# EMC TEST REPORT

| | | | |
|---|---|---|---|
| **Project No.** | LBE20162919 | **Issue No.** | 0 |
| **Applicant** | **Name of organization** | Samsung Electronics Co., Ltd. | |
| | **Address** | (Maetan-dong) 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Republic of Korea | |
| | **Date of application** | August 22, 2016 | |
| **EUT** | **Type of device** | ☒ Class B personal computers and peripherals<br>☐ All other devices | |
| | **Equipment authorization** | ☐ Declaration of Conformity ☒ Certification ☐ Verification | |
| | **FCC ID** | A3LSMG532F | |
| | **Kind of product** | Mobile Phone | |
| | **Model No.** | SM-G532F/DS | |
| | **Variant Model No.** | Refer to clause 4.6 | |
| | **Manufacturer** | Samsung Electronics Vietnam Thai Nguyen Co., Ltd.<br>Yen Binh Industrial Zone Pho Ten Dist., Thai Nguyen Province, Vietnam | |
| **Applied Standards** | | 47 CFR Part 15, Subpart B, Class B / ANSI C63.4-2014 | |
| **Test Period** | | August 29, 2016 ~ August 30, 2016 | |
| **Issue date** | | August 30, 2016 | |

**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** : Eun-Kyung Oh | **Reviewed by** : Young-Hun Kim |

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SAMSUNG

**CS & Environment Center of Samsung Electronics Co., Ltd.**
(Maetan-dong) 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-so, 16677, Republic of Korea

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# 1. Report Information

## 1.1 Revision history

| No. | Revised detailed information |
|---|---|
| Issue 0 | There are no revisions and this version is basic test report. |

# 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 Disturbance (Mains port) | 47 CFR Part 15, Subpart B / ANSI C63.4-2014 (Class B) | Complied |
| ☒ | Radiated Disturbance | | Complied |

# 3. General Information

## 3.1 Test facility

The CS & Environment center is located on Samsung Electronics Co., Ltd. at (Maetan-dong) 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Republic of 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 center is operated as testing laboratory in accordance with the requirements of ISO/IEC 17025:2005.



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# 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:

| Mark | Description | Model No. | Serial No. | Manufacturer / Trademark | FCC ID / DoC |
|---|---|---|---|---|---|
| A | Mobile Phone | SM-G532F/DS | - | SAMSUNG | A3LSMG532F |
| B | Battery | EB-BG530CBE | AA2H626hS/2-B | SAMSUNG | - |
| C | Headset | EHS61ASFWE | - | SAMSUNG | - |
| D | Data Cable | ECB-DU68WE | - | SAMSUNG | - |
| E | microSD Card | 32GB | - | SAMSUNG | - |
| F | Desk-Top Computer | DM-C410 | HFGD97AB700278X | SAMSUNG | DoC |
| | | DM300S3A | - | SAMSUNG | DoC |
| G | LCD TV Monitor | PE22BS | N849HVMP702249R | SAMSUNG | DoC |
| | | EM23TS | NC26H1KSB01550B | SAMSUNG | DoC |
| H | Mouse | SML-210PB | TAKD125024 V | SAMSUNG | DoC |
| | | | TAKD124911 M | SAMSUNG | DoC |
| I | Keyboard | SDM8500P | 8M001183 | SAMSUNG | DoC |
| | | | 8M001033 | SAMSUNG | DoC |
| J | Gigabit Switch 8 | J9794A | CN33FQ703Q | HP | DoC |
| | | | CN33FQ71XK | HP | DoC |
| K | Power Supply | EADP-15DC A | DIKD1245096741 | Delta | DoC |
| | | | DIKD1245096576 | Delta | DoC |
| L | Travel Adapter | ETA0U83EWE | RT1H122CS/A-E | SAMSUNG | - |



