



TEST REPORT

Part 15 Subpart B&C 15.225

Equipment under test Balance Inquiry

Model name KSCC-CB-I100

FCC ID RTQKSCCCBI100

Applicant LG CNS Co., Ltd.

Manufacturer ATEC Co., Ltd.

Date of test(s) 2012.03.07 ~ 2012.04.17

Date of issue 2012.04.20

Issued to



LG CNS CO., LTD.

Prime Tower, #10-1, Hoehyun-dong, 2-ga, Jung-gu, Seoul, South Korea

Issued by

KES Co., Ltd.

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Revision history

Revision	Date of issue	Test report No.	Description
-	2012.04.20	KES-RF-120031	Initial



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1.0 General product description

Equipment under test	Balance Inquiry
Model name	KSCC-CB-I100
Serial number	N/A
Frequency Range	13.561 MHz
Modulation technique	ASK
Number of channels	1
Antenna type	Loop antenna
Power source	AC 110 V

1.1 Test frequency

	Low channel	Middle channel	High channel
Frequency (MHz)	13.561	N/A	N/A

1.2 Model differences

N/A

1.3 Device modifications

Please refer to the attestation letter. (Device modification letter)



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1.4 Test facility




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The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.5 Test measurement procedure

The measurement procedure described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.4-2003).

1.6 Laboratory accreditations and listings

Country	Agency	Scope of accreditation	Logo
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



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2.0 Summary of tests

Section in FCC Part 15	Parameter	Status
15.225(a)	The field strength of fundamental	C
15.225(b)(c)	The field strength of spurious emission(In-band)	C
15.225(d) 15.209	The field strength of spurious emission(Out-band)	C
15.225(e)	The frequency tolerance	C
15.215(c)	20 dB bandwidth	C
15.207	AC conducted emission	C
Note 1: C=Complies NC=Not complies NT=Not tested NA=Not applicable		



2.1 Test data

2.1.1 Fundamental, 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 for Quasi-peak detection (QP) at frequency below 9 kHz~ 150 kHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 9 kHz for Quasi-peak detection (QP) at frequency below 150 kHz~ 30 MHz.

[30 MHz to 1 GHz]

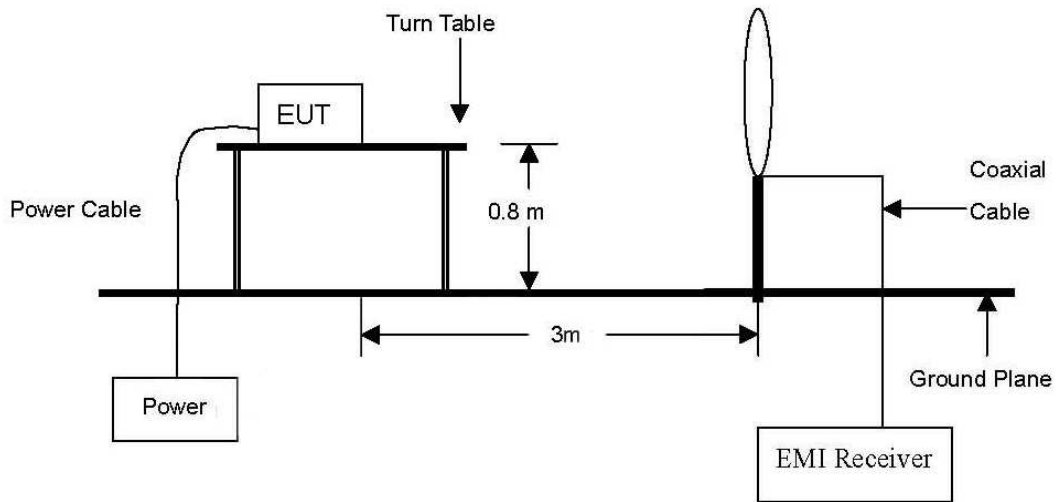
The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity.

