

EMC TEST REPORT

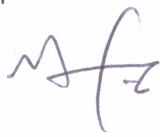
Project No.	LBE20134861	Issue No.	1		
Applicant	Name of organization	Samsung Electronics Co., Ltd.			
	Address	(Maetan dong) 129, Samsung-ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do 443-742 Korea			
	Date of application	September 25, 2013			
EUT	Type of device	Class B personal computers and peripherals			
	Equipment authorization	☐ Declaration of Conformity ☒ Certification ☐ Verification			
	FCC ID	A3LWEA303I			
	Kind of product	WLAN Access Point			
	Model No.	WEA303i			
	Variant Model No.	-			
	Manufacturer	Samsung Electronics Co.,Ltd. #244, 1Gongdan-ro, Gumi-Si, Gyeongsangbuk-Do, 730-030, Korea			
Applied Standards		47 CFR Part 15, Subpart B / ANSI C63.4-2009			
		ICES-003 Issue 5			
Test Period		October 7, 2013 ~ October 14, 2013			
Issue date		November 13, 2013			
Test result : Complied The equipment under test has found to be compliant with the applied standards. The result is not applied the uncertainty concept. This mean that the result is applied the original (standard) limit. (Refer to the attached test result for more detail.)					
Tested by : Min Gon Kim 		Reviewed by : Tae Young Jang 			
The test results in this report only apply to the tested sample. This report must not be reproduced, except in full, without written permission from CS & Environment center.					
 (Maetan dong) 129, Samsung-ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do 443-742 Korea Tel: 82 31 277 7752, Fax: 82 31 277 7753					

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1. Report information

1.1 Revision history

No.	Revised detailed information
Issue 0	There are no revisions and this version is basic test report.
Issue 1	Changed the information of AC Adapter by customer's request. (4 page)

1.2 Sample calculation

1.2.1 Conducted disturbance (at 10 MHz)

- Limit = 60 dB μ V (Quasi-peak limit)
- Level (50 dB μ V) = Meter Reading (40.2 dB μ V) + Factor (9.8 dB = AMN factor 9.7 dB + Cable loss 0.1 dB)
- Margin (10 dB) = Limit (60 dB μ V) - Level (50 dB μ V) = 10 dB below limit

1.2.2 Radiated disturbance (at 100 MHz)

- Limit = 30 dB μ V/m at 10 m
- Level (20 dB μ V/m)
 - = Meter Reading (40 dB μ V) + Factor (- 20 dB (1/m) = antenna factor + cable loss – amplifier gain)
- Margin (10 dB) = Limit (30 dB μ V/m) - Level (20 dB μ V/m) = 10 dB below limit

2. Summary of test results

2.1 Emission

The EUT has been tested according to the following specifications:

Applied	Test type	Applied standard	Result
☒	Conducted Disturbance (Mains Port)	47 CFR Part 15, Subpart B / ANSI C63.4-2009 (Class B)	Complied
☒	Radiated Disturbance		Complied

- Note : These results are deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference – Causing Equipment Regulations

3. General Information

3.1 Test facility

The CS & Environment center is located on Samsung Electronics Co., Ltd. at (Maetan dong) 129, Samsung-ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do 443-742 Korea. All testing are performed in Semi-anechoic chambers conforming to the site attenuation Characteristics defined by ANSI C63.4, CISPR 22, 16-1 and 16-2. and Shielded rooms.

The CS & Environment Centre is operated as EMC testing laboratory in accordance with the requirements of ISO/IEC 17025:2005.

4. Test Setup configuration

4.1 Test Peripherals

The cables used for these peripherals are either permanently attached by the peripheral manufacturer or coupled with an assigned cable as defined below.

The following is a listing of the EUT and peripherals utilized during the performance of EMC test:

Seq	Description	Model No.	Serial No.	Manufacturer	Fcc ID / DoC
A	WLAN Access Point	WEA303i	-	Samsung	A3LWEA303I
B	AC Adapter	SHA24S12-US	13082800002	Weihei Sungho Electronics	-
C	PoE Switch	iES4250GP	S4XD350023	Samsung	DoC
D	Note PC	SENS P580	ZSVB93EZ702365L	Samsung	DoC
E	Note PC	NP9000X4B	HRN491GC100016E	Samsung	DoC
F	Note PC	NP200B5B	HRW891CC600072F	Samsung	DoC

4.2 EUT operating mode

To achieve compliance applied standard specification, the following mode(s) were made during compliance testing:

Operating Mode 1 (Test mode)	Networking (Ethernet & WLAN) using AC Adapter
Operating Mode 2 (Test mode)	Networking (Ethernet & WLAN) using PoE

4.3 Details of Sampling

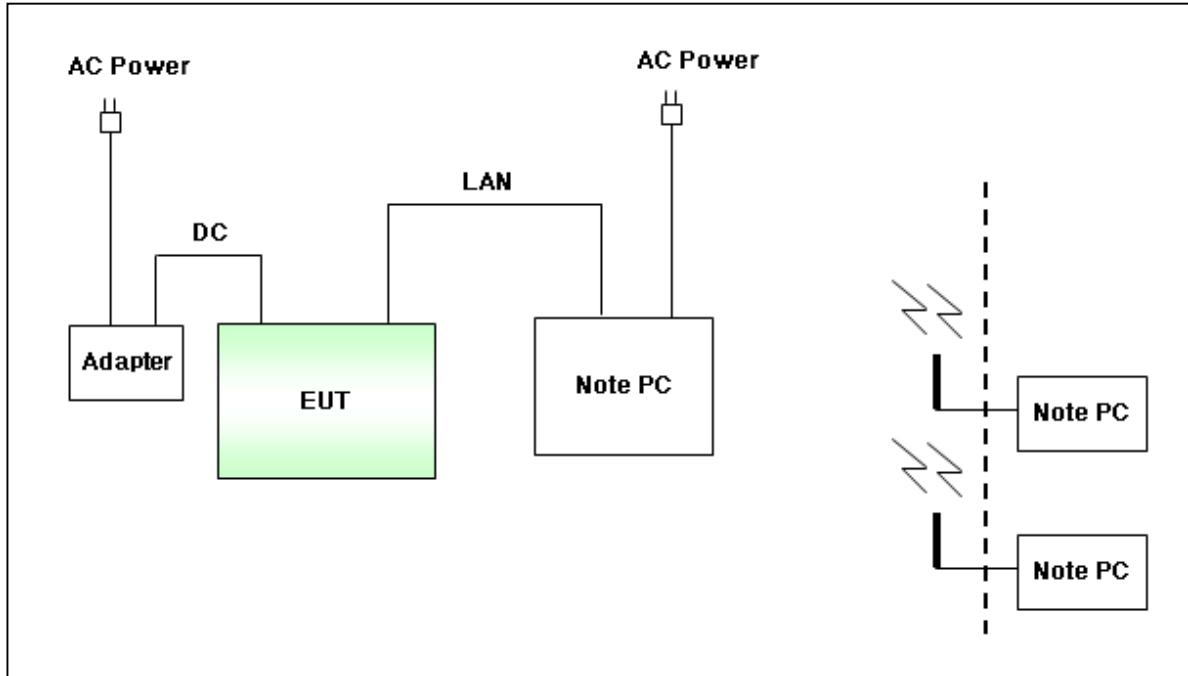
Customer selected, single unit.

