

TEST REPORT

of

FCC Part 15 Subpart C §15.209

FCC ID: OSLOKA-105W

Equipment Under Test : UNIT ASSY - WIRELESS CHARGING
Model Name : OKA-105W
Applicant : Omron Automotive Electronics Korea Co., Ltd.
Manufacturer : Omron Automotive Electronics Korea Co., Ltd.
Date of Receipt : 2018.06.12
Date of Test(s) : 2018.06.18 ~ 2018.07.04
Date of Issue : 2018.07.05

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

Tested By:



Nancy Park

Date:

2018.07.05

Technical
Manager:



Jungmin Yang

Date:

2018.07.05

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RTT5041-19(2017.07.10)(0)

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A4(210 mm x 297 mm)

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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, 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 : Omron Automotive Electronics Korea Co., Ltd.

Address : 790-12, Bogaewonsam-ro, Bogae-myeon, Anseong-si, Gyeonggi-do, South Korea, 17507

Contact Person : Nam, Sang-Il

Phone No. : +82 2 850 5789

1.3. Details of manufacturer

Company : Same as applicant

Address : Same as applicant

1.4. Description of EUT

Kind of Product	UNIT ASSY - WIRELESS CHARGING
Model Name	OKA-105W
Power Supply	DC 12.0 V
Frequency Range	111 kHz
Antenna Type	Inductive loop coil antenna

1.5. Declaration by the manufacturer

- The EUT has 3 loop coil antennas with one amplifier, and only one antenna can transmit at once.

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1.6. 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, 2018	Annual	Jun. 15, 2019
Test Receiver	R&S	ESU26	100109	Feb. 07, 2018	Annual	Feb. 07, 2019
Amplifier	H.P.	8447F	2944A03909	Aug. 11, 2017	Annual	Aug. 11, 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.
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

► Support equipment

Description	Manufacturer	Model	FCC ID
Samsung Mobile Phone	Samsung Electronics Co., Ltd.	SM-G900L	A3LSMG900S

1.7. 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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1.8. 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.

EUT configuration	Description
Charging Mode with client device (Model: SM-G900L, FCC ID: A3LSMG900S)	1 % of battery
	50 % of battery
	99 % of battery

Note;

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

1.9. 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	Radiated emission, Spurious Emission and Field Strength of Fundamental	Complied
2.1049	20 dB Bandwidth	Complied

1.10. Measurement Uncertainty

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

Parameter	Uncertainty (dB)
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 %.

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1.11. Test Report Revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL012844	2018.07.05	Initial

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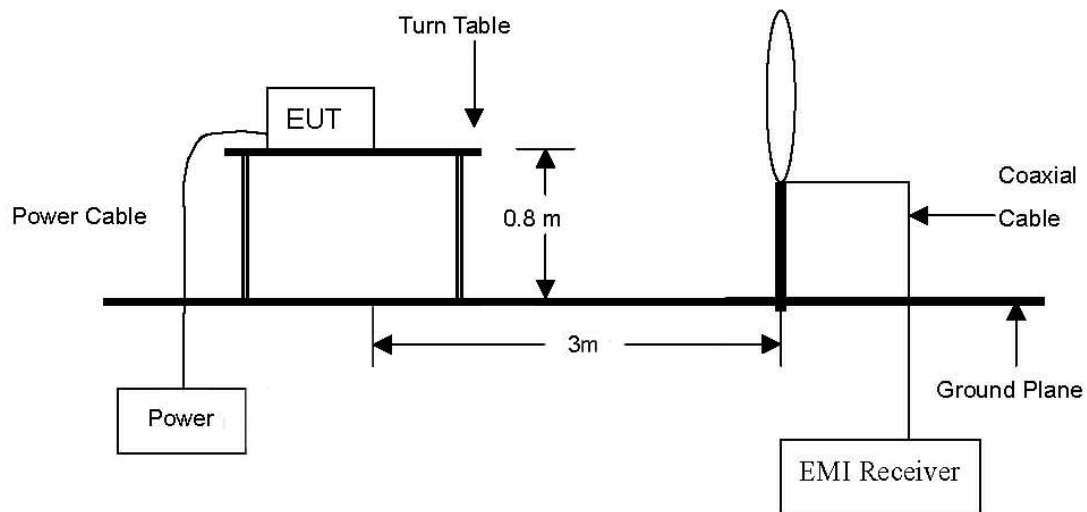
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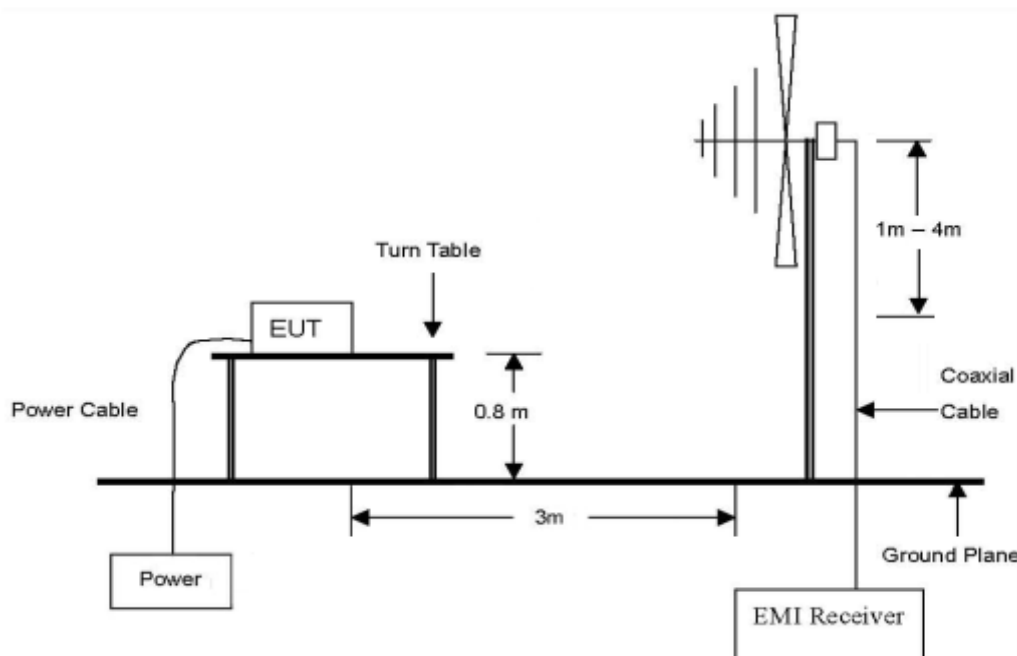
2. Field Strength of Fundamental and Spurious Emission

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.



