

EMC TEST REPORT


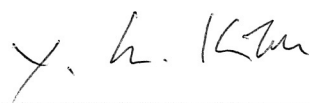
Project No.	LBE20190905	Issue No.	0
Applicant	Name of organization	Samsung Electronics Co., Ltd.	
	Address	(Maetan-dong) 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Republic of Korea	
	Date of application	July 15, 2019	
EUT	Type of device	<input checked="" type="checkbox"/> All other Receivers subject to part15 <input type="checkbox"/> Class B Personal Computers and peripherals <input checked="" type="checkbox"/> Other Class B digital devices and peripherals <input type="checkbox"/> FM Broadcast Receiver	
	Equipment authorization	<input checked="" type="checkbox"/> Certification <input type="checkbox"/> Supplier's Declaration of Conformity	
	FCC ID	A3LSMR825	
	Kind of product	Smart Wearable	
	Model No.	SM-R825U	
	Variant Model No.	Refer to clause 4.6	
	Manufacturer	SAMSUNG ELECTRONICS CO., LTD 94-1, Imsu-dong, Gumi-si, Gyengsangbuk-do, 730-722, Republic of Korea SAMSUNG ELECTRONICS VIETNAM Co., Ltd. Yen Phong I Industrial Park, Yen Trung Commune, Yen Phong District, Bac Ninh Province	
Applied Standards	47 CFR Part 15, Subpart B, Class B / ANSI C63.4-2014		
Test Period	July 15, 2019 ~ July 26, 2019		
Issue date	July 29, 2019		
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 : Jeong-Soo Kim 		Reviewed by : Young-Hun Kim 	
The test results in this report only apply to the tested sample. This report must not be reproduced, except in full, without written permission from Global CS Center.			
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.	Date of Issue	Revised detailed information
Issue 0	July 29, 2019	There are no revisions and this version is basic test report.

1.2 Licensed band test report no.

No.	Remark
HCT-RF-1907-FI027	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 (Mains port)	47 CFR Part 15 Subpart B / ANSI C63.4-2014 (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	Smart Wearable	SM-R825U	-	SAMSUNG	A3LSMR825
B	Battery	EB-BR820ABY	-	SAMSUNG	-
C	Wireless Charger	EP-OR825	-	SAMSUNG	A3LEPOR825
D	Travel Adapter	EP-TA50KWK	DK5KB12VS/A-E	SAMSUNG	-
E	Laptop Computer	Latitude5580	1CHRYM2	Dell	-
			D3HRYM2	Dell	-
F	Laptop AC Adapter	LA65NM130	5D77	Dell	-
			5B3C	Dell	-
G	Mouse	AA-SM7PCP	CN57BA5903634ADV 8JK281082	SAMSUNG	-
			CNBA5903634ADV8J 31O3050	SAMSUNG	-
H	Router	DIR-806A	RF0F1D5000688	D-Link	-
			RF0F1D8011504	D-Link	-
I	OTG Gender	EE-UG970	-	SAMSUNG	-

4.2 EUT operating mode

To achieve compliance applied standard specification including both JAB and CXX requirement, the following mode(s) were made during compliance testing:

4.2.1 Conducted Emission

No.	Operating mode
1	Cellular receiver(LTE FDD B26 Center Frequency) + Wireless Charging (w/TA)
2	Audio playback from internal memory data + Wireless Charging (w/TA)
3	Wireless Charging (w/USB port of Laptop Computer)

4.2.2 Radiated Emission

No.	Operating mode
1	Wireless Charging (w/TA)
2	Audio playback from internal memory data
3	Wireless Charging (w/USB port of Laptop Computer)

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:

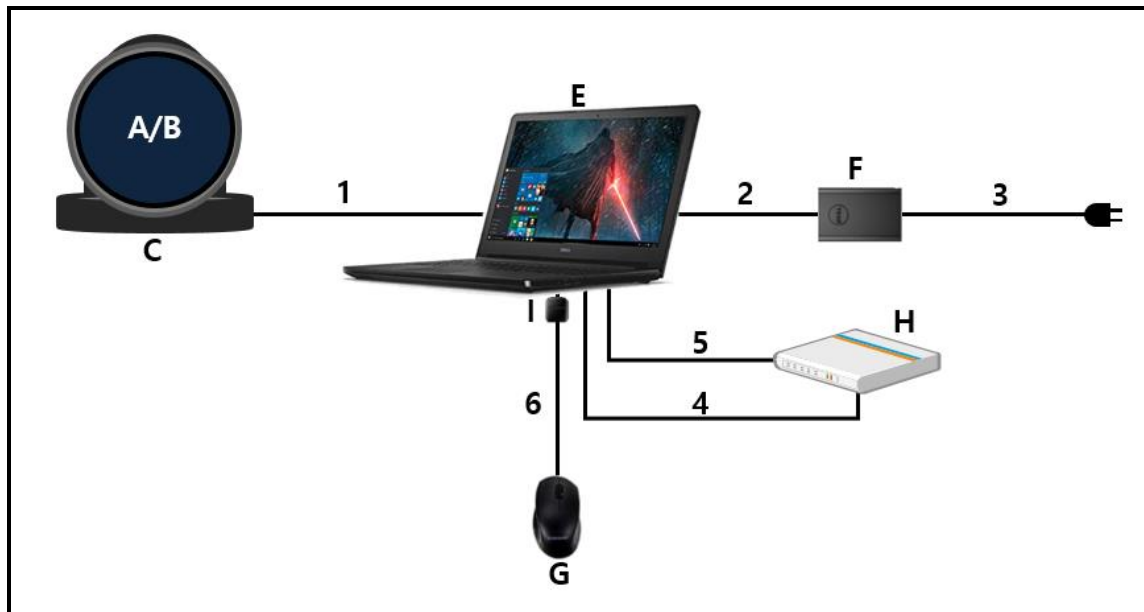
No.	Connected cable	Length [m]	Shielded [Y/N]	Note
1	Wireless Charger cable	0.8	No	For Wireless Charger
2	Power	1.8	No	From Laptop to AC Adapter
3	Power	1.5	No	For AC Adapter
4	LAN	1.5	No	From Laptop to Router
5	USB	0.8	No	From Laptop to Router for DC Power
6	USB	1.2	No	From OTG Gender to Mouse

