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# TEST REPORT

## Part 15 Subpart B&C 15.247

**Equipment under test** NS2U

**Model name** NS Zigbee Coordinator

**FCC ID** OCWNS-ZIGCOORDI

**Applicant** NStech Co., Ltd.

**Manufacturer** SystemBase Co., Ltd.

**Date of test(s)** 2012.06.27 ~ 2012.07.05

**Date of issue** 2012.07.06

**Issued to**

**NStech Co., Ltd.**

USA Distribution Center 1320 S. Priest Drive, Suite 104, Tempe, United States

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### Revision history

Revision	Date of issue	Test report No.	Description
-	2012.07.06	KES-RF-120050	Initial



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### 1.0 General product description

Equipment under test	NS2U
Model name	NS Zigbee Coordinator
Serial number	N/A
Zigbee module FCC ID	UNTRP-M100A
Frequency Range	2 405 MHz ~ 2 480 MHz
Modulation technique	DSSS
Number of channels	16
Antenna type &gain	Unique type(Dipole antenna) // 5 dBi
Power source	AC 120 V

### 1.1 Test frequency

	Low channel	Middle channel	High channel
Frequency (MHz)	2 405	2 445	2 480

### 1.2 Information about variant model

N/A

### 1.3 Device modifications

N/A



#### 1.4 Test facility

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

#### 1.5 Laboratory accreditations and listings

Country	Agency	Scope of accreditation	Logo
USA	FCC	3 & 10 meter Open Area Test Site 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 Site and one conducted site	 4769B-1



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### 2.0 Summary of tests

Section in FCC Part 15	Parameter	Status
15.205 15.209	Radiated spurious emission and band edge	C

Note 1: C=Complies NC=Not complies NT=Not tested NA=Not applicable

## 2.1 Test data

### 2.1.1 Radiated spurious emission & band edge

#### Test location

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

#### Test procedures

Radiated emissions were measured according to the KDB 558074 D01.

The testing was performed in accordance to ANSI C63.4-2003/2009

[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 and 1 GHz to 24 GHz]

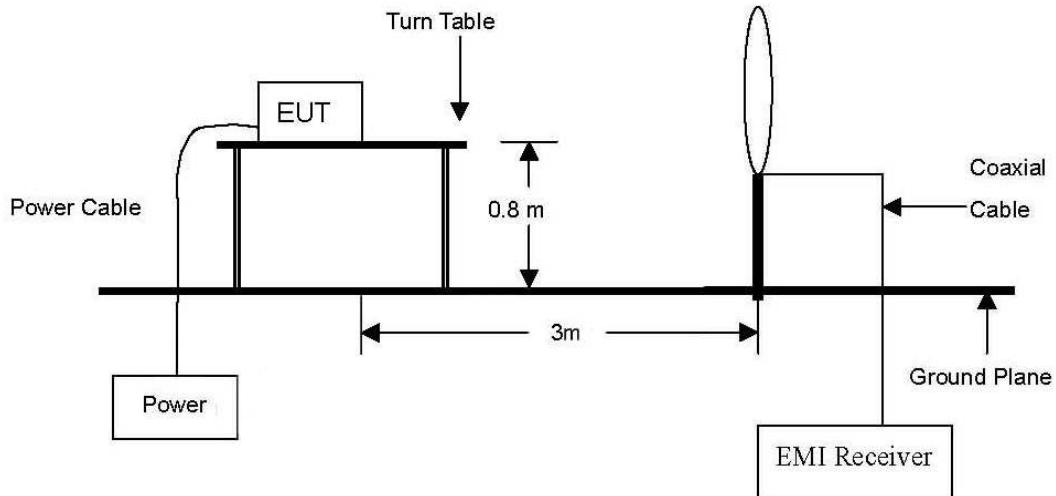
The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity.

