

EMC TEST REPORT



Project No.	LBE20210323	Issue No.	1
Applicant	Name of organization	Samsung Electronics Co., Ltd.	
	Address	(Maetan-dong) 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea	
	Date of receipt	May 3, 2021	
EUT	Type of device	<input 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	A3LSMR890	
	Kind of product	Smart Wearable	
	Model No.	SM-R890	
	Variant Model No.	Refer to clause 4.6	
	Manufacturer	Lot G3, Que Vo Industrial Park (Expanded Area), Nam Son Ward, Bac Ninh City, Bac Ninh Province, Vietnam	
Applied Standards	47 CFR Part 15, Subpart B / ANSI C63.4-2014		
Test Period	May 10, 2021 ~ May 14, 2021		
Issue date	May 24, 2021		
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.)			
Issued by : Eun-Kyung Oh 		Reviewed by : Sun-Ho 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. * Not KOLAS Report			
Samsung Electronics Co., Ltd., Global CS Center (Maetan-dong) 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea			

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1. Report Information

1.1 Revision history

No.	Date of Issue	Revised detailed information
Issue 0	May 17, 2021	There are no revisions and this version is basic test report.
Issue 1	May 24, 2021	Added variant model in Clause 4.6.1. Added FCC ID of Wireless Charger in Clause 4.1.

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 Emission (Mains port)	47 CFR Part 15, Subpart B / ANSI C63.4-2014 (Class B)	Complied
<input checked="" type="checkbox"/>	Radiated Emission		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, 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 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	Smart Wearable	SM-R890	-	SAMSUNG	A3LSMR890
B	Battery	EB-BR890ABY	-	SAMSUNG	-
C	Wireless Charger	EP-OR825	-	SAMSUNG	FCC ID : A3LEPOR825 IC : 649E-EPOR825
D	Travel Adapter	EP-TA200	R37NBJAHBM5DK3	DongYang	-
E	Laptop Computer	Latitude5580	1CHRYM2	Dell	DOC
			D3HRYM2	Dell	DOC
F	Laptop AC Adapter	LA65NM130	5DEA	Dell	DOC
			5B3C	Dell	DOC
G	Mouse	AA-SM7PCPB	CN57BA5903634ADV8J31O3050	SAMSUNG	DOC
			CNBA5903634ADV8J31O3050	SAMSUNG	DOC
H	Router	DIR-806A	RF0F1D8011501	D-Link	DOC
			RF0F1D8011504	D-Link	DOC

4.2 EUT operating mode

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

4.2.1 Conducted Emission

No.	Operating mode
1	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.

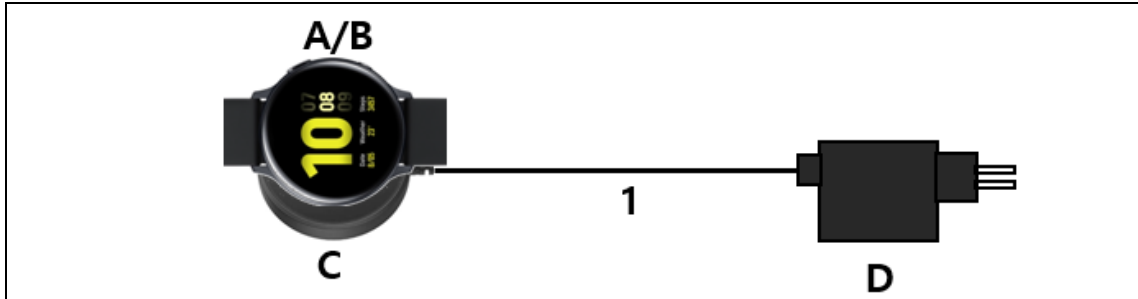
4.4 Used cable description

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:

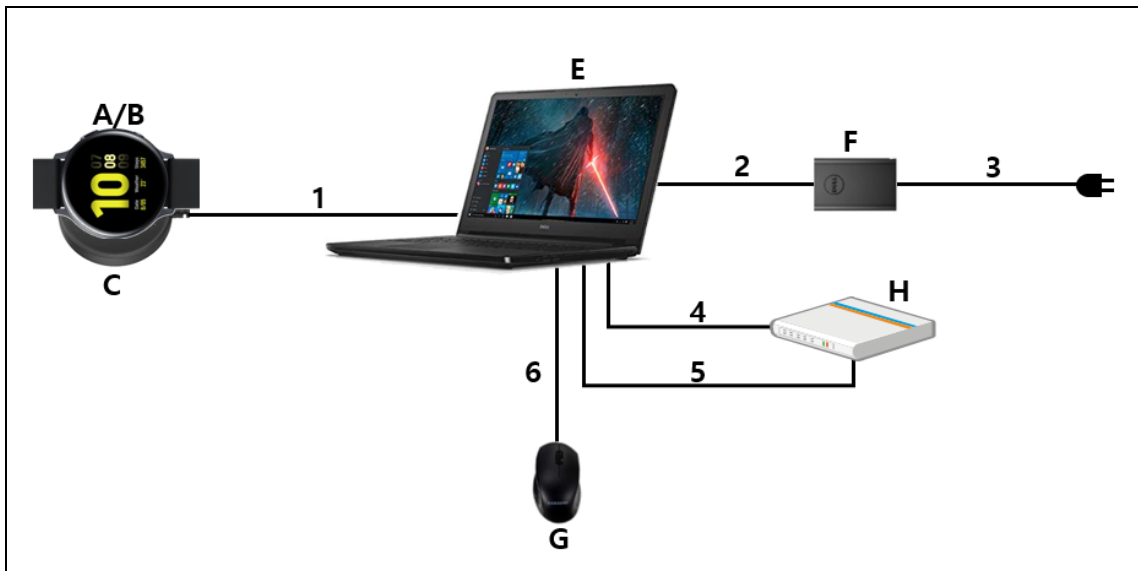
No.	Connected cable	Length [m]	Shielded [Y/N]	Note
1	Wireless Charger cable	0.8	No	For Wireless Charger
2	Power	1.8	No	From Laptop Computer to Laptop AC Adapter
3	Power	1.5	No	For Laptop AC Adapter
4	LAN	1.5	No	From Laptop Computer to Router
5	USB	0.8	Yes	From Laptop Computer to Router for DC Power
6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