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

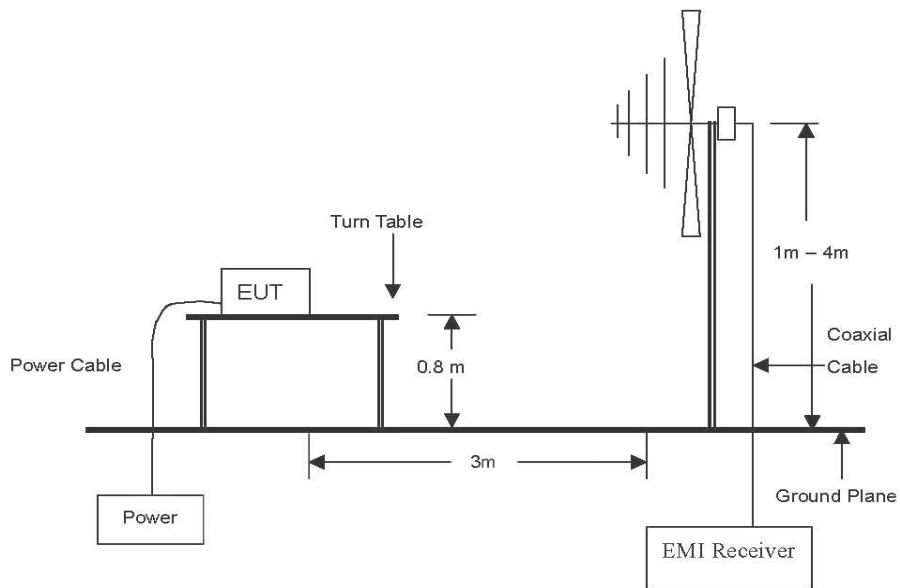
The spectrum analyzer is set to:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 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

In the section 15.209:

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)	Distance (Meters)	Radiated ($\mu\text{V}/\text{m}$)
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.

In the section 15.225:

- (a) The field strength of any emissions within the band 13.553 ~ 13.567 MHz shall not exceed 15,848 microvolts/meter (= 84 dB $\mu\text{V}/\text{m}$) at 30 meters.
- (b) Within the bands 13.410 ~ 13.553 MHz and 13.567 ~ 13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter (=50.5 dB $\mu\text{V}/\text{m}$) at 30 meters.
- (c) Within the bands 13.110 ~ 13.410 MHz and 13.710 ~ 14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter (=40.5 dB $\mu\text{V}/\text{m}$) at 30 meters.
- (d) The field strength of any emissions appearing outside of the 13.110 ~ 14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.
- (e) The frequency tolerance of the carrier signal shall be maintained within +/-0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

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Test results for fundamental

Radiated emissions		Ant.	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Distance (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
13.561	46.07	H	18.30	0.57	-40	24.94	84.00	59.06
13.561	50.01	V	18.30	0.57	-40	28.88	84.00	55.12

Test results for in-band & out-band(9 MHz to 14.010 MHz)

Radiated emissions		Ant.	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Distance (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
8.413	14.94	H	18.17	0.49	-40	-6.40	29.54	35.94
8.413	14.81	V	18.17	0.49	-40	-6.53	29.54	36.07

Test results for in-band & out-band(14.010 MHz to 30 MHz)

Radiated emissions		Ant.	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Distance (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
16.536	15.65	H	18.60	0.62	-40	-5.13	29.54	34.67
16.536	15.55	V	18.60	0.62	-40	-5.23	29.54	34.77

※ Remark

1. Actual = Reading + Ant. factor + Cable loss + Distance
2. Distance correction below 30 MHz = $40\log(3\text{ m}/30\text{ m})$
Measurement distance: 3 m
3. Detector mode: Quasi peak
4. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.



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Test results (Below 1000 MHz)

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)
42.10	23.74	H	13.37	1.25	38.35	40.00	1.65
42.10	23.41	V	13.37	1.25	38.02	40.00	1.98
56.70	23.50	V	13.29	1.40	38.19	40.00	1.81
68.80	25.40	V	11.75	1.52	38.67	40.00	1.33
93.10	31.72	V	8.02	1.83	41.57	43.50	1.93
119.70	28.38	V	11.19	2.07	41.64	43.50	1.86
170.70	24.25	V	12.42	2.52	39.19	43.50	4.31
226.40	22.05	H	10.85	3.09	36.00	46.00	10.00
228.90	23.22	V	10.94	3.11	37.27	46.00	8.73
284.60	21.77	H	12.84	3.51	38.12	46.00	7.88
340.40	18.03	H	14.27	3.88	36.18	46.00	9.82
367.10	17.83	H	14.87	4.04	36.74	46.00	9.26
476.20	17.17	H	17.23	4.69	39.09	46.00	6.91
502.90	22.00	H	17.79	4.85	44.64	46.00	1.36
774.50	11.15	H	21.99	6.21	39.34	46.00	6.66
786.60	10.01	H	22.17	6.27	38.45	46.00	7.55
878.80	13.09	H	23.07	6.69	42.84	46.00	3.16
878.80	9.59	V	23.07	6.69	39.34	46.00	6.66

※ Remark

1. Actual = Reading + Ant. factor + Cable loss
2. Detector mode: Quasi peak
3. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.



