

# EMC TEST REPORT

|                          |                                |                                                                                                                                                                                                                                                                                                               |   |
|--------------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <b>Project No.</b>       | LBE20181943                    | <b>Issue No.</b>                                                                                                                                                                                                                                                                                              | 0 |
| <b>Applicant</b>         | <b>Name of organization</b>    | Samsung Electronics Co., Ltd.                                                                                                                                                                                                                                                                                 |   |
|                          | <b>Address</b>                 | (Maetan-dong) 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Republic of Korea                                                                                                                                                                                                                  |   |
|                          | <b>Date of application</b>     | November 29, 2018                                                                                                                                                                                                                                                                                             |   |
| <b>EUT</b>               | <b>Type of device</b>          | <input checked="" type="checkbox"/> All other Receivers subject to part15<br><input checked="" type="checkbox"/> Class B Personal Computers and peripherals<br><input checked="" type="checkbox"/> Other Class B digital devices and peripherals<br><input checked="" type="checkbox"/> FM Broadcast Receiver |   |
|                          | <b>Equipment authorization</b> | <input checked="" type="checkbox"/> Certification <input type="checkbox"/> Supplier's Declaration of Conformity                                                                                                                                                                                               |   |
|                          | <b>FCC ID</b>                  | A3LSMG970KOR                                                                                                                                                                                                                                                                                                  |   |
|                          | <b>Kind of product</b>         | Mobile Phone                                                                                                                                                                                                                                                                                                  |   |
|                          | <b>Model No.</b>               | SM-G970N                                                                                                                                                                                                                                                                                                      |   |
|                          | <b>Variant Model No.</b>       | Refer to clause 4.6                                                                                                                                                                                                                                                                                           |   |
|                          | <b>Manufacturer</b>            | SAMSUNG ELECTRONICS CO., LTD<br>94-1, Imsu-dong, Gumi-si, Gyengsangbuk-do,<br>730-722, Republic of Korea<br>SAMSUNG ELECTRONICS HUIZHOU CO.,LTD.<br>516229, Chenjiang Town, HuiZhou City,<br>Guangdong Province, China                                                                                        |   |
| <b>Applied Standards</b> |                                | 47 CFR Part 15, Subpart B, Class B / ANSI C63.4-2014                                                                                                                                                                                                                                                          |   |
| <b>Test Period</b>       |                                | November 30, 2018 ~ December 10, 2018                                                                                                                                                                                                                                                                         |   |
| <b>Issue date</b>        |                                | December 14, 2018                                                                                                                                                                                                                                                                                             |   |

## 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** : Soo-Joon Kim

*S. J. Kim*

**Reviewed by** : Young-Hun Kim

*Y. H. Kim*

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Global CS Center of Samsung Electronics Co., Ltd.

(Maetan-dong) 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 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. |

## 1.2 RSE test report no.

| No.         | Remark                                                                            |
|-------------|-----------------------------------------------------------------------------------|
| 12563993-E1 | The cellular receiver mode refers to the radiated spurious emissions 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   |
|-------------------------------------|---------------------------------------|---------------------------------------------------------|----------|
| <input checked="" type="checkbox"/> | Conducted Disturbance<br>(Mains port) | 47 CFR Part 15 Subpart B / ANSI C63.4-2014<br>(Class B) | Complied |
| <input checked="" type="checkbox"/> | Radiated Disturbance                  |                                                         | Complied |

# 3. General Information

## 3.1 Test facility

The Global CS Center is located on Samsung Electronics Co., Ltd. at (Maetan-dong) 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Republic of Korea. All testing are performed in Semi-anechoic chambers conforming to the site attenuation characteristics defined by ANSI C63.4, CISPR 32, CISPR 16-1-4 and Shielded rooms. And all antennas are properly calibrated using ANSI C63.5:2017.

The Global CS Center is operated as 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:

| Mark | Description       | Model No.   | Serial No.        | Manufacturer / Trademark | FCC ID       |
|------|-------------------|-------------|-------------------|--------------------------|--------------|
| A    | Mobile Phone      | SM-G970N    | -                 | SAMSUNG                  | A3LSMG970KOR |
| B    | Battery           | EB-BG970ABU | -                 | SAMSUNG                  | -            |
| C    | Headset           | EO-IG955    | -                 | SAMSUNG                  | -            |
| D    | Data Cable        | EP-DG970BBE | -                 | SAMSUNG                  | -            |
|      |                   | JCA141      | BW2K1709000770    | J5CREATE                 |              |
| E    | Micro SD Card     | 64GB        | -                 | SAMSUNG                  | -            |
| F    | Travel Adapter    | EP-TA200    | R37KB5B02S1SE3    | SAMSUNG                  | -            |
| G    | Desk-Top Computer | DM-C410     | HFGD97AB700278X   | SAMSUNG                  | -            |
|      |                   | DM300S      | A20100622         | SAMSUNG                  | -            |
| H    | LCD TV Monitor    | PE22BS      | N849HVMP702249R   | SAMSUNG                  | -            |
|      |                   | EM23TS      | NC26H1KSB01550B   | SAMSUNG                  | -            |
| I    | DP Monitor        | 27DU88      | 711NTQD8H004      | LG                       |              |
| J    | Power Supply      | LCAP31      | EH8NN629490055062 | LG                       |              |
| K    | Mouse             | SML-210PB   | TAKD125024 V      | SAMSUNG                  | -            |
|      |                   |             | TAKD124911 M      | SAMSUNG                  | -            |
|      |                   | MOARU0      | 0733002158        | SAMSUNG                  | -            |
| L    | Keyboard          | SDM8500P    | 8M001183          | SAMSUNG                  | -            |
|      |                   |             | 8M001033          | SAMSUNG                  | -            |
| M    | Gigabit Switch 8  | J9794A      | CN33FQ703Q        | HP                       | -            |
|      |                   |             | CN33FQ71XK        | HP                       | -            |
| N    | Power Supply      | EADP-15DC A | DIKD1245096741    | Delta                    | -            |
|      |                   |             | DIKD1245096576    | Delta                    | -            |
| O    | OTG Gender        | EE-UG970    | -                 | SAMSUNG                  | -            |

## 4.2 EUT operating mode

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

### 4.2.1 Conducted Emission

| No. | Operating mode                                                                                |
|-----|-----------------------------------------------------------------------------------------------|
| 1   | Camera (rear) + Charging (w/ TA) + Cellular receiver (GSM850 Center Frequency) + FM (Low Ch.) |
| 2   | Camera (front) + Charging (w/ TA) + FM (Mid Ch.)                                              |
| 3   | Charging (w/ TA) + FM (High Ch.)                                                              |
| 4   | Video + Audio playback from internal memory data + Charging (w/ TA)                           |
| 5   | USB Data Communication with PC (from external memory data)                                    |

### 4.2.2 Radiated Emission

| No. | Operating mode                                                                  |
|-----|---------------------------------------------------------------------------------|
| 1   | Camera (rear) + Charging (w/ TA) + FM (Low Ch.)                                 |
| 2   | Camera (front) +USB OTG (w/USB gender: mouse) + FM (Mid Ch.)                    |
| 3   | FM (High Ch.)                                                                   |
| 4   | Video + Audio playback from internal memory data + Display out(Direct DP Cable) |
| 5   | USB Data Communication with PC (from external memory data)                      |

## 4.3 Details of Sampling

Customer selected, single unit.

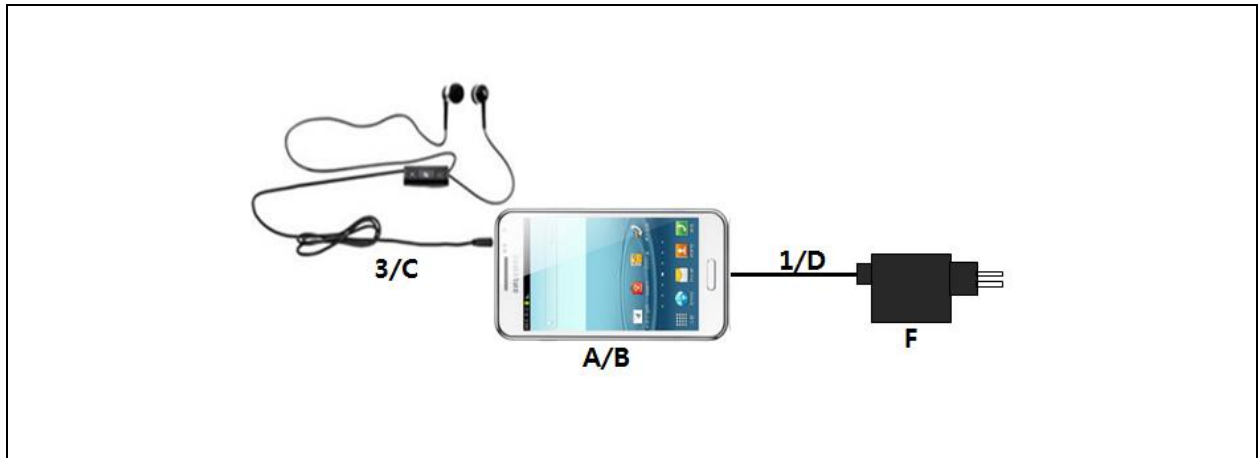
#### 4.4 Used cable description

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:

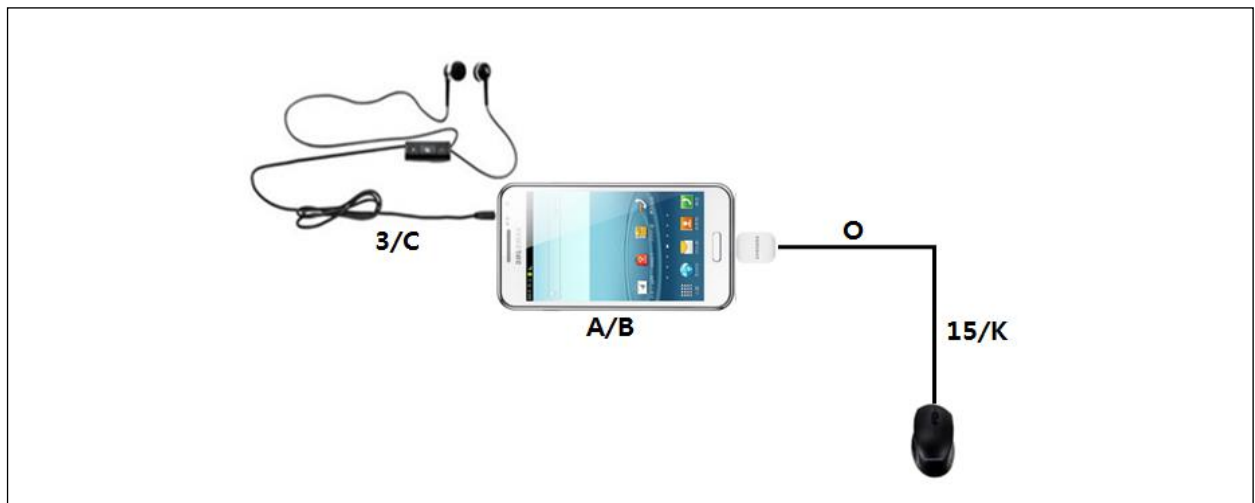
| No. | Connected cable | Length [m] | Shielded [Y/N] | Note                                        |
|-----|-----------------|------------|----------------|---------------------------------------------|
| 1   | Data Cable      | 1.0        | Yes            | From EUT to Desk-Top Computer               |
| 2   | DP Cable        | 1.1        | Yes            | From EUT to DP Monitor                      |
| 3   | Headset         | 1.2        | No             | For EUT                                     |
| 4   | Power           | 1.8        | No             | For Desk-Top Computer                       |
| 5   | Power           | 1.2        | No             | From DP Monitor to Power Supply             |
| 6   | Power           | 1.6        | No             | For Power Supply                            |
| 7   | Power           | 1.8        | No             | For LCD TV Monitor                          |
| 8   | Power           | 1.8        | No             | From Gigabit Switch 8 to Power Supply       |
| 9   | Power           | 1.8        | No             | For Power Supply                            |
| 10  | LAN             | 1.5        | No             | From Desk-Top Computer to Gigabit Switch 8  |
| 11  | LAN             | 1.5        | No             | From Gigabit Switch 8 to Local Area Network |
| 12  | RGB             | 1.8        | Yes            | From Desk-Top Computer to LCD TV Monitor    |
| 13  | PS/2            | 1.5        | Yes            | From Desk-Top Computer to Mouse             |
| 14  | PS/2            | 1.5        | Yes            | From Desk-Top Computer to Keyboard          |
| 15  | USB             | 1.5        | Yes            | For USB OTG Gender                          |



