

EMC TEST REPORT

Project No.	LBE20161418	Issue No.	1
Applicant	Name of organization	Samsung Electronics Co., Ltd.	
	Address	(Maetan dong) 129, Samsung-ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do 16677 Korea	
	Date of application	April 15, 2016	
EUT	Kind of product	LED Monitor	
	Model No.	LH49QMFP	
		Variant Model No.	QM49F, LH49QMFPLGC, LH49QMFPLGC/**, SMT-4933, SMT-4933***** (The symbol "*" in the model name can be any alphanumeric character)
	Manufacturer	(Maetan dong) 129, Samsung-ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do 16677 Korea	
Applied Standards		EN 55032:2012/AC:2013	
		EN 55024:2010	
		EN 61000-3-2:2006+A1:2009+A2:2009	
		EN 61000-3-3:2013	
Test Period	April 22, 2016 ~ May 11, 2016		
Issue date	February 28, 2017		
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 : Kyung Yun Lee 		Reviewed by : Min Gon Kim 	

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1. Report Information

1.1 Revision history

No.	Revised detailed information
Issue 0 (May 13, 2016)	There are no revisions and this version is basic test report.
Issue 1 (February 28, 2017)	The variant models are added (SMT-4933, SMT-4933*****)

1.2 Sample calculation (example)

1.2.1 Conducted disturbance (at 10 MHz)

- Limit = 60 dB μ V (Quasi-peak limit)
- Level (50 dB μ V) = Meter Reading (40.2 dB μ V) + Factor (9.8 dB = AMN factor 9.7 dB + Cable loss 0.1 dB)
- Margin (10 dB) = Limit (60 dB μ V) - Level (50 dB μ V) = 10 dB below limit

1.2.2 Radiated disturbance (at 100 MHz)

- Limit = 30 dB μ V/m at 10 m
- Level (20 dB μ V/m)
 - = Meter Reading (40 dB μ V) + Factor (- 20 dB (1/m) = antenna factor + cable loss – amplifier gain)
- Margin (10 dB) = Limit (30 dB μ V/m) - Level (20 dB μ V/m) = 10 dB below limit

2. Summary of test results

2.1 Emission

The EUT has been tested according to the following specifications:

Applied	Test type	Applied standard	Result
☒	Conducted Emissions	EN 55032:2012/AC:2013 (☒ Class A, ☐ Class B)	Complied
☒	Radiated Emissions		Complied
☒	Harmonics current	EN 61000-3-2:2006 +A1:2009+A2:2009 (☐ Class A, ☒ Class D)	Complied
☒	Voltage fluctuation & Flicker	EN 61000-3-3:2013	Complied

2.2 Immunity

Immunity test applied the normative documents of EN55024:2010.

The EUT has been tested according to the following specifications:

Applied	Test type		Applied standard	Performance Criterion	
				Test Result	Specification
☒	Electrostatic discharge		EN61000-4-2:2009	A ☐ B ☒ C ☐	B
☒	Radiated, radio-frequency, electromagnetic field		EN61000-4-3:2006 +A1:2008+A2:2010	A ☒ B ☐ C ☐	A
☒	Electrical fast transient/burst		EN61000-4-4:2012	A ☒ B ☐ C ☐	B
☒	Surge		EN61000-4-5:2006	A ☒ B ☐ C ☐	B
☒	Radio-frequency conducted		EN61000-4-6:2014	A ☒ B ☐ C ☐	A
☒	Voltage dips, short interruptions and voltage variations	< 5%, 0.5P	EN61000-4-11:2004	A ☒ B ☐ C ☐	B
		70%, 25P	EN61000-4-11:2004	A ☒ B ☐ C ☐	C
		< 5%, 250P	EN61000-4-11:2004	A ☐ B ☒ C ☐	C

All immunity test was applied the above standard versions by customer's request instead of normative reference.

[Standard deviation 1] Electrical fast transient/burst immunity test was done according to EN 61000-4-4:2012 instead of EN 61000-4-4:2004.

[Standard deviation 2] Electrical fast transient/burst immunity test was done according to EN 61000-4-6:2014 instead of EN 61000-4-6:2009.

3. General Information

3.1 Test facility

The CS & Environment Centre is located on Samsung Electronics Co., Ltd. at (Maetan dong) 129, Samsung-ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do 16677 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 Centre is operated as EMC testing laboratory in accordance with the requirements of ISO/IEC 17025:2005.

4. Test Setup configuration

4.1 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	Note
LED Monitor	LH49QMFP	-	Samsung	EUT
PC	DM-V200	ZLPZ9WAZ800015D	Samsung	PC
USB Keyboard	SKG-300UB	TAKD500698	Samsung	For PC
USB Mouse	SC-1000	20-1EI01S501	Samsung	For PC
USB Memory	Cruzer	-	Sandisk	To EUT

4.2 EUT operating mode

To achieve compliance applied standard specification, the following mode(s) were made during compliance testing:

Operating Mode 1	DVI IN [Play moving color bar + Ping]
Operating Mode 2	HDMI IN [H-Scrolling +Digital White Noise + Ping]
Operating Mode 3	DP IN [Play moving color bar + Ping]

4.3 Details of Sampling

Customer selected, single unit.

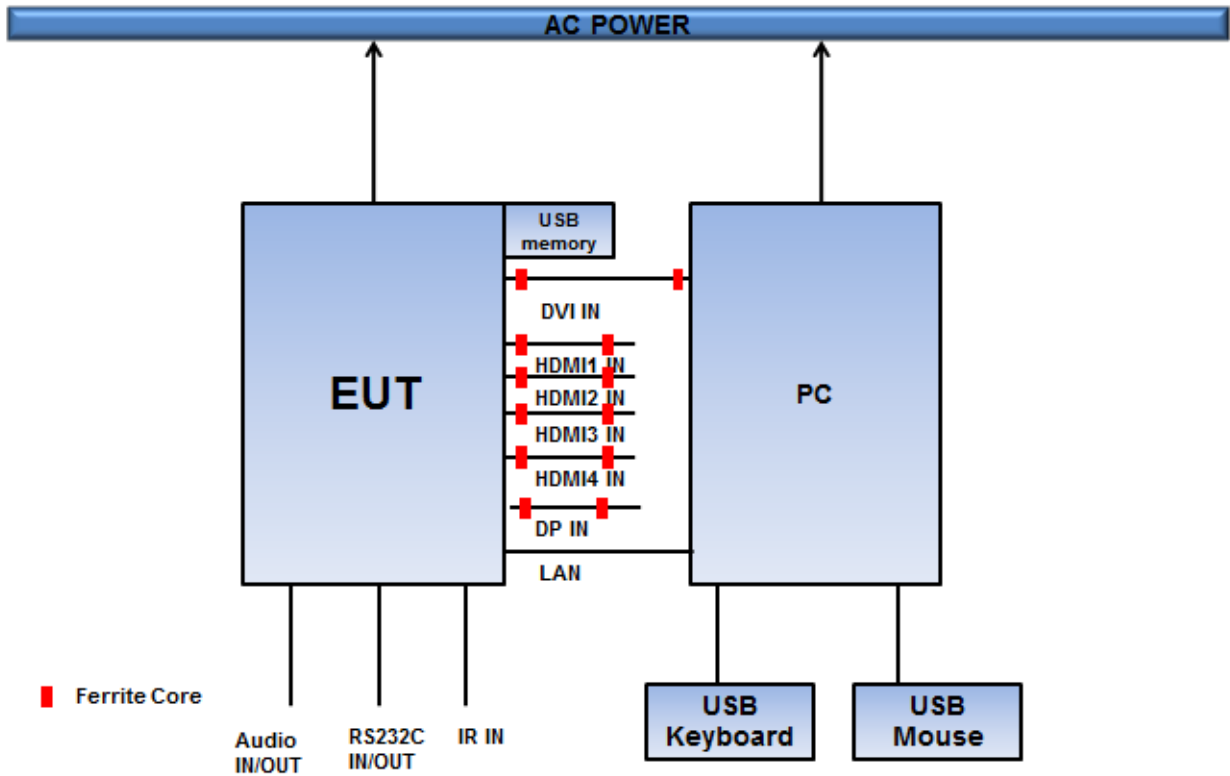
4.4 Used cable description

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
AC POWER	1.2	N	For EUT
DVI IN	1.2	Y*)	From EUT to PC
HDMI1 IN	1.2	Y*)	From EUT to PC
DP IN	1.2	Y*)	From EUT to PC
LAN	2.0	N	From EUT to PC
IR IN	1.2	N	Cable Termination
HDMI2 IN	1.2	Y*)	Cable Termination
HDMI3 IN	1.2	Y*)	Cable Termination
HDMI4 IN	1.2	Y*)	Cable Termination
Audio IN/OUT	1.2	N	Cable Termination
RS232C IN/OUT	1.2	N	Cable Termination

*) Ferrite cores used

4.5 Test Arrangement



4.6 EUT Description

The following features describe EUT represented by this report:

Items	Description
Horizontal Frequency(kHz)	30 ~ 80
Vertical Frequency(Hz)	60 ~ 75
Max Internal frequency	933 MHz (DDR3 Memory)

4.7 Clock Frequencies

Kind of Clocks	Frequency[MHz]
DDR3	933

4.8 Test configuration and condition

The EUT was performed by the EMI testing program in CS & Environment Centre.

1. Connect DVI output of PC on EUT's DVI IN port, play color bar with moving picture element according to ITU-R BT 471-1 on EUT's screen.
Also Ping test is conducted when the EUT has LAN during the test.
2. . Connect HDMI output of PC on EUT's HDMI IN port, H-scrolling on EUT's screen and play digital white noise.
Also Ping test is conducted when the EUT has LAN during the test.
3. Connect DP output of PC on EUT's DP IN port, play color bar with moving picture element according to ITU-R BT 471-1 on EUT's screen.
Also Ping test is conducted when the EUT has LAN during the test.

Cables were attached to each of the available I/O Ports. Where applicable, peripherals were attached to the I/O cables.

- **Testing Voltage : AC 230 V, 50 Hz**
- **Testing resolution : 1 920 X 1 080 @ 60 Hz**

4.9 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.)

Test type		Measurement uncertainty (C.L. 95 %, k = 2)
Conducted disturbance	Main terminal	3.54 dB
	Telecommunication	3.03 dB
Radiated Disturbance (30 MHz ~ 1 GHz)	Horizontal	4.89 dB
	Vertical	4.84 dB
Radiated Disturbance (1 GHz ~ 6 GHz)	Horizontal	3.89 dB
	Vertical	4.07 dB
Harmonics current		7.82 %
Voltage fluctuation & Flicker		6.33 %

4.10 Performance Criteria

During and/or after immunity testing, the EUT was monitored to the following performance criterion.

Criterion	Operating mode(s)	Description
A	1, 2, 3	No noticeable degradation or loss of function is allowed during the test. The EUT shall continue to operate as intended without operator intervention. The product conforms with the requirements of clause 7 of EN55024:2010. The product conforms with the requirements of Annex of EN55024:2010. ☐ Annex A ☒ Annex B ☒ Annex C ☐ Annex D ☐ Annex E
B	1, 2, 3	No noticeable degradation or loss of function is allowed after the test. The EUT shall continue to operate as intended without operator intervention. During the test, no degradation of performance is allowed. No change of operating state or stored data is allowed to persist after the test. The product conforms with the requirements of clause 7 of EN55024:2010. The product conforms with the requirements of Annex of EN55024:2010. ☐ Annex A ☒ Annex B ☒ Annex C ☐ Annex D ☐ Annex E
C	1, 2, 3	Loss of function is allowed, provided that the function is self recoverable or can be restored by the operation of the controls by the user. The product conforms with the requirements of clause 7 of EN55024:2010. The product conforms with the requirements of Annex of EN55024:2010. ☐ Annex A ☒ Annex B ☒ Annex C ☐ Annex D ☐ Annex E

※ During and/or after immunity testing for ANNEX C, the EUT was monitored by Burn-In software and ping-test command to evaluate the following performance criterion.

Criterion	Error rate / Protocol failure	Request for retry	Speed of data transmission rate	Loss of link
A	Below 10 %	Below 500 packets	Up to 10% of initial value	Without loss of link
B	Over 10% during test, but below 10% when the program restart after test	Over 500 packets during test, but below 500 packets when the program restart after test.	Over 10% of initial value during test, but below 10% of initial value when the program restart after test.	With loss of link and it recovers without user's operation
C	Over 10% during test and after test.	Over 500 packets during test and after test.	Over 10% of initial value during test and after test.	With loss of link and it recovers with user's operation

5. Results of individual test

5.1 Conducted emissions

Both conducted lines are measured in Quasi-Peak and C/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 emissions at the mains ports

Frequency range Limits(MHz)	Resolution Bandwidth(kHz)	Limits of Class A, dB(μV)		Limits of Class B, dB(μV)	
		Quasi-peak	C/Average	Quasi-peak	C/Average
0.15 ~ 0.50	9	79	66	66 ~ 56	56 ~ 46
0.50 ~ 5	9	73	60	56	46
5 ~ 30	9			60	50
NOTE 1 The lower limit shall apply at the transition frequency					
NOTE 2 The Class B limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.					

Limits of asymmetric mode conducted emissions

Frequency Range Limits (MHz)	Resolution Bandwidth (kHz)	Limits of Class A				Limits of Class B			
		Voltage, dB(μV)		Current, dB(μA)		Voltage, dB(μV)		Current, dB(μA)	
		Quasi-peak	C/Average	Quasi-peak	C/Average	Quasi-peak	C/Average	Quasi-peak	C/Average
0.15 ~ 0.50	9	97 ~ 87	84 ~ 74	53 ~ 43	40 ~ 30	84 ~ 74	74 ~ 64	40 ~ 30	30 ~ 20
0.50 ~ 30	9	87	74	43	30	74	64	30	20
NOTE 1 The limits decrease linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.									
NOTE 2 The current and voltage disturbance limits are derived for use with an impedance stabilization network (ISN) which presents a common mode (asymmetric mode) impedance of 0.15kΩ to the telecommunication port under test (conversion factor is 20 log ₁₀ 150/I = 44 dB).									

If the reading on the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 seconds at each measurement frequency, the highest reading shall be recorded, with the exception of any brief isolated high reading (which shall be ignored).