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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., §§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 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.

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: 1 % battery status of client device

Radiated Emissions			Ant.	Correction Factors		Total		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)
Ant. 1									
0.111	56.70	Average	H	19.69	0.05	76.44	-3.56	26.70	30.26
Ant. 2									
0.111	58.80	Average	H	19.69	0.05	78.54	-1.46	26.70	28.16
Ant. 3									
0.111	62.82	Average	H	19.69	0.05	82.56	2.56	26.70	24.14

Remark:

1. According to §15.31 (f)(2), 300 m Result (dBμV/m) = 3 m Result (dBμV/m) - 40log(300/3) (dBμV/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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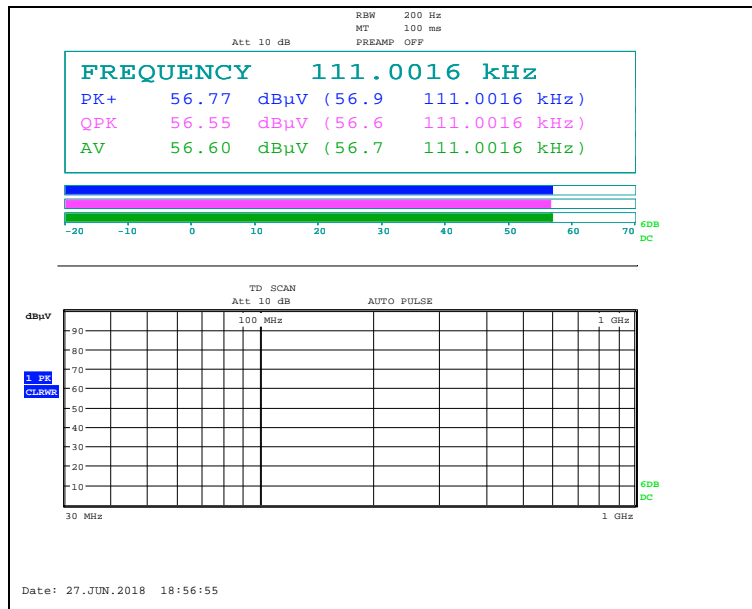
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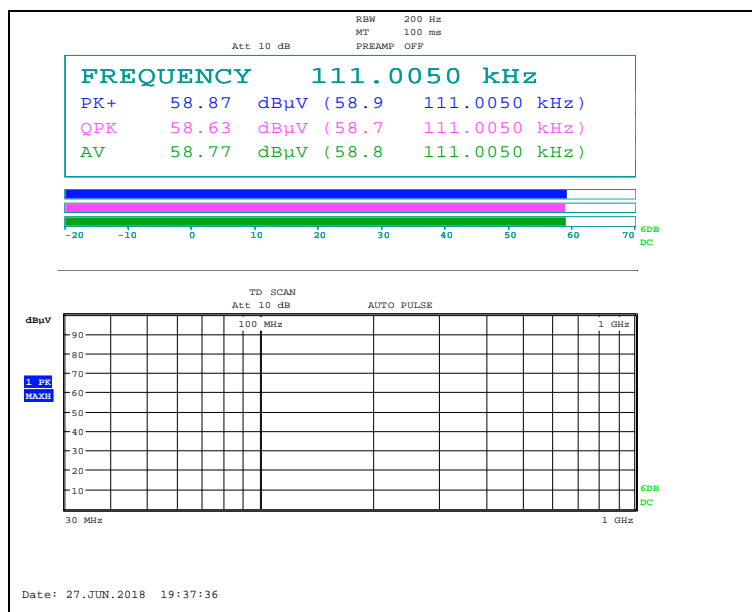
Test plots

Test Condition: 1 % battery status of client device

Ant. 1

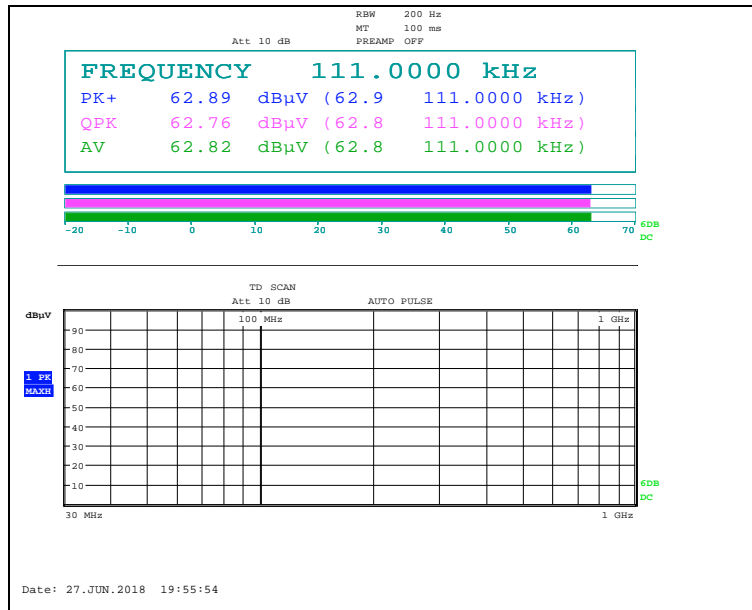


Ant. 2



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Ant. 3



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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: 1 % battery status of client device

Ant. 1

Below 30 MHz

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dBμV/m) at 3 m	Actual (dBμV/m) at 300 m or 30 m	Limit (dBμV/m) at 300 m or 30 m	Margin (dB)
0.019	43.70	Average	H	19.97	0.03	63.70	-16.30	42.03	58.33
0.048	34.30	Average	H	19.77	0.03	54.10	-25.90	33.98	59.88
0.067	35.10	Average	H	19.75	0.04	54.89	-25.11	31.08	56.19
0.333	31.82	Average	H	19.60	0.24	51.66	-28.34	17.16	45.50
2.589	7.90	Quasi Peak	H	19.78	0.74	28.42	-11.58	19.34	30.92
Above 3.000	Not detected	-	-	-	-	-	-	-	-