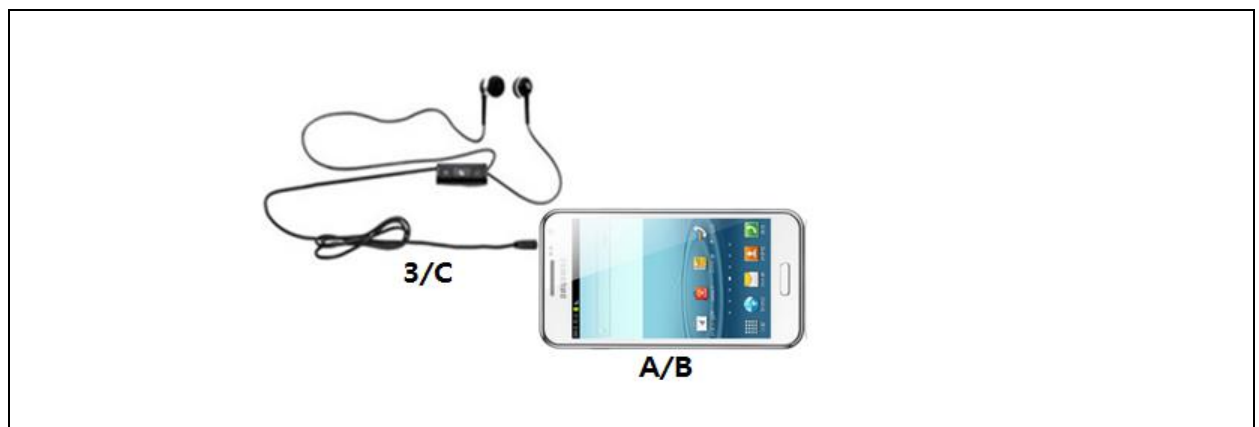
## 4.5.2 Radiated Emission



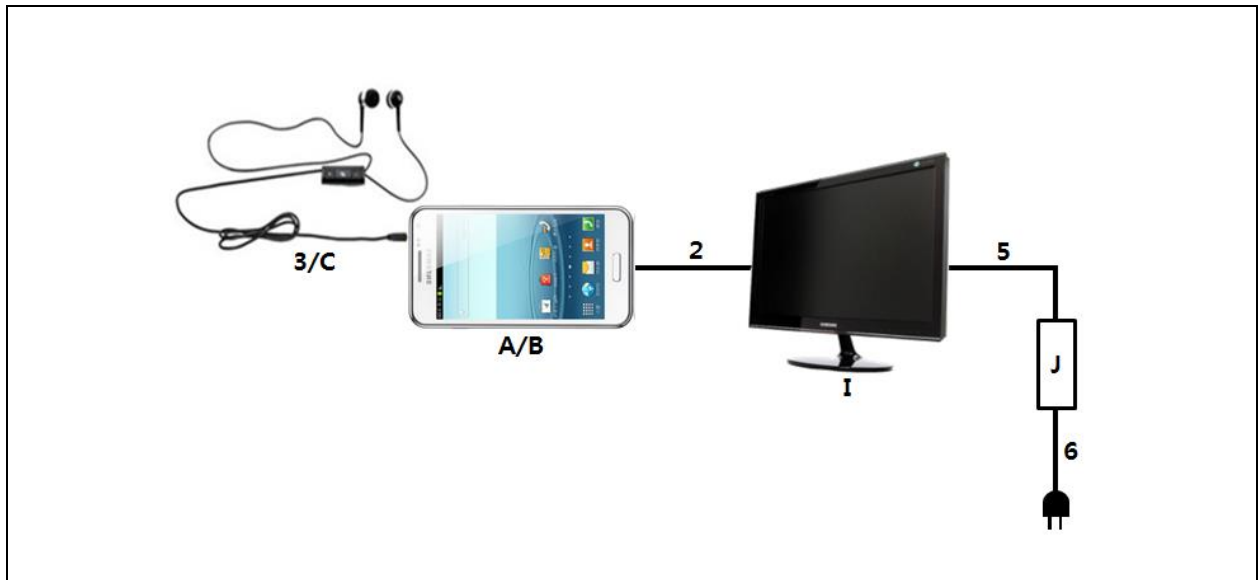
[ Mode 1 ]



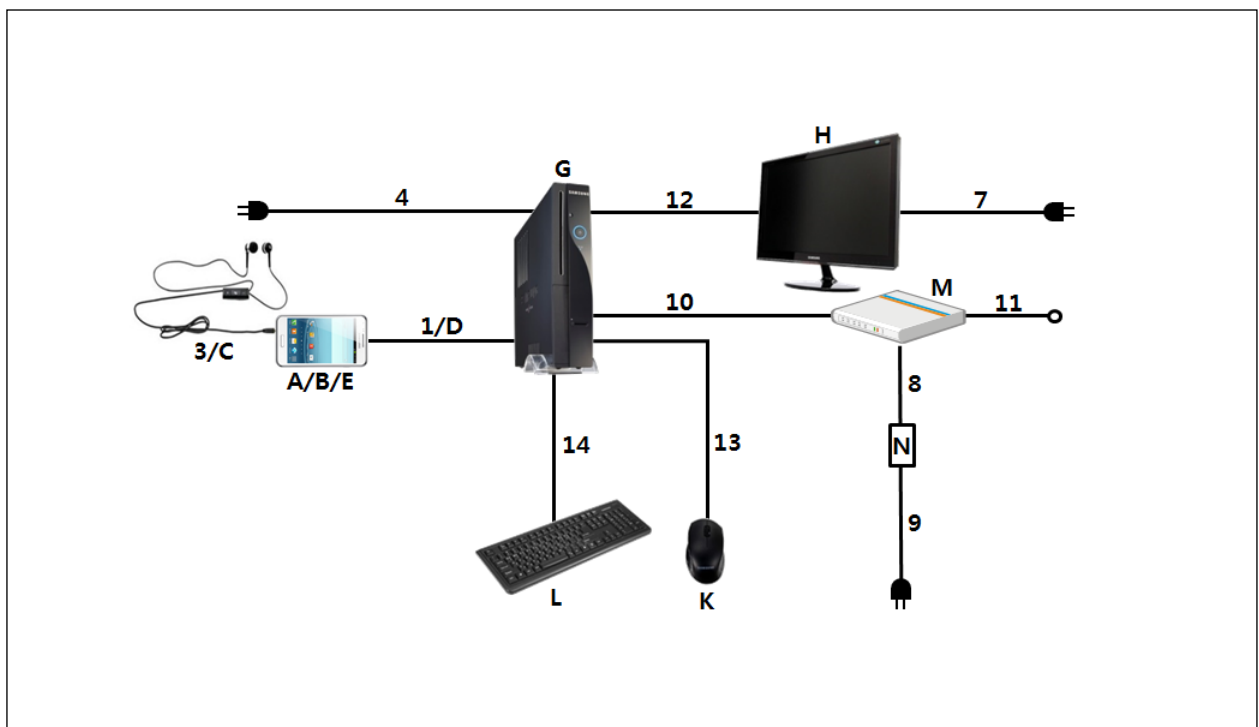
[ Mode 2 ]



[ Mode 3 ]



[ Mode 4 ]



[ Mode 5 ]

## 4.6 EUT Description

The EUT is a bar type mobile phone which can operate on GSM850/900/1800/1900, WCDMA FDD1/2/4/5/8, LTE FDD1/2/3/4/5/7/8/12/13/17/18/19/20/25/26/28/66, LTE TDD38/39/40/41/, TD-SCDMA B34/B39 bands and incorporates a Camera, Bluetooth, ANT+, Wi-Fi, FM Radio, GPS, NFC, Wireless Charging, MST, OTG, DP and MP3/MP4 player.

### 4.6.1 The variant models

- None

## 4.7 EUT Frequencies

| The highest frequencies<br>(Generated and used) | Frequency [ MHz ] |
|-------------------------------------------------|-------------------|
| Wi-Fi                                           | 5 825             |

## 4.8 Test configuration and condition

The system was configured for testing in a typical fashion that a customer would normally use. Cables were attached to each of the available I/O Ports. Where applicable, peripherals were attached to the I/O cables. All the external I/O ports are exercised, as well as internal and the external SD card, by writing and reading arbitrary data or charging with TA.

The EUT was investigated in three orientations and the worst case orientation is reported.

RX mode(850MHz) radiated testing was performed with the GSM850 RX Test mode at center frequency. All licensed communication (850MHz) RX mode, GSM/WCDMA/LTE, test results are not significantly different.

The FM radio mode radiated testing was performed with the Low/Mid/High channel.

The video and music were repetitively played connected to the earphone.

The video and music were played on monitor through Display Out function using direct DP Cable or DP converter.

The EUT was connected to USB mouse using USB OTG gender

The camera of the EUT was operated continuously.

Power source for the EUT operating was supplied by CVCF made by the Pacific 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 16-4-2 and UKAS M3003)

### 4.9.1 Emission

| Test type                             |            | Measurement uncertainty<br>(C.L. 95 %, k = 2) |
|---------------------------------------|------------|-----------------------------------------------|
| Conducted disturbance                 | AC Mains   | 3.52 dB                                       |
| Radiated Disturbance<br>(Below 1 GHz) | Horizontal | 4.99 dB                                       |
|                                       | Vertical   | 4.90 dB                                       |
| Radiated Disturbance<br>(Above 1 GHz) | Horizontal | 5.33 dB                                       |
|                                       | Vertical   | 5.32 dB                                       |

## 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<br>[ MHz ] | Resolution Bandwidth<br>[ 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.  
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

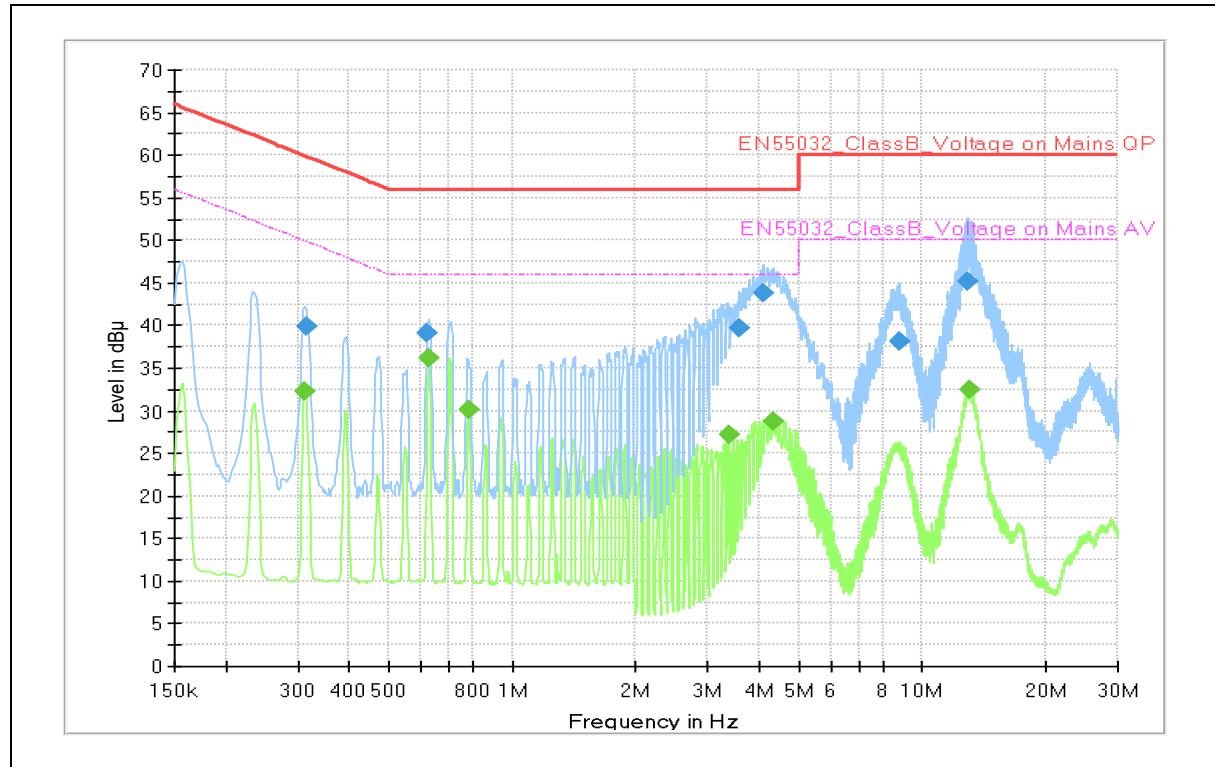
| EMC No. | Test Instrument              | Model name | Manufacturer | Serial No.  | Calibration |                  |
|---------|------------------------------|------------|--------------|-------------|-------------|------------------|
|         |                              |            |              |             | Date        | Interval (Month) |
| E5I-109 | Universal Radio Communicator | CMU200     | R&S          | 110431      | 2017-12-06  | 12               |
| E5I-043 | LISN                         | ENV216     | R&S          | 101630      | 2018-08-17  | 12               |
| E5I-017 | EMI Test Receiver            | ESU8       | R&S          | 100483      | 2018-01-12  | 12               |
| E5I-127 | LISN                         | ENV216     | R&S          | 102061      | 2018-07-23  | 12               |
| -       | Test software                | EMC32      | R&S          | Ver 9.26.01 | -           | -                |

