

TEST REPORT

of

FCC Part 15 Subpart C §15.209

FCC ID: YZP-PWMAW815A

Equipment Under Test : FAST WIRELESS CHARGER
Model Name : PWMA-W815A
Variant Model Name : PWMA-W815x ('x' can be A to Z)
Applicant : LG Innotek Co., Ltd.
Manufacturer : LG Innotek Co., Ltd.
Date of Receipt : 2018.03.21
Date of Test(s) : 2018.04.09 ~ 2018.05.23
Date of Issue : 2018.05.24

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

Tested By:



Nancy Park

Date:

2018.05.24

Technical
Manager:



Jungmin Yang

Date:

2018.05.24

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A4(210 mm x 297 mm)

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, 15807

-Designation number: KR0150

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

Fax No. : +82 31 688 0921

1.2. Details of applicant

Applicant : LG Innotek Co., Ltd.

Address : 26, Hanamsandan 5beon-ro, Gwangsan-gu, Gwangju, 62229, Korea

Contact Person : Jeong, In-Chang

Phone No. : +82 62 950 0332

1.3. Details of manufacturer

Company : Same as above

Address : Same as above

1.4. Description of EUT

Kind of Product	FAST WIRELESS CHARGER
Model Name	PWMA-W815A
Variant Model Name	PWMA-W815x ('x' can be A to Z)
Power Supply	DC 12.0 V
Frequency Range	110 kHz - 145 kHz
Antenna Type	Inductive loop coil antenna

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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	100768	Mar. 12, 2018	Annual	Mar. 12, 2019
Signal Generator	R&S	SMBV100A	255834	Jun. 15, 2017	Annual	Jun. 15, 2018
Test Receiver	R&S	ESU26	100109	Feb. 07, 2018	Annual	Feb. 07, 2019
Amplifier	H.P.	8447D	2944A03909	Aug. 16, 2017	Annual	Aug. 16, 2018
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 23, 2017	Biennial	Aug. 23, 2019
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB9163	01126	Mar. 26, 2018	Biennial	Mar. 26, 2020
Antenna Master	INNCO systems GmbH	MA4640-XP-ET	MA4640/536/3 8330516/L	N.C.R.	N/A	N.C.R.
Turn Table	Innco systems GmbH	DS 1200 S	N/A	N.C.R.	N/A	N.C.R.
Controller	Innco systems GmbH	CONTROLLER CO3000-4P	CO3000/963/3 8330516/L	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L x W x H (9.6 m x 6.4 m x 6.6 m)	N/A	N.C.R.	N/A	N.C.R.
Test Receiver	R&S	ESCI 7	100911	Feb. 20, 2018	Annual	Feb. 20, 2019
Two-Line V-Network	R&S	ENV216	100190	Dec. 08, 2017	Annual	Dec. 08, 2018
Shield Room	SY Corporation	L x W x H (6.5 m x 3.5 m x 3.5 m)	N/A	N.C.R.	N/A	N.C.R.
Coaxial Cable	SUCOFLEX	104 (3 m)	MY3258414	Jan. 12, 2018	Semi-annual	Jul. 12, 2018
Coaxial Cable	SUCOFLEX	104 (10 m)	MY3145814	Jan. 12, 2018	Semi-annual	Jul. 12, 2018

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► Support equipment

Description	Manufacturer	Model	FCC ID
Samsung Mobile Phone	Samsung Electronics Co., Ltd.	SM-G920L	A3LSMG920KOR

- In the case of a 15 W test, Measurement for WPT was investigated with resistor jig provided by the manufacturer.

Description	Manufacturer	Model	Part Number
Resistor jig	TOSHIBA	Wireless power receiver evaluation module	TC7766WBG

Condition of resistor jig	
Output Voltage	DC 12.3 V
Output Current	1.23 A
Output Power	15 W
Resistor	Cement resistors 10 ohm

1.6. Information of Variant Models

Model Name	Description
PWMA-W815A	- Basic model
PWMA-W815x	- Same to basic model, but the manual and label format of the product will be different.

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1.7. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15 Subpart C		
Section	Test Item	Result
15.209	Field Strength of Fundamental and Spurious Emission	Complied
2.1049	20 dB Bandwidth	Complied
15.207	AC Power Line Conducted Emission	Complied

1.8. 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. In the case of a 15 W test, EUT was investigated with resistor jig under normal charging condition.

EUT configuration	Description
Charging Mode with client device (Model: SM-G920L, FCC ID: A3LSMG920KOR)	1 % of battery
	50 % of battery
	100 % of battery

Note:

EUT was investigated with client device under normal charging condition as above then worst value was only reported.

1.9. 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)

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1.10. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty (dB)
Conducted Disturbance	± 3.30
Radiated Disturbance, 9 kHz to 30 MHz	± 3.59
Radiated Disturbance, below 1 GHz	± 5.88

Uncertainty figures are valid to a confidence level of 95 %.

1.11. Test Report Revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL012612	2018.04.23	Initial
1	F690501/RF-RTL012612-1	2018.05.24	Added 30 MHz to 1 GHz radiated emission test result

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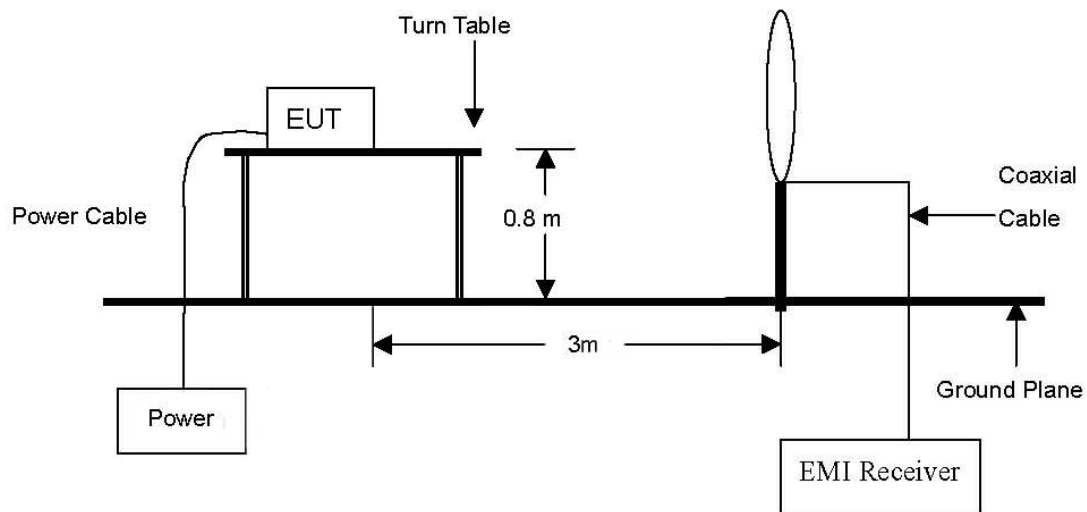
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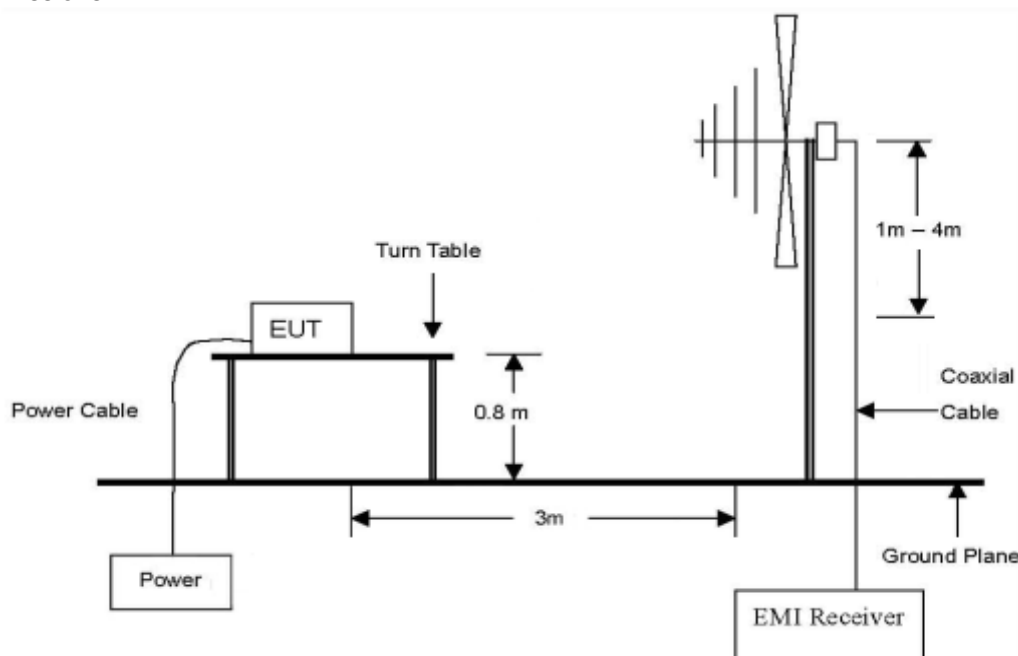
2. Field Strength of Fundamental and Spurious Emission

