.80	0.00	9.86	45.13	31.93	65.16	55.16	20.03	23.23
0.26	N	19.05	10.91	9.62	0.00	9.85	38.52	30.38	61.43	51.43	22.91	21.05
0.52	N	20.04	9.47	9.88	0.00	9.85	39.77	29.20	56.00	46.00	16.23	16.80
0.79	N	22.92	9.28	9.80	0.00	9.85	42.57	28.93	56.00	46.00	13.43	17.07
0.91	N	20.69	8.23	9.70	0.00	9.85	40.24	27.78	56.00	46.00	15.76	18.22
2.19	N	15.35	6.81	9.60	0.04	9.86	34.85	26.31	56.00	46.00	21.15	19.69

[Test Mode : MHL]

Freq. (MHz)	Line (H/N)	Level (dB μ V)		LISN (dB)	CL (dB)	P/L (dB)	Result (dB μ V)		Limit (dB μ V)		Margin (dB)	
		Q/P	A/V				Q/P	A/V	Q/P	A/V	Q/P	A/V
0.17	H	22.57	13.17	9.70	0.00	9.86	42.13	32.73	64.96	54.96	22.83	22.23
0.25	H	24.16	14.20	9.60	0.00	9.85	43.61	33.65	61.76	51.76	18.15	18.11
0.34	H	16.49	6.96	9.76	0.00	9.85	36.10	26.57	59.20	49.20	23.10	22.63
0.88	H	14.81	4.76	9.70	0.00	9.85	34.36	24.31	56.00	46.00	21.64	21.69
4.17	H	15.31	5.28	9.60	0.10	9.86	34.87	24.84	56.00	46.00	21.13	21.16
4.97	H	19.42	8.57	9.60	0.10	9.86	38.98	28.13	56.00	46.00	17.02	17.87
0.17	N	23.34	11.18	9.80	0.00	9.86	43.00	30.84	65.06	55.06	22.06	24.22
0.26	N	18.05	9.34	9.61	0.00	9.85	37.51	28.80	61.56	51.56	24.05	22.76
0.43	N	15.85	8.81	9.90	0.00	9.85	35.60	28.56	57.29	47.29	21.69	18.73
0.76	N	16.33	9.02	9.80	0.00	9.85	35.98	28.67	56.00	46.00	20.02	17.33
4.43	N	17.49	8.12	9.60	0.10	9.86	37.05	27.68	56.00	46.00	18.95	18.32
4.96	N	17.71	8.65	9.60	0.10	9.86	37.27	28.21	56.00	46.00	18.73	17.79

 Measurement Uncertainty : 3.05 dB (The confidential level is about 95 %, $k=2$)

 Note :

- Line (H) : Hot
- Line (N) : Neutral
- CL: Cable Loss
- LISN : LISN Factor
- P/L = Pulse Limiter Factor
- Result = Level + CL + LISN + P/L
- Margin = Limit – Result

Ex) In case

 Freq ; 0.5 MHz, level ; 30 dB(μ V), CL ; 0.2 dB, LISN ; 9.5 dB, P/L: 9.8 dB

Result = Level + CL + LISN + P/L

$$= 30 + 0.2 + 9.5 + 9.8 = 49.5$$

Margin = Limit – Result

$$= 79 - 49.5 = 29.5$$

See Appendix A (Conducted Emission)

2.4 Radiated Emission

The initial preliminary exploratory scans were performed over the measuring frequency range (30 MHz to 6 GHz) using a max hold mode incorporating a Peak detector and using the software of EMC32 (Version V8.53 from R&S). The final test data was measured using a Quasi-Peak detector below 1 GHz and Peak and CISPR Average detector above 1 GHz.

Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency.

2.4.1 Test Equipments

Equipment	Model	Manufacturer	Serial No	Cal Due. Date
EMI TEST RECEIVER	ESU26	R&S	100194	2016.08.20
BILOG ANTENNA	VULB 9163	SCHWARZBECK	9163-390	2017.04.16
Double Ridged Horn Antenna	HF907	R&S	100208	2017.08.31
AMPLIFIER	8447D	HP	2727A05143	2016.08.11
AMPLIFIER	SCU 18	R&S	10070	2017.02.15
3m SEMI-ANECHOIC CHAMBER	-	Will Tech	-	-

Note : The Antenna calibration period is 2 years, but the other equipment calibration period are 1 year.