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## 4.2 EUT operating mode

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

| | |
|---|---|
| **Operating Mode 1** | USB Mode (Data Communication) |

## 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 in terface port of the EUT, and where practical, each cable shall be terminated in a device ty pical of actual usage. The type(s) of interconnecting cables to be used and the interface p ort (of the EUT) to which these were connected:

| No. | Connected cable | Length [m] | Shielded [Y/N] | Note |
|---|---|---|---|---|
| 1 | Data Cable | 0.8 | Yes | From EUT to Desk-Top Computer |
| 2 | Headset | 1.6 | No | For EUT |
| 3 | Power | 1.8 | No | For Desk-Top Computer |
| 4 | Power | 1.8 | No | For LCD TV Monitor |
| 5 | Power | 1.8 | No | From Gigabit Switch 8 to Power Supply |
| 6 | Power | 1.8 | No | For Power Supply |
| 7 | LAN | 1.5 | No | From Desk-Top Computer to Gigabit Switch 8 |
| 8 | LAN | 1.5 | No | From Gigabit Switch 8 to Local Area Network |
| 9 | RGB | 1.8 | Yes | From Desk-Top Computer to LCD TV Monitor |
| 10 | PS/2 | 1.5 | Yes | From Desk-Top Computer to Mouse |
| 11 | PS/2 | 1.5 | Yes | From Desk-Top Computer to Keyboard |



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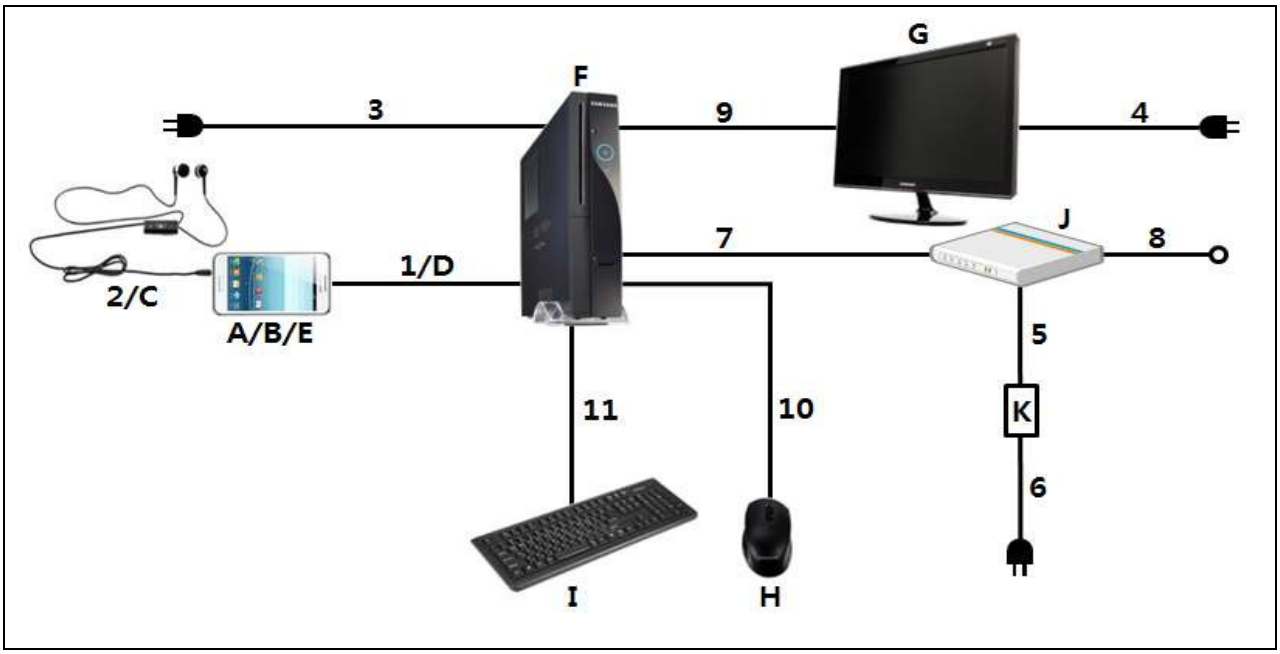
## 4.5 Test arrangement




## 4.6 EUT Description

The EUT is a bar type Mobile Phone which can operate on GSM850/900/1800/1900, WCDMA FDD1/2/5/8, LTE FDD1/3/5/7/8/20 and incorporates a camera, bluetooth, Wi-Fi, FM Radio, GPS and MP3/MP4 player.