5.1.1 Test instrumentation

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Test Receiver	ESU08	R&S	100085	2015-05-20	12
Two Line V-Network	ENV216	R&S	100116	2015-09-04	12
Two Line V-Network	ESH3-Z5	R&S	100261	2015-06-12	12
Impedance Stabilization Network	ENY81	R&S	100121	2015-06-16	12
Test Software	EMC32	R&S	Ver 8.54.0	-	-

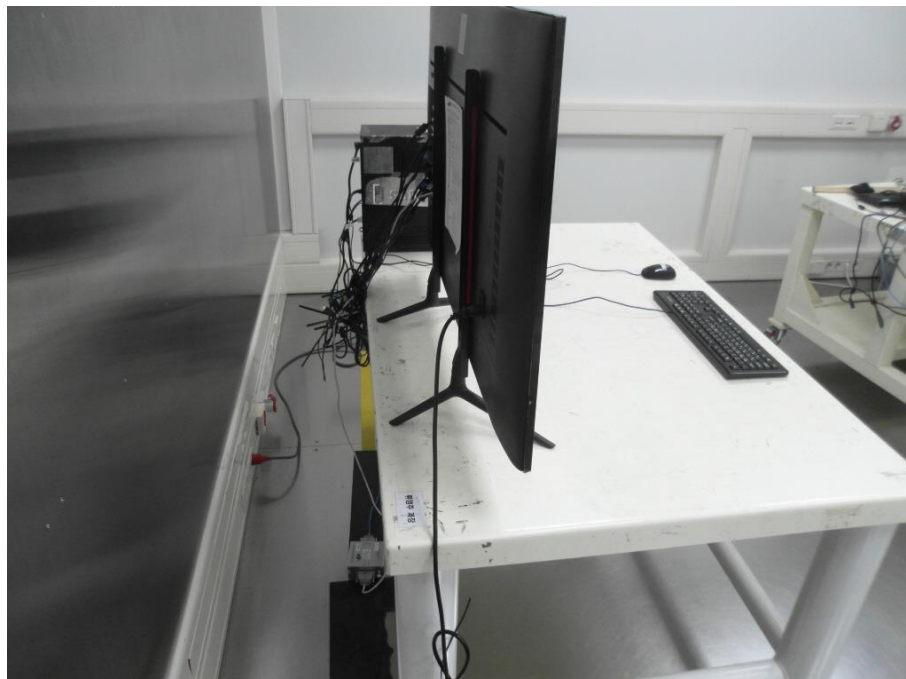
5.1.2 Temperature and humidity condition

Test date	April 22, 2016	Test engineer		Kyung Yun Lee	
Climate condition	Ambient temperature	23.1 ℃	Relative humidity	37.5 %	
	Atmospheric pressure	101.3 kPa			
Test place	Shielded Room #1				

5.1.3 Photograph of Test Setup



Front

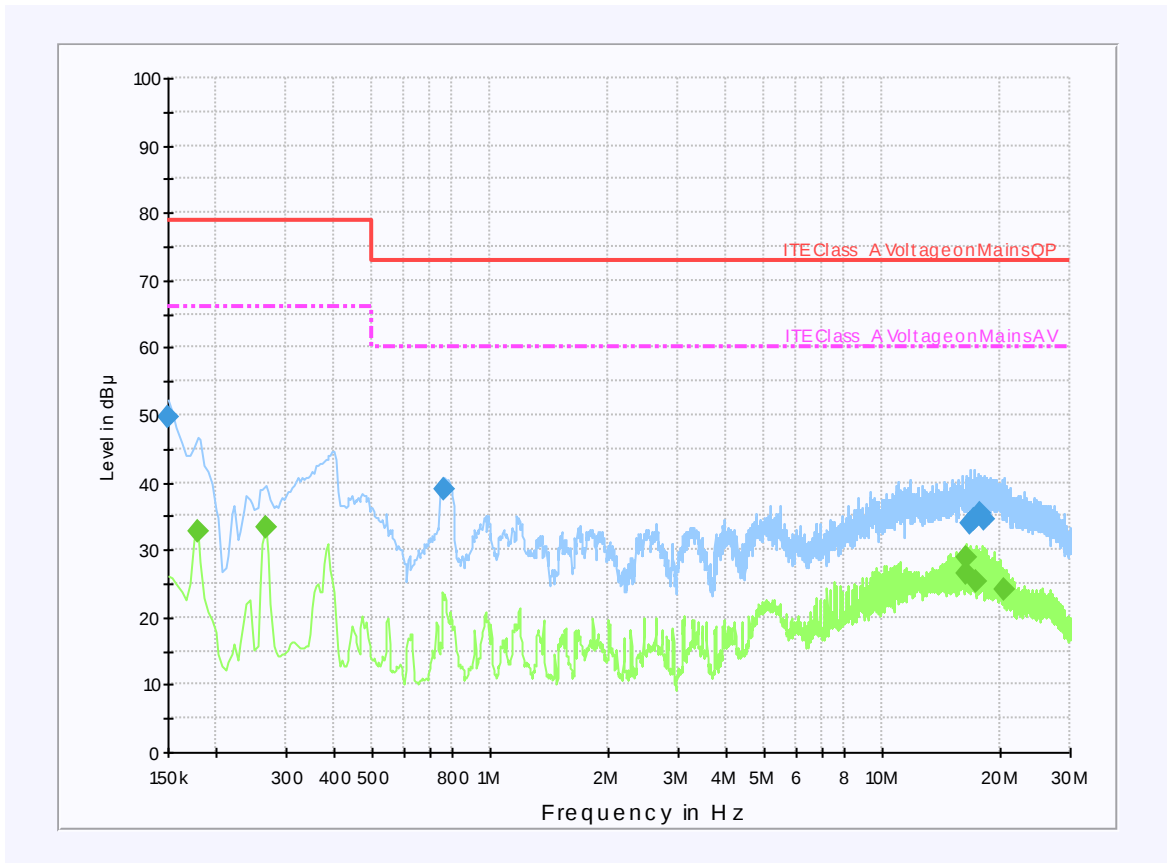


Rear

5.1.4 Test results (mains port)

- Operating Mode : 1

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 C/Average)

Quasi-peak final measurement results table

Frequency [MHz]	Quasi-Peak [dBμV]	Line	Factor [dB]	Margin [dB]	Limit [dBμV]
0.150	49.6	N	9.9	29.4	79.0
0.762	39.1	L1	10.1	33.9	73.0
16.636	33.9	L1	10.8	39.1	73.0
17.000	34.4	L1	10.8	38.6	73.0
17.664	35.4	L1	10.8	37.6	73.0
18.200	34.5	L1	10.8	38.5	73.0

C/Average final measurement results table

Frequency [MHz]	C/Average [dBμV]	Line	Factor [dB]	Margin [dB]	Limit [dBμV]
0.178	32.7	N	10.0	33.3	66.0
0.266	33.3	N	9.8	32.7	66.0
16.324	28.8	L1	10.8	31.2	60.0
16.332	26.4	L1	10.8	33.6	60.0
17.268	25.3	L1	10.8	34.7	60.0
20.348	24.0	L1	10.8	36.0	60.0

Note1) Level (Quasi-Peak and C/Average) = Meter Reading + Factor

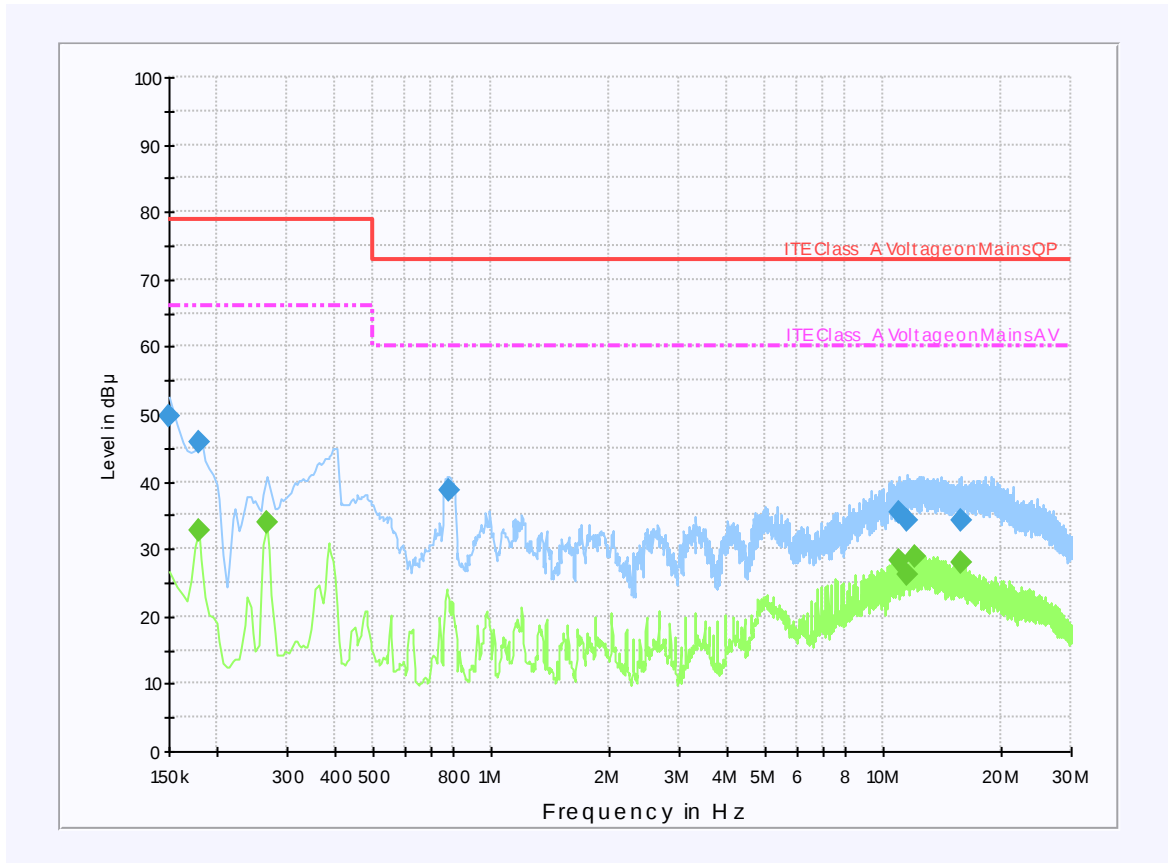
Note2) Line = Polarity of input power (Live or Neutral)

N : Abbreviation of Neutral Polarity, L1 : Abbreviation of Live Polarity,

Note3) Factor = LISN Insertion Loss + Cable Loss

Note4) Margin = Limit – Level (Quasi-Peak and C/Average)

Note5) C/Average : Abbreviation of CISPR-Average

- Operating Mode : 2**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 C/Average)

Quasi-peak final measurement results table

Frequency [MHz]	Quasi-Peak [dBμV]	Line	Factor [dB]	Margin [dB]	Limit [dBμV]
0.150	49.6	N	9.9	29.4	79.0
0.178	46.0	L1	10.0	33.0	79.0
0.778	38.6	L1	10.1	34.4	73.0
10.964	35.4	N	10.5	37.6	73.0
11.412	34.3	N	10.5	38.7	73.0
15.776	34.3	N	10.8	38.7	73.0

C/Average final measurement results table

Frequency [MHz]	C/Average [dBμV]	Line	Factor [dB]	Margin [dB]	Limit [dBμV]
0.178	32.9	N	10.0	33.1	66.0
0.266	33.9	N	9.8	32.1	66.0
10.964	28.3	N	10.5	31.7	60.0
11.412	26.3	N	10.5	33.7	60.0
12.040	28.9	N	10.5	31.1	60.0
15.776	27.8	L1	10.8	32.2	60.0

Note1) Level (Quasi-Peak and C/Average) = Meter Reading + Factor

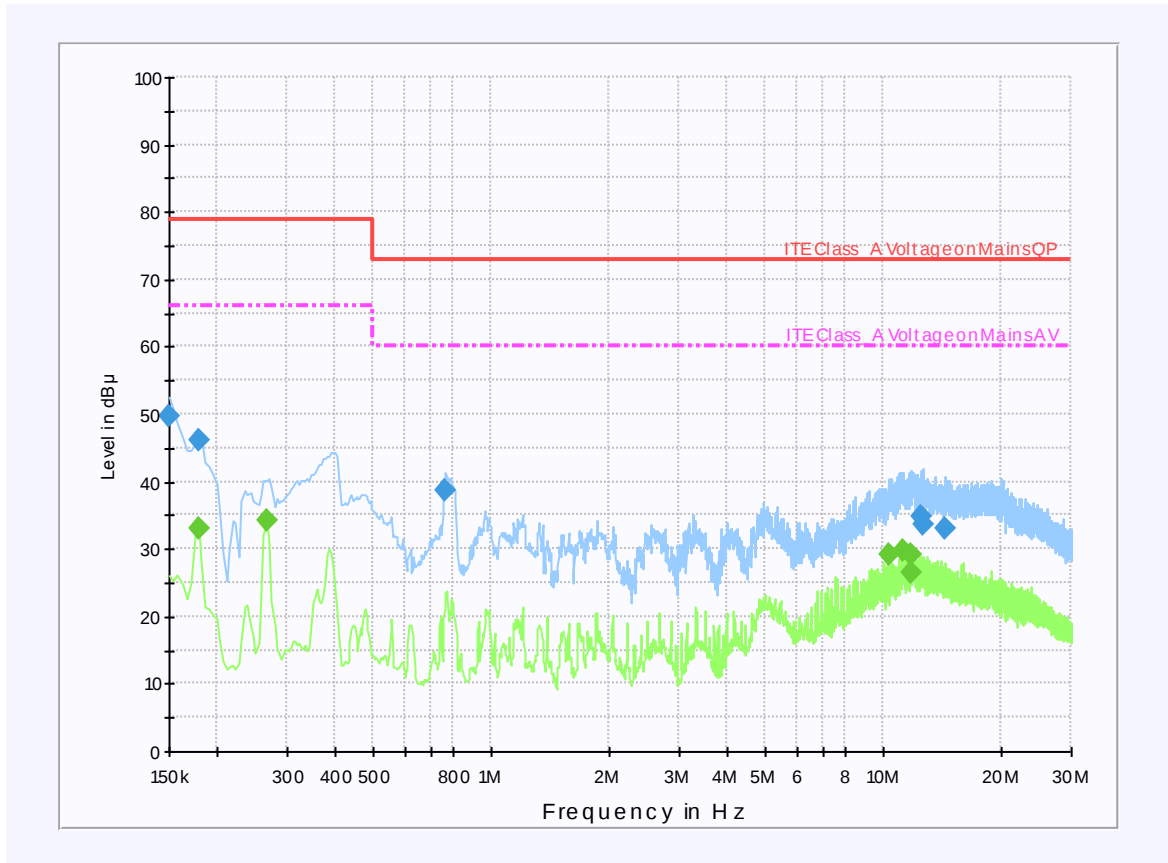
Note2) Line = Polarity of input power (Live or Neutral)

N : Abbreviation of Neutral Polarity, L1 : Abbreviation of Live Polarity,

Note3) Factor = LISN Insertion Loss + Cable Loss

Note4) Margin = Limit – Level (Quasi-Peak and C/Average)