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

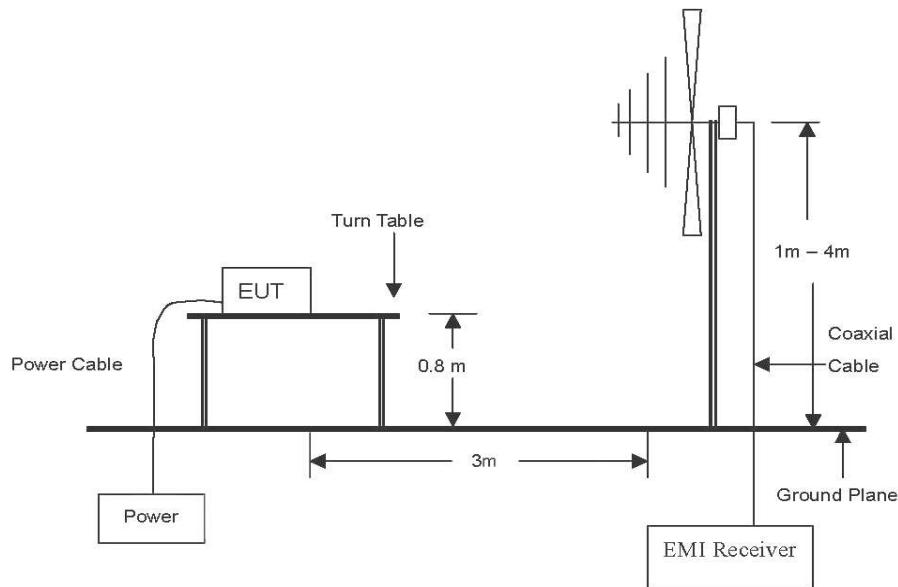
The spectrum analyzer is set to:

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.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1 GHz.

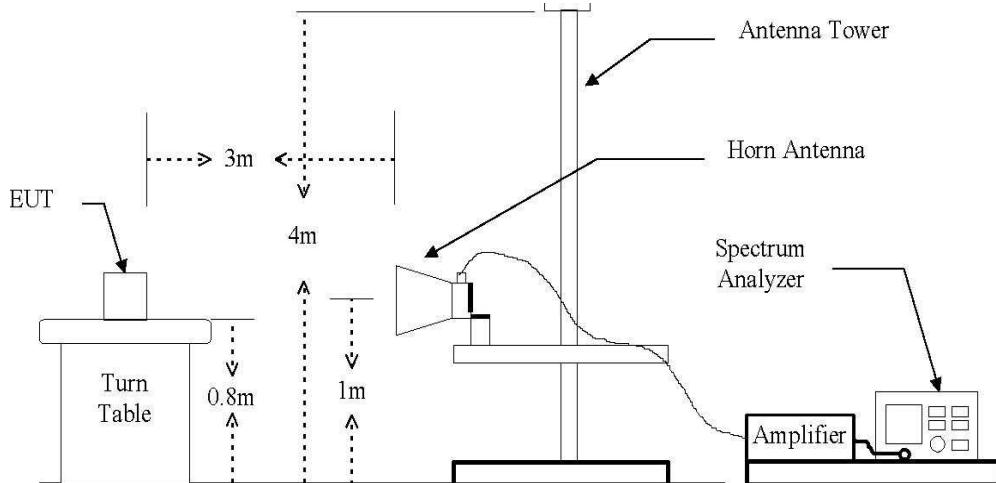
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions.



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



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 24 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 ( $\mu$ 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.



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### Test results (Below 30 MHz)

The frequency spectrum from 9 kHz to 30 MHz was investigated. Emission levels are not reported much lower than the limits by over 20 dB.

Radiated emissions		Ant.	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	F <sub>d</sub> (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
The emission level is very lower than the limit by over 20 dB								

#### \* Remark

1. All spurious emission at channels are almost the same below 30 MHz, so that middle channel was chosen at representative in final test.
2. Actual = Reading + Ant. factor + Cable loss + F<sub>d</sub>
3. F<sub>d</sub> = 40log(D<sub>m</sub> / D<sub>s</sub>)

Where:

F<sub>d</sub> = Distance factor in dB  
D<sub>m</sub> = Measurement distance in meters  
D<sub>s</sub> = Specification distance in meters



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### Test results (Below 1 000 MHz)

The frequency spectrum from 30 MHz to 1 000 MHz was investigated. Emission levels are not reported much lower than the limits by over 20 dB.