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.



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 C63.10:2013.

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 Quasi Peak and Average Detect Function and Specified Bandwidth with Maximum Hold Mode.

2.3.2. Test Procedures for emission from above 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 below 1 GHz and 1.5 meter above the ground at a 3 meter anechoic chamber test site above 1 GHz. 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 bi-log antenna, a horn 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.

Note;

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 meter open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788 D01 Radiated Test Site v01.

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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: 5 W (1 % battery status of client device)

Radiated Emissions			Ant.	Correction Factors		Total		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)
0.139	51.50	Average	H	19.68	0.05	71.23	-8.77	24.74	33.51

Test Condition: 15 W

Radiated Emissions			Ant.	Correction Factors		Total		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)
0.127	63.41	Average	H	19.69	0.05	83.15	3.15	25.53	22.38

Remark;

1. According to §15.31 (f)(2) 300 m Result (dB μ V/m) = 3 m Result (dB μ V/m) - 40log(300/3) (dB μ V/m).
2. 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.
3. The limit above was calculated based on table of §15.209 (a).

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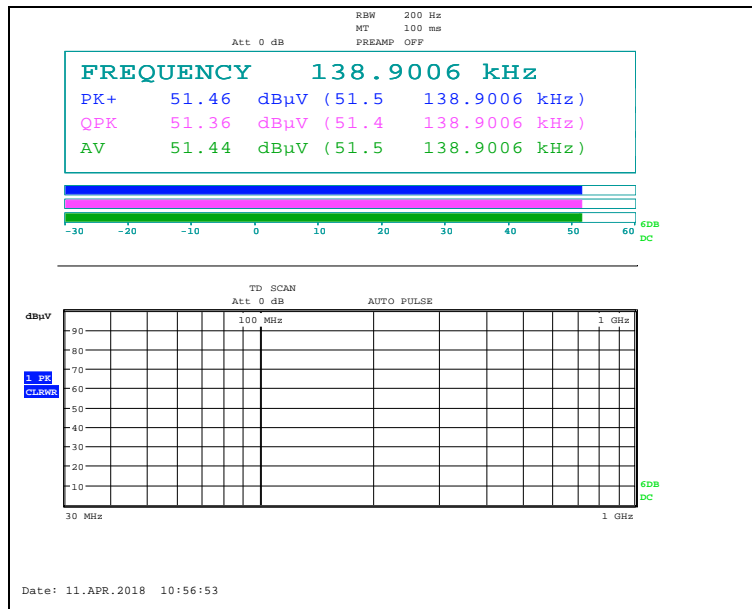
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A4(210 mm x 297 mm)

Test plots

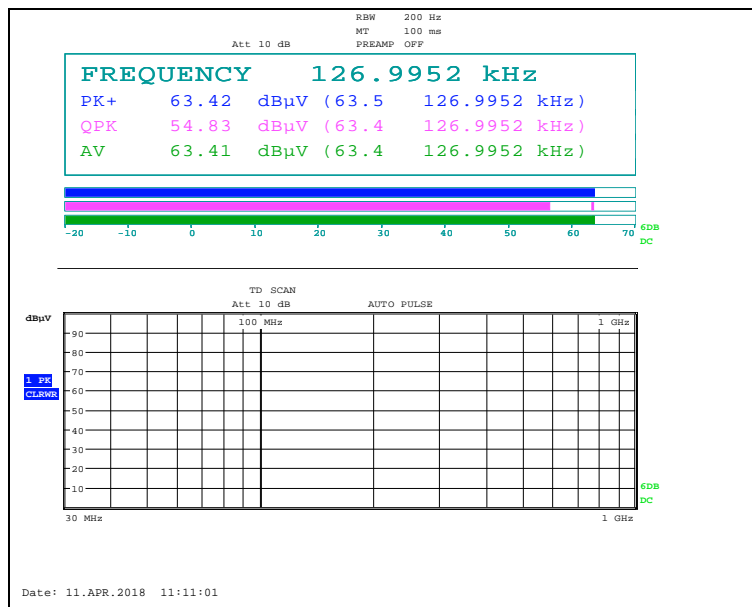
Test Condition: 5 W

Charging mode (1 % battery status of client device)



Test Condition: 15 W

Charging mode



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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. The field strength of spurious emission was measured in one orthogonal EUT position (X-axis).