2.4.2 Test Site

3m SEMI-ANECHOIC CHAMBER in Giheung 2 Laboratory

2.4.3 Environment Conditions & Test Results

① Below 1 GHz

Temperature : (Minimum 20.8, Maximum 21.9) °C

Humidity : (Minimum 40.0, Maximum 43.0) %R.H.

Atmospheric Pressure : (100.3) kPa

Test Date : July 11, 2016

② Above 1 GHz

Temperature : (Minimum 23.0, Maximum 24.0) °C

Humidity : (Minimum 46.0, Maximum 46.0) %R.H.

Atmospheric Pressure : (99.7) kPa

Test Date : July 12, 2016

2.4.4 Test Results

① Below 1 GHz

[Test Mode : HDMI]

Freq. (MHz)	Level (dB μ V)	Pol. (H/V)	A (°)	H (cm)	AF (dB/m)	CL (dB)	AG (dB)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
38.05	33.18	H	300	231	12.65	0.30	27.02	19.11	40.00	20.89
118.76	37.23	H	85	129	9.65	1.29	26.86	21.31	43.50	22.19
207.90	42.12	H	53	361	11.33	1.83	26.69	28.59	43.50	14.91
445.45	37.86	H	121	293	16.87	2.74	27.66	29.81	46.00	16.19
41.35	45.29	V	141	360	13.31	0.73	27.00	32.33	40.00	7.67
61.43	39.87	V	107	365	11.70	1.01	27.00	25.58	40.00	14.42
148.44	41.71	V	353	259	8.03	1.38	26.80	24.32	43.50	19.18

[Test Mode : MHL]

Freq. (MHz)	Level (dB μ V)	Pol. (H/V)	A ($^{\circ}$)	H (cm)	AF (dB/m)	CL (dB)	AG (dB)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
47.56	31.98	H	16	352	13.71	1.10	27.00	19.79	40.00	20.21
297.04	36.06	H	214	181	13.57	2.19	26.60	25.22	46.00	20.78
445.55	36.50	H	231	212	16.87	2.74	27.66	28.45	46.00	17.55
742.56	31.90	H	285	344	21.15	3.63	28.23	28.45	46.00	17.55
38.63	45.71	V	124	355	12.79	0.30	27.01	31.79	40.00	8.21
61.43	39.54	V	134	390	11.70	1.01	27.00	25.25	40.00	14.75
148.53	36.89	V	107	156	8.03	1.39	26.80	19.51	43.50	23.99
222.74	39.34	V	163	296	11.72	1.89	26.68	26.27	46.00	19.73

 Measurement Uncertainty (Horizontal) : 5.17 dB (The confidential level is about 95%, $k=2$)

 Measurement Uncertainty (Vertical) : 5.21 dB (The confidential level is about 95%, $k=2$)

② Above 1 GHz

[Test Mode : HDMI]

Freq. (MHz)	Level (dB μ V)	Pol. (H/V)	A ($^{\circ}$)	H (cm)	AF (dB)	CL (dB)	Amp. (dB)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Peak Detector										
1336.50	55.91	H	25	300	25.54	5.48	46.20	40.73	74.00	33.27
1485.00	53.72	H	224	200	26.26	6.04	46.43	39.59	74.00	34.41
1633.00	54.63	H	136	200	26.85	6.45	46.57	41.36	74.00	32.64
1336.00	56.52	V	33	200	25.54	5.48	46.20	41.34	74.00	32.66
1485.00	55.76	V	128	300	26.26	6.04	46.43	41.63	74.00	32.37
1782.00	53.04	V	52	100	27.44	6.83	46.42	40.89	74.00	33.11
Average Detector (C-AV)										
1336.50	44.98	H	25	300	25.54	5.48	46.20	29.80	54.00	24.20
1485.00	44.69	H	224	200	26.26	6.04	46.43	30.56	54.00	23.44
1633.00	45.18	H	136	200	26.85	6.45	46.57	31.91	54.00	22.09
1336.00	44.67	V	33	200	25.54	5.48	46.20	29.49	54.00	24.51
1485.00	43.26	V	128	300	26.26	6.04	46.43	29.13	54.00	24.87
1782.00	43.26	V	52	100	27.44	6.83	46.42	31.11	54.00	22.89