4.6.1 The variant models

- SM-G532F

## 4.7 Clock Frequencies

| Kind of Clocks | Frequency [ MHz ] |
|---|---|
| CPU | 1 450 |



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## 4.8 Test configuration and condition

☐ The EUT exercise program which is the samsung standardized emission test program for Windows was used during all EMC measurements were tested. This program was contained on the PC hard disk drive. Once loaded, the program sequentially exercises each system component in turn.

☒ The EUT was exercised during the testing by data read and write cycles repeated with internal/ external storage devices. At the end of the test, the copied back data was compared with origin

☐ The EUT was connected to the PC by using USB data cable to charge.

☐ The system was configured for testing in a typical fashion that a customer would normally use, and was tested while in an automated non-attendant mode.

Power source for the EUT operating was supplied by CVCF made by the Pacific Power Source Corp.

**- Test Voltage : AC 120 V, 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.)

4.9.1 Emission

| Test type | | Measurement uncertainty (C.L. 95 %, k = 2) |
|---|---|---|
| Conducted disturbance | AC Mains | 2.85 dB |
| Radiated Disturbance (30 MHz ~ 1 GHz) | Horizontal | 4.99 dB |
| | Vertical | 4.90 dB |
| Radiated Disturbance (1 GHz ~ 6 GHz) | Horizontal | 4.83 dB |
| | Vertical | 4.84 dB |



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# 5. Results of individual test

## 5.1 Conducted disturbance

The EUT was connected to the Desk-Top Computer which was powered from one LISN for the measurements. The support equipment power cables were connected to a second LISN.
Both conducted lines are measured in Quasi-Peak and CISPR-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 disturbance at the mains ports of Class B ITE**

| Frequency range Limits [ MHz ] | Resolution Bandwidth [ kHz ] | Limits [ dB(μV) ] | |
|---|---|---|---|
| | | Quasi-peak | Average |
| 0,15 to 0,50 | 9 | 66 to 56 | 56 to 46 |
| 0,50 to 5 | 9 | 56 | 46 |
| 5 to 30 | 9 | 60 | 50 |
| NOTE 1 The lower limit shall apply at the transition frequency.<br>NOTE 2 The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. | | | |

### 5.1.1 Test instrumentation

| EMC No. | Test Instrument | Model name | Manufacturer | Serial No. | Calibration | |
|---|---|---|---|---|---|---|
| | | | | | Date | Interval (Month) |
| E5I-043 | LISN | ENV216 | R&S | 101630 | 2016-08-05 | 12 |
| E5I-018 | EMI Test Receiver | ESU8 | R&S | 100484 | 2016-05-13 | 12 |
| E5I-127 | LISN | ENV216 | R&S | 102061 | 2016-06-24 | 12 |

### 5.1.2 Temperature and humidity condition

| | | | |
|---|---|---|---|
| **Test date** | 2016-08-30 | **Test engineer** | Eun-Kyung Oh |
| **Climate condition** | Ambient temperature | (22.7 ~ 22.9) ℃ | Limit (15.0 to 35.0) ℃ |
| | Relative humidity | (54.8 ~ 55.0) % R.H. | Limit (5.0 to 75.0) % R.H. |
| | Atmospheric pressure | (100.4 ~ 100.6) kPa | Limit (86.0 to 106.0) kPa |
| **Test place** | Shield Room (SR14) | | |