4.5 Test arrangement

4.5.1 Conducted Emission



[Mode 1 - 2]

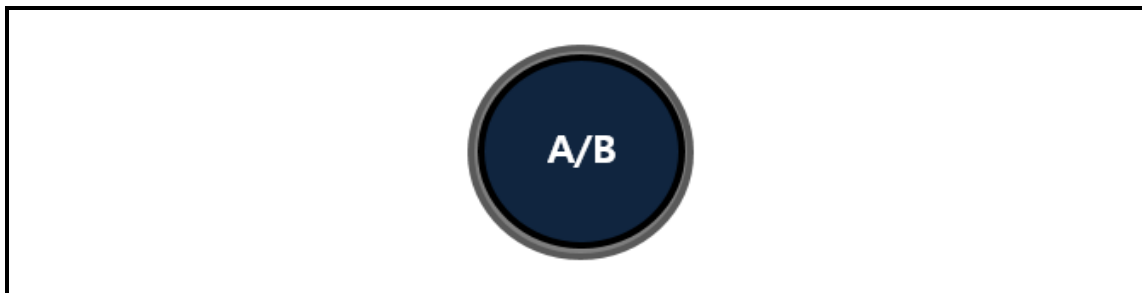


[Mode 3]

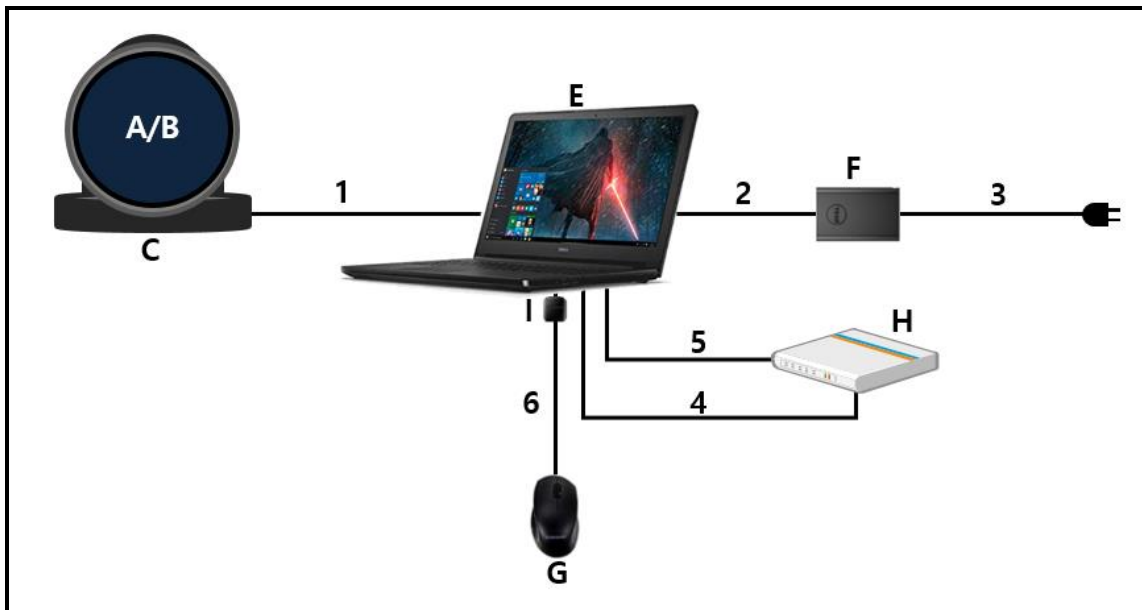
4.5.2 Radiated Emission



[Mode 1]



[Mode 2]



[Mode 3]

4.6 EUT Description

The EUT is a Watch type Smart Wearable which can operate on WCDMA FDD2/4/5, LTE FDD2/4/5/12/13/25/26/66 bands and incorporates a Bluetooth, Wi-Fi, GNSS, NFC, Wireless Charging and Audio.

4.6.1 The variant models

- SM-R825F

4.7 EUT Frequencies

The highest frequencies (Generated and used)	Frequency [MHz]
Bluetooth	2 480

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.

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

The EUT was charged with Wireless Charger connected to Travel Adapter and USB port of Laptop Computer.

Cellular RX mode testing was performed with the LTE FDD26 RX Test mode at center frequency. All licensed communication Cellular RX mode, WCDMA/LTE, test results are not significantly different.

The audio were repetitively played 1 kHz sound.

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 (C.L. 95 %, k = 2)
Conducted disturbance	AC Mains	2.83 dB
Radiated Disturbance (Below 1 GHz)	Horizontal	4.99 dB
	Vertical	4.90 dB
Radiated Disturbance (Above 1 GHz)	Horizontal	5.13 dB
	Vertical	5.12 dB

5. Results of individual test

5.1 Conducted disturbance

The EUT is connected to a LISN via travel adapter. If the EUT is connected to the Laptop Computer USB port, the Laptop AC adapter is connected to a 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(μ V)]	
		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

