

EMC TEST REPORT

Project No.	LBE20160213	Issue No.	1
Applicant	Name of organization	Samsung Electronics Co., Ltd.	
	Address	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677 Rep. of Korea	
	Date of application	January 18, 2016	
EUT	Type of device	<input checked="" type="checkbox"/> Class B personal computers and peripherals <input type="checkbox"/> All other devices	
	Equipment authorization	<input type="checkbox"/> Declaration of Conformity <input checked="" type="checkbox"/> Certification <input type="checkbox"/> Verification	
	FCC ID	A3LSMG935X	
	Kind of product	Mobile Phone	
	Model No.	SM-G935X	
	Variant Model No.	Refer to clause 4.6	
	Manufacturer	SAMSUNG ELECTRONICS HUIZHOU CO.,LTD. 516229, Chenjiang Town, HuiZhou City, Guangdong Province, China SAMSUNG ELECTRONICS CO., LTD. 302, 3 Gongdan 3-ro, Gumi-si, Gyengsangbuk-do, 39388, Republic of Korea	
Applied Standards	FCC Part 15, Subpart B, Class B / ANSI C63.4-2009		
Test Period	January 20, 2016 ~ January 25, 2016		
Issue date	February 12, 2016		

Test result : Complied

The equipment under test has found to be compliant with the applied standards.
 (Refer to thtlfe attached test result for more detail.)

Tested by : Sung-Wook Choi

S. W. Choi

Reviewed by : Young-Hun Kim

Y. H. Kim

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SAMSUNG

CS & Environment Center of Samsung Electronics Co., Ltd.

129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677 Rep. of Korea

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1. Report Information

1.1 Revision history

No.	Revised detailed information
Issue 0	- LBE20160213 (SAMSUNG)
Issue 1	- Modified the clock frequency. (2 400 MHz → 2 300 MHz)

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 (Mains port)	FCC Part 15 Subpart B / ANSI C63.4-2009 (Class B)	Complied
<input checked="" type="checkbox"/>	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.

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-G935X	-	SAMSUNG	A3LSMG935X
B	Battery	EB-BG935ABE	-	SAMSUNG	-
C	Headset	EO-EG920BW	-	SAMSUNG	-
D	Data Cable	EP-DG925UWE	-	SAMSUNG	-
E	micro SD Card	32GB	-	SAMSUNG	-
F	Desk-Top Computer	DM300S3A	-	SAMSUNG	DoC
			EBDEDC6FFD	SAMSUNG	DoC
G	LCD TV Monitor	PE22BS	N849HVMP702249R	SAMSUNG	DoC
		EF23TS	NC26H1KSB01550B	SAMSUNG	DoC
H	Mouse	SML-210PB	TAKD125024 V	SAMSUNG	DoC
			TAKD124911M	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

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)
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4.3 Details of Sampling

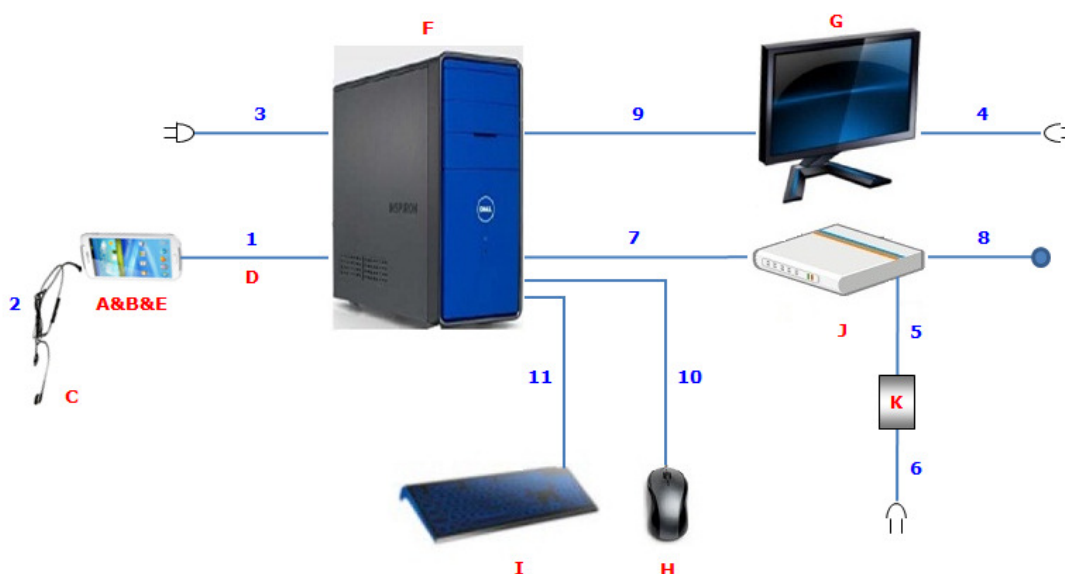
Customer selected, single unit.