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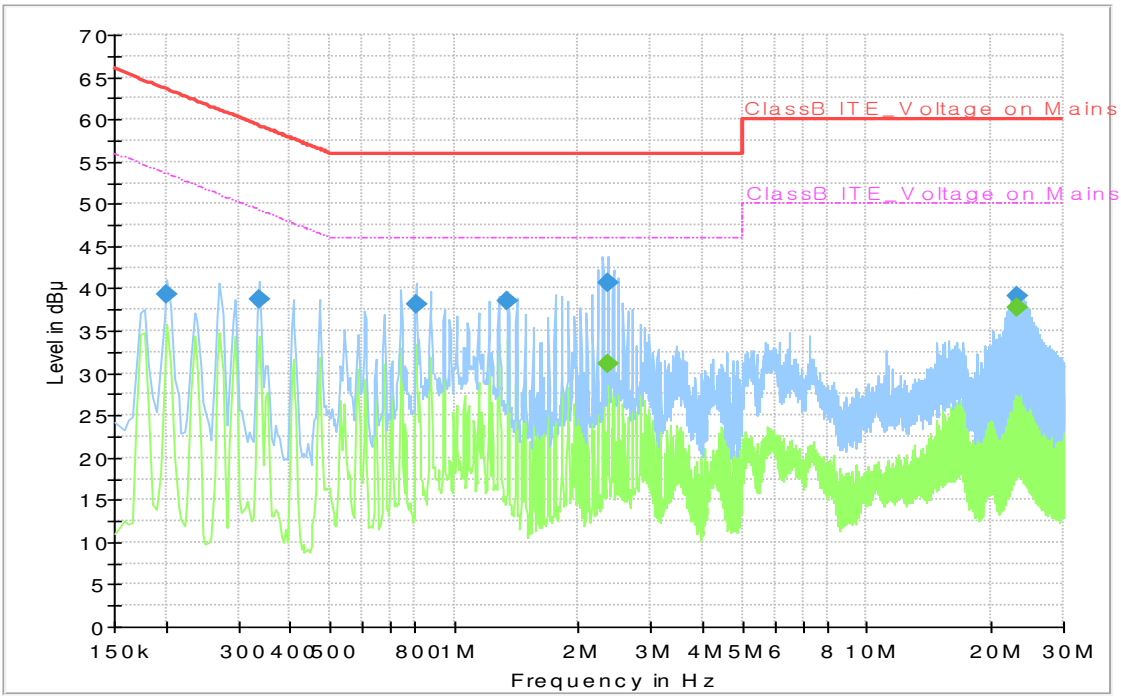
## 5.1.3 Test results

### ☐ Operating Mode 1: AC Mains




Note 1) Two graphs measured for both Live(L1) and Neutral(N) of the LISN are combined into one graph.

Quasi-peak /CAV final measurement results table:

| Frequency (MHz) | QuasiPeak (dBµV) | CAV (dBµV) | Limit (dBµV) | Margin (dB) | Line | Corr. (dB) |
|---|---|---|---|---|---|---|
| 0.201 | 39.3 | --- | 63.6 | 24.3 | N | 9.9 |
| 0.337 | 38.7 | --- | 59.3 | 20.6 | L1 | 10.2 |
| 0.809 | 38.1 | --- | 56.0 | 17.9 | L1 | 10.1 |
| 1.349 | 38.5 | --- | 56.0 | 17.5 | L1 | 10.0 |
| 2.361 | --- | 31.1 | 46.0 | 14.9 | L1 | 10.0 |
| 2.361 | 40.6 | --- | 56.0 | 15.4 | L1 | 10.0 |
| 23.201 | 39.1 | --- | 60.0 | 20.9 | N | 11.0 |
| 23.205 | --- | 37.7 | 50.0 | 12.3 | N | 11.0 |

Note 2) Level (QP and/or CAV) = Meter Reading (QP and/or CAV) + Corr. (LISN Insertion Loss + Cable Loss)
Margin (QP and/or CAV) = Limit – Level (QP and/or CAV)
QP = Quasi-Peak, CAV = CISPR-Average, Corr. = Correction Factor



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## 5.2 Radiated disturbance

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.

Peak measurements were made over the changeable frequency range 30 MHz to 1 GHz at a measurement distance of 10 m for the following antenna and turntable arrangements:

| Antenna Height [ cm ] | Antenna Polarisation | Resolution Bandwidth [ kHz ] | Video Bandwidth [ kHz ] | Turntable position [ degrees ] |
|---|---|---|---|---|
| 100 ~ 400 | Horizontal, Vertical | 120 | 300 | Continuous |

Measurements within 6 dB of the limit were then maximized by adjusting turntable position.
Final measurements were made using quasi-peak detector.

