

## ***FCC EVALUATION REPORT FOR CERTIFICATION***

**Applicant : LG Electronics Inc.****19-1, Cheongho-ri, Jinwi-myeon,****Pyeongteak-si, Gyeonggi-do, Korea.****Attn: Mr. Sang-Wook Lee, Chief research engineer****Date of Issue : September 30, 2009****Order Number: GETEC-C1-09-197****Test Report Number: GETEC-E3-09-113****Test Site: Gumi College EMC Center****FCC Registration Number: (100749, 443957)****FCC ID.: BEJCF181D****Applicant: LG Electronics Inc.**

|                          |                                                    |
|--------------------------|----------------------------------------------------|
| <b>Rule Part(s)</b>      | <b>: FCC Part 15 Subpart B</b>                     |
| <b>Equipment Class</b>   | <b>: Class B computing device peripheral (JBP)</b> |
| <b>EUT Type</b>          | <b>: Full HD Projector</b>                         |
| <b>Type of Authority</b> | <b>: Certification</b>                             |
| <b>Model Name</b>        | <b>: CF181D</b>                                    |
| <b>Trade Name</b>        | <b>: LG</b>                                        |

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 best 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,****Hyounng Seop Kim, Associate Engineer**  
**GUMI College EMC center****Tae-Sig Park, Technical Manager**  
**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:** 299, Gongdan-dong, Gumi-si, Gyeongbuk, Korea.

**Contact Person:** Mr. Sang -Wook Lee, Chief research engineer

**Tel Number:** +82-54-460-7314

- **FCC ID.** BEJCF181D
- **EUT Type** Full HD Projector
- **Model Name** CF181D
- **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** September 17, 2009
- **Place of Test** **Gumi College EMC Center** ( FCC Registration Number: 100749, 443957)  
407, Bugok-dong, Gumi-si, Gyeongbuk, Korea.
- **Test Report Number** GETEC-E3-09-113
- **Dates of Issue** September 30, 2009



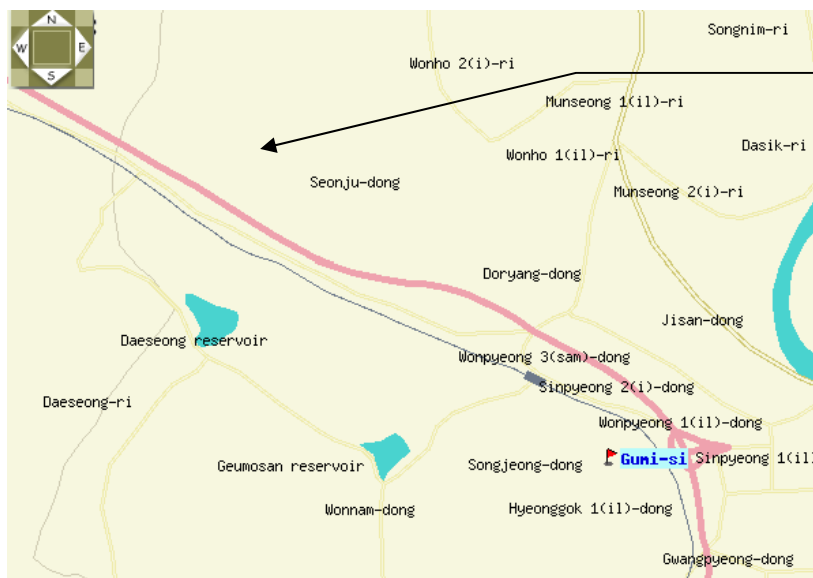
## 2. Introduction

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. Full HD Projector (Model Name: CF181D)**

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 on October 19, 1992



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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. Full HD Projector (Model Name: CF181D) FCC ID.: BEJCF181D**

| MODEL                                | CF181D (CF181D-JS)                                                        |
|--------------------------------------|---------------------------------------------------------------------------|
| Resolution                           | 1920(Horizontal) x 1080(Vertical)pixel                                    |
| Horizontal / Vertical Ratio          | 16 : 9 (horizontal:vertical)                                              |
| LCOS panel size                      | 0.61 inches                                                               |
| Screen size<br>(Projection distance) | Wide : 30 ~ 300 inches(0.9 ~ 9.1m)<br>Tele : 30 ~ 300 inches(1.6 ~ 16.4m) |
| Projection off-set ratio             | 120%                                                                      |
| Remote control distance              | 12m                                                                       |
| Zoom ratio                           | 1:1.8                                                                     |
| Video compatibility                  | NTSC/PAL/SECAM/NTSC4.43/PAL-M/PAL-N/PAL 60                                |
| Power                                | AC 100 - 240V~50/60Hz, 3.0A-1.2A                                          |
| Height(mm/inches)                    | 173/6.8                                                                   |
| Breadth(mm/inches)                   | 366/14.4                                                                  |
| Length(mm/inches)                    | 447.5/17.6                                                                |
| Weight(kg/pound)                     | 9.8/21.6                                                                  |

#### Operating Condition

##### Temperature

In operation : 32~104°F(0°C~40°C)  
In storage and transit : -4~140°F(-20°C~60°C)

##### Humidity

In operation : 0~ 75% relative humidity by dry hygrometer  
Not in operation : 0 ~ 85% relative humidity by dry hygrometer

#### Projector Lamp

##### Lamp model

AJ-LAF1

##### Lamp power consumption

220W

|                          |         |
|--------------------------|---------|
| Maximum Frequency range: | 148 MHz |
|--------------------------|---------|



### 3.2 Support Equipment / Cables used

#### 3.2.1 Used Support Equipment

| Description | Manufacturer       | Model Name        | S/N & FCC ID                                |
|-------------|--------------------|-------------------|---------------------------------------------|
| PC          | SAMSUNG            | DB-P60            | S/N: 729W97AP500001M<br>FCC ID: DoC         |
| Video card  | SUMA               | Geforce FX 7600GT | S/N: NE/7600GXTD21V407003711<br>FCC ID: DoC |
| Key-board   | COMPAQ             | 166516-AD6        | S/N: B13BBOR391006D<br>FCC ID: AQ6-23K15    |
| PS2 mouse   | LOGITECH           | M-S69             | S/N: 334684-108<br>FCC ID: JNZ211443        |
| Joystick    | Microsoft          | X05-92626         | S/N: 9262600296169<br>FCC ID: DoC           |
| DVD player  | LG Electronics Inc | LC-954            | S/N: 3850R-Z674K<br>FCC ID: DoC             |
| Printer     | Hewlett Packard    | 970CXI            | S/N: MY9B01F1FG<br>FCC ID: DoC              |

*See "Appendix D – Test Setup Photographs" for actual system test set-up*

#### 3.2.2 Used Cable(s)

| Cable Name            | Condition                           | Description                           |
|-----------------------|-------------------------------------|---------------------------------------|
| Power cable           | Connected to the EUT                | 1.8 m unshielded                      |
| Video(RGB)input cable | Connected to the EUT and PC         | 1.8 m shielded with two ferrite cores |
| Video(HDMI/DVI)cable  | Connected to the EUT and PC         | 1.95 m shielded                       |
| Component cable       | Connected to the EUT and DVD player | 2.0 m shielded                        |
| Video input cable     | Connected to the EUT and DVD player | 1.8 m shielded                        |
| S-video cable         | Connected to the EUT and DVD player | 1.8 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)**
  - Projection mode
    - Radiated emission: 1 920 \* 1 080 / 60 Hz (RGB: Analog), 1 920 \* 1 080 / 60 Hz (HDMI)
    - Conducted emission: 1 920 \* 1 080 / 60 Hz (RGB: Analog), 1 920 \* 1 080 / 60 Hz (HDMI)  
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



## 4.2 Conducted Emission

The Line conducted emission test facility is inside a 4 m × 8 m × 2.5 m shielded enclosure.