#### 5.1.2 Temperature and humidity condition

|                   |                      |                      |                             |
|-------------------|----------------------|----------------------|-----------------------------|
| Test date         | 2018-12-03           | Test engineer        | Soo-Joon Kim                |
| Climate condition | Ambient temperature  | (23.4 ~ 23.7) °C     | Limit (15.0 to 35.0) °C     |
|                   | Relative humidity    | (46.1 ~ 46.8) % R.H. | Limit (25.0 to 75.0) % R.H. |
|                   | Atmospheric pressure | (100.8 ~ 101.2) kPa  | Limit (86.0 to 106.0) kPa   |
| Test place        | Shield Room (SR8)    |                      |                             |

### 5.1.3 Test results

#### ☐ Operating Mode 1: AC Mains

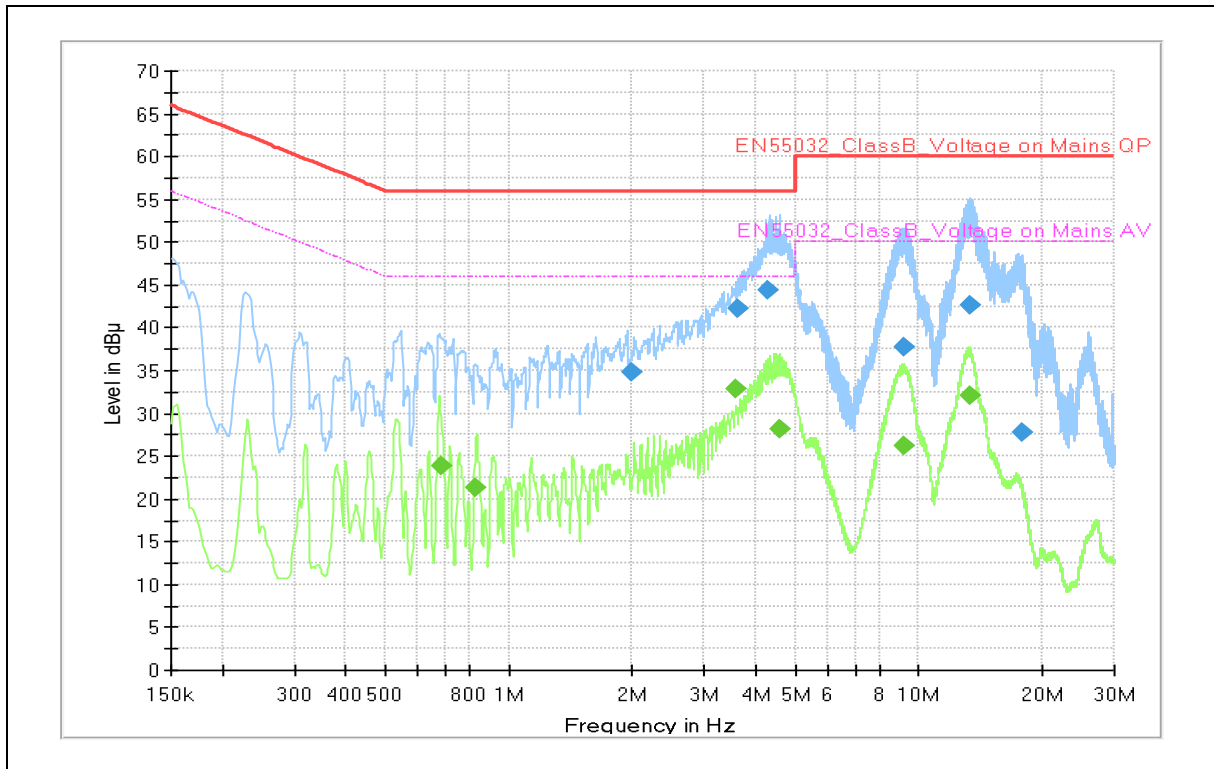


Note 1) Two graphs measured for both Live(L1) and Neutral(N) of the LISN are combined into one graph.

QP / CAV final measurement results table:

| Frequency (MHz) | QP (dBμV) | CAV (dBμV) | Limit (dBμV) | Margin (dB) | Line | Corr. (dB) |
|-----------------|-----------|------------|--------------|-------------|------|------------|
| 0.311           | ---       | 32.3       | 49.9         | 17.6        | L1   | 10.1       |
| 0.315           | 39.9      | ---        | 59.8         | 19.9        | L1   | 10.1       |
| 0.620           | 39.1      | ---        | 56.0         | 16.9        | L1   | 10.2       |
| 0.624           | ---       | 36.2       | 46.0         | 9.8         | L1   | 10.2       |
| 0.781           | ---       | 30.1       | 46.0         | 15.9        | L1   | 10.1       |
| 3.376           | ---       | 27.1       | 46.0         | 18.9        | L1   | 10.0       |
| 3.563           | 39.7      | ---        | 56.0         | 16.3        | L1   | 10.0       |
| 4.107           | 43.8      | ---        | 56.0         | 12.2        | L1   | 10.0       |
| 4.322           | ---       | 28.7       | 46.0         | 17.3        | L1   | 10.0       |
| 8.760           | 38.1      | ---        | 60.0         | 21.9        | N    | 10.2       |
| 12.945          | 45.1      | ---        | 60.0         | 14.9        | N    | 10.4       |
| 13.081          | ---       | 32.5       | 50.0         | 17.5        | N    | 10.4       |

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

☐ Operating Mode 2: AC Mains


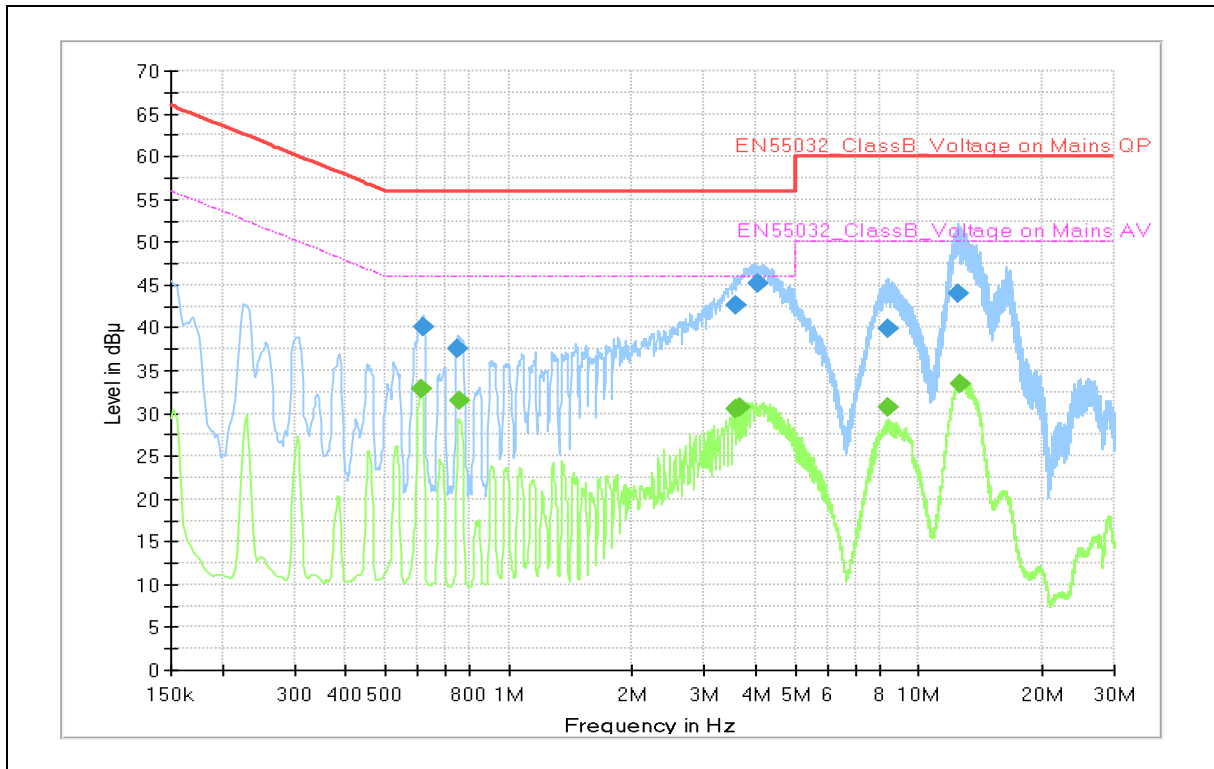
Note 1) Two graphs measured for both Live(L1) and Neutral(N) of the LISN are combined into one graph.

QP / CAV final measurement results table:

| Frequency (MHz) | QP (dBμV) | CAV (dBμV) | Limit (dBμV) | Margin (dB) | Line | Corr. (dB) |
|-----------------|-----------|------------|--------------|-------------|------|------------|
| 0.684           | ---       | 23.9       | 46.0         | 22.1        | L1   | 10.2       |
| 0.829           | ---       | 21.4       | 46.0         | 24.6        | L1   | 10.0       |
| 1.988           | 34.9      | ---        | 56.0         | 21.1        | L1   | 10.0       |
| 3.593           | ---       | 32.9       | 46.0         | 13.1        | L1   | 10.0       |
| 3.607           | 42.2      | ---        | 56.0         | 13.8        | L1   | 10.0       |
| 4.289           | 44.3      | ---        | 56.0         | 11.7        | L1   | 10.0       |
| 4.600           | ---       | 28.1       | 46.0         | 17.9        | L1   | 10.0       |
| 9.162           | 37.8      | ---        | 60.0         | 22.2        | L1   | 10.1       |
| 9.188           | ---       | 26.3       | 50.0         | 23.7        | L1   | 10.1       |
| 13.295          | 42.7      | ---        | 60.0         | 17.3        | L1   | 10.3       |
| 13.295          | ---       | 32.0       | 50.0         | 18.0        | L1   | 10.3       |
| 17.853          | 27.8      | ---        | 60.0         | 32.2        | L1   | 10.5       |

