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Test report No.:
KES-RF-14T0031-R1
Page (1) of (30)

TEST REPORT

FCC Part 15C

Equipment under test Wireless Charger

Model name KWS-210

FCC ID 2ACCKWS-210

Applicant KOMATECH Co.,Ltd.

Manufacturer KOMATECH Co.,Ltd.

Date of test(s) 2014.06.14 ~ 2014.06.16

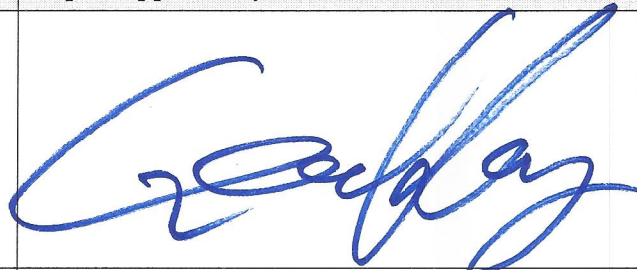
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Test and report completed by :	Report approval by :
	
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The test results in the report only apply to the tested sample.



Revision history

Revision	Date of issue	Test report No.	Description
-	2014.05.29	KES-RF-14T0031	Initial
R1	2014.06.17	KES-RF-14T0031-R1	Re-test of Radiated emission



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1. General information

1.1. EUT description

Equipment under test	Wireless Charger
Model name	KWS-210
Serial number	N/A
Frequency Range	121 kHz ~150 kHz
Modulation technique	ASK
Antenna type	Internal type(Coil antenna)
Power source	AC 110 V Adapter
Note	N/A

1.2. Test frequency

	Frequency Range
Frequency (kHz)	121 kHz ~150 kHz

1.3. Information about derivative model

N/A

1.4. Device modifications

N/A

1.5. Device information

1.6. Test facility

C-3701, Simin-daero 365-40, Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
473-29, Gayeo-ro, Yeosu-si, Gyeonggi-do, Korea

The open area test site is constructed in conformance with the requirements ANSI C63.4-2003/2009.

1.7. Laboratory accreditations and listings

Country	Agency	Scope of accreditation	Certificate No.
USA	FCC	3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements.	343818
KOREA	KC	EMI (10 meter Open Area Test Site and two conducted sites) Radio (3 & 10 meter Open Area Test Sites and one conducted site)	KR0100
CANADA	IC	3 & 10 meter Open Area Test Sites and one conducted site	4769B-1

2.1 Summary of tests

FCC Part Sections	RSS Sections	Parameter	Test results
15.209	RSS-Gen [7.2.5]	Radiated spurious emission	Pass
15.207	RSS-Gen [7.2.4]	AC conducted emissions	Pass

Statement;

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2003/2009) were used in the measurement of the DUT.

2.2 Test mode

Mode	Charging current	Description
Charging mode With load	220 mA	Using Max load
	460 mA	Using Mid load
	800 mA	Using Min load
Charging mode With Mobile Phone	-	< 1% of Battery status
	-	50% of Battery status

2.3 Battery status during charging

< 1% of Battery, 50 % of Battery

2.4 Fundamental emission comparison

The level of call connecting of GSM850 mode was more than airplane mode, charging with Mobile Phone in standby mode and charging with Mobile Phone turned off mode. So GSM850 mode was selected.

3. Test results

3.1. Radiated spurious emission

Test location

Testing was performed at a test distance of 3 meter Open Area Test Site

Test procedures

[9 kHz to 30 MHz]

The EUT was placed on the top of a rotating table 0.8 meter 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 function and specified bandwidth with maximum hold mode.

The spectrum analyzer is set to:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 200 Hz / 300 Hz for peak detection (PK) at frequency below 9 kHz~ 150 kHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 9 kHz / 10 kHz for peak detection (PK) at frequency below 150 kHz~ 30 MHz.
3. For the frequency bands 9~ 90 kHz, 110~490 kHz the radiated emission limits are based on measurements employing an average detector.

[30 MHz to 1 GHz]

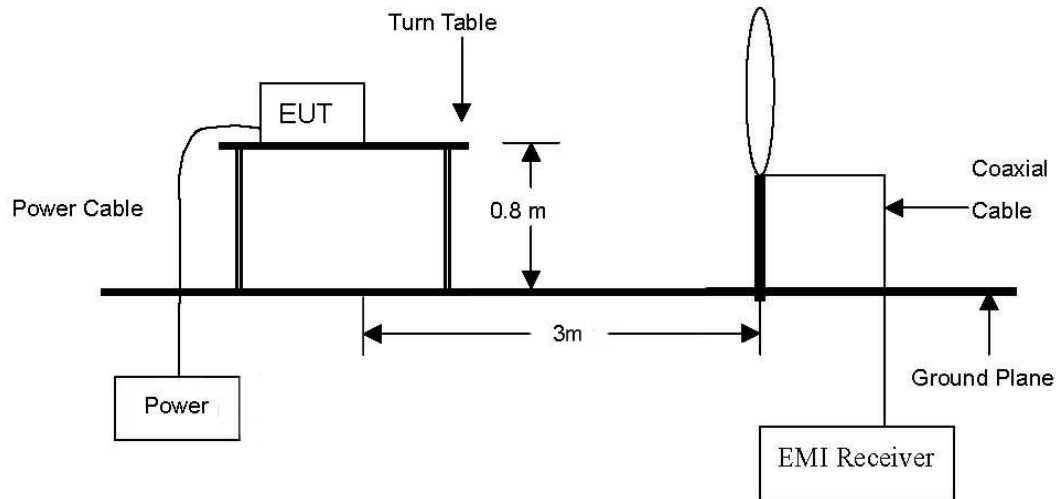
The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity.

The measurement was made in both the vertical and horizontal polarization, and the maximum value is presented in the report.