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

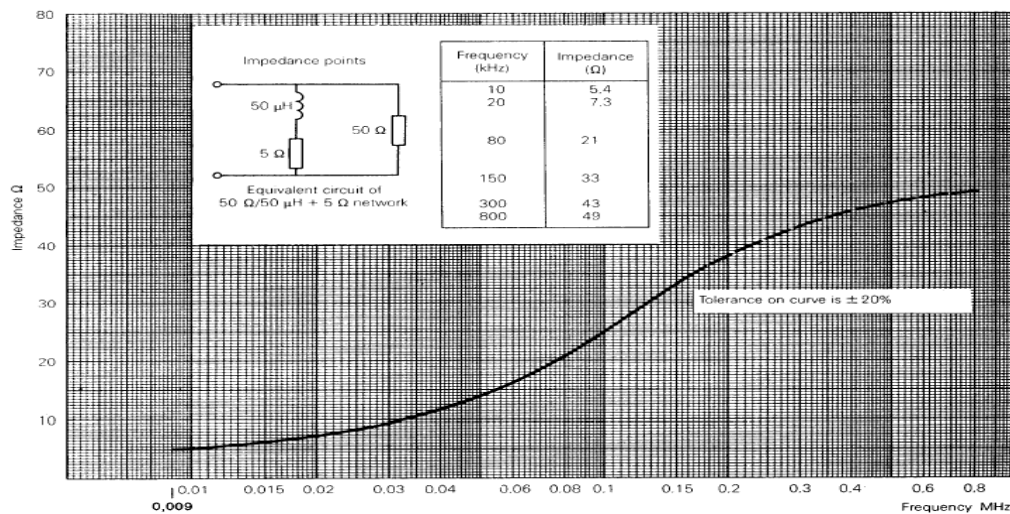


Fig 2. Impedance of LISN



### 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.

The spectrum was scanned from 30 MHz to 1 000 MHz using bicornical log antenna (Schwarzbeck, VULB9160). Above 1 GHz, horn antenna (Schwarzbeck, BBHA9120D) was used.

Final measurements were made outdoors at 3 m /10 m test range.

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

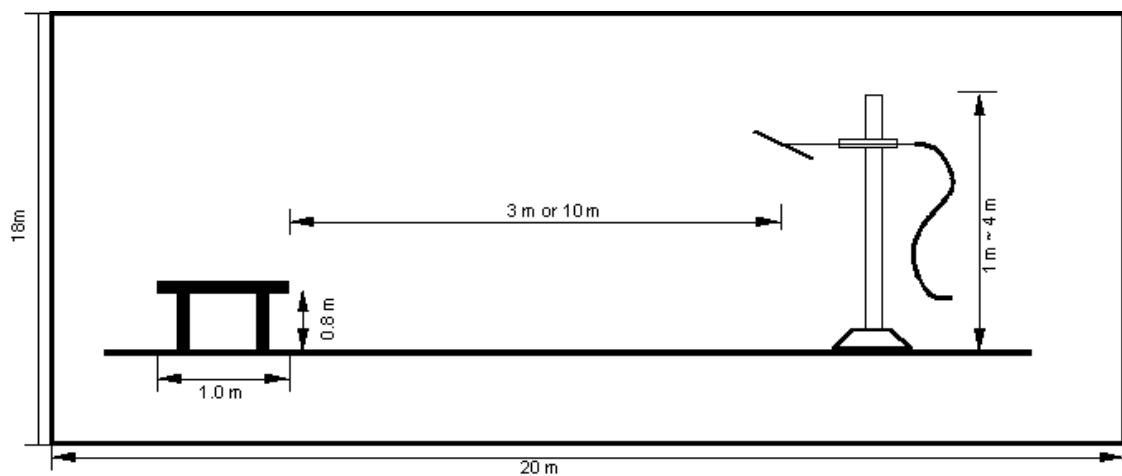


Fig 3. Dimensions of Open Site Test Area



## 5. Conducted Emission

### 5.1 Operating Environment

Temperature : 27 °C  
Relative Humidity : 50 % 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.

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)  | ± 2.97 dB   | Confidence levels of 95 % (k=2) |
| Conducted emission (150 kHz ~ 30 MHz) | ± 4.05 dB   | Confidence levels of 95 % (k=2) |



#### 5.4 Limit

| RFI Conducted                                               | FCC Limit(dB) 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. 13. 2009       |
| ■ - ESH3-Z5 | Rohde & Schwarz | LISN              | 838979/020    | 12. 12. 2009       |
| ■ - ESH2-Z5 | Rohde & Schwarz | LISN              | 829991/009    | 12. 12. 2009       |

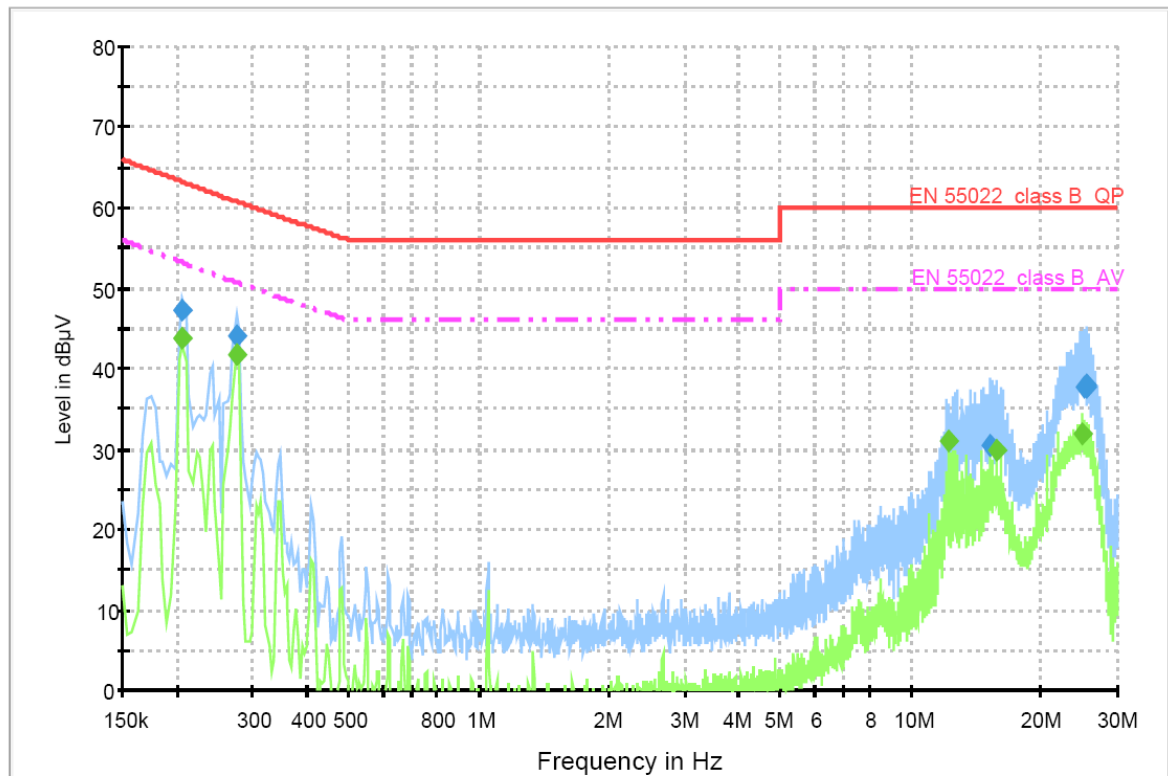
#### 5.6 Test data for Conducted Emission

- . Test Date : September 17, 2009  
- . Resolution Bandwidth : 9 kHz  
- . Frequency Range : 0.15 MHz ~ 30 MHz



◆ Test resolution: 1 920 \* 1 080 / 60 Hz (RGB: Analog mode)

## 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 |
|-----------------|------------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.206000        | 47.2             | 1000.000        | 9.000           | GND | L1   | 9.9        | 16.0        | 63.2         |         |
| 0.274000        | 44.0             | 1000.000        | 9.000           | GND | L1   | 10.0       | 16.8        | 60.8         |         |
| 15.234000       | 30.6             | 1000.000        | 9.000           | GND | L1   | 10.6       | 29.4        | 60.0         |         |
| 25.274000       | 37.8             | 1000.000        | 9.000           | GND | L1   | 11.0       | 22.2        | 60.0         |         |
| 25.366000       | 37.9             | 1000.000        | 9.000           | GND | L1   | 11.0       | 22.1        | 60.0         |         |
| 25.562000       | 37.7             | 1000.000        | 9.000           | GND | L1   | 11.0       | 22.3        | 60.0         |         |