4.5 Test arrangement

4.5.1 Conducted Emission

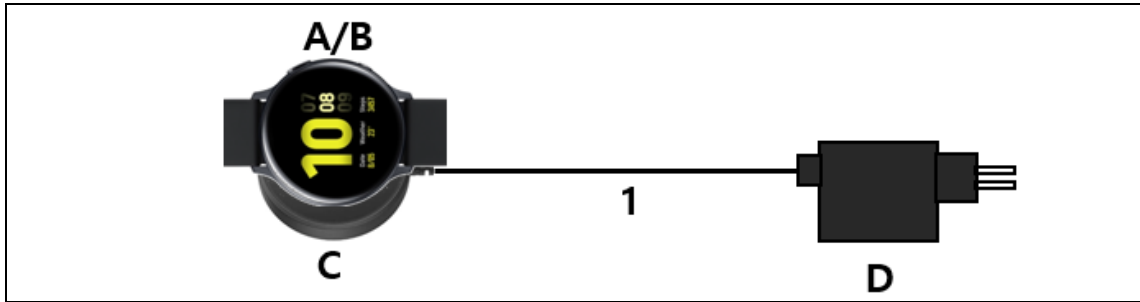


[Mode 1 - 2]



[Mode 3]

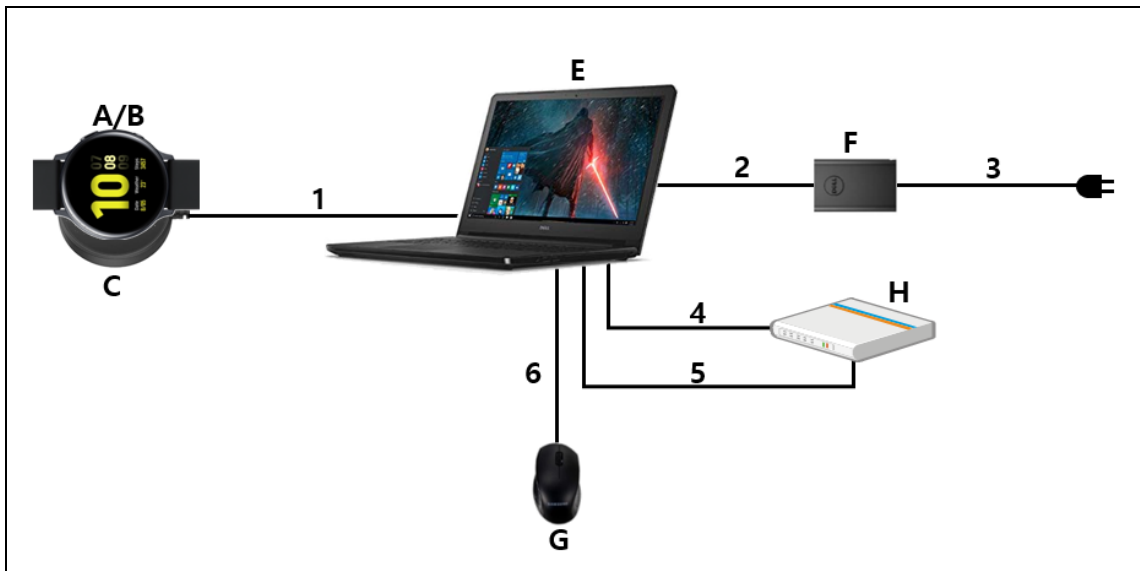
4.5.2 Radiated Emission



[Mode 1]



[Mode 2]



[Mode 3]

4.6 EUT Description

The EUT is a Watch type Smart Wearable which can incorporate Bluetooth, Wi-Fi, GNSS, NFC, Wireless Charging and Audio.

4.6.1 The variant models

- SM-R890X

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.

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.

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. approximately 95 %, k = 2)
Conducted Emission	AC Mains	2.83 dB
Radiated Emission (Below 1 GHz)	Horizontal	4.47 dB
	Vertical	5.67 dB
Radiated Emission (Above 1 GHz)	Horizontal	5.21 dB
	Vertical	5.21 dB

* Remark

1) The values for uncertainty of conducted and radiated emissions are less than the corresponding values of U_{cispr} given in CISPR 16-4-2. Therefore no adjustment of measurement results is necessary when comparing them with the relevant limits.

5. Results of individual test

5.1 Conducted Emission

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 emission 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