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

### □ Operating Mode 3: AC Mains



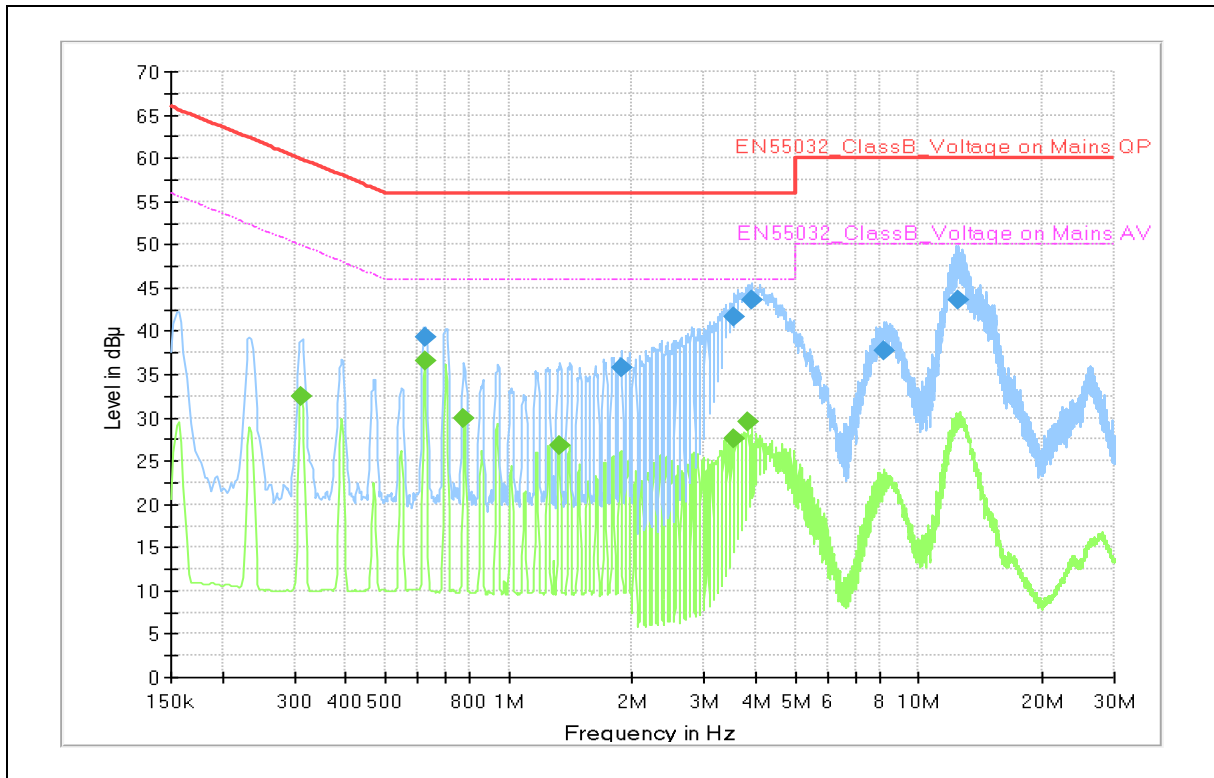
Note 1) Two graphs measured for both Live(L1) and Neutral(N) of the LISN are combined into one graph.

QP / CAV final measurement results table:

| Frequency (MHz) | QP (dBμV) | CAV (dBμV) | Limit (dBμV) | Margin (dB) | Line | Corr. (dB) |
|-----------------|-----------|------------|--------------|-------------|------|------------|
| 0.610           | ---       | 32.8       | 46.0         | 13.2        | L1   | 10.2       |
| 0.617           | 40.2      | ---        | 56.0         | 15.8        | L1   | 10.2       |
| 0.752           | 37.6      | ---        | 56.0         | 18.4        | L1   | 10.1       |
| 0.754           | ---       | 31.5       | 46.0         | 14.5        | L1   | 10.1       |
| 3.562           | 42.5      | ---        | 56.0         | 13.5        | N    | 9.9        |
| 3.596           | ---       | 30.5       | 46.0         | 15.5        | L1   | 10.0       |
| 3.680           | ---       | 30.8       | 46.0         | 15.2        | L1   | 10.0       |
| 4.032           | 45.1      | ---        | 56.0         | 10.9        | L1   | 10.0       |
| 8.444           | ---       | 30.7       | 50.0         | 19.3        | L1   | 10.1       |
| 8.455           | 39.9      | ---        | 60.0         | 20.1        | L1   | 10.1       |
| 12.479          | 44.0      | ---        | 60.0         | 16.0        | N    | 10.4       |
| 12.604          | ---       | 33.4       | 50.0         | 16.6        | N    | 10.4       |

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

# ☐ Operating Mode 4: AC Mains



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

QP / CAV final measurement results table:

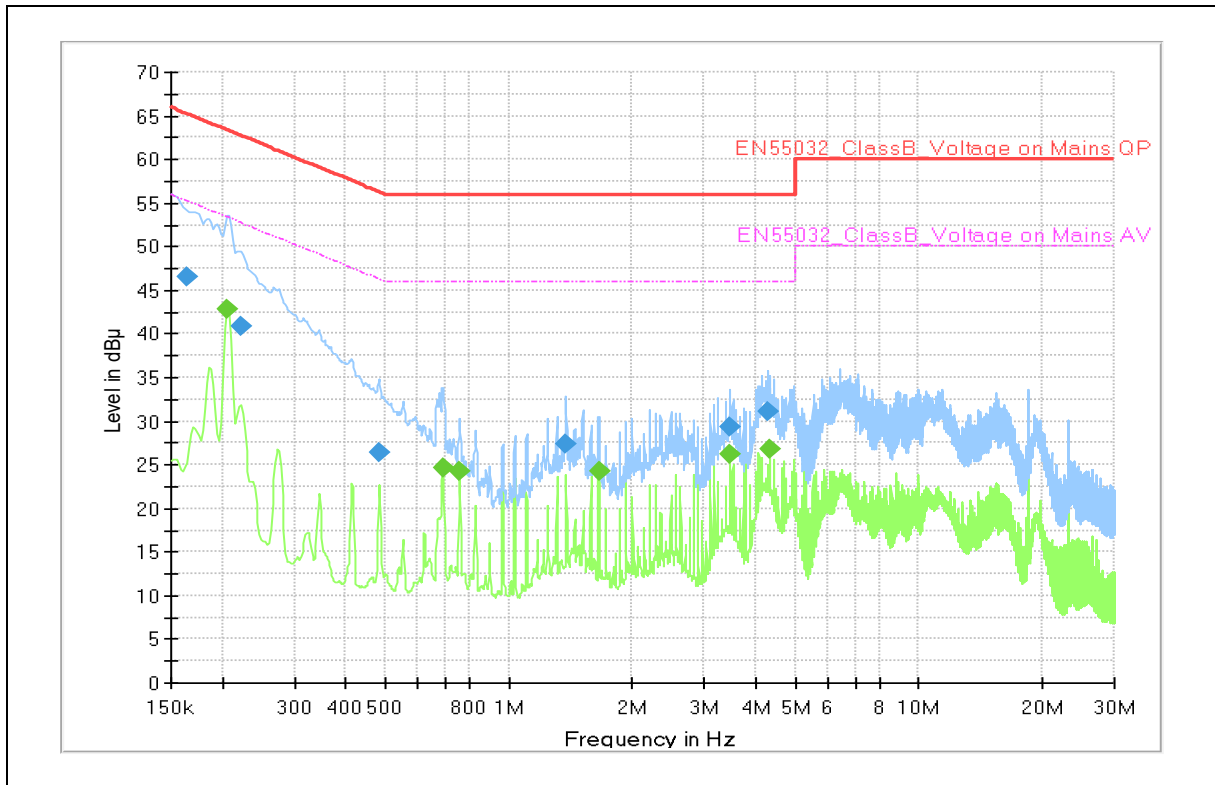
| Frequency (MHz) | QP (dB $\mu$ V) | CAV (dB $\mu$ V) | Limit (dB $\mu$ V) | Margin (dB) | Line | Corr. (dB) |
|-----------------|-----------------|------------------|--------------------|-------------|------|------------|
| 0.311           | ---             | 32.4             | 49.9               | 17.5        | L1   | 10.1       |
| 0.624           | ---             | 36.6             | 46.0               | 9.4         | L1   | 10.2       |
| 0.627           | 39.4            | ---              | 56.0               | 16.6        | L1   | 10.2       |
| 0.779           | ---             | 29.9             | 46.0               | 16.1        | L1   | 10.1       |
| 1.328           | ---             | 26.8             | 46.0               | 19.2        | L1   | 10.0       |
| 1.884           | 35.9            | ---              | 56.0               | 20.1        | L1   | 10.0       |
| 3.526           | ---             | 27.6             | 46.0               | 18.4        | L1   | 10.0       |
| 3.557           | 41.7            | ---              | 56.0               | 14.3        | N    | 9.9        |
| 3.843           | ---             | 29.5             | 46.0               | 16.5        | L1   | 10.0       |
| 3.927           | 43.5            | ---              | 56.0               | 12.5        | L1   | 10.0       |
| 8.255           | 37.7            | ---              | 60.0               | 22.3        | L1   | 10.1       |
| 12.521          | 43.6            | ---              | 60.0               | 16.4        | N    | 10.4       |

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

## □ Operating Mode 5: AC Mains



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

QP / CAV final measurement results table:

| Frequency (MHz) | QP (dBμV) | CAV (dBμV) | Limit (dBμV) | Margin (dB) | Line | Corr. (dB) |
|-----------------|-----------|------------|--------------|-------------|------|------------|
| 0.164           | 46.5      | ---        | 65.3         | 18.8        | L1   | 9.8        |
| 0.205           | ---       | 42.8       | 53.4         | 10.6        | L1   | 9.9        |
| 0.222           | 40.7      | ---        | 62.7         | 22.0        | L1   | 9.8        |
| 0.482           | 26.5      | ---        | 56.3         | 29.8        | N    | 10.0       |
| 0.689           | ---       | 24.6       | 46.0         | 21.4        | N    | 9.9        |
| 0.759           | ---       | 24.2       | 46.0         | 21.8        | N    | 9.9        |
| 1.382           | 27.4      | ---        | 56.0         | 28.6        | N    | 9.7        |
| 1.657           | ---       | 24.3       | 46.0         | 21.7        | N    | 9.8        |
| 3.450           | ---       | 26.2       | 46.0         | 19.8        | N    | 9.7        |
| 3.452           | 29.2      | ---        | 56.0         | 26.8        | N    | 9.7        |
| 4.278           | 31.1      | ---        | 56.0         | 24.9        | L1   | 9.8        |
| 4.348           | ---       | 26.7       | 46.0         | 19.3        | L1   | 9.8        |

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

## 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<br>[ cm ] | Antenna Polarisation | Resolution<br>Bandwidth<br>[ kHz ] | Video<br>Bandwidth<br>[ kHz ] | Turntable position<br>[ 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 generated or used in the device or on which the device operate or tunes 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<br>[ cm ] | Antenna Polarisation | Resolution<br>Bandwidth<br>[ MHz ] | Video<br>Bandwidth<br>[ MHz ] | Turntable position |
|--------------------------|----------------------|------------------------------------|-------------------------------|--------------------|
| 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<br>[ MHz ] | Field Strength          |                               |                                |
|-----------------------------------|-------------------------|-------------------------------|--------------------------------|
|                                   | 3 m [ $\mu\text{V/m}$ ] | 3 m [ dB( $\mu\text{V/m}$ ) ] | 10 m [ dB( $\mu\text{V/m}$ ) ] |
| 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.

