

EMC TEST REPORT


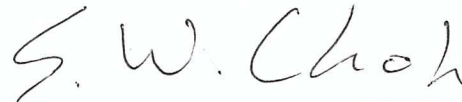
Project No.	LBE20191555	Issue No.	1
Applicant	Name of organization	Samsung Electronics Co., Ltd.	
	Address	(Maetan-dong) 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Republic of Korea	
	Date of application	December 31, 2019	
EUT	Type of device	<input type="checkbox"/> All other Receivers subject to part15 <input checked="" 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	A3LSMT723	
	Kind of product	Digital Attractor	
	Model No.	SM-T723	
	Variant Model No.	Refer to clause 4.6	
	Manufacturer	SAMSUNG ELECTRONICS CO., LTD. 302, 3 Gongdan 3-ro, Gumi-si, Gyengsangbuk-do, 39388, Republic of Korea	
Applied Standards	47 CFR Part 15, Subpart B, Class B / ANSI C63.4-2014		
Test Period	January 6, 2020 ~ January 9, 2020		
Issue date	January 15, 2020		
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 		Reviewed by : Sung-Wook Choi 	
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	14 January 2020	There are no revisions and this version is basic test report.
Issue 1	15 January 2020	Uncheck all other receiver on 1 page and remove CYY on clause 4.2

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 an ISO/IEC 17025:2005 accredited testing laboratory by the National Radio Research Agency with designation No. KR0004. for EMC testing.

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	Digital Attractor	SM-T723	-	SAMSUNG	A3LSMT723
B	Data Cable	ECB-DU68WE	-	SAMSUNG	-
C	Travel Adapter	EP-TA200	R37M7FA00H1DK3	SAMSUNG	-
D	OTG Gender	EE-UG970	-	SAMSUNG	-
E	Data Cable	EP-DG950CBE	-	SAMSUNG	-
F	Laptop Computer	Latitude5580	1CHRYM2	Dell	DoC
		Latitude5580	D3HRYM2	Dell	DoC
G	Laptop AC Adapter	LA65NM130	5D77	Dell	DoC
		LA65NM130	5B3C	Dell	DoC
H	Mouse	AA-SM7PCPB	CN57BA5903634ADV 8JJCD4371	SAMSUNG	DoC
		SNJ-B138	Z5F8353	SAMSUNG	DoC
I	Router	DIR-806A	RF0F1D8011501	D-Link	DoC
			RF0F1D8011504	D-Link	DoC

4.2 EUT operating mode

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

4.2.1 Conducted Emission

No.	Operating mode
1	Video playback from internal memory data + WiFi idle
2	USB Data Communication with PC

4.2.2 Radiated Emission

No.	Operating mode
1	Video playback from internal memory data + WiFi idle
2	USB Data Communication with PC

4.3 Details of Sampling

Customer selected, single unit.

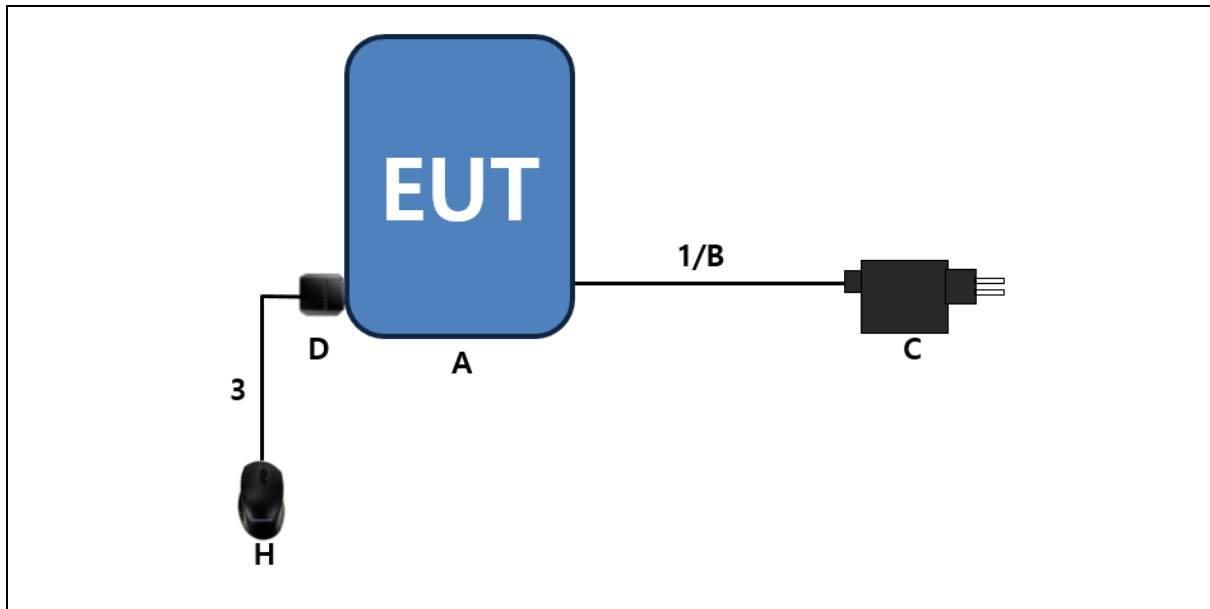
4.4 Used cable description

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:

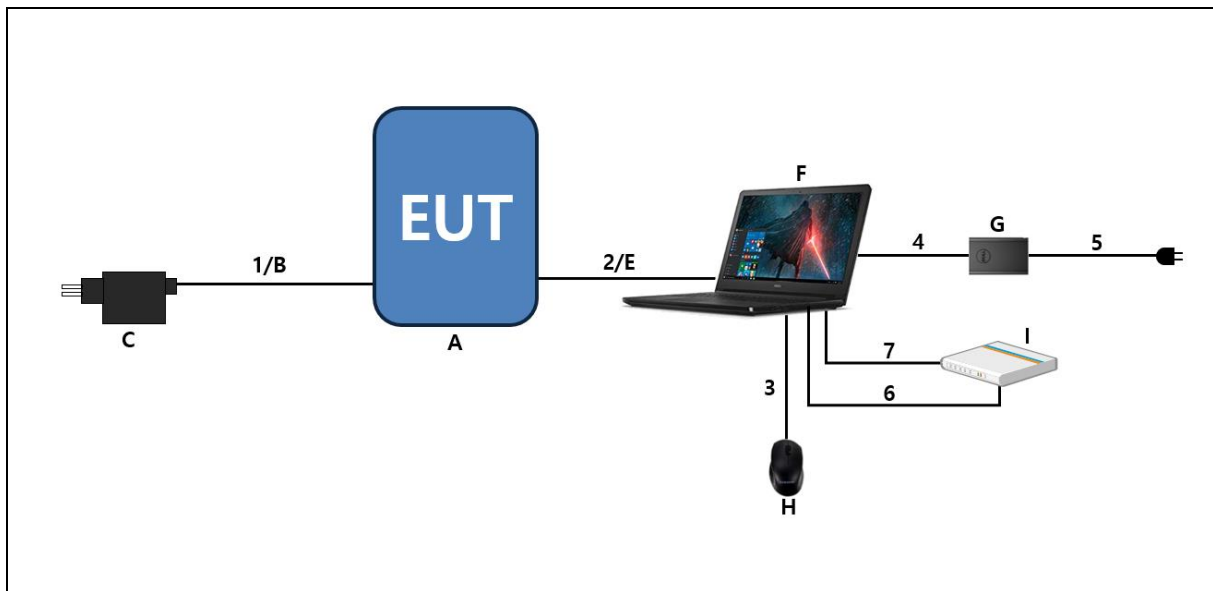
No.	Connected cable	Length [m]	Shielded [Y/N]	Note
1	Data Cable	0.8	Y	From EUT to Travel Adapter
2	Data Cable	1.0	Y	From EUT to Laptop Computer
3	USB	1.8	N	From Laptop Computer/EUT to Mouse
4	Power	1.8	N	From Laptop Computer to AC Adapter
5	Power	1.5	N	For Laptop AC Adapter
6	LAN	1.5	N	From Laptop Computer to Router
7	USB	0.8	N	From Laptop Computer to Router for DC Power