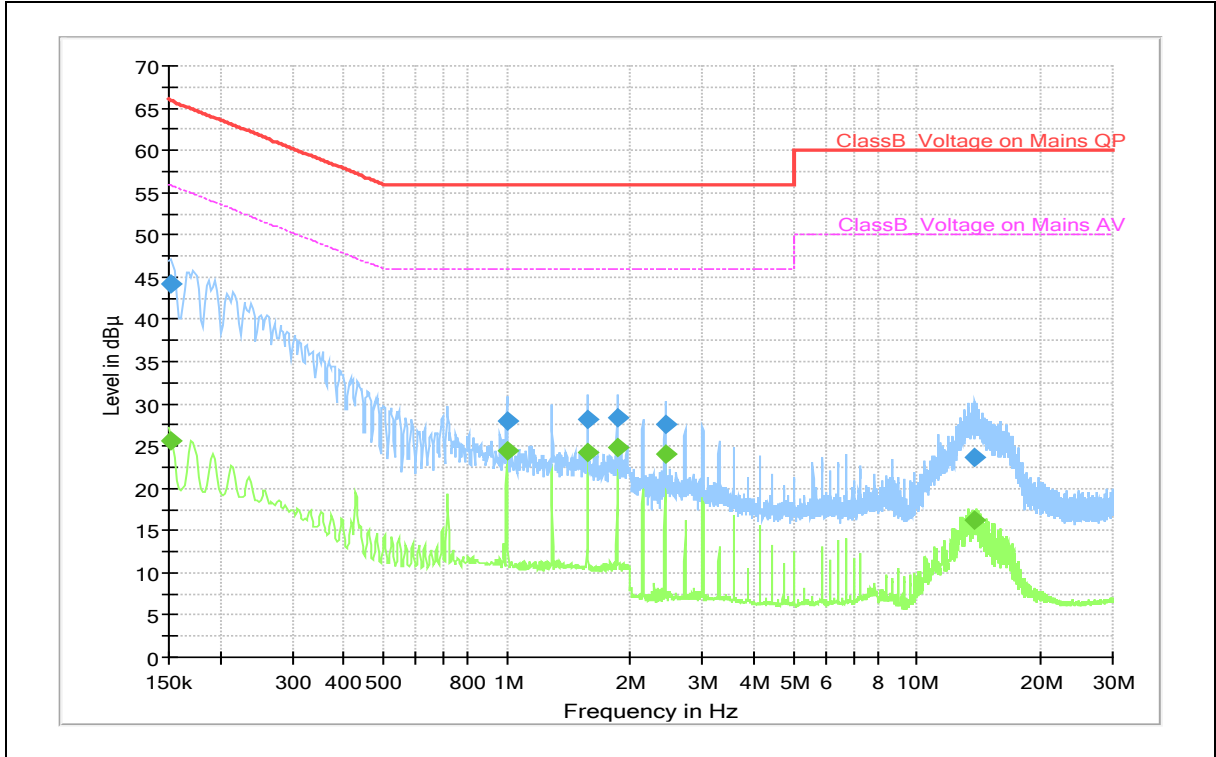
EMC No.	Test Instrument	Model name	Manufacturer	Serial No.	Next Calibration	
					Date	Interval (Month)
E5I-015	EMI Test Receiver	ESU8	R&S	100481	2021-07-01	12
E5I-127	LISN	ENV216	R&S	102061	2021-07-29	12
-	Test software	EMC32	R&S	Ver 9.26.01	-	-

5.1.2 Temperature and humidity condition

Test date	2021-05-14	Test engineer	Eun-Kyung Oh
Climate condition	Ambient temperature	(23.8 \pm 0.5) °C	Limit (15.0 to 35.0) °C
	Relative humidity	(41.6 \pm 0.5) % R.H.	Limit (25.0 to 75.0) % R.H.
	Atmospheric pressure	(101.3 \pm 0.5) kPa	Limit (86.0 to 106.0) kPa
Test place	Shield Room (SR8)		

5.1.3 Test results

Operating Mode 1: AC Mains



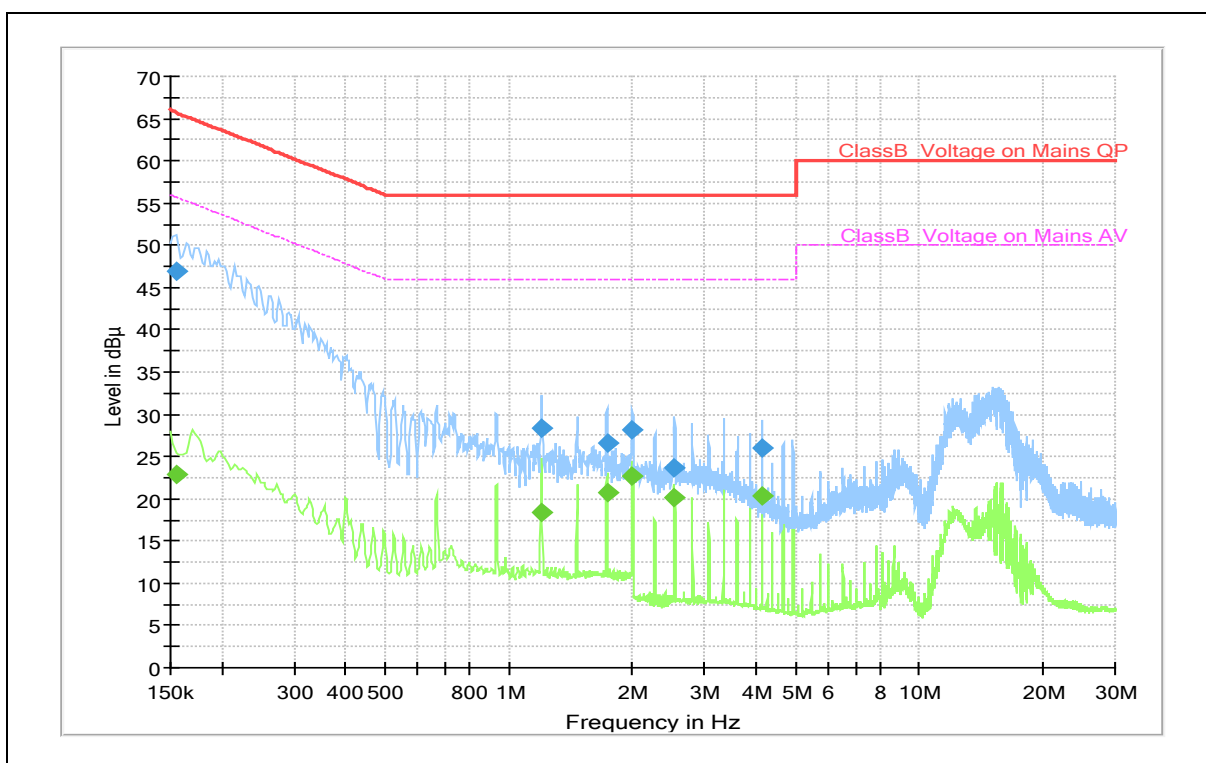
Note 1) Two graphs measured for both Live(L1) and Neutral(N) of the LISN are combined into one graph.