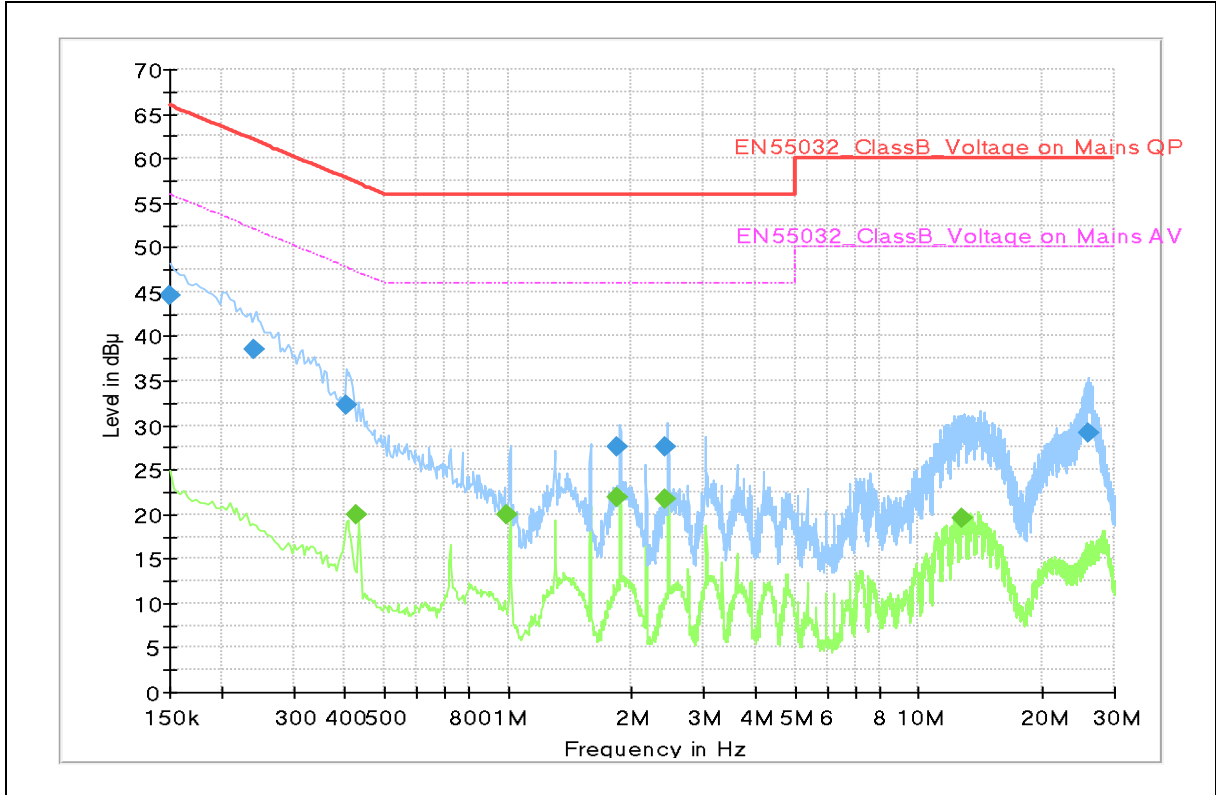
EMC No.	Test Instrument	Model name	Manufacturer	Serial No.	Calibration	
					Date	Interval (Month)
E5I-043	Two-Line V-Network	ENV216	R&S	101630	2018-08-17	12
E5I-017	EMI Test Receiver	ESU8	R&S	100483	2019-01-16	12
-	Test software	EMC32	R&S	Ver 9.26.01	-	-

5.1.2 Temperature and humidity condition

Test date	2019-07-26	Test engineer	Jeong-Soo Kim
Climate condition	Ambient temperature	(22.4 ~ 23.0) °C	Limit (15.0 to 35.0) °C
	Relative humidity	(53.2 ~ 53.9) % R.H.	Limit (25.0 to 75.0) % R.H.
	Atmospheric pressure	(100.1 ~ 100.6) 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:

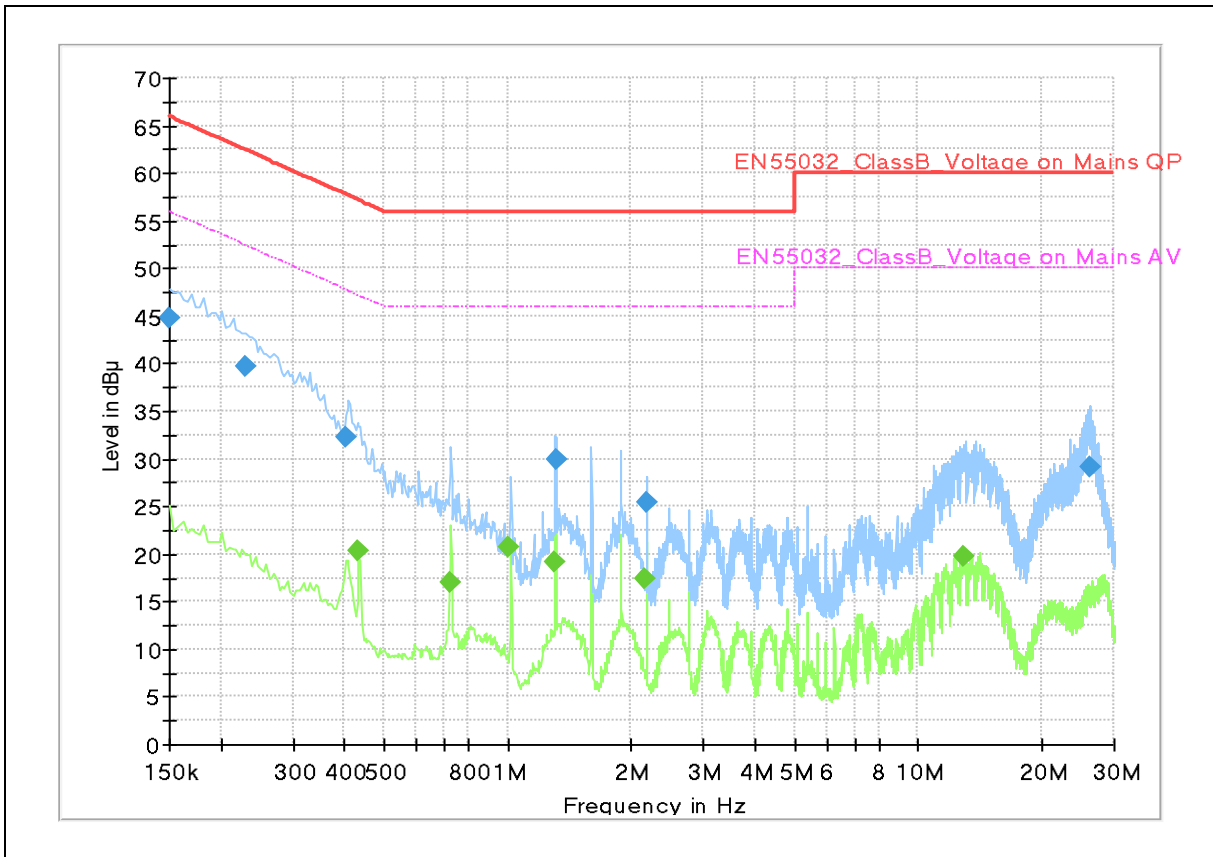
Frequency (MHz)	QP (dBµV)	CAV (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.150	44.6	---	66.0	21.4	L1	9.9
0.241	38.6	---	62.1	23.5	L1	9.9
0.405	32.3	---	57.8	25.5	L1	10.2
0.425	---	19.9	47.4	27.5	N	10.2
0.993	---	20.0	46.0	26.0	L1	10.0
1.841	---	21.8	46.0	24.2	L1	10.0
1.841	27.7	---	56.0	28.3	L1	10.0
2.409	---	21.6	46.0	24.4	L1	10.0
2.409	27.5	---	56.0	28.5	L1	10.0
12.809	---	19.6	50.0	30.4	L1	10.3
25.999	29.1	---	60.0	30.9	L1	10.7

