

TEST REPORT

OF

FCC Part 15 Subpart C §15.209

FCC ID: A3LEPOR720

Equipment Under Test : WIRELESS CHARGER
Model Name : EP-OR720
Applicant : Samsung Electronics Co., Ltd.
Manufacturer : Samsung Electronics Co., Ltd.
Date of Test(s) : 2015.08.03 ~ 2015.08.26
Date of Issue : 2015.08.27

In the configuration tested, the EUT complied with the standards specified above.

Tested By:



Date:

2015.08.27

Wonjun Sim

Approved By:



Date:

2015.08.27

Hyunchae You

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1. General Information

1.1. Testing laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

- Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 435-837

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>.

Phone No. : +82 31 688 0901

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1.2. Details of applicant

Applicant : Samsung Electronics Co., Ltd.

Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 443-742 Korea, Republic of

Contact Person : Lee, Joo-Ho

Phone No. : + 82 31 301 3356

1.3. Description of EUT

Kind of Product	WIRELESS CHARGER
Model Name	EP-OR720
Power Supply	DC 5 V (Used AC 100 V ~ 240 V adaptor)
Frequency Range	168 kHz ~ 190 kHz
Operating Conditions	-20 °C ~ 60 °C
Antenna Type	Inductive loop coil antenna
H/W Version	rev0.6
S/W Version	SAORBISO_30_OTP1_8_18_15b(3s)

1.4. Declarations by the manufacturer

- N/A

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1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal Date	Cal Interval	Cal Due.
Spectrum Analyzer	R&S	FSV30	103210	Dec. 29, 2014	Annual	Dec. 29, 2015
Signal Generator	R&S	SMBV100A	255834	Jun. 22, 2015	Annual	Jun. 22, 2016
Preamplifier	H.P.	8447F	2944A03909	Aug. 27, 2014	Annual	Aug. 27, 2015
Test Receiver	R&S	ESU26	100109	Mar. 03, 2015	Annual	Mar. 03, 2016
Test Receiver	R&S	ESCI 7	100911	Dec. 24, 2014	Annual	Dec. 24, 2015
Loop Antenna	R&S	HFH2-Z2	100118	Jun. 04, 2015	Biennial	Jun. 04, 2017
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB9163	396	Jun. 18, 2015	Biennial	Jun. 18, 2017
Two-Line V-Network	R&S	ENV216	100190	Dec. 25, 2014	Annual	Dec. 25, 2015
Antenna Master	INN-CO	MM4000	N/A	N.C.R.	N/A	N.C.R.
Turn Table	INN-CO	DS 1200 S	N/A	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N.C.R.	N/A	N.C.R.
Shield Room	SY Corporation	L × W × H (6.5 m × 3.5 m × 3.5 m)	N/A	N.C.R.	N/A	N.C.R.

1.6. Sample calculation

Where relevant, the following sample calculation is provided:

Field strength level (dB μ V/m) = Measured level (dB μ V) + Antenna factor (dB) + Cable loss (dB) – amplifier gain (dB)

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1.7. Worst case of test configurations

In order to check all kinds of possible configurations, EUT was evaluated with appropriate client and under each charging condition as below table.

EUT configuration	Description
Charging Mode with Smart Wearable Device (Name: SM-R720)	Less than 1 % of battery
	Less than 50 % of battery
	100 % full charging of battery

1.8. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15 Subpart C §15.209		
Section in FCC 15 Subpart C	Test Item	Result
15.209 15.209(a)	Radiated emission, Spurious Emission and Field Strength of Fundamental	Complied
2.1049	20 dB Bandwidth	Complied
15.207	Transmitter AC Power Line Conducted Emission	Complied