Test Condition: 5 W

Charging mode with client device (1 % battery status of client device)

Below 30 MHz

Radiated Emissions			Ant.	Correction Factors		Total		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 or 30 m	Limit (dB μ V/m) at 300 m or 30 m	Margin (dB)
0.069	28.90	Average	H	19.74	0.04	48.68	-31.32	30.83	62.15
0.088	16.50	Average	H	19.72	0.04	36.26	-43.74	28.71	72.45
0.416	30.00	Average	H	19.60	0.31	49.91	-30.09	15.22	45.31
0.695	21.90	Quasi Peak	H	19.64	0.57	42.11	2.11	30.76	28.65
Above 0.700	Not detected	-	-	-	-	-	-	-	-

Above 30 MHz

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
45.80	46.80	Peak	V	14.32	-25.59	35.53	40.00	4.47
63.59	47.20	Peak	V	11.49	-25.39	33.30	40.00	6.70
141.63	46.60	Peak	H	8.33	-24.72	30.21	43.50	13.29
233.86	40.80	Peak	H	12.15	-24.06	28.89	46.00	17.11
325.81	37.60	Peak	H	14.09	-23.56	28.13	46.00	17.87
405.43	35.10	Peak	V	16.01	-23.08	28.03	46.00	17.97
Above 500.00	Not detected	-	-	-	-	-	-	-

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Test Condition: 15 W
Charging mode with client device
Below 30 MHz

Radiated Emissions			Ant.	Correction Factors		Total		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 or 30 m	Limit (dB μ V/m) at 300 m or 30 m	Margin (dB)
0.069	29.30	Average	H	19.74	0.04	49.08	-30.92	30.83	61.75
0.099	13.40	Quasi Peak	H	19.70	0.04	33.14	-46.86	27.69	74.55
0.383	41.60	Average	H	19.60	0.28	61.48	-18.52	15.94	34.46
0.637	32.10	Quasi Peak	H	19.63	0.51	52.24	12.24	31.52	19.28
Above 0.700	Not detected	-	-	-	-	-	-	-	-

Above 30 MHz

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
46.98	44.60	Peak	V	14.34	-25.57	33.37	40.00	6.63
137.27	52.50	Peak	V	8.56	-24.74	36.32	43.50	7.18
241.95	45.90	Peak	H	12.54	-24.07	34.37	46.00	11.63
318.54	43.30	Peak	H	13.77	-23.66	33.41	46.00	12.59
374.39	39.40	Peak	H	15.09	-23.21	31.28	46.00	14.72
911.08	39.00	Peak	V	22.51	-22.86	38.65	46.00	7.35

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Remark;

1. According to §15.31 (f)(2)
 - 300 m Result (dB μ V/m) = 3 m Result (dB μ V/m) - 40log(300/3) (dB μ V/m)
 - 30 m Result (dB μ V/m) = 3 m Result (dB μ V/m) - 40log(30/3) (dB μ V/m)
2. 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 (dB μ V/m)
 - 490 kHz to 1.705 MHz: 20log(24 000 / F (kHz)) at 30 m (dB μ V/m)
3. 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.
4. Spurious emissions for all channels and modes were investigated and almost the same below 1 GHz.
5. Radiated spurious emission measurement as below.
(Actual = Reading + AF + AMP + CL)
6. According to §15.31(o), emission levels are not report much lower than the limits by over 20 dB.

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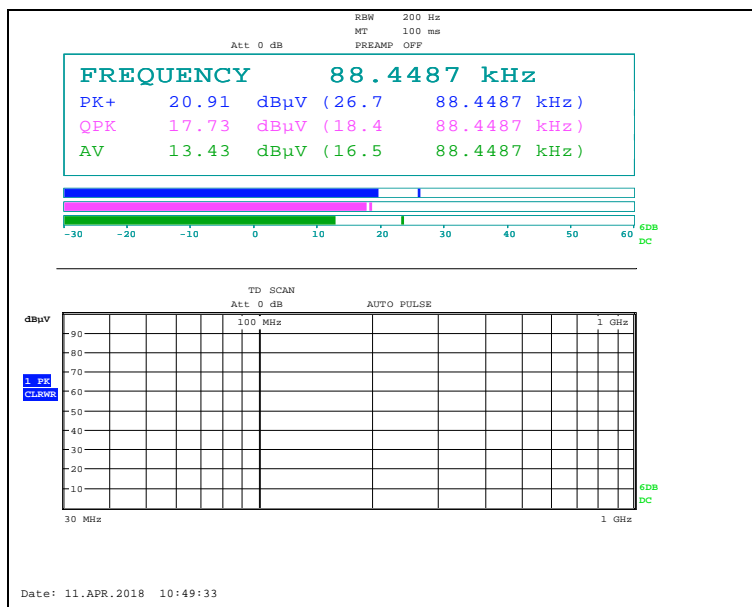
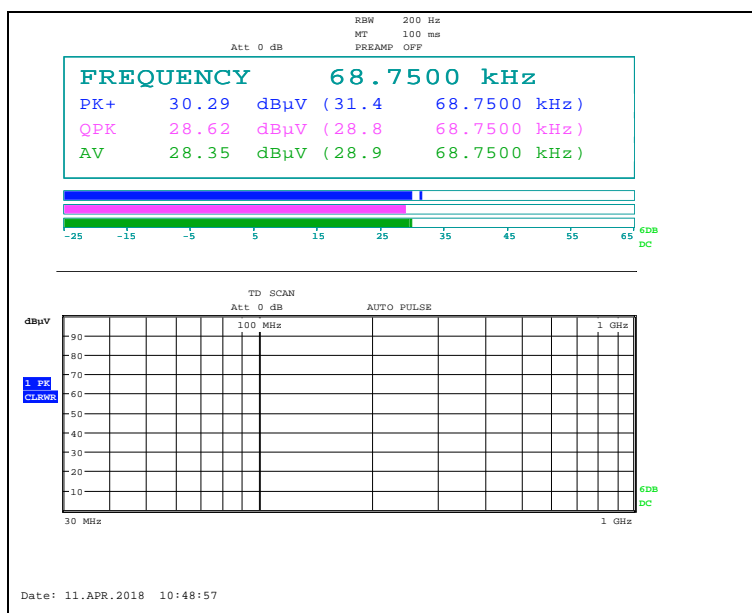
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Test plots

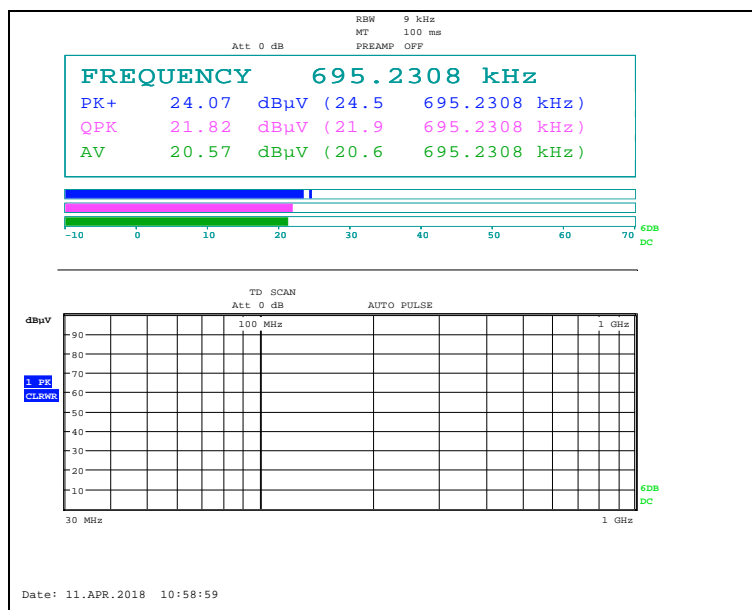
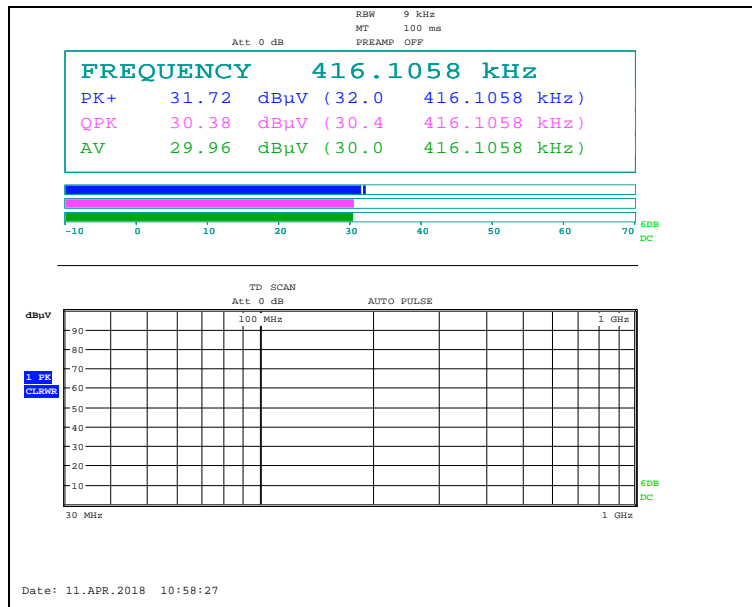
Test Condition: 5 W