[Test Mode : MHL]

Freq. (MHz)	Level (dB(μ V))	Pol. (H/V)	A ($^{\circ}$)	H (cm)	AF (dB)	CL (dB)	Amp. (dB)	Result (dB(μ V/m))	Limit (dB(μ V/m))	Margin (dB)
Peak Detector										
1336.50	56.43	H	341	200	25.54	5.48	46.20	41.25	74.00	32.75
1485.00	51.36	H	309	200	26.26	6.04	46.43	37.23	74.00	36.77
1633.50	56.88	H	26	200	26.86	6.45	46.57	43.62	74.00	30.38
1485.00	53.63	V	317	100	26.26	6.04	46.43	39.50	74.00	34.50
1633.50	50.58	V	185	200	26.86	6.45	46.57	37.32	74.00	36.68
2228.00	51.63	V	67	300	28.97	7.76	45.73	42.63	74.00	31.37
Average Detector (C-AV)										
1336.50	49.97	H	341	200	25.54	5.48	46.20	34.79	54.00	19.21
1485.00	41.65	H	309	200	26.26	6.04	46.43	27.52	54.00	26.48
1633.50	52.14	H	26	200	26.86	6.45	46.57	38.88	54.00	15.12
1485.00	45.64	V	317	100	26.26	6.04	46.43	31.51	54.00	22.49
1633.50	41.71	V	185	200	26.86	6.45	46.57	28.45	54.00	25.55
2228.00	38.33	V	67	300	28.97	7.76	45.73	29.33	54.00	24.67

 Measurement Uncertainty (Horizontal) : 5.13 dB (The confidential level is about 95%, $k=2$)

 Measurement Uncertainty (Vertical) : 5.07 dB (The confidential level is about 95%, $k=2$)

Note 1: • AF = Antenna Factor • CL = Cable Loss • Amp = Amplifier Gain
 • POL (H) = Horizontal • POL (V) = Vertical • A : Angle
 • H : Height • Margin = Limit – Result • Result = Level + AF + CL – Amp

Ex) In case

 Freq ; 100 MHz, level ; 30 dB(μ V/m), AF ; 10 dB/m, CL ; 4 dB, Amp ; 25 dB

Result = Level + AF + CL – Amp

= 30 + 10 + 4 - 25

= 19

Margin = Limit – Result

= 43.5 – 19

= 24.5

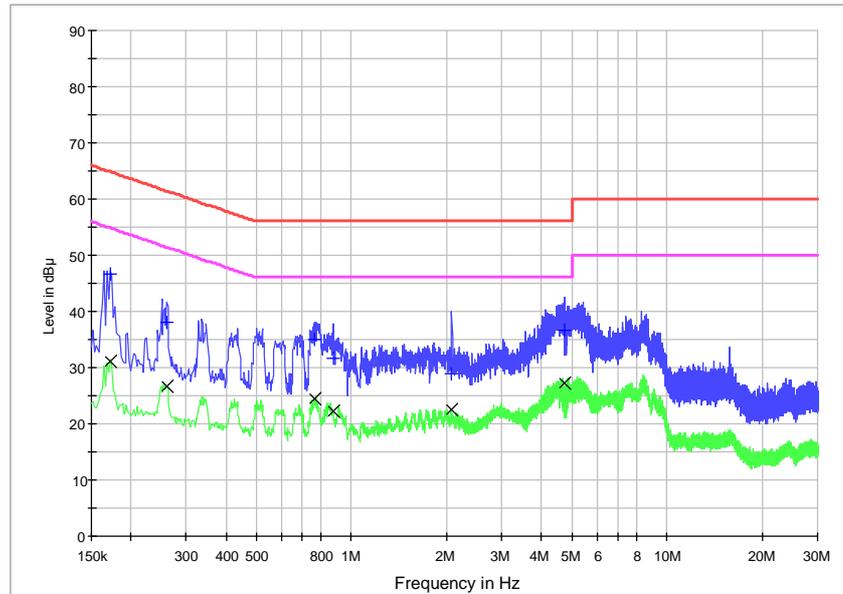
See Appendix B (Radiated Emission)