QP / CAV final measurement results table:

Frequency (MHz)	QP (dBµV)	CAV (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.152	---	25.71	55.88	30.17	N	10.0
0.152	44.16	---	65.88	21.72	N	10.0
1.003	---	24.35	46.00	21.65	N	10.0
1.003	28.01	---	56.00	27.99	N	10.0
1.574	---	24.27	46.00	21.73	N	9.9
1.574	28.12	---	56.00	27.88	N	9.9
1.860	---	24.84	46.00	21.16	N	9.9
1.860	28.28	---	56.00	27.72	N	9.9
2.434	---	24.14	46.00	21.86	N	9.9
2.434	27.61	---	56.00	28.39	N	9.9
13.882	---	16.30	50.00	33.70	N	10.4
13.882	23.70	---	60.00	36.30	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



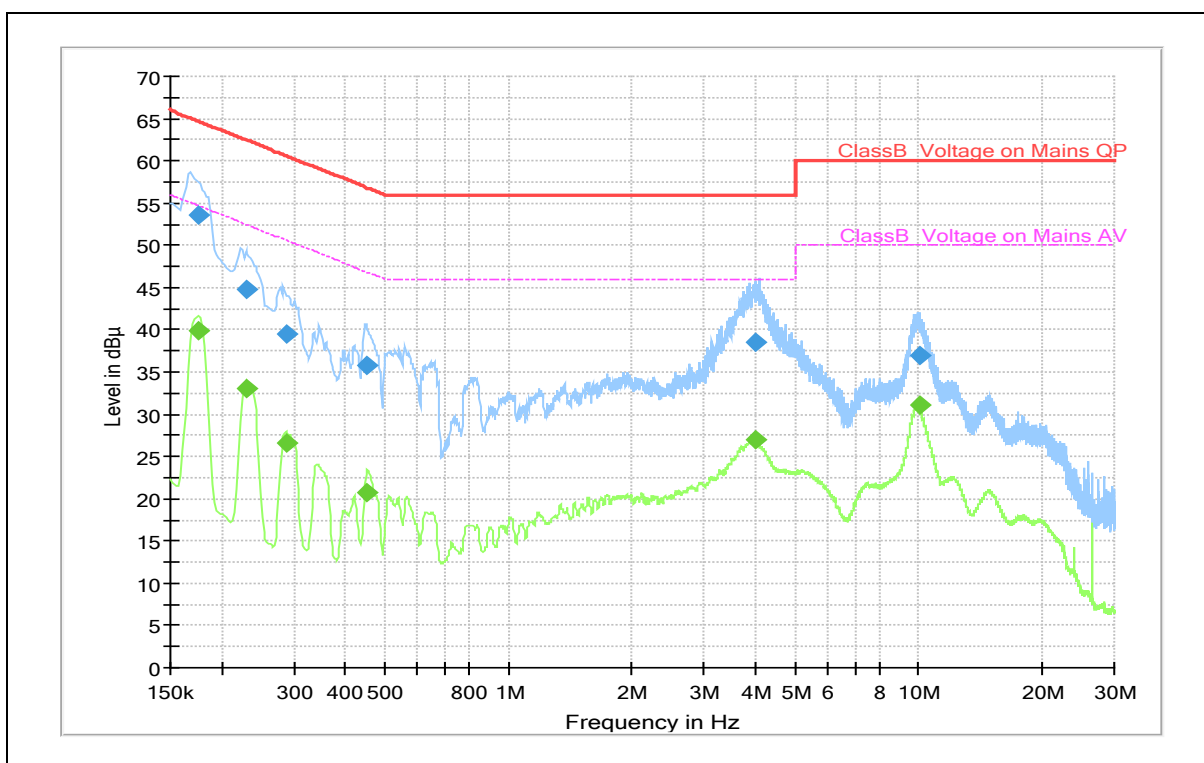
Note 1) Two graphs measured for both Live(L1) and Neutral(N) of the LISN are combined into one graph.

QP / CAV final measurement results table:

Frequency (MHz)	QP (dBμV)	CAV (dBμV)	Limit (dBμV)	Margin (dB)	Line	Corr. (dB)
0.155	47.00	---	65.75	18.75	N	10.0
0.155	---	22.87	55.75	32.88	N	10.0
1.201	---	18.29	46.00	27.71	L1	10.0
1.201	28.34	---	56.00	27.66	L1	10.0
1.734	26.60	---	56.00	29.40	L1	9.9
1.734	---	20.70	46.00	25.30	L1	9.9
2.004	---	22.70	46.00	23.30	N	9.9
2.004	28.10	---	56.00	27.90	N	9.9
2.540	---	20.21	46.00	25.79	N	9.9
2.540	23.63	---	56.00	32.37	N	9.9
4.130	---	20.33	46.00	25.67	N	10.0
4.130	25.99	---	56.00	30.01	N	10.0

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

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)
0.175	53.50	---	64.73	11.24	N	10.2
0.175	---	39.89	54.73	14.84	N	10.2
0.229	44.84	---	62.50	17.66	L1	9.8
0.229	---	33.03	52.50	19.46	L1	9.8
0.287	39.59	---	60.60	21.01	L1	9.9
0.287	---	26.60	50.60	24.00	L1	9.9
0.449	---	20.80	46.89	26.09	L1	10.1
0.449	35.70	---	56.89	21.19	L1	10.1
3.986	38.55	---	56.00	17.45	N	9.8
3.986	---	27.02	46.00	18.98	N	9.8
10.037	---	31.08	50.00	18.92	L1	9.8
10.037	36.89	---	60.00	23.11	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 emission

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 3 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 emission 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.	Next Calibration	
					Date	Interval (Month)
E5I-021	EMI Test Receiver	ESU40	R&S	100376	2022-02-04	12
E5I-035	Horn Antenna	HF907	R&S	102506	2021-08-30	24
E5I-040	Signal Conditioning Unit	SCU-18	R&S	10210	2022-04-06	12
E5I-120	BiLog Antenna	CBL6112D	TESEQ	36997	2022-05-15	24
E5I-189	6 dB Fixed Attenuator	8491A	Keysight	MY52462295	2022-05-15	24
E5I-093	Preamplifier	310N	SONOMA	273122	2022-01-21	12
E5I-037	WideBand Horn Antenna	WBH 18-40K	R&S	11201	2023-02-15	24
E5I-042	Signal Conditioning Unit	SCU-40A	R&S	10004	2021-09-09	12
-	Test software	EP7RE	TOYO	Ver 5.8.2	-	-
-	Test software	EMC32	R&S	Ver 9.25.00	-	-