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
51.8	27.06	V	13.60	1.34	42.00	43.00	1.00
107.6	28.83	H	9.63	1.97	40.43	43.50	3.07
131.9	25.95	H	12.09	2.17	40.22	43.50	3.28
131.9	26.72	V	12.09	2.17	40.99	43.50	2.51
250.7	24.84	H	11.69	3.29	39.83	46.00	6.17
265.2	27.43	H	12.18	3.39	43.00	46.00	3.00
265.2	28.96	V	12.18	3.39	44.53	46.00	1.47
274.9	28.44	H	12.51	3.45	44.40	46.00	1.60
274.9	26.49	V	12.51	3.45	42.45	46.00	3.55
301.6	24.94	H	13.40	3.62	41.96	46.00	4.04
325.9	26.84	H	13.94	3.78	44.56	46.00	1.44
325.9	23.81	V	13.94	3.78	41.53	46.00	4.47
376.8	25.09	H	15.09	4.09	44.27	46.00	1.73
396.2	24.67	H	15.52	4.20	44.39	46.00	1.61
396.2	24.45	V	15.52	4.20	44.17	46.00	1.83
551.4	16.89	H	18.76	5.08	40.73	46.00	5.27
660.5	18.54	V	20.40	5.62	44.56	46.00	1.44
924.8	13.08	V	23.44	6.89	43.40	46.00	2.60
51.8	27.06	V	13.60	1.34	42.00	43.00	1.00

### \* Remark

1. All spurious emission at channels are almost the same below 1 GHz, so that middle channel was chosen at representative in final test.
2. Actual = Reading + Ant. factor + Amp + CL (Cable loss)
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 (Above 1 000 MHz)

#### Low channel

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB $\mu$ N)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dB $\mu$ N/m)	Limit (dB $\mu$ N/m)	Margin (dB)
2 390.0	55.77	Peak	H	28.31	-38.88	45.20	74.00	28.80
2 390.0	42.63	Average	H	28.31	-38.88	32.06	54.00	21.94
2 390.0	55.58	Peak	V	28.31	-38.88	45.01	74.00	28.99
2 390.0	42.68	Average	V	28.31	-38.88	32.11	54.00	21.89
4 810.0	68.34	Peak	H	33.92	-31.64	70.62	74.00	3.38
4 810.0	48.74	Average	H	33.92	-31.64	51.02	54.00	2.98
4 810.0	70.33	Peak	V	33.92	-31.64	72.61	74.00	1.39
4 810.0	49.44	Average	V	33.92	-31.64	51.72	54.00	2.28

#### Middle channel

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB $\mu$ N)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dB $\mu$ N/m)	Limit (dB $\mu$ N/m)	Margin (dB)
4 890.0	65.59	Peak	V	34.19	-31.02	68.76	74.00	5.24
4 890.0	48.52	Average	V	34.19	-31.02	51.69	54.00	2.31
4 890.0	70.16	Peak	H	34.19	-31.02	73.33	74.00	0.67
4 890.0	49.47	Peak	V	34.19	-31.02	52.64	54.00	1.36



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### High channel

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB $\mu$ N)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dB $\mu$ N/m)	Limit (dB $\mu$ N/m)	Margin (dB)
2 483.5	67.43	Peak	V	28.50	-38.73	57.20	74.00	16.80
2 483.5	53.06	Average	V	28.50	-38.73	42.83	54.00	11.17
2 483.5	67.32	Peak	H	28.50	-38.73	57.09	74.00	16.91
2 483.5	53.20	Peak	V	28.50	-38.73	42.97	54.00	11.03
4 960.0	65.03	Peak	V	34.42	-30.47	68.98	74.00	5.02
4 960.0	47.96	Average	V	34.42	-30.47	51.91	54.00	2.09
4 960.0	69.60	Peak	H	34.42	-30.47	73.55	74.00	0.45
4 960.0	48.91	Peak	V	34.42	-30.47	52.86	54.00	1.14

#### ※ Remark

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.
4. Actual = Reading + Ant. factor + Amp + CL (Cable loss)
5. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

## 2.1.8 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 $\mu$ 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.