Charging mode (1 % battery status of client device)

Below 30 MHz

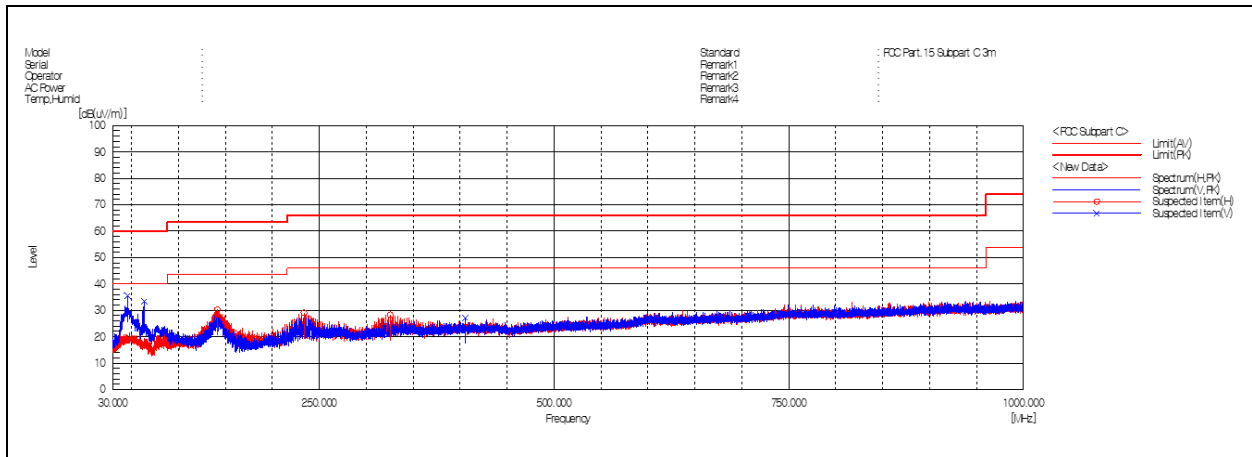


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Above 30 MHz



Remark;

- Traces shown in the plot were made by using a peak detector.

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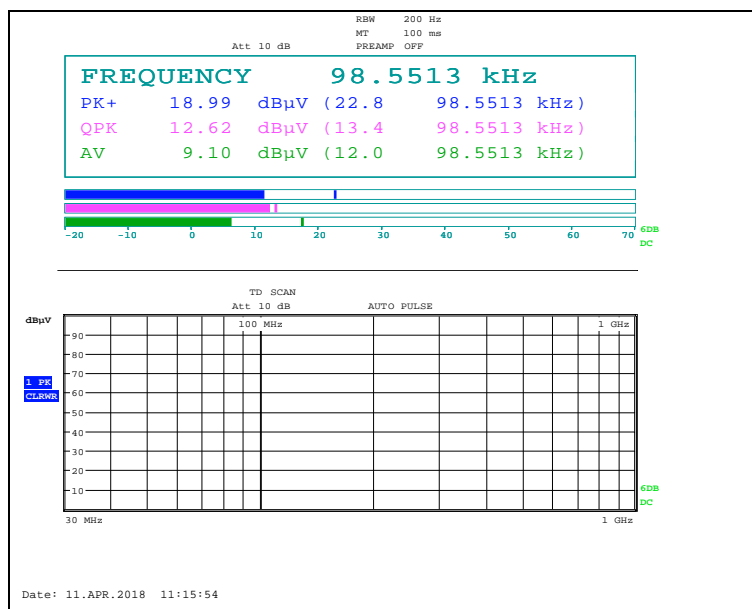
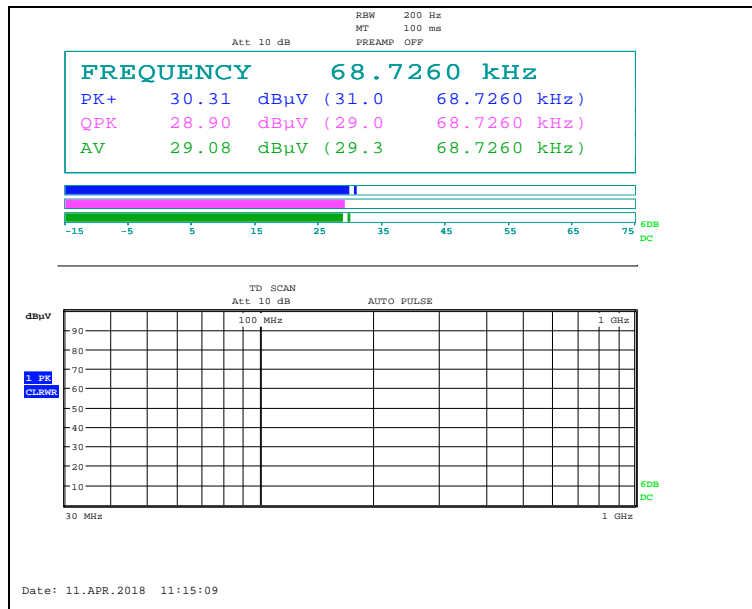
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A4(210 mm x 297 mm)

