MPE TEST REPORT

of

FCC CFR 47 part 1, 1.1307(b), 1.1310
FCC ID: A3LWIDT20R

Equipment Under Test	:	Wi-Fi Module
Model Name	:	WIDT20R
Serial No.	:	N/A
Applicant	:	SAMSUNG ELECTRONICS CO., LTD.
Manufacturer	:	SAMSUNG ELECTRONICS CO., LTD.
Date of Test(s)	:	2011.11.08 ~ 2011.12.21
Date of Issue	:	2012.01.09

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

Tested By: **Date** **2011.12.28**

Duke Ko

Approved By: **Date** **2011.12.28**

Feel Jeong

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1. General information

1.1. Testing laboratory

SGS Korea Co., Ltd.(Gunpo Laboratory)
- 705, Dongchun-Dong Sooji-Gu, Yongin-Shi, Kyungki-Do, South Korea.
- Wireless Div. 2FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040

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1.2 Details of applicant

Applicant : SAMSUNG ELECTRONICS CO., LTD.
Address : 416, Maetan3-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea
Contact Person : Lee, Jay Woo
Phone No. : +82 +31 277 2569

1.3 Description of EUT

Kind of Product	Wi-Fi Module
Model Name	WIDT20R
Serial Number	N/A
Power Supply	DC 5 V
Frequency Range	2 412 ㎒ ~ 2 462 ㎒ (11b/g/n_HT20) 2 422 ㎒ ~ 2 452 ㎒ (11b/g/n_HT40) 5 745 ㎒ ~ 5 825 ㎒ (11a/n_HT20) 5 755 ㎒ ~ 5 795 ㎒ (11a/n_HT40) 5 180 ㎒ ~ 5 240 ㎒ (11a/n_ HT20 – Non DFS) 5 190 ㎒ ~ 5 230 ㎒ (11a/n_ HT40 – Non DFS) 5 260 ㎒ ~ 5 320 ㎒ (11a/n_ HT20 – DFS) 5 270 ㎒ ~ 5 310 ㎒ (11a/n_ HT40 – DFS) 5 500 ㎒ ~ 5 700 ㎒ (11a/n_ HT20 – DFS) 5 510 ㎒ ~ 5 670 ㎒ (11a/n_ HT40 – DFS)
Modulation Technique	DSSS, OFDM
Number of Channels	11 channel(11b/g/n_HT20), 7 channel(11b/g/n_HT40), 5 channel(11a/n_HT20), 2 channel(11a/n_HT40), 4 channel(11a/n_HT20 – Non DFS), 2 channel(11a/n_HT40 – Non DFS), 15 channel (11a/n_HT20 - DFS), 7 channel (11a/n_HT40 - DFS)
Antenna Type	Fixed type (2 Tx / 2 Rx)
Antenna Gain	**ANT0** 2.19 ㏈i(11b/g/n), 2.48 ㏈i(11a/n), 0.56 ㏈i(11a/n – Non DFS), 1.47 ㏈i(11a/n -DFS) **ANT1** 2.92 ㏈i(11b/g/n), 1.21 ㏈i(11a/n), 2.13 ㏈i(11a/n – Non DFS), 2.37 ㏈i(11a/n -DFS)

1.4. Declaration by the manufacturer

- N/A

1.5. Description of test mode

802.11 b mode:
We found out the test mode with the highest power level after we analyze all the data rates. 11 Mbps data rate is chose worst case as a representative.
802.11a/g mode:
We found out the test mode with the highest power level after we analyze all the data rates. 54 Mbps data rate is chose (worst case) as a representative.
802.11n mode:
We found out the test mode with the highest power level after we analyze all the data rates. MCS32 data rate is chose (worst case) as a representative.

1.6. Test Report Revision

Revision	Report number	Description
0	F690501/RF-RTL005221	Initial
1	F690501/RF-RTL005221-1	- Update 5 745 ~ 5825 MHz data - Update worst case of simultaneous transmission situation.