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



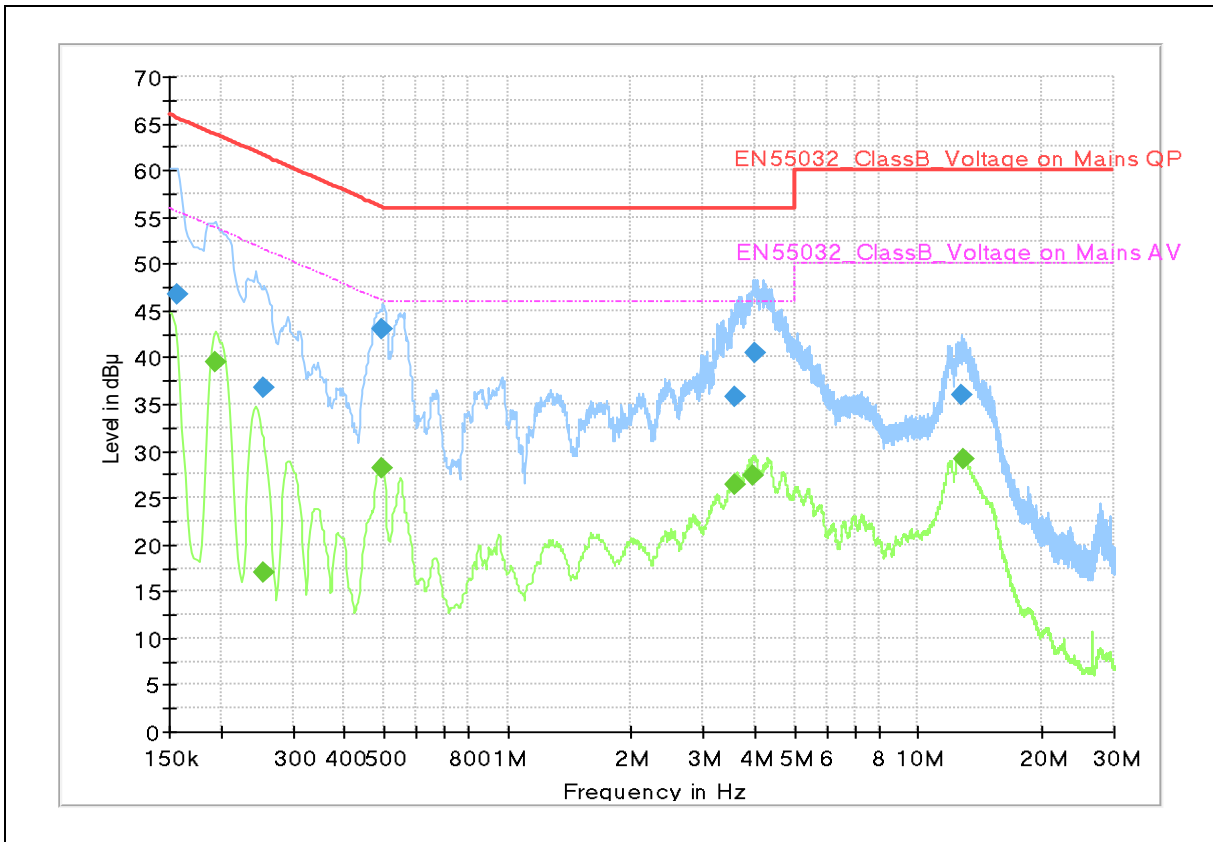
Note 1) Two graphs measured for both Live(L1) and Neutral(N) of the LISN are combined into one graph.

QP / CAV final measurement results table:

Frequency (MHz)	QP (dBµV)	CAV (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.150	44.7	---	66.0	21.3	L1	9.9
0.229	39.7	---	62.5	22.8	L1	9.9
0.405	32.3	---	57.8	25.5	L1	10.2
0.433	---	20.3	47.2	26.9	L1	10.2
0.721	---	17.0	46.0	29.0	L1	10.1
1.009	---	20.7	46.0	25.3	N	9.9
1.297	---	19.2	46.0	26.8	N	9.9
1.309	29.9	---	56.0	26.1	L1	10.0
2.165	---	17.4	46.0	28.6	L1	10.0
2.177	25.5	---	56.0	30.5	L1	10.0
12.841	---	19.8	50.0	30.2	L1	10.3
26.337	29.1	---	60.0	30.9	L1	10.7

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 (dB μ V)	CAV (dB μ V)	Limit (dB μ V)	Margin (dB)	Line	Corr. (dB)
0.156	46.7	---	65.6	18.9	N	9.8
0.195	---	39.5	53.8	14.3	L1	9.9
0.255	36.8	---	61.6	24.8	N	9.7
0.255	---	17.0	51.6	34.6	N	9.7
0.496	---	28.1	46.1	18.0	L1	10.0
0.496	42.9	---	56.1	13.2	L1	10.0
3.581	35.7	---	56.0	20.3	N	9.7
3.597	---	26.4	46.0	19.6	L1	9.8
3.970	---	27.5	46.0	18.5	L1	9.8
4.020	40.4	---	56.0	15.6	N	9.7
12.792	36.0	---	60.0	24.0	L1	9.9
12.916	---	29.2	50.0	20.8	L1	9.9