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	1.2	Yes	From EUT to PC
2	Headset	1.2	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 <td 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

4.5 Test arrangement



4.6 EUT Description

The EUT is a bar type Mobile Phone which can operate on incorporates a camera, Bluetooth, Wi-Fi, GPS, ANT+, NFC, MST, OTG, Wireless Charging, MP3 and MP4 player.

4.6.1 The variant models

- None

4.7 Clock Frequencies

Kind of Clocks	Frequency [MHz]	Kind of Clocks	Frequency [MHz]
CPU	2 300	-	-

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 original.
- 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	2.86 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

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 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.
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

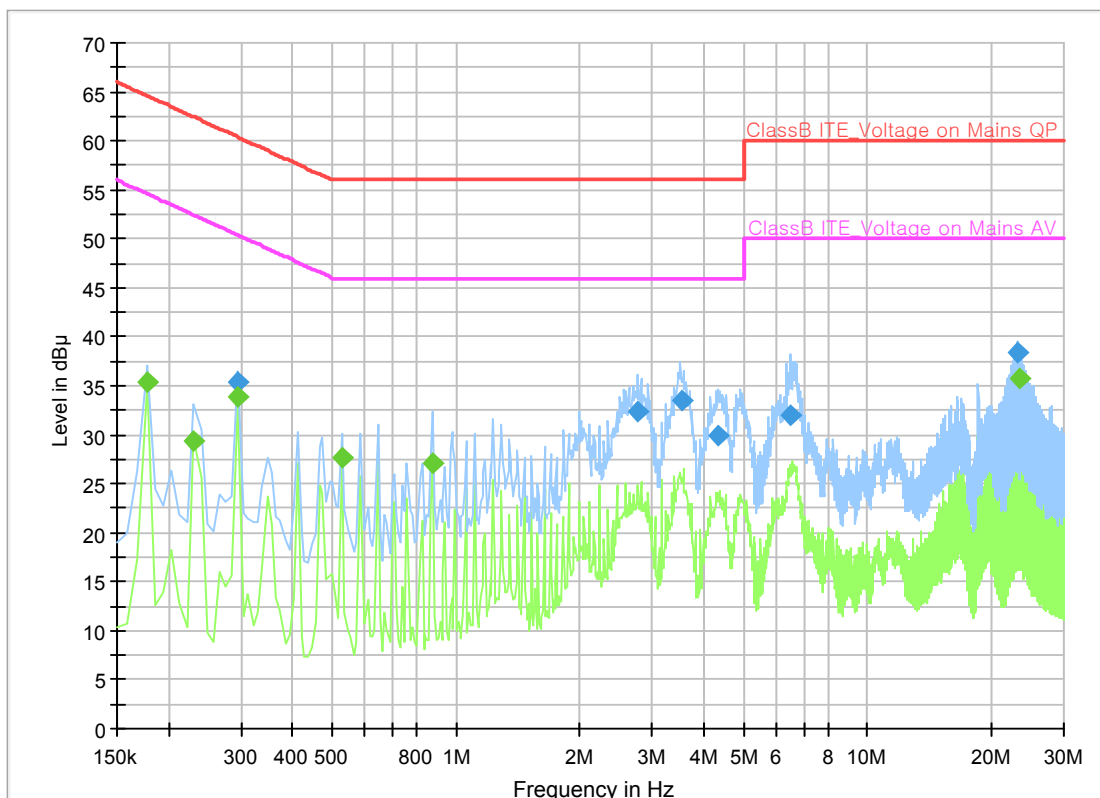
EMC No.	Test Instrument	Model name	Manufacturer	Serial No.	Calibration	
					Date	Interval (Month)
E5I-010	LISN	ESH3-Z5	R&S	100263	2015-11-06	12
E5I-018	EMI Test Receiver	ESU8	R&S	100484	2015-06-05	12
E5I-043	LISN	ENV216	R&S	101630	2015-06-27	12