4.5 Test arrangement

4.5.1 Conducted Emission

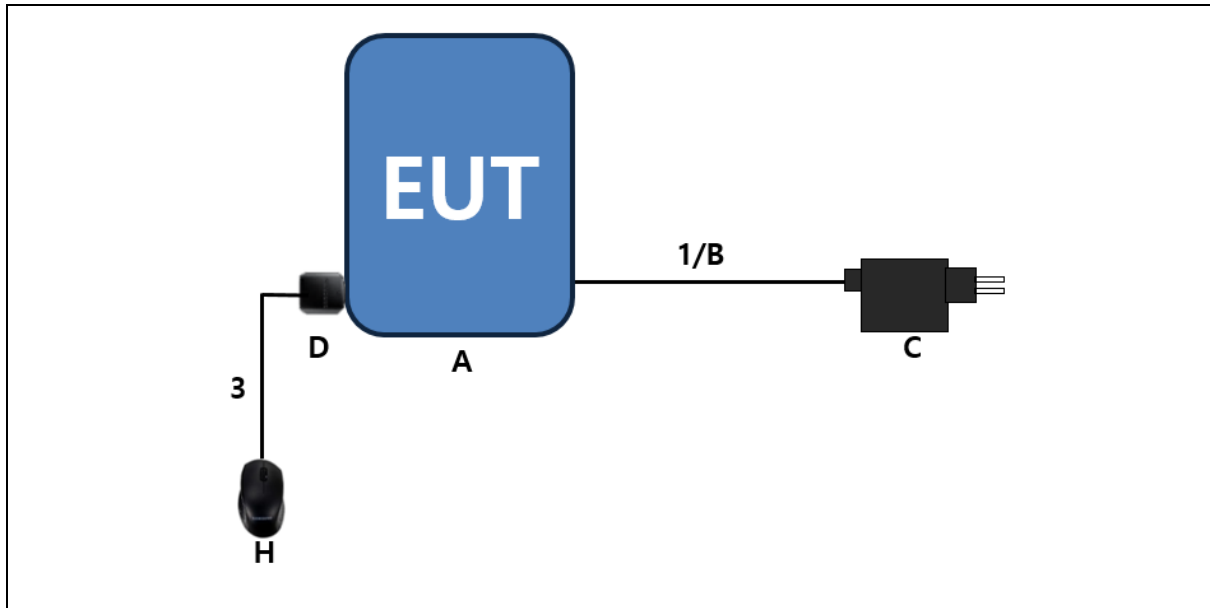


[Mode 1]

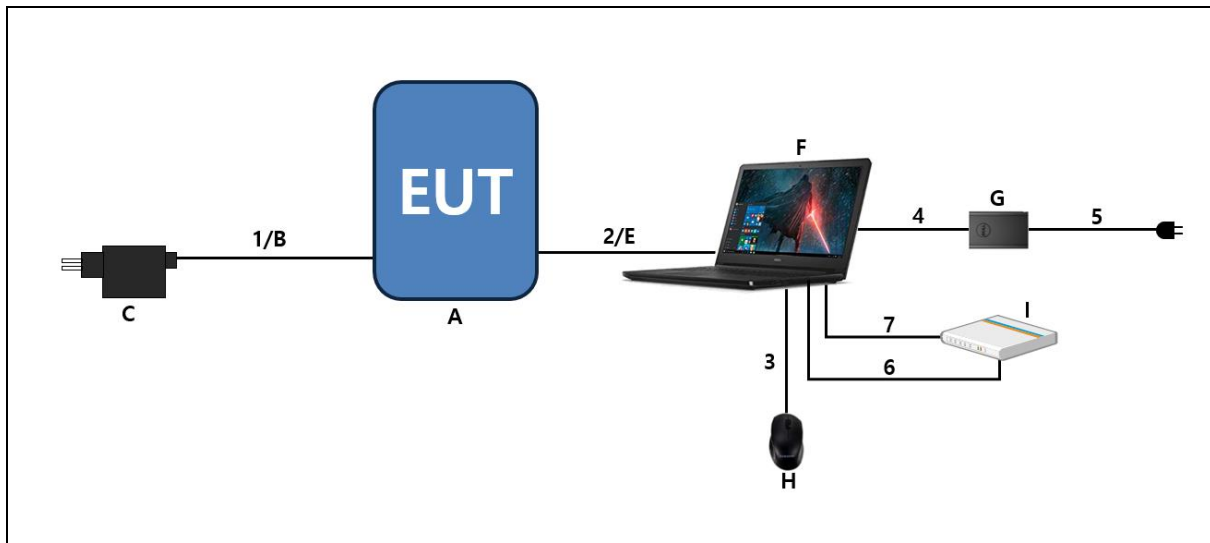


[Mode 2]

4.5.2 Radiated Emission



[Mode 1]



[Mode 2]

4.6 EUT Description

The EUT is a Digital Attractor which incorporate Wi-Fi and video.

4.6.1 The variant models

- None

4.7 EUT Frequencies

The highest frequencies (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 if available, by writing and reading arbitrary data or powered by TA.

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

The video were repetitively played.

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 (30 MHz ~ 1 GHz)	Horizontal	4.99 dB
	Vertical	4.90 dB
Radiated Disturbance (1 GHz ~ 6 GHz)	Horizontal	4.96 dB
	Vertical	4.95 dB
Radiated Disturbance (6 GHz ~ 18 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(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