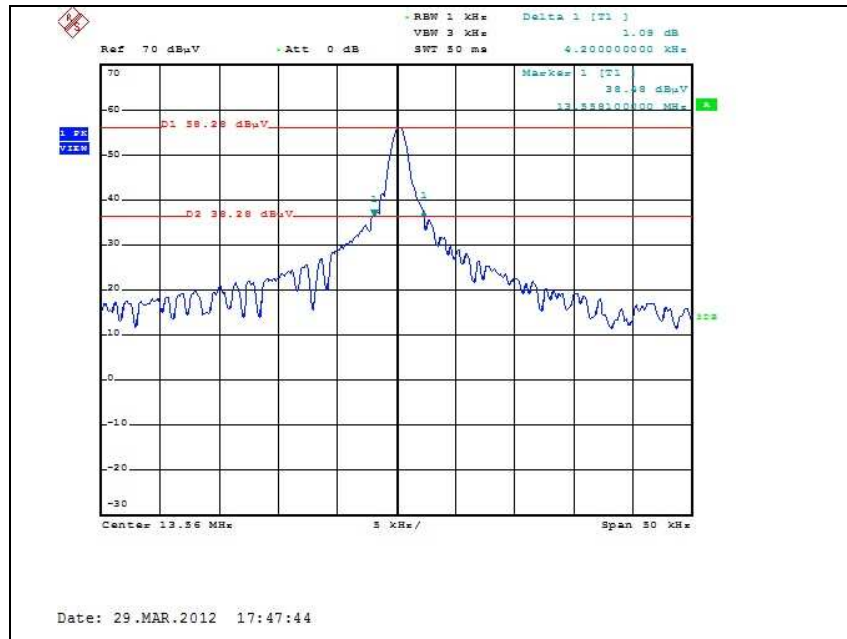
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2.1.2 20 dB bandwidth

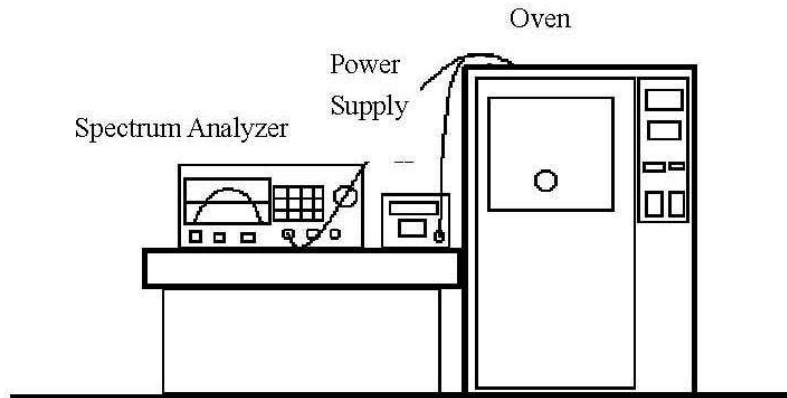
Test setup: The EUT was connected to a spectrum analyzer.

Test procedure: The 20 dB bandwidth was measured by using a spectrum analyzer.



2.1.3 Frequency tolerance

Test setup



Test procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. The transmission time was measured with the spectrum analyzer using RBW=1 kHz, VBW=1 kHz.
3. Set the temperature of chamber to -20°C. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a 10°C decreased per stage until the highest temperature 50°C is measured, record all measured frequencies on each temperature step.

Limit

According to FCC Part 15 Section 15.225 (e),

The frequency tolerance of the carrier signal shall be maintained within +/-0.01 % of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85 % to 115 % of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.



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Test results

Test voltage (%)	Test voltage (V)	Temperature (°C)	Measure frequency (MHz)	Frequency deviation (Hz)	Deviation (%)
100 %	AC 110	-20	13.560 884	884	65.192
100 %		-10	13.560 912	912	67.257
100 %		0	13.560 841	841	62.021
100 %		10	13.560 742	742	54.720
100 %		20	13.561 032	1032	76.106
100 %		30	13.560 740	740	54.572
100 %		40	13.560 877	877	64.676
100 %		50	13.560 919	919	67.773
85 %		AC 93.5	20	13.560 810	810
115 %	AC 126.5	20	13.560 913	913	67.330



2.1.4 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 (dB μ V/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

Decreases with the logarithm of the frequency.