5.1.2 Temperature and humidity condition

Test date	2016-01-25	Test engineer	Sung-Wook Choi
Climate condition	Ambient temperature	(23.4~ 23.7) °C	Limit (15.0 to 35.0) °C
	Relative humidity	(45.3~ 46.1) % R.H.	Limit (25.0 to 75.0) % R.H.
	Atmospheric pressure	(102.5 ~ 102.6) kPa	Limit (86.0 to 106.0) kPa
Test place	Shield Room (SR14)		

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.

Final measurement results table (QP/CAV):

Frequency (MHz)	QP Level (dB μ V)	CAV Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Line	Corr. (dB)
0.177	---	35.4	54.6	19.2	N	10.0
0.231	---	29.4	52.4	23.0	L1	9.8
0.294	35.5	---	60.4	24.9	L1	9.9
0.294	---	33.9	50.4	16.5	L1	9.9
0.528	---	27.7	46.0	18.3	L1	10.1
0.879	---	27.1	46.0	18.9	L1	10.0
2.760	32.4	---	56.0	23.6	N	10.0
3.525	33.4	---	56.0	22.6	N	9.9
4.344	30.0	---	56.0	26.0	L1	9.7
6.495	32.0	---	60.0	28.0	L1	9.7
23.253	38.4	---	60.0	21.6	N	10.2
23.433	---	35.7	50.0	14.3	N	10.2

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 [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

Antenna Height [cm]	Antenna Polarisation	Resolution Bandwidth [MHz]	Video Bandwidth [MHz]	Turntable position [degrees]
100 ~ 400	Horizontal, Vertical	1	3	0 ~ 345 (Step size: 15 degrees)

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 [$\mu\text{V/m}$]	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-123	EMI Test Receiver	ESU8	R&S	100475	2015-05-11	12
E5I-020	EMI Test Receiver	ESU40	R&S	100375	2015-06-01	12
E5I-035	Double-Ridged Waveguide Horn Antenna	HF907	R&S	100506	2015-05-07	24
E5I-070	BiLog Antenna	CBL6112D	TESEQ	35383	2015-06-14	24
E5I-121	BiLog Antenna	CBL6112D	TESEQ	36999	2014-06-26	24
E5I-073	Preamplifier	310N	Sonoma	332016	2015-06-01	12
E5I-074	Preamplifier	310N	Sonoma	332017	2015-06-01	12