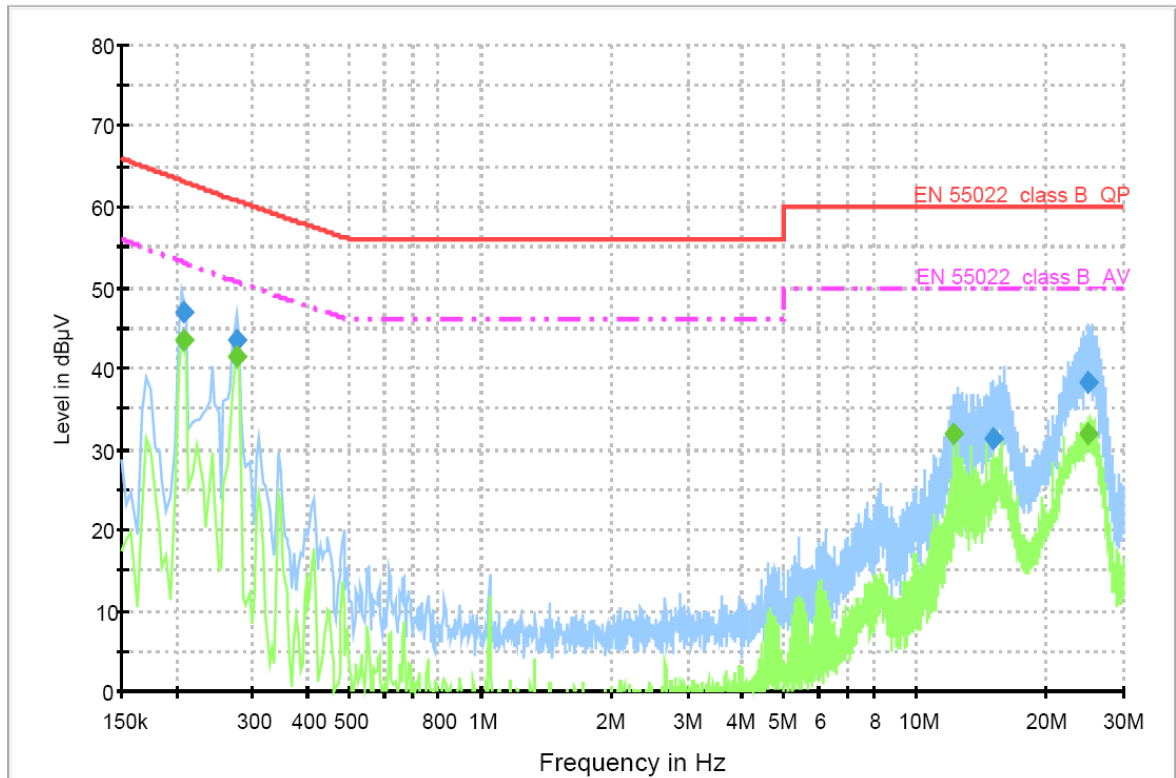
### Final Measurement Detector 2

| Frequency (MHz) | Average (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | PE  | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) | Comment |
|-----------------|----------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.206000        | 43.8           | 1000.000        | 9.000           | GND | L1   | 9.9        | 9.4         | 53.2         |         |
| 0.274000        | 41.8           | 1000.000        | 9.000           | GND | L1   | 10.0       | 9.0         | 50.8         |         |
| 12.190000       | 31.1           | 1000.000        | 9.000           | GND | L1   | 10.4       | 18.9        | 50.0         |         |
| 15.842000       | 29.8           | 1000.000        | 9.000           | GND | L1   | 10.6       | 20.2        | 50.0         |         |
| 24.990000       | 31.9           | 1000.000        | 9.000           | GND | L1   | 11.0       | 18.1        | 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 |
|-----------------|------------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.208000        | 46.8             | 1000.000        | 9.000           | GND | N    | 9.9        | 16.3        | 63.1         |         |
| 0.276000        | 43.6             | 1000.000        | 9.000           | GND | N    | 10.0       | 17.1        | 60.7         |         |
| 15.048000       | 31.4             | 1000.000        | 9.000           | GND | N    | 10.6       | 28.6        | 60.0         |         |
| 24.980000       | 38.3             | 1000.000        | 9.000           | GND | N    | 10.8       | 21.7        | 60.0         |         |

### Final Measurement Detector 2

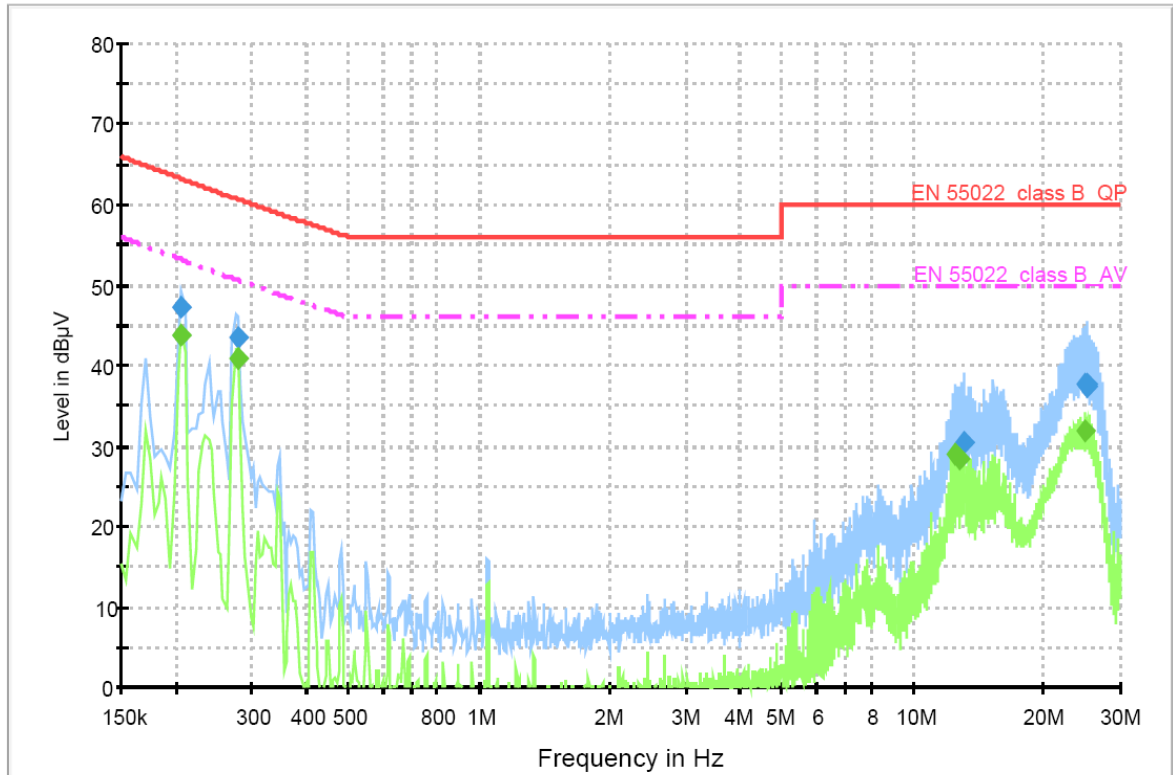
| Frequency (MHz) | Average (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | PE  | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|-----------------|----------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.208000        | 43.3           | 1000.000        | 9.000           | GND | N    | 9.9        | 9.8         | 53.1         |         |
| 0.276000        | 41.6           | 1000.000        | 9.000           | GND | N    | 10.0       | 9.1         | 50.7         |         |
| 12.188000       | 31.9           | 1000.000        | 9.000           | GND | N    | 10.4       | 18.1        | 50.0         |         |
| 25.016000       | 31.8           | 1000.000        | 9.000           | GND | N    | 10.8       | 18.2        | 50.0         |         |

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



◆ Test resolution: 1 920 \* 1 080 / 60 Hz (HDMI mode)

## 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 |
|-----------------|------------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.206000        | 47.2             | 1000.000        | 9.000           | GND | L1   | 9.9        | 16.0        | 63.2         |         |
| 0.278000        | 43.6             | 1000.000        | 9.000           | GND | L1   | 10.0       | 17.1        | 60.7         |         |
| 13.074000       | 30.6             | 1000.000        | 9.000           | GND | L1   | 10.5       | 29.4        | 60.0         |         |
| 24.974000       | 37.6             | 1000.000        | 9.000           | GND | L1   | 11.0       | 22.4        | 60.0         |         |
| 25.074000       | 37.6             | 1000.000        | 9.000           | GND | L1   | 11.0       | 22.4        | 60.0         |         |
| 25.274000       | 37.4             | 1000.000        | 9.000           | GND | L1   | 11.0       | 22.6        | 60.0         |         |