1.9. Test Report Revision

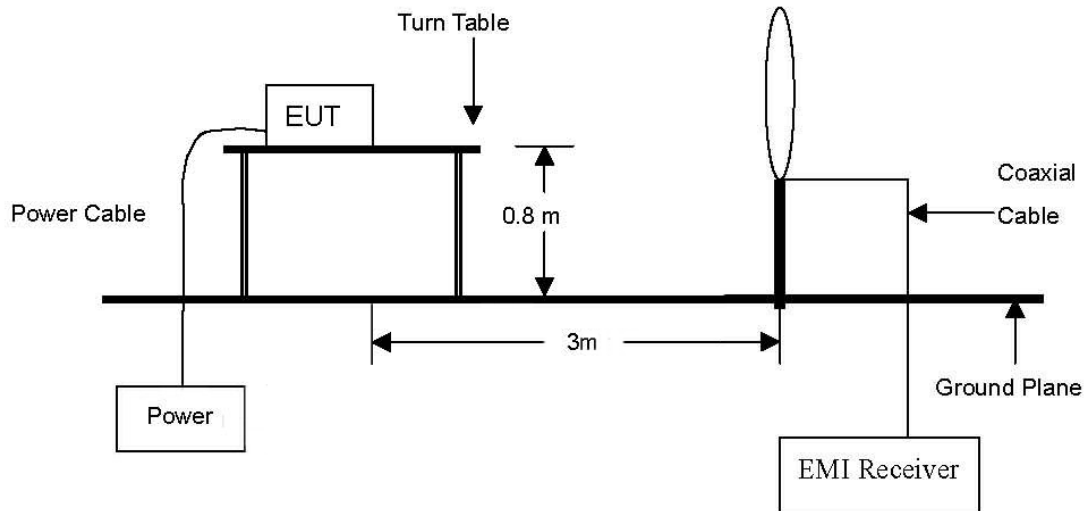
Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL009065	2015.08.27	Initial

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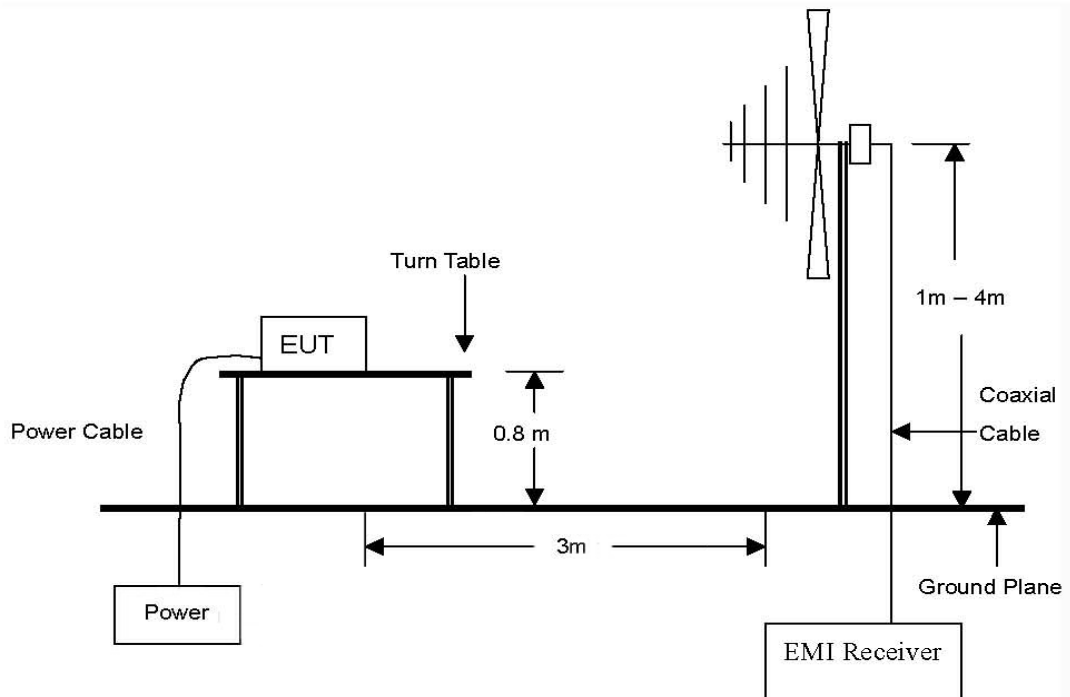
2. Field Strength of Fundamental and Spurious Emission

2.1. Test Setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



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2.2. Limit

2.2.1. Radiated emission limits, general requirements

According to §15.209 (a), Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meter)
0.009 - 0.490	2 400/F(kHz)	300
0.490 - 1.705	24 000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241

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2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2009

2.3.1. Test Procedures for emission from 9 kHz to 30 MHz

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

2.3.2. Test Procedures for emission from 30 MHz to 1 000 MHz

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3 meter away from the interference-receiving antenna.
- The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

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2.4. Field Strength of Fundamental Test Result

Ambient temperature : (23 ± 1) °C
Relative humidity : 47 % R.H.