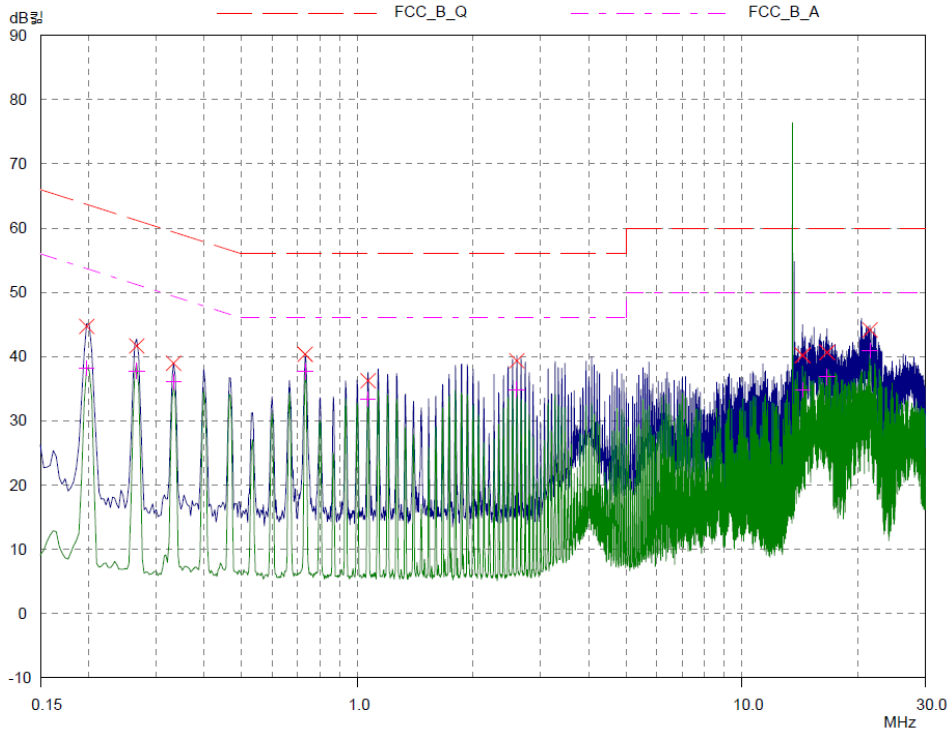
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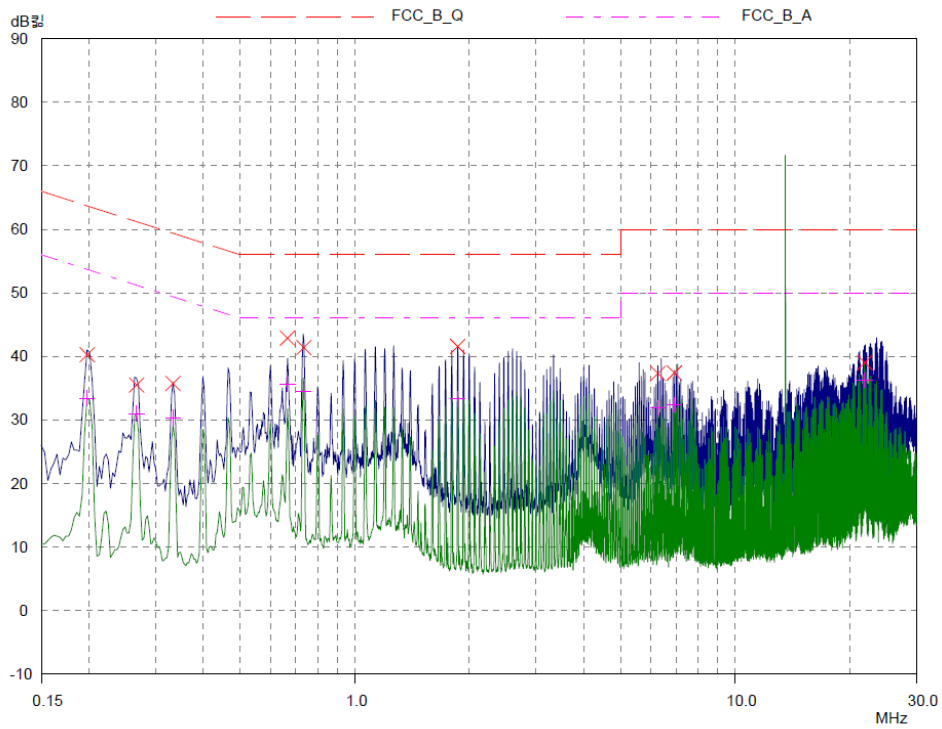
Test results