### 5.2.1 Test instrumentation

| EMC No. | Test Instrument          | Model name | Manufacturer | Serial No.  | Calibration |                  |
|---------|--------------------------|------------|--------------|-------------|-------------|------------------|
|         |                          |            |              |             | Date        | Interval (Month) |
| E5I-022 | Signal Generator         | SMB100A    | R&S          | 175856      | 2018-05-11  | 12               |
| E5I-016 | EMI Test Receiver        | ESU8       | R&S          | 100482      | 2018-06-08  | 12               |
| E5I-021 | EMI Test Receiver        | ESU40      | R&S          | 100376      | 2018-01-31  | 12               |
| E5I-149 | Horn Antenna             | HF907      | R&S          | 102525      | 2018-06-15  | 24               |
| E5I-039 | Signal Conditioning Unit | SCU-18     | R&S          | 10211       | 2018-01-22  | 12               |
| E5I-037 | Wide Band Horn Antenna   | WBH 18-40K | R&S          | 11201       | 2017-10-13  | 24               |
| E5I-042 | Signal Conditioning Unit | SCU-40A    | R&S          | 10004       | 2018-09-05  | 12               |
| E5I-120 | BiLog Antenna            | CBL6112D   | TESEQ        | 36997       | 2018-04-23  | 24               |
| E5I-072 | BiLog Antenna            | CBL6112D   | TESEQ        | 36009       | 2018-04-23  | 24               |
| E5I-073 | Preamplifier             | 310N       | SONOMA       | 332016      | 2018-05-09  | 12               |
| E5I-074 | Preamplifier             | 310N       | SONOMA       | 332017      | 2018-05-09  | 12               |
| -       | Test software            | EP7RE      | TOYO         | Ver 5.8.2   | -           | -                |
| -       | Test software            | EMC32      | R&S          | Ver 9.25.00 | -           | -                |

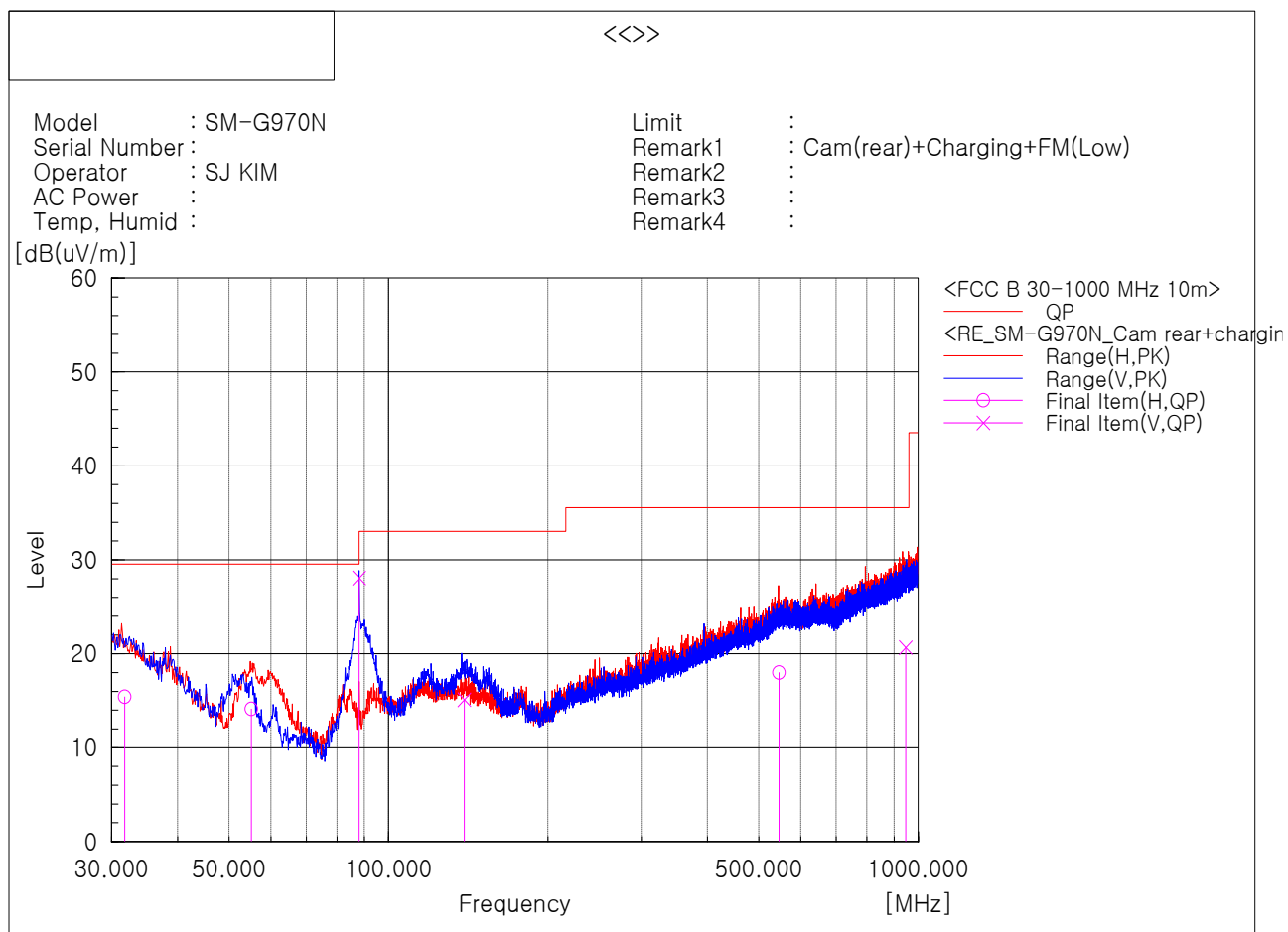
### 5.2.2 Temperature and humidity condition

|                          |                              |                      |                             |
|--------------------------|------------------------------|----------------------|-----------------------------|
| <b>Test date</b>         | 2018-11-30, 2018-12-10       | <b>Test engineer</b> | Soo-Joon Kim                |
| <b>Climate condition</b> | Ambient temperature          | (22.6 ~ 22.8) °C     | Limit (15.0 to 35.0) °C     |
|                          | Relative humidity            | (47.9 ~ 48.4) % R.H. | Limit (25.0 to 75.0) % R.H. |
|                          | Atmospheric pressure         | (102.0 ~ 102.4) kPa  | Limit (86.0 to 106.0) kPa   |
| <b>Test place</b>        | Semi-Anechoic Chamber (SAC4) |                      |                             |

## 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   | 31.775          | H   | 23.4                | -8.0          | 15.4                 | 29.5                | 14.1           | 400         | 332         | 1      |
| 2   | 55.112          | H   | 32.8                | -18.7         | 14.1                 | 29.5                | 15.4           | 400         | 144         | 1      |
| 3   | 87.993          | V   | 44.3                | -16.2         | 28.1                 | 29.5                | 1.4            | 105         | 306         | 2      |
| 4   | 138.944         | V   | 27.5                | -12.4         | 15.1                 | 33.0                | 17.9           | 111         | 357         | 2      |
| 5   | 545.827         | H   | 22.0                | -4.0          | 18.0                 | 35.5                | 17.5           | 142         | 240         | 1      |
| 6   | 947.050         | V   | 19.9                | 0.8           | 20.7                 | 35.5                | 14.8           | 216         | 61          | 2      |

\* Radiated emissions (Rx frequency 87.993 MHz) from the transceiver shall be ignored

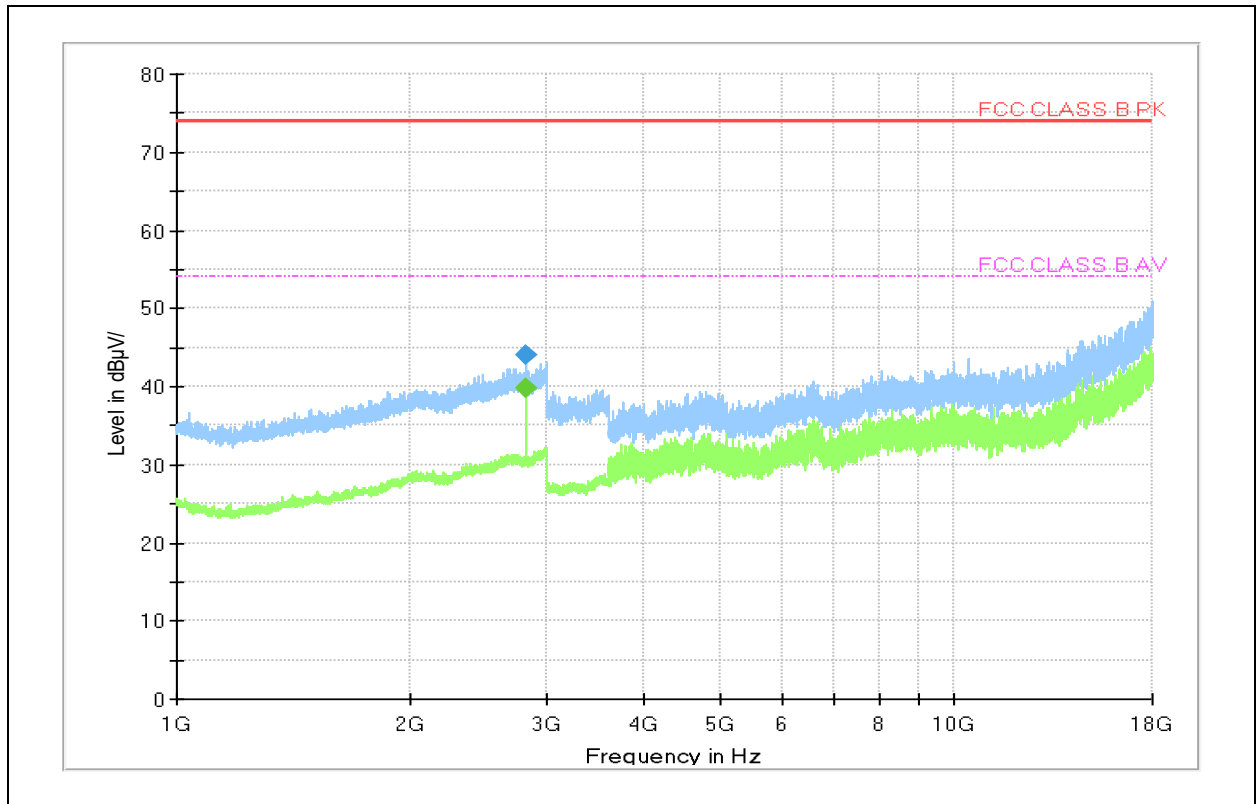
Note1) Receiving antenna polarization : Horizontal, Vertical

Test Distance : 10 m, Antenna Height : 1 to 4 meters

Result (QP) = Reading (QP) + c.f (Antenna Factor + Cable Loss - Amp. Gain)

Margin (QP) = Limit - Level (QP)

QP = Quasi-Peak, c.f = Correction Factor

**- Frequencies above 1 GHz**

| Frequency (MHz) | PK (dBμV/m) | CAV (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|-------------|--------------|----------------|-------------|-------------|-----|---------------|------------|
| 2 811.600       | ---         | 39.7         | 54.0           | 14.3        | 100.0       | H   | 31.0          | 15.5       |
| 2 811.600       | 43.9        | ---          | 74.0           | 30.1        | 100.0       | H   | 31.0          | 15.5       |

Note 1) We have also tested from 18 GHz to 30 GHz and found no emissions

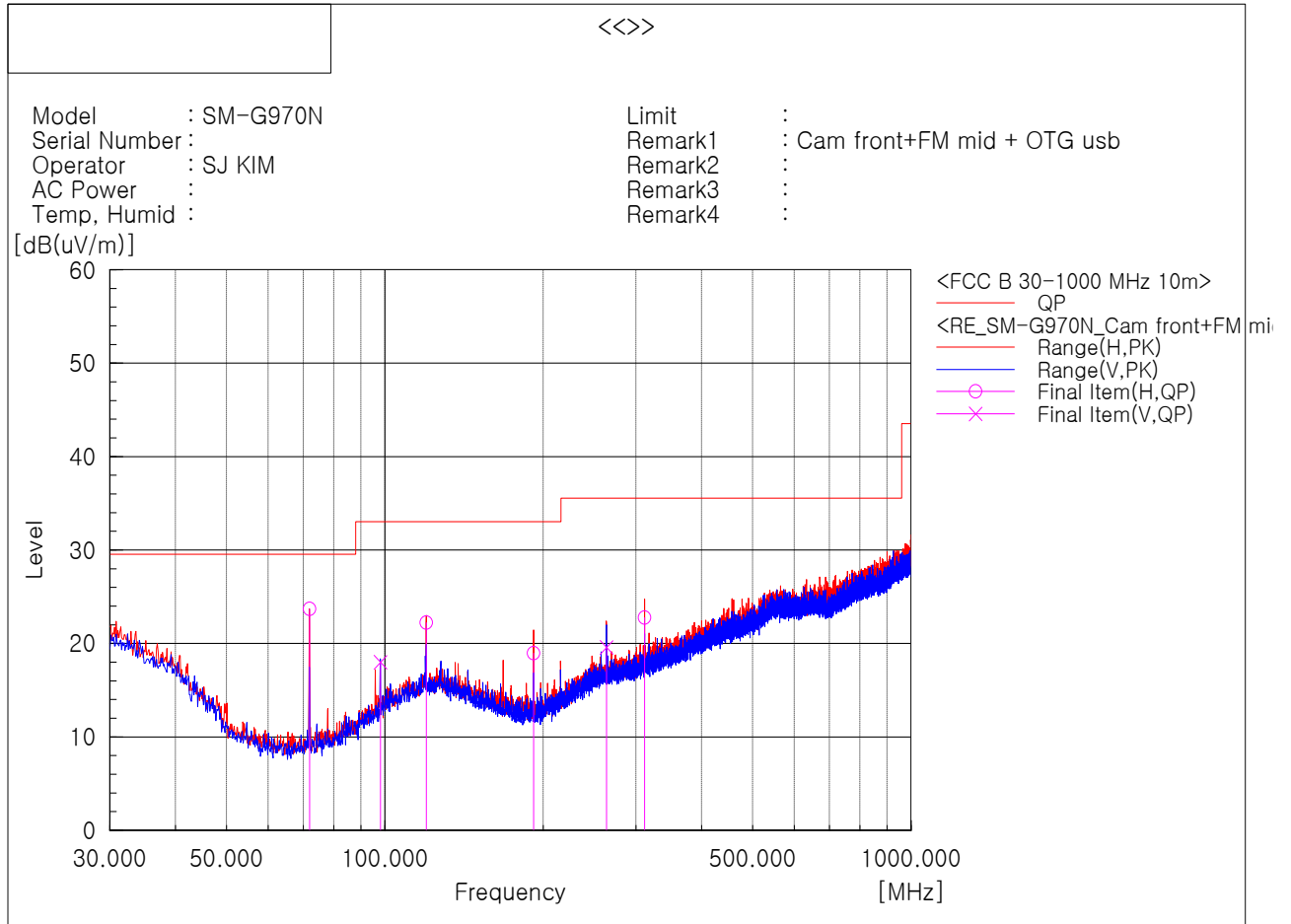
Note 2) Receiving antenna polarization : Horizontal, Vertical