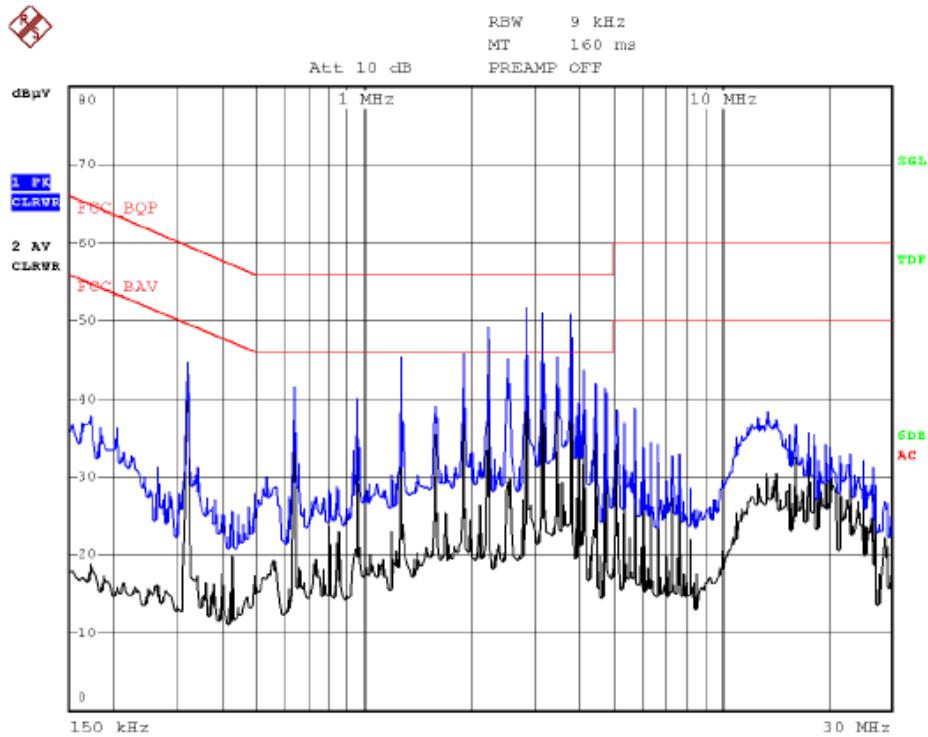
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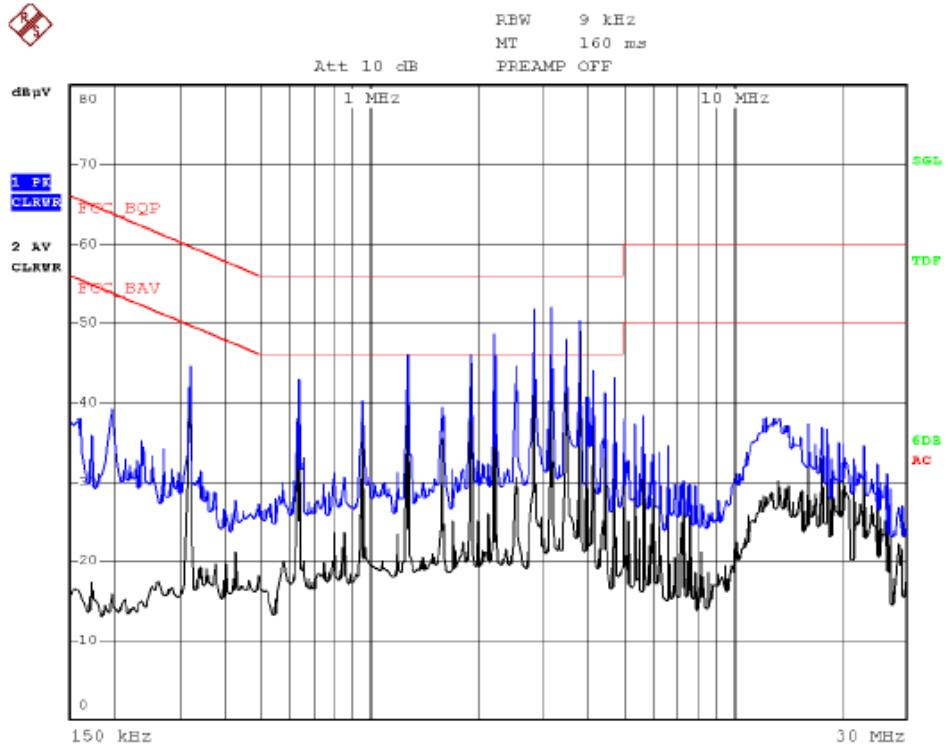
### Test results