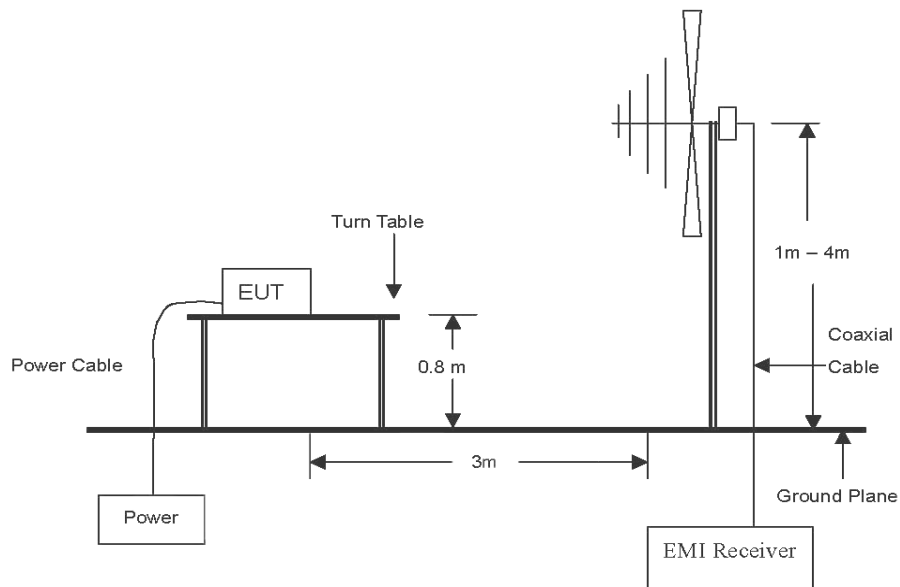
The spectrum analyzer is set to:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 120 kHz for Peak detection (PK) or Quasi-peak detection (QP) at frequency below 1 GHz.

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.



Limit

According to 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values :

Frequency (MHz)	Distance (Meters)	Radiated ($\mu\text{V/m}$)
0.009 ~ 0.490	300	2400 / F(kHz)
0.490 ~ 1.705	30	24000 / F(kHz)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

**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.

Test results (Below 30 MHz)

The frequency spectrum from 9 kHz to 30 MHz was investigated.

- Charging with load (Max)

Radiated emissions			Correction factors			Total	Limit	
Frequency (MHz)	Detect	Reading (dB μ V)	Ant. factor (dB/m)	Cable loss (dB)	F _d (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
0.099 4*	Peak	33.94	19.70	0.02	-80	-26.34	24.14	-50.48
	-	-				-	-	-
0.129 3**	Peak	51.75	19.69	0.03	-80	-8.53	28.56	-37.09
	Avg	51.38				-8.90	18.56	-27.46
0.388 1	Peak	33.61	19.60	0.08	-80	-26.71	16.18	-42.89
	Avg	33.53				-26.79	6.18	-32.97
0.644 4	Peak	28.16	19.60	0.13	-40	7.89	37.24	-29.35
	-	-				-	-	-
0.904 6	Peak	30.56	19.60	0.17	-40	10.33	26.53	-16.20
	-	-				-	-	-

- Charging with load (Mid)

Radiated emissions			Correction factors			Total	Limit	
Frequency (MHz)	Detect	Reading (dB μ V)	Ant. factor (dB/m)	Cable loss (dB)	F _d (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
0.107 5*	Peak	36.29	19.70	0.02	-80	-23.99	22.33	-46.32
	-	-				-	-	-
0.129 3**	Peak	51.93	19.69	0.03	-80	-8.35	28.56	-36.91
	Avg	51.80				-8.48	18.56	-27.04
0.386 9	Peak	32.43	19.60	0.08	-80	-27.89	16.20	-44.09
	Avg	32.29				-28.03	6.20	-34.23
0.645 2	Peak	27.54	19.60	0.13	-40	7.27	37.20	-29.93
	-	-				-	-	-
0.904 5	Peak	31.77	19.60	0.17	-40	11.54	26.53	-14.99
	-	-				-	-	-

- Charging with load (Min)

Radiated emissions			Correction factors			Total	Limit	
Frequency (MHz)	Detect	Reading (dB μ V)	Ant. factor (dB/m)	Cable loss (dB)	F _d (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
0.098 2*	Peak	30.76	19.70	0.02	-80	-29.52	24.44	-53.96
	-	-				-	-	-
0.121 3**	Peak	49.56	19.69	0.02	-80	-10.73	29.79	-40.52
	Avg	49.41				-10.88	19.79	-30.67
0.360 7	Peak	33.22	19.60	0.07	-80	-27.11	16.65	-43.76
	Avg	33.05				-27.28	6.65	-33.93
0.600 7	Peak	26.17	19.60	0.13	-40	5.90	39.95	-34.05
	-	-				-	-	-
0.839 9	Peak	27.43	19.60	0.16	-40	7.19	28.57	-21.38
	-	-				-	-	-

- Charging with Mobile Phone (< 1% of Battery)

Radiated emissions			Correction factors			Total	Limit	
Frequency (MHz)	Detect	Reading (dB μ V)	Ant. factor (dB/m)	Cable loss (dB)	F _d (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
0.109 7*	Peak	24.68	19.70	0.02	-80	-35.60	21.88	-57.48
	-	-				-	-	-
0.148 8**	Peak	51.52	19.68	0.03	-80	-8.77	26.13	-34.90
	Avg	51.33				-8.96	16.13	-25.09
0.447 5	Peak	29.31	19.60	0.09	-80	-31.00	15.36	-46.36
	Avg	29.19				-31.12	5.36	-36.48
1.041 8	Peak	23.67	19.60	0.19	-40	3.46	23.04	-19.58
	-	-				-	-	-

- Charging with Mobile Phone (50% of Battery)

Radiated emissions			Correction factors			Total	Limit	
Frequency (MHz)	Detect	Reading (dB μ V)	Ant. factor (dB/m)	Cable loss (dB)	F _d (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
0.100 9*	Peak	36.37	19.70	0.02	-80	-23.91	23.79	-47.70
	-	-				-	-	-
0.149 9**	Peak	53.22	19.68	0.03	-80	-7.07	26.01	-33.08
	Avg	53.08				-7.21	16.01	-23.22
0.450 3	Peak	29.48	19.60	0.09	-80	-30.83	15.33	-46.16
	Avg	29.22				-31.09	5.33	-36.42
1.049 6	Peak	23.70	19.60	0.20	-40	3.50	22.87	-19.37
	-	-				-	-	-

※ Remark

1. “*” means measurement frequency of the restricted of 90~110 kHz.
2. “**” means Fundamental frequency.
3. Measurement distance : 3 m.
4. Actual = Reading + Ant. factor + Cable loss + F_d
5. $F_d = 40\log(D_m / D_s)$

Where:

F_d = Distance factor in dB

D_m = Measurement distance in meters

D_s = Specification distance in meters

For 300m: $40\log(300/3) = 80$ dB for frequency band 0.009 MHz to 0.490 MHz

For 30m: $40\log(30/3) = 40$ dB for frequency band 0.490 MHz to 30 MHz

Test results (Below 1 000 MHz)

The frequency spectrum from 30 MHz to 1 000 MHz was investigated.