Above 30 MHz

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
46.85	39.60	Peak	V	14.34	-26.87	27.07	40.00	12.93
101.86	33.10	Peak	V	12.17	-26.23	19.04	43.50	24.46
132.58	43.60	Peak	H	8.89	-25.86	26.63	43.50	16.87
192.80	39.60	Peak	H	10.95	-25.22	25.33	43.50	18.17
212.89	40.10	Peak	H	11.07	-25.13	26.04	43.50	17.46
301.24	42.20	Peak	H	13.51	-24.41	31.30	46.00	14.70
Above 400.00	Not detected	-	-	-	-	-	-	-

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Ant. 2

Below 30 MHz

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	CL (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)
0.019	45.00	Average	H	19.97	0.03	65.00	-15.00	42.03	57.03
0.048	34.90	Average	H	19.77	0.03	54.70	-25.30	33.98	59.28
0.067	35.00	Average	H	19.75	0.04	54.79	-25.21	31.08	56.29
0.335	30.10	Average	H	19.60	0.24	49.94	-30.06	17.10	47.16
Above 1.000	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)
43.58	40.80	Peak	V	14.10	-26.94	27.96	40.00	12.04
136.62	42.80	Peak	H	8.60	-25.86	25.54	43.50	17.96
184.80	40.40	Peak	H	9.88	-25.33	24.95	43.50	18.55
212.93	40.00	Peak	V	11.08	-25.13	25.95	43.50	17.55
289.27	42.60	Peak	H	13.28	-24.51	31.37	46.00	14.63
313.36	41.30	Peak	H	13.67	-24.46	30.51	46.00	15.49
Above 400.00	Not detected	-	-	-	-	-	-	-

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-Ant. 3

Below 30 MHz

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	CL (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)
0.019	45.70	Average	H	19.97	0.03	65.70	-14.30	42.03	56.33
0.048	34.70	Average	H	19.77	0.03	54.50	-25.50	33.98	59.48
0.067	35.10	Average	H	19.75	0.04	54.89	-25.11	31.08	56.19
0.335	34.10	Average	H	19.60	0.24	53.94	-26.06	17.10	43.16
Above 1.000	Not detected	-	-	-	-	-	-	-	-

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Above 30 MHz

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
44.87	41.40	Peak	V	14.28	-26.91	28.77	40.00	11.23
124.49	39.60	Peak	H	9.58	-25.92	23.26	43.50	20.24
184.80	39.60	Peak	H	9.88	-25.33	24.15	43.50	19.35
212.89	41.50	Peak	H	11.07	-25.13	27.44	43.50	16.06
297.32	44.50	Peak	H	13.45	-24.43	33.52	46.00	12.48
830.70	39.80	Peak	V	21.31	-23.68	37.43	46.00	8.57
Above 900.00	Not detected	-	-	-	-	-	-	-

Remark:

- According to §15.31 (f)(2)
 - 300 m Result (dBμV/m) = 3 m Result (dBμV/m) - 40log(300/3) (dBμV/m)
 - 30 m Result (dBμV/m) = 3 m Result (dBμV/m) - 40log(30/3) (dBμV/m)
- 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 MHz: 20log (24 000 / F (kHz)) at 30 m (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.
- Radiated spurious emission measurement as below.
(Actual = Reading + AF + AMP + CL)

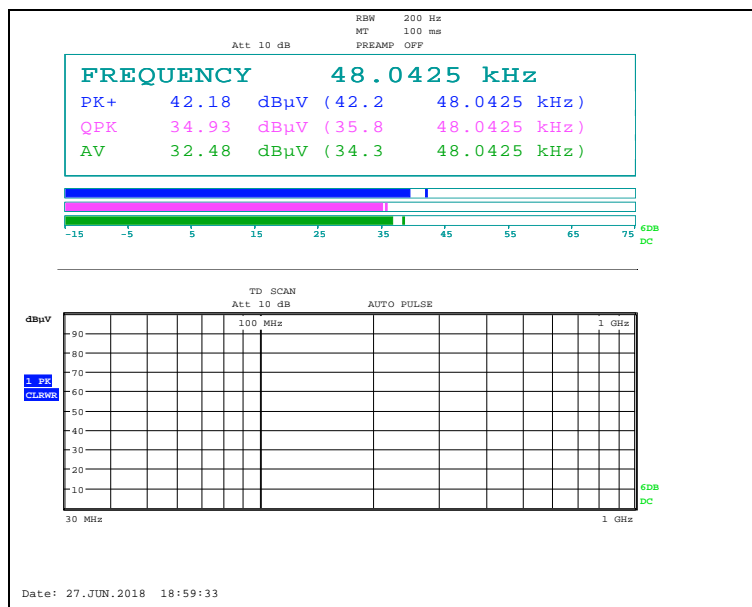
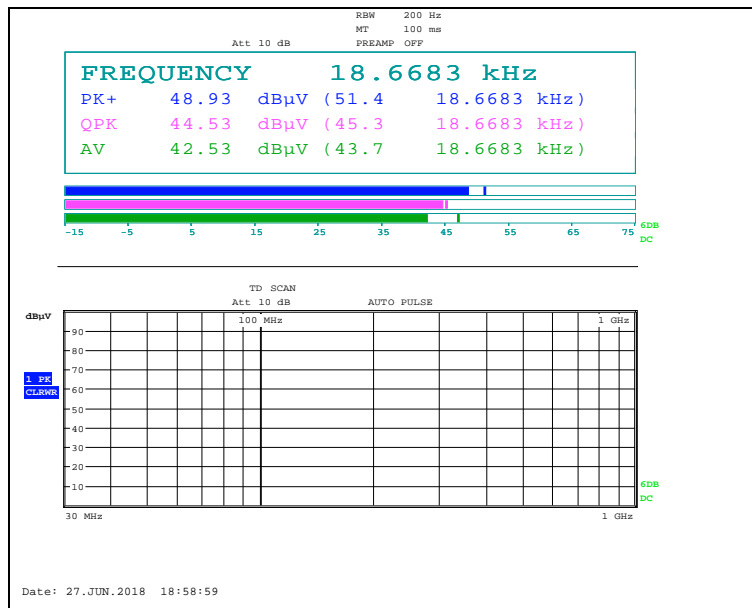
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Test Condition: 1 % battery status of client device