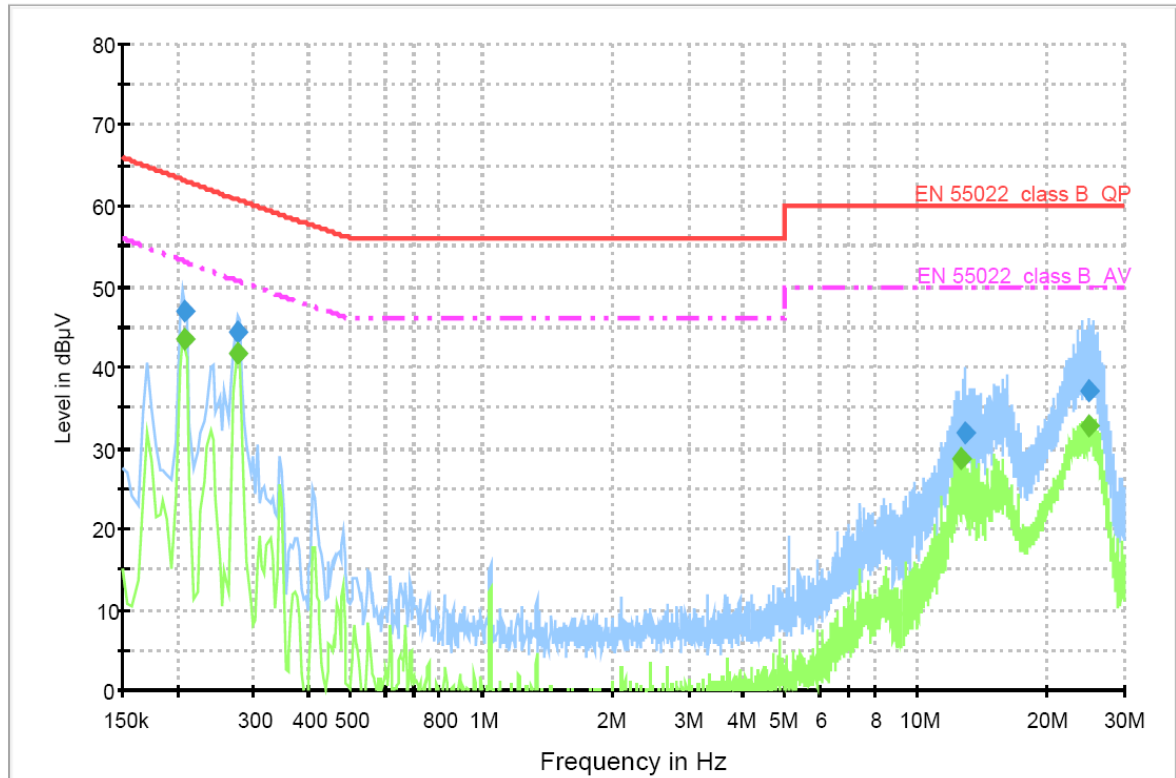
## Final Measurement Detector 2

| Frequency (MHz) | Average (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | PE  | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|-----------------|----------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.206000        | 43.8           | 1000.000        | 9.000           | GND | L1   | 9.9        | 9.4         | 53.2         |         |
| 0.278000        | 40.9           | 1000.000        | 9.000           | GND | L1   | 10.0       | 9.7         | 50.6         |         |
| 12.502000       | 29.1           | 1000.000        | 9.000           | GND | L1   | 10.5       | 20.9        | 50.0         |         |
| 12.790000       | 28.3           | 1000.000        | 9.000           | GND | L1   | 10.5       | 21.7        | 50.0         |         |
| 25.018000       | 31.8           | 1000.000        | 9.000           | GND | L1   | 11.0       | 18.2        | 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 |
|-----------------|------------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.208000        | 46.8             | 1000.000        | 9.000           | GND | N    | 9.9        | 16.3        | 63.1         |         |
| 0.276000        | 44.4             | 1000.000        | 9.000           | GND | N    | 10.0       | 16.3        | 60.7         |         |
| 12.936000       | 31.9             | 1000.000        | 9.000           | GND | N    | 10.5       | 28.1        | 60.0         |         |
| 24.996000       | 37.2             | 1000.000        | 9.000           | GND | N    | 10.8       | 22.8        | 60.0         |         |

### Final Measurement Detector 2

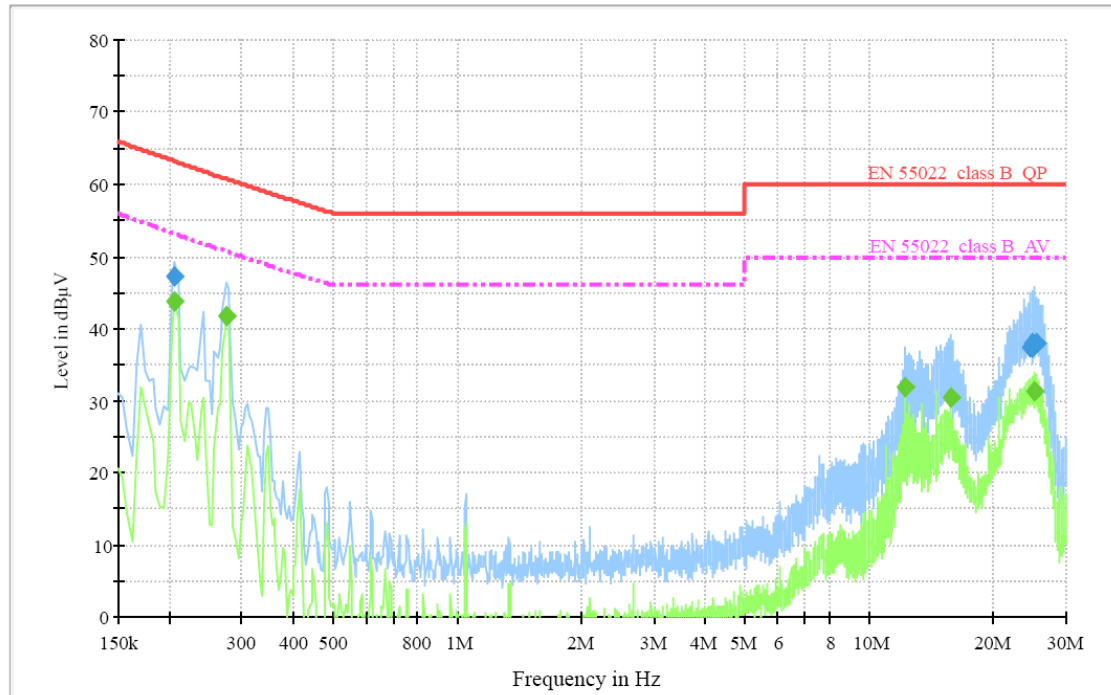
| Frequency (MHz) | Average (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | PE  | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) | Comment |
|-----------------|----------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.208000        | 43.3           | 1000.000        | 9.000           | GND | N    | 9.9        | 9.8         | 53.1         |         |
| 0.276000        | 41.8           | 1000.000        | 9.000           | GND | N    | 10.0       | 8.9         | 50.7         |         |
| 12.644000       | 28.7           | 1000.000        | 9.000           | GND | N    | 10.4       | 21.3        | 50.0         |         |
| 24.776000       | 32.6           | 1000.000        | 9.000           | GND | N    | 10.8       | 17.4        | 50.0         |         |

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



◆ Test resolution: 1 024 \* 768 / 60 Hz (RGB: Analog mode)

## 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 |
|-----------------|------------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.206000        | 47.2             | 1000.000        | 9.000           | GND | L1   | 9.9        | 16.16       | 63.36        |         |
| 24.726000       | 37.3             | 1000.000        | 9.000           | GND | L1   | 11.0       | 22.70       | 60.00        |         |
| 24.798000       | 37.4             | 1000.000        | 9.000           | GND | L1   | 11.0       | 22.60       | 60.00        |         |
| 24.898000       | 37.9             | 1000.000        | 9.000           | GND | L1   | 11.0       | 22.10       | 60.00        |         |
| 25.322000       | 37.7             | 1000.000        | 9.000           | GND | L1   | 11.0       | 22.30       | 60.00        |         |
| 25.354000       | 37.8             | 1000.000        | 9.000           | GND | L1   | 11.0       | 22.20       | 60.00        |         |