4.4 Used cable description

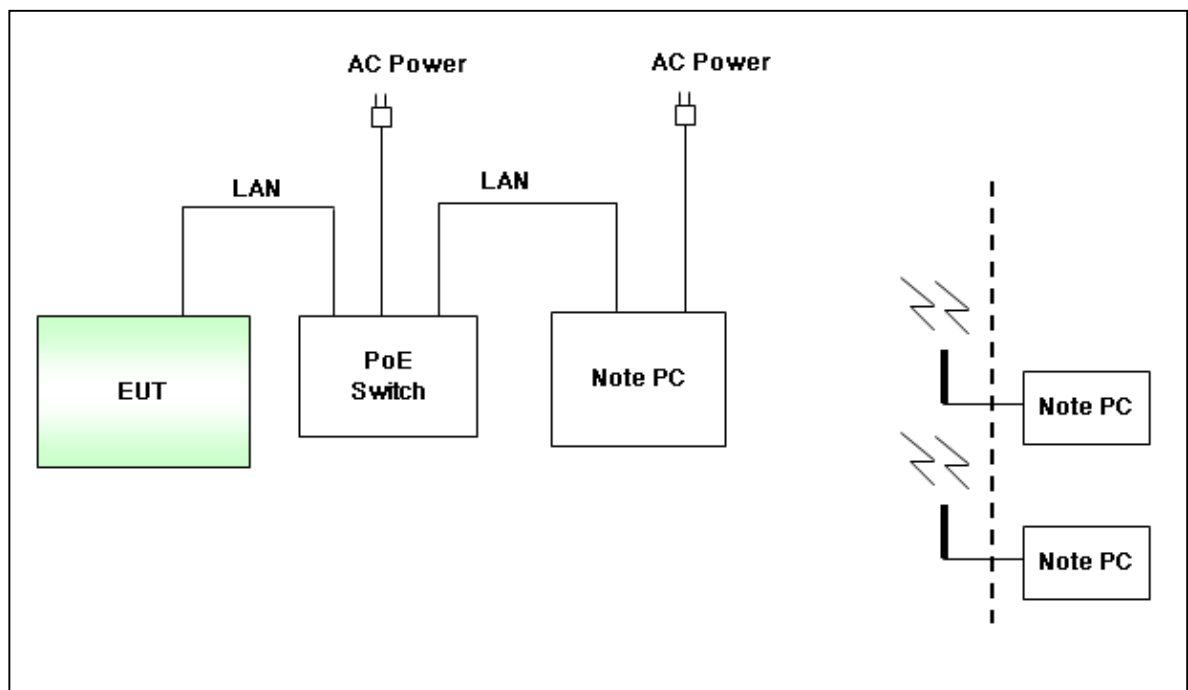
The EUT is configured, installed, arranged and operated in a manner consistent with typical applications. Interface cables/loads/devices are connected to at least one of each type of interface port of the EUT, and where practical, each cable shall be terminated in a device typical of actual usage. The type(s) of interconnecting cables to be used and the interface port (of the EUT) to which these were connected;

No.	Connected cable	Length [m]	Shielded [Y/N]	Note
1	Power	1.8	No	For EUT
2	Power	1.5	Yes	For PC
3	LAN	2.0	Yes	From PC to EUT
4	LAN	2.0	No	From PoE Switch to EUT
5	LAN	2.0	No	From PoE Switch to PC

4.5 Test arrangement



[Mode 1]



[Mode 2]

4.6 EUT Description

The following features describe EUT represented by this report:

Item	Specification	Remarks
CPU	Freescale P1010 e500@ 800 MHz	-
Main Memory	SEC, DDR3, 800 MHz 1Gb X 2, total 256MB SEC, NAND, 128MB	-
LAN	Broadcom, BCM54612, 10/100/1000 Ethernet	-
WLAN	2.4 GHz : QCA, AR9590 3x3 802.11abgn 5 GHz : QCA, AR9590 3x3 802.11abgn	-
SIO	Maxim, MAX3232 RS-232	-
WLAN(Monitor)	QCA, AR9342 2x2 802.11abgn 2.4/5 GHz Serial Flash 16Mbit DDR1, 400MHz 512Mb (32MX16bit)	-
Power	PoE(802.3af) 12V/2A (Optional)	-

4.7 Clock Frequencies

Kind of Clocks	Frequency[MHz]	Kind of Clocks	Frequency[MHz]
CPU Speed	800	DDR3	800
Ref	66	PCIE	100
PHY	25	USB	24
Monitor(CPU)	40	WLAN	40

4.8 Test configuration and condition

The interface cables were connected to one of each type of functional interface port on the EUT, the system was configured for testing in a typical fashion that a customer would normally use.

The EUT was connected to a PC through the Ethernet port with Unshielded Twisted Pair Ethernet cable. Ethernet testing was performed at 1 000 Mbps, 100 Mbps, 10 Mbps operation.

Also, the EUT was connected to a PC through IEEE802.11 a/b/g/n function.

Additionally, the EUT tested when supplied of power using PoE Switch.

- **Testing Voltage : AC 120 V, 60 Hz**

4.9 Measurement uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus: (According to CISPR 16-4 and UKAS Lab 34.)

4.9.1 Emission

Test type		Measurement uncertainty (C.L. 95 %, k = 2)
Conducted disturbance	Main terminal	3.31 dB
Radiated Disturbance (30 MHz ~ 1 GHz)	Horizontal	4.69 dB
	Vertical	4.83 dB
Radiated Disturbance (Above 1 GHz)	Horizontal	5.61 dB
	Vertical	5.60 dB

5. Results of individual test

5.1 Conducted disturbance

Both conducted lines are measured in Quasi-Peak and Average mode, including the worst-case data points for each tested configuration. The EUT measured in accordance with the methods described in standards.