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical. The field strength of spurious emission was measured in one orthogonal EUT position (x-axis).

Test condition : Normal charging mode with Smart Wearable Device

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBμV/m) at 3 m	Actual (dBμV/m) at 300 m	Limit (dBμV/m) at 300 m	Margin (dB)
Charging mode with client (less than 1 % battery status)									
0.189	43.70	Average	H	19.56	0.11	63.37	-16.63	22.07	38.70
Charging mode with client (less than 50 % battery status)									
0.189	43.70	Average	H	19.56	0.11	63.37	-16.63	22.07	38.70
Charging mode with client (100 % battery status)									
0.189	45.00	Average	H	19.56	0.11	64.67	-15.33	22.07	37.40

Note;

- According to §15.31 (f)(2) 300 m Result(dBμV/m) = 3 m Result(dBμV/m) – 40log(300/3) (dBμV/m)
- According to §15.209 (d), the measurements were tested by using Quasi peak detector except for the frequency bands 9 – 90 kHz, 110 – 490 kHz and above 1 GHz in these three bands on measurements employing an average detector.
- The limit above was calculated based on table of §15.209 (a).

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2.5. Spurious Emission Test Result

Ambient temperature : (23 ± 1) °C
Relative humidity : 47 % R.H.

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Test condition : Normal charging mode with Smart Wearable Device

Charging mode with client device (less than 1 % battery status)

-Below 30 MHz

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m) at 300 m	Margin (dB)
0.026	31.70	Average	H	19.80	0.13	51.63	-28.37	39.30	67.67
0.035	32.40	Average	H	19.70	0.13	52.23	-27.77	36.72	64.49
0.064	19.40	Average	H	19.67	0.11	39.18	-40.82	31.48	72.30
Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 30 m	Limit (dB μ V/m) at 30 m	Margin (dB)
0.881	26.00	Quasi peak	H	19.40	0.28	45.68	5.68	28.70	23.02
2.431	16.50	Quasi peak	H	19.33	0.37	36.20	-3.80	29.54	33.34

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-Above 30 MHz

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB μ V/m) at 3 m	Limit (dB μ V/m) at 3 m	Margin (dB)
37.80	43.30	Peak	V	13.65	-26.76	30.19	40.00	9.81
45.72	40.50	Peak	V	14.67	-26.64	28.53	40.00	11.47
110.27	39.30	Peak	H	13.25	-25.78	26.77	43.50	16.73
171.86	42.30	Peak	H	10.28	-25.14	27.44	43.50	16.06
205.85	40.40	Peak	V	11.98	-24.72	27.66	43.50	15.84
311.18	37.90	Peak	V	15.46	-23.97	29.39	46.00	16.61
Above 400.00	Not detected	-	-	-	-	-	-	-

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Charging mode with client device (less than 50 % battery status)
-Below 30 MHz

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m) at 300 m	Margin (dB)
0.026	31.50	Average	H	19.80	0.13	51.43	-28.57	39.30	67.87
0.035	37.70	Average	H	19.70	0.13	57.53	-22.47	36.72	59.19
0.064	19.30	Average	H	19.67	0.11	39.08	-40.92	31.48	72.40
Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 30 m	Limit (dB μ V/m) at 30 m	Margin (dB)
0.498	28.70	Quasi peak	H	19.40	0.19	48.29	8.29	33.66	25.37
2.424	16.70	Quasi peak	H	19.33	0.37	36.40	-3.60	29.54	33.14