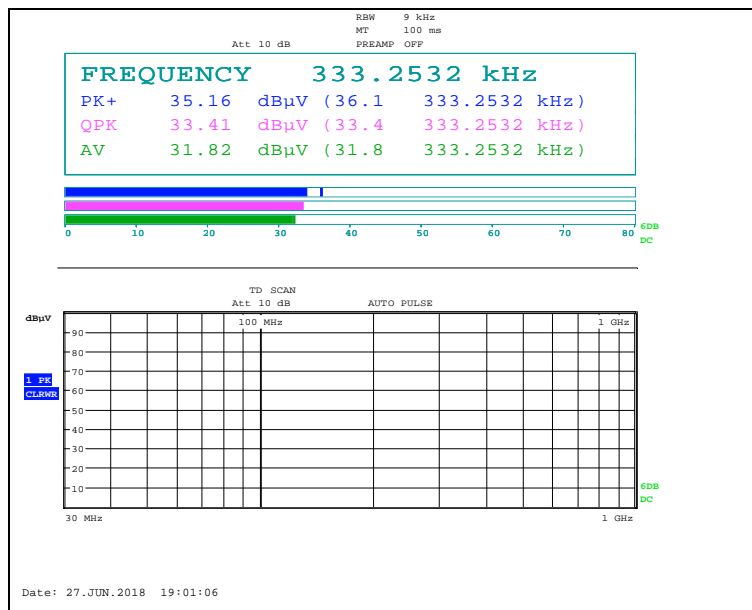
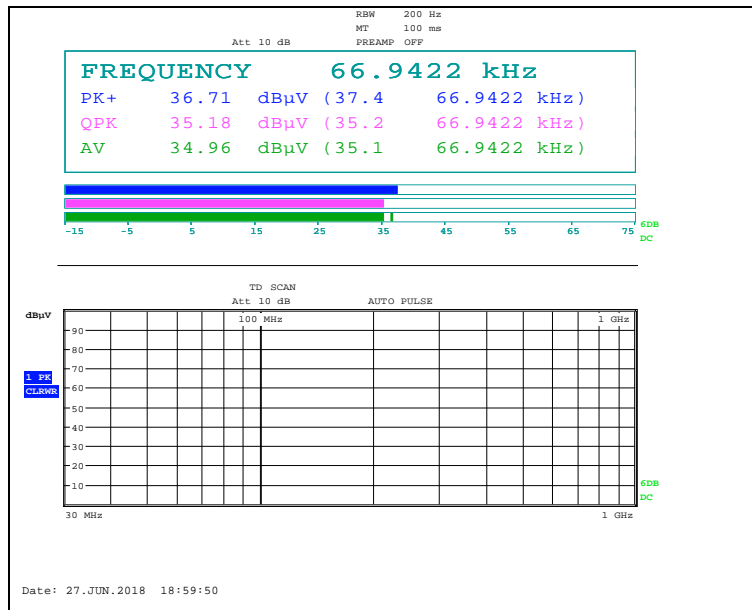
Test plots

- Ant. 1

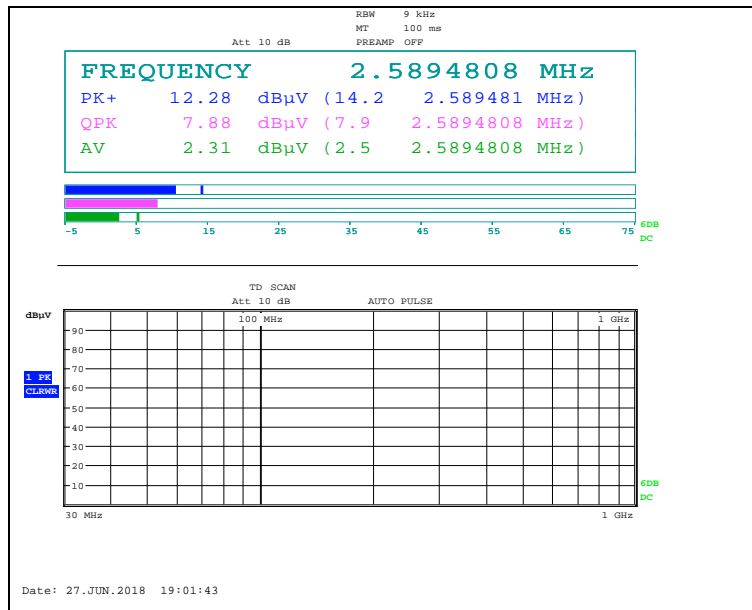
Below 30 MHz



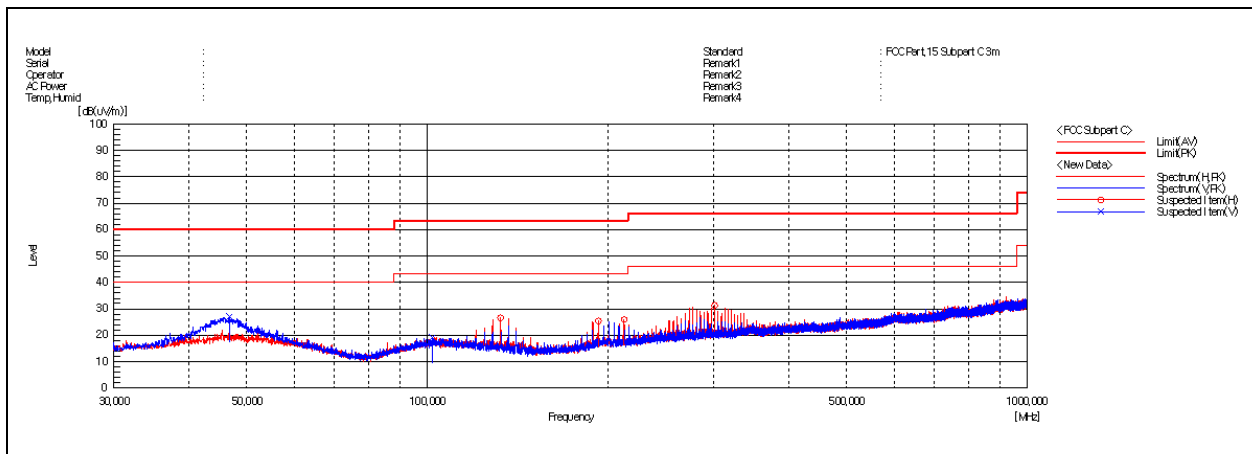
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Above 30 MHz