- Charging with load (Max)

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
No emissions were detected at a level greater than 20 dB below limit							

- Charging with load (Med)

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
No emissions were detected at a level greater than 20 dB below limit							

- Charging with load (Min)

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
No emissions were detected at a level greater than 20 dB below limit							

- Charging with Mobile Phone (< 1% of Battery)

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
No emissions were detected at a level greater than 20 dB below limit							

- Charging with Mobile Phone (50% of Battery)

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
No emissions were detected at a level greater than 20 dB below limit							

※ Remark

1. Actual = Reading + Ant. factor + Cable loss

3.2. AC conducted emissions

Frequency range of measurement

150 kHz to 30 MHz

Instrument settings

IF Band Width: 9 kHz

Test procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m. Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit

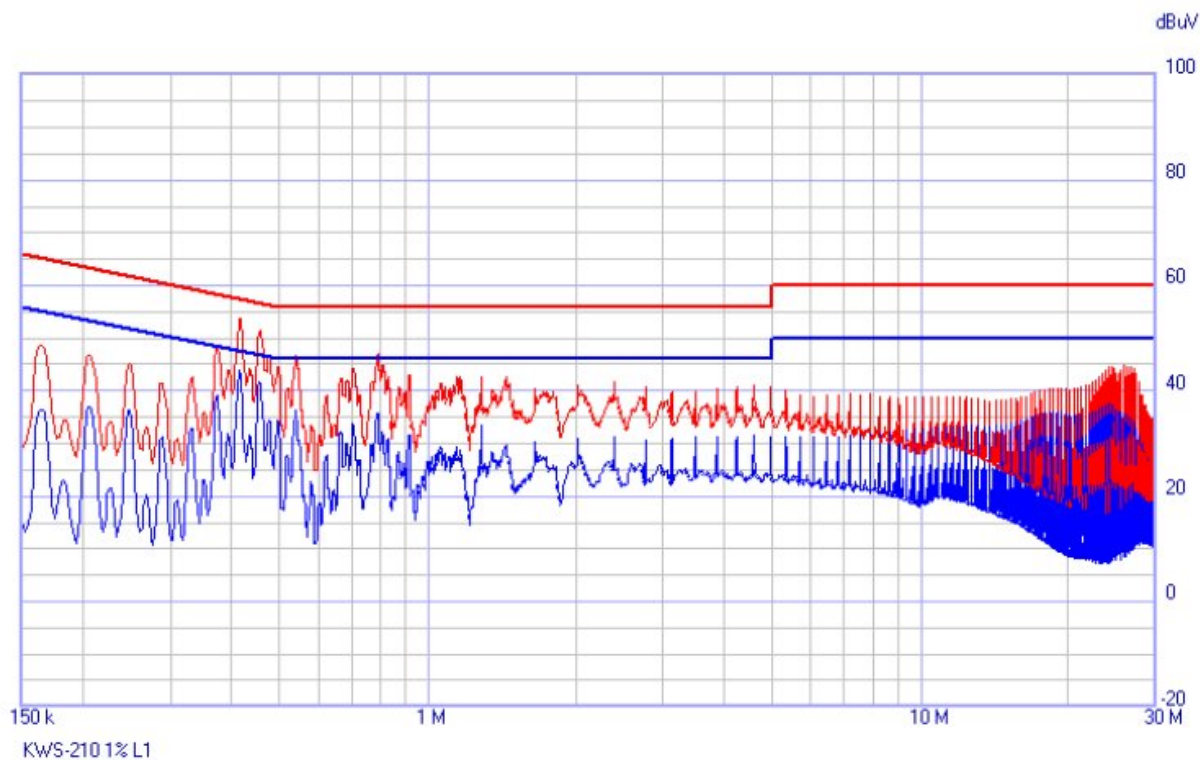
According to 15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the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

Frequency of Emission (MHz)	Conducted limit (dBμV/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

※ Remark

1. Decreases with the logarithm of the frequency.

Test results

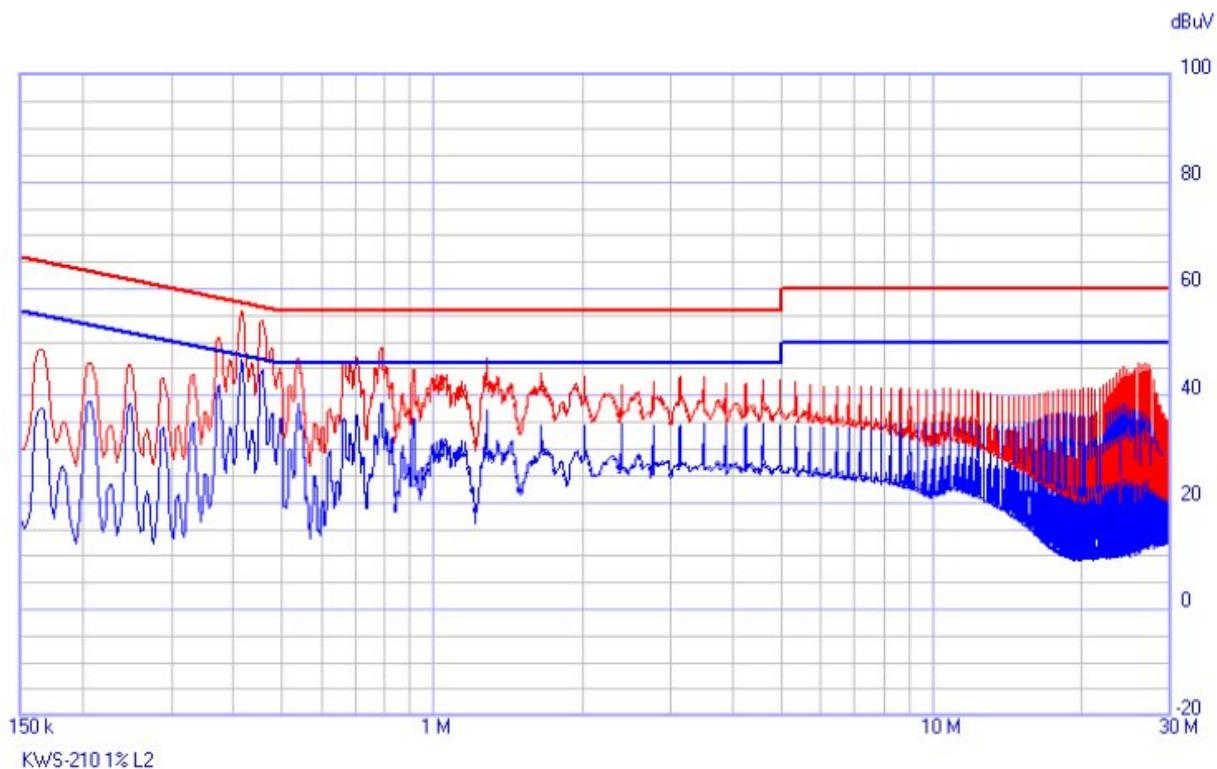


Mode: < 1% of Battery status

Frequency (MHz)	Result	
	QP (dBμV)	C-AVG (dBμV)
0.1643	48.52	36.39
0.4158	53.76	43.99
0.5406	46.58	35.42
0.7880	46.64	35.83
5.3197	39.86	31.21
25.8679	44.99	35.66

Note; Hot Line

Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).