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

☐ Operating Mode 2**- 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   | 71.898          | H   | 42.8                | -19.1         | 23.7                 | 29.5                | 5.8            | 400         | 115         | 1      |
| 2   | 98.059          | V   | 32.2                | -14.2         | 18.0                 | 33.0                | 15.0           | 150         | 113         | 2      |
| 3   | 119.820         | H   | 34.8                | -12.6         | 22.2                 | 33.0                | 10.8           | 400         | 259         | 1      |
| 4   | 191.700         | H   | 34.4                | -15.4         | 19.0                 | 33.0                | 14.0           | 399         | 225         | 1      |
| 5   | 263.646         | V   | 30.0                | -10.4         | 19.6                 | 35.5                | 15.9           | 100         | 247         | 2      |
| 6   | 311.524         | H   | 32.9                | -10.1         | 22.8                 | 35.5                | 12.7           | 215         | 352         | 1      |

\* Radiated emissions (Rx frequency 98.059 MHz) from the transceiver shall be ignored

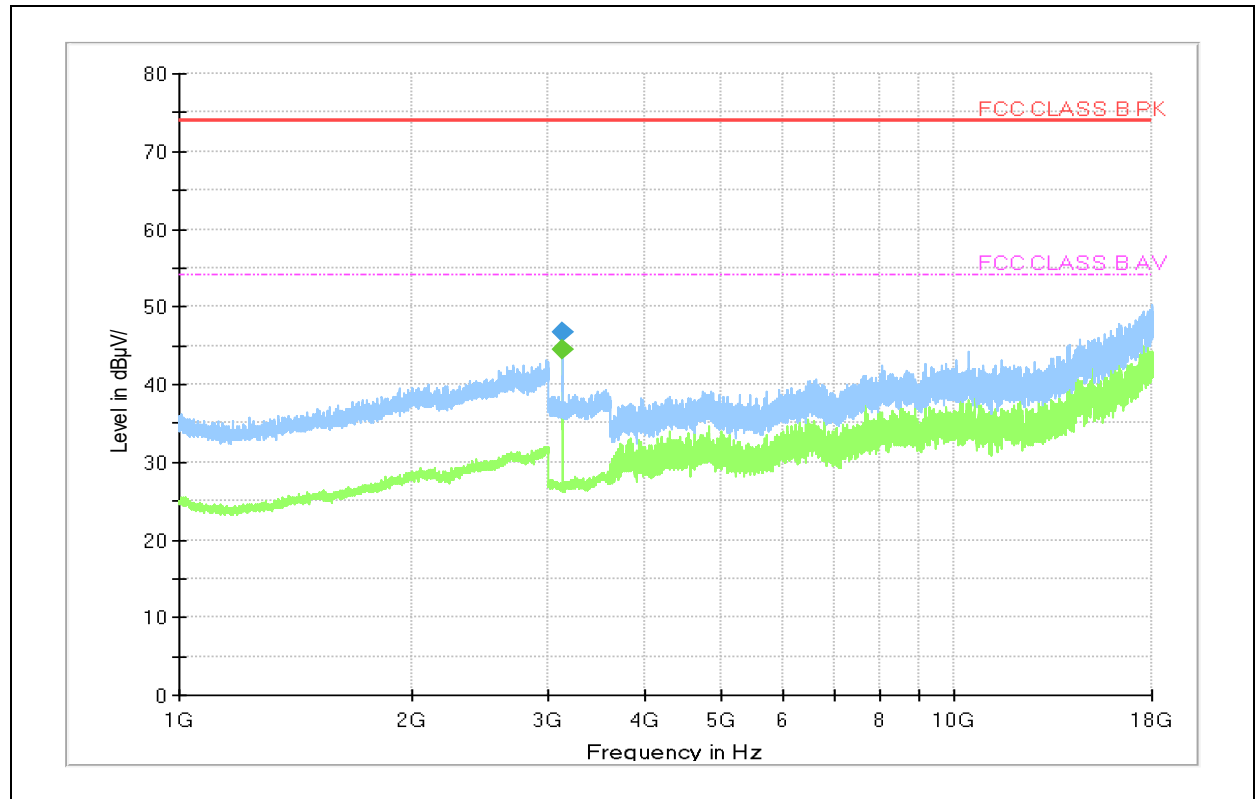
Note1) Receiving antenna polarization : Horizontal, Vertical

Test Distance : 10 m, Antenna Height : 1 to 4 meters

Result (QP) = Reading (QP) + c.f (Antenna Factor + Cable Loss - Amp. Gain)

Margin (QP) = Limit - Level (QP)

QP = Quasi-Peak, c.f = Correction Factor

**- Frequencies above 1 GHz**

| Frequency (MHz) | PK (dBμV/m) | CAV (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|-------------|--------------|----------------|-------------|-------------|-----|---------------|------------|
| 3 130.000       | ---         | 44.4         | 54.0           | 9.6         | 100.0       | H   | 84.0          | 0.9        |
| 3 130.000       | 46.7        | ---          | 74.0           | 27.3        | 100.0       | H   | 84.0          | 0.9        |

Note 1) We have also tested from 18 GHz to 30 GHz and found no emissions

Note 2) Receiving antenna polarization : Horizontal, Vertical

Test Distance : 3 m, Antenna Height : 1 to 4 meters

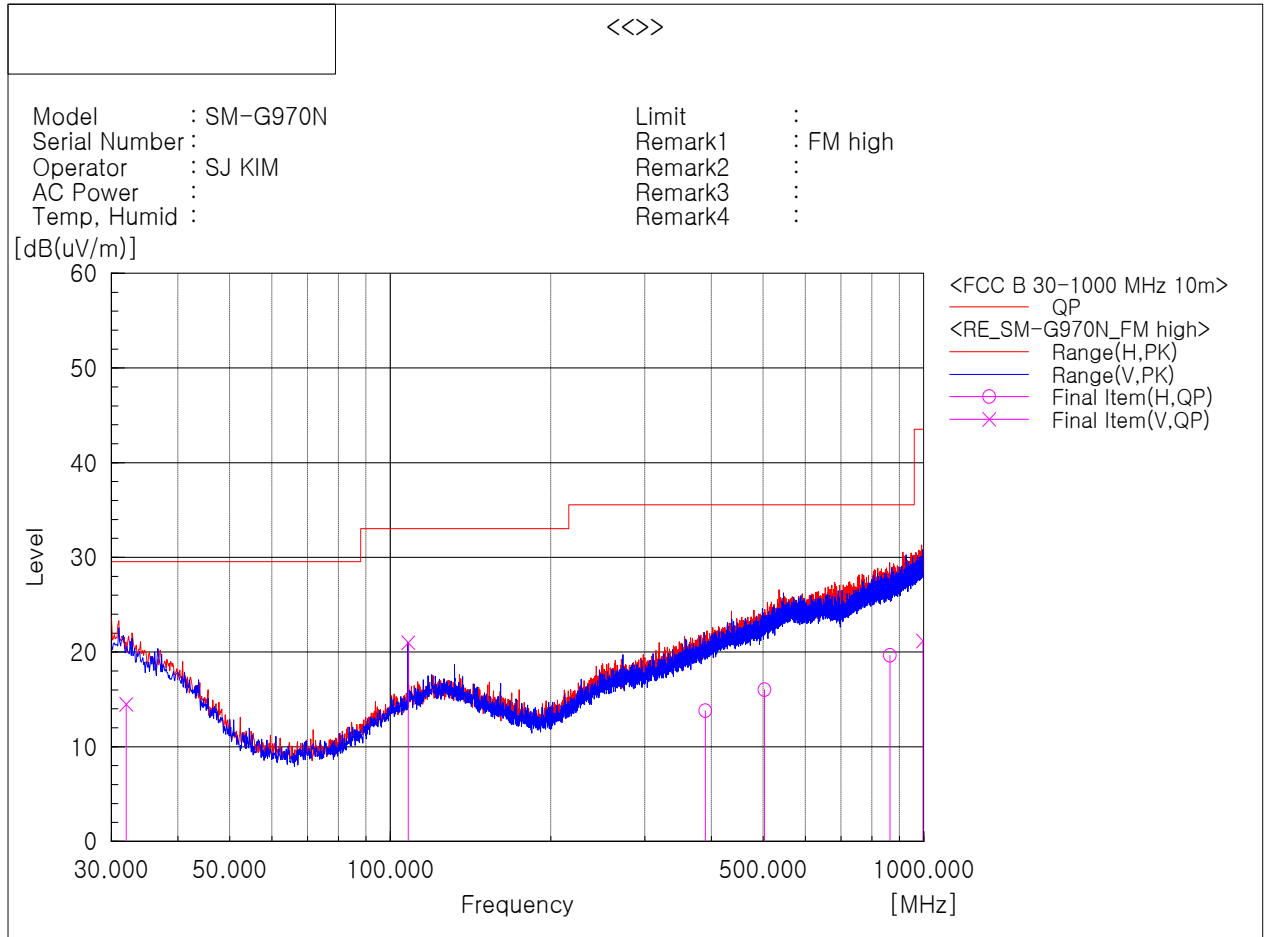
Level (PK and/or CAV) = Reading (PK and/or CAV) + Corr. (Antenna Factor + Cable Loss - Amp. Gain)

Margin (PK and/or CAV) = Limit – Level (PK and/or CAV)

PK = Peak, CAV = CISPR-Average, Corr. = Correction Factor

☐ Operating Mode 3

## - 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   | 31.979          | V   | 22.5                | -8.0          | 14.5                 | 29.5                | 15.0           | 349         | 360         | 2      |
| 2   | 107.998         | V   | 33.9                | -12.9         | 21.0                 | 33.0                | 12.0           | 118         | 360         | 2      |
| 3   | 389.674         | H   | 21.6                | -7.8          | 13.8                 | 35.5                | 21.7           | 159         | 360         | 1      |
| 4   | 503.116         | H   | 21.6                | -5.6          | 16.0                 | 35.5                | 19.5           | 190         | 360         | 1      |
| 5   | 863.993         | H   | 20.8                | -1.1          | 19.7                 | 35.5                | 15.8           | 347         | 360         | 1      |
| 6   | 996.509         | V   | 19.3                | 1.9           | 21.2                 | 43.5                | 22.3           | 400         | 360         | 2      |

\* Radiated emissions (Rx frequency 107.998 MHz) from the transceiver shall be ignored