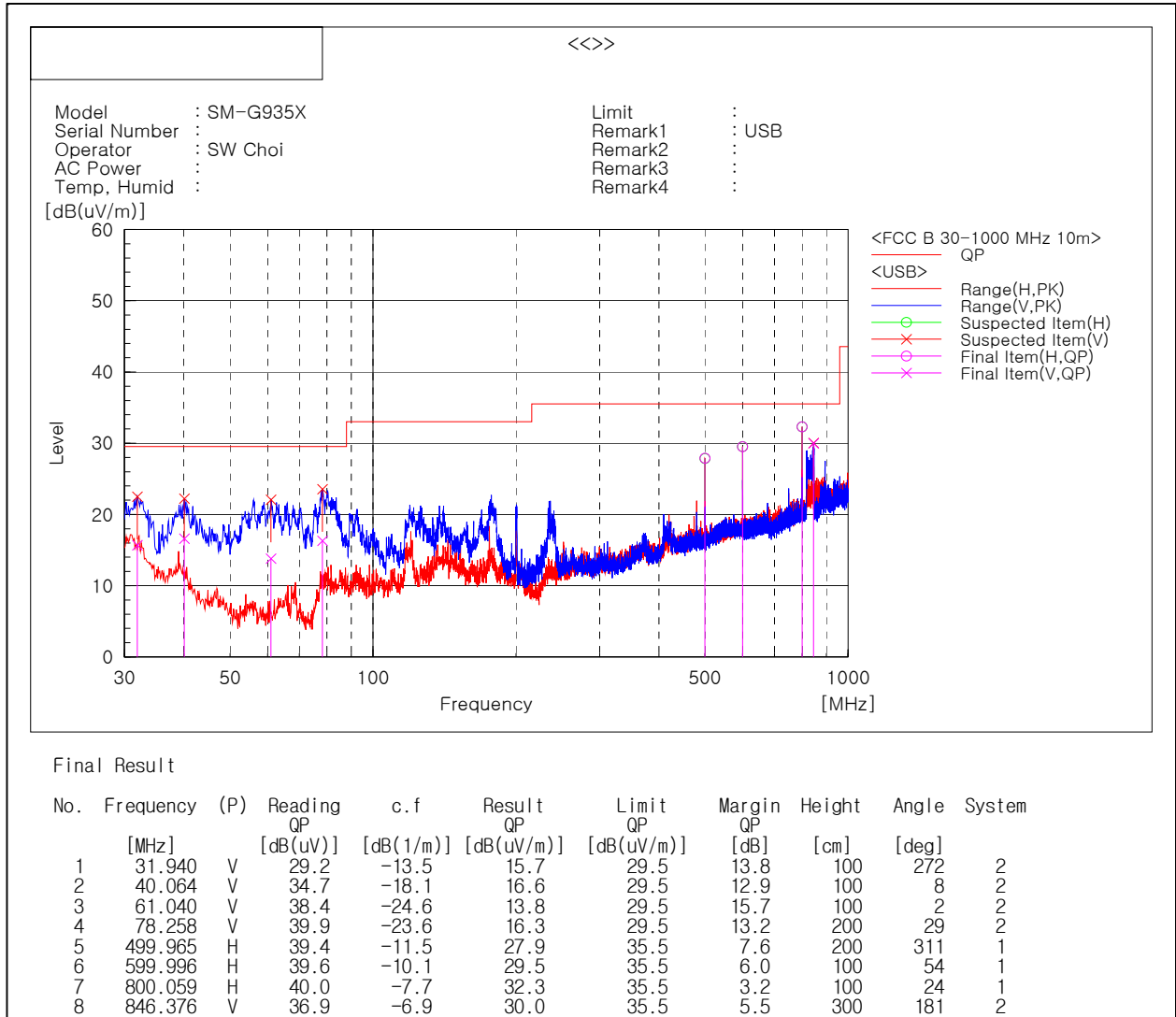
5.2.2 Temperature and humidity condition

Test date	2016-01-20	Test engineer	Sung-Wook Choi
Climate condition	Ambient temperature	(21.5~ 21.7) °C	Limit (15.0 to 35.0) °C
	Relative humidity	(49.6 ~ 50.5) % R.H.	Limit (25.0 to 75.0) % R.H.
	Atmospheric pressure	(102.5 ~ 102.6) kPa	Limit (86.0 to 106.0) kPa
Test place	Semi-Anechoic Chamber (SAC8)		