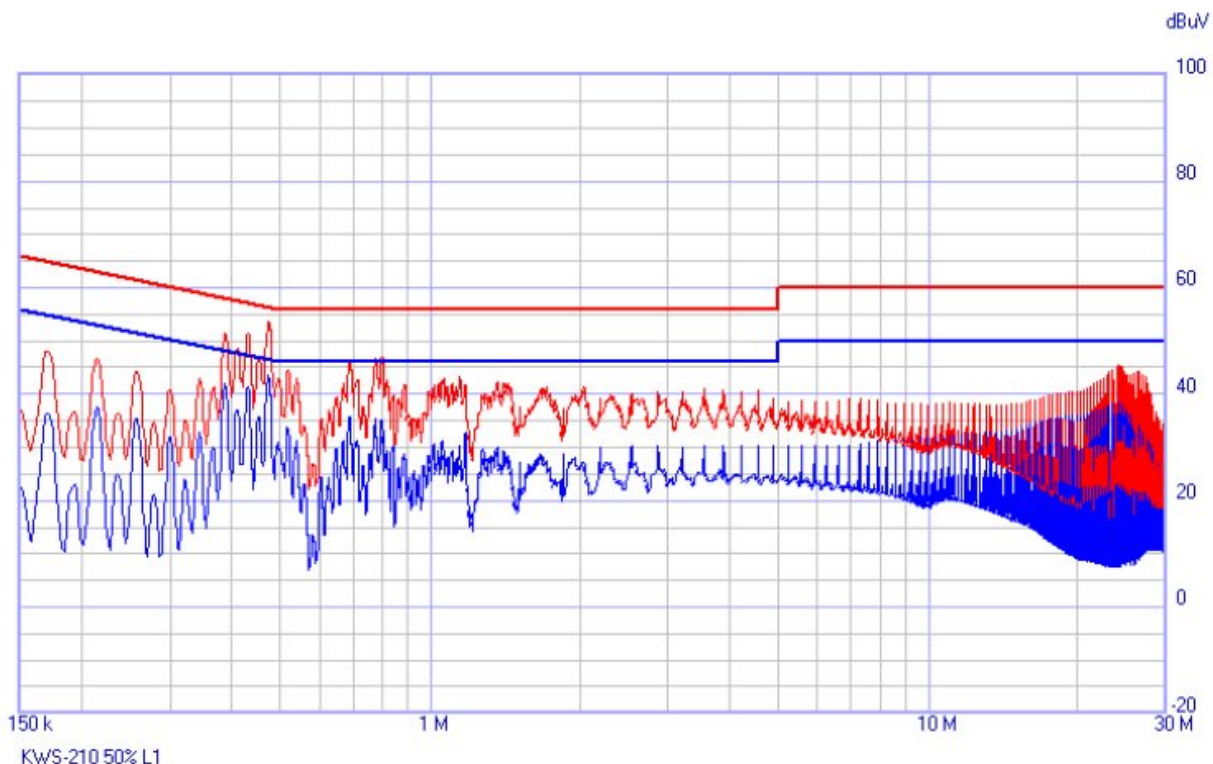


Mode: < 1% of Battery status

Frequency (MHz)	Result	
	QP (dBμV)	C-AVG (dBμV)
0.1643	48.56	37.64
0.4117	55.62	45.85
0.5365	47.18	38.51
0.7880	48.97	38.42
5.3177	42.66	34.45
25.8617	46.17	36.99

Note; Neutral Line

Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).