Appendix A : Conducted Emission

[Test Mode : HDMI]

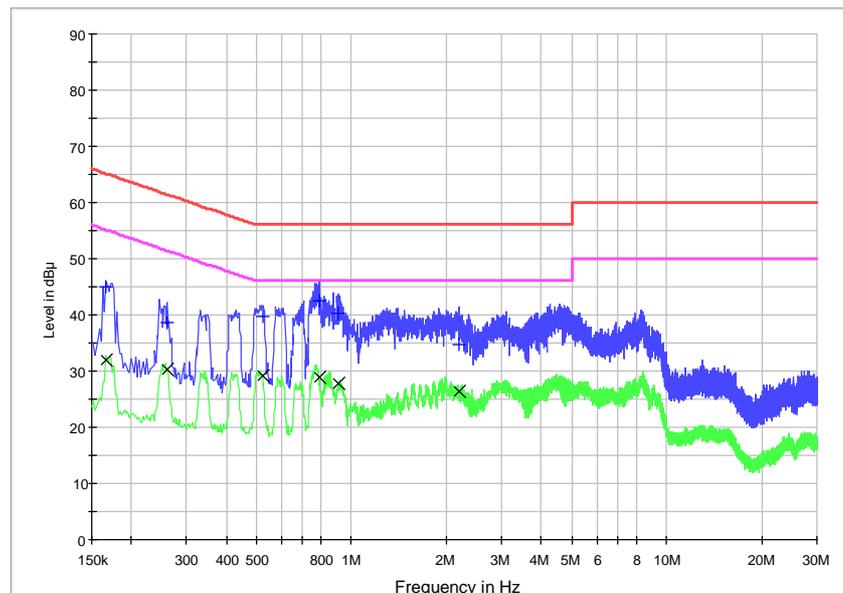
Line : HOT

LISN ENV216 (150kHz-30MHz) Pre



Line : Neutral

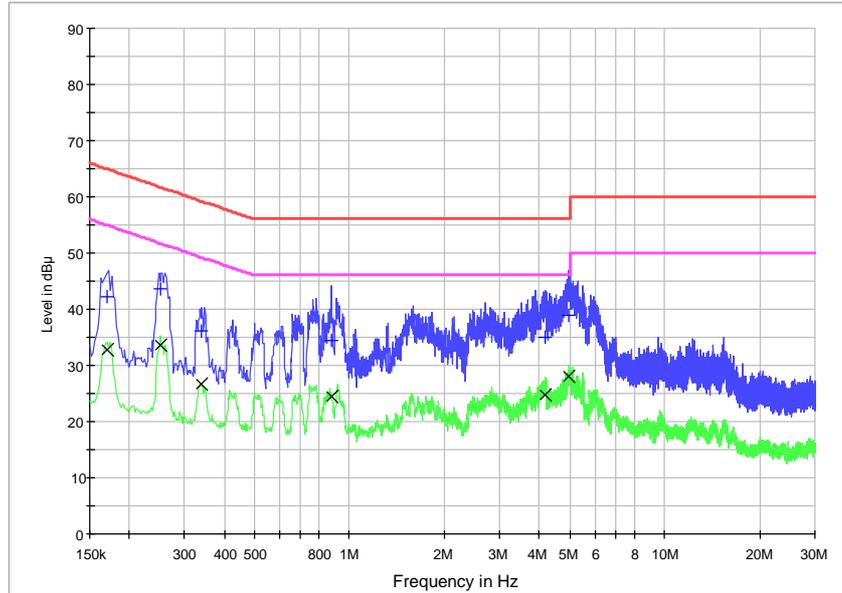
LISN ENV216 (150kHz-30MHz) Pre



[Test Mode : MHL]