Test Condition: 15 W

Charging mode

Below 30 MHz



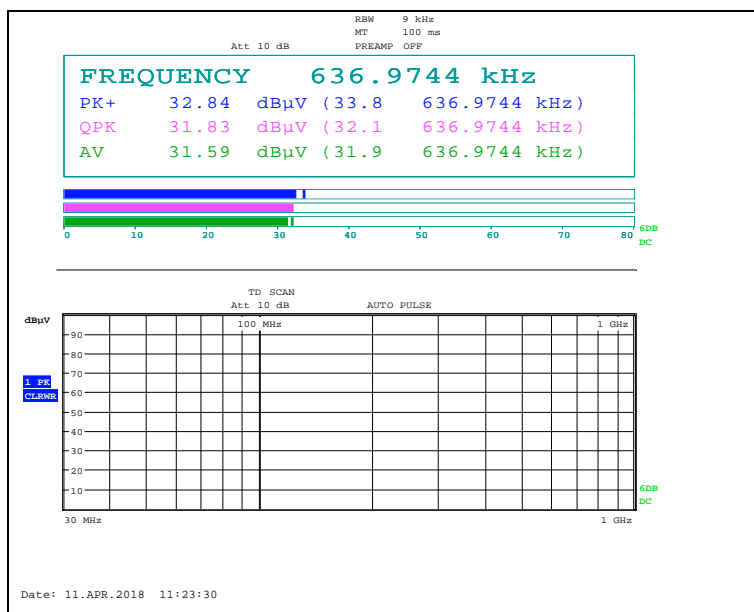
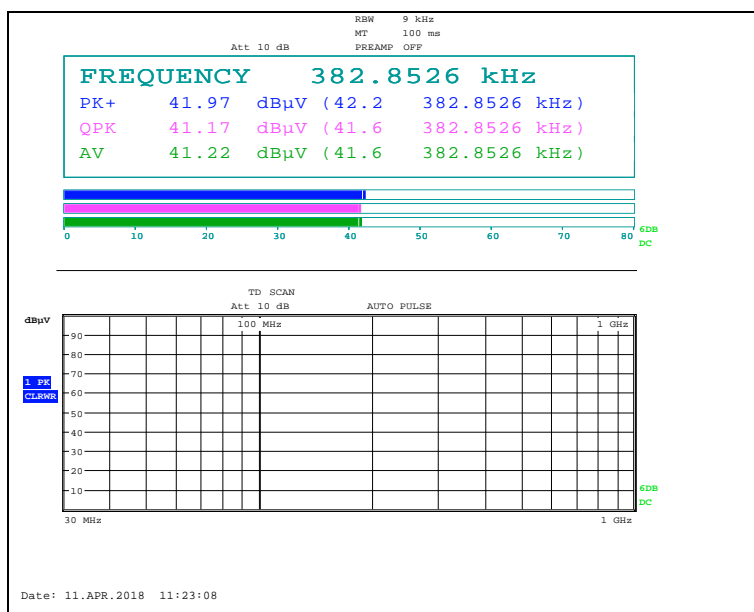
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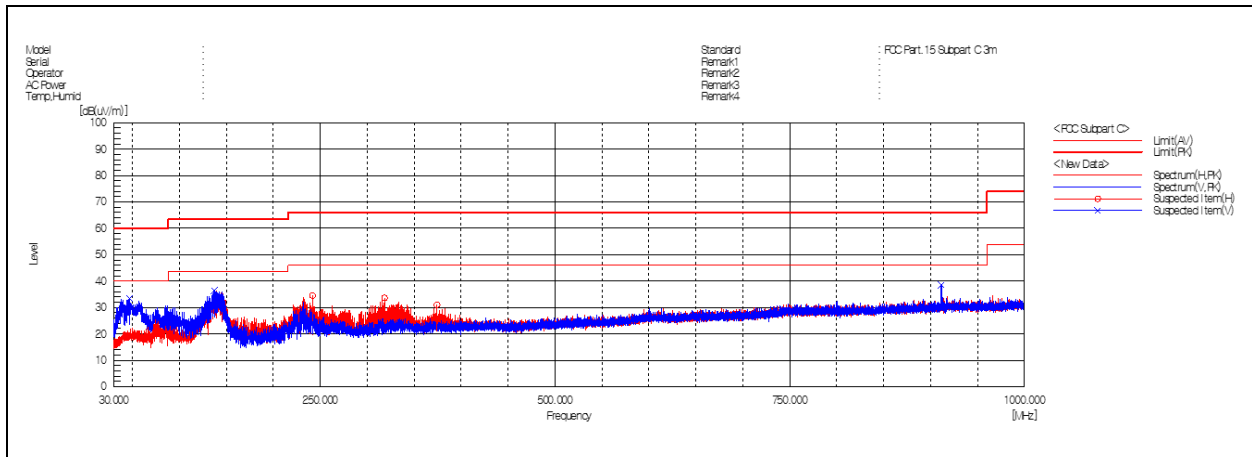
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Above 30 MHz



Remark;

- Traces shown in the plot were made by using a peak detector.

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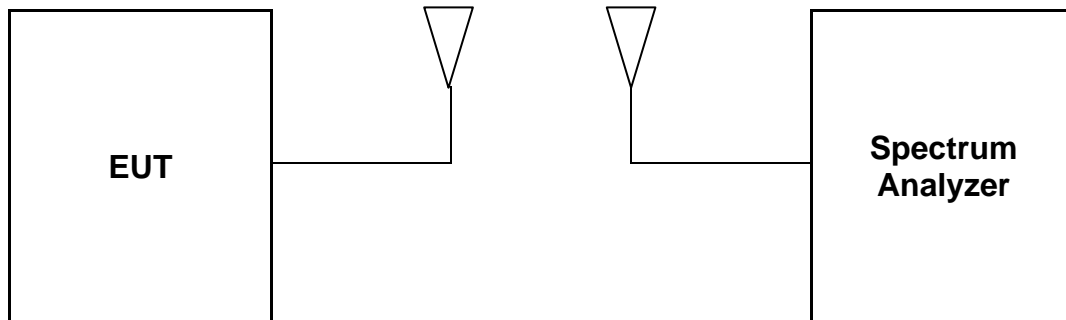
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3. 20 dB Bandwidth

3.1. Test Setup



3.2. Limit

None; for reporting purposed only

3.3. Test Procedure

- Span = set to capture all products of the modulation process, including the emission skirts.
RBW = 200 Hz, VBW = 200 Hz, 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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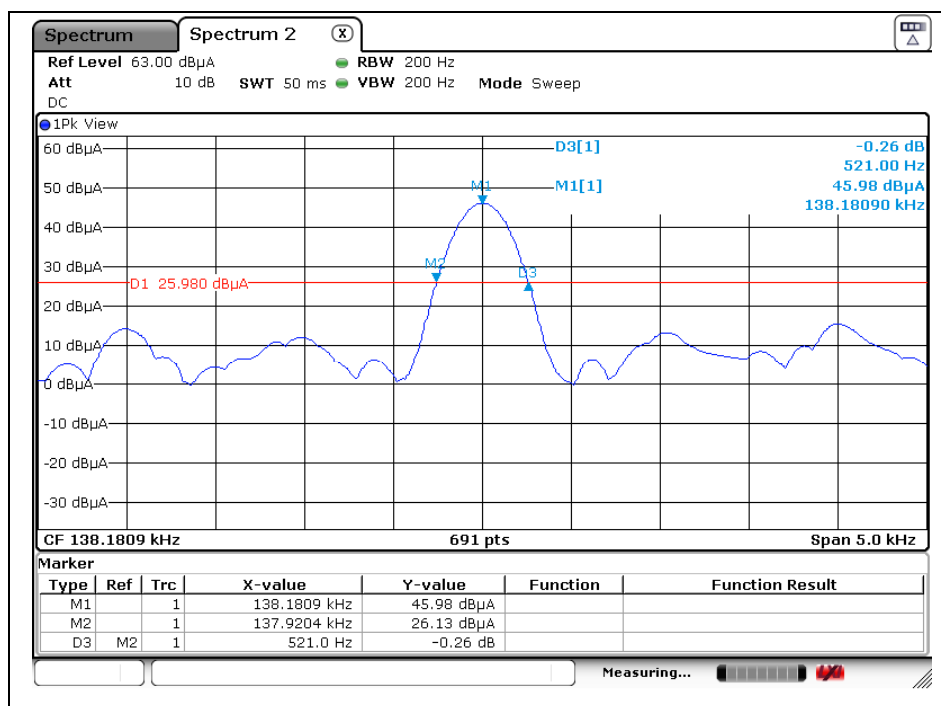
3.4. Test Result