Remark:

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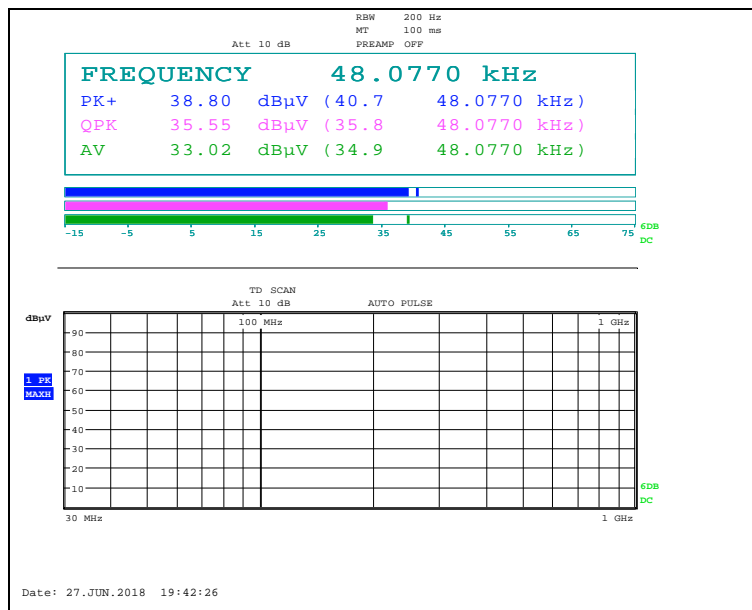
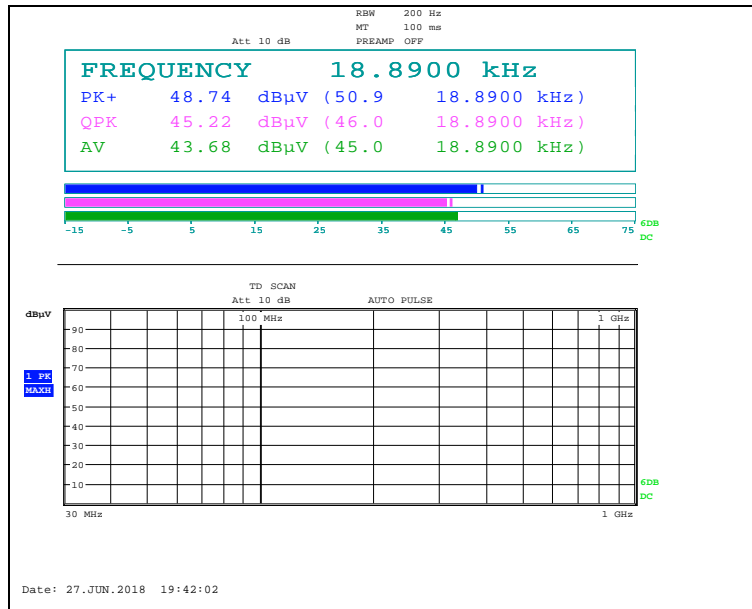
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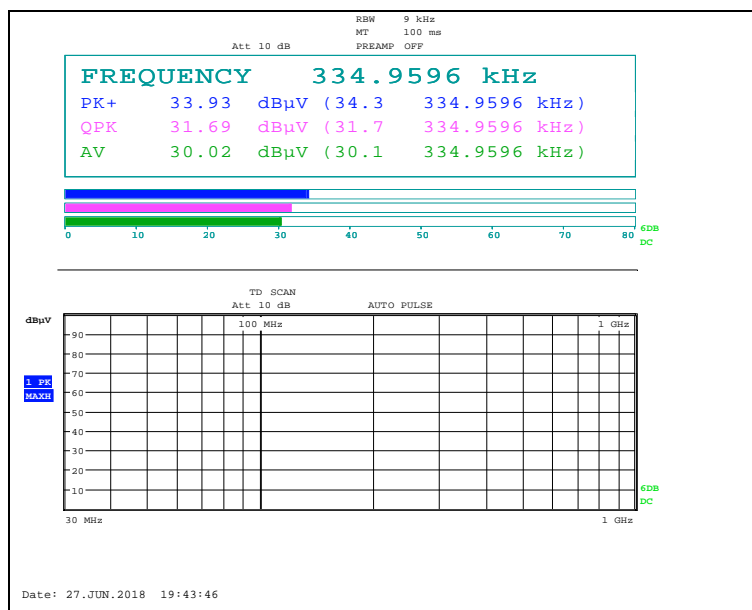
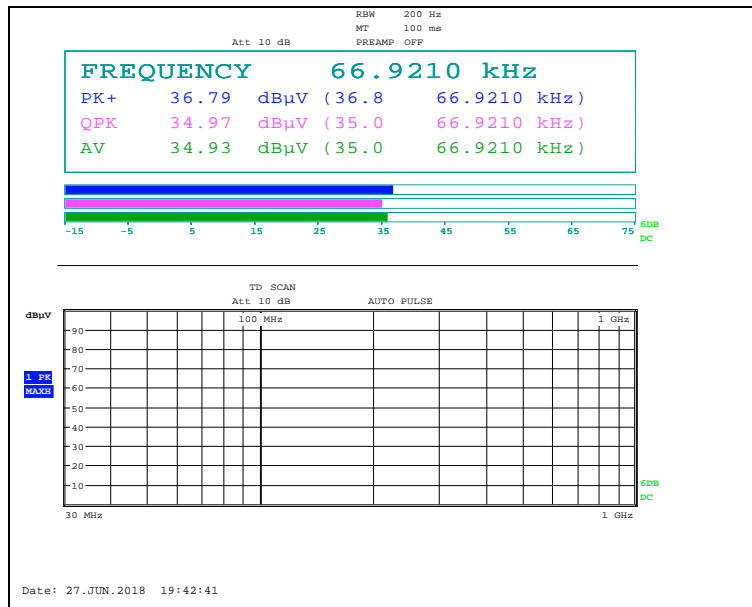
A4(210 mm x 297 mm)