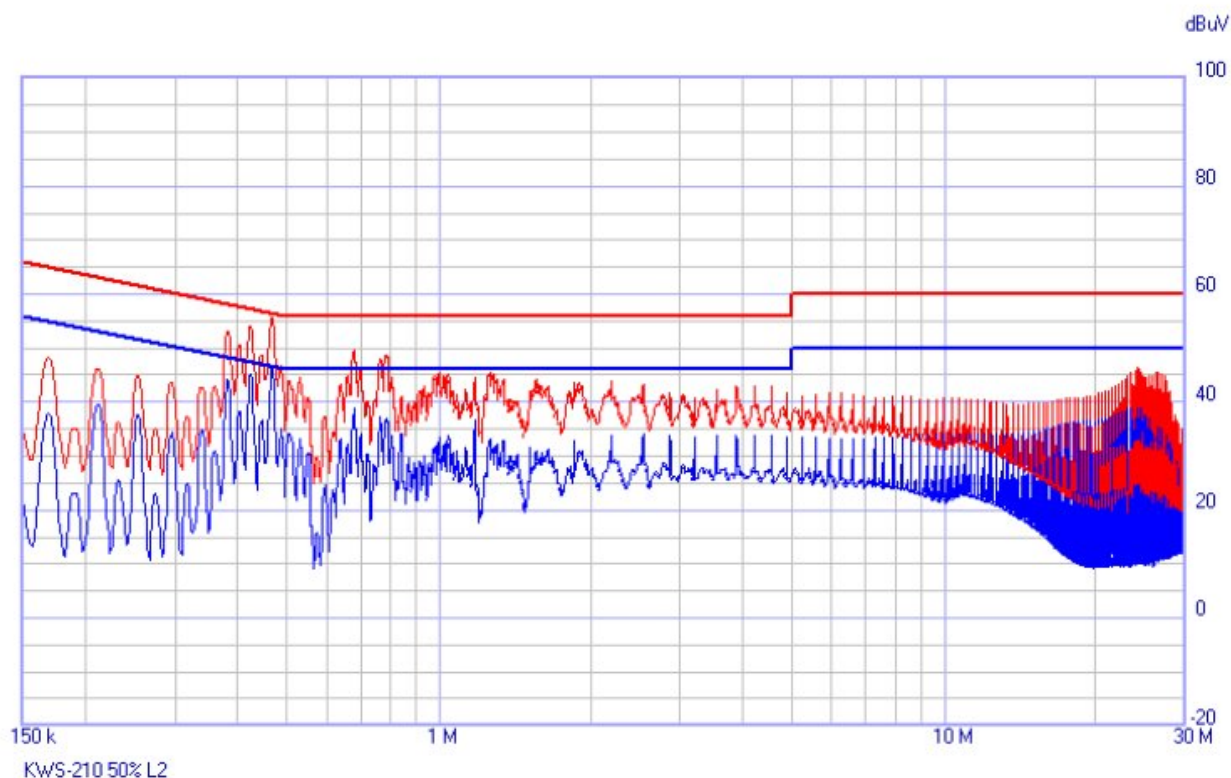


Mode: 50% of Battery status

Frequency (MHz)	Result	
	QP (dBμV)	C-AVG (dBμV)
0.1704	48.13	36.43
0.4731	53.54	43.65
0.6898	46.16	35.37
0.7982	47.10	34.81
5.5549	38.79	30.32
24.5816	44.36	35.64

Note; Hot Line

Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).

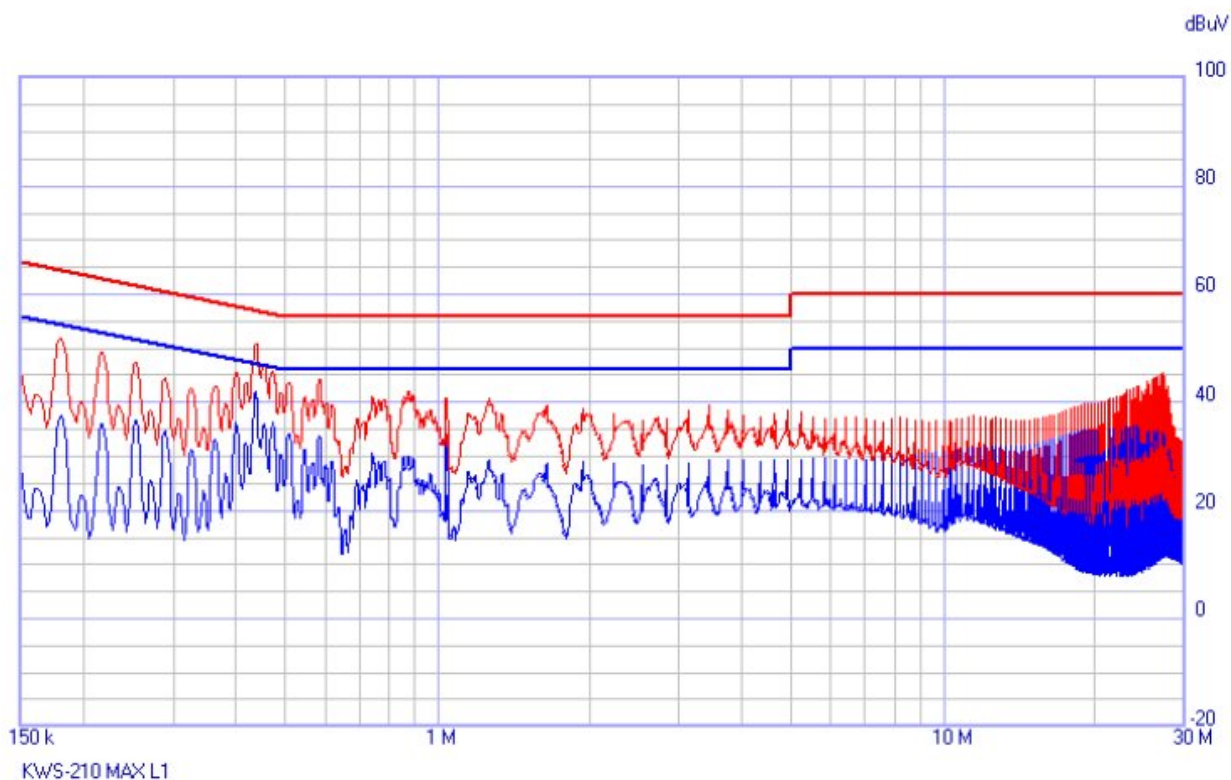


Mode: 50% of Battery status

Frequency (MHz)	Result	
	QP (dB μ V)	C-AVG (dB μ V)
0.1663	48.02	37.41
0.4649	55.70	46.04
0.6796	49.47	38.86
0.7859	48.68	37.08
5.8923	41.77	33.23
24.4159	45.62	38.70

Note; Neutral Line

Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).