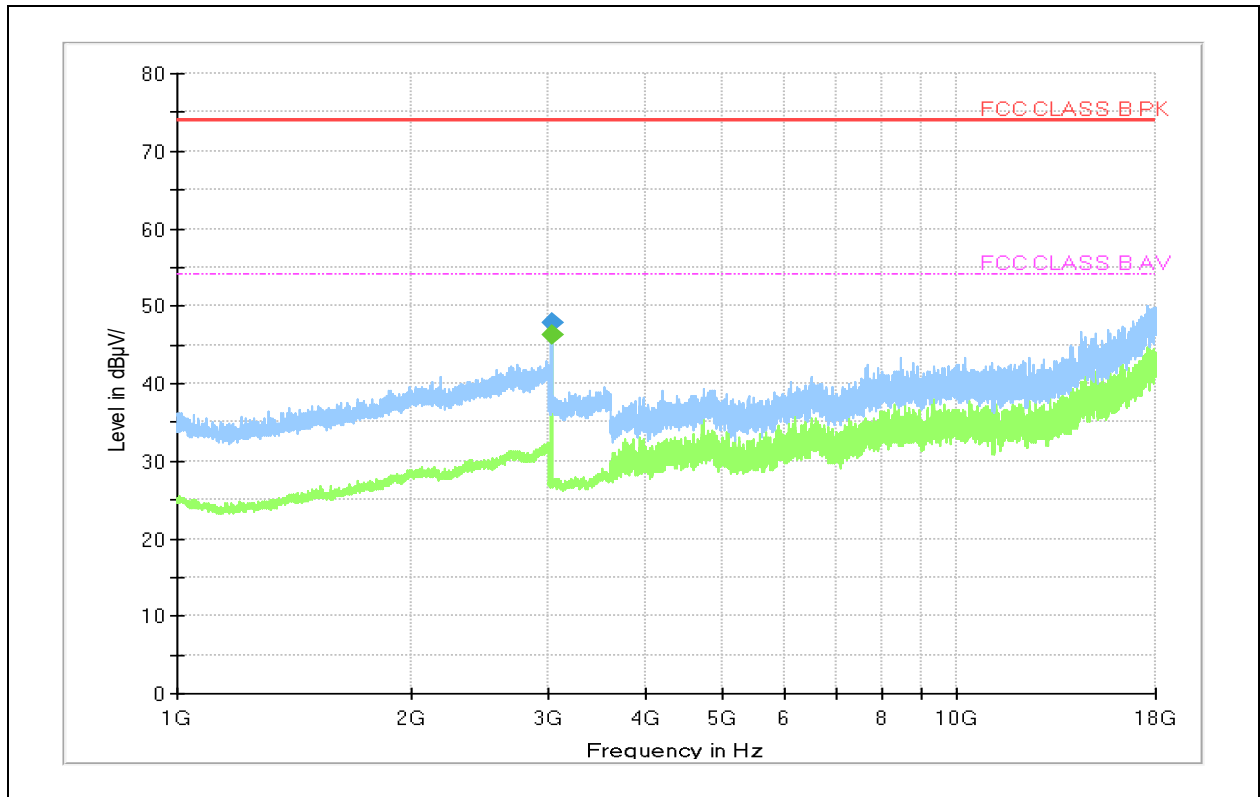
Note1) Receiving antenna polarization : Horizontal, Vertical

Test Distance : 10 m, Antenna Height : 1 to 4 meters

Result (QP) = Reading (QP) + c.f (Antenna Factor + Cable Loss - Amp. Gain)

Margin (QP) = Limit - Level (QP)

QP = Quasi-Peak, c.f = Correction Factor

**- Frequencies above 1 GHz**

| Frequency (MHz) | PK (dBμV/m) | CAV (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|-------------|--------------|----------------|-------------|-------------|-----|---------------|------------|
| 3 020.500       | ---         | 46.2         | 54.0           | 7.8         | 100.0       | H   | 148.0         | 0.8        |
| 3 020.500       | 47.9        | ---          | 74.0           | 26.1        | 100.0       | H   | 148.0         | 0.8        |

Note 1) We have also tested from 18 GHz to 30 GHz and found no emissions

Note 2) Receiving antenna polarization : Horizontal, Vertical

Test Distance : 3 m, Antenna Height : 1 to 4 meters

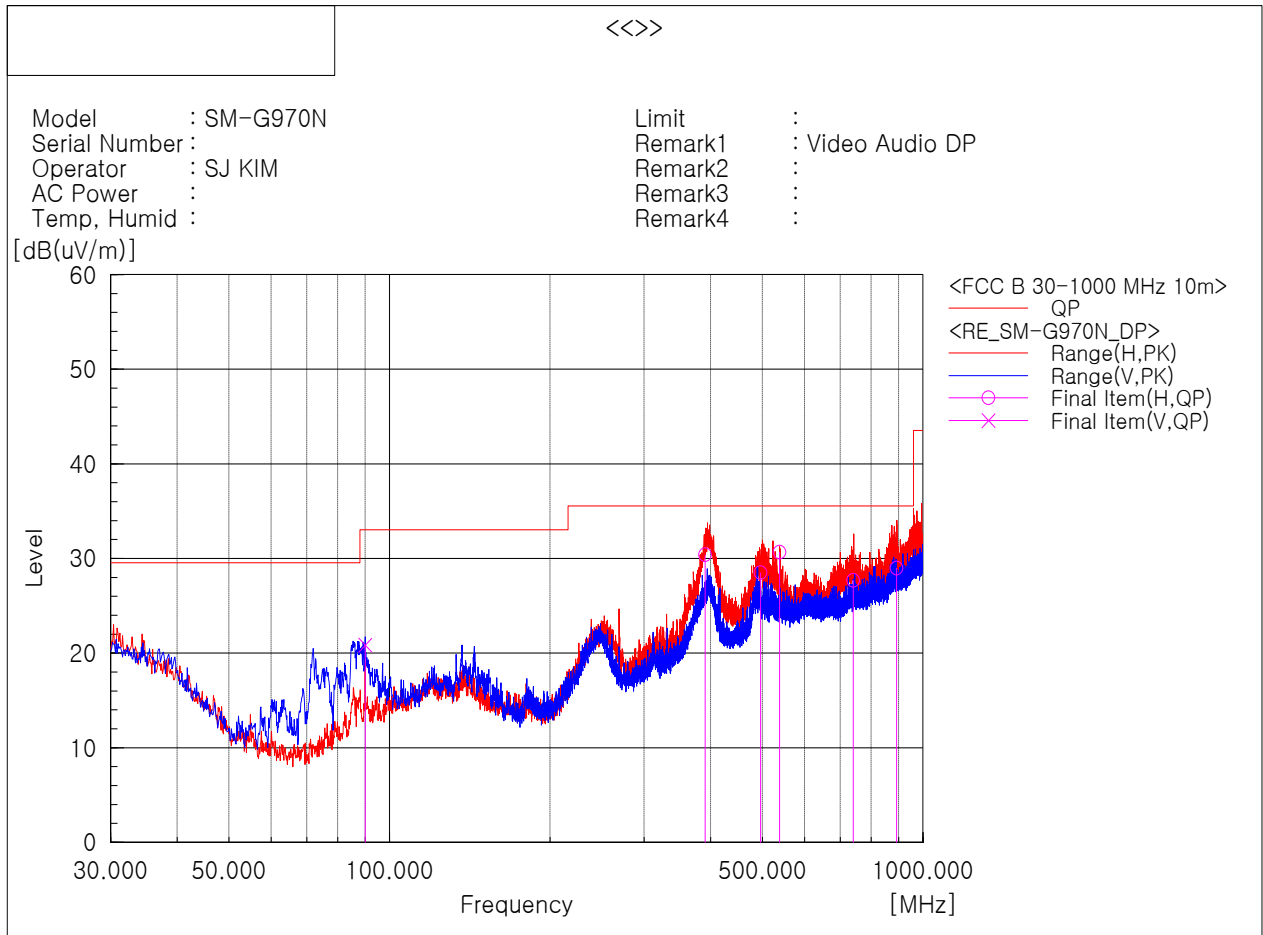
Level (PK and/or CAV) = Reading (PK and/or CAV) + Corr. (Antenna Factor + Cable Loss - Amp. Gain)

Margin (PK and/or CAV) = Limit – Level (PK and/or CAV)

PK = Peak, CAV = CISPR-Average, Corr. = Correction Factor

☐ Operating Mode 4

## - 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   | 89.991          | V   | 36.7                | -15.8         | 20.9                 | 33.0                | 12.1           | 149         | 88          | 2      |
| 2   | 390.357         | H   | 38.2                | -7.8          | 30.4                 | 35.5                | 5.1            | 297         | 58          | 1      |
| 3   | 495.765         | H   | 34.3                | -5.8          | 28.5                 | 35.5                | 7.0            | 167         | 232         | 1      |
| 4   | 538.542         | H   | 34.9                | -4.2          | 30.7                 | 35.5                | 4.8            | 150         | 220         | 1      |
| 5   | 740.045         | H   | 30.3                | -2.6          | 27.7                 | 35.5                | 7.8            | 101         | 224         | 1      |
| 6   | 892.552         | H   | 29.9                | -0.9          | 29.0                 | 35.5                | 6.5            | 101         | 259         | 1      |

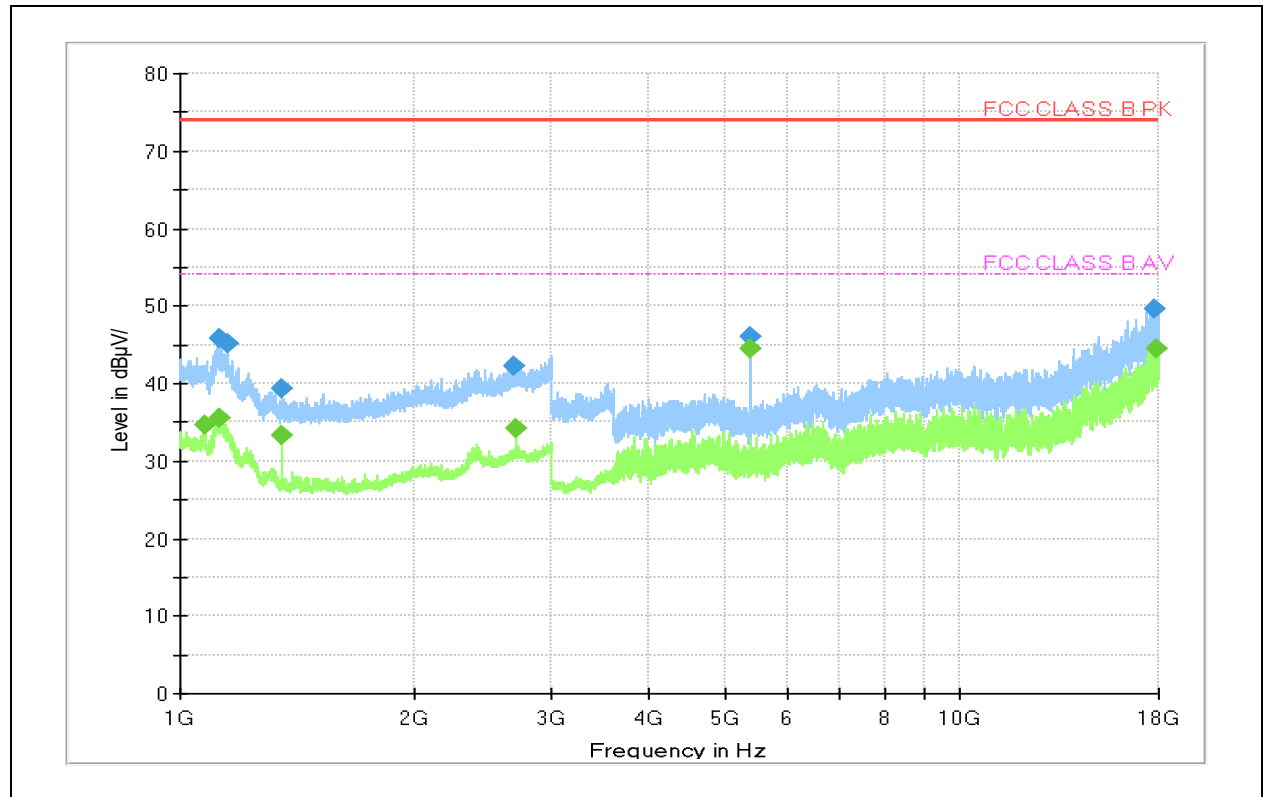
Note1) Receiving antenna polarization : Horizontal, Vertical