Frequency (MHz)	Correction		Phase Hot/ Neutral	Quasi peak			Average		
	LISN	Cable Loss		Reading	Result	Limit	Reading	Result	Limit
0.150	0.56	0.01	Hot	33.87	34.44	<b>66.00</b>	18.25	18.82	<b>56.00</b>
0.318	0.47	0.02	Hot	43.07	43.56	<b>59.76</b>	13.27	13.76	<b>49.76</b>
0.638	0.48	0.02	Hot	37.63	38.14	<b>56.00</b>	37.64	38.15	<b>46.00</b>
2.226	0.55	0.06	Hot	40.37	40.98	<b>56.00</b>	39.75	40.36	<b>46.00</b>
3.178	0.56	0.07	Hot	42.83	43.46	<b>56.00</b>	40.32	40.95	<b>46.00</b>
3.814	0.56	0.08	Hot	33.96	34.60	<b>56.00</b>	31.35	31.99	<b>46.00</b>
0.150	0.46	0.01	Neutral	33.65	34.12	<b>66.00</b>	16.84	17.31	<b>56.00</b>
0.318	0.29	0.02	Neutral	42.84	43.15	<b>59.76</b>	42.85	43.16	<b>49.76</b>
1.270	0.23	0.04	Neutral	41.15	41.43	<b>56.00</b>	40.64	40.92	<b>46.00</b>
2.218	0.26	0.05	Neutral	45.97	46.29	<b>56.00</b>	42.51	42.83	<b>46.00</b>
3.718	0.30	0.08	Neutral	43.26	43.63	<b>56.00</b>	41.73	42.10	<b>46.00</b>
3.802	0.30	0.08	Neutral	44.35	44.73	<b>56.00</b>	42.26	42.64	<b>46.00</b>

**[Hot]**



**[Neutral]**





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### Appendix A. Test equipment used for test

Equipment	Manufacturer	Model	Calibration due.
Spectrum Analyzer	R&S	FSV30	2013.01.10
Vector Signal Generator	R&S	SMBV2100A	2013.01.10
Signal Generator	HP	8360B	2013.06.06
Loop Antenna	R&S	HFH2-Z2.335.4711.52	2013.03.10
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	2013.10.25
Horn Antenna	A.H. System	SAS-571	2013.03.22
High Pass Filter	Wainwright Instrument	WHJS3000-10TT	2013.01.10
Preamplifier	HP	8447F	2013.05.04
Preamplifier	A.H.	PAM-0118	2013.05.04
EMC Analyzer	Agilent	E7405A	2012.08.22
Test Receiver	R&S	ESCI	2013.05.10
LISN	R&S	ESH2-Z5	2012.10.10
Pulse Limiter	R&S	ESH3-Z2	2013.05.10

### Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Netbook	Lenovo	S10-2	2957N5K
Notebook	LG Electronics	LGR51	903QTAFO20768

**Appendix B. Test setup photos****Radiated field emissions**

**AC conducted emission**