Limits for conducted disturbance at the mains ports

Frequency range Limits(MHz)	Resolution Bandwidth(kHz)	Limits of Class A, dB(μV)		Limits of Class B, dB(μV)	
		Quasi-peak	Average	Quasi-peak	Average
0.15 ~ 0.50	9	79	66	66 ~ 56	56 ~ 46
0.50 ~ 5	9	73	60	56	46
5 ~ 30	9			60	50
NOTE 1 The lower limit shall apply at the transition frequency					
NOTE 2 The Class B limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.					

If the reading on the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 seconds at each measurement frequency, the highest reading shall be recorded, with the exception of any brief isolated high reading (which shall be ignored).

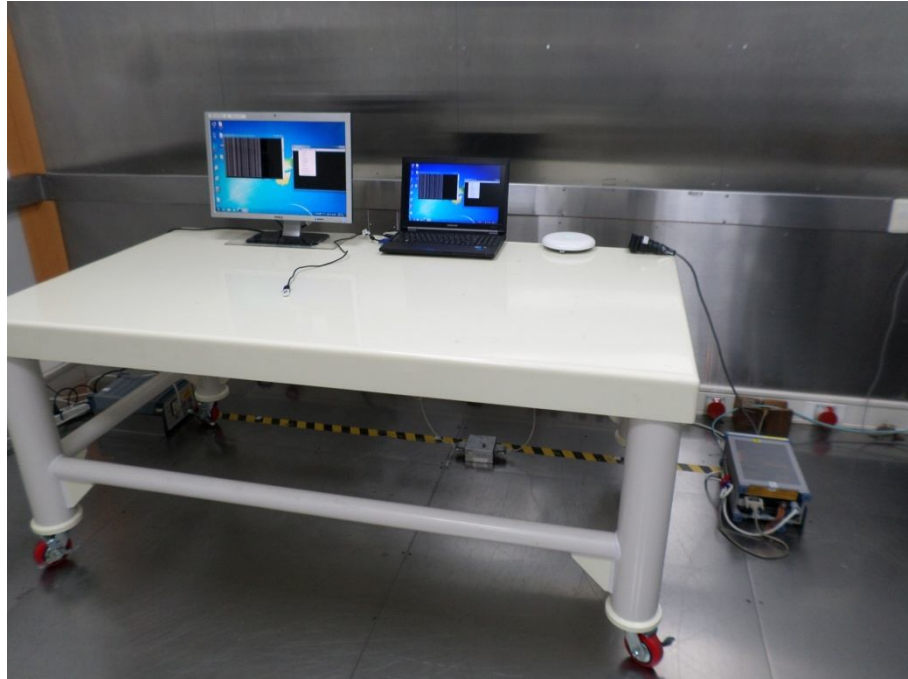
5.1.1 Test instrumentation

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
EMI TEST RECEIVER	ESU	R&S	100482	2013-08-29	12
Artificial Mains Network	ENV216	R&S	101369	2012-12-07	12
Artificial Mains Network	ESH2-Z5	R&S	831886/006	2013-01-08	12

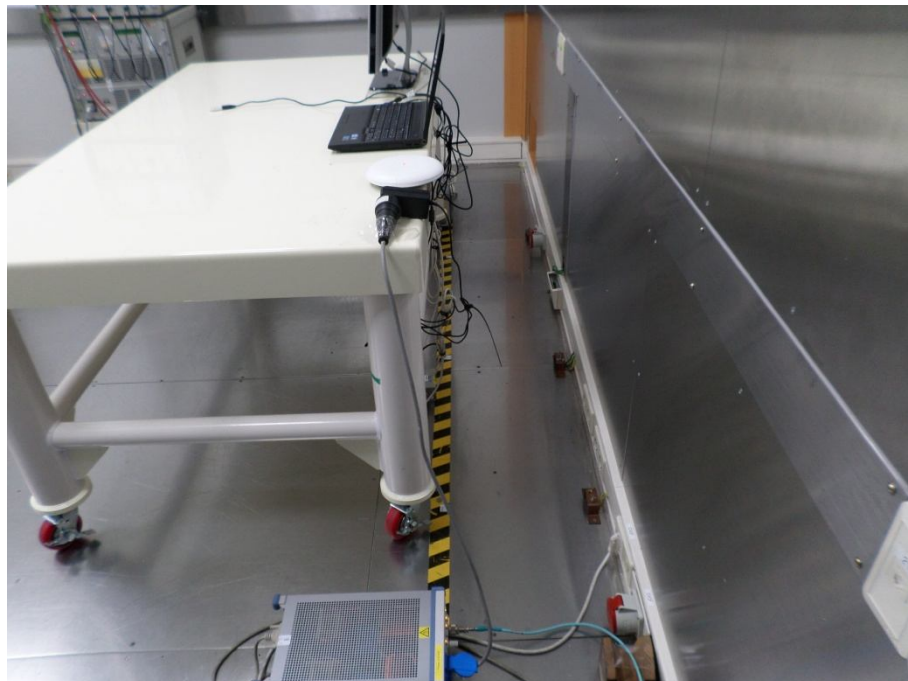
5.1.2 Temperature and humidity condition

Test date	October 14, 2013	Test engineer		Min Gon Kim	
Climate condition	Ambient temperature	22.4 °C	Relative humidity		45 %
	Atmospheric pressure	100.4 kPa			
Test place	Shielded Room #8				