2. RF Exposure Evaluation

2.1 Environmental evaluation and exposure limit according to FCC CFR 47 part 1, 1.1307(b), 1.1310

According to FCC 1.1310 : The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (㎒)	Electric Field Strength(V/m)	Magnetic Field Strength (A/m)	Power Density (㎽/㎠)	Average Time
(A) Limits for Occupational /Control Exposures				
300 – 1 500	--	--	F/300	6
1 500 – 100 000	--	--	5	6
(B) Limits for General Population/Uncontrol Exposures				
300 – 1 500	--	--	F/1500	30
1 500 – 100 000	**--**	**--**	**1**	**30**

2.1.1. Friis transmission formula: Pd = (Pout*G)/(4*pi*R^2)

Where Pd = power density in ㎽/㎠

Pout = output power to antenna in ㎽

G = gain of antenna in linear scale

Pi = 3.1416

R = distance between observation point and center of the radiator in ㎝

Pd the limit of MPE, 1 ㎽/㎠. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

2.1.2. Test Result of RF Exposure Evaluation

Test Item : RF Exposure Evaluation Data
Test Mode : Normal Operation

2.1.3. Output Power into Antenna & RF Exposure Evaluation Distance

Operation Mode	Antenna	Channel	Channel Frequency (㎒)	Output Average Power to Antenna (dB m)	Duty Cycle (%)	Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)
11b	ANT0	Low	2 412	16.05	100	2.19	0.013 3
		Middle	2 437	16.39	100	2.19	0.014 2
		High	2 462	16.37	100	2.19	0.014 3
	ANT1	Low	2 412	15.49	100	2.92	0.013 8
		Middle	2 437	15.40	100	2.92	0.013 5
		High	2 462	15.00	100	2.92	0.012 3
11g	ANT0	Low	2 412	14.77	100	2.19	0.009 9
		Middle	2 437	14.33	100	2.19	0.008 9
		High	2 462	14.83	100	2.19	0.010 0
	ANT1	Low	2 412	13.24	100	2.92	0.008 2
		Middle	2 437	13.38	100	2.92	0.008 5
		High	2 462	13.53	100	2.92	0.008 8
Non DFS 11n_HT20	ANT0	Low	2 412	9.04	100	2.19	0.002 6
		Middle	2 437	9.23	100	2.19	0.002 8
		High	2 462	9.11	100	2.19	0.002 7
	ANT1	Low	2 412	9.66	100	2.92	0.003 6
		Middle	2 437	9.62	100	2.92	0.003 6
		High	2 462	9.33	100	2.92	0.003 3
	ANT0+ANT1 (Calculated)	Low	2 412	12.37	100	2.92	0.006 7
		Middle	2 437	12.44	100	2.92	0.006 8
		High	2 462	12.23	100	2.92	0.006 5

Operation Mode	Antenna	Channel	Channel Frequency (㎒)	Output Average Power to Antenna (dB m)	Duty Cycle (%)	Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)
Non DFS 11n_HT40	ANT0	Low	2 422	13.82	100	2.19	0.007 9
		Middle	2 437	14.09	100	2.19	0.008 4
		High	2 452	14.31	100	2.19	0.008 9
	ANT1	Low	2 422	12.90	100	2.92	0.007 6
		Middle	2 437	13.33	100	2.92	0.008 4
		High	2 452	13.12	100	2.92	0.008 0
	ANT0+ANT1 (Calculated)	Low	2 422	16.39	100	2.92	0.017 0
		Middle	2 437	16.74	100	2.92	0.018 4
		High	2 452	16.77	100	2.92	0.018 5