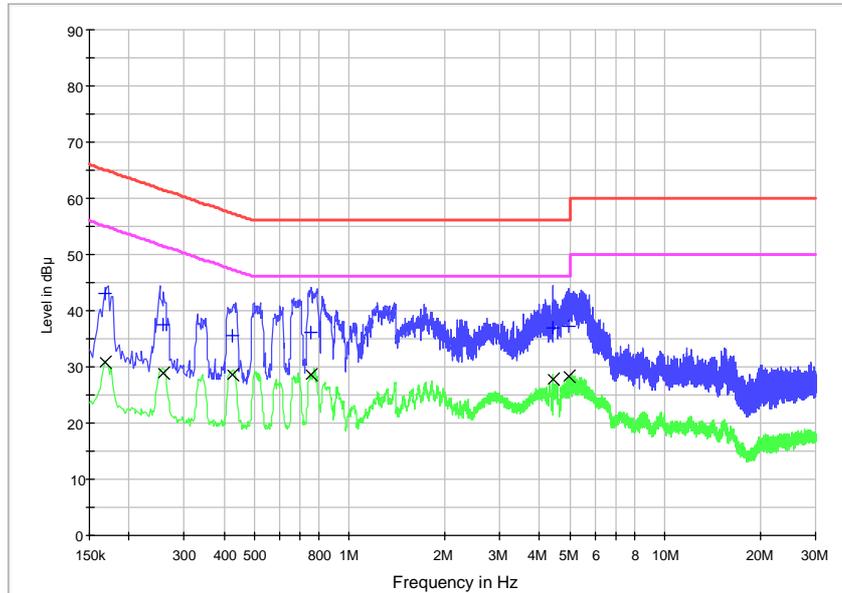
Line : HOT

LISN ENV216 (150kHz-30MHz) Pre



Line : Neutral

LISN ENV216 (150kHz-30MHz) Pre

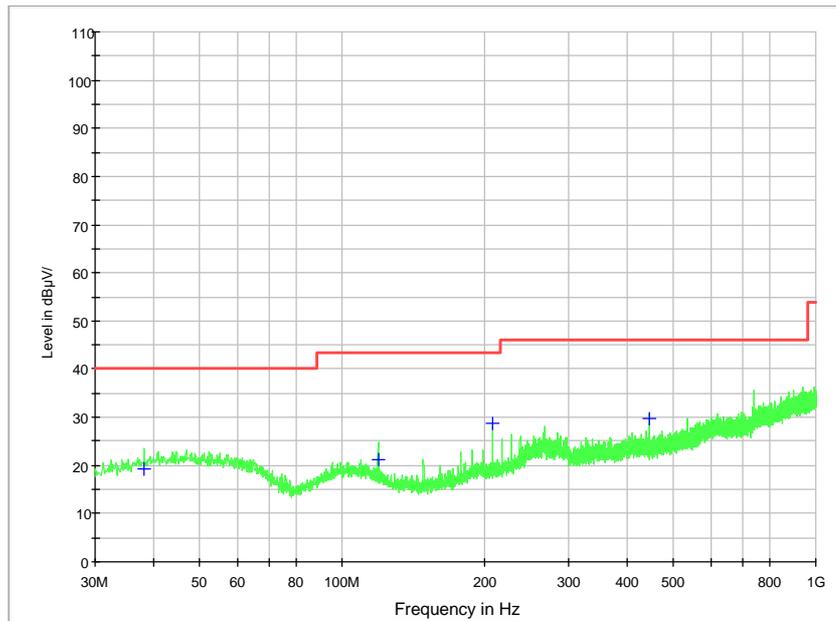