5.1.3 Photograph of Test Setup



Front

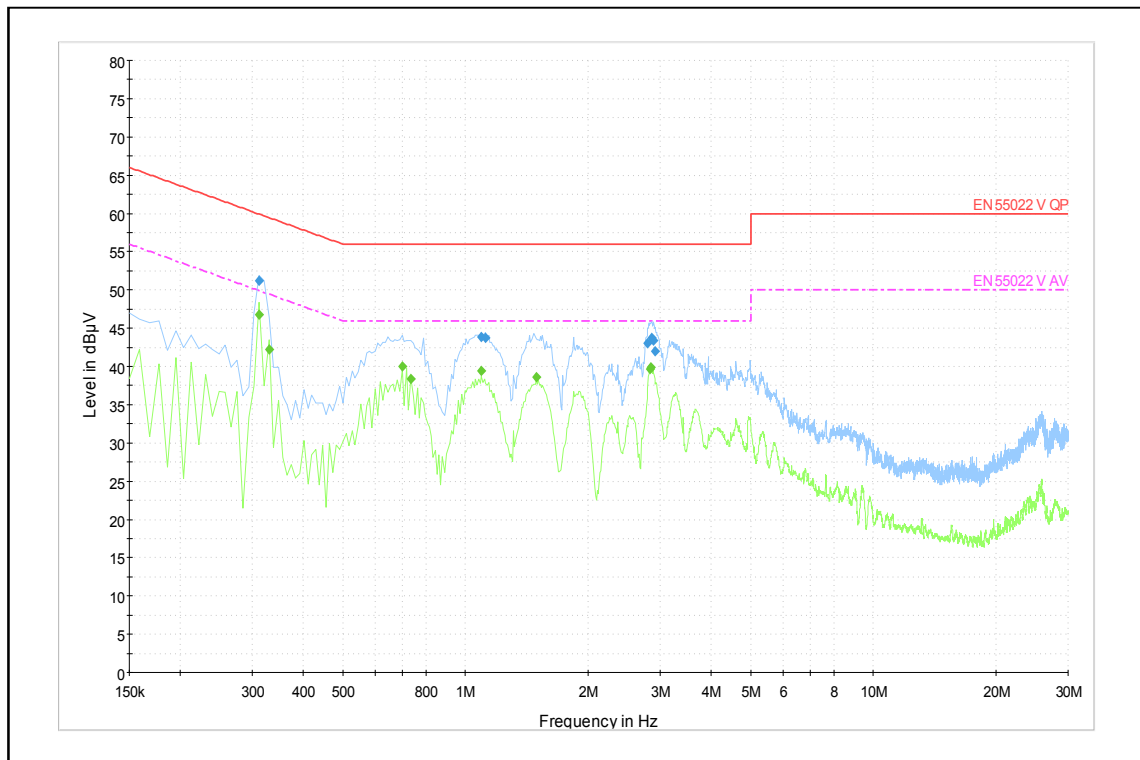


Rear

5.1.4 Test results (mains port)

- Operating Mode : 1

Test Graph



Note) Two graphs measured for both Live(L1) and Neutral(N) of the LISN are combined into one graph.

Test Results (Quasi-Peak and C/Average)

Quasi-peak final measurement results table

Frequency [MHz]	Quasi-Peak [dBuV]	Line	Factor [dB]	Margin [dB]	Limit [dBuV]
0.312	51.2	N	10.0	8.7	59.9
1.095	43.8	N	9.8	12.2	56.0
1.122	43.8	N	9.8	12.2	56.0
2.796	43.0	N	9.7	13.0	56.0
2.859	43.7	N	9.7	12.3	56.0
2.895	43.4	N	9.7	12.6	56.0
2.922	41.9	N	9.7	14.1	56.0

C/Average final measurement results table

Frequency [MHz]	C/Average [dBuV]	Line	Factor [dB]	Margin [dB]	Limit [dBuV]
0.312	46.7	N	10.0	3.2	49.9
0.330	42.2	L1	10.0	7.3	49.5
0.699	40.0	N	9.9	6.0	46.0
0.735	38.3	N	9.9	7.7	46.0
1.095	39.5	N	9.8	6.5	46.0
1.491	38.6	N	9.8	7.4	46.0
2.832	39.6	N	9.7	6.4	46.0
2.850	39.9	N	9.7	6.1	46.0

Note) Level (Quasi-Peak and/or C/Average) = Meter Reading (Quasi-Peak and/or C/Average) + Factor (LISN Insertion Loss + Cable Loss)

Margin = Limit – Level (Quasi-Peak and/or C/Average)

5.2 Radiated disturbance

Of those disturbances above ($L - 20$ dB), where L is the limit level in logarithmic units, record at least the disturbance levels and the frequencies of the six highest disturbances.

The following data lists the significant emission frequencies, measured levels, correction factors (for antenna and cables), orientation of table, polarization and height of antenna, the corrected reading, the limit, and the amount of margin. All measurements were taken utilizing quasi-peak detection unless stated otherwise.

Measurements were performed at an antenna to EUT distance of 10 meters and elevated between 1 and 4 meters. Both vertical and horizontal antenna polarizations were measured.

Limits for radiated disturbance of ITE at a measuring distance of 10 m

Frequency range Limits (MHz)	Resolution Bandwidth(kHz)	Quasi-peak Limits, dB(μ V/m)	
		Class A	Class B
30 ~ 230	120	40	30
230 ~ 1 000	120	47	37
NOTE 1 The lower limit shall apply at the transition frequency			
NOTE 2 Additional provisions may be required for cases where interference occurs.			

Peak measurements were made over the changeable frequency range 1 GHz to 40 GHz in accordance with internal maximum operating frequency at a measurement distance of 3 m for the following antenna and turntable arrangements:

Antenna Height (cm)	Antenna Polarisation	Turntable position (degrees)
100 ~ 400	Horizontal, Vertical	Continuous

Limits for Class B equipment at a measurement distance of 3 m

Frequency range Limits GHz	Peak Limits dB μ V/m	Average Limits dB μ V/m
Above 1 GHz	74	54
NOTE The lower limit shall apply at the transition frequency		

Measurements within 20 dB of the limit were then maximized by adjusting turntable position. Final measurements were made using a average detector.

Results checked manually; and points close to the limit line were re-measured.