Note5) C/Average : Abbreviation of CISPR-Average

- Operating Mode : 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 C/Average)

Quasi-peak final measurement results table

Frequency [MHz]	Quasi-Peak [dBμV]	Line	Factor [dB]	Margin [dB]	Limit [dBμV]
0.150	49.9	N	9.9	29.1	79.0
0.178	46.1	L1	10.0	32.9	79.0
0.762	38.8	L1	10.1	34.2	73.0
12.444	34.9	N	10.6	38.1	73.0
12.596	33.6	L1	10.6	39.4	73.0
14.388	33.1	N	10.7	39.9	73.0

C/Average final measurement results table

Frequency [MHz]	C/Average [dBμV]	Line	Factor [dB]	Margin [dB]	Limit [dBμV]
0.178	33.1	N	10.0	32.9	66.0
0.266	34.2	N	9.8	31.8	66.0
10.240	29.0	N	10.4	31.0	60.0
11.208	29.7	N	10.5	30.3	60.0
11.728	26.5	N	10.5	33.5	60.0
11.760	29.2	N	10.5	30.8	60.0

Note1) Level (Quasi-Peak and C/Average) = Meter Reading + Factor

Note2) Line = Polarity of input power (Live or Neutral)

N : Abbreviation of Neutral Polarity, L1 : Abbreviation of Live Polarity,

Note3) Factor = LISN Insertion Loss + Cable Loss

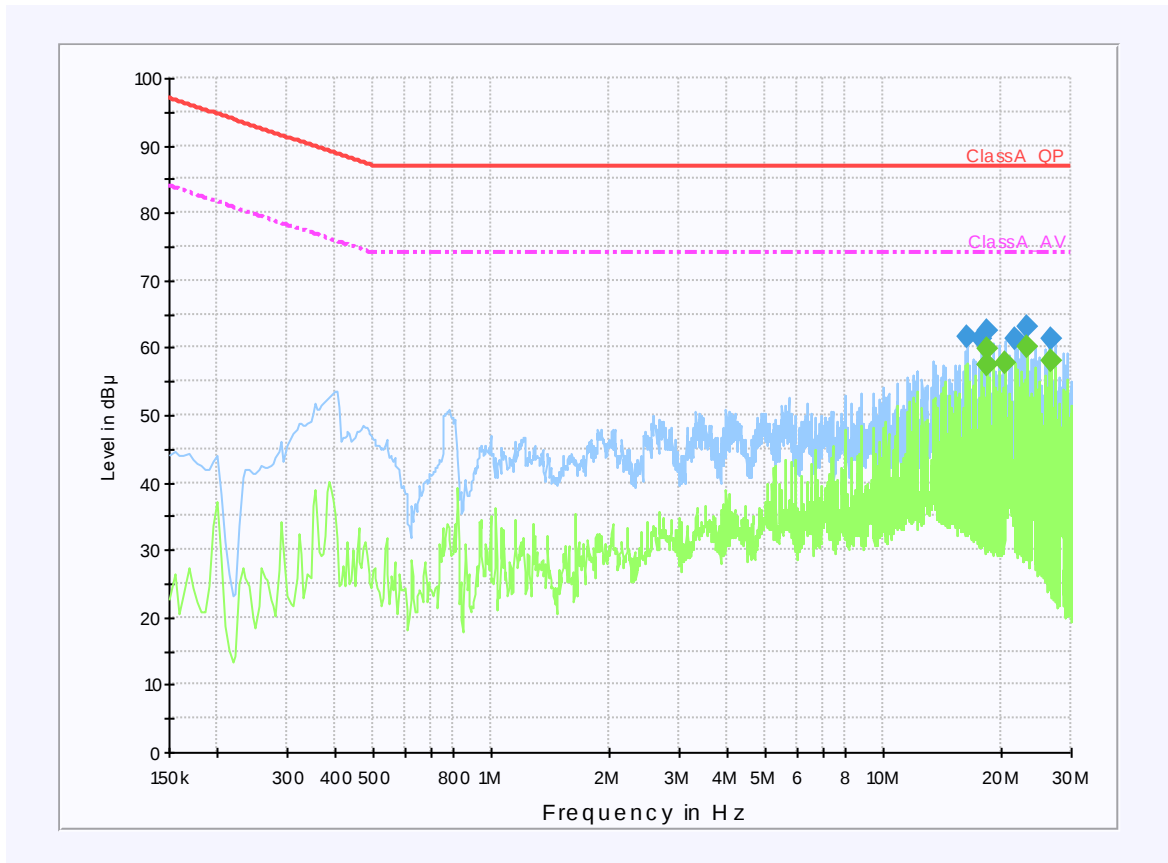
Note4) Margin = Limit – Level (Quasi-Peak and C/Average)

Note5) C/Average : Abbreviation of CISPR-Average

5.1.5 Test results (telecommunication port)

- Operating Mode : 100 M duplex LAN communication Mode

Test Graph



Test Results (Quasi-Peak and C/Average)

Quasi-peak final measurement results table

Frequency [MHz]	Quasi-Peak [dBμV]	Factor [dB]	Margin [dB]	Limit [dBμV]
16.228	61.7	9.9	25.3	87.0
17.695	61.2	10.0	25.8	87.0
18.244	62.5	10.0	24.5	87.0
21.664	61.4	10.1	25.6	87.0
23.126	63.1	10.1	23.9	87.0
26.609	61.2	10.2	25.8	87.0

C/Average final measurement results table

Frequency [MHz]	C/Average [dBμV]	Factor [dB]	Margin [dB]	Limit [dBμV]
18.244	59.8	10.0	14.2	74.0
18.302	57.5	10.0	16.5	74.0
18.365	57.5	10.0	16.5	74.0
20.260	57.8	10.0	16.2	74.0
23.126	60.1	10.1	13.9	74.0
26.609	58.1	10.2	15.9	74.0

Note1) Level (Quasi-Peak and C/Average) = Meter Reading + Factor

Note2) Factor = ISN Insertion Loss + Cable Loss

Note3) Margin = Limit – Level (Quasi-Peak and C/Average)

Note4) C/Average : Abbreviation of CISPR-Average

5.2 Radiated emissions

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 meters and elevated between 1 and 4 meters. Both vertical and horizontal antenna polarizations were measured.

Below 1 GHz, peak detector function mode for prescan was used with resolution bandwidth of 120 kHz and a video bandwidth of 300 kHz and sweep method.

The sweep time for prescan set below 200 ms up and final measurement with quasi-peak detector evaluated for suspected frequencies points, which are detected from prescan measurement.

Final measurements consisted of 3 steps.

First step, frequency fine tuning to find exact disturbance frequency.

Second step, rechecking to search for maximum height and azimuth for interference from EUT

In final step, there are conducted measuring with quasi-peak detector for points which are detected from 1st step & 2nd step.

Limits for Radiated emissions

Frequency range Limits (MHz)	Distance (m)	Resolution Bandwidth(kHz)	Quasi-peak Limits, dB(μV/m)	
			Class A	Class B
30 ~ 230	10	120	40	30
230 ~ 1 000		120	47	37
30 ~ 230	3	120	50	40
230 ~ 1 000		120	57	47

Peak measurements were made over the changeable frequency range 1 GHz to 6 GHz in accordance with internal maximum operating frequency at a measurement distance of 3 m for the following antenna and turntable arrangements:

Antenna Height(m)	Antenna Polarisation	Turntable position (degrees)
1.26	Horizontal, Vertical	Continuous

Limits above 1 GHz at a measurement distance of 3 m

Frequency range Limits (GHz)	Resolution Bandwidth (MHz)	Limits of Class A, dB(μ V/m)		Limits of Class B, dB(μ V/m)	
		Peak	C/Average	Peak	C/Average
1 ~ 3	1	76	56	70	50
3 ~ 6	1	80	60	74	54
NOTE The lower limit shall apply at the transition frequency					

Measurements within 20 dB of the limit were then maximized by adjusting turntable position. Final measurements were made using an C/Average detector.

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

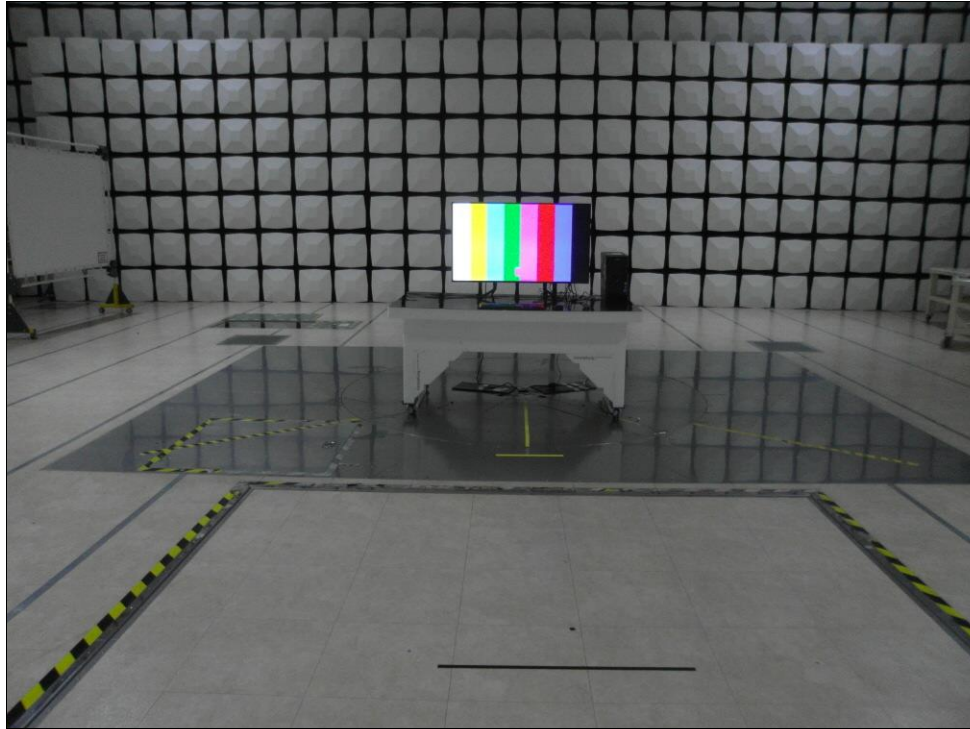
5.2.1 Test instrumentation

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Bilog Antenna	CBL6112D	Schaffner	22603	2015-06-15	24
Bilog Antenna	CBL6112D	Schaffner	22601	2015-06-15	24
Test receiver	ESCI	R&S	100368	2015-08-13	12
Test receiver	ESCI	R&S	100136	2015-09-25	12
Amplifier	310N	Sonoma	251675	2016-02-05	12
Amplifier	310N	Sonoma	251676	2015-07-10	12
Horn Antenna	HF907	R&S	100016	2015-05-07	24
Test receiver	ESU26	R&S	100132	2015-09-11	12
Preamplifier	SCU 18	R&S	10049	2015-12-08	12
RF Selector	NS4900	TOYO	-	-	-
Ant. Mast	MA4000	inn-co	-	-	-
Ant. Mast	MA4000	inn-co	-	-	-
Ant. Mast	MA2000	inn-co	-	-	-
Mast Controller	CO2000	inn-co	CO2000/545/ 23341109/L	-	-
Mast Controller	CO2000	inn-co	CO2000/190/ 9271204/L	-	-
Mast Controller	CO2000	inn-co	CO2000/189/ 9271204/L	-	-
Test Software	EP5/RE	TOYO	Ver 5.3.7	-	-

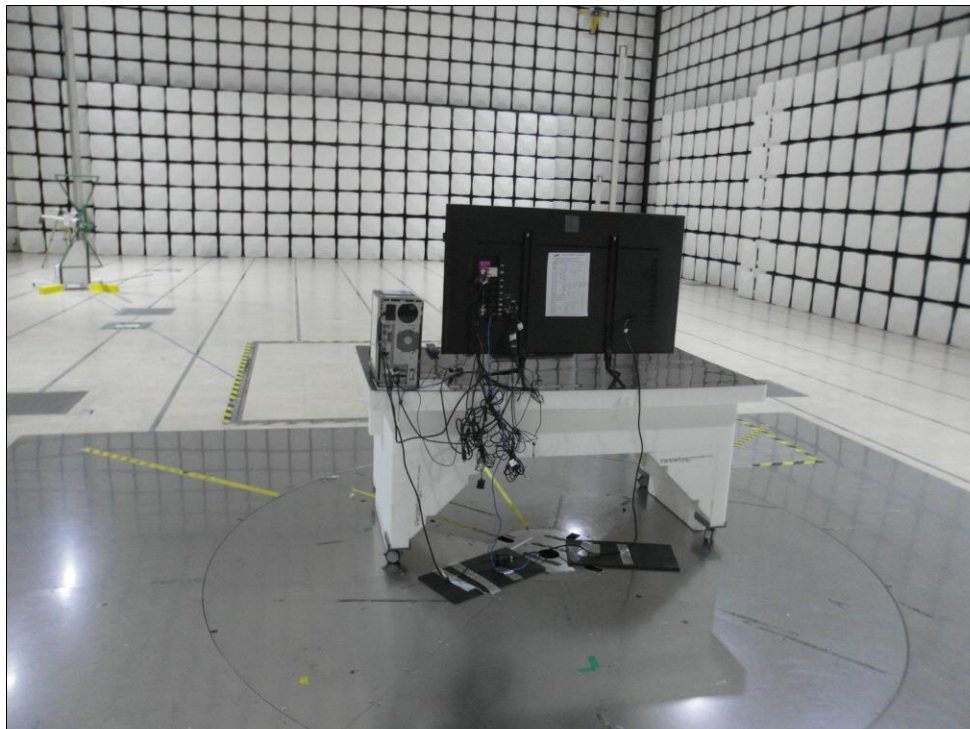
5.2.2 Temperature and humidity condition

Test date	April 25, 2016	Test engineer		Kyung Yun Lee	
Climate condition	Ambient temperature	22.7 °C	Relative humidity		29.8 %
	Atmospheric pressure	101.2 kPa			
Test place	10 m Semi-Anechoic Chamber				