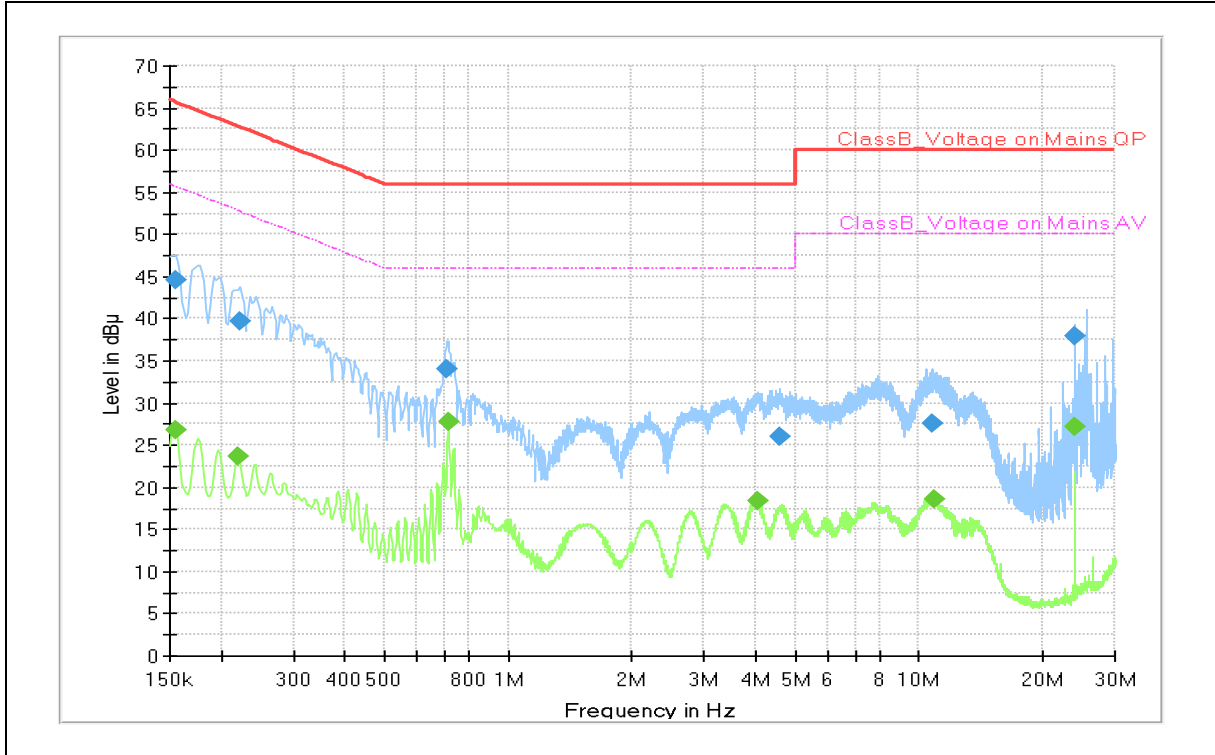
EMC No.	Test Instrument	Model name	Manufacturer	Serial No.	Calibration	
					Date	Interval (Month)
E5I-017	EMI Test Receiver	ESU8	R&S	100483	2019-01-16	12
E5I-127	LISN	ENV216	R&S	102061	2019-08-01	12
-	Test software	EMC32	R&S	Ver 9.26.01	-	-

5.1.2 Temperature and humidity condition

Test date	2020-01-06	Test engineer	Soo-Joon Kim
Climate condition	Ambient temperature	(22.4 ~ 22.7) °C	Limit (15.0 to 35.0) °C
	Relative humidity	(41.0 ~ 41.7) % R.H.	Limit (25.0 to 75.0) % R.H.
	Atmospheric pressure	(101.8 ~ 102.1) kPa	Limit (86.0 to 106.0) kPa
Test place	Shield Room (SR8)		

5.1.3 Test results

□ Operating Mode 1: AC Mains



QP / CAV final measurement results table:

Frequency (MHz)	QP (dBµV)	CAV (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.155	---	26.9	55.8	28.9	N	10.0
0.155	44.6	---	65.8	21.2	N	10.0
0.220	---	23.7	52.8	29.1	L1	9.8
0.222	39.6	---	62.7	23.1	N	9.9
0.710	34.0	---	56.0	22.0	L1	10.0
0.715	---	27.8	46.0	18.2	N	10.1
4.036	---	18.4	46.0	27.6	N	10.0
4.603	26.0	---	56.0	30.0	N	10.0
10.748	27.5	---	60.0	32.5	N	10.3
10.849	---	18.5	50.0	31.5	N	10.3
24.043	---	27.2	50.0	22.8	N	10.7
24.043	38.0	---	60.0	22.0	N	10.7