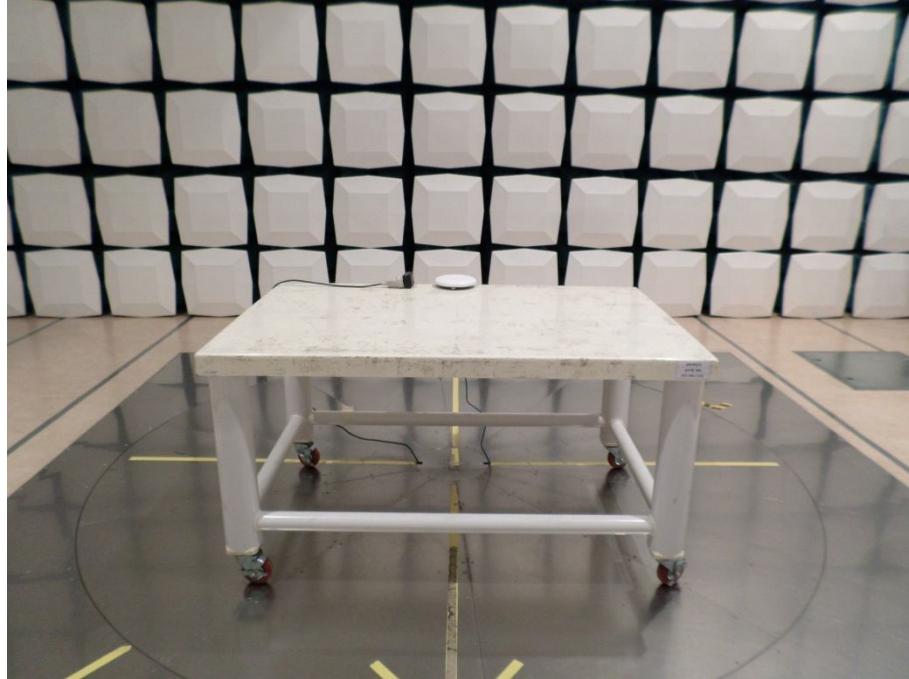
5.2.1 Test instrumentation

Test instrumentation	Model name	Manufacturer	Serial or Firmware (No./Ver.)	Calibration	
				Date	Interval (Month)
Antenna Mast	AM 4.0	Maturo	AM4.0/061/2410908	-	-
Antenna Mast	AM 4.0	Maturo	AM4.0/060/2410908	-	-
Controller	MCU	Maturo	MCU/100/2410908	-	-
Controller	HD100	HD	100/723	-	-
Preamplifier	317	SONOMA	282424	2012-11-14	12
Preamplifier	317	SONOMA	282425	2012-11-14	12
Preamplifier	310N	SONOMA	273121	2012-11-14	12
BILOG Antenna	CBL6112B	Schaffner	2805	2012-04-19	24
BILOG Antenna	CBL6112D	TESEQ	25513	2013-08-01	24
EMI TEST RECEIVER	ESU-26	R&S	100364	2013-07-25	12
EMI TEST RECEIVER	ESU-08	R&S	100485	2013-07-25	12
EMI TEST RECEIVER	ESIB-26	R&S	100355	2013-02-06	12
Preamplifier	310N	SONOMA	282362	2012-11-14	12
Double-Ridged Waveguide Horn Antenna	HF906	R&S	100028	2012-08-13	24

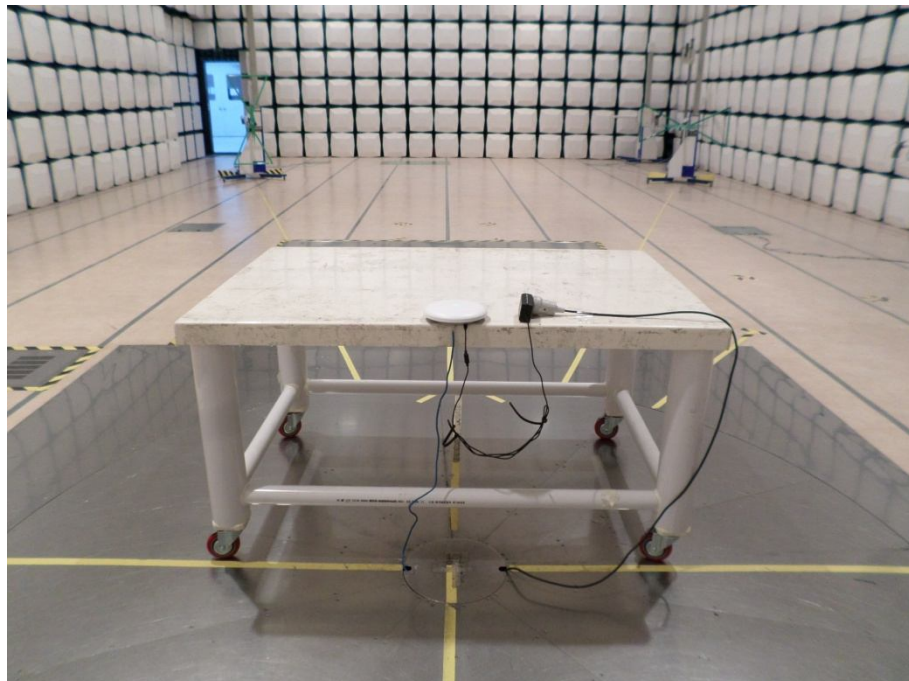
5.2.2 Temperature and humidity condition

Test date	October 7, 2013	Test engineer	Min Gon Kim	
Climate condition	Ambient temperature	23.2 ℃	Relative humidity	43 %
	Atmospheric pressure	101.2 kPa		
Test place	10 m #1 Semi-Anechoic Chamber & 3m Fully-Anechoic Chamber			