5.2.3.1 Photograph of Test Setup (30 MHz ~ 1 000 MHz)

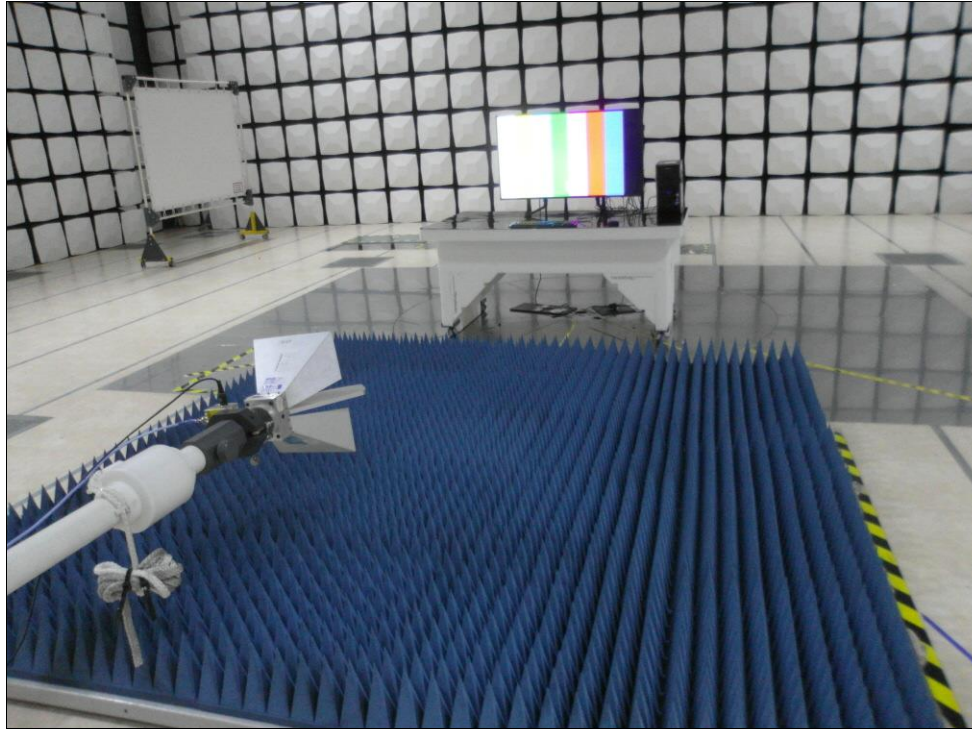


Front

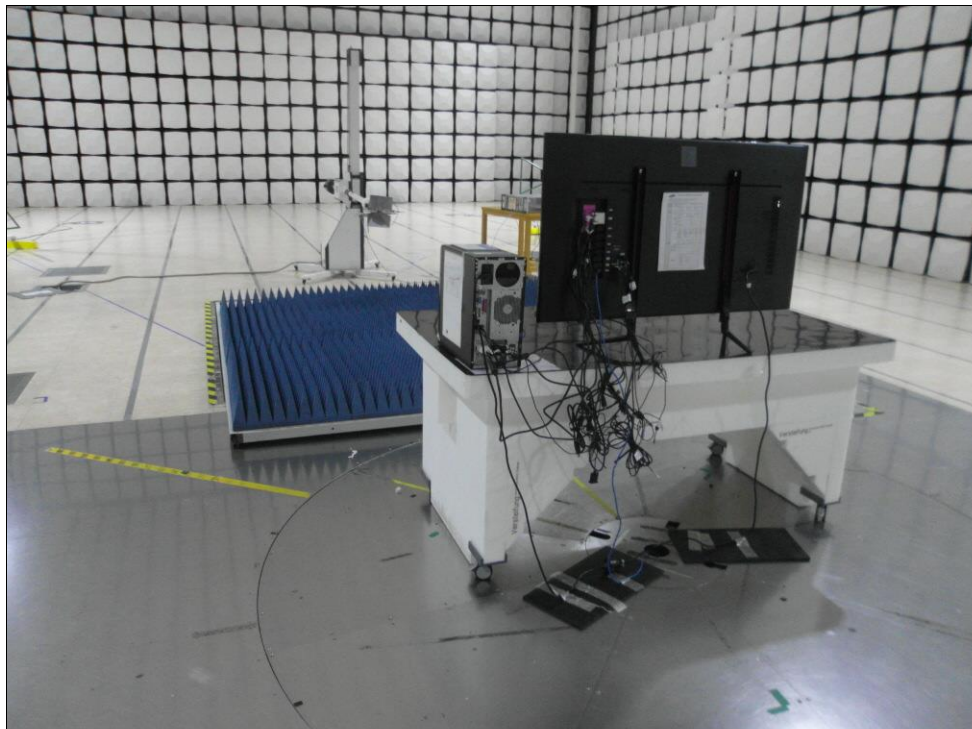


Rear

5.2.3.2 Photograph of Test Setup (Above 1 GHz)



Front

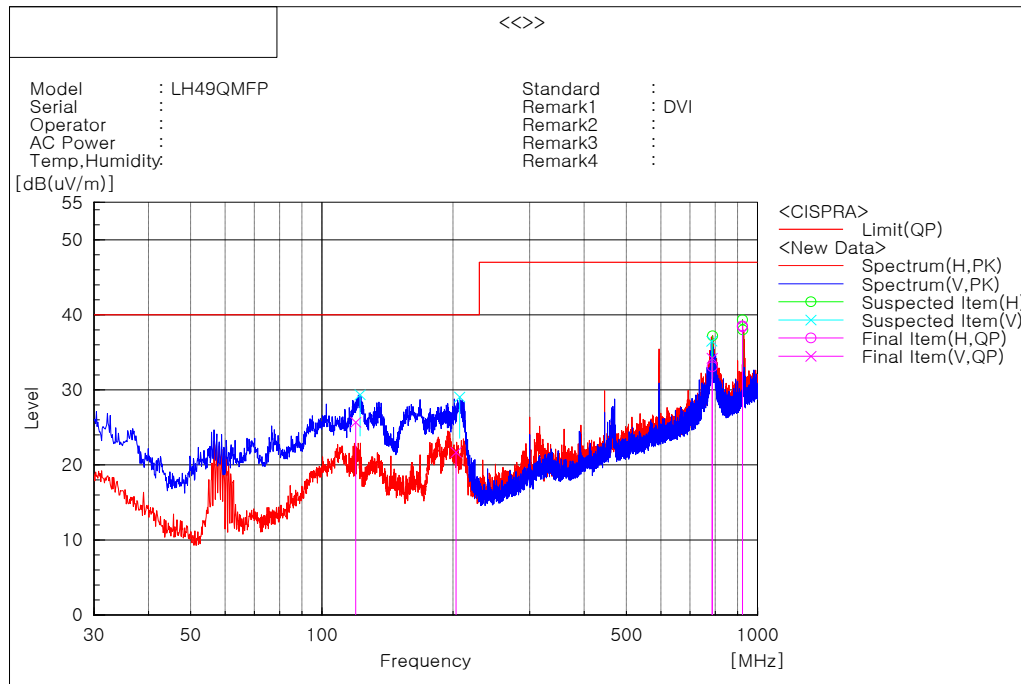


Rear

5.2.4 Test results

5.2.4.1 30 MHz ~ 1 000 MHz results

- Operating Mode : 1



Frequency [MHz]	(P) 1)	Reading QP 2) [dB(μV)]	Factor 3) [dB(1/m)]	Level QP 4) [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP 5) [dB]	Height [cm]	Angle [deg]
119.531	V	43.8	-17.4	26.4	40.0	13.6	113.0	292.4
203.246	V	41.5	-19.4	22.1	40.0	17.9	101.0	233.9
786.601	V	38.9	-4.9	34.0	47.0	13.0	153.0	164.9
787.620	H	37.5	-4.7	32.8	47.0	14.2	100.0	256.9
923.700	H	40.5	-2.6	37.9	47.0	9.1	226.0	162.4
923.700	H	40.4	-2.6	37.8	47.0	9.2	238.0	164.9

Note1) (P) : Abbreviation of Antenna Polarity

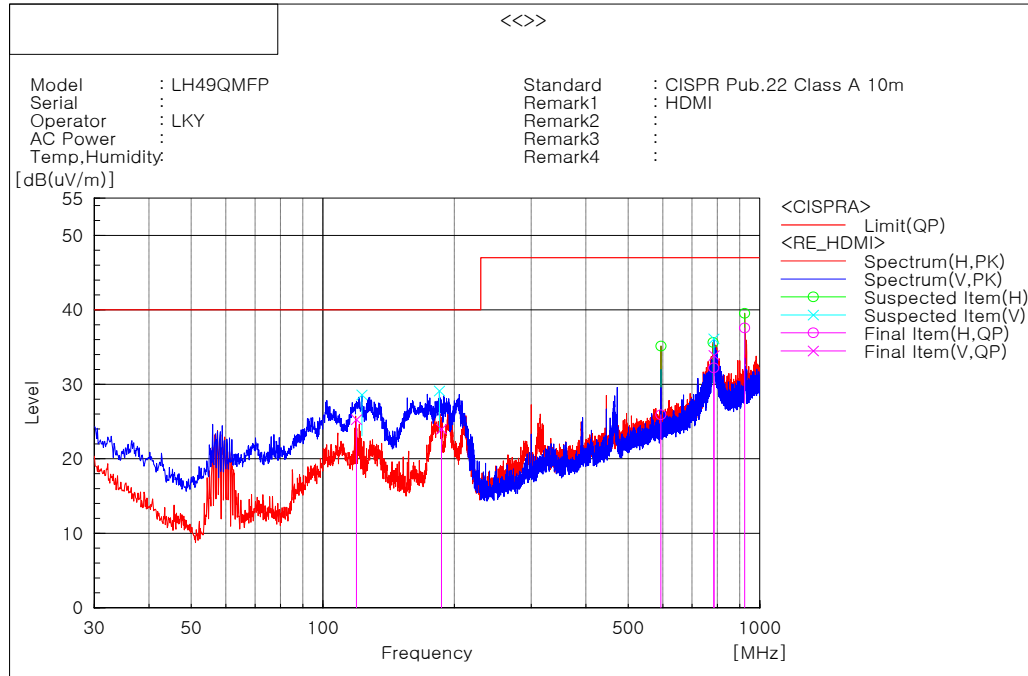
Note2) Reading QP : Received raw Quasi-peak signal

Note3) Factor = Antenna factor + Cable loss – Amplifier gain

Note4) Level QP = Reading QP + Factor, Real signal Quasi-peak level

Note5) Margin QP = Limit – Level QP

QP : Abbreviation of Quasi-peak

- Operating Mode : 2

Frequency [MHz]	(P) ₁₎	Reading QP ₂₎ [dB(μV)]	Factor ₃₎ [dB(1/m)]	Level QP ₄₎ [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP ₅₎ [dB]	Height [cm]	Angle [deg]
119.361	V	43.4	-17.4	26.0	40.0	14.0	111.0	280.1
186.808	V	43.9	-19.9	24.0	40.0	16.0	100.0	313.3
593.901	H	32.7	-7.1	25.6	47.0	21.4	102.0	156.1
784.551	H	36.6	-4.8	31.8	47.0	15.2	100.0	261.2
786.154	V	38.7	-4.9	33.8	47.0	13.2	168.0	154.0
923.705	H	39.6	-2.6	37.0	47.0	10.0	102.0	253.2

Note1) (P) : Abbreviation of Antenna Polarity

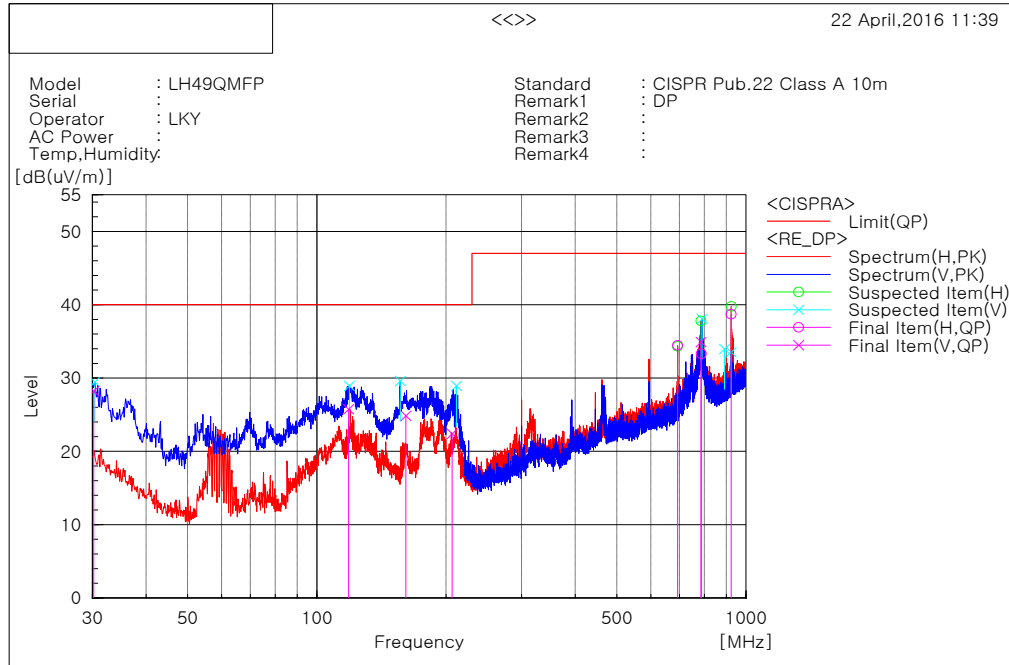
Note2) Reading QP : Received raw Quasi-peak signal

Note3) c.f = Antenna factor + Cable loss – Amplifier gain

Note4) Result QP = Reading QP + Factor, Real signal Quasi-peak level

Note5) Margin QP = Limit – Level QP

QP : Abbreviation of Quasi-peak

- Operating Mode : 3

Frequency [MHz]	(P) ₁₎	Reading QP ₂₎ [dB(μV)]	Factor ₃₎ [dB(1/m)]	Level QP ₄₎ [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP ₅₎ [dB]	Height [cm]	Angle [deg]
30.209	V	41.8	-12.5	29.3	40.0	10.7	101.0	23.6
118.599	V	43.8	-17.5	26.3	40.0	13.7	100.0	276.5
161.197	V	44.2	-19.1	25.1	40.0	14.9	100.0	1.0
206.553	V	42.1	-19.4	22.7	40.0	17.3	102.0	301.9
692.774	H	40.6	-6.4	34.2	47.0	12.8	100.0	258.7
785.579	V	39.7	-4.9	34.8	47.0	12.2	154.0	159.8
786.518	H	37.7	-4.8	32.9	47.0	14.1	250.0	256.7
923.686	H	40.7	-2.6	38.1	47.0	8.9	237.0	163.8