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

Test condition	EUT status	20 dB Bandwidth (Hz)	Limit
5 W	With client device	521.00	Reporting proposed only
15 W		505.10	

Test plots

Test Condition: 5 W (1 % battery status of client device)



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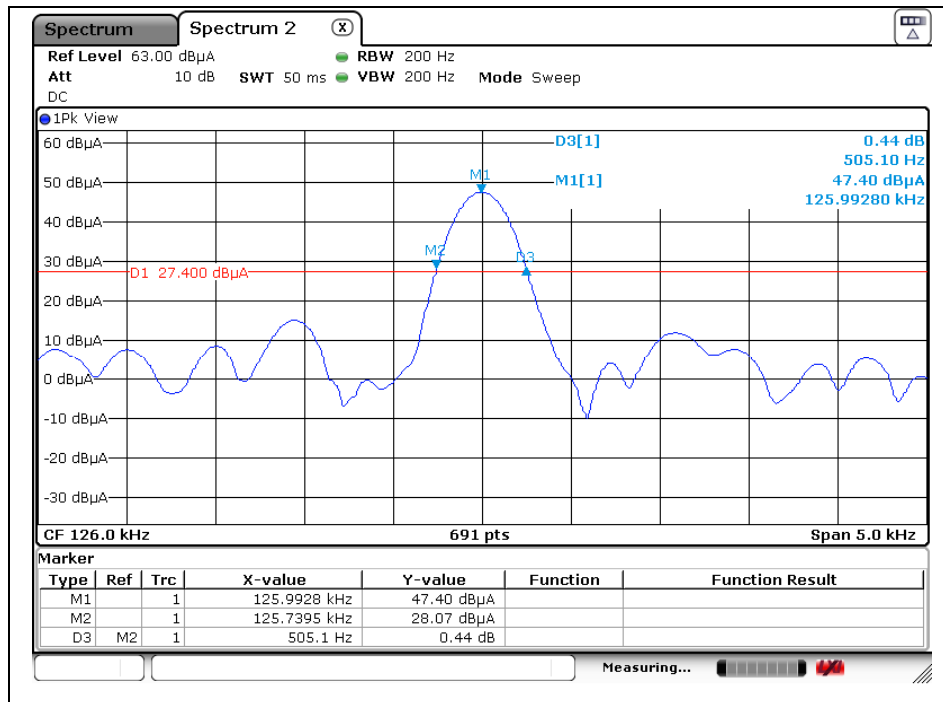
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Test Condition: 15 W



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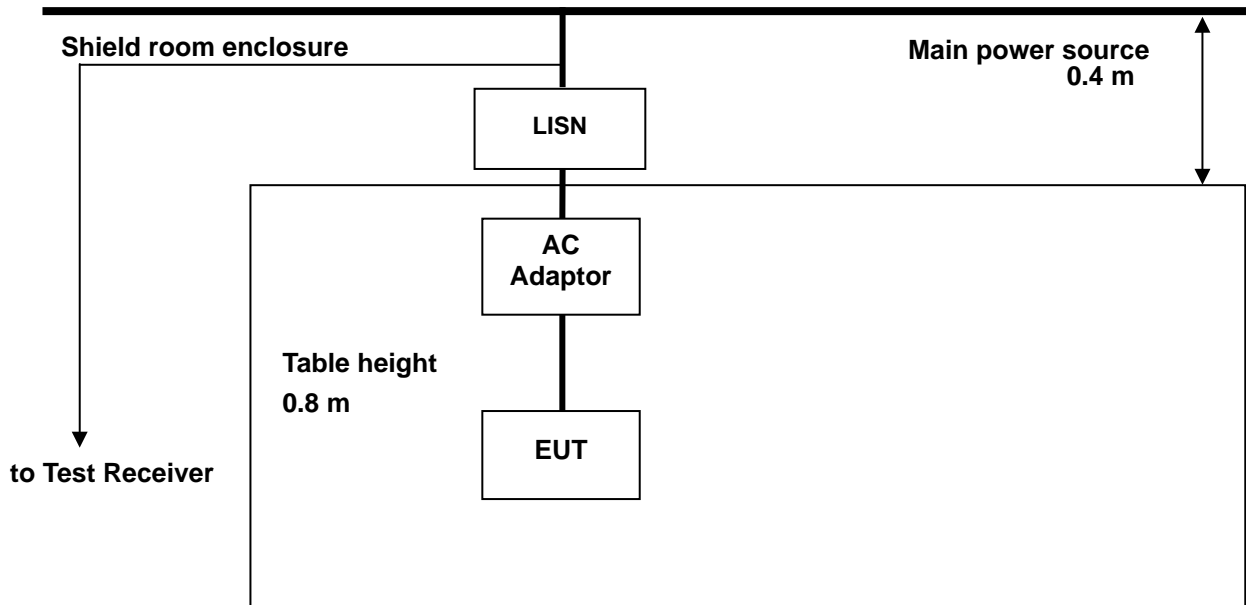
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A4(210 mm x 297 mm)

4. 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 to 56*	56 to 46*
0.50-5.00	56	46
5.00-30.0	60	50

* Decreases with the logarithm of the frequency.

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A4(210 mm x 297 mm)

4.3. Test Procedures

AC conducted emissions from the EUT were measured according to the dictates of ANSI C63.10-2013

- a. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 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.
- b. 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.
- c. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
- d. 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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A4(210 mm × 297 mm)

4.4. Test Results

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

Ambient temperature : (24 ± 1) °C
Relative humidity : 47 % R.H.

Frequency range : 150 kHz to 30 MHz
Measured Bandwidth : 9 kHz

Test Condition: 5 W

Charging mode with Client device (1 % battery status of client device)