5.2.3.1 Photograph of Test Setup (30 ~ 1 000 MHz)

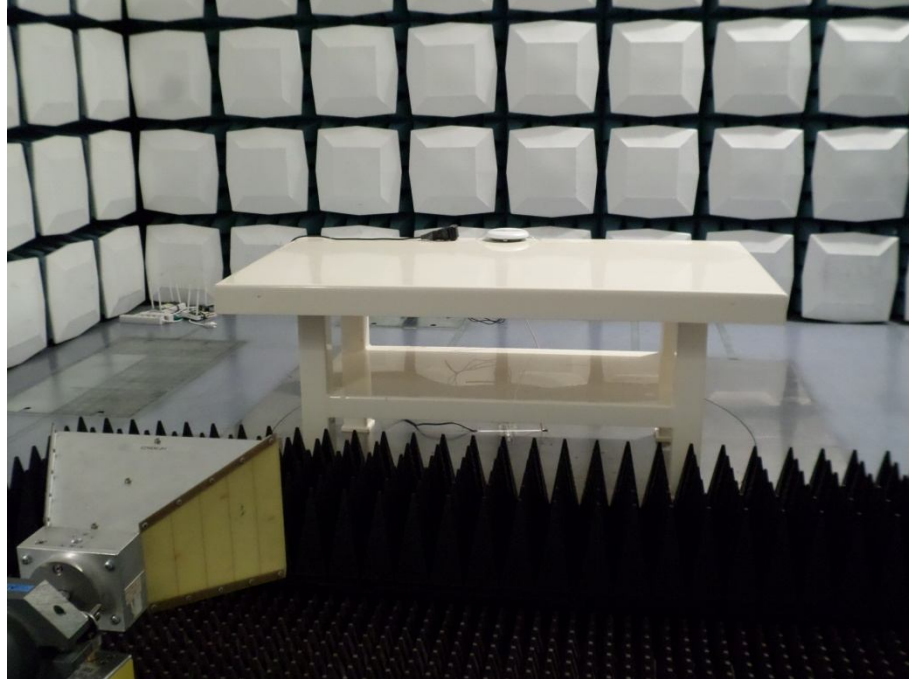


Front



Rear

5.2.3.2 Photograph of Test Setup (Above 1 GHz)



Front



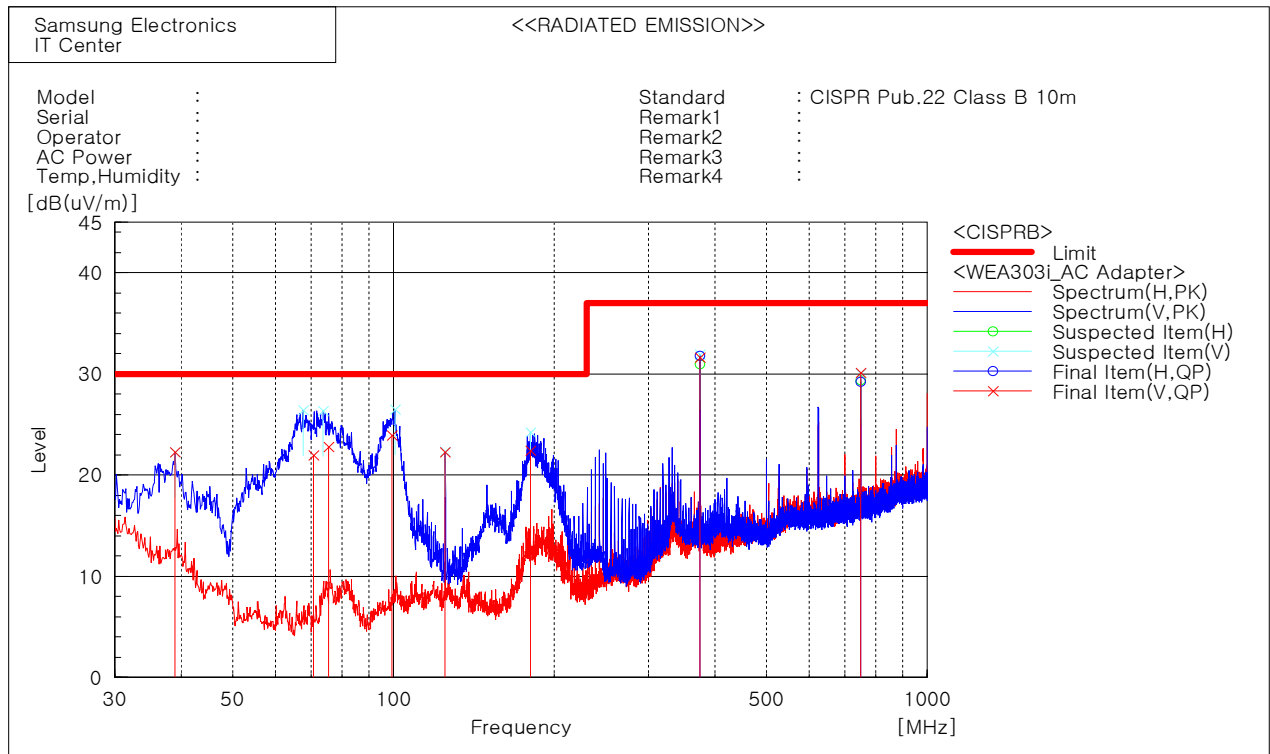
Rear

5.2.4 Test results

5.2.4.1 Below 1 GHz results

- Operating Mode : 1

Test Graph and Results



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	System
1	38.851	V	45.2	-22.9	22.3	30.0	7.7	100.0	222.0	2
2	70.755	V	52.1	-30.1	22.0	30.0	8.0	197.0	165.0	2
3	75.518	V	52.2	-29.4	22.8	30.0	7.2	372.0	187.0	2
4	99.321	V	48.4	-24.5	23.9	30.0	6.1	261.0	231.0	2
5	124.939	V	45.7	-23.4	22.3	30.0	7.7	100.0	23.0	2
6	180.703	V	48.3	-25.9	22.4	30.0	7.6	100.0	115.0	2
7	374.993	V	50.7	-19.1	31.6	37.0	5.4	366.0	292.0	2
8	374.996	H	50.0	-18.2	31.8	37.0	5.2	276.0	96.0	1
9	749.998	H	40.5	-11.3	29.2	37.0	7.8	110.0	59.0	1
10	750.104	V	43.1	-13.0	30.1	37.0	6.9	299.0	88.0	2

Note) Receiving antenna polarization : Horizontal and/or Vertical

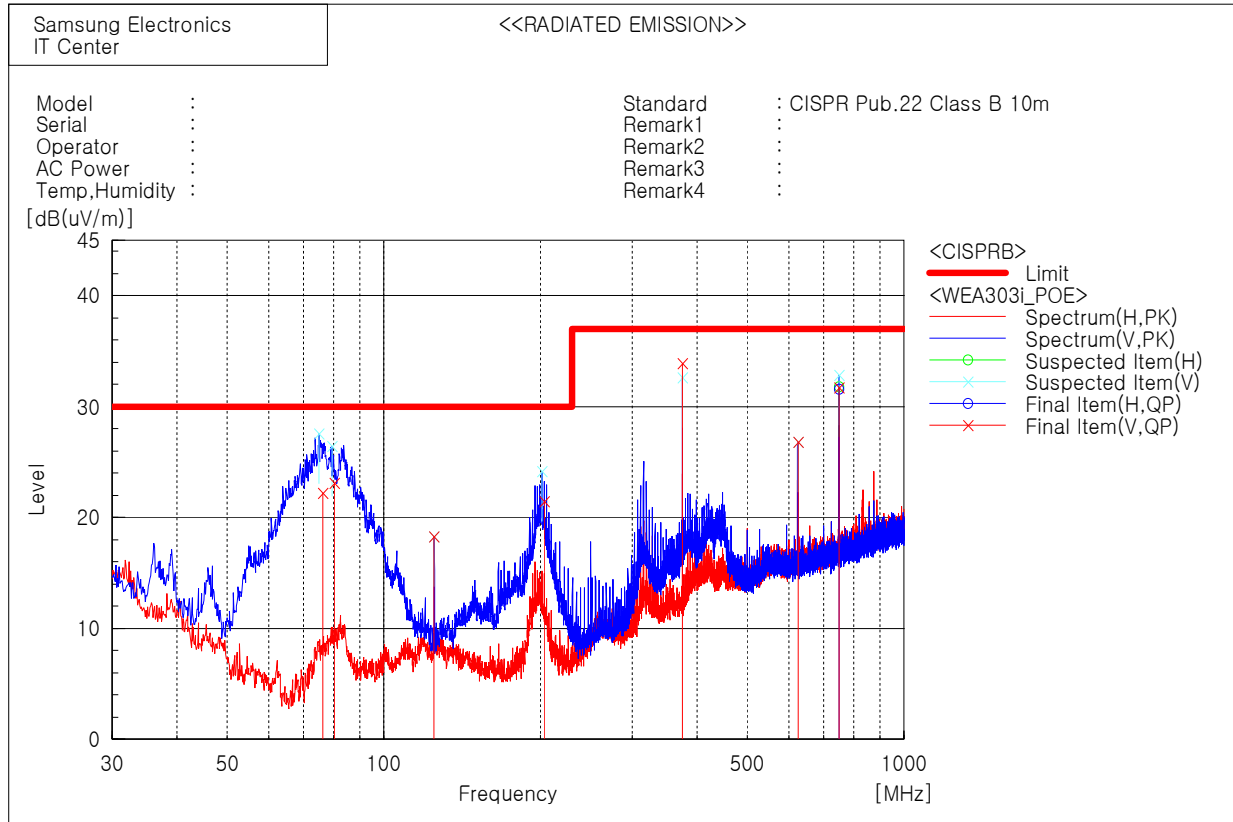
Test Distance : 10m, Antenna Height : 1 to 4 meters