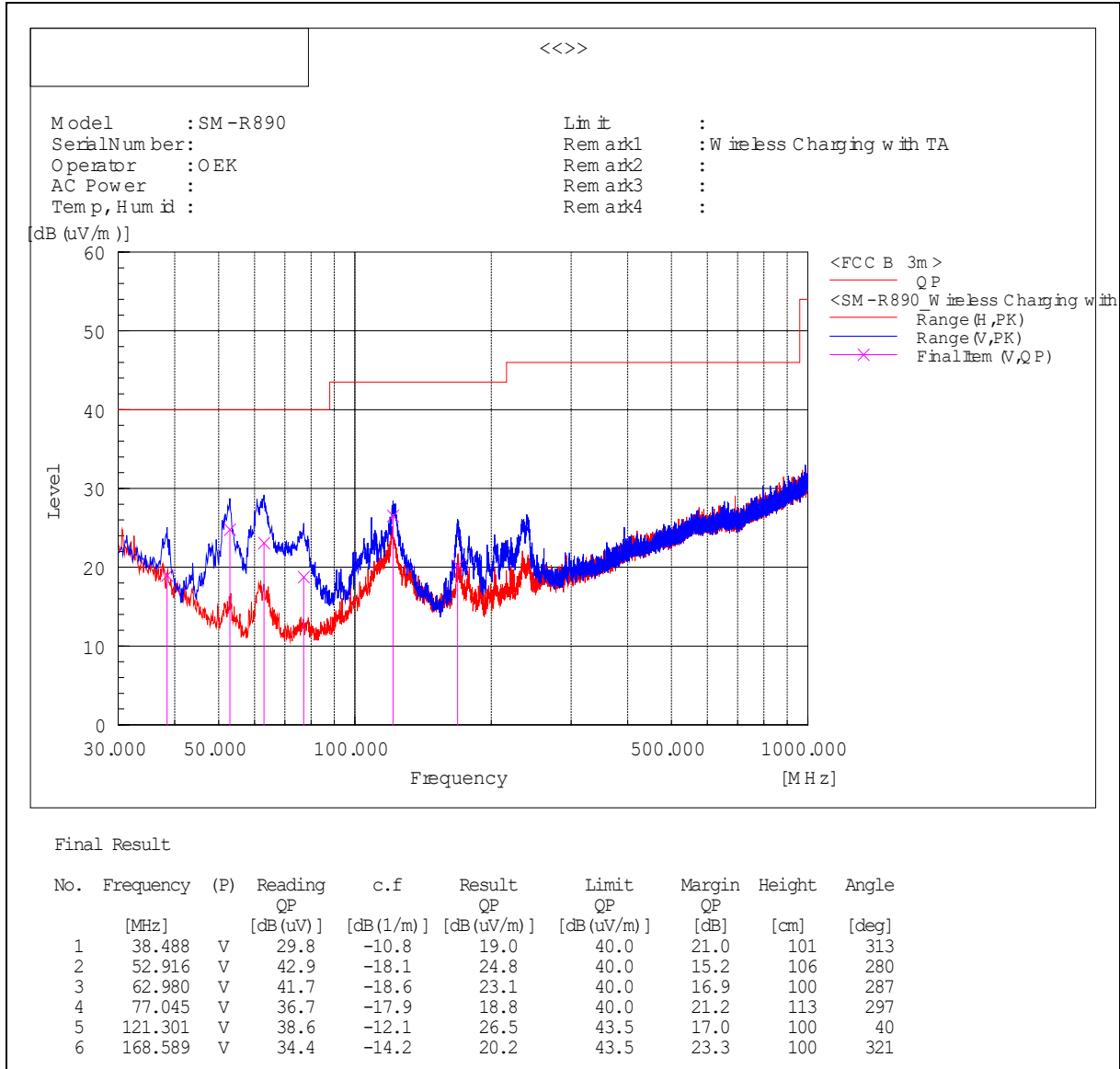
5.2.2 Temperature and humidity condition

Test date	2021-05-10	Test engineer	Eun-Kyung Oh
Climate condition	Ambient temperature	(22.4 ± 0.5) °C	Limit (15.0 to 35.0) °C
	Relative humidity	(42.5 ± 0.5) % R.H.	Limit (25.0 to 75.0) % R.H.
	Atmospheric pressure	(101.7 ± 0.5) kPa	Limit (86.0 to 106.0) kPa
Test place	Semi-Anechoic Chamber (SAC5)		