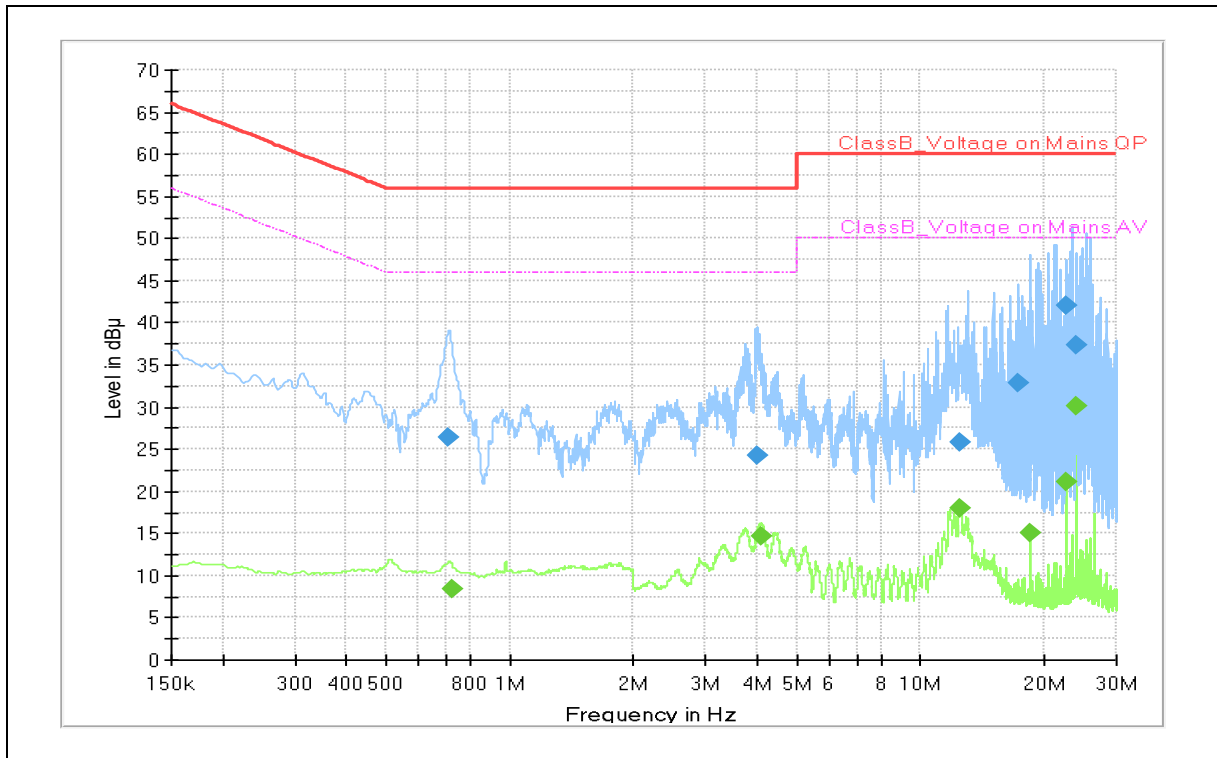
Note 1) Two graphs measured for both Live(L1) and Neutral(N) of the LISN are combined into one graph.

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



QP / CAV final measurement results table:

Frequency (MHz)	QP (dBμV)	CAV (dBμV)	Limit (dBμV)	Margin (dB)	Line	Corr. (dB)
0.710	26.3	---	56.0	29.7	L1	10.0
0.726	---	8.4	46.0	37.6	N	10.0
3.998	24.3	---	56.0	31.7	L1	9.8
4.112	---	14.7	46.0	31.3	L1	9.8
12.424	25.9	---	60.0	34.1	N	9.9
12.482	---	18.0	50.0	32.0	N	9.9
17.221	32.9	---	60.0	27.1	L1	9.9
18.431	---	15.1	50.0	34.9	L1	9.9
22.529	---	21.1	50.0	28.9	L1	9.9
22.533	42.0	---	60.0	18.0	L1	9.9
24.043	---	30.2	50.0	19.8	L1	9.9
24.059	37.4	---	60.0	22.6	L1	9.9

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

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 operates 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

Note) Distance correction formula from $D_1(3\text{m})$ to $D_2(10\text{m})$
: Limit at $D_2 = \text{Limit at } D_1 + 20\text{Log}(D_1 / D_2)$

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-037	WideBand Horn Antenna	WBH 18-40K	R&S	11201	2019-01-31	24
E5I-042	Signal Conditioning Unit	SCU-40A	R&S	10004	2019-09-11	12
E5I-120	BiLog Antenna	CBL6112D	TESEQ	36997	2018-04-23	24
E5I-072	BiLog Antenna	CBL6112D	TESEQ	36009	2018-04-23	24
E5I-075	Preamplifier	310N	SONOMA	332018	2019-05-09	12
E5I-076	Preamplifier	310N	SONOMA	332019	2019-05-09	12
-	Test software	EP7RE	TOYO	Ver 5.8.2	-	-
-	Test software	EMC32	R&S	Ver 9.25.00	-	-