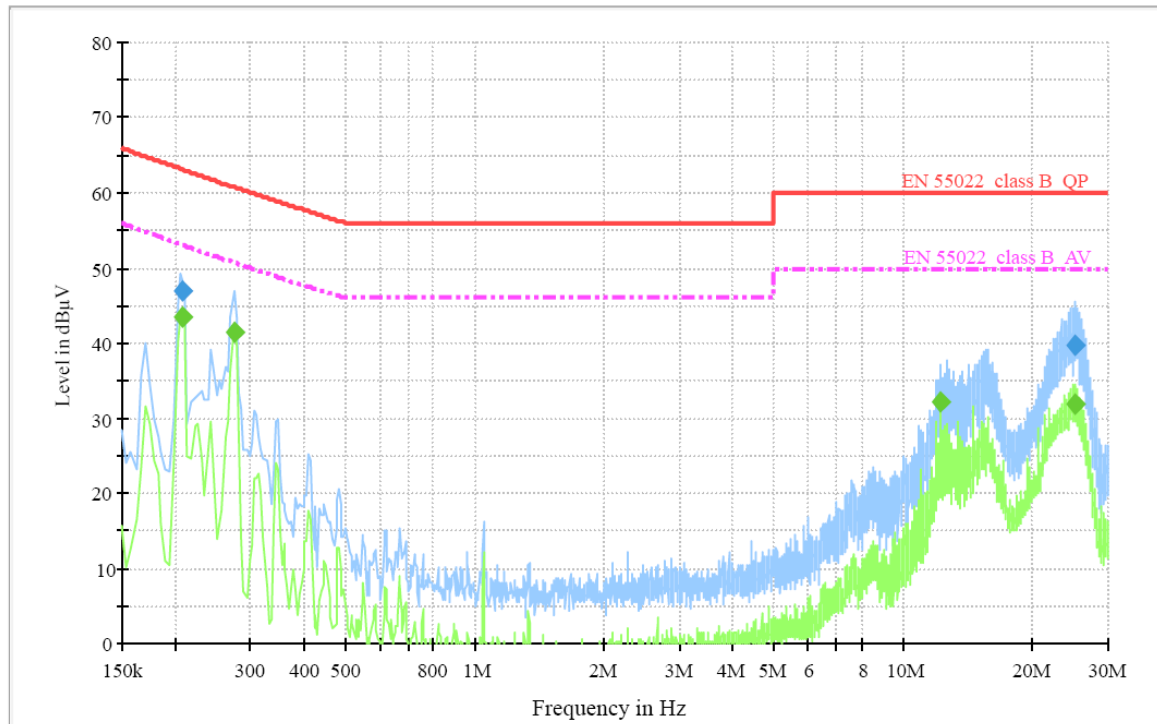
## Final Measurement Detector 2

| Frequency (MHz) | Average (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | PE  | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) | Comment |
|-----------------|----------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.206000        | 43.8           | 1000.000        | 9.000           | GND | L1   | 9.9        | 9.56        | 53.36        |         |
| 0.274000        | 41.9           | 1000.000        | 9.000           | GND | L1   | 10.0       | 9.09        | 50.99        |         |
| 12.190000       | 31.8           | 1000.000        | 9.000           | GND | L1   | 10.4       | 18.20       | 50.00        |         |
| 15.846000       | 30.6           | 1000.000        | 9.000           | GND | L1   | 10.6       | 19.40       | 50.00        |         |
| 25.122000       | 31.4           | 1000.000        | 9.000           | GND | L1   | 11.0       | 18.60       | 50.00        |         |

< 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 |
|-----------------|------------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.208000        | 46.8             | 1000.000        | 9.000           | GND | N    | 9.9        | 16.48       | 63.28        |         |
| 25.228000       | 39.6             | 1000.000        | 9.000           | GND | N    | 10.8       | 20.40       | 60.00        |         |

## Final Measurement Detector 2

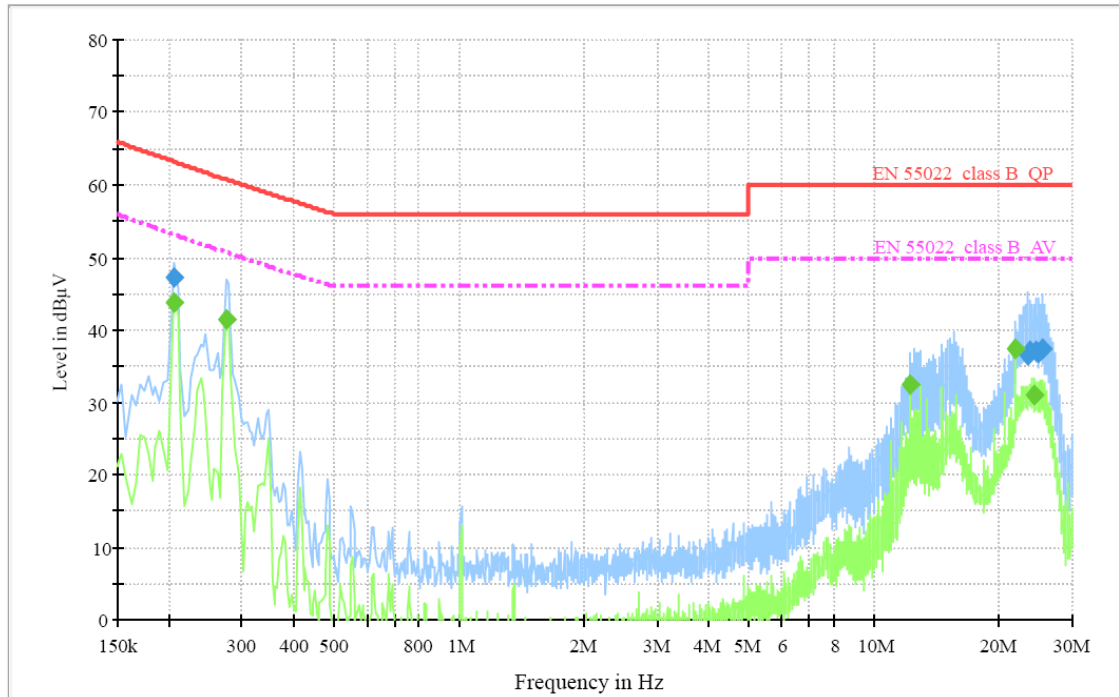
| Frequency (MHz) | Average (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | PE  | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) | Comment |
|-----------------|----------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.208000        | 43.3           | 1000.000        | 9.000           | GND | N    | 9.9        | 9.98        | 53.28        |         |
| 0.276000        | 41.6           | 1000.000        | 9.000           | GND | N    | 10.0       | 9.33        | 50.93        |         |
| 12.188000       | 32.1           | 1000.000        | 9.000           | GND | N    | 10.4       | 17.90       | 50.00        |         |
| 25.284000       | 31.8           | 1000.000        | 9.000           | GND | N    | 10.8       | 18.20       | 50.00        |         |

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



◆ Test resolution: 640 \* 480 / 60 Hz (RGB: Analog mode)

## 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 |
|-----------------|------------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.206000        | 47.2             | 1000.000        | 9.000           | GND | L1   | 9.9        | 16.16       | 63.36        |         |
| 23.610000       | 36.4             | 1000.000        | 9.000           | GND | L1   | 11.0       | 23.60       | 60.00        |         |
| 23.810000       | 37.1             | 1000.000        | 9.000           | GND | L1   | 11.0       | 22.90       | 60.00        |         |
| 24.578000       | 37.1             | 1000.000        | 9.000           | GND | L1   | 11.0       | 22.90       | 60.00        |         |
| 24.810000       | 36.9             | 1000.000        | 9.000           | GND | L1   | 11.0       | 23.10       | 60.00        |         |
| 25.342000       | 37.4             | 1000.000        | 9.000           | GND | L1   | 11.0       | 22.60       | 60.00        |         |