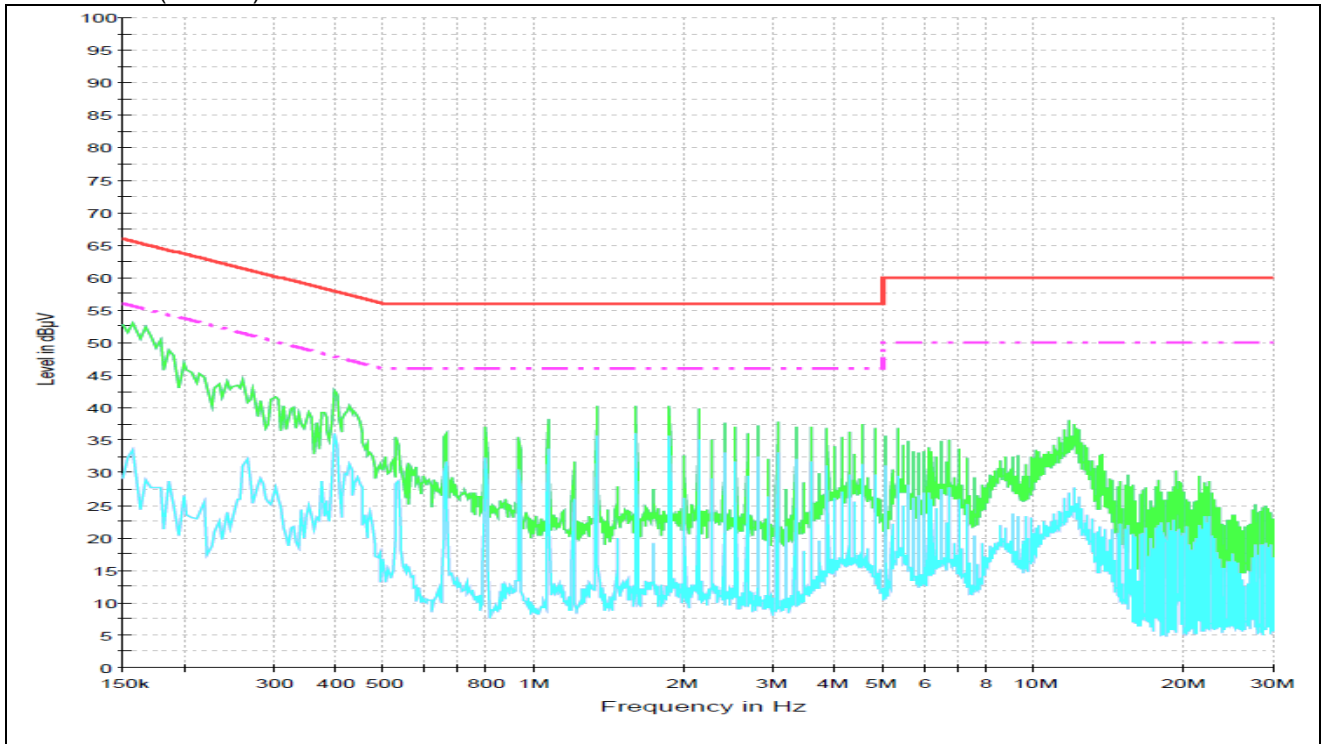
FREQ. (MHz)	LEVEL (dBμV)		LINE	LIMIT (dBμV)		MARGIN (dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.16	49.30	30.60	N	65.46	55.46	16.16	24.86
0.27	39.30	32.50	N	61.12	51.12	21.82	18.62
0.40	41.10	35.90	N	57.85	47.85	16.75	11.95
1.33	38.80	35.50	N	56.00	46.00	17.20	10.50
4.52	35.30	31.10	N	56.00	46.00	20.70	14.90
11.69	33.70	27.00	N	60.00	50.00	26.30	23.00
0.18	44.60	23.20	H	64.49	54.49	19.89	31.29
0.40	34.70	29.10	H	57.85	47.85	23.15	18.75
0.53	25.80	19.10	H	56.00	46.00	30.20	26.90
1.59	27.80	23.60	H	56.00	46.00	28.20	22.40
11.94	27.80	21.50	H	60.00	50.00	32.20	28.50
22.69	21.90	19.70	H	60.00	50.00	38.10	30.30

Remark:

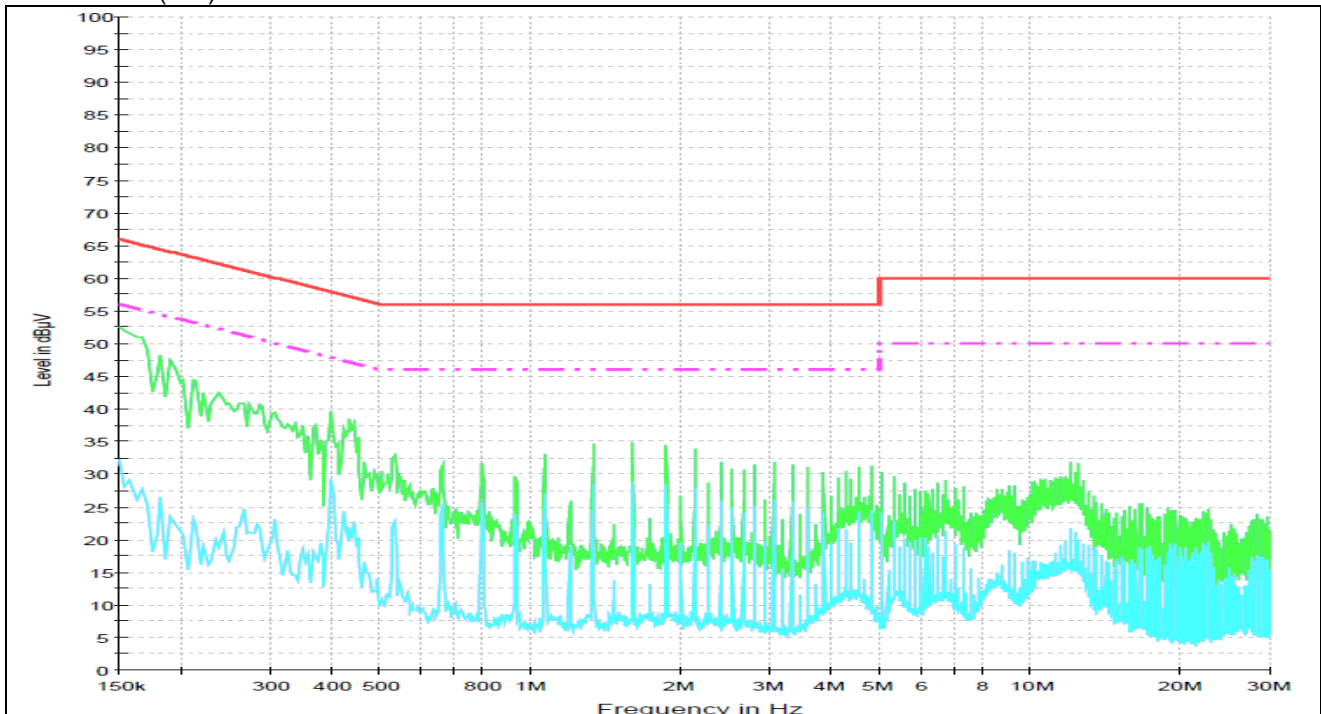
- Line (H): Hot, Line (N): Neutral.
- All charging mode with client device (1 %, 50 %, and 100 % of battery) were tested.
As worst condition, charging mode with client device (1 %) is reported.
- The limit for Class B device(s) from 150 kHz to 30 MHz are specified in Section of the Title 47 CFR.
- Traces shown in plot were made by 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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A4(210 mm x 297 mm)