Level QP (Quasi-Peak) = Reading QP + Factor (Antenna Factor + Cable Loss - Amp. Gain)

Margin QP (Quasi-Peak) = Limit - Level QP

- Operating Mode : 2

Test Graph and Results



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	System
1	76.368	V	51.5	-29.3	22.2	30.0	7.8	379.0	263.0	2
2	80.393	V	51.4	-28.3	23.1	30.0	6.9	131.0	227.0	2
3	124.939	V	41.7	-23.4	18.3	30.0	11.7	100.0	22.0	2
4	203.685	V	47.3	-25.8	21.5	30.0	8.5	121.0	65.0	2
5	375.022	V	53.0	-19.1	33.9	37.0	3.1	400.0	35.0	2
6	625.095	V	40.9	-14.1	26.8	37.0	10.2	100.0	60.0	2
7	749.992	V	44.7	-13.0	31.7	37.0	5.3	230.0	46.0	2
8	750.044	H	42.8	-11.3	31.5	37.0	5.5	112.0	77.0	1

Note) Receiving antenna polarization : Horizontal and/or Vertical

Test Distance : 10m, Antenna Height : 1 to 4 meters

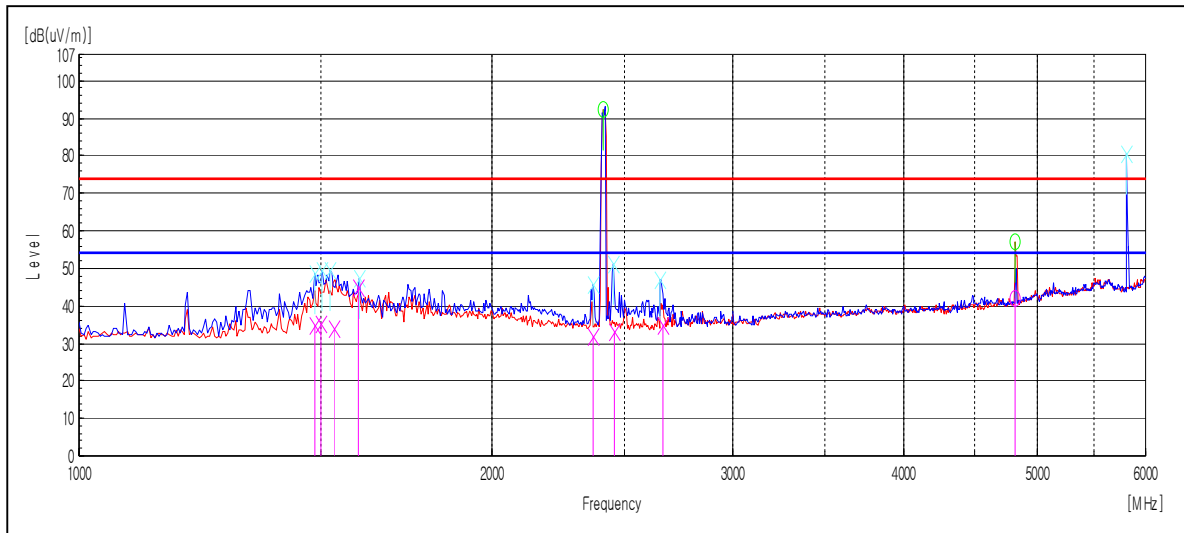
Level QP (Quasi-Peak) = Reading QP + Factor (Antenna Factor + Cable Loss - Amp. Gain)

Margin QP (Quasi-Peak) = Limit - Level QP

5.2.4.2 Above 1 GHz results

- Operating Mode : 1

Test Graph and Results



Peak Measurement

Frequency [MHz]	POL	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level PK [dB(uV/m)]	Limit [dB(uV/m)]	Margin PK [dB]	Height [cm]	Angle [deg]
1 484.970	V	56.5	-7.7	48.8	74.0	25.2	105.0	187.0
1 505.010	V	57.4	-7.7	49.7	74.0	24.3	100.0	0.0
1 525.050	V	57.2	-7.6	49.6	74.0	24.4	103.0	217.0
1 601.202	V	54.7	-7.2	47.5	74.0	26.5	103.0	358.0
2 370.742	V	50.3	-4.6	45.7	74.0	28.3	112.0	61.0
2 410.822	H	96.9	-4.6	92.3	74.0	-18.3	100.0	184.0
2 454.910	V	55.8	-4.6	51.2	74.0	22.8	100.0	0.0
2 655.311	V	50.4	-3.3	47.1	74.0	26.9	107.0	143.0
4 821.643	H	54.0	3.2	57.2	74.0	16.8	109.0	210.0
5 813.627	V	75.7	4.8	80.5	74.0	-6.5	125.0	262.0

C/Average Measurement

Frequency [MHz]	POL	Reading AV [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Limit [dB(uV/m)]	Margin AV [dB]	Height [cm]	Angle [deg]
1 484.890	V	42.4	-7.7	34.7	54.0	19.3	104.0	186.0
1 500.121	V	43.1	-7.7	35.4	54.0	18.6	100.0	359.0
1 536.072	V	41.3	-7.5	33.8	54.0	20.2	103.0	218.0
1 600.040	V	52.3	-7.2	45.1	54.0	8.9	106.0	357.0
2 370.261	V	36.7	-4.6	32.1	54.0	21.9	112.0	62.0
2 459.079	V	37.8	-4.6	33.2	54.0	20.8	100.0	1.0
2 665.411	V	37.9	-3.2	34.7	54.0	19.3	109.0	143.0
4 819.840	H	38.8	3.2	42.0	54.0	12.0	100.0	209.0

Note1) Radiated emissions (Tx / Rx frequency and Harmonics) from the transceiver shall be ignored.