-Above 30 MHz

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB μ V/m) at 3 m	Limit (dB μ V/m) at 3 m	Margin (dB)
53.93	47.50	Peak	H	15.31	-26.49	36.32	40.00	3.68
105.86	39.60	Peak	H	13.85	-25.80	27.65	43.50	15.85
157.56	40.30	Peak	V	8.33	-25.26	23.37	43.50	20.13
186.29	38.70	Peak	H	10.86	-24.93	24.63	43.50	18.87
201.81	39.80	Peak	V	11.79	-24.76	26.83	43.50	16.67
305.36	37.90	Peak	V	15.31	-23.93	29.28	46.00	16.72
Above 400.00	Not detected	-	-	-	-	-	-	-

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Charging mode with client device (100 % battery status)
-Below 30 MHz

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m) at 300 m	Margin (dB)
0.025	31.00	Average	H	19.83	0.13	50.96	-29.04	39.65	68.69
0.035	32.20	Average	H	19.70	0.13	52.03	-27.97	36.72	64.69
0.064	19.10	Average	H	19.67	0.11	38.88	-41.12	31.48	72.60
Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 30 m	Limit (dB μ V/m) at 30 m	Margin (dB)
0.895	24.90	Quasi peak	H	19.40	0.28	44.58	4.58	28.57	23.99
2.419	16.60	Quasi peak	H	19.33	0.37	36.30	-3.70	29.54	33.24

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-Above 30 MHz

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dBμV/m) at 3 m	Limit (dBμV/m) at 3 m	Margin (dB)
37.26	44.40	Peak	H	15.50	-26.77	33.13	40.00	6.87
53.24	46.20	Peak	H	15.39	-26.51	35.08	40.00	4.92
107.64	39.50	Peak	H	13.61	-25.79	27.32	43.50	16.18
171.70	40.90	Peak	V	8.51	-25.14	24.27	43.50	19.23
206.14	40.30	Peak	V	11.99	-24.71	27.58	43.50	15.92
304.43	38.80	Peak	V	15.29	-23.93	30.16	46.00	15.84
Above 400.00	Not detected	-	-	-	-	-	-	-

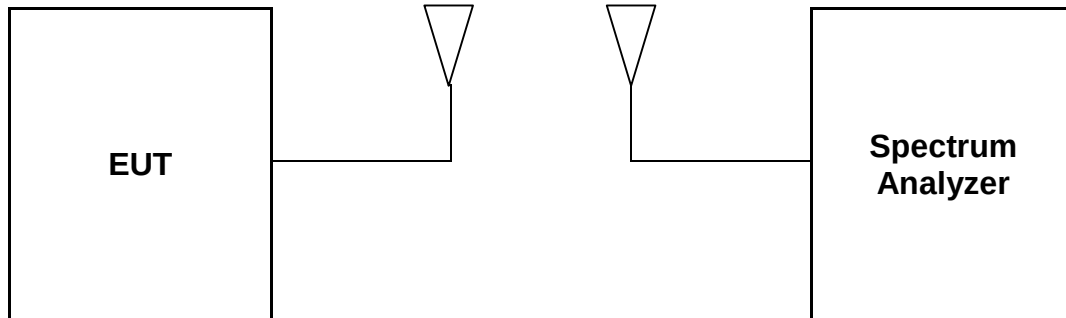
Note;

1. According to §15.31 (f)(2) 300 m Result(dBμV/m) = 3 m Result(dBμV/m) – 40log(300/3) (dBμV/m)
2. 30 m Result(dBμV/m) = 3 m Result(dBμV/m) – 40log(30/3) (dBμV/m)
3. According to field strength table of general requirement in §15.209 (a), field strength limits below 1.705 MHz were calculated as below.
 - 9 kHz to 490 kHz : 20log(2 400 / F (kHz)) at 300 m (dBμV/m)
 - 490 kHz to 1 705 kHz : 20log(24 000 / F (kHz)) at 30 m (dBμV/m)
4. According to §15.209 (d), the measurements were tested by using Quasi peak detector except for the frequency bands 9 – 90 kHz, 110 – 490 kHz and above 1 GHz in these three bands on measurements employing an average detector.
5. All results above 30 MHz are peak detector.