Test Condition: 15 W

FREQ. (MHz)	LEVEL (dB μ V)		LINE	LIMIT (dB μ V)		MARGIN (dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.37	46.90	42.20	N	58.50	48.50	11.60	6.30
0.50	39.00	34.70	N	56.00	46.00	17.00	11.30
2.39	42.70	38.20	N	56.00	46.00	13.30	7.80
5.03	46.70	42.30	N	60.00	50.00	13.30	7.70
12.58	43.00	38.60	N	60.00	50.00	17.00	11.40
23.78	27.00	34.40	N	60.00	50.00	33.00	15.60
0.16	51.10	33.10	H	65.46	55.46	14.36	22.36
0.19	47.50	30.60	H	64.04	54.04	16.54	23.44
0.37	38.60	34.50	H	58.50	48.50	19.90	14.00
2.63	35.40	19.10	H	56.00	46.00	20.60	26.90
5.29	34.50	22.10	H	60.00	50.00	25.50	27.90
12.60	30.80	20.90	H	60.00	50.00	29.20	29.10

Remark:

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

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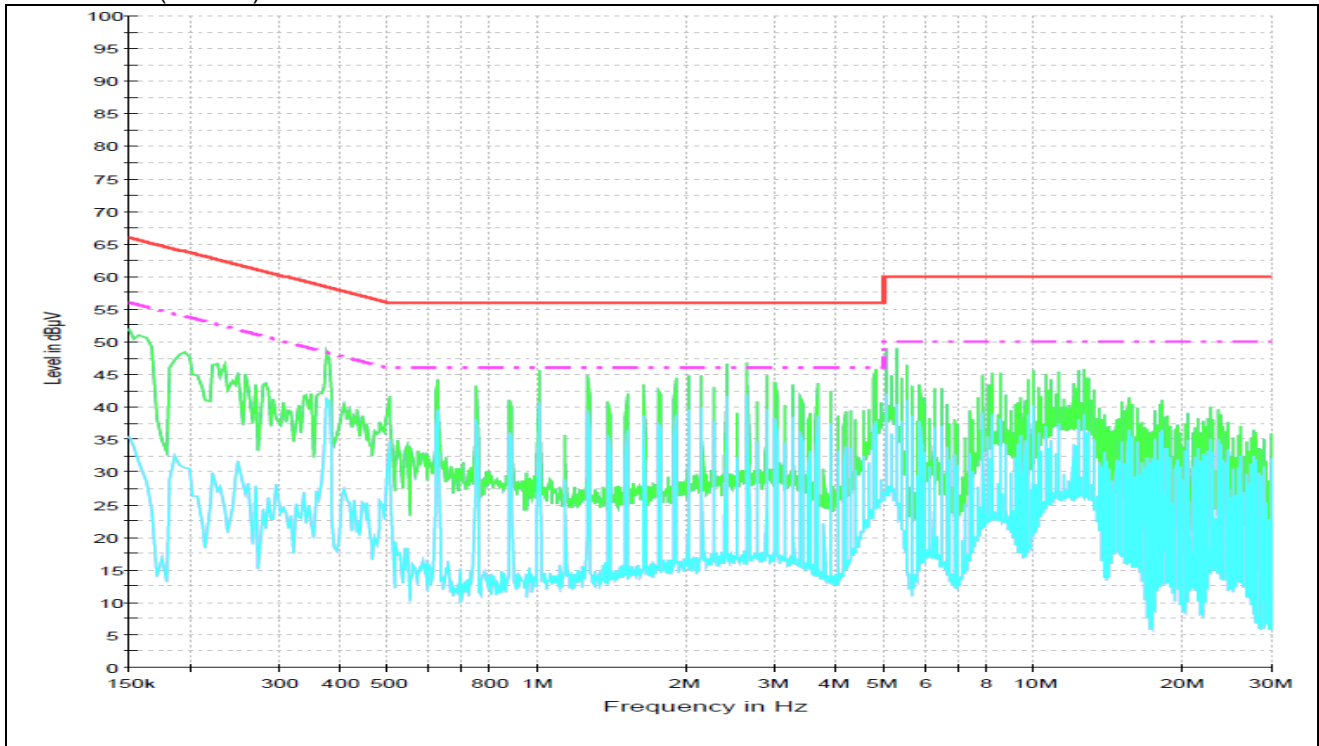
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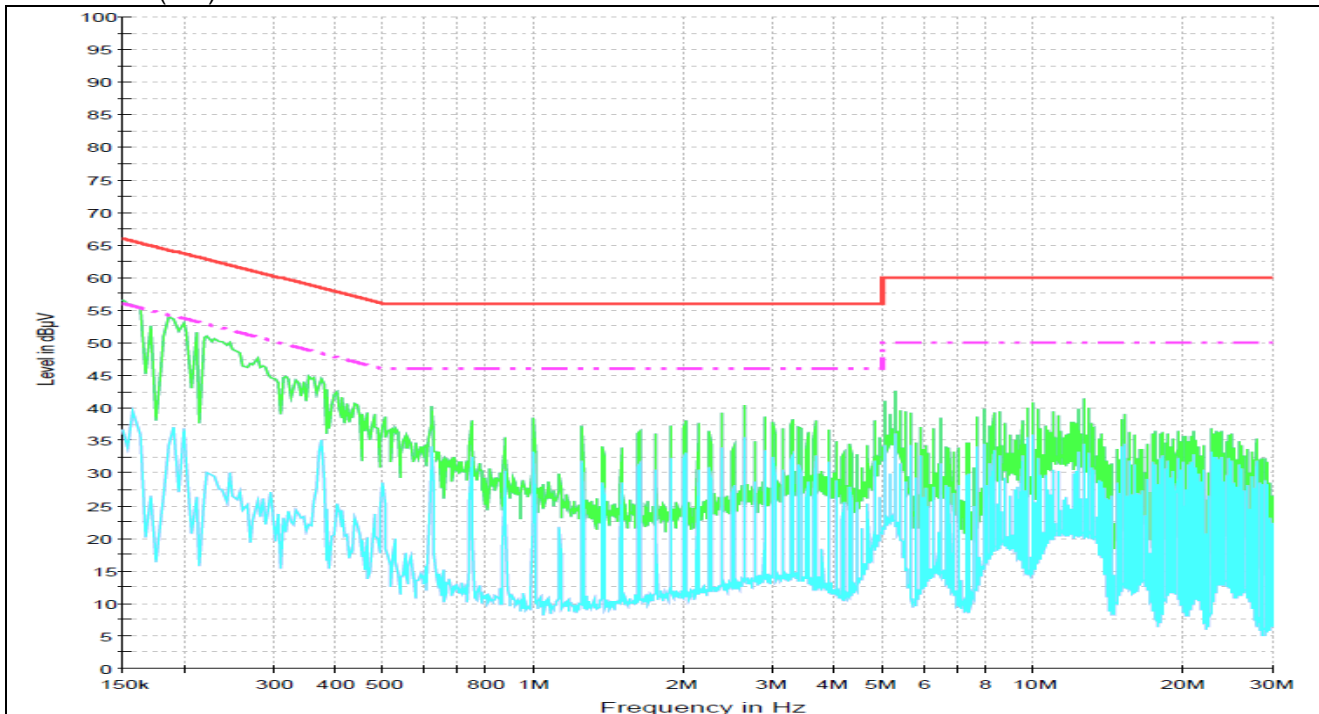
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A4(210 mm x 297 mm)

Test mode: (Neutral)



Test mode: (Hot)



- End of the Test Report -

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A4(210 mm x 297 mm)