- Wi-Fi b/g/n : Operating frequencies (2 412 ~ 2 472) MHz / Harmonics (4 824 ~ 4 944) MHz
- Wi-Fi a/n : Operating frequencies (5 180 ~ 5 825) MHz

Note2) Receiving antenna polarization : Horizontal and Vertical

Level PK(Peak) = Reading PK(Peak) + Factor(Antenna Factor + Cable Loss - Amp. Gain)

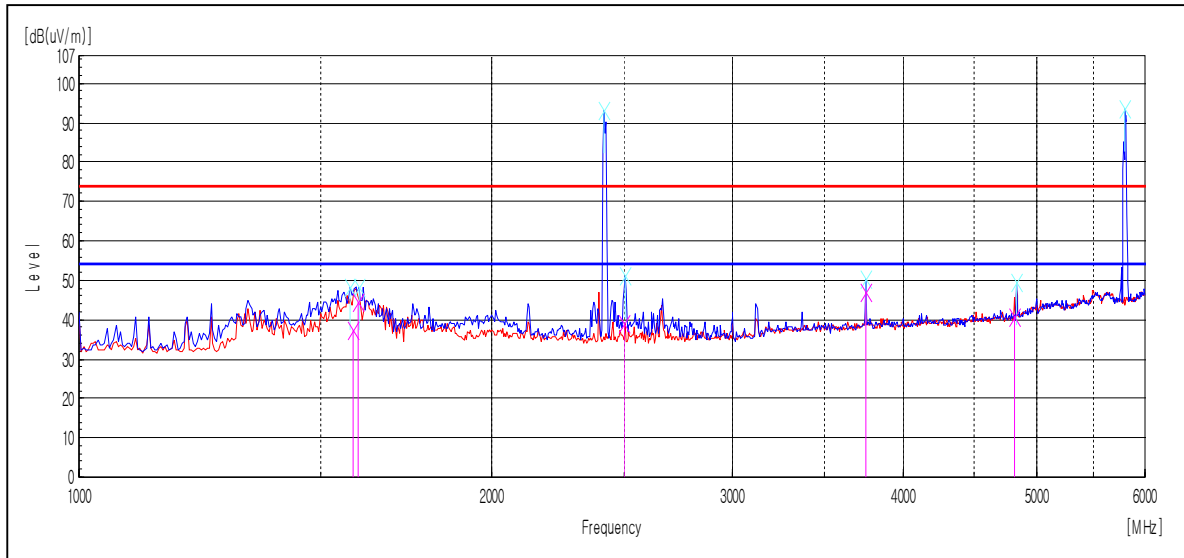
Level AV (C/Average) = Reading AV (C/Average) + Factor(Antenna Factor + Cable Loss - Amp. Gain)

Margin PK (Peak) = Limit – Level PK (Peak)

Margin AV (C/Average) = Limit – Level AV (C/Average)

- Operating Mode : 2

Test Graph and Results



Peak Measurement

Frequency [MHz]	POL	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level PK [dB(uV/m)]	Limit [dB(uV/m)]	Margin PK [dB]	Height [cm]	Angle [deg]
1 577.154	V	55.5	-7.3	48.2	74.0	25.8	100.0	61.0
1 601.202	V	55.6	-7.2	48.4	74.0	25.6	103.0	0.0
2 414.830	V	97.6	-4.6	93.0	74.0	-19.0	112.0	208.0
2 503.006	V	55.7	-4.5	51.2	74.0	22.8	104.0	2.0
3 751.503	V	49.1	1.1	50.2	74.0	23.8	115.0	157.0
4 833.667	V	46.4	3.3	49.7	74.0	24.3	100.0	179.0
5 801.603	V	88.8	4.7	93.5	74.0	-19.5	100.0	213.0

C/Average Measurement

Frequency [MHz]	POL	Reading AV [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Limit [dB(uV/m)]	Margin AV [dB]	Height [cm]	Angle [deg]
1 584.068	V	44.8	-7.3	37.5	54.0	16.5	100.0	60.0
1 599.980	V	51.8	-7.2	44.6	54.0	9.4	103.0	1.0
2 500.201	V	43.6	-4.5	39.1	54.0	14.9	116.0	1.0
3 750.481	V	45.8	1.1	46.9	54.0	7.1	105.0	157.0
4 822.305	V	37.7	3.2	40.9	54.0	13.1	106.0	179.0

Note1) Radiated emissions (Tx / Rx frequency and Harmonics) from the transceiver shall be ignored.

- Wi-Fi b/g/n : Operating frequencies (2 412 ~ 2 472) MHz / Harmonics (4 824 ~ 4 944) MHz
- Wi-Fi a/n : Operating frequencies (5 180 ~ 5 825) MHz

Note2) Receiving antenna polarization : Horizontal and Vertical

Level PK(Peak) = Reading PK(Peak) + Factor(Antenna Factor + Cable Loss - Amp. Gain)

Level AV (C/Average) = Reading AV (C/Average) + Factor(Antenna Factor + Cable Loss - Amp. Gain)

Margin PK (Peak) = Limit – Level PK (Peak)

Margin AV (C/Average) = Limit – Level AV (C/Average)

Appendix – EUT photography



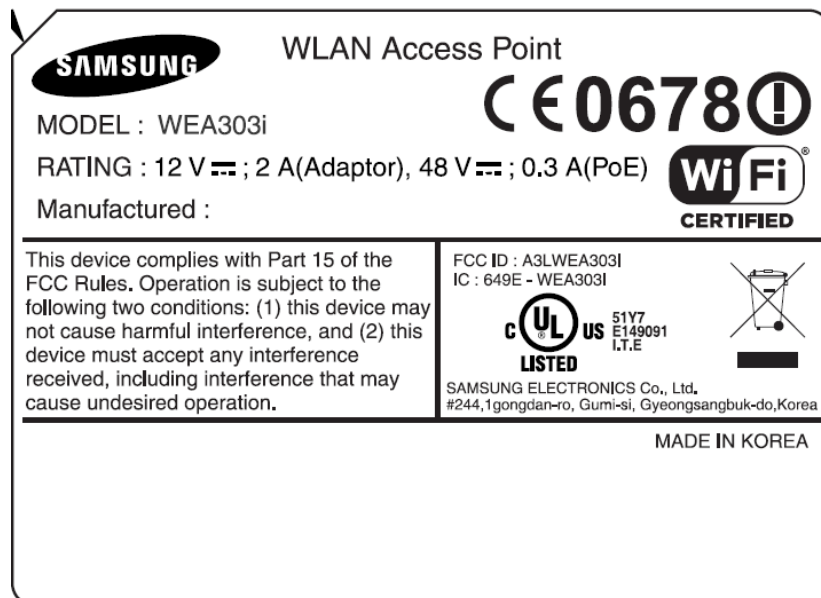
Front View



Rear View & Label Location



Label Location



Label