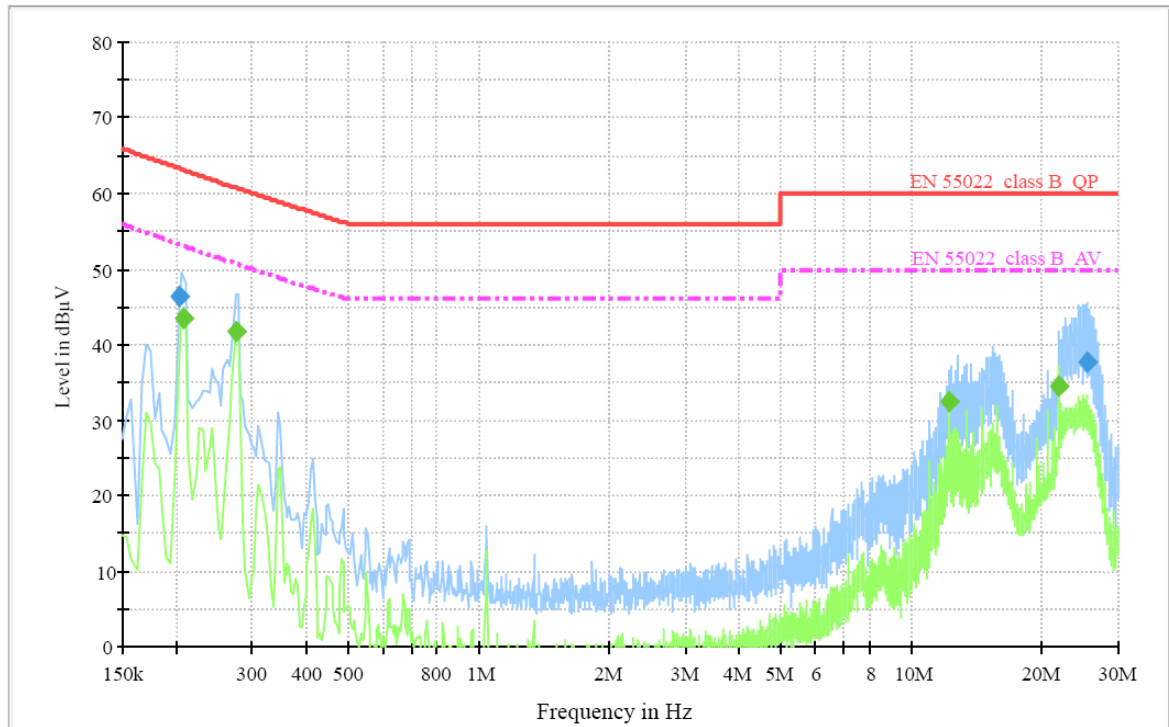
## Final Measurement Detector 2

| Frequency (MHz) | Average (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | PE  | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) | Comment |
|-----------------|----------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.206000        | 43.7           | 1000.000        | 9.000           | GND | L1   | 9.9        | 9.66        | 53.36        |         |
| 0.274000        | 41.5           | 1000.000        | 9.000           | GND | L1   | 10.0       | 9.49        | 50.99        |         |
| 12.194000       | 32.6           | 1000.000        | 9.000           | GND | L1   | 10.4       | 17.40       | 50.00        |         |
| 21.946000       | 37.3           | 1000.000        | 9.000           | GND | L1   | 10.9       | 12.70       | 50.00        |         |
| 24.418000       | 31.1           | 1000.000        | 9.000           | GND | L1   | 11.0       | 18.90       | 50.00        |         |

< 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 |
|-----------------|------------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.204000        | 46.5             | 1000.000        | 9.000           | GND | N    | 9.9        | 16.94       | 63.44        |         |
| 25.452000       | 37.6             | 1000.000        | 9.000           | GND | N    | 10.8       | 22.40       | 60.00        |         |

## Final Measurement Detector 2

| Frequency (MHz) | Average (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | PE  | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) | Comment |
|-----------------|----------------|-----------------|-----------------|-----|------|------------|-------------|--------------|---------|
| 0.208000        | 43.3           | 1000.000        | 9.000           | GND | N    | 9.9        | 9.98        | 53.28        |         |
| 0.276000        | 41.8           | 1000.000        | 9.000           | GND | N    | 10.0       | 9.13        | 50.93        |         |
| 12.192000       | 32.3           | 1000.000        | 9.000           | GND | N    | 10.4       | 17.70       | 50.00        |         |
| 21.944000       | 34.5           | 1000.000        | 9.000           | GND | N    | 10.8       | 15.50       | 50.00        |         |

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



## 6. Radiated Emission

### 6.1 Operating Environment

Temperature : 21 °C  
Relative Humidity : 50 % R.H.

### 6.2 Test Set-up

A preliminary scan with peak mode was performed in the semi anechoic chamber and found frequency for open area test site.

The formal radiated emission was measured at 3 m / 10 m distance open area test site.

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                                                | Uncertainty | Remark                          |
|-----------------------------------------------------------|-------------|---------------------------------|
| Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical)       | ± 3.54 dB   | Confidence levels of 95 % (k=2) |
| Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)     | ± 3.49 dB   | Confidence levels of 95 % (k=2) |
| Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)    | ± 3.85 dB   | Confidence levels of 95 % (k=2) |
| Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)  | ± 3.76 dB   | Confidence levels of 95 % (k=2) |
| Radiated emission (30 MHz ~ 300 MHz, 10 m, Vertical)      | ± 3.21 dB   | Confidence levels of 95 % (k=2) |
| Radiated emission (30 MHz ~ 300 MHz, 10 m, Horizontal)    | ± 3.32 dB   | Confidence levels of 95 % (k=2) |
| Radiated emission (300 MHz ~ 1 000 MHz, 10 m, Vertical)   | ± 3.77 dB   | Confidence levels of 95 % (k=2) |
| Radiated emission (300 MHz ~ 1 000 MHz, 10 m, Horizontal) | ± 3.84 dB   | Confidence levels of 95 % (k=2) |



#### 6.4 Limit

| Frequency<br>(MHz) | FCC Limit @ 3 m.<br>dB $\mu$ V/m | CISPR Limit @ 10 m.<br>dB $\mu$ 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 |
|-----------------------------------|-----------------|------------------------|---------------|--------------------|
| ■ - ESI                           | Rohde & Schwarz | EMI test receiver      | 830482/010    | 12. 14. 2009       |
| ■ - VULB9160                      | Schwarzbeck     | Broadband Test Antenna | 3193          | 12. 11. 2009       |
| ■ - BBHA9120D                     | Schwarzbeck     | Horn ANT               | 207           | 12. 26. 2009       |
| ■ - MCU066                        | maturo GmbH     | MCU066                 | 1390306       | N/A                |
| ■ - TT2.5SI                       | maturo GmbH     | Turntable              | 1390307       | N/A                |
| ■ - AM 4.0                        | maturo GmbH     | Antenna Mast           | 1390308       | N/A                |
| ■ - AFS 44 00101800-<br>25-10P-44 | MITEQ           | Preamplifier           | 1258943       | 11. 11. 2009       |