Note1) (P) : Abbreviation of Antenna Polarity

Note2) Reading QP : Received raw Quasi-peak signal

Note3) c.f = Antenna factor + Cable loss – Amplifier gain

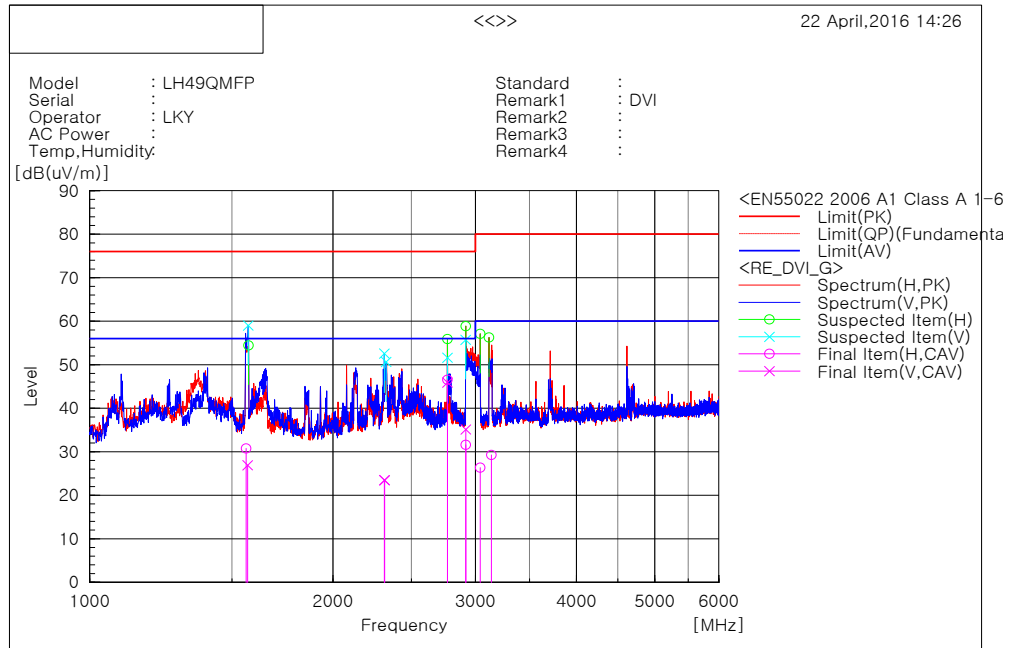
Note4) Result QP = Reading QP + Factor, Real signal Quasi-peak level

Note5) Margin QP = Limit – Level QP

QP : Abbreviation of Quasi-peak

5.2.4.2 Above 1 GHz results

- Operating Mode : 1



Peak Measurement

Frequency [MHz]	POL	Reading AV [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Limit [dB(uV/m)]	Margin AV [dB]	Height [cm]	Angle [deg]
1 571.000	V	70.2	-11.3	58.9	76.0	17.1	126.0	263.6
1 572.000	H	65.6	-11.3	54.3	76.0	21.7	126.0	94.3
2 315.000	V	61.2	-8.9	52.3	76.0	23.7	126.0	263.6
2 326.000	V	59.3	-8.8	50.5	76.0	25.5	126.0	263.6
2 771.000	H	63.1	-7.4	55.7	76.0	20.3	126.0	206.6
2 771.000	V	58.8	-7.4	51.4	76.0	24.6	126.0	189.1
2 918.000	V	62.4	-6.8	55.6	76.0	20.4	126.0	189.1
2 919.000	H	65.6	-6.8	58.8	76.0	17.2	126.0	169.9
3 041.000	H	63.3	-5.7	57.6	80.0	22.4	126.0	94.3
3 118.000	H	62.1	-5.1	57.0	80.0	23.0	126.0	169.9

C/Average Measurement

Frequency [MHz]	POL	Reading AV [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Limit [dB(uV/m)]	Margin AV [dB]	Height [cm]	Angle [deg]
1 561.870	H	42.0	-11.4	30.6	56.0	25.4	126.0	95.0
1 568.500	V	38.1	-11.3	26.8	56.0	29.2	126.0	264.2
2 314.360	V	32.1	-8.9	23.2	56.0	32.8	126.0	263.1
2 316.210	V	32.1	-8.9	23.2	56.0	32.8	126.0	263.1
2 771.180	V	53.1	-7.4	45.7	56.0	10.3	126.0	189.5
2 771.190	H	53.7	-7.4	46.3	56.0	9.7	126.0	207.1
2 918.550	H	38.3	-6.8	31.5	56.0	24.5	126.0	170.5
2 918.740	V	41.8	-6.8	35.0	56.0	21.0	126.0	189.5
3 041.720	H	32.5	-5.7	26.8	60.0	33.2	126.0	95.0
3 139.440	H	35.0	-5.0	30.0	60.0	30.0	126.0	169.4

Note) Receiving antenna polarization : Horizontal and Vertical

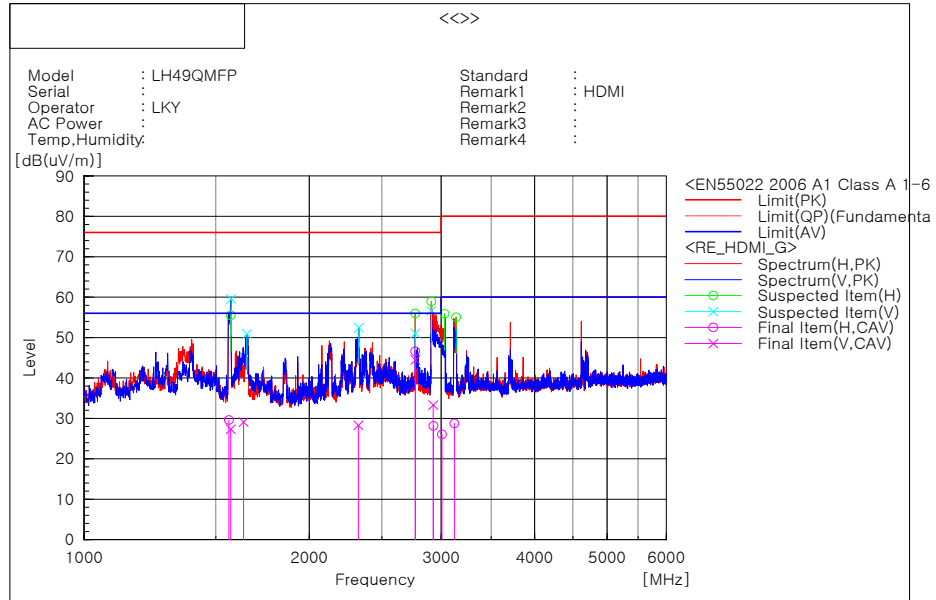
Level PK (Peak) = Reading PK(Peak) + Factor(Antenna Factor + Cable Loss - Amp. Gain)

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

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

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

* C/Average : Abbreviation of CISPR-Average

- Operating Mode : 2**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]
1 571.000	H	66.7	-11.3	55.4	76.0	20.6	126.0	95.3
1 572.000	V	70.8	-11.3	59.5	76.0	16.5	126.0	264.5
1 650.000	V	61.6	-10.7	50.9	76.0	25.1	126.0	226.6
2 328.000	V	61.1	-8.8	52.3	76.0	23.7	126.0	226.6
2 771.000	V	58.3	-7.4	50.9	76.0	25.1	126.0	189.9
2 771.000	H	63.2	-7.4	55.8	76.0	20.2	126.0	207.5
2 911.000	H	65.7	-6.9	58.8	76.0	17.2	126.0	95.3
2 911.000	V	63.3	-6.9	56.4	76.0	19.6	126.0	189.9
3 033.000	H	62.1	-5.8	56.3	80.0	23.7	126.0	95.3
3 142.000	H	60.7	-5.0	55.7	80.0	24.3	126.0	169.8

C/Average Measurement

Frequency [MHz]	POL	Reading AV [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Limit [dB(uV/m)]	Margin AV [dB]	Height [cm]	Angle [deg]
1 561.560	H	40.8	-11.4	29.4	56.0	26.6	126.0	96.0
1 570.320	V	38.5	-11.3	27.2	56.0	28.8	126.0	263.9
1 633.640	V	39.9	-10.8	29.1	56.0	26.9	126.0	226.0
2 325.260	V	36.9	-8.8	28.1	56.0	27.9	126.0	226.0
2 771.100	H	53.8	-7.4	46.4	56.0	9.6	126.0	206.9
2 771.330	V	51.7	-7.4	44.3	56.0	11.7	126.0	189.2
2 927.490	V	39.9	-6.7	33.2	56.0	22.8	126.0	189.2
2 930.540	H	34.7	-6.7	28.0	56.0	28.0	126.0	96.0
3 008.750	H	32.3	-6.0	26.3	60.0	33.7	126.0	96.0
3 125.810	H	34.5	-5.1	29.4	60.0	30.6	126.0	169.2

Note) Receiving antenna polarization : Horizontal and Vertical

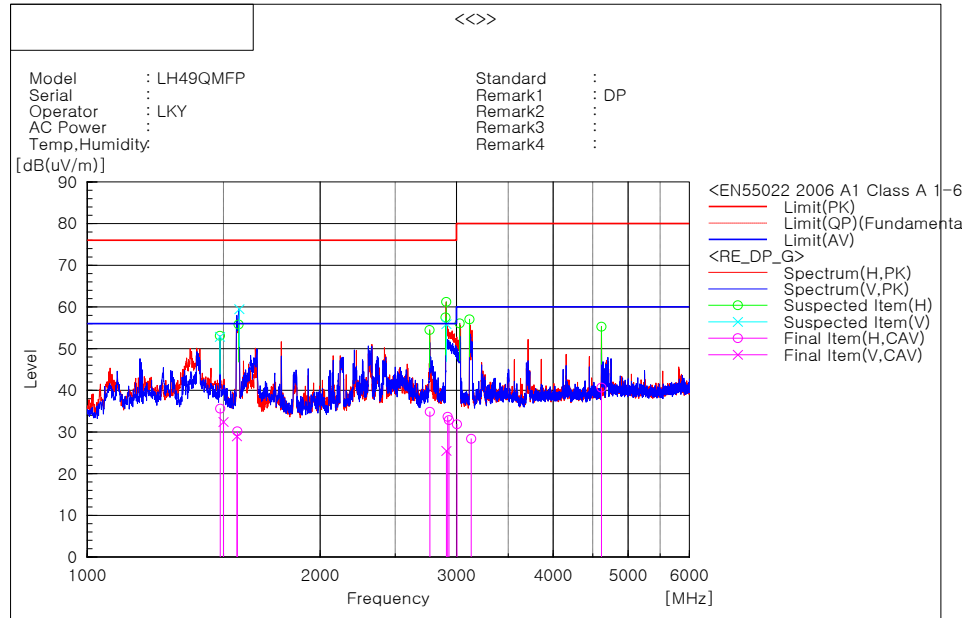
Level PK (Peak) = Reading PK(Peak) + Factor(Antenna Factor + Cable Loss - Amp. Gain)

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

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

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

* C/Average : Abbreviation of CISPR-Average

- Operating Mode : 3**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]
1 484.000	V	64.4	-11.7	52.7	76.0	23.3	126.0	132.4
1 484.000	H	64.7	-11.7	53.0	76.0	23.0	126.0	264.4
1 569.000	H	67.0	-11.3	55.7	76.0	20.3	126.0	189.8
1 572.000	V	70.7	-11.3	59.4	76.0	16.6	126.0	132.4
2 770.000	H	61.7	-7.4	54.3	76.0	21.7	126.0	301.3
2 904.000	H	64.2	-6.9	57.3	76.0	18.7	126.0	226.5
2 910.000	H	67.9	-6.9	61.0	76.0	15.0	126.0	189.8
2 911.000	V	62.6	-6.9	55.7	76.0	20.3	126.0	94.6
3 029.000	H	62.3	-5.8	56.5	80.0	23.5	126.0	189.8
3 118.000	H	62.8	-5.1	57.7	80.0	22.3	126.0	264.4
4 618.000	H	58.6	-3.1	55.5	80.0	24.5	126.0	264.4

C/Average Measurement

Frequency [MHz]	POL	Reading AV [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Limit [dB(uV/m)]	Margin AV [dB]	Height [cm]	Angle [deg]
1 485.270	H	47.2	-11.7	35.5	56.0	20.5	126.0	263.9
1 499.950	V	43.9	-11.7	32.2	56.0	23.8	126.0	131.9
1 560.710	V	40.2	-11.4	28.8	56.0	27.2	126.0	131.9
1 563.190	H	41.4	-11.4	30.0	56.0	26.0	126.0	189.1
2 771.240	H	42.0	-7.4	34.6	56.0	21.4	126.0	300.6
2 911.090	V	32.2	-6.9	25.3	56.0	30.7	126.0	94.0
2 922.800	H	40.3	-6.8	33.5	56.0	22.5	126.0	225.8
2 933.840	H	39.4	-6.7	32.7	56.0	23.3	126.0	189.1
3 004.140	H	38.1	-6.0	32.1	60.0	27.9	126.0	189.1
3 135.140	H	34.1	-5.0	29.1	60.0	30.9	126.0	263.9
4 618.360	H	43.9	-3.0	40.9	60.0	19.1	126.0	263.9

Note) Receiving antenna polarization : Horizontal and Vertical

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

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

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

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

* C/Average : Abbreviation of CISPR-Average

5.3 Harmonics current

The EUT operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.

The power consumption, steady state harmonic currents were measured in the tested operating mode(s).

The basic test procedure was in accordance with the applied standard of clause 2.1.