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3. 20 dB Bandwidth

3.1. Test Setup



3.2. Limit

None; for reporting purposed only

3.3. Test Procedure

20 dB Bandwidth

- Span = approximately 2 to 3 times the 20 dB bandwidth, RBW = greater than 1 % of the 20 dB bandwidth, VBW = RBW, Sweep = auto, Detector = peak, Trace = max hold.
- The marker-to-peak function to set the mark to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is 20 dB bandwidth of the emission.

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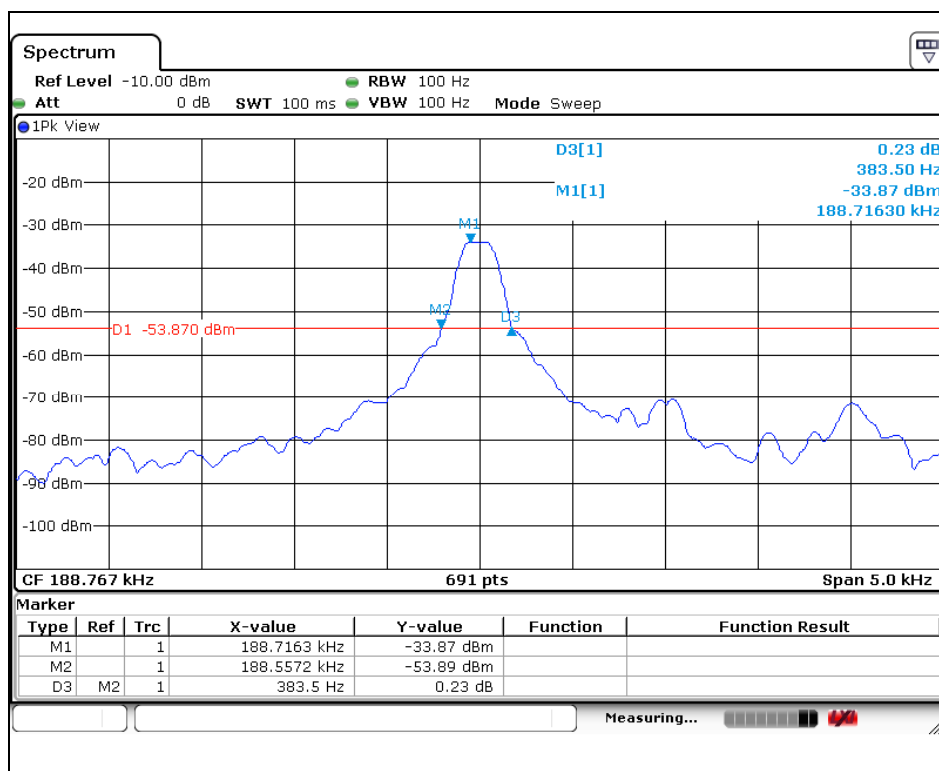
3.4. Test Result

Ambient temperature : (23 ± 1) °C
Relative humidity : 47 % R.H.

Test condition : Normal charging mode with Smart Wearable Device

EUT status	20 dB Bandwidth (kHz)	Limit
With client device (100 % of battery)	0.384	Reporting proposed only