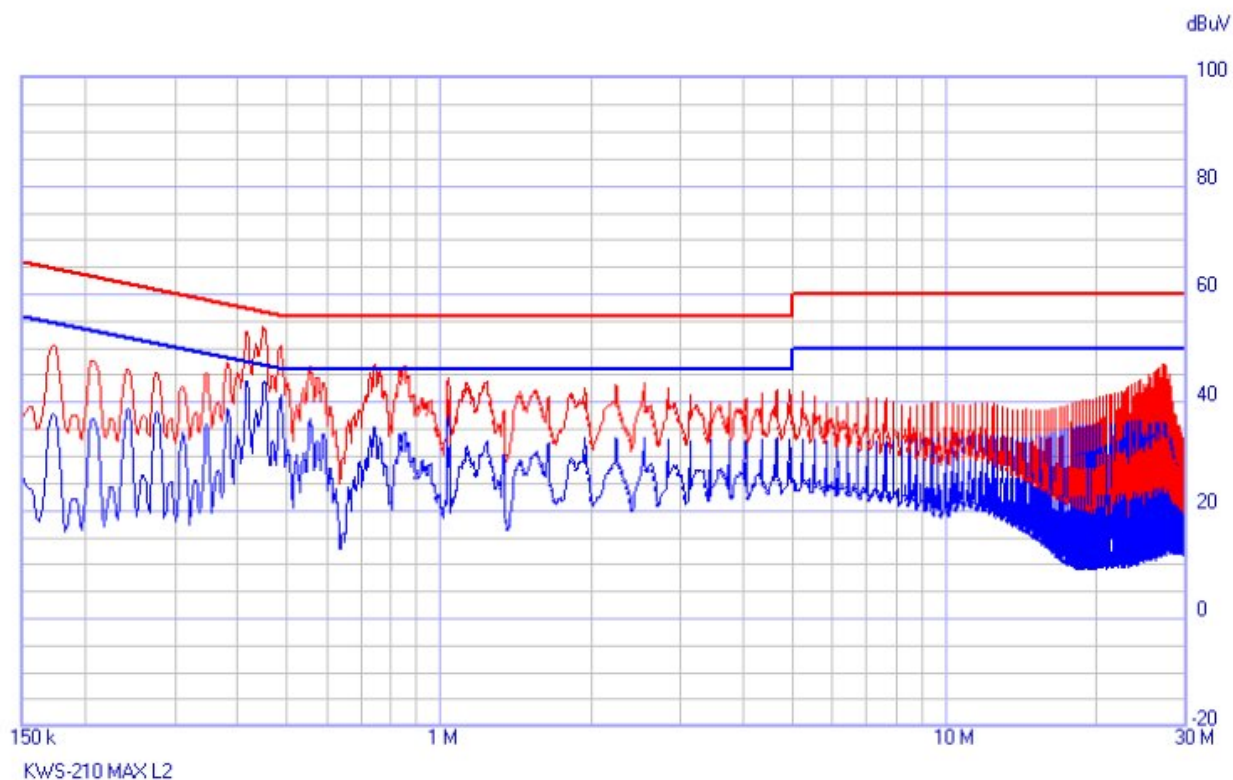


Mode: Using Max Load

Frequency (MHz)	Result	
	QP (dBμV)	C-AVG (dBμV)
0.1806	51.78	37.43
0.4363	50.97	41.87
0.5794	43.01	32.92
3.4915	35.10	21.83
5.2031	38.23	29.45
26.9476	45.38	34.53

Note; Hot Line

Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).

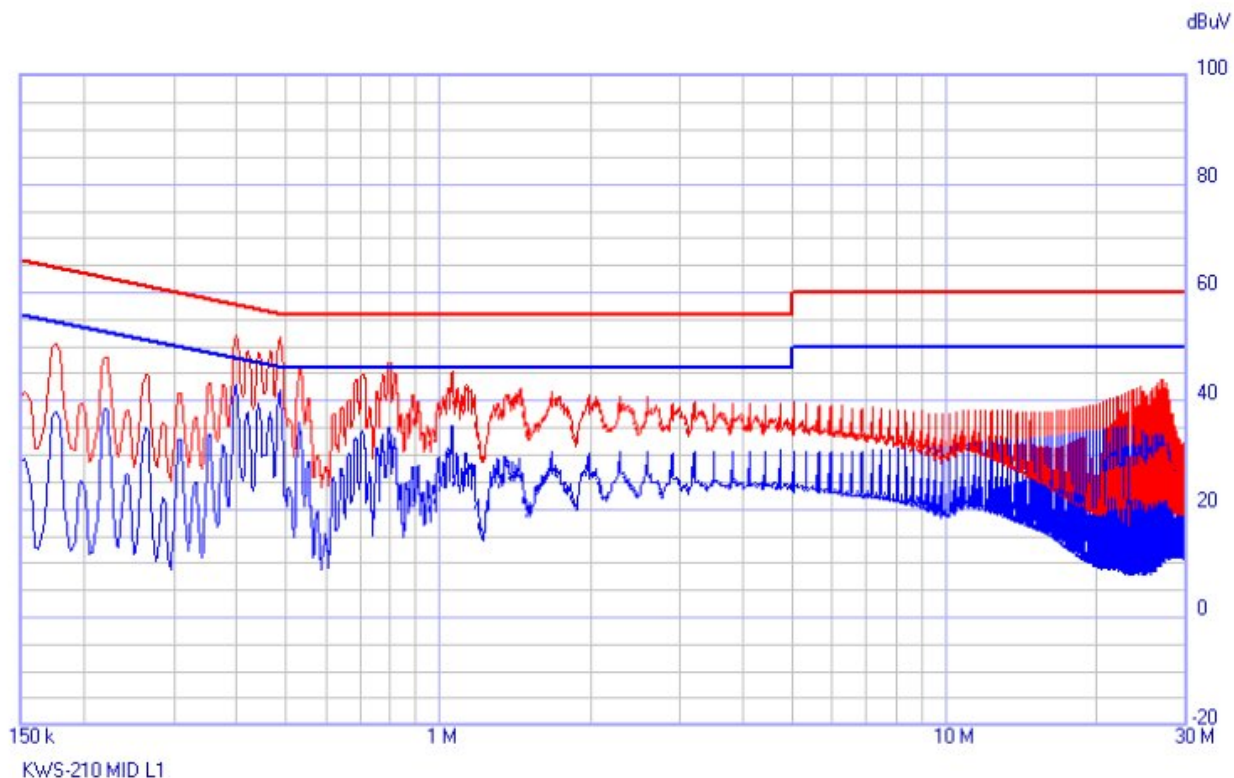


Mode: Using Max Load

Frequency (MHz)	Result	
	QP (dBμV)	C-AVG (dBμV)
0.1724	50.52	37.93
0.4485	53.85	43.15
0.5549	46.64	37.04
2.5855	38.76	27.53
5.2093	42.05	33.27
27.2442	46.68	35.94

Note; Neutral Line

Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).