Peak/CISPR-average measurements were made over the changeable frequency range 1 GHz to 40 GHz or 5th harmonics of the highest frequency in accordance with internal maximum operating frequency at a measurement distance of 3 m for the following antenna and turntable arrangements:
The measurements above 1 GHz were performed with the bore-sighting antenna aimed at the EUT.

| Antenna Height [ cm ] | Antenna Polarisation | Resolution Bandwidth [ MHz ] | Video Bandwidth [ MHz ] | Turntable position [ degrees ] |
|---|---|---|---|---|
| 100 ~ 400 | Horizontal, Vertical | 1 | 3 | Continuous |

Measurements within 6 dB of the limit were then maximized by adjusting turntable position.
Final measurements were made using peak and CISPR-average detectors.

**Limits for radiated disturbance of Class B ITE at a measuring distance of 3 m and 10 m**

| Frequency range Limits [ MHz ] | Field Strength | | |
|---|---|---|---|
| | 3 m [ μV/m ] | 3 m [ dB(μV/m) ] | 10 m [ dB(μV/m) ] |
| 30 to 88 | 100 | 40.0 | 29.5 |
| 88 to 216 | 150 | 43.5 | 33.0 |
| 216 to 960 | 200 | 46.0 | 35.5 |
| Above 960 | 500 | 54.0 | 43.5 |

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



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## 5.2.1 Test instrumentation

| EMC No. | Test Instrument | Model name | Manufacturer | Serial No. | Calibration | |
|---|---|---|---|---|---|---|
| | | | | | Date | Interval (Month) |
| E5I-015 | EMI Test Receiver | ESU8 | R&S | 100481 | 2016-05-13 | 12 |
| E5I-020 | EMI Test Receiver | ESU40 | R&S | 100375 | 2016-06-01 | 12 |
| E5I-035 | Horn Antenna | HF907 | R&S | 100506 | 2015-05-07 | 24 |
| E5I-070 | BiLog Antenna | CBL6112D | TESEQ | 35383 | 2015-06-15 | 24 |
| E5I-120 | BiLog Antenna | CBL6112D | TESEQ | 36997 | 2016-04-21 | 24 |
| E5I-093 | Preamplifier | 310N | SONOMA | 273122 | 2016-01-21 | 12 |
| E5I-094 | Preamplifier | 310N | SONOMA | 282363 | 2016-01-21 | 12 |

## 5.2.2 Temperature and humidity condition

| **Test date** | 2016-08-29 | **Test engineer** | Eun-Kyung Oh |
|---|---|---|---|
| **Climate condition** | Ambient temperature | (20.6 ~ 20.8) ℃ | Limit (15.0 to 35.0) ℃ |
| | Relative humidity | (58.6 ~ 58.8) % R.H. | Limit (25.0 to 75.0) % R.H. |
| | Atmospheric pressure | (99.6 ~ 99.8) kPa | Limit (86.0 to 106.0) kPa |
| **Test place** | Semi-Anechoic Chamber (SAC8) | | |