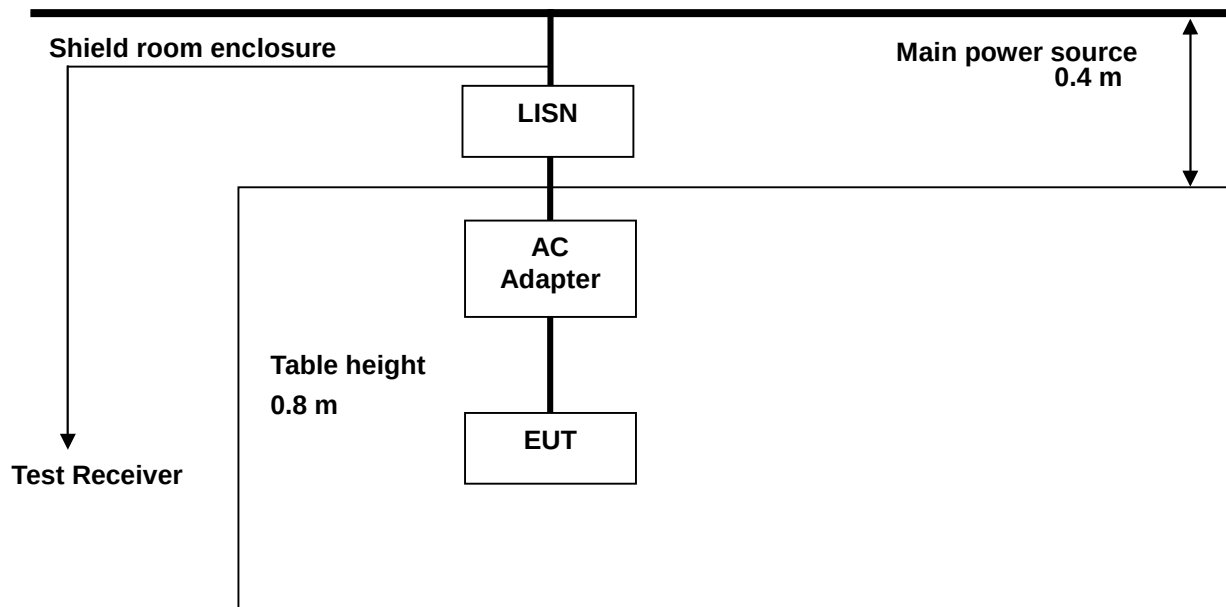
20 dB Bandwidth (With client device)



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4. Transmitter AC Power Line Conducted Emission

4.1. Test Setup



4.2. Limit

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H / 50 ohm line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall be on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

* Decreases with the logarithm of the frequency.

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4.3. Test Procedures

AC conducted emissions from the EUT were measured according to the dictates of ANSI C63.4:2009

1. The test procedure is performed in a 6.5 m × 3.6 m × 3.6 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

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4.4. Test Results

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

Ambient temperature : (23 ± 1) °C
Relative humidity : 47 % R.H.

Frequency range : 0.15 MHz – 30 MHz
Measured Bandwidth : 9 kHz

Test condition : Normal charging mode with Smart Wearable Device

Charging mode with client device (100 % status)

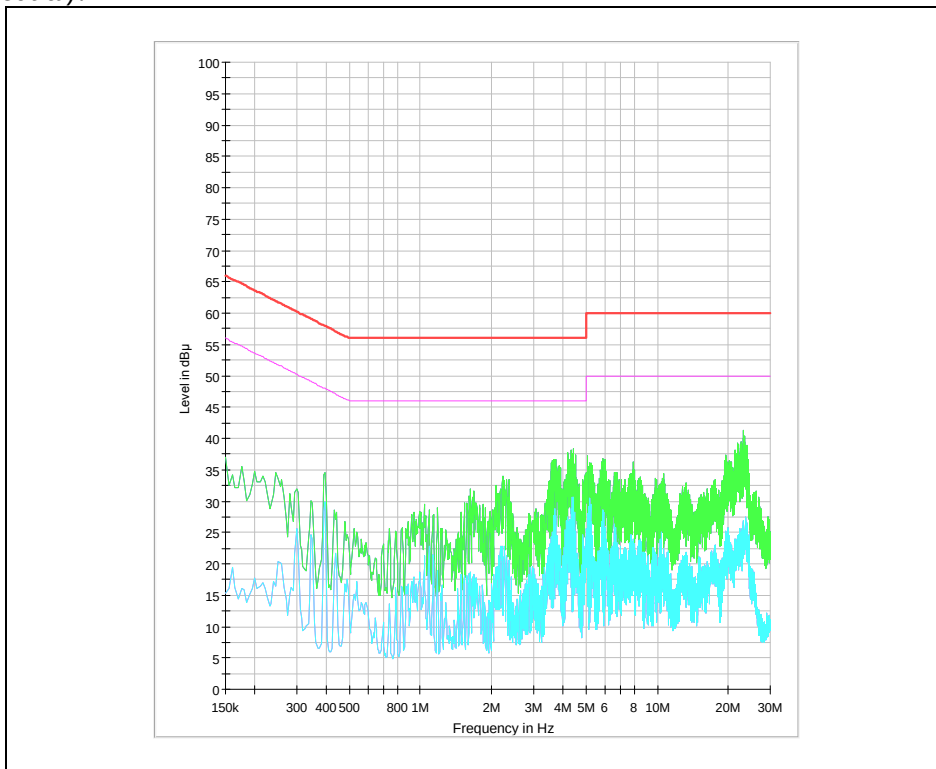
FREQ. (MHz)	LEVEL(dB μ V)		LINE	LIMIT(dB μ V)		MARGIN(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.40	31.50	29.30	N	57.85	47.85	26.35	18.55
2.23	26.60	20.70	N	56.00	46.00	29.40	25.30
4.44	30.80	24.50	N	56.00	46.00	25.20	21.50
5.91	31.90	28.90	N	60.00	50.00	28.10	21.10
19.58	29.10	21.20	N	60.00	50.00	30.90	28.80
23.18	34.20	24.20	N	60.00	50.00	25.80	25.80
0.40	33.40	24.30	H	57.85	47.85	24.45	23.55
2.23	32.40	25.80	H	56.00	46.00	23.60	20.20
4.35	37.10	29.00	H	56.00	46.00	18.90	17.00
5.92	34.50	27.20	H	60.00	50.00	25.50	22.80
19.88	35.50	26.80	H	60.00	50.00	24.50	23.20
23.57	40.60	32.40	H	60.00	50.00	19.40	17.60