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 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 [cm]	Antenna Polarisation	Resolution Bandwidth [MHz]	Video Bandwidth [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 [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-016	EMI Test Receiver	ESU8	R&S	100482	2019-05-29	12
E5I-021	EMI Test Receiver	ESU40	R&S	100376	2019-01-30	12
E5I-149	Horn Antenna	HF907	R&S	102525	2018-06-15	24
E5I-039	Signal Conditioning Unit	SCU-18	R&S	10211	2019-01-23	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	2019-05-09	12
E5I-074	Preamplifier	310N	SONOMA	332017	2019-05-09	12
-	Test software	EP7RE	TOYO	Ver 5.8.2	-	-
-	Test software	EMC32	R&S	Ver 9.25.00	-	-

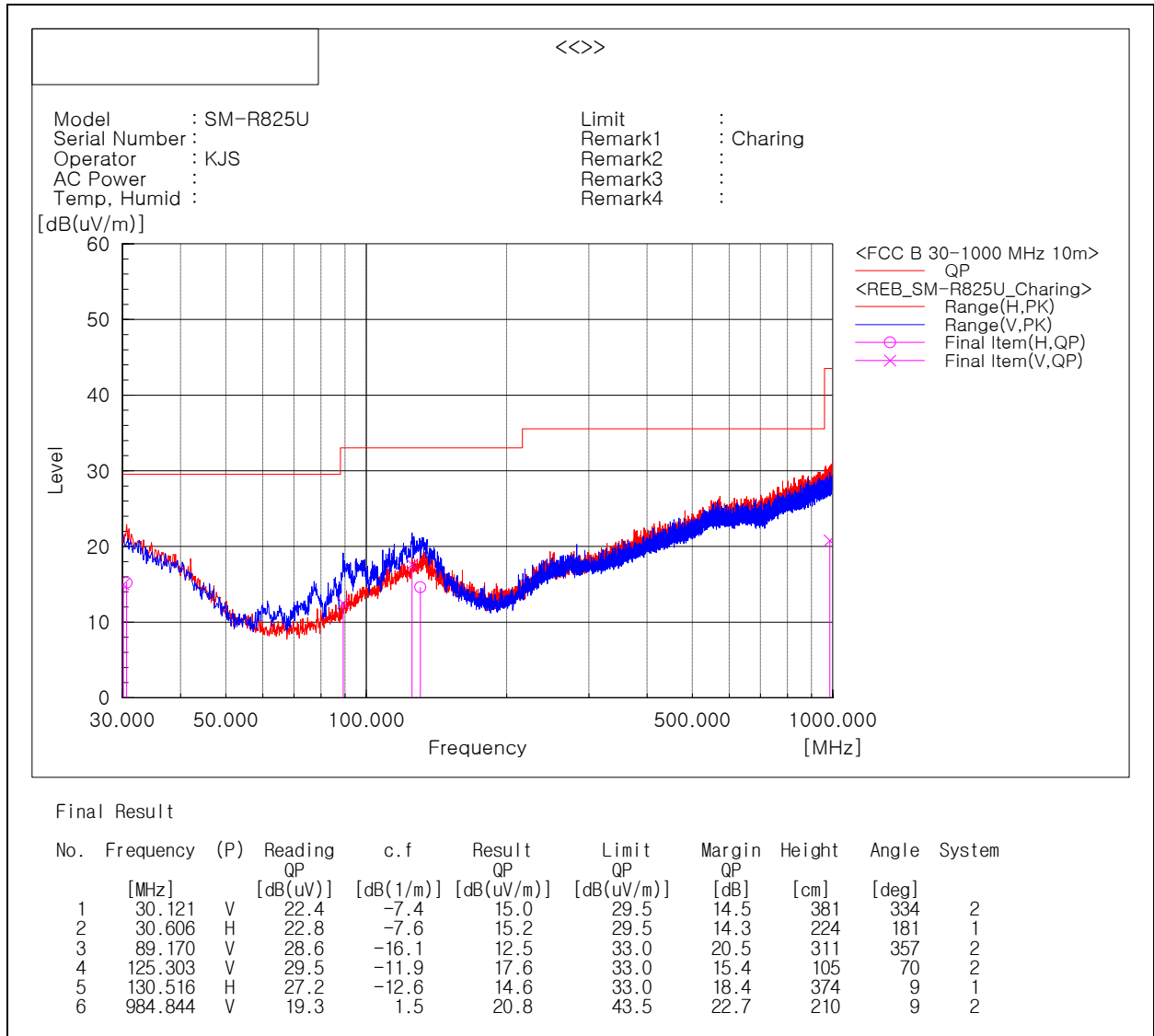
5.2.2 Temperature and humidity condition

Test date	2019-07-15	Test engineer	Jeong-Soo Lee
Climate condition	Ambient temperature	(22.9 ~ 23.5) °C	Limit (15.0 to 35.0) °C
	Relative humidity	(48.4 ~ 49.6) % R.H.	Limit (25.0 to 75.0) % R.H.
	Atmospheric pressure	(100.1 ~ 100.5) kPa	Limit (86.0 to 106.0) kPa
Test place	Semi-Anechoic Chamber (SAC4)		