- Ant. 2

Below 30 MHz

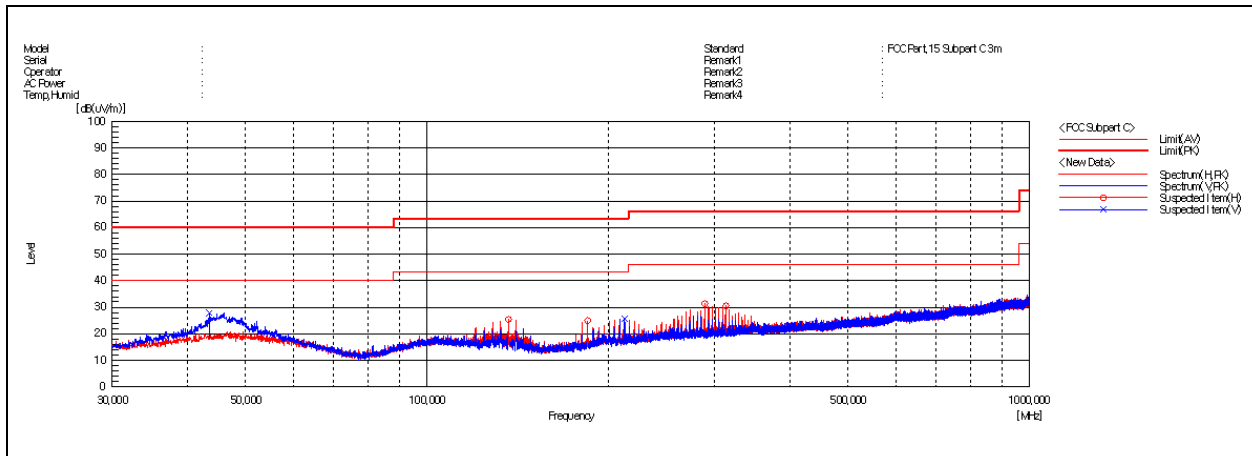


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Above 30 MHz



Remark:

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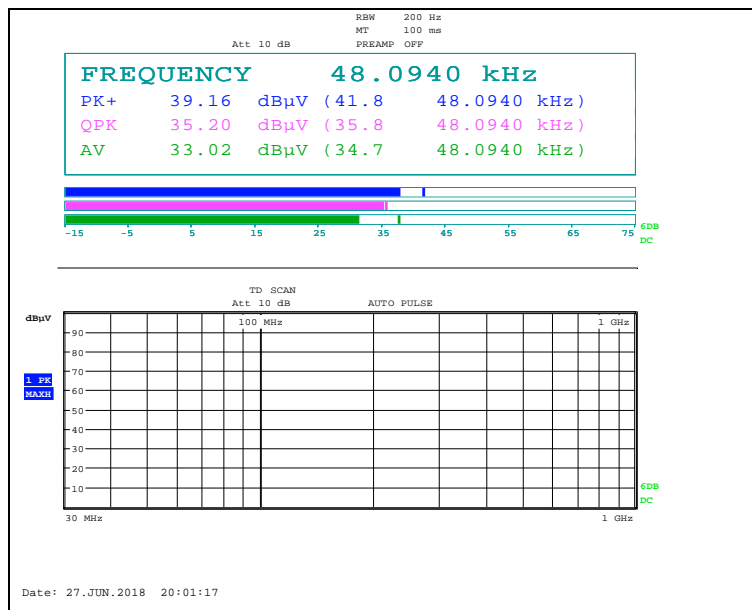
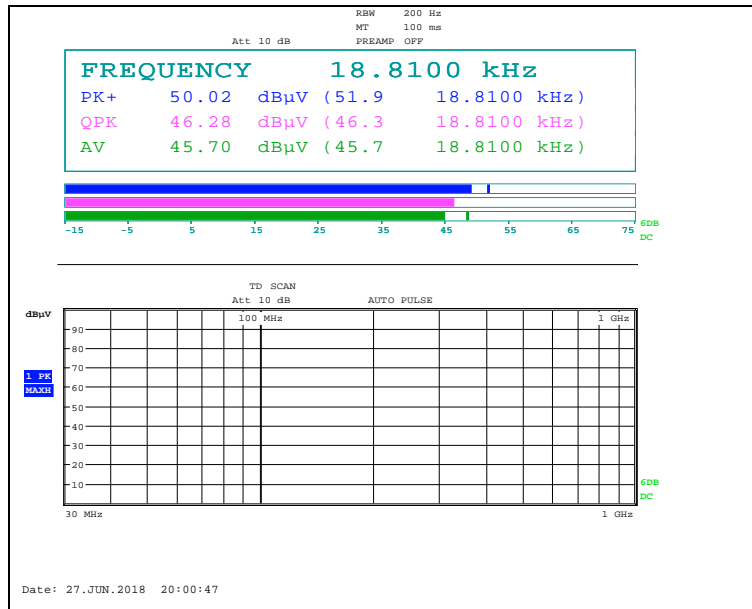
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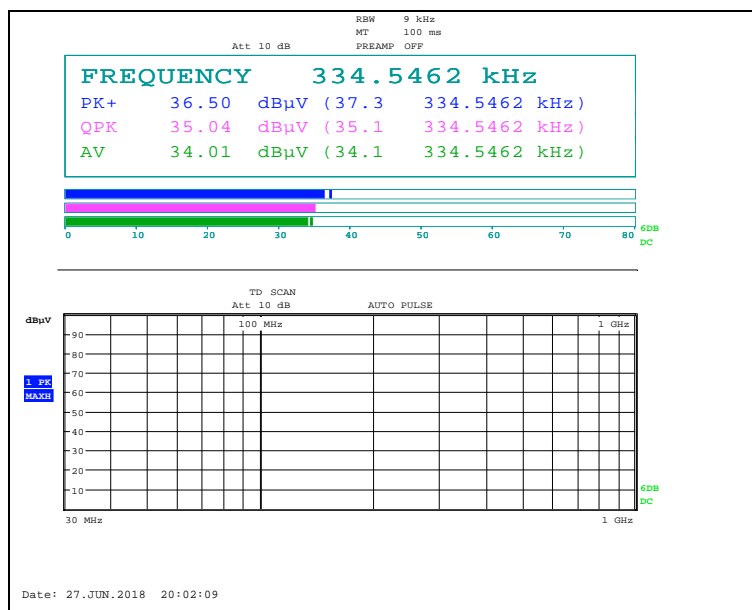
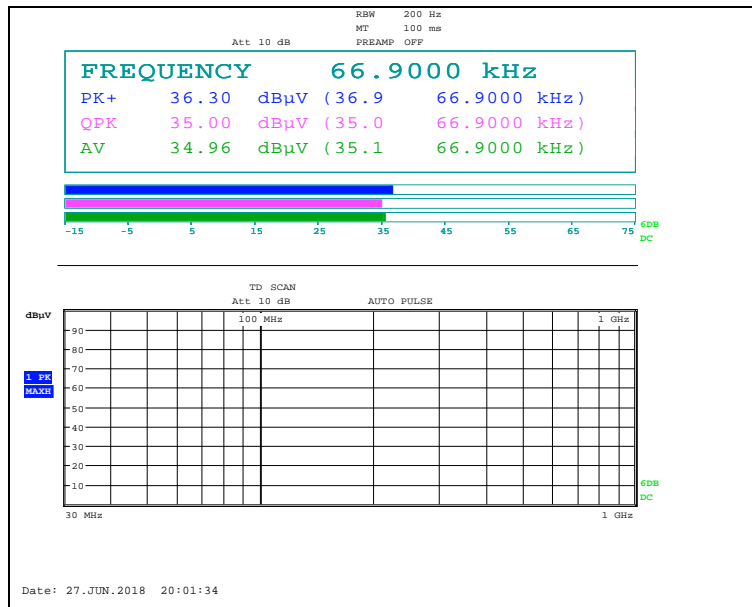
A4(210 mm x 297 mm)