5.3.1 Test instrumentation

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Universal Power Analyser	PM6000A	VOLTECH	200006700364	2015-07-24	12
Reference Impedance Network	NI2415	Zimmer Electronic	A0412051	2015-07-24	12
Test Software	IEC61000	Voltech	Ver 1.24.12	-	-
Firmware	PM6000	Voltech	Ver 1.22.07RC6	-	-

5.3.2 Temperature and humidity condition

Test date	May 9, 2016	Test engineer		Kyung Yun Lee	
Climate condition	Ambient temperature	23.1 °C	Relative humidity		38.7 %
	Atmospheric pressure	101.2 kPa			
Test place	Shielded Room #3				

5.3.3 Photograph of Test setup



5.3.4 Test results

- Operating Mode : 2

Test Results

Product: LFD Serial no: Description: Test Date: 2016 May 9 3:25pm Result Name: HEM_LH49QMFP		2016 May 9 3:29pm Page 1 of 1
Type of Test: EN61000:2006 Harmonics inc. interharmonics to EN61000-4-7:2002 Limits: Class D Power Analyzer: Voltech PM6000 SN: 200006700364 Firmware version: v1.22.07RC6 Channel(s): 1. SN: 090015501131, 28 Adjusted Date: 1 JUN 2015. 2. SN: 090015500945, 28 Adjusted Date: 2 JUN 2015. 3. SN: 090015501189, 28 Adjusted Date: 2 JUN 2015. 4. SN:None Adjusted Date:None 5. SN:None Adjusted Date:None 6. SN:None Adjusted Date:None Shunt(s): 1. SN: 091024301096, 4 Adjusted Date: 4 JUN 2015. 2. SN: 091024301097, 4 Adjusted Date: 4 JUN 2015. 3. SN: 091024301098, 4 Adjusted Date: 4 JUN 2015. 4. SN:None Adjusted Date:None 5. SN:None Adjusted Date:None 6. SN:None Adjusted Date:None AC Source: Mains / Manual Source		
Harmonic Results Against Chosen Limits: PASS	Notes:	
Test Parameter Details	User Entered	Measured
Operating Frequency:	50	49.9840
Operating Voltage:	230	230.3611
Specified Power:	100.0000	108.5321
Fundamental Current:	0.0000	0.4817
Power Factor:	0.0000	0.9160
Average Input Current:		0.5134
Maximum POHC:		0.0042
POHC Limit:		0.0430
Maximum THC:		0.1861
Minimum Power:	75	
Class Multiplier:	1.0000	
Test Duration:	00:02:30	

Product:	LFD	2016 May 9 4:28pm
Serial no:		Page 1 of 1
Description:		
Result Name:	HEM_LH49QMFP	
Voltech IEC61000-3 Windows Software 1.24.12	Test Date:	2016 May 9 3:25pm
Type of Test:	Fluctuating Harmonics Test - Worst Case Table (2006)	
Power Analyzer:	Voltech PM6000 SN: 200006700364 Firmware version: v1.22.07RC6	
Channel(s):	1. SN: 090015501131, 28 Adjusted Date: 1 JUN 2015. 2. SN: 090015500945, 28 Adjusted Date: 2 JUN 2015. 3. SN: 090015501189, 28 Adjusted Date: 2 JUN 2015. 4. SN: None Adjusted Date: None 5. SN: None Adjusted Date: None 6. SN: None Adjusted Date: None	
Shunt(s):	1. SN: 091024301096, 4 Adjusted Date: 4 JUN 2015. 2. SN: 091024301097, 4 Adjusted Date: 4 JUN 2015. 3. SN: 091024301098, 4 Adjusted Date: 4 JUN 2015. 4. SN: None Adjusted Date: None 5. SN: None Adjusted Date: None 6. SN: None Adjusted Date: None	
AC Source:	Mains / Manual Source	
Overall Result:	PASS	

Class	Class D
Class Multiplier	1

Harm	Limit 1	Limit 2	Average Reading	<L1 <L2	Max Reading	<L2	Pass FAIL	Harm	Limit 1	Limit 2	Average Reading	<L1 <L2	Max Reading	<L2	Pass FAIL
2	None	None	8.926mA		12.00mA		N/A	3	340.0mA	510.0mA	184.5mA	✓✓	184.9mA	✓	Pass
4	None	None	6.908mA		7.717mA		N/A	5	190.0mA	285.0mA	10.67mA	✓✓	11.45mA	✓	Pass
6	None	None	1.761mA		2.209mA		N/A	7	100.0mA	150.0mA	1.443mA	N/A	2.101mA	N/A	N/A
8	None	None	0.683mA		0.945mA		N/A	9	50.00mA	75.00mA	5.621mA	✓✓	5.851mA	✓	Pass
10	None	None	0.482mA		0.668mA		N/A	11	35.00mA	52.50mA	5.203mA	✓✓	5.378mA	✓	Pass
12	None	None	0.404mA		0.512mA		N/A	13	29.61mA	44.42mA	2.756mA	N/A	2.860mA	N/A	N/A
14	None	None	0.439mA		0.582mA		N/A	15	25.66mA	38.50mA	0.903mA	N/A	0.969mA	N/A	N/A
16	None	None	0.417mA		0.526mA		N/A	17	22.64mA	33.97mA	2.506mA	N/A	2.589mA	N/A	N/A
18	None	None	0.362mA		0.448mA		N/A	19	20.26mA	30.39mA	2.236mA	N/A	2.303mA	N/A	N/A
20	None	None	0.393mA		0.521mA		N/A	21	18.33mA	27.50mA	1.339mA	N/A	1.388mA	N/A	N/A
22	None	None	0.387mA		0.468mA		N/A	23	16.73mA	25.10mA	1.299mA	N/A	1.364mA	N/A	N/A
24	None	None	0.496mA		0.582mA		N/A	25	15.40mA	23.10mA	1.581mA	N/A	1.634mA	N/A	N/A
26	None	None	0.335mA		0.373mA		N/A	27	14.25mA	21.38mA	1.408mA	N/A	1.468mA	N/A	N/A
28	None	None	0.404mA		0.484mA		N/A	29	13.27mA	19.91mA	1.052mA	N/A	1.100mA	N/A	N/A
30	None	None	0.382mA		0.493mA		N/A	31	12.41mA	18.62mA	1.432mA	N/A	1.503mA	N/A	N/A
32	None	None	0.354mA		0.475mA		N/A	33	11.66mA	17.50mA	1.404mA	N/A	1.478mA	N/A	N/A
34	None	None	0.369mA		0.434mA		N/A	35	11.00mA	16.50mA	1.025mA	N/A	1.115mA	N/A	N/A
36	None	None	0.399mA		0.519mA		N/A	37	10.40mA	15.60mA	1.003mA	N/A	1.073mA	N/A	N/A
38	None	None	0.372mA		0.439mA		N/A	39	9.871mA	14.80mA	1.321mA	N/A	1.370mA	N/A	N/A
40	None	None	0.363mA		0.415mA		N/A								

<L1 : Reading is below limit 1.

<L2 : Reading is below limit 2.

N/A : Harmonic current below 0.6% of rated current or 5mA, whichever is greater, are disregarded.

5.4 Voltage fluctuation & Flicker

The EUT operated to produce the most unfavorable sequence of voltage changes under normal operating conditions. During the flicker measurement, the measure time shall include that part of whole operation cycle in which the EUT produce the most unfavorable sequence of voltage changes.

Limits of voltage fluctuations and flicker at the supply terminals

Short-term flicker indicator, Pst	Relative steady-state voltage change, dc	Value of $d(t)$ during a voltage change, $d(t) > 3.3\%$	Maximum relative voltage change, d_{max}
1.0	3.3 %	500 ms	· 4 % : without additional conditions · 6 % : switched manually, or switched automatically more frequently than twice per day, and also has either a delayed restart · 7 % : attended whilst in use, or switched on automatically, or is intended to be switched on manually, no more than twice per day, and also has either a delayed restart

5.4.1 Test instrumentation

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Universal Power Analyser	PM6000A	VOLTECH	200006700364	2015-07-24	12
Reference Impedance Network	NI2415	Zimmer Electronic	A0412051	2015-07-24	12
Test Software	IEC61000	Voltech	Ver 1.24.12	-	-
Firmware	PM6000	Voltech	Ver 1.22.07RC6	-	-

5.4.2 Temperature and humidity condition

Test date	May 9, 2016	Test engineer		Kyung Yun Lee	
Climate condition	Ambient temperature	23.1 ℃	Relative humidity	38.9 %	
	Atmospheric pressure	101.3 kPa			
Test place	Shielded Room #3				

5.4.3 Photograph of Test setup



5.4.4 Test results

Pst (Short term Flicker) Results

- Operating Mode : 2

Product:	LFD	2016 May 9 3:56pm
Serial no:		Page 1 of 1
Description:		
Result Name:	FLK_LH49QMFP	
Voltech IEC61000-3	Windows Software 1.24.12	Test Date: 2016 May 9 3:35pm
Type of Test:	Flickermeter Test - Table	
Power Analyzer:	Voltech PM6000 SN: 200006700364 Firmware Version: v1.22.07RC6	
	Channel(s):	
	1. SN: 090015501131, 28 Adjusted Date: 1 JUN 2015. 2. SN: 090015500945, 28 Adjusted Date: 2 JUN 2015.	
	3. SN: 090015501189, 28 Adjusted Date: 2 JUN 2015. 4. SN:None Adjusted Date:None	
	5. SN:None Adjusted Date:None 6. SN:None Adjusted Date:None	
	Shunt(s):	
	1. SN: 091024301096, 4 Adjusted Date: 4 JUN 2015. 2. SN: 091024301097, 4 Adjusted Date: 4 JUN 2015.	
	3. SN: 091024301098, 4 Adjusted Date: 4 JUN 2015. 4. SN:None Adjusted Date:None	
	5. SN:None Adjusted Date:None 6. SN:None Adjusted Date:None	
AC Source:	Mains / Manual Source	
Overall Result:	Notes:	
PASS	test duration only 20 minutes	
	Measurement method - Voltage	

	Pst	dc (%)	dmax (%)	d(t) > 3.3%(ms)
Limit	N/A	N/A	6.000	N/A
Reading 1	N/A	N/A	0.235	N/A
Reading 2	N/A	N/A	0.240	N/A

5.5 Electrostatic discharge

Contact discharges to the conductive surfaces and coupling planes:

The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the test points are subjected to at least 50 indirect discharges to the center of the front edge of the horizontal coupling plane.

The remaining three test points are each receive at least 50 direct contact discharges.

If no direct contact test points are available, then at least 200 indirect discharges be applied in the indirect mode. Test is performed at a maximum repetition rate of one discharge per second.

Air discharges at slots and apertures and insulating surfaces:

On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air discharge method. This investigation should be restricted to those area normally handled by the user.

A minimum of 10 single air discharges shall be applied to the selected test point for each such area. The EUT was tested with all I/O ports exercised. Test results are listed below.

The basic test procedure was in accordance with the applied standard of clause 2.2.

Performance criteria

Application of discharge	Test specification (kV)	Performance criteria
Contact discharge	±4	B
Air Discharge	±2, 4, 8	B

5.5.1 Test instrumentation

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
ESD SIMULATOR	MINIZAP	THERMO	0412247	2015-11-09	12
Vertical Plane	VCP-1	Thermo Keytek	-	-	-

5.5.2 Temperature and humidity condition

Test date	May 11, 2016	Test engineer		Kyung Yun Lee	
Climate condition	Ambient temperature	22.7 ℃	Relative humidity	38.1 %	
	Atmospheric pressure	101.2 kPa			
Test place	Shielded Room #3				

5.5.3 Photograph of Test setup

The EUT was set up as per normal use over a horizontal coupling plane and in accordance with the requirements of the applied standard.



5.5.4 Test Condition and Result

- **EUT Operating Mode(s) and Monitoring of EUT** : The EUT Operating Mode was tested and the EUT was monitored visually for degradation. After the test stored parameters and functionality was verified.
- **Description of test points and Record**

10 air discharges and 25 contact discharges of each polarity and test voltage level were applied to the test points as below:

	No.	Applied Point	Method	Test Level	Tested No	Criteria	Result
Indirect		Horizontal Plane	Contact	± 4 kV	50	B	A
Indirect		Vertical Plane	Contact	± 4 kV	200	B	A
Direct	1	DVI	Contact	± 4 kV	50	B	B
Direct	2	HDMI4	Contact	± 4 kV	50	B	B
Direct	3	HDMI3	Contact	± 4 kV	50	B	B
Direct	4	HDMI2	Contact	± 4 kV	50	B	B
Direct	5	HDMI1	Contact	± 4 kV	50	B	B
Direct	6	USB1	Contact	± 4 kV	50	B	B
Direct	7	USB2	Contact	± 4 kV	50	B	B
Direct	8	LAN	Contact	± 4 kV	50	B	B
Direct	9	USB Service	Contact	± 4 kV	50	B	B
Direct	10	Screen	Air	± 2 kV, ± 4 kV, ± 8 kV	60	B	B
Direct	11	RS232C IN	Air	± 2 kV, ± 4 kV, ± 8 kV	60	B	B
Direct	12	RS232C OUT	Air	± 2 kV, ± 4 kV, ± 8 kV	60	B	B
Direct	13	Audio IN	Air	± 2 kV, ± 4 kV, ± 8 kV	60	B	B
Direct	14	Audio Out	Air	± 2 kV, ± 4 kV, ± 8 kV	60	B	B
Direct	15	IR IN	Air	± 2 kV, ± 4 kV, ± 8 kV	60	B	B
Direct	15	IR OUT	Air	± 2 kV, ± 4 kV, ± 8 kV	60	B	B

A = Performance within criterion A, B = performance within criterion B, C = performance within criterion C

For LAN, Following results were derived by Burn-In software and ping-test command.

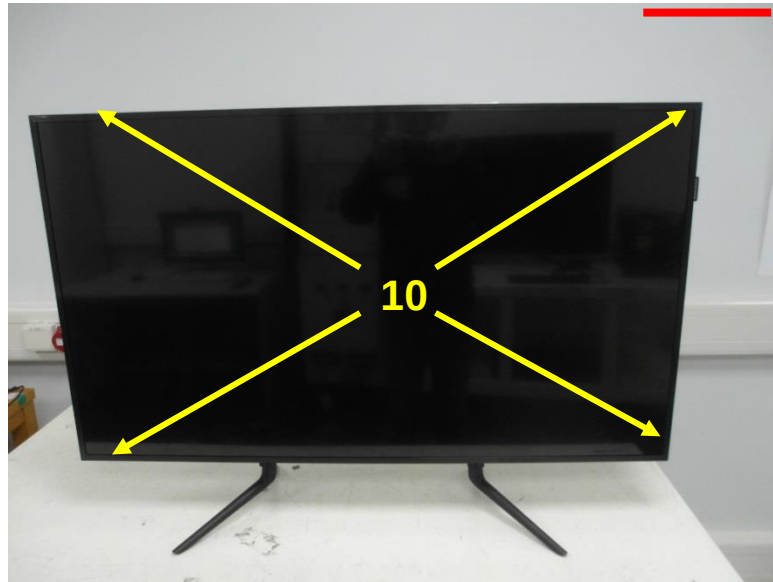
	Error rate/ Protocol failure (%)	Request for retry (Packets)	Loss of link (Yes or No)	Speed of data transmission rate (packet/s)	
				Initial value	After test
Measured Value	0	0	No	1 329	1 301
Result	A	A	A	A	

- Test Results : Complied

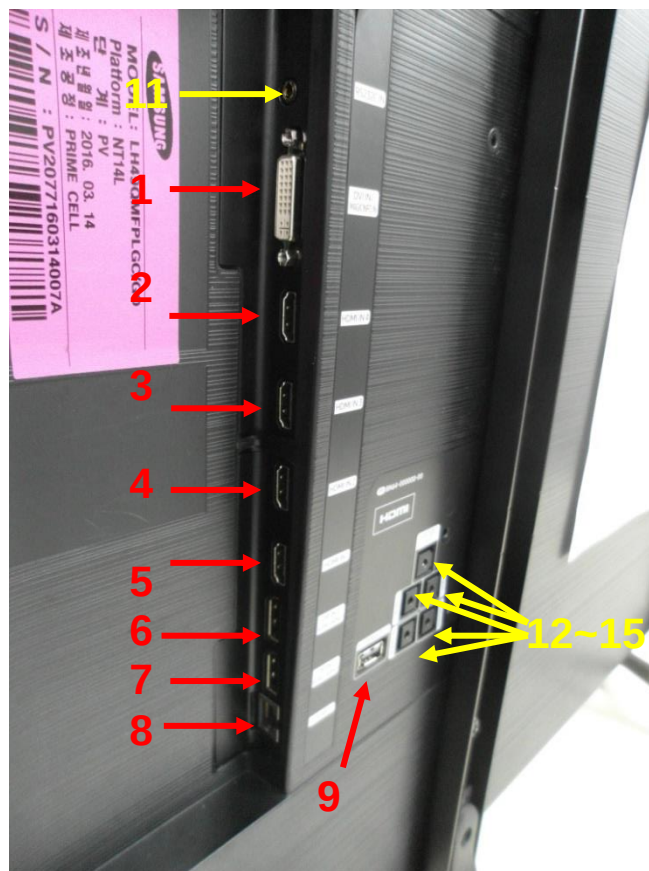
During discharge on EUT, screen flickered short time. But after the test, it works normal condition without operator's action.