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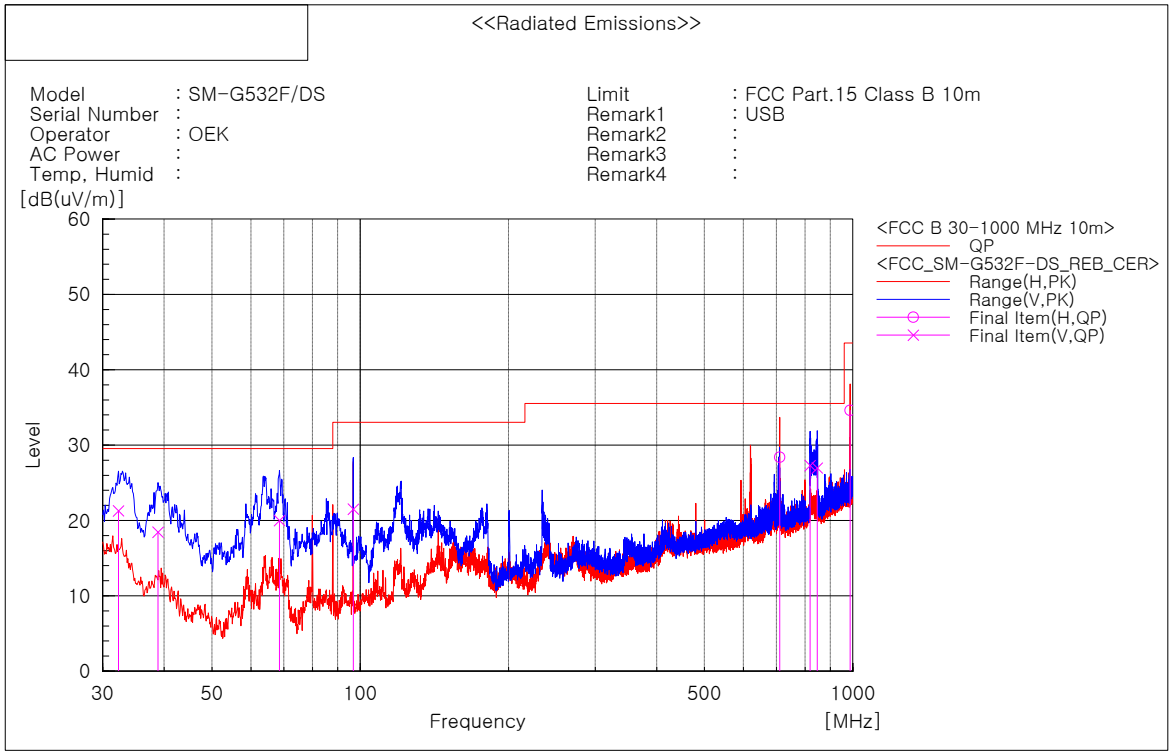
## 5.2.3 Test results

### ☐ Operating Mode 1

### - Frequencies below 1 GHz




Final Result

| No. | Frequency [MHz] | (P) | Reading QP [dB(uV)] | c.f [dB(1/m)] | Result QP [dB(uV/m)] | Limit QP [dB(uV/m)] | Margin QP [dB] | Height [cm] | Angle [deg] | System |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 32.304 | V | 34.1 | -12.8 | 21.3 | 29.5 | 8.2 | 100 | 9 | 2 |
| 2 | 38.851 | V | 34.8 | -16.4 | 18.4 | 29.5 | 11.1 | 100 | 0 | 2 |
| 3 | 68.558 | V | 43.7 | -23.7 | 20.0 | 29.5 | 9.5 | 100 | 269 | 2 |
| 4 | 96.809 | V | 40.9 | -19.4 | 21.5 | 33.0 | 11.5 | 200 | 4 | 2 |
| 5 | 710.213 | H | 37.7 | -9.3 | 28.4 | 35.5 | 7.1 | 100 | 353 | 1 |
| 6 | 819.095 | V | 33.8 | -6.5 | 27.3 | 35.5 | 8.2 | 300 | 148 | 2 |
| 7 | 847.346 | V | 33.1 | -6.1 | 27.0 | 35.5 | 8.5 | 300 | 155 | 2 |
| 8 | 987.026 | H | 39.6 | -5.0 | 34.6 | 43.5 | 8.9 | 100 | 313 | 1 |

Note) Receiving antenna polarization : Horizontal, Vertical
Test Distance : 10 m, Antenna Height : 1 to 4 meters
Level (QP) = Reading (QP) + c.f (Antenna Factor + Cable Loss - Amp. Gain)
Margin (QP) = Limit – Level (QP)
QP = Quasi-Peak, c.f = Correction Factor