Appendix B : Radiated Emission

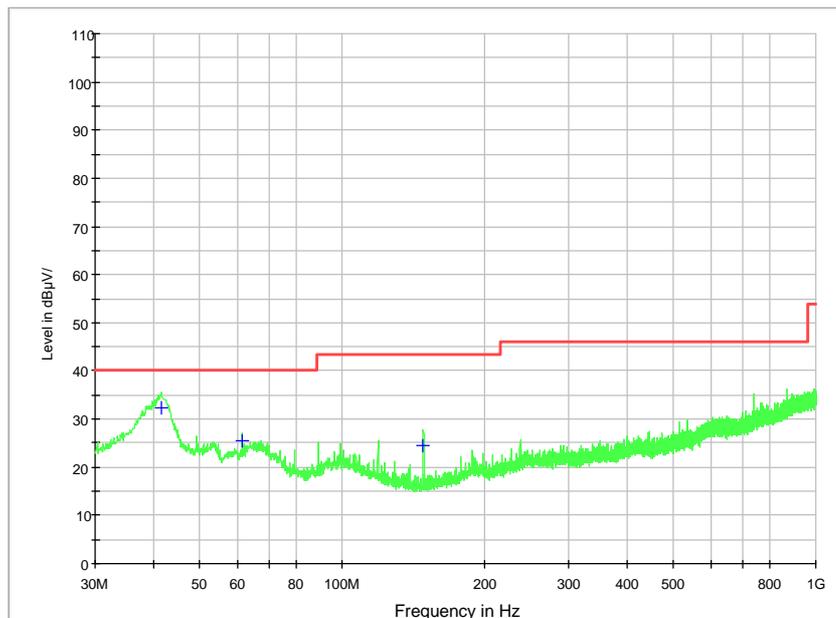
① Below 1 GHz

[Test Mode : HDMI]

[Horizontal]

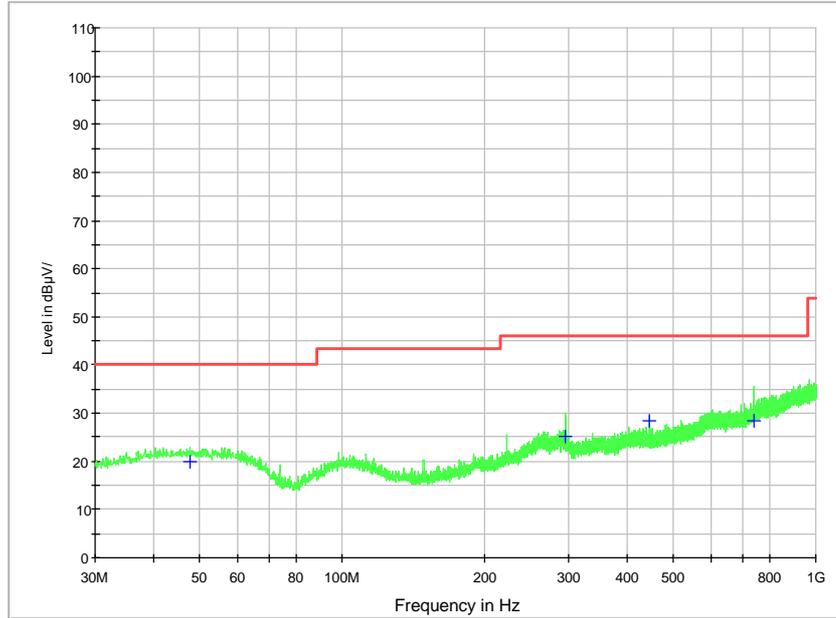


[Vertical]