- Ant. 3

Below 30 MHz

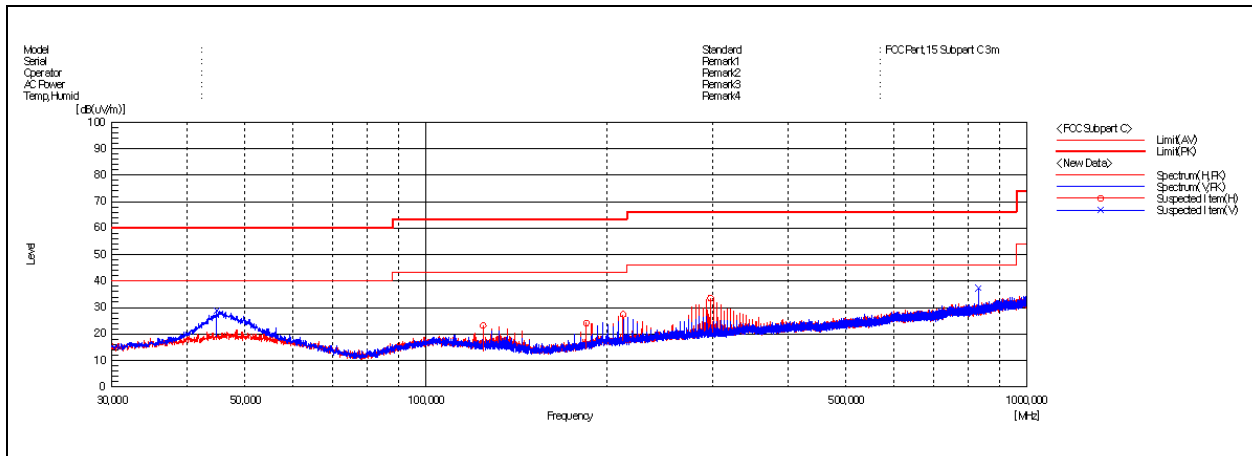


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Above 30 MHz



Remark:

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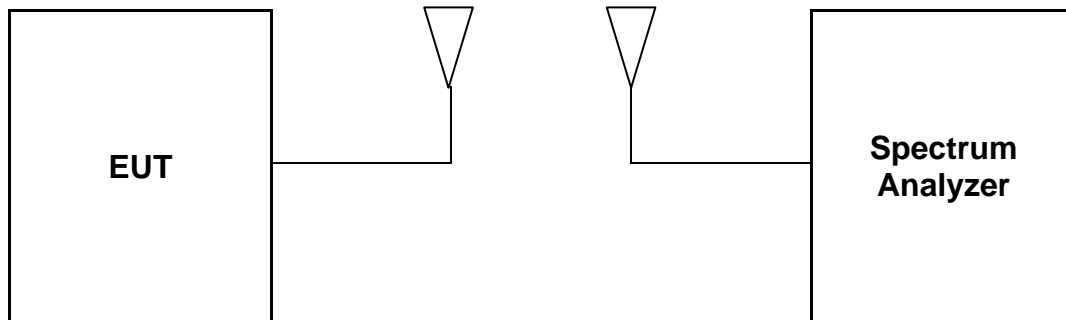
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A4(210 mm x 297 mm)

3. 20 dB Bandwidth

3.1. Test Setup



3.2. Limit

None; for reporting purposed only

3.3. Test Procedure

- a. 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.
- b. 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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A4(210 mm x 297 mm)