5.2.3 Test results

Operating Mode 1

- Frequency range below 1GHz



Note) Receiving antenna polarization : Horizontal, Vertical

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

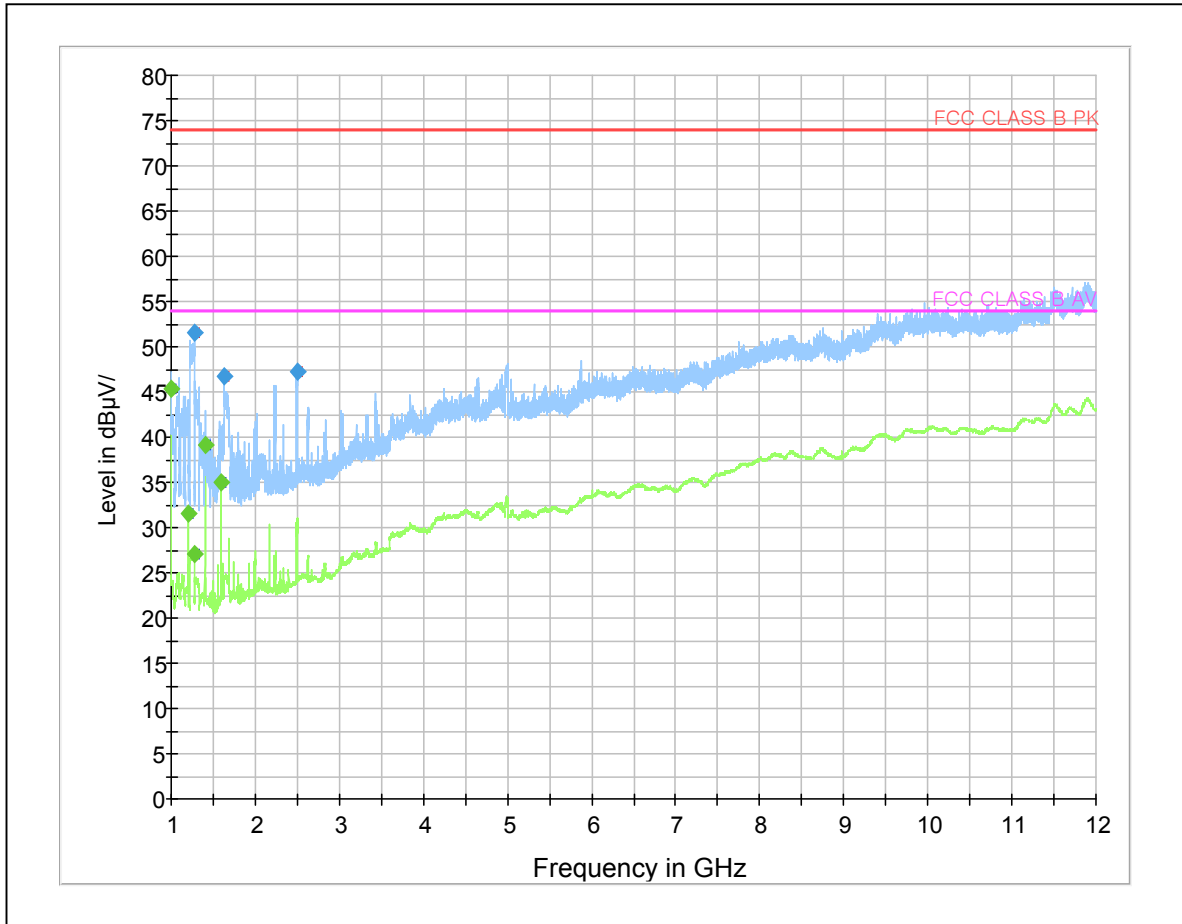
Level (QP) = Reading (QP) + c.f (Antenna Factor + Cable Loss - Amp. Gain)

Margin (QP) = Limit - Level (QP)

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

Operating Mode 1

- Frequency range above 1GHz



MEASUREMENT RESULT (PK/CAV):

Frequency (MHz)	PK Level (dBµV/m)	CAV Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth	Corr (dB)
1 000.000	---	45.4	54.0	8.6	100.0	H	0.0	-7.9
1 200.000	---	31.6	54.0	22.4	100.0	V	180.0	-8.5
1 271.500	51.6	---	74.0	22.4	100.0	V	105.0	-8.4
1 271.500	---	27.0	54.0	27.0	100.0	V	135.0	-8.4
1 400.000	---	39.2	54.0	14.8	100.0	H	90.0	-7.0
1 600.000	---	35.0	54.0	19.0	100.0	H	300.0	-5.7
1 636.000	46.8	---	74.0	27.2	100.0	V	270.0	-5.1
2 499.000	47.3	---	74.0	26.7	100.0	H	180.0	0.3

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