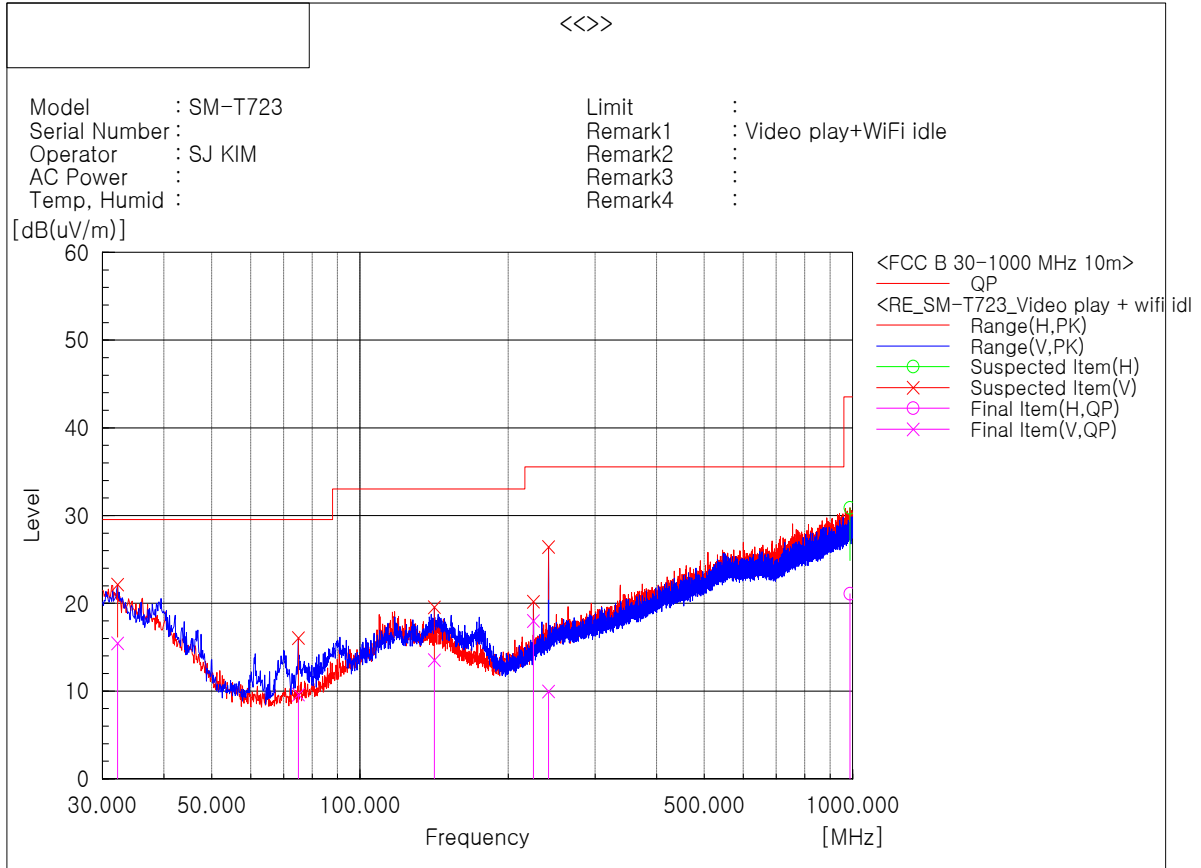
5.2.2 Temperature and humidity condition

Test date	2020-01-08 ~ 2020-01-09	Test engineer	Soo-Joon Kim
Climate condition	Ambient temperature	(21.7 ~ 22.1) °C	Limit (15.0 to 35.0) °C
	Relative humidity	(44.2 ~ 46.8) % R.H.	Limit (25.0 to 75.0) % R.H.
	Atmospheric pressure	(101.1 ~ 101.7) kPa	Limit (86.0 to 106.0) kPa
Test place	Semi-Anechoic Chamber (SAC4)		