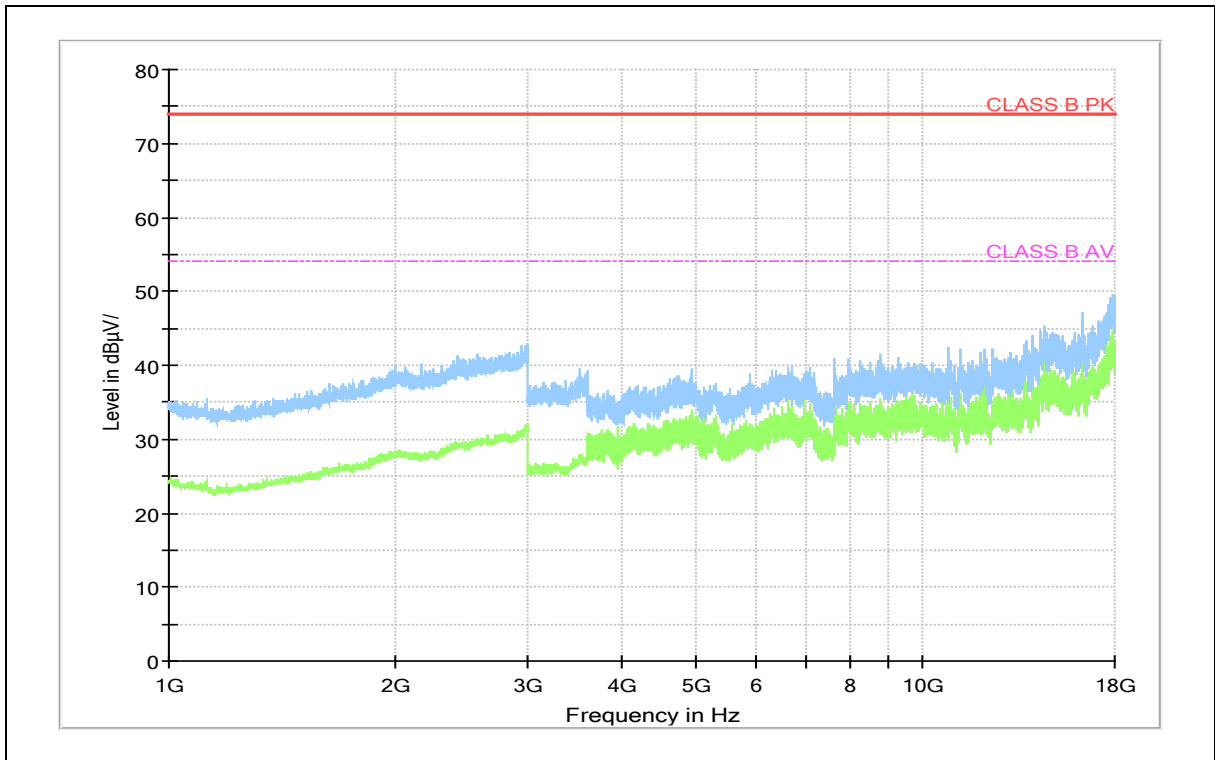
5.2.3 Test results

Operating Mode 1

- Frequencies below 1 GHz



Note1) Receiving antenna polarization : Horizontal, Vertical
 Test Distance : 3 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

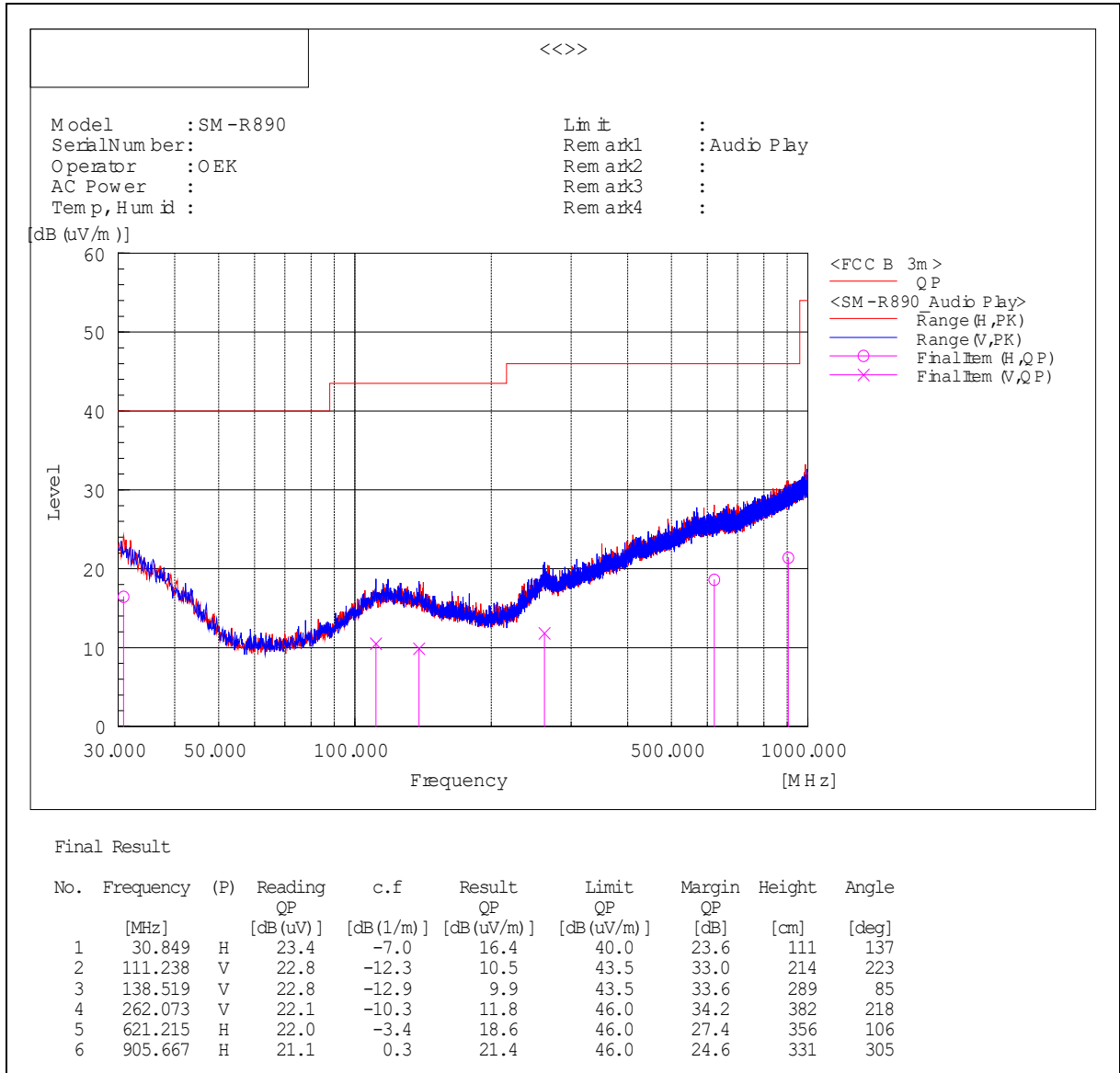
Level (PK and/or CAV) = Reading (PK and/or CAV) + Corr. (Antenna Factor + Cable Loss - Amp. Gain)