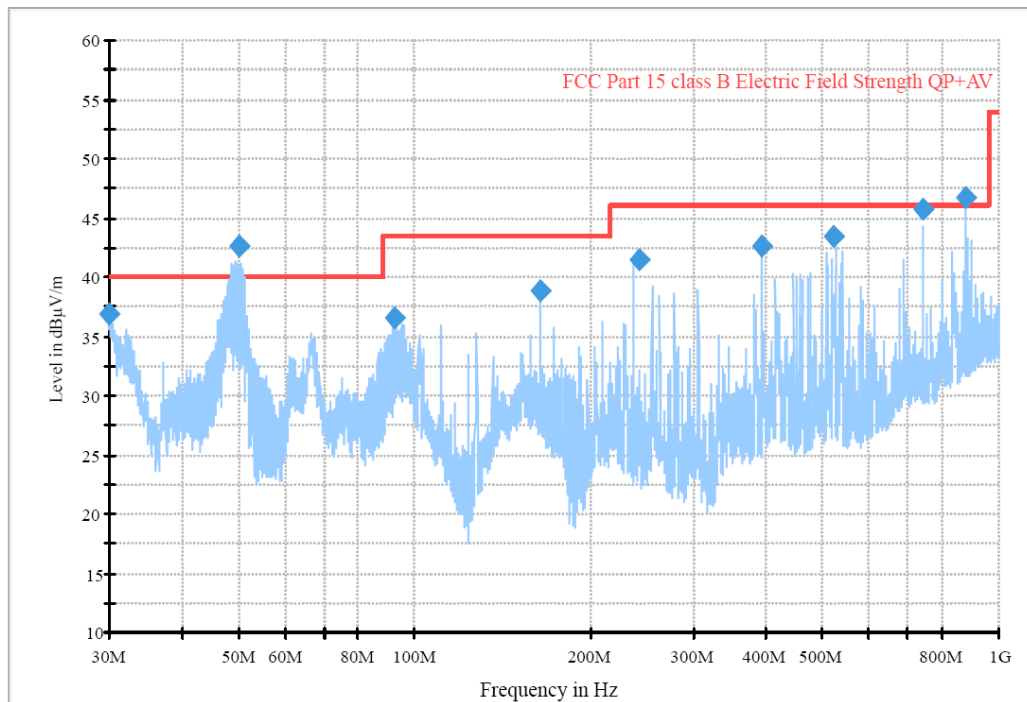


## 6.6 Test data for Radiated Emission

- Test Date : September 17, 2009
- Resolution Bandwidth : 120 kHz/ 1 MHz
- Frequency Range : 30 MHz ~ 2 000 MHz
- Measurement Distance : 3 m

- ◆ Operating Condition: 1 920 \* 1 080 / 60 Hz (RGB: Analog mode)  
Detector mode: Quasi- peak detector mode

FCC\_ESIB\_Direct\_RE with Scans



## Final Result 1

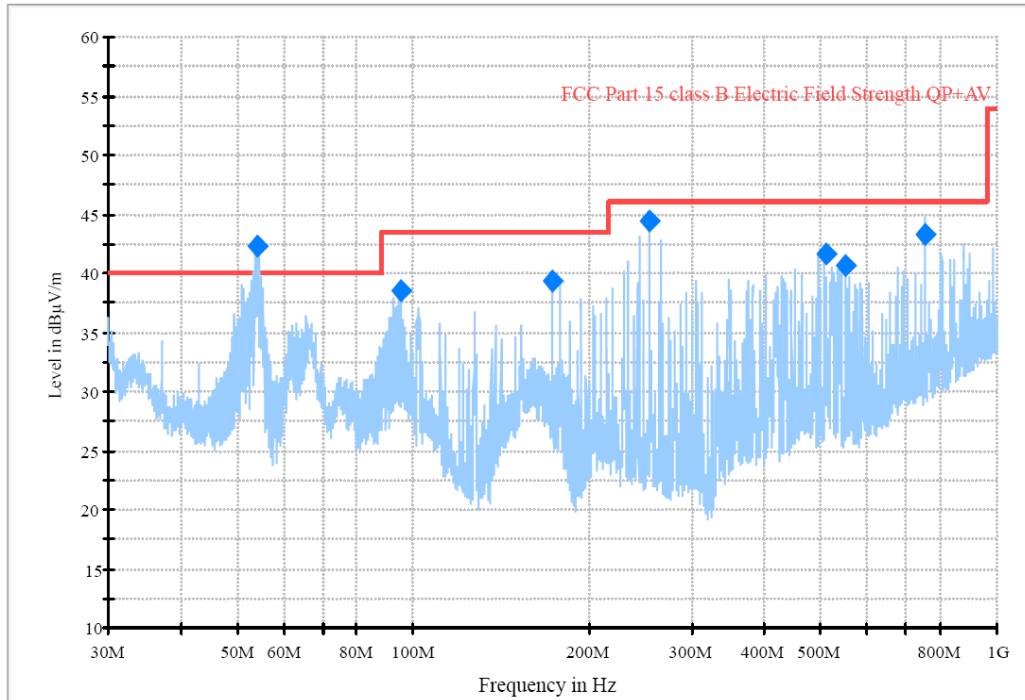
| Frequency (MHz) | MaxPeak (dBμV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) | Q.P   |
|-----------------|------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|-------|
| 30.050000       | 36.9             | 1000.0          | 120.000         | 106.0       | H            | 346.0         | 12.9       | 9.98        | 40.00          | 30.02 |
| 50.050000       | 42.6             | 1000.0          | 120.000         | 100.0       | H            | 77.0          | 13.7       | 6.63        | 40.00          | 33.37 |
| 92.400000       | 36.6             | 1000.0          | 120.000         | 140.0       | H            | 319.0         | 10.4       | 9.48        | 43.50          | 34.02 |
| 163.750000      | 38.9             | 1000.0          | 120.000         | 155.0       | V            | 0.0           | 15.2       | 14.68       | 43.50          | 28.82 |
| 241.900000      | 41.5             | 1000.0          | 120.000         | 126.0       | V            | 282.0         | 14.4       | 17.98       | 46.00          | 28.02 |
| 392.000000      | 42.7             | 1000.0          | 120.000         | 100.0       | V            | 351.0         | 19.6       | 14.25       | 46.00          | 31.75 |
| 519.790000      | 43.4             | 1000.0          | 120.000         | 105.0       | H            | 268.0         | 22.9       | 13.14       | 46.00          | 32.86 |
| 742.496000      | 45.7             | 1000.0          | 120.000         | 111.0       | V            | 183.0         | 28.9       | 4.55        | 46.00          | 41.45 |
| 880.400000      | 46.7             | 1000.0          | 120.000         | 177.0       | V            | 284.0         | 31.0       | 7.87        | 46.00          | 38.13 |

< Fig 12. Radiated emission result (30 MHz ~ 1 000 MHz)>



- ◆ Operating Condition: 1 920 \* 1 080 / 60 Hz (HDMI mode)  
Detector mode: Quasi- peak detector mode

ESCI\_Radiated Field Strength\_30M\_1GHz



## Final Result 1

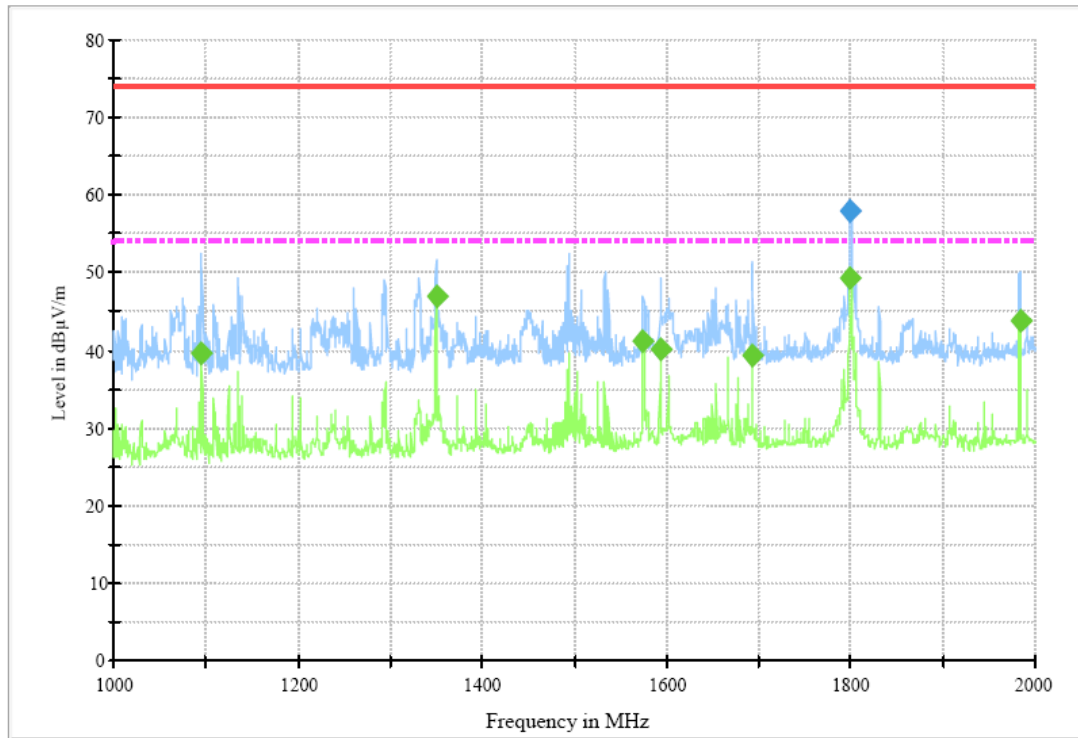
| Frequency (MHz) | MaxPeak (dBμV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) | Q.P   |
|-----------------|------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|-------|
| 54.170000       | 42.3             | 1000.0          | 120.000         | 100.0       | H            | 116.0         | 13.6       | 5.60        | 40.00          | 34.40 |
| 95.300000       | 38.6             | 1000.0          | 120.000         | 200.0       | V            | 136.0         | 10.7       | 14.25       | 43.50          | 29.25 |
| 173.250000      | 39.4             | 1000.0          | 120.000         | 172.0       | V            | 194.0         | 14.8       | 7.50        | 43.50          | 36.00 |
| 254.096000      | 44.5             | 1000.0          | 120.000         | 102.0       | V            | 185.0         | 14.9       | 4.60        | 46.00          | 41.40 |
| 508.170000      | 41.7             | 1000.0          | 120.000         | 200.0       | H            | 170.0         | 22.6       | 15.21       | 46.00          | 30.79 |
| 552.300000      | 40.7             | 1000.0          | 120.000         | 186.0       | V            | 170.0         | 23.8       | 13.48       | 46.00          | 32.52 |
| 750.750000      | 43.2             | 1000.0          | 120.000         | 119.0       | V            | 169.0         | 29.1       | 7.29        | 46.00          | 38.71 |