5.2.3 Test results

Operating Mode 1

- Frequencies below 1 GHz



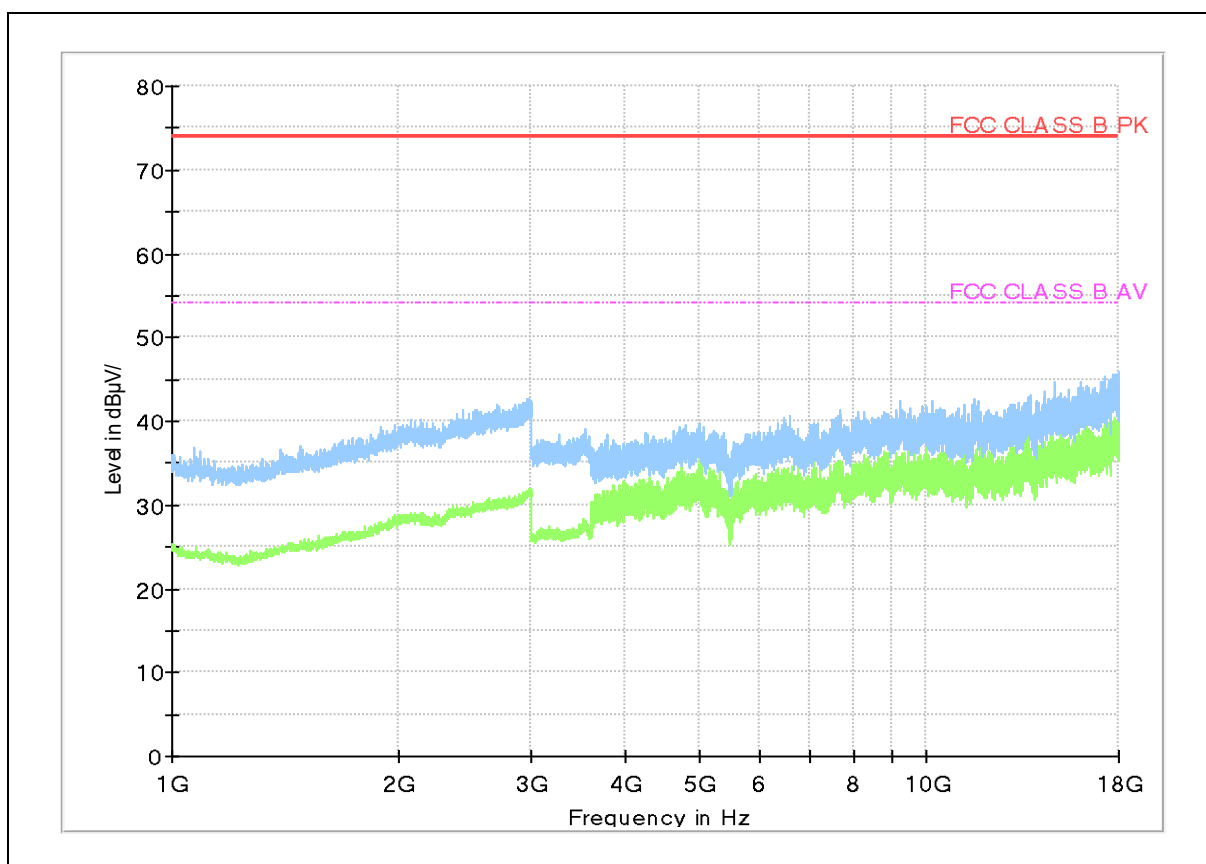
Note1) Receiving antenna polarization : Horizontal, Vertical

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

Note 1) Receiving antenna polarization : Horizontal, Vertical

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

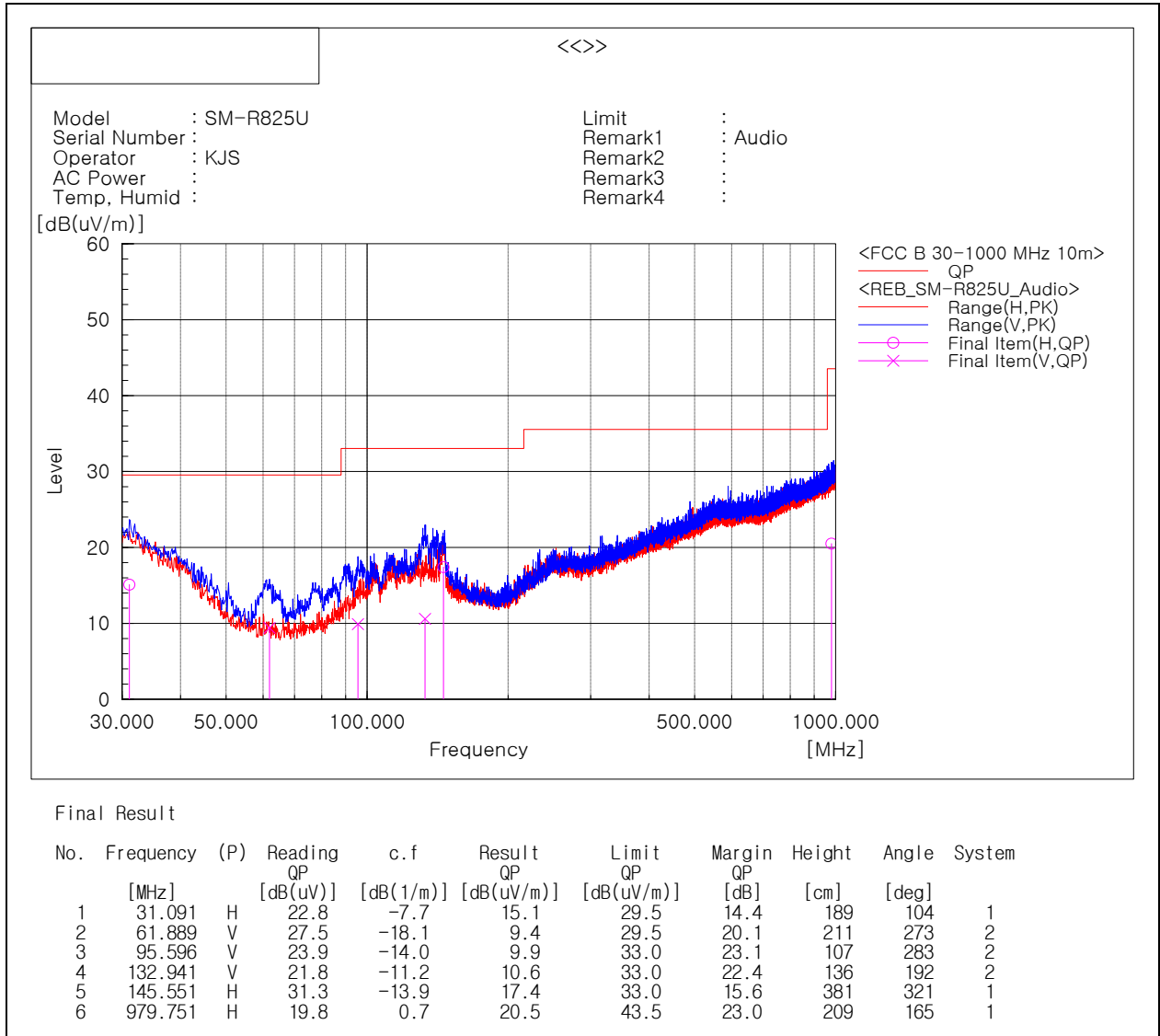
Level (PK and/or CAV) = Reading (PK and/or CAV) + Corr. (Antenna Factor + Cable Loss - Amp. Gain)