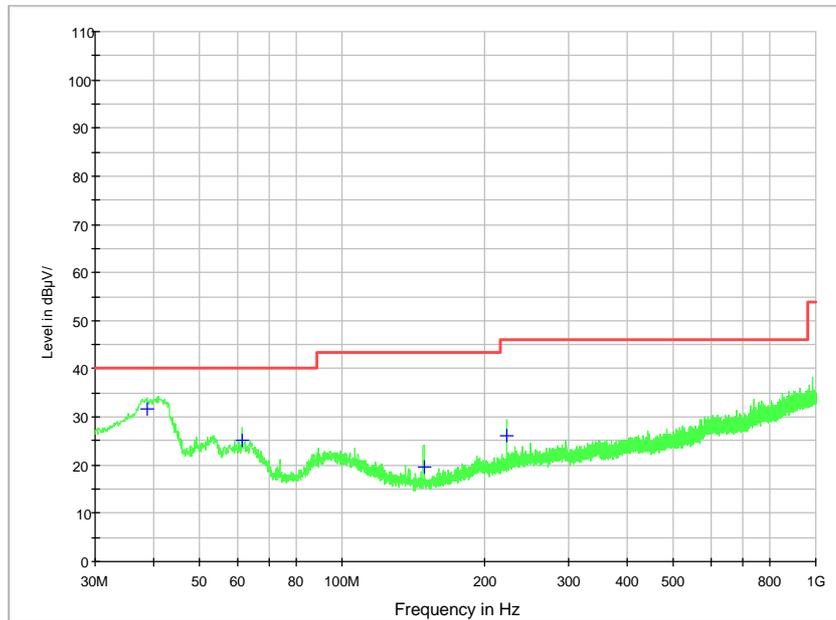


[Test Mode : MHL]

[Horizontal]



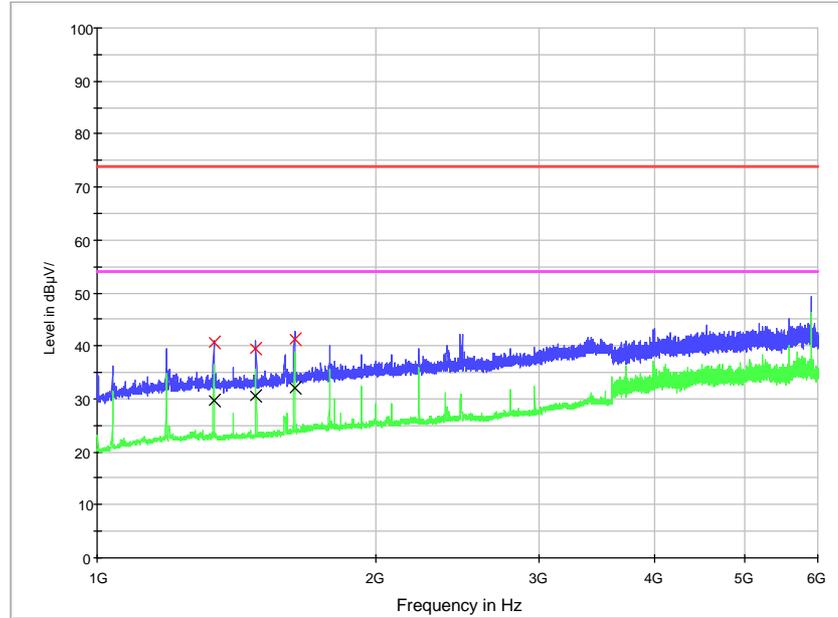
[Vertical]



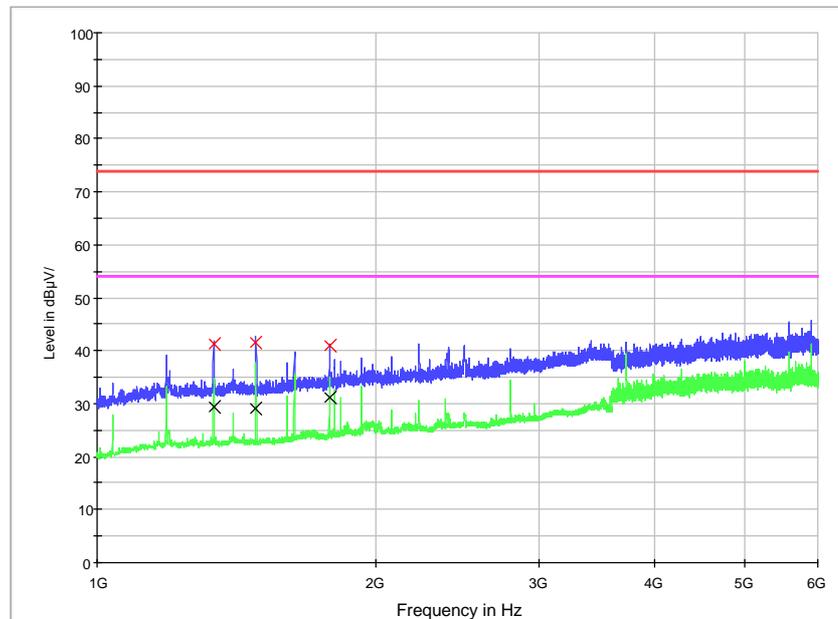
② Above 1 GHz

[Test Mode : HDMI]