5.5.5 Tested points

— Air
— Air/ Contact
— Contact



[Front]



[Rear]

5.6 Radiated, radio-frequency, electromagnetic field

The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.

The basic test procedure was in accordance with the applied standard of clause 2.2.

Performance criteria

Test range (MHz)	Test specification	Performance criteria	Remarks
80 ~ 1 000	3 V/m (unmodulated, r.m.s) 80 % AM(1 kHz)	A	The test level specified is prior to modulation See *)
*) The frequency range is scanned as specified. However, when specified in Annex A, EN55024, an additional comprehensive functional test shall be carried out at a limited number of frequencies. The selected frequencies are: 80, 120, 160, 230, 434, 460, 600, 863 and 900 MHz (± 1 %). (For Telephony terminal equipment)			

5.6.1 Test instrumentation

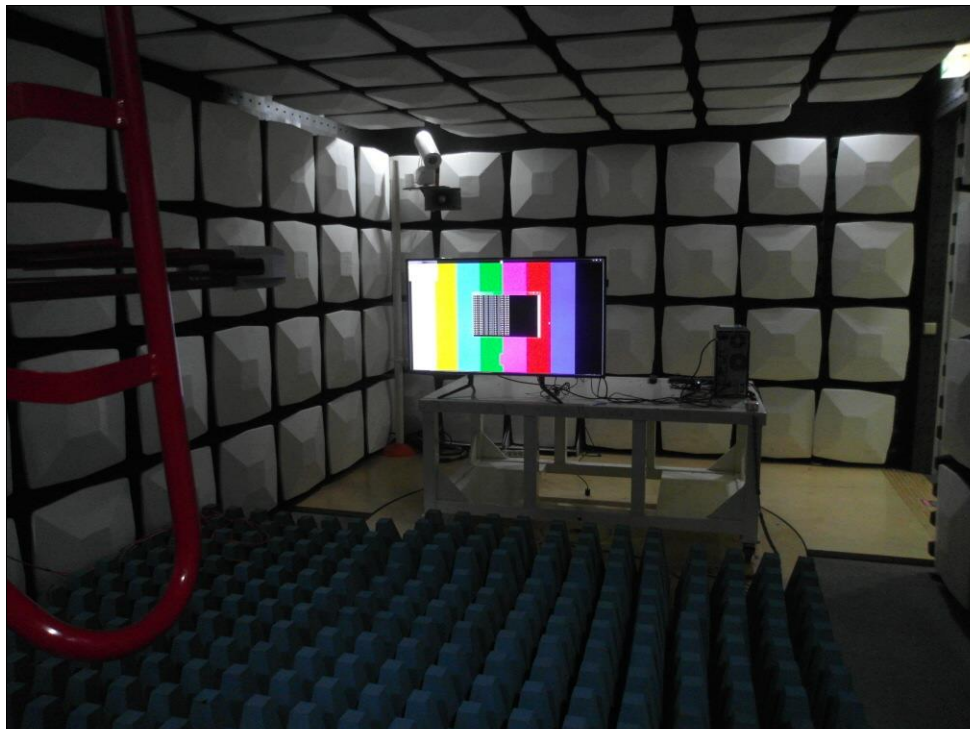
Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				date	Interval
Signal Generator	SMB100A	R&S	110196	2015-09-11	12
Power meter	NRP2	R&S	104463	2015-09-15	12
Insertion Unit	NRP2-Z91	R&S	103066	2015-09-15	12
Insertion Unit	NRP2-Z91	R&S	103065	2015-09-15	12
RF Amplifier	60S1G3	AR	311853	2016-02-19	12
RF Amplifier	250W1000A	AR	312241	2016-02-19	12
Antenna	3149	ETS	140081	2016-04-20	12
Electric Field Probe	FL7006/KIT	AR	0347381	2015-12-26	12
Sound Acoustic Tester	TST-1000	TESTEK	150024	2015-10-28	12
Antenna Stand	AS1500-EP-8KG	AR	-	-	-
Relay Switching Unit	TS-RSP	AR	-	-	-
Test Software	EMC32	R&S	Ver 8.54.0	-	-

5.6.2 Temperature and humidity condition

Test date	May 10, 2016	Test engineer	Kyung Yun Lee	
Climate condition	Ambient temperature	22.7 °C	Relative humidity	35.1 %
	Atmospheric pressure	101.7 kPa		
Test place	Fully Anechoic Chamber			

5.6.3 Photograph of Test setup

The EUT was set up as per normal use in a pre-calibrated field area in accordance with the requirements of the applied standard.



5.6.4 Test conditions and Result

- **EUT Operating Mode(s) and Monitoring of EUT** : The EUT Operating Mode was tested and the EUT was monitored visually for degradation and loss of function. After the test stored parameters and functionality was verified.

- **Test Field Strength and Frequency Range**

The EUT was subjected to the following electromagnetic fields:

80 MHz to 1 GHz, sinusoidal carrier, amplitude modulated with 1 kHz audio frequency at 80% depth and with a dwell time of 3 seconds.

Frequency (MHz)	Side of EUT exposed to field	Polarity	Performance Result
80 ~ 1 000	Front	Horizontal	A
		Vertical	A
	Left	Horizontal	A
		Vertical	A
	Right	Horizontal	A
		Vertical	A
	Rear	Horizontal	A
		Vertical	A

A = Performance within criterion A, B = performance within criterion B, C = performance within criterion C

For LAN, Following results were derived by Burn-In software and ping-test command.

	Error rate/ Protocol failure (%)	Request for retry (Packets)	Loss of link (Yes or No)	Speed of data transmission rate (packet/s)	
				Initial value	After test
Measured Value	0	0	No	1 229	1 120
Result	A	A	A	A	

- **Test Results : Complied**

The operating performance observed, during and after the test, was found to be in accordance with the failure criterion required.

5.7 Electrical fast transient/burst

Test on power supply ports and on protective earth terminals

Stationary, floor-mounted equipment

The test voltage applied between a reference ground plane and each of the power supply terminals, a.c. or d.c., and on the terminal for the protective or function earth on the cabinet of the EUT. The EFT/B-generator shall be located on the reference plane.

The EUT and all cables to the EUT shall be placed on the insulation support 0.1 m above the ground reference plane.

The length of the "hot wire" from the coaxial output of the EFT/B-generator to the terminals on the EUT is $0.5 \text{ m} \pm 0.05 \text{ m}$. This connection was unshielded but well insulated.

All other connections of the EUT are in accordance with its functional requirements.

Non-stationary mounted EUT, connected to the mains supply by flexible cord and plugs

The test voltage is applied between each of the power supply conductors and the protective earth at the power supply outlet to which the EUT is to be connected.

Test on I/O and communication ports

As far as possible, the capacitive coupling clamp is used for coupling the test voltage into the lines. However, if the clamp cannot be used due to mechanical problems (size, cable routing) in the cabling, it may be replaced by a tape or a conductive foil enveloping the lines under test.

The capacitance of this coupling arrangement with foil or tape is equivalent to that of the standard coupling clamp. In other cases, it is useful to couple the EFT/B-generator to the terminals of the lines via discrete 100 pF capacitors instead of the distributed capacitance of the clamp or of the foil or tape arrangement.

The basic test procedure was in accordance with the applied standard of clause 2.2.

Performance criteria

Applied conditions	Test specification	Performance criteria
Open-circuit output test voltage a.c. power ports signal and telecommunication ports d.c. power ports	1 kV(Peak) 0.5 kV(Peak) 0.5 kV(Peak)	B
Wave shape of the pulse	5/50 Tr/Th ns	
Repetition Frequency	5 kHz	

5.7.1 Test instrumentation

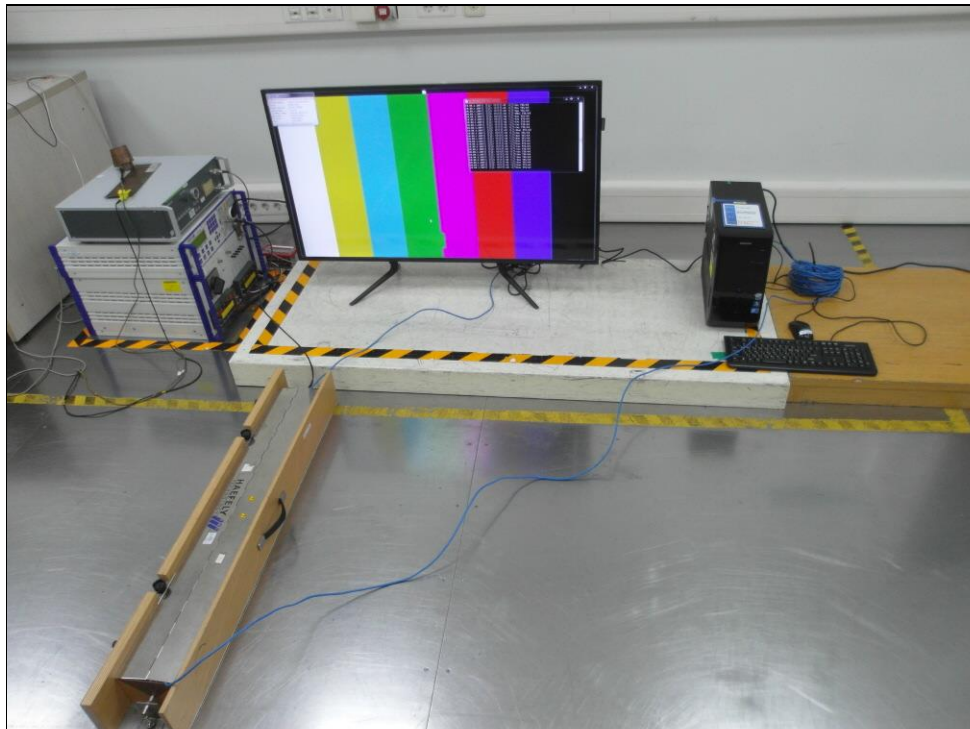
Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Clamp	IP4A	Haefely	152499	2015-06-02	12
Burst Tester	PEFT 4010	Haefely	152608	2015-06-01	12
Test Software	WinFEAT&R	Haefely	Ver 1.70	-	-

5.7.2 Temperature and humidity condition

Test date	May 9, 2016	Test engineer		Kyung Yun Lee	
Climate condition	Ambient temperature	21.3 ℃	Relative humidity	36.5 %	
	Atmospheric pressure	101.1 kPa			
Test place	Shielded Room #5				

5.7.3 Photograph of Test setup

The EUT was set up on the insulation support 0.1 m above the ground reference plane in accordance with the requirements of the applied standard.



5.7.4 Test conditions and Result

- **EUT Operating Mode(s) and Monitoring of EUT** : The EUT Operating Mode was tested and the EUT was monitored visually for degradation and loss of function. After the test stored parameters and functionality was verified.
- **EFT Burst Parameters and Coupling Methods**

AC Port via CDN

Port	Voltage (kV)	Phase wave Shapes & Repetitions	Burst duration (ms)	Burst period (ms)	Pol.	Test duration (min)	Angle	Result
Live+Neutral+Ground	1	5/50 ns, 5 kHz	15	300	+/-	1	Async	A

Communication Port via a capacitive coupling clamp

Port	Voltage (kV)	Phase wave Shapes & Repetitions	Burst duration (ms)	Burst period (ms)	Pol.	Test duration (min)	Angle	Result
LAN Line	0.5	5/50ns, 5kHz	15	300	+/-	1	Async	A

A = Performance within criterion A, B = performance within criterion B, C = performance within criterion C

* DVI, RGB ports were not applied EFT testing because those typical cables do not exceed 3 m long.

For LAN, Following results were derived by Burn-In software and ping-test command.

	Error rate/ Protocol failure (%)	Request for retry (Packets)	Loss of link (Yes or No)	Speed of data transmission rate (packet/s)	
				Initial value	After test
Measured Value	0	0	No	1 119	1 005
Result	A	A	A	A	

- Test Result : Complied

The operating performance observed, during and after the test, was found to be in accordance with the failure criterion required.

5.8 Surge

The basic test procedure was in accordance with the applied standard of clause 2.2.

Performance criteria

Applied conditions		Test specification	Performance criteria
Combination wave a.c. power ports d.c. power ports Waveform parameter Open-circuit voltage Short-circuit current	Line to Line 1 kV(Peak) ① Line to earth 2 kV(Peak) ① 0.5 kV(Peak) ② 1.2/50 Tr/Th μs 8/20 Tr/Th μs	B	
Signal and telecommunication ports Waveform parameter Open-circuit voltage	Line to ground 1 kV(Peak) ②③④⑤ 10/700 Tr/Th μs		
① When the manufacturer specifies protection measures and it is impractical to simulate these measures during the tests, then the applied test levels shall be reduced to 0,5 kV (line to line) and 1 kV (line to earth (ground)). ② Applicable only to ports which according to the manufacturer's specification may connect directly to outdoor cables. ③ For ports where primary protection is intended, surges are applied at voltages up to 4 kV with the primary protectors fitted. Otherwise the 1 kV test level is applied without primary protection in place. ④ Test applied to all lines simultaneously to earth (ground). ⑤ Where the coupling network for the 10/700 μs waveform affects the functioning of high speed data ports, the test shall be carried out using a 1,2/50 (8/20) μs waveform and appropriate coupling network.			