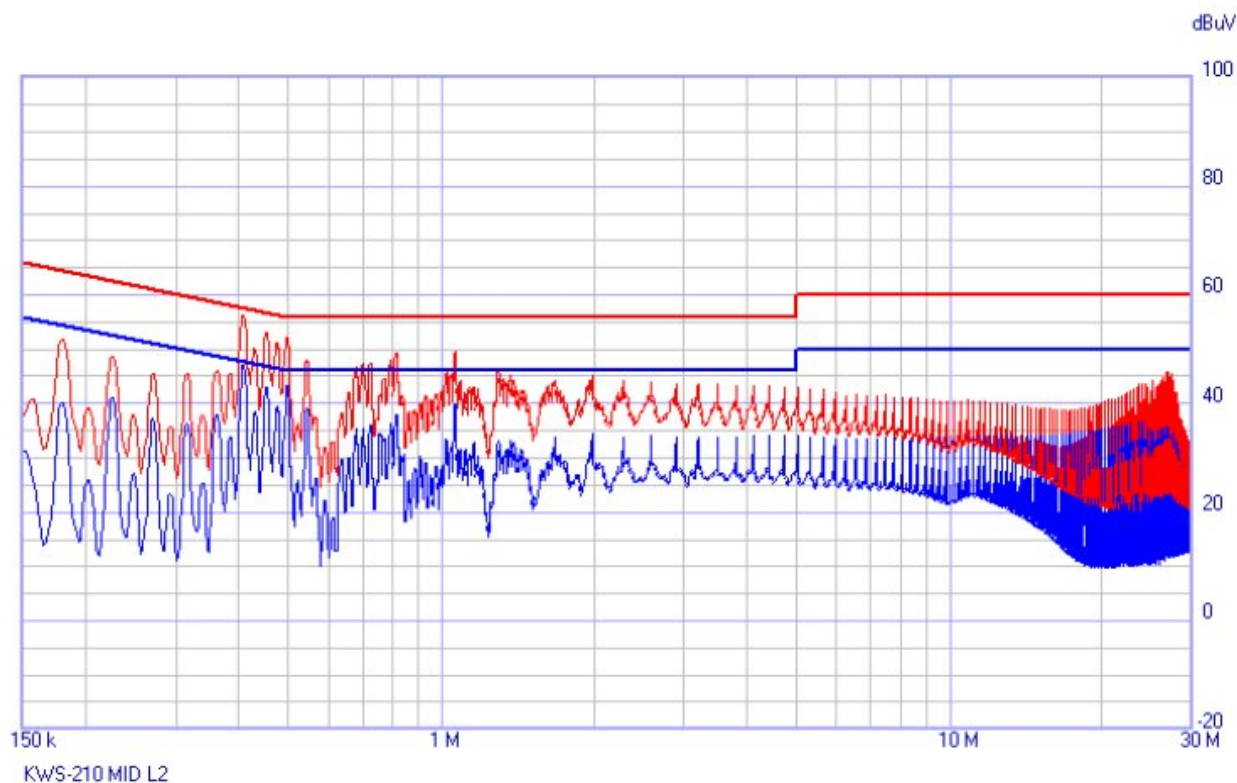


Mode: Using Mid Load

Frequency (MHz)	Result	
	QP (dBμV)	C-AVG (dBμV)
0.1745	50.54	38.05
0.3994	52.20	42.56
0.5344	45.73	33.50
0.7982	47.18	35.12
5.3095	39.35	30.73
27.1603	43.34	33.11

Note; Hot Line

Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).

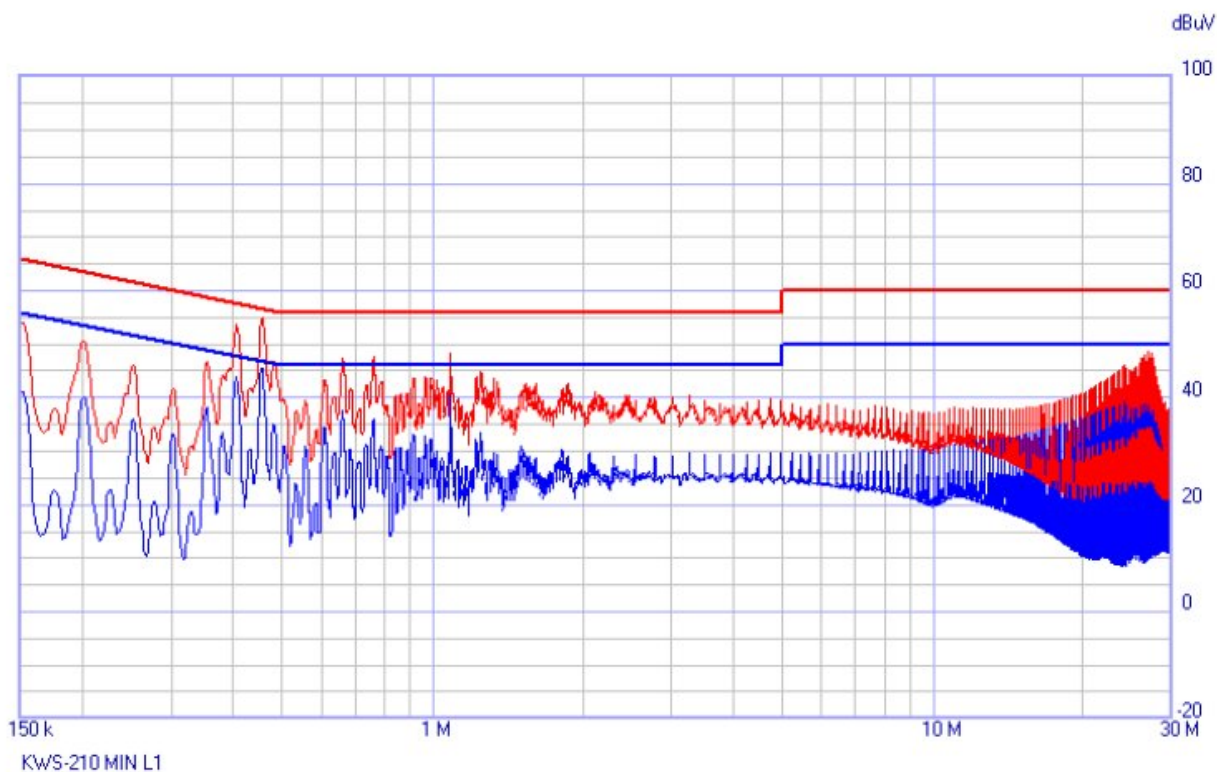


Mode: Using Mid Load

Frequency (MHz)	Result	
	QP (dBμV)	C-AVG (dBμV)
0.1786	51.82	40.23
0.4056	56.19	46.95
0.8146	49.17	38.03
1.0620	49.45	39.84
5.3136	42.71	33.80
26.8740	45.80	35.58

Note; Neutral Line

Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).