Frequency (MHz)	Correction		Phase Hot/ Neutral	Quasi peak			Average		
	LISN	Cable Loss		Reading	Result	Limit	Reading	Result	Limit
0.198	9.529	0.035	H	35.106	44.670	63.694	28.666	38.230	53.694
0.198	9.540	0.035	N	30.665	40.240	63.694	23.855	33.430	53.694
0.267	9.537	0.035	H	32.088	41.660	61.211	28.178	37.750	51.211
0.267	9.547	0.035	N	25.908	35.490	61.211	21.448	31.030	51.211
0.333	9.543	0.034	H	29.363	38.940	59.376	26.533	36.110	49.376
0.333	9.553	0.034	N	26.163	35.750	59.376	20.773	30.360	49.376
0.666	9.560	0.045	N	33.275	42.880	56.000	26.005	35.610	46.000
0.732	9.541	0.049	H	30.770	40.360	56.000	28.050	37.640	46.000
0.735	9.561	0.049	N	31.770	41.380	56.000	24.920	34.530	46.000
1.068	9.551	0.056	H	26.633	36.240	56.000	23.803	33.410	46.000
1.866	9.570	0.077	N	31.923	41.570	56.000	23.633	33.280	46.000
2.601	9.566	0.089	H	29.665	39.320	56.000	25.205	34.860	46.000
6.267	9.625	0.161	N	27.543	37.330	60.000	22.083	31.870	50.000
6.933	9.639	0.176	N	27.585	37.400	60.000	22.605	32.420	50.000
14.412	9.684	0.204	H	30.292	40.180	60.000	24.932	34.820	50.000
16.680	9.707	0.227	H	30.706	40.640	60.000	26.916	36.850	50.000
21.549	9.746	0.280	H	34.124	44.150	60.000	30.894	40.920	50.000
21.936	10.135	0.282	N	28.603	39.020	60.000	25.833	36.250	50.000

[Hot]



[Neutral]





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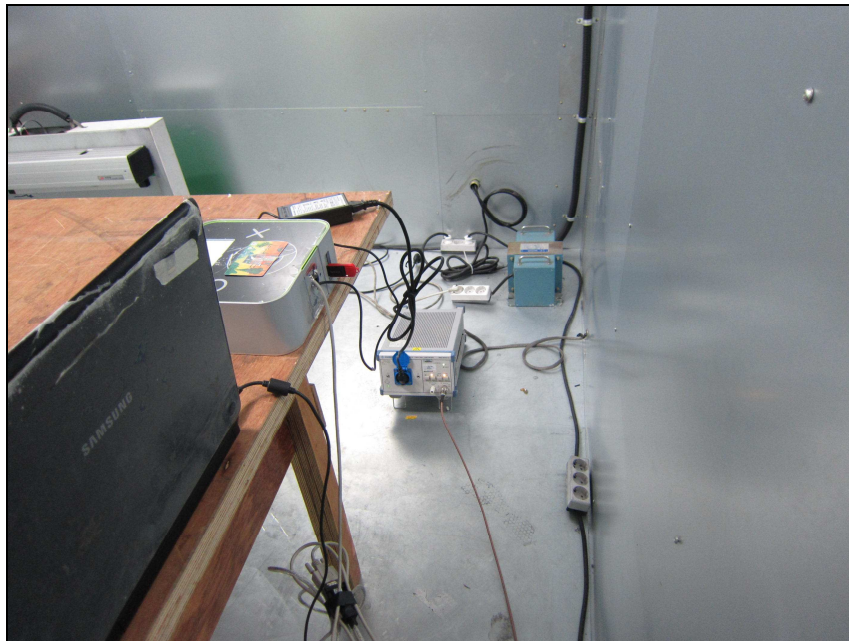
Appendix A. Test equipment used for test

Equipment	Manufacturer	Model	Calibration due.
Spectrum Analyzer	R&S	FSP	2012.05.04
AC Power Supply	DAEGWANG	3-5-1292	2012.08.04
Loop Antenna	R&S	HFH2-Z2.335.4711.52	2013.03.10
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	2013.04.28
Temperature chamber	TABAI	MC711P	2012.05.06
EMI Test Receiver	Agilent	E7405A	2012.08.22
EMI Test Receiver	R&S	ESHS10	2012.05.09
LISN	R&S	ENV216	2013.02.27

Peripheral device

Device	Manufacturer	Model No.	Serial No.
Netbook	Lenovo	S10-2	2957N5K

Appendix B. Test setup photos





N/A