5.2.3 Test results

Operating Mode 1

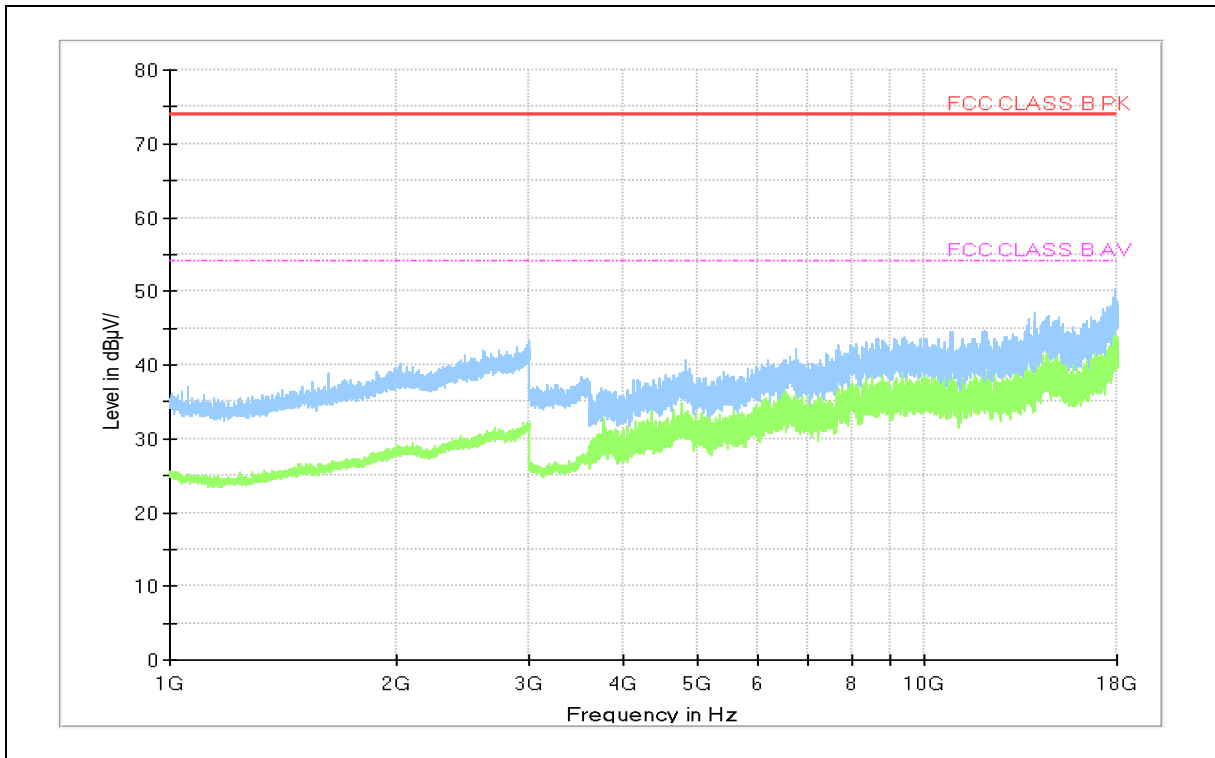
- Frequencies below 1 GHz



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	32.183	V	23.4	-8.0	15.4	29.5	14.1	290	218	2
2	74.984	V	28.1	-18.5	9.6	29.5	19.9	130	72	2
3	141.550	V	26.1	-12.6	13.5	33.0	19.5	102	58	2
4	225.036	V	30.6	-12.6	18.0	35.5	17.5	109	134	2
5	241.339	V	21.5	-11.5	10.0	35.5	25.5	103	114	2
6	987.875	H	19.8	1.3	21.1	43.5	22.4	170	264	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

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

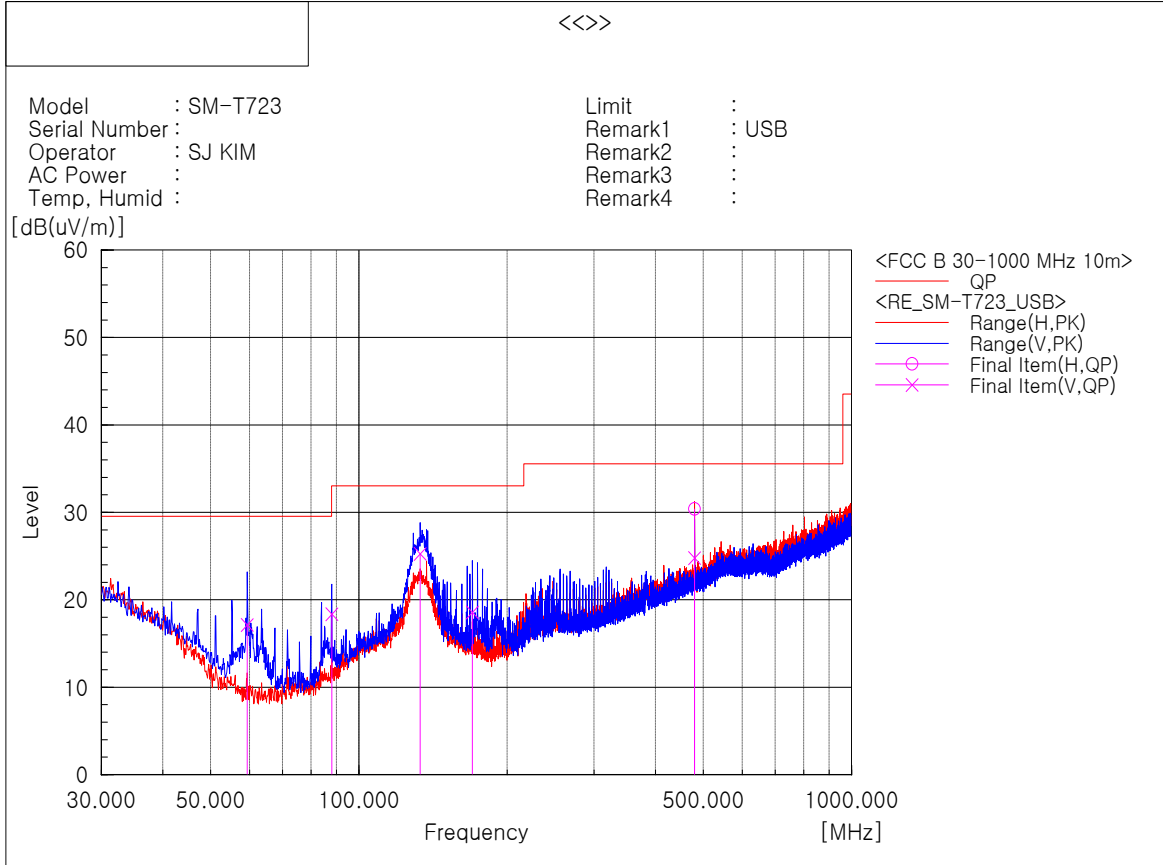
Level (PK and/or CAV) = Reading (PK and/or CAV) + Corr. (Antenna Factor + Cable Loss - Amp. Gain)