Test Distance : 10 m, Antenna Height : 1 to 4 meters

Result (QP) = Reading (QP) + c.f (Antenna Factor + Cable Loss - Amp. Gain)

Margin (QP) = Limit - Level (QP)

QP = Quasi-Peak, c.f = Correction Factor

**- Frequencies above 1 GHz**

| Frequency (MHz) | PK (dBμV/m) | CAV (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|-------------|--------------|----------------|-------------|-------------|-----|---------------|------------|
| 1 077.200       | ---         | 34.6         | 54.0           | 19.4        | 100.0       | H   | 124.0         | 6.5        |
| 1 122.800       | ---         | 35.5         | 54.0           | 18.5        | 100.0       | H   | 124.0         | 6.4        |
| 1 122.800       | 45.7        | ---          | 74.0           | 28.3        | 100.0       | H   | 124.0         | 6.4        |
| 1 150.400       | 45.2        | ---          | 74.0           | 28.8        | 100.0       | H   | 124.0         | 6.4        |
| 1 350.000       | ---         | 33.3         | 54.0           | 20.7        | 100.0       | H   | 131.0         | 8.0        |
| 1 350.000       | 39.3        | ---          | 74.0           | 34.7        | 100.0       | H   | 131.0         | 8.0        |
| 2 682.800       | 42.3        | ---          | 74.0           | 31.7        | 100.0       | H   | 128.0         | 15.6       |
| 2 700.000       | ---         | 34.2         | 54.0           | 19.8        | 100.0       | H   | 176.0         | 15.8       |
| 5 399.500       | ---         | 44.5         | 54.0           | 9.5         | 100.0       | H   | 129.0         | 6.5        |
| 5 400.000       | 46.0        | ---          | 74.0           | 28.0        | 100.0       | H   | 129.0         | 6.5        |
| 17 831.000      | 49.6        | ---          | 74.0           | 24.4        | 100.0       | V   | 228.0         | 34.7       |
| 17 867.500      | ---         | 44.5         | 54.0           | 9.5         | 100.0       | H   | 139.0         | 34.2       |

Note 1) We have also tested from 18 GHz to 30 GHz and found no emissions

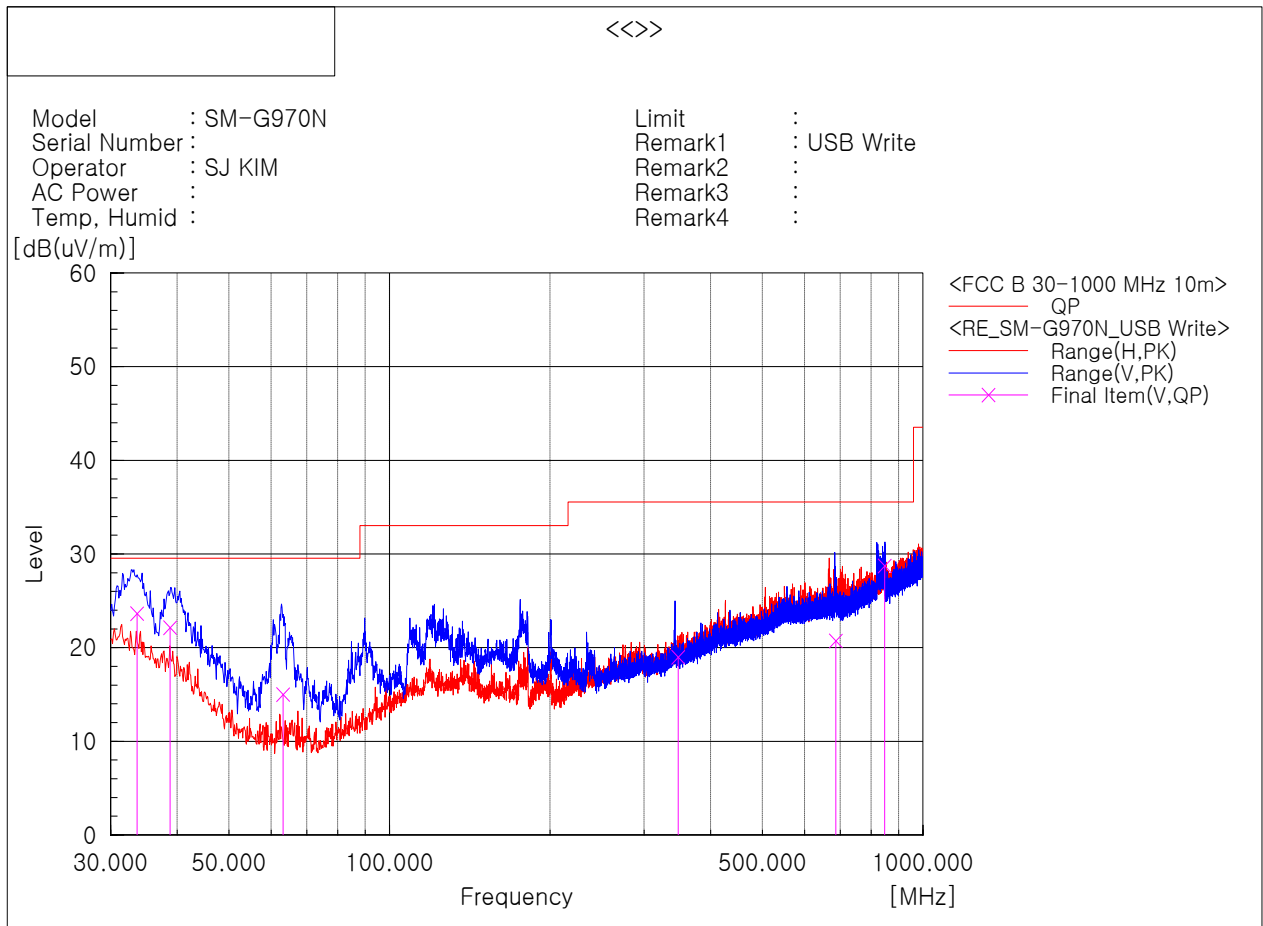
Note 2) Receiving antenna polarization : Horizontal, Vertical

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

☐ Operating Mode 5**- 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   | 33.617          | V   | 32.1                | -8.5          | 23.6                 | 29.5                | 5.9            | 100         | 2           | 2      |
| 2   | 38.781          | V   | 32.5                | -10.4         | 22.1                 | 29.5                | 7.4            | 100         | 331         | 2      |
| 3   | 63.149          | V   | 33.7                | -18.7         | 15.0                 | 29.5                | 14.5           | 400         | 251         | 2      |
| 4   | 347.521         | V   | 27.5                | -8.5          | 19.0                 | 35.5                | 16.5           | 348         | 261         | 2      |
| 5   | 686.628         | V   | 23.8                | -3.1          | 20.7                 | 35.5                | 14.8           | 203         | 218         | 2      |
| 6   | 848.125         | V   | 29.5                | -0.8          | 28.7                 | 35.5                | 6.8            | 313         | 161         | 2      |

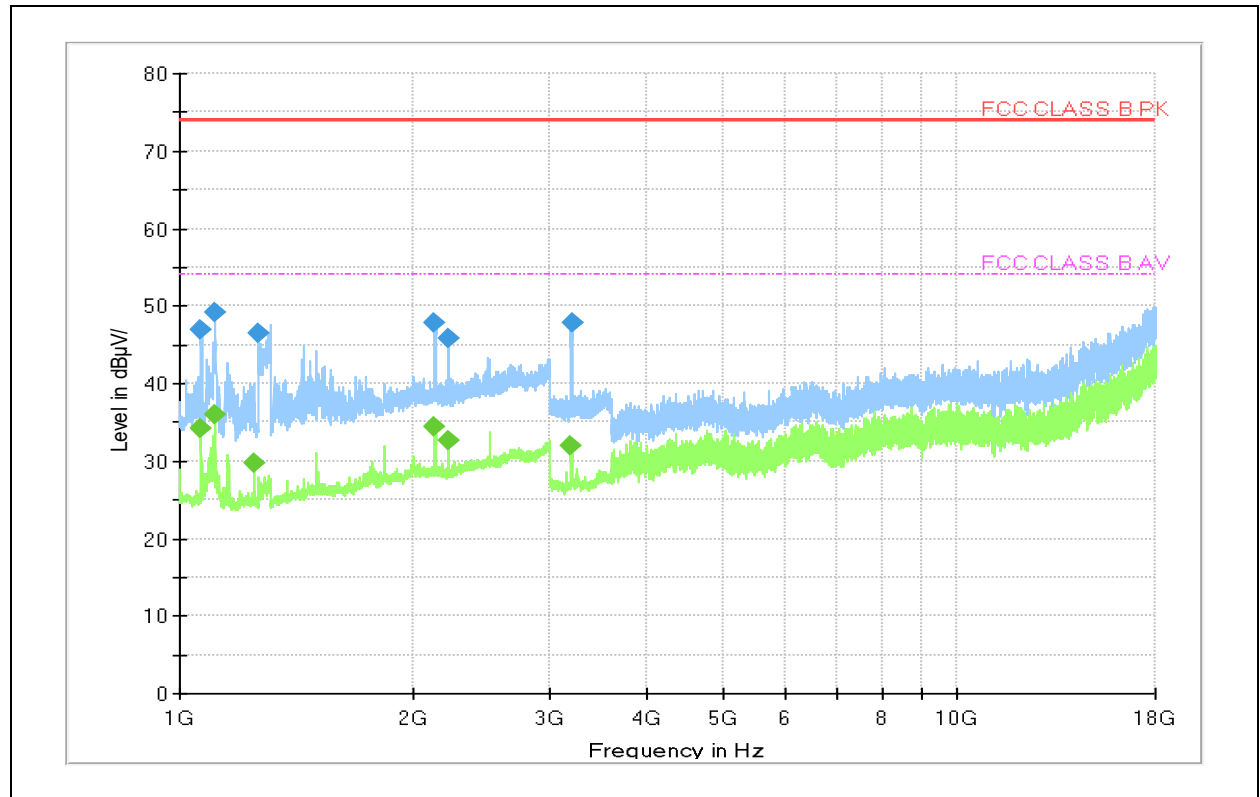
Note1) Receiving antenna polarization : Horizontal, Vertical

Test Distance : 10 m, Antenna Height : 1 to 4 meters

Result (QP) = Reading (QP) + c.f (Antenna Factor + Cable Loss - Amp. Gain)

Margin (QP) = Limit - Level (QP)

QP = Quasi-Peak, c.f = Correction Factor

**- Frequencies above 1 GHz**

| Frequency (MHz) | PK (dBμV/m) | CAV (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|-------------|--------------|----------------|-------------|-------------|-----|---------------|------------|
| 1 062.400       | 47.0        | ---          | 74.0           | 27.0        | 100.0       | V   | 335.0         | 6.5        |
| 1 064.800       | ---         | 34.2         | 54.0           | 19.8        | 100.0       | V   | 335.0         | 6.5        |
| 1 109.600       | ---         | 36.0         | 54.0           | 18.0        | 100.0       | H   | 263.0         | 6.5        |
| 1 109.600       | 49.2        | ---          | 74.0           | 24.8        | 100.0       | H   | 263.0         | 6.5        |
| 1 249.600       | ---         | 29.8         | 54.0           | 24.2        | 100.0       | H   | 195.0         | 7.3        |
| 1 262.000       | 46.5        | ---          | 74.0           | 27.5        | 100.0       | V   | 149.0         | 7.3        |
| 2 126.000       | ---         | 34.4         | 54.0           | 19.6        | 100.0       | H   | 237.0         | 12.9       |
| 2 126.000       | 47.8        | ---          | 74.0           | 26.2        | 100.0       | H   | 237.0         | 12.9       |
| 2 220.800       | 45.9        | ---          | 74.0           | 28.1        | 100.0       | H   | 174.0         | 12.8       |
| 2 221.600       | ---         | 32.7         | 54.0           | 21.3        | 100.0       | H   | 174.0         | 12.8       |
| 3 188.000       | ---         | 31.9         | 54.0           | 22.1        | 100.0       | H   | 230.0         | 0.9        |
| 3 198.500       | 47.8        | ---          | 74.0           | 26.2        | 100.0       | H   | 230.0         | 0.8        |

Note 1) We have also tested from 18 GHz to 30 GHz and found no emissions

Note 2) 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