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

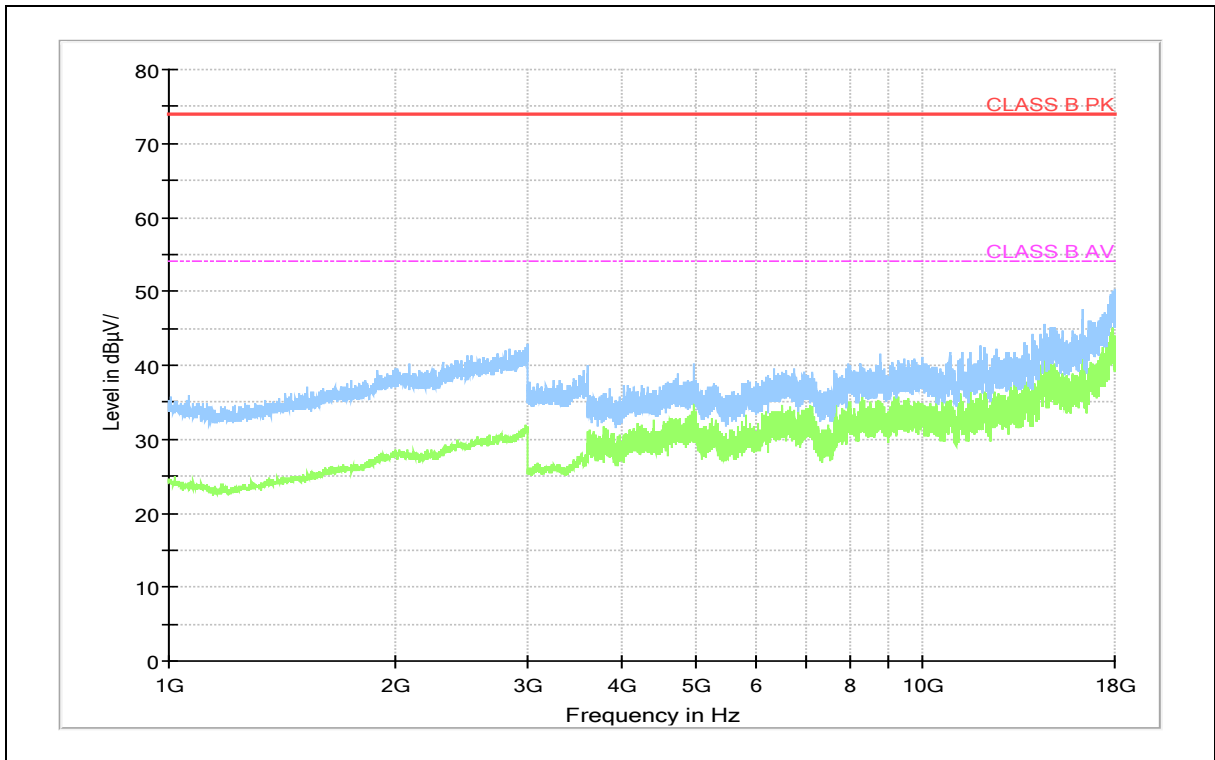
PK = Peak, CAV = CISPR-Average, Corr. = Correction Factor

Operating Mode 2

- Frequencies below 1 GHz



Note1) Receiving antenna polarization : Horizontal, Vertical
 Test Distance : 3 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

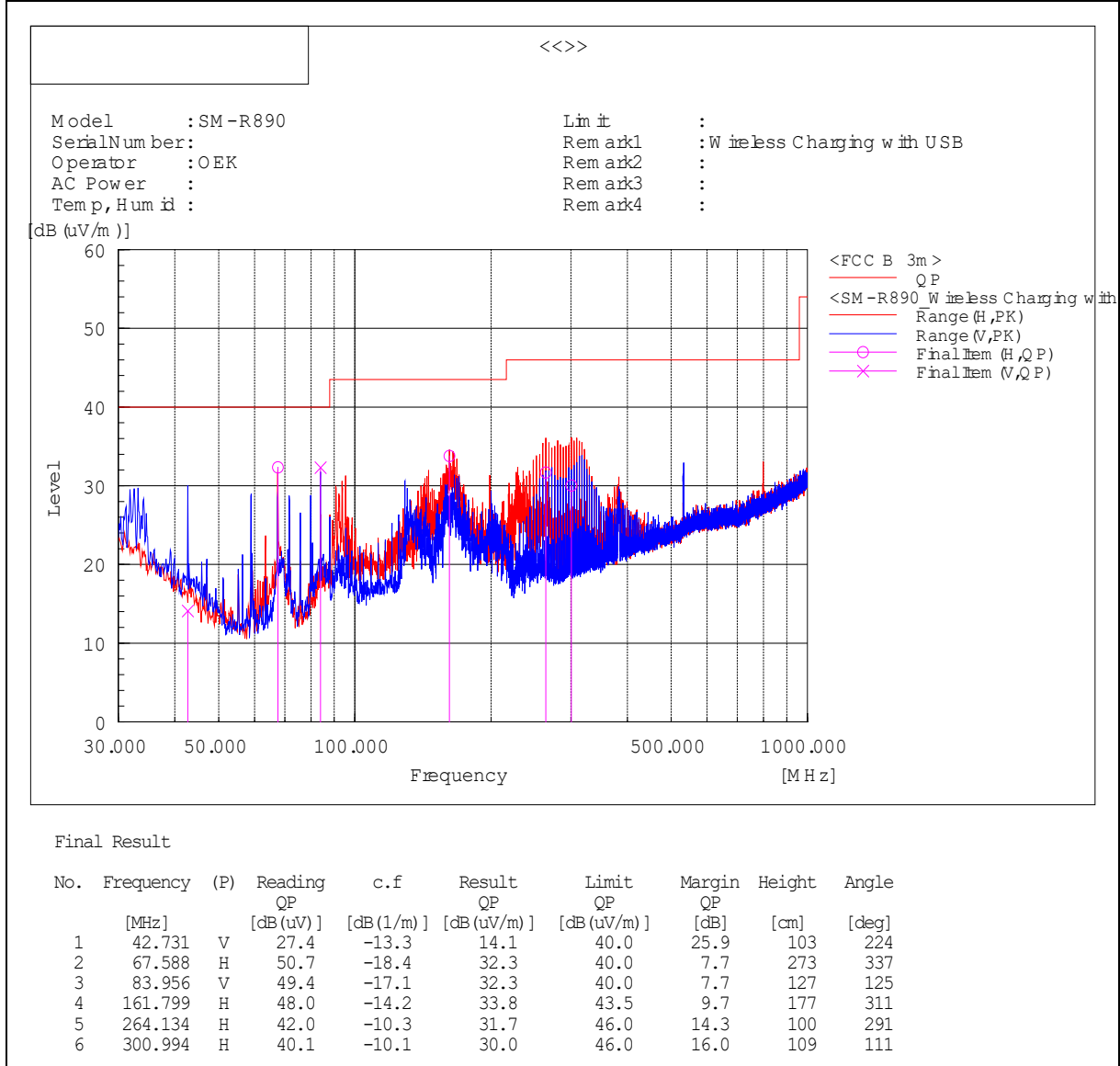
Level (PK and/or CAV) = Reading (PK and/or CAV) + Corr. (Antenna Factor + Cable Loss - Amp. Gain)