< Fig 13. Radiated emission result (30 MHz ~ 1 000 MHz)>



- ◆ Operating Condition: 1 920 \* 1 080 / 60 Hz (RGB: Analog mode)  
Detector mode: Peak detector mode / Average detector mode

FCC\_ESIB\_Preamplifier\_RE with Scans



### Final Result 1

| Frequency (MHz) | MaxPeak-MaxHold (dBμV/m) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) | Comment |
|-----------------|--------------------------|-------------|--------------|---------------|------------|-------------|----------------|---------|
| 1800.000000     | 57.9                     | 150.0       | H            | 0.0           | -13.1      | 16.1        | 74.0           |         |

### Final Result 2

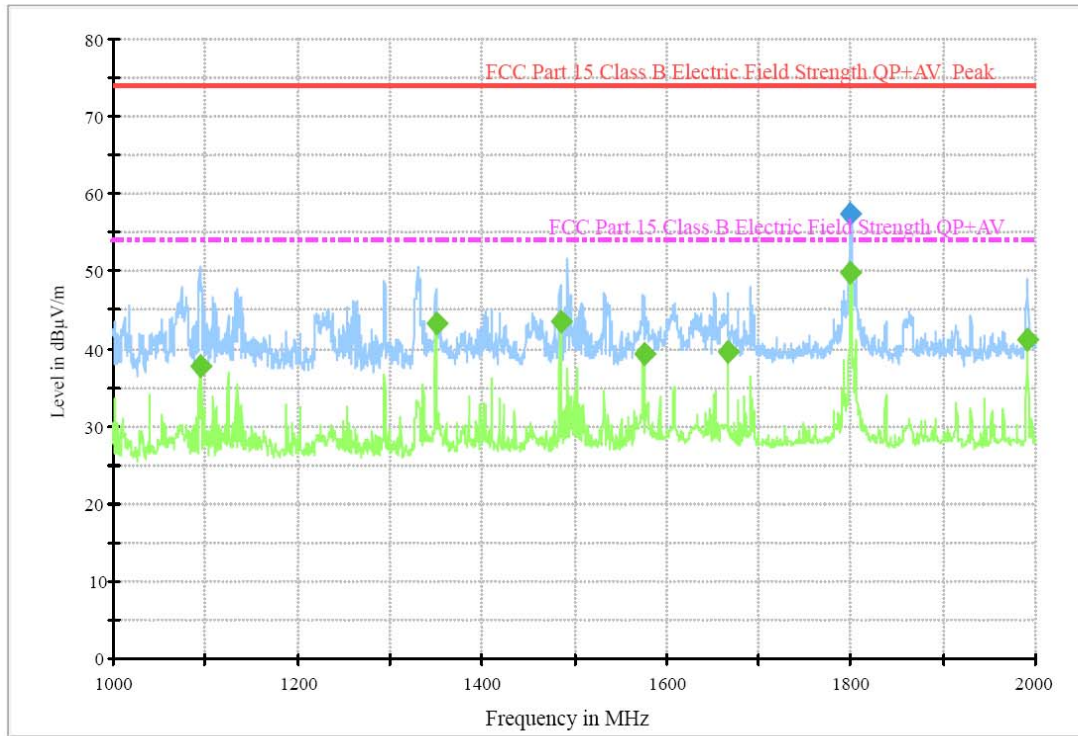
| Frequency (MHz) | Average-MaxHold (dBμV/m) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) | Comment |
|-----------------|--------------------------|-------------|--------------|---------------|------------|-------------|----------------|---------|
| 1095.200000     | 39.5                     | 150.0       | V            | 0.0           | -15.5      | 14.5        | 54.0           |         |
| 1350.000000     | 47.0                     | 200.0       | V            | 270.0         | -14.4      | 7.0         | 54.0           |         |
| 1574.800000     | 41.1                     | 150.0       | V            | 0.0           | -13.8      | 12.9        | 54.0           |         |
| 1593.200000     | 40.2                     | 150.0       | V            | 180.0         | -13.7      | 13.8        | 54.0           |         |
| 1693.600000     | 39.3                     | 100.0       | V            | 180.0         | -13.6      | 14.7        | 54.0           |         |
| 1800.000000     | 49.3                     | 150.0       | H            | 0.0           | -13.1      | 4.7         | 54.0           |         |
| 1983.600000     | 43.8                     | 150.0       | V            | 270.0         | -12.6      | 10.2        | 54.0           |         |

< Fig 14. Radiated emission result (1 000 MHz ~ 2 000 MHz)>



- ◆ Operating Condition: 1 920 \* 1 080 / 60 Hz (HDMI mode)  
Detector mode: Peak detector mode / Average detector mode

FCC\_ESIB\_Preamplifier\_RE with Scans



## Final Result 1

| Frequency (MHz) | MaxPeak-MaxHold (dBμV/m) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) | Comment |
|-----------------|--------------------------|-------------|--------------|---------------|------------|-------------|----------------|---------|
| 1800.000000     | 57.5                     | 150.0       | H            | 0.0           | -13.1      | 16.5        | 74.0           |         |

## Final Result 2

| Frequency (MHz) | Average-MaxHold (dBμV/m) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) | Comment |
|-----------------|--------------------------|-------------|--------------|---------------|------------|-------------|----------------|---------|
| 1094.000000     | 37.8                     | 100.0       | V            | 0.0           | -15.5      | 16.2        | 54.0           |         |
| 1350.000000     | 43.2                     | 100.0       | H            | 270.0         | -14.4      | 10.8        | 54.0           |         |
| 1484.800000     | 43.4                     | 150.0       | V            | 180.0         | -14.2      | 10.6        | 54.0           |         |
| 1575.200000     | 39.3                     | 100.0       | V            | 180.0         | -13.8      | 14.7        | 54.0           |         |
| 1666.800000     | 39.7                     | 100.0       | V            | 0.0           | -13.6      | 14.3        | 54.0           |         |
| 1800.000000     | 49.9                     | 150.0       | H            | 0.0           | -13.1      | 4.1         | 54.0           |         |
| 1991.200000     | 41.2                     | 150.0       | V            | 270.0         | -12.6      | 12.8        | 54.0           |         |

< Fig 15. Radiated emission result (1 000 MHz ~ 2 000 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 $\mu\text{V}$ = 48 dB $\mu\text{V}$                 |
| Reading                              | = 39.2 dB $\mu\text{V}$                                   |
| $10^{(39.2\text{dB}\mu\text{V}/20)}$ | = 91.2 $\mu\text{V}$                                      |
| Margin                               | = 48 dB $\mu\text{V}$ - 39.2 dB $\mu\text{V}$<br>= 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 $\mu\text{V}$                                                       |
| 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 $\mu\text{V}/\text{m}$<br>= 3.2 dB |



## 8. Recommendation & Conclusion

The data collected shows that the **LG Electronics Inc. Full HD Projector (Model Name: CF181D)** was complies with §15.107 and 15.109 of the FCC Rules.