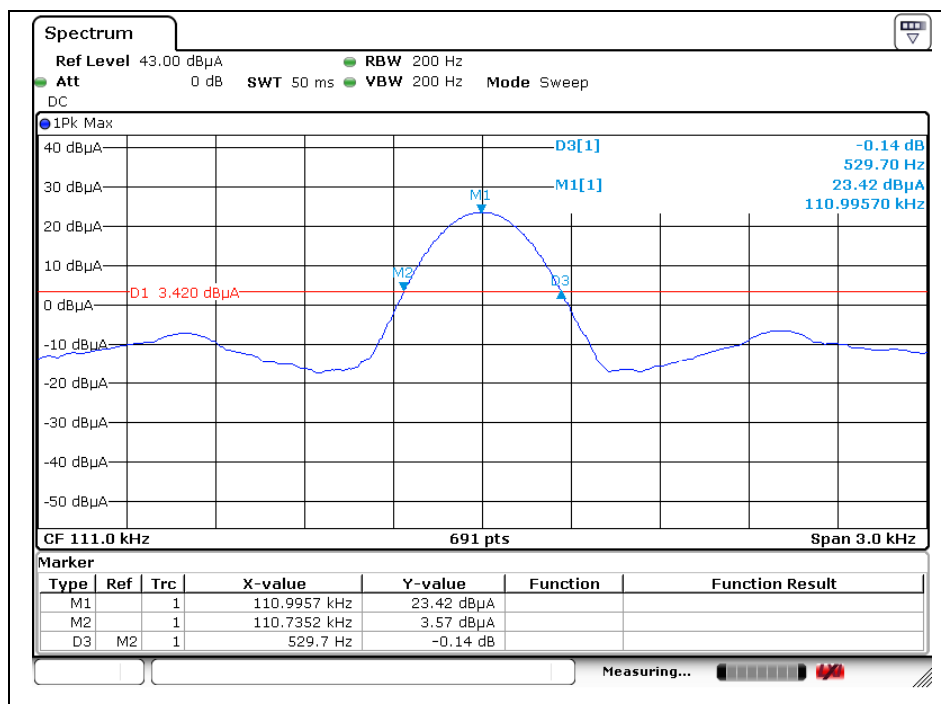
3.4. Test Result

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

Test condition	EUT status	20 dB Bandwidth (Hz)	Limit
Ant. 1	With client device (1 % battery status of client device)	529.70	Reporting proposed only
Ant. 2		516.60	
Ant. 3		521.00	

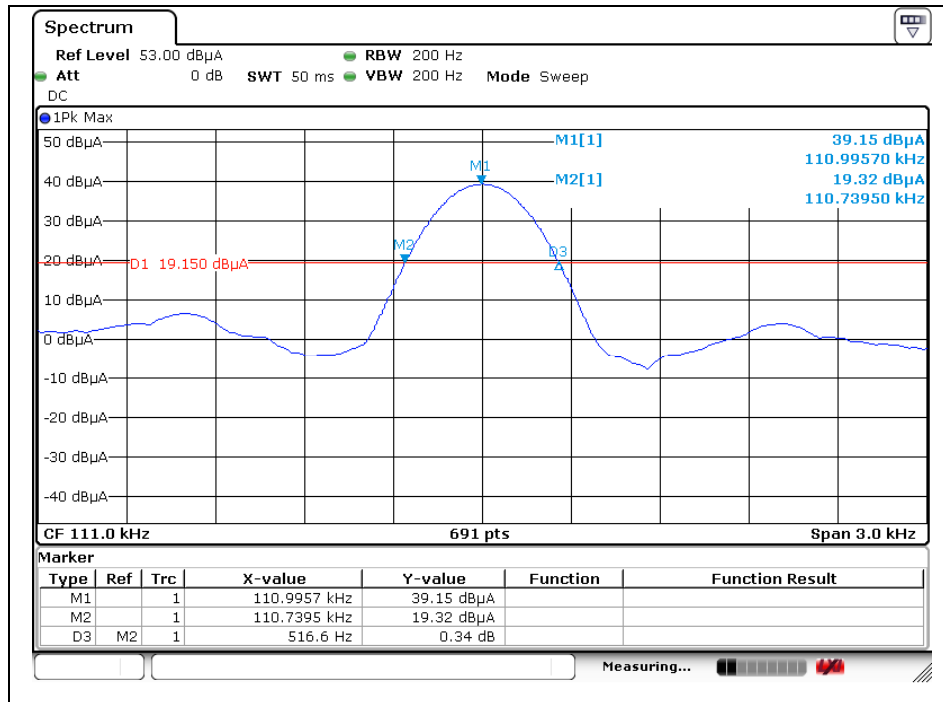
Test plots

Ant. 1

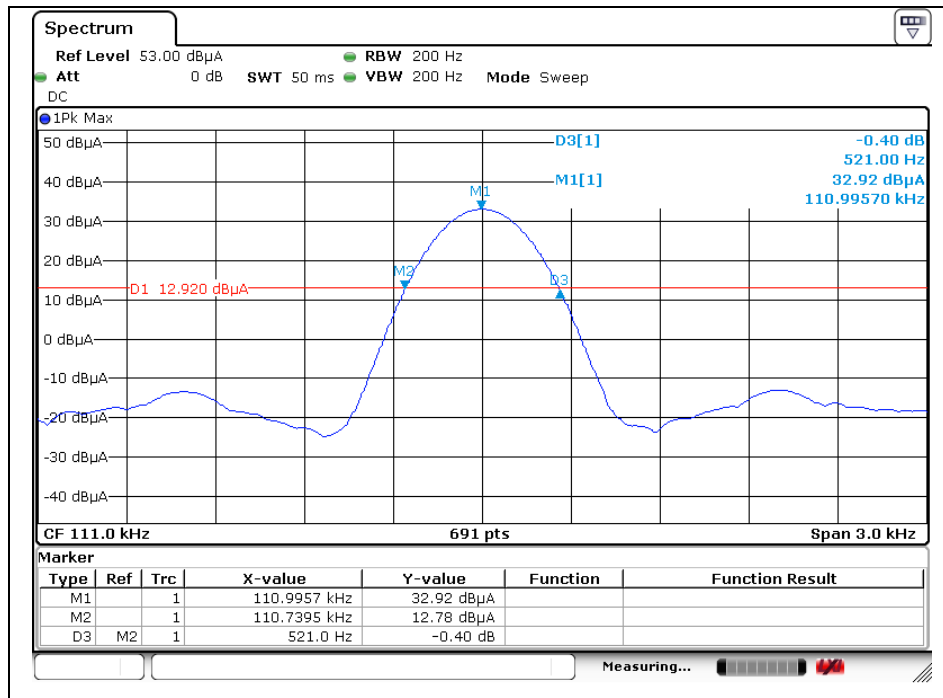


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Ant. 2



Ant. 3



- End of the Test Report -

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A4(210 mm x 297 mm)