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



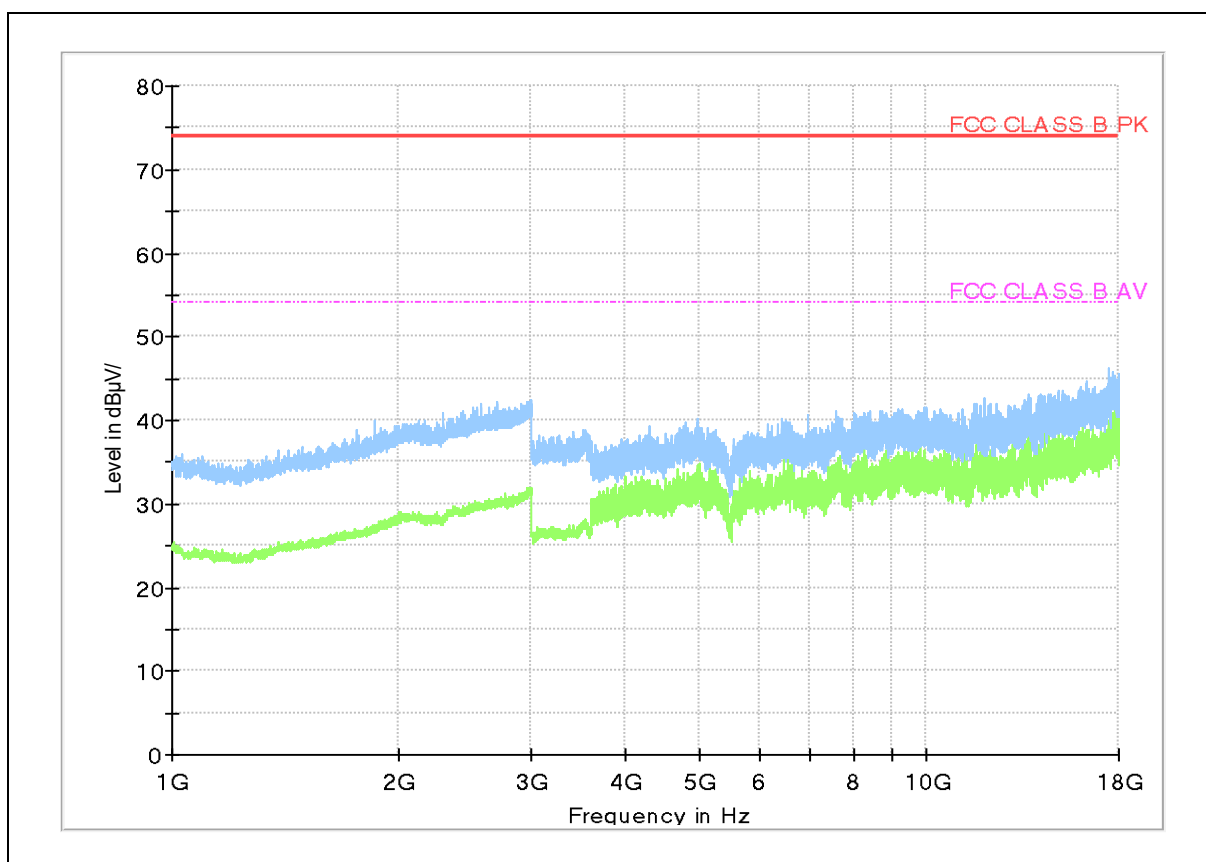
Note1) Receiving antenna polarization : Horizontal, Vertical

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

Note 1) Receiving antenna polarization : Horizontal, Vertical

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

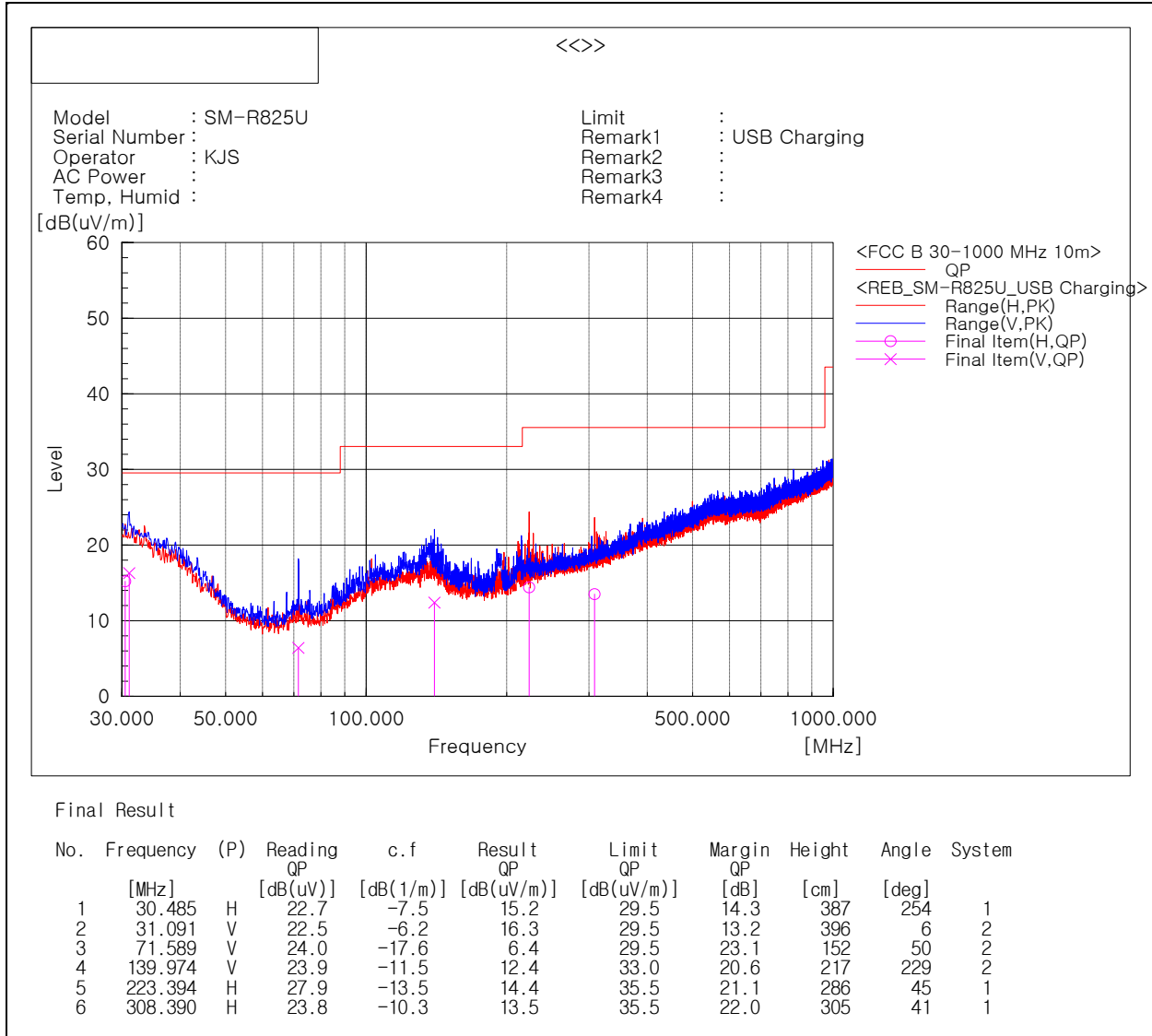
Level (PK and/or CAV) = Reading (PK and/or CAV) + Corr. (Antenna Factor + Cable Loss - Amp. Gain)