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

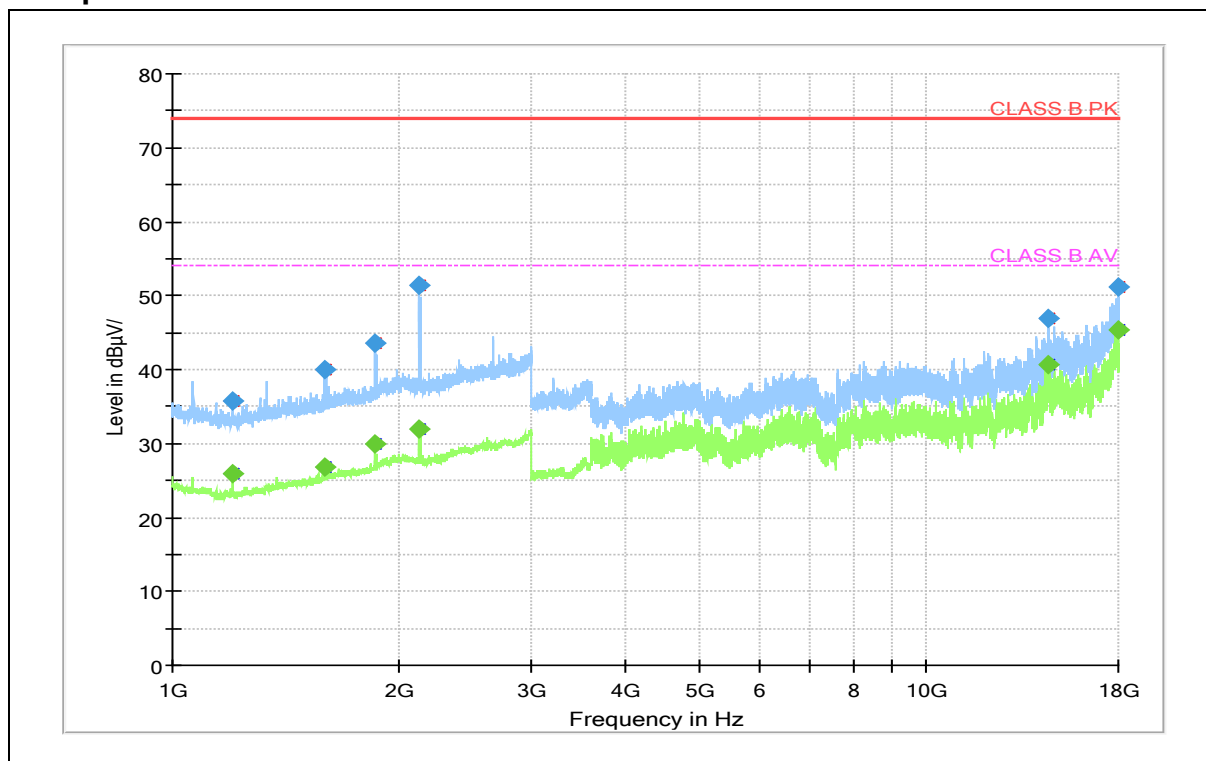
PK = Peak, CAV = CISPR-Average, Corr. = Correction Factor

Operating Mode 3

- Frequencies below 1 GHz



Note1) Receiving antenna polarization : Horizontal, Vertical
 Test Distance : 3 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)
1 200.000	---	26.02	54.00	27.98	101.0	V	187.0	5.9
1 200.000	35.81	---	74.00	38.19	100.0	V	187.0	5.9
1 595.000	40.03	---	74.00	33.97	103.2	V	142.0	9.2
1 596.500	---	26.90	54.00	27.10	104.5	V	124.0	9.2
1 860.000	---	29.97	54.00	24.03	107.8	V	0.0	10.5
1 861.000	43.53	---	74.00	30.47	101.5	V	0.0	10.6
2 127.500	---	31.88	54.00	22.12	100.0	V	348.0	11.6
2 127.500	51.45	---	74.00	22.55	103.9	V	348.0	11.6
14 489.000	---	40.57	54.00	13.43	103.5	V	41.0	29.2
14 493.500	46.91	---	74.00	27.09	106.2	V	183.0	29.2
17 997.000	---	45.40	54.00	8.60	108.5	V	34.0	37.8
17 997.000	51.23	---	74.00	22.77	102.0	V	34.0	37.8

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