5.8.1 Test instrumentation

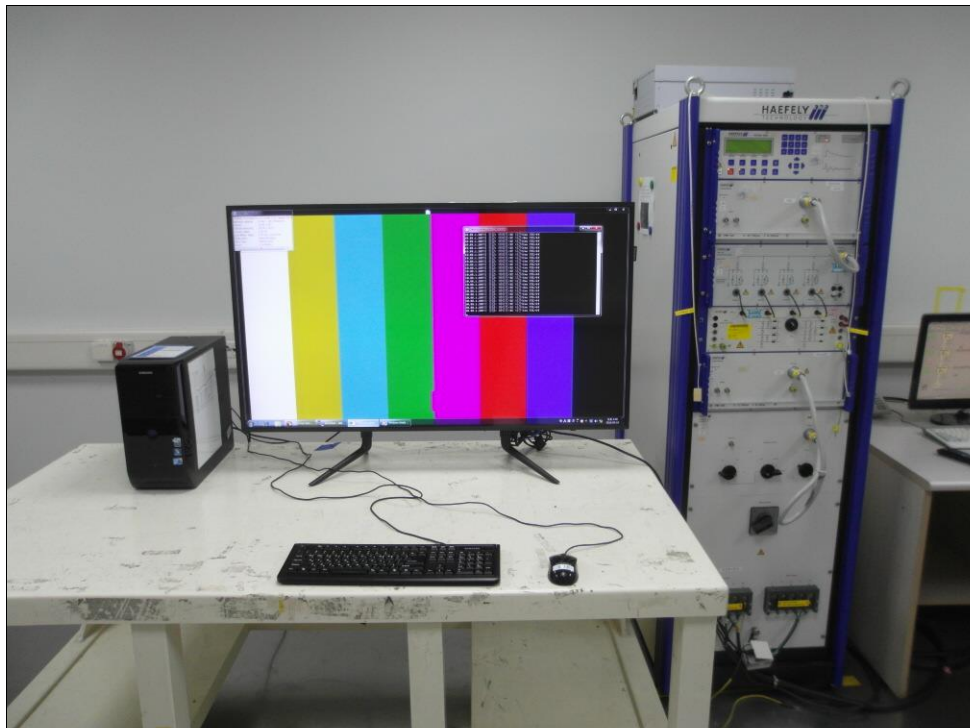
Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Surge 8000	PSURGE 8000	Haefely	152602	2015-07-30	12
Coupling Decoupling Network	FP-SURGE 100M	Haefely	152636	2015-07-30	12
Surge Impulse Module	PIM100	Haefely	152288	2015-07-30	12
Test Software	WinFEAT&R	Haefely	Ver 1.70	-	-

5.8.2 Temperature and humidity condition

Test date	May 9, 2016	Test engineer		Kyung Yun Lee	
Climate condition	Ambient temperature	21.1 ℃	Relative humidity	35.2 %	
	Atmospheric pressure	101.3 kPa			
Test place	Shielded Room #2				

5.8.3 Photograph Test setup

The EUT was set up as per normal use on a table 0.8 m above the ground reference plane and in accordance with the requirements of the applied standard.



5.8.4 Test conditions and Result

- **EUT Operating Mode(s) and Monitoring of EUT** : The EUT Operating Mode was tested and the EUT was monitored visually for degradation and loss of function. After the test stored parameters and functionality was verified.
- **Surge Parameters**

AC Port via CDN

Port	Voltage (kV)	Phase wave Shape (μs)	Angle (degrees)	Repetition time (s)	Pol.	No. of pulse	Result
L – N	0.5	1.2/50(8/20)	0,90,180,270	60	+/-	5	A
L – N	1.0	1.2/50(8/20)	0,90,180,270	60	+/-	5	A
L – G	0.5	1.2/50(8/20)	0,90,180,270	60	+/-	5	A
L – G	1.0	1.2/50(8/20)	0,90,180,270	60	+/-	5	A
L – G	2.0	1.2/50(8/20)	0,90,180,270	60	+/-	5	A
N – G	0.5	1.2/50(8/20)	0,90,180,270	60	+/-	5	A
N – G	1.0	1.2/50(8/20)	0,90,180,270	60	+/-	5	A
N – G	2.0	1.2/50(8/20)	0,90,180,270	60	+/-	5	A

A = Performance within criterion A, B = performance within criterion B, C = performance

For LAN, Following results were derived by Burn-In software and ping-test command.

	Error rate/ Protocol failure (%)	Request for retry (Packets)	Loss of link (Yes or No)	Speed of data transmission rate (packet/s)	
				Initial value	After test
Measured Value	0	0	No	1 331	1 203
Result	A	A	A	A	

Test Result : Complied

The operating performance observed, during and after the test, was found to be in accordance with the failure criterion required.

5.9 Conducted disturbances, induced by radio-frequency fields

The test was performed with the test generator connected to each of the coupling and decoupling devices in turn while one of the other non-excited RF input ports of the coupling devices is terminated by a 50-ohm load resistor.

Attempts should be made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility. Test results are listed below.

The basic test procedure was in accordance with the applied standard of clause 2.2.

Performance criteria

Test range [MHz]	Test specification	Performance criteria	Remarks
0.15 ~ 80	3 V(unmodulated, r.m.s) 80 % AM(1 kHz)	A	See 1), 2)
1) The frequency range is scanned as specified. However, when specified in Annex A, an additional comprehensive functional test shall be carried out at a limited number of frequencies. The selected frequencies for conducted tests are: 0,2; 1; 7,1; 13,56; 21; 27,12 and 40,68 MHz (± 1 %). (For Telephony terminal equipment) 2) Applicable only to cables which according to the manufacturer's specification supports communication on cable lengths greater than 3m.			

5.9.1 Test instrumentation

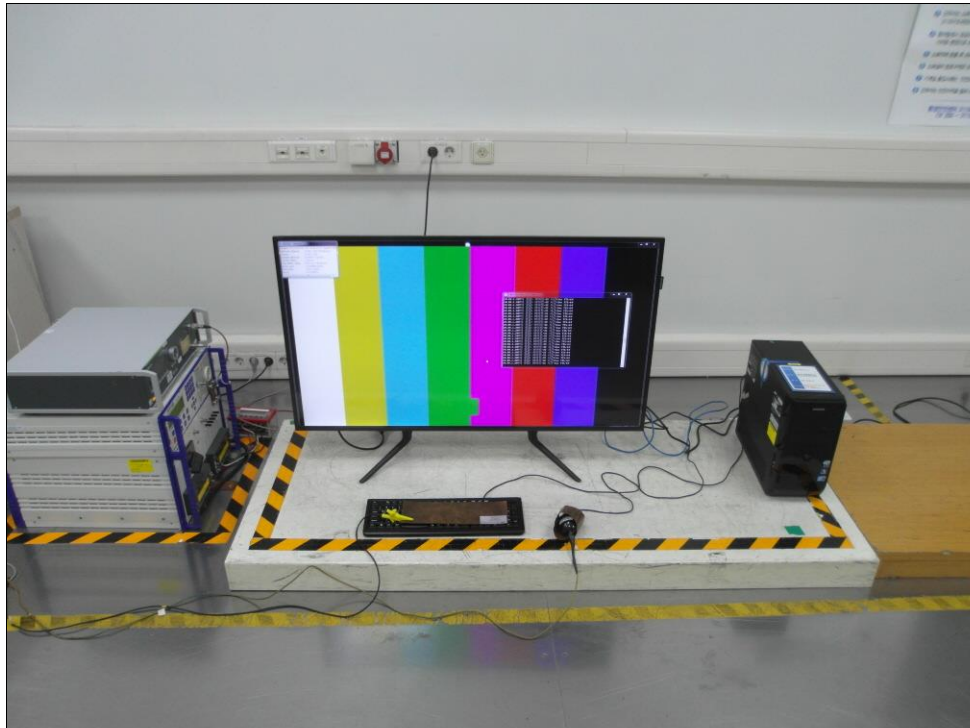
Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				date	Interval (Month)
RF-Generator	CWS 500N1	EM Test	P150614886 0	2015-09-23	12
Attenuator	50F-006-300-2	R&S	43608-401-1	2015-07-14	12
Coupling and Decoupling Network	CDN M016	Schaffner	21246	2016-04-01	12
Coupling and Decoupling Network	CDN M016	Schaffner	20571	2016-03-16	12
Coupling and Decoupling Network	CDN T800	TESEQ	39198	2015-12-15	12
Test Software	icd.control	EM Test	Ver 5.2.5	-	-

5.9.2 Temperature and humidity condition

Test date	May 4, 2016	Test engineer	Kyung Yun Lee	
Climate condition	Ambient temperature	23.1 ℃	Relative humidity	35.7 %
	Atmospheric pressure	101.2 kPa		
Test place	Shielded Room #5			

5.9.3 Photograph of Test Setup

The EUT was set up on the insulation support 0.1 m above the ground reference plane in accordance with the requirements of the applied standard.



[Front]



[Rear]

5.9.4 Test conditions and Result

- **EUT Operating Mode(s) and Monitoring of EUT** : The EUT Operating Mode was tested and the EUT was monitored visually for degradation and loss of function. After the test stored parameters and functionality was verified.

- **Test Voltage and Frequency Range**

Port	Frequency Range (MHz)	Level (V)	Modulation	Coupling method	Result
AC Mains	0.15 ~ 80	3	1kHz, 80% AM	Direct via M016 CDN	A
LAN Line	0.15 ~ 80	3	1kHz, 80% AM	Direct via T800 CDN	A

A = Performance within criterion A, B = performance within criterion B, C = performance within criterion C

Step size = 1 %, Dwell time = 3 seconds

* DVI, RGB ports were not applied CS testing because those typical cables do not exceed 3 m long.

For LAN, Following results were derived by Burn-In software and ping-test command.

	Error rate/ Protocol failure (%)	Request for retry (Packets)	Loss of link (Yes or No)	Speed of data transmission rate (packet/s)	
				Initial value	After test
Measured Value	0	0	No	1 277	1 119
Result	A	A	A	A	

- **Test Result : Complied**

The operating performance observed, during and after the test, was found to be in accordance with the failure criterion required.

5.10 Voltage dips, short interruptions and voltage variations

The EUT is tested for each selected combination of test levels and duration with a sequence of three dips/interruptions with intervals of 10 s minimum (between each test event).

Each representative mode of operation shall be tested. Abrupt changes in supply voltage shall occur at zero crossings of the voltage waveform.

The basic test procedure was in accordance with the applied standard of clause 2.2.

Performance criteria

Performance criteria				
Environmental phenomenon	Test specification	Units	Performance criteria	Remarks
Voltage dips	>95 0.5	% reduction periods	B	See NOTE
	30 25		C	
Voltage interruptions	>95 250		C	
[NOTE] Changes to occur at 0 degree crossover point of the voltage waveform.				

5.10.1 Test instrumentation

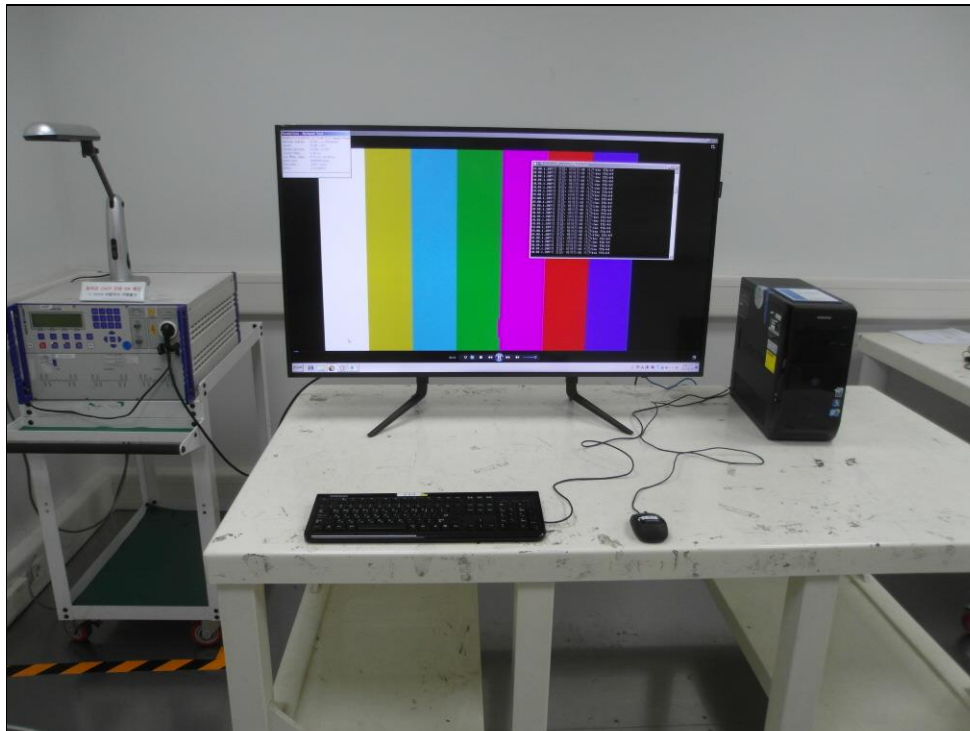
Test instrumentation	Manufacturer	Model name	Serial or Firmware (No./Ver.)	Calibration	
				date	Interval (Month)
Voltage Dips	PLINE1610	HAEFELY	083690-21	2016-03-03	12

5.10.2 Temperature and humidity condition

Test date	May 3, 2016	Test engineer		Kyung Yun Lee	
Climate condition	Ambient temperature	21.5 ℃	Relative humidity		36.5 %
	Atmospheric pressure	101.3 kPa			
Test place	Shielded Room #2				

5.10.3 Photograph of Test setup

The EUT was set up as per normal use in accordance with the requirements of the applied standard.



5.10.4 Test Conditions and Result

- **EUT Operating Mode(s) and Monitoring of EUT** : The EUT Operating Mode was tested and the EUT was monitored visually for degradation and loss of function. After the test stored parameters and functionality was verified.

- **Dips and interruptions Parameters**

- **Test mains voltage = 100 V**

Port	Duration (ms)	No. of applications	Time between applications (s)	Angles (degrees)	Result
< 5 % test voltage = 0 V	10	6	10	0, 180	A
70 % test voltage = 70 V	500	6	10	0	A
< 5 % test voltage = 0V	5 000	6	10	0	B

A = Performance within criterion A, B = performance within criterion B, C = performance within criterion C

- **Test mains voltage = 240 V**

Port	Duration (ms)	No. of applications	Time between applications (s)	Angles (degrees)	Result
< 5 % test voltage = 0 V	10	6	10	0, 180	A
70 % test voltage = 168 V	500	6	10	0	A
< 5 % test voltage = 0V	5 000	6	10	0	B

A = Performance within criterion A, B = performance within criterion B, C = performance within criterion C

For LAN, Following results were derived by Burn-In software and ping-test command.

	Error rate/ Protocol failure (%)	Request for retry (Packets)	Loss of link (Yes or No)	Speed of data transmission rate (packet/s)	
				Initial value	After test
Measured Value	0.004	37	Yes	1 299	1 121
Result	A	A	B	A	

- Test Result : Complied

The operating performance observed, during and after the test, was found to be in accordance with the failure criterion required.

The EUT's power was turned off during the voltage interruption testing.

However the EUT was become to normal condition without operator's action after all of VDI testing was finished.

Appendix – EUT photographs



Front



Rear