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



Note1) Receiving antenna polarization : Horizontal, Vertical

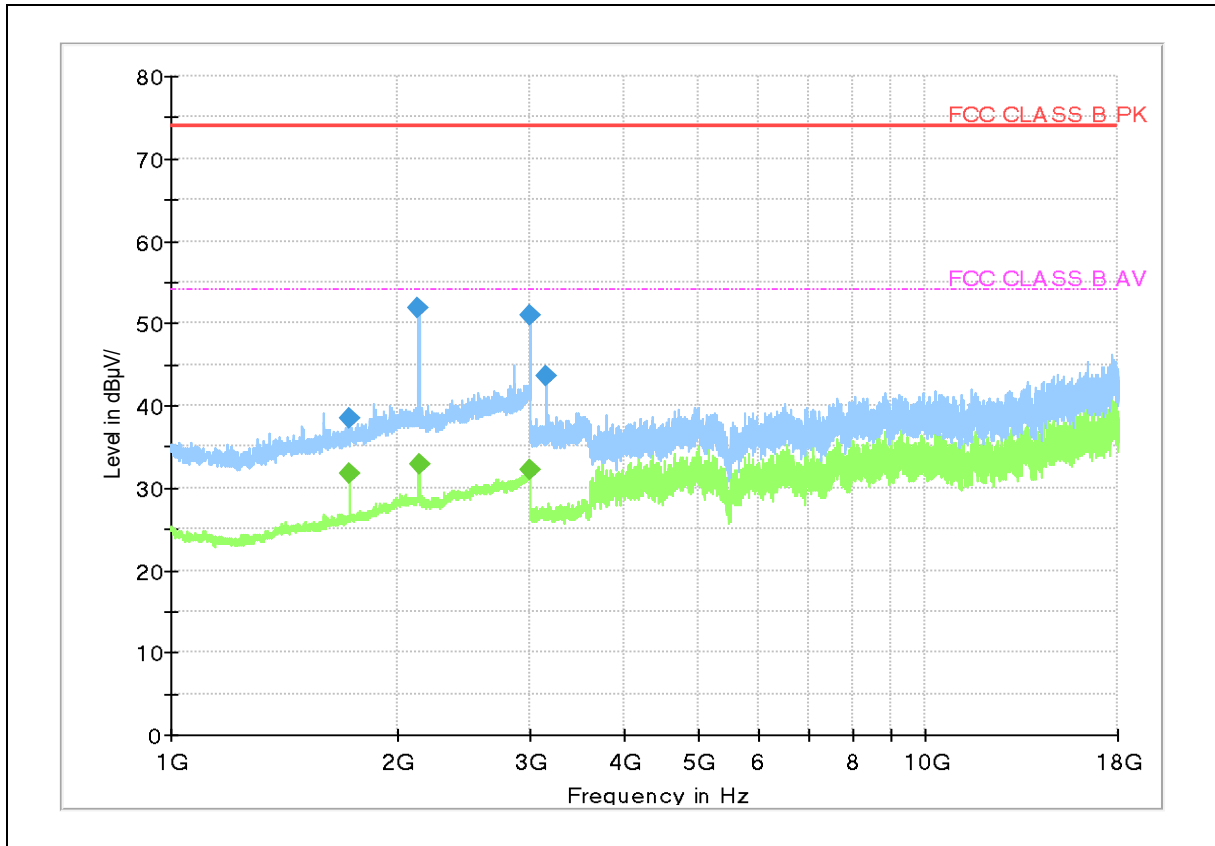
Test Distance : 10 m, Antenna Height : 1 to 4 meters

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)	PoI	Azimuth (deg)	Corr. (dB)
1 722.000	---	31.7	54.0	22.3	100.0	H	277.0	10.2
1 722.500	38.5	---	74.0	35.5	100.0	H	277.0	10.2
2 126.500	51.8	---	74.0	22.2	100.0	V	356.0	12.4
2 131.000	---	32.8	54.0	21.2	100.0	H	140.0	12.4
2 996.000	50.9	---	74.0	23.1	100.0	V	104.0	16.3
2 997.500	---	32.3	54.0	21.7	100.0	V	139.0	16.3
3 138.500	43.6	---	74.0	30.4	100.0	V	112.0	1.2

Note 1) 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