Note ;

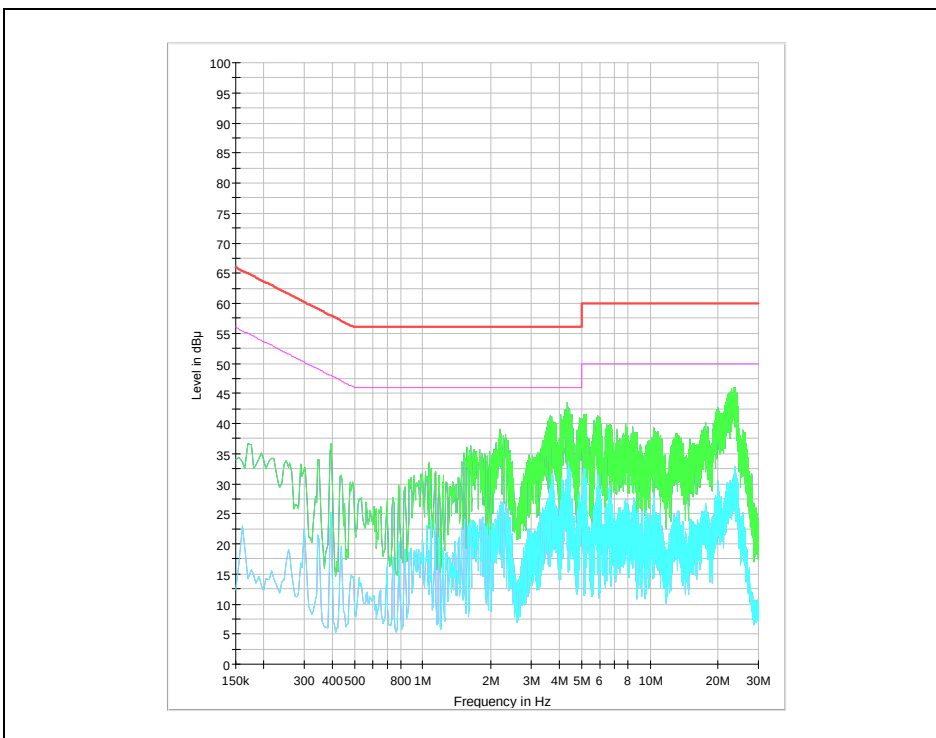
- Line (H): Hot, Line (N): Neutral
- Charging mode with client device(1 %, 50 %, and 100 % of battery) are tested. As worst condition, Charging mode with client device(100 %) is reported.
- The limit for Class B device(s) from 150 kHz to 30 MHz are specified in Section of the Title 47 CFR.
- Traces shown in plot mad using a peak detector and average detector.
- Deviations to the Specifications: None.

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Test mode: (Neutral)\



Test mode: (Hot)



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