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	59.343	V	35.9	-18.8	17.1	29.5	12.4	102	158	2
2	88.079	V	34.7	-16.3	18.4	33.0	14.6	151	38	2
3	133.063	V	37.3	-12.1	25.2	33.0	7.8	100	275	2
4	169.923	V	32.9	-14.3	18.6	33.0	14.4	101	338	2
5	479.959	V	30.2	-5.4	24.8	35.5	10.7	399	226	2
6	480.002	H	36.3	-5.9	30.4	35.5	5.1	204	123	1

Note1) Receiving antenna polarization : Horizontal, Vertical

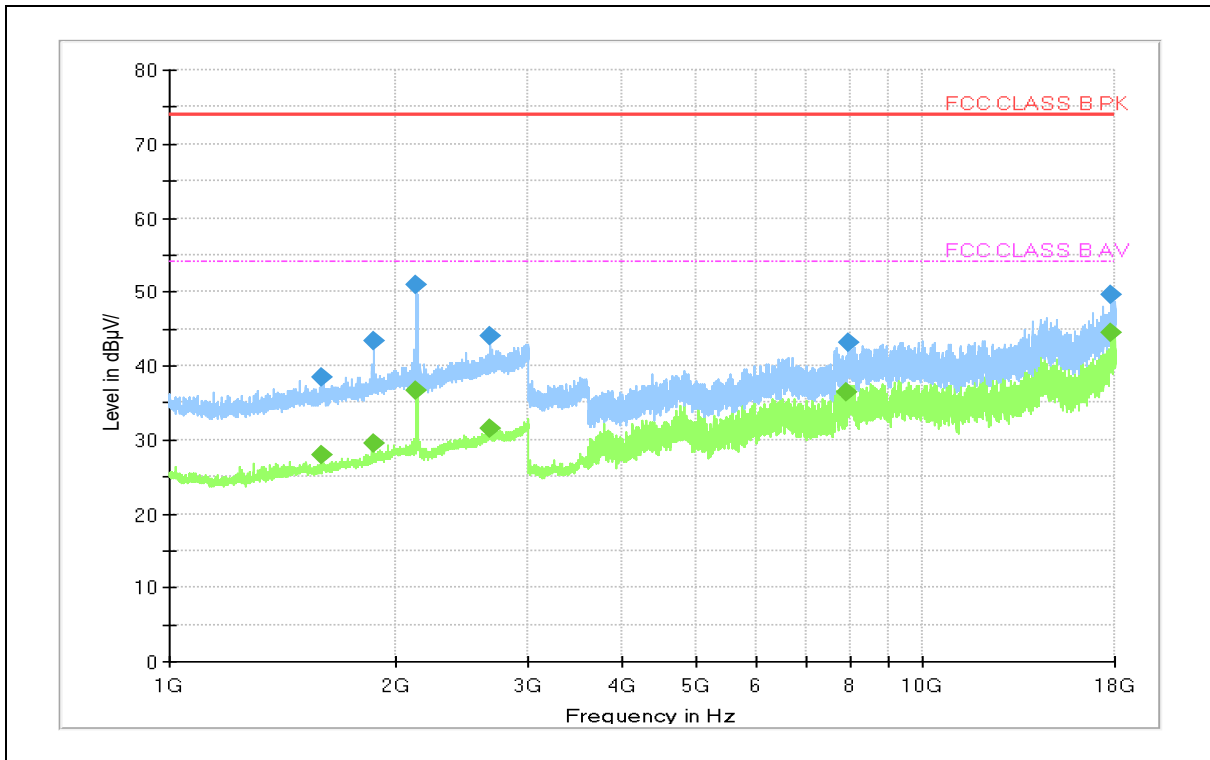
Test Distance : 10 m, Antenna Height : 1 to 4 meters

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/)	CAV (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1 594.800	38.4	---	74.0	35.6	100.0	V	160.0	10.1
1 595.600	---	28.0	54.0	26.0	100.0	V	131.0	10.1
1 864.800	43.4	---	74.0	30.6	100.0	V	21.0	11.7
1 865.600	---	29.4	54.0	24.6	110.0	V	0.0	11.7
2 124.800	---	36.7	54.0	17.3	100.0	V	27.0	12.9
2 130.000	51.0	---	74.0	23.0	120.0	V	126.0	12.9
2 660.400	---	31.5	54.0	22.5	113.0	V	346.0	15.1
2 664.000	44.1	---	74.0	29.9	140.0	V	32.0	15.1
7 940.000	---	36.5	54.0	17.5	100.0	V	110.0	15.3
7 954.500	43.2	---	74.0	30.8	107.0	V	190.0	15.4
17 797.500	---	44.6	54.0	9.4	100.0	H	238.0	36.1
17 830.500	49.5	---	74.0	24.5	101.0	H	171.0	35.5

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