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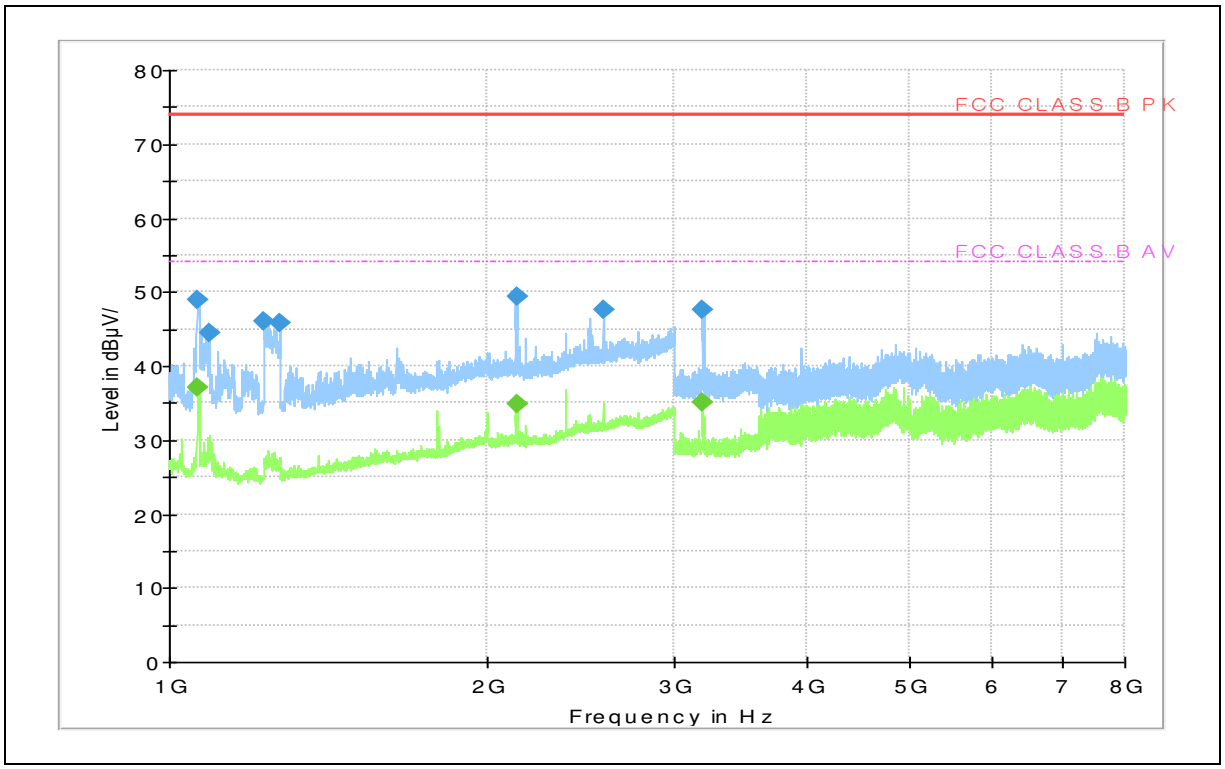
## - Frequencies above 1 GHz




| Frequency (MHz) | MaxPeak (dB µ V/m) | CAV (dB µ V/m) | Limit (dB µ V/m) | Margin (dB) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|
| 1 063.600 | --- | 37.0 | 54.0 | 17.0 | 100.0 | H | 174.0 | 6.7 |
| 1 064.000 | 48.9 | --- | 74.0 | 25.1 | 100.0 | H | 214.0 | 6.7 |
| 1 090.400 | 44.4 | --- | 74.0 | 29.6 | 100.0 | V | 156.0 | 6.7 |
| 1 228.400 | 46.1 | --- | 74.0 | 27.9 | 100.0 | V | 177.0 | 7.0 |
| 1 272.000 | 45.8 | --- | 74.0 | 28.2 | 100.0 | V | 150.0 | 7.3 |
| 2 132.400 | 49.3 | --- | 74.0 | 24.7 | 100.0 | H | 236.0 | 13.2 |
| 2 132.400 | --- | 34.9 | 54.0 | 19.1 | 100.0 | H | 236.0 | 13.2 |
| 2 568.800 | 47.6 | --- | 74.0 | 26.4 | 100.0 | H | 242.0 | 14.8 |
| 3 196.333 | 47.6 | --- | 74.0 | 26.4 | 100.0 | H | 306.0 | 0.8 |
| 3 196.333 | --- | 35.0 | 54.0 | 19.0 | 100.0 | H | 306.0 | 0.8 |

Note ) Receiving antenna polarization : Horizontal, Vertical
Test Distance : 3 m, Antenna Height : 1 to 4 meters
Level (PK and/or CAV) = Reading (PK and/or CAV) + Corr. (Antenna Factor + Cable Loss - Amp. Gain)
Margin (PK and/or CAV) = Limit – Level (PK and/or CAV)
PK = Peak, CAV = CISPR-Average, Corr. = Correction Factor



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