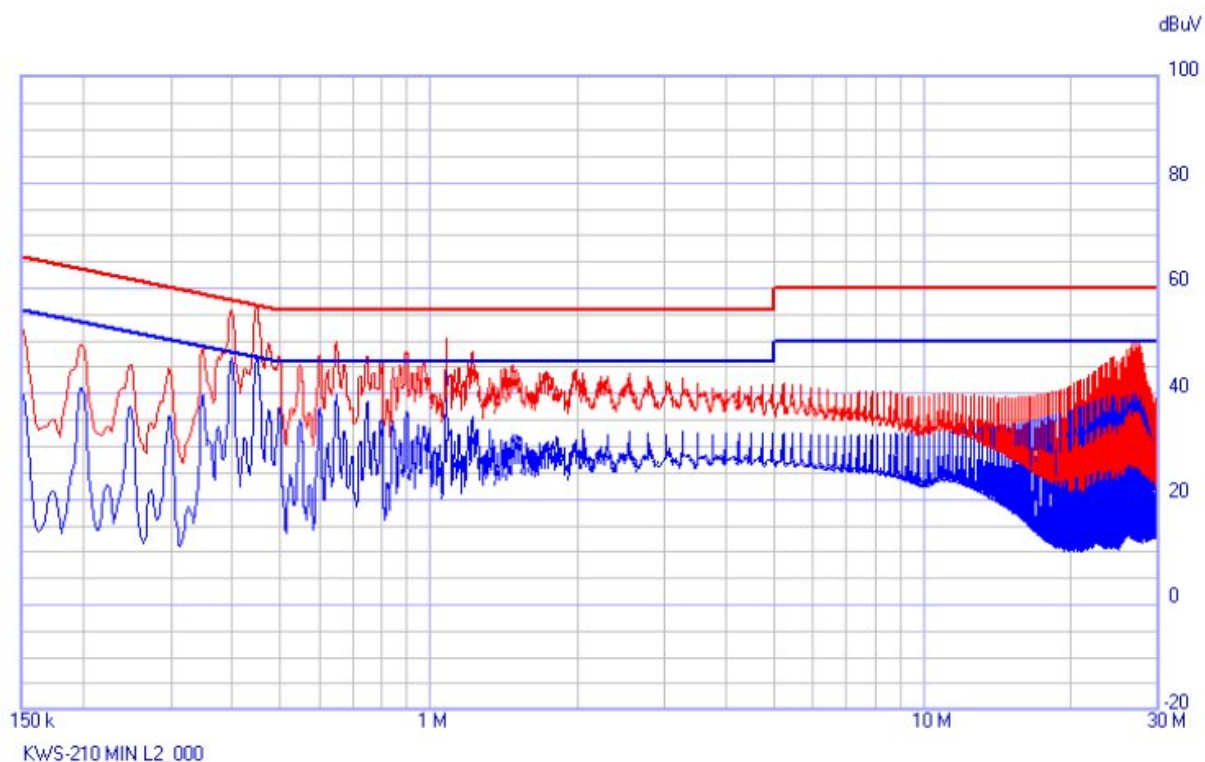


Mode: Using Min Load

Frequency (MHz)	Result	
	QP (dBμV)	C-AVG (dBμV)
0.1520	53.91	41.10
0.4547	54.57	45.33
0.6612	47.29	36.93
1.0845	48.46	40.39
5.3034	36.75	24.73
26.9047	48.64	38.68

Note; Hot Line

Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).



Mode: Using Min Load

Frequency (MHz)	Result	
	QP (dB μ V)	C-AVG (dB μ V)
0.1500	52.65	40.62
0.4485	56.09	46.42
0.6489	49.86	39.89
1.0825	50.57	44.20
5.1827	42.08	32.51
27.1276	49.80	40.05

Note; Neutral Line

Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).

Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial number	Cal Interval	Calibration due.
Spectrum analyzer	R&S	FSV30	101389	1 year	2015.04.30
Vector signal generator	R&S	SMBV2100A	1407.6004K02	1 year	2015.01.06
Radio Communication Tester	R&S	CMU200	107627	1 year	2014.12.27
Loop antenna	R&S	HFH2-Z2.335.4711.52	826532	2 years	2015.04.25
Trilog-broadband antenna	Schwarzbeck	VULB 9168	9168-385	2 years	2015.05.09
Preamplifier	HP	8447F	2805A02570	1 year	2015.04.30
AC power supply	HP	6813A	전-3-5-1292	1 year	2014.08.05
EMI Test Receiver	LIG NEX1	ISA-80	L0912K014	1 year	2014.11.15
EMI Receiver/Signal Analyzer	Narda S.T.S / PMM	PMM 9010F	020WW31006	1 year	2015.04.04
LISN	R&S	ENV216	101137	1 year	2015.02.21

Peripheral device

Device	Manufacturer	Model No.	Note
Wireless Charging Cover(with load)	KOMATECH Co.,Ltd.	N/A	-
Mobile Phone	SAMSUNG ELECTRONICS CO., LTD.	SHV-E210S (FCC ID : A3LSHVE210S)	-

-The above devices were supported by manufacturer.

Appendix B. Test setup photo

Radiated Emission (below 30 MHz_with Load)



Radiated Emission ((below 30 MHz_with Phone)



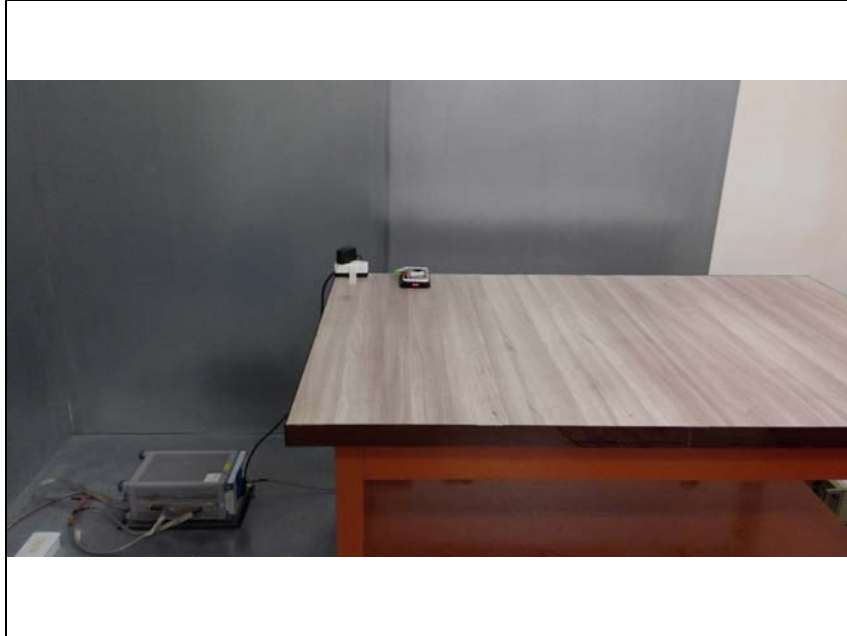
Radiated Emission (below 1 GHz_with Load)



Radiated Emission ((below 1 GHz_with Phone)



AC conducted Emission (with Load)



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The test results in the report only apply to the tested sample.

AC conducted Emission (with Phone)