[Horizontal]

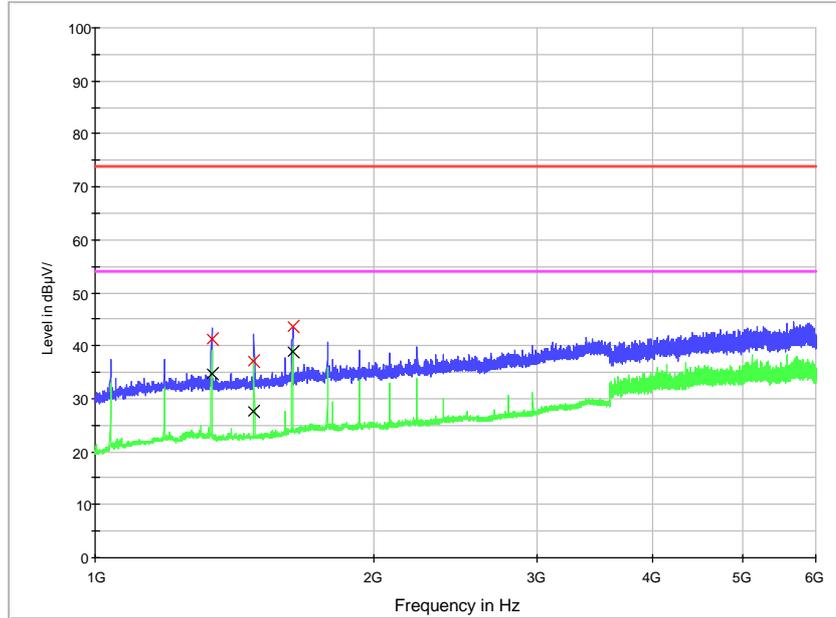


[Vertical]

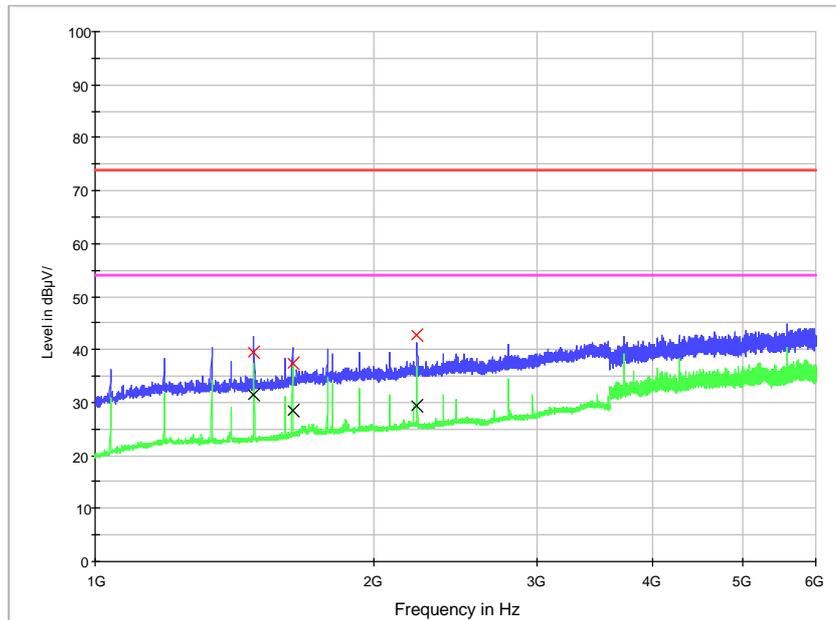


[Test Mode : MHL]

[Horizontal]



[Vertical]



- End of Test Report -