Operation Mode	Antenna	Channel	Channel Frequency (㎒)	Output Average Power to Antenna (dB m)	Duty Cycle (%)	Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)
11a	ANT0	Low	5 745	11.27	100	2.48	0.004 7
		Middle	5 785	11.21	100	2.48	0.004 7
		High	5 825	10.89	100	2.48	0.004 3
	ANT1	Low	5 745	11.52	100	1.21	0.003 7
		Middle	5 785	11.69	100	1.21	0.003 9
		High	5 825	11.15	100	1.21	0.003 4
Non DFS 11n_HT20	ANT0	Low	5 745	11.35	100	2.48	0.004 8
		Middle	5 785	11.25	100	2.48	0.004 7
		High	5 825	11.09	100	2.48	0.004 5
	ANT1	Low	5 745	12.05	100	1.21	0.004 2
		Middle	5 785	11.89	100	1.21	0.004 1
		High	5 825	11.54	100	1.21	0.003 7
	ANT0+ANT1 (Calculated)	Low	5 745	14.72	100	2.48	0.010 4
		Middle	5 785	14.59	100	2.48	0.010 1
		High	5 825	14.33	100	2.48	0.009 5
Non DFS 11n_HT40	ANT0	Low	5 755	11.94	100	2.48	0.005 5
		High	5 795	11.85	100	2.48	0.005 4
	ANT1	Low	5 755	12.24	100	1.21	0.004 4
		High	5 795	11.25	100	1.21	0.003 5
	ANT0+ANT1 (Calculated)	Low	5 755	15.10	100	2.48	0.011 4
		High	5 795	14.57	100	2.48	0.010 1

Operation Mode	Antenna	Channel	Channel Frequency (㎒)	Output Average Power to Antenna (dB m)	Duty Cycle (%)	Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)
Non DFS 11a	ANT0	Low	5 180	5.98	100	0.56	0.000 9
		Middle	5 220	4.30	100	0.56	0.000 6
		High	5 240	4.35	100	0.56	0.000 6
	ANT1	Low	5 180	9.11	100	2.13	0.002 6
		Middle	5 220	8.18	100	2.13	0.002 1
		High	5 240	7.83	100	2.13	0.002 0
Non DFS 11n_HT20	ANT0	Low	5 180	6.36	100	0.56	0.001 0
		Middle	5 220	4.78	100	0.56	0.000 7
		High	5 240	4.75	100	0.56	0.000 7
	ANT1	Low	5 180	9.75	100	2.13	0.003 1
		Middle	5 220	8.51	100	2.13	0.002 3
		High	5 240	7.87	100	2.13	0.002 0
	ANT0+ANT1 (Calculated)	Low	5 180	11.39	100	2.13	0.004 5
		Middle	5 220	10.04	100	2.13	0.003 3
		High	5 240	9.59	100	2.13	0.003 0
Non DFS 11n_HT40	ANT0	Low	5 190	4.00	100	0.56	0.000 6
		High	5 230	3.12	100	0.56	0.000 5
	ANT1	Low	5 190	7.74	100	2.13	0.001 9
		High	5 230	6.79	100	2.13	0.001 6
	ANT0+ANT1 (Calculated)	Low	5 190	9.27	100	2.13	0.002 7
		High	5 230	8.34	100	2.13	0.002 2

Operation Mode	Antenna	Channel	Channel Frequency (㎒)	Output Average Power to Antenna (dB m)	Duty Cycle (%)	Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)
DFS 11a	ANT0	Upper Band	5 260	5.08	100	1.47	0.000 9
			5 300	4.70	100	1.47	0.000 8
			5 320	4.59	100	1.47	0.000 8
		Lower Band	5 500	8.35	100	1.47	0.001 9
			5 600	8.35	100	1.47	0.001 9
			5 700	12.15	100	1.47	0.004 6
	ANT1	Upper Band	5 260	8.58	100	2.37	0.002 5
			5 300	7.48	100	2.37	0.001 9
			5 320	7.08	100	2.37	0.001 8
		Lower Band	5 500	8.59	100	2.37	0.002 5
			5 600	7.74	100	2.37	0.002 0
			5 700	12.72	100	2.37	0.006 4
DFS 11n_HT20	ANT0	Upper Band	5 260	5.15	100	1.47	0.000 9
			5 300	4.82	100	1.47	0.000 8
			5 320	4.78	100	1.47	0.000 8
		Lower Band	5 500	8.70	100	1.47	0.002 1
			5 600	8.45	100	1.47	0.002 0
			5 700	12.04	100	1.47	0.004 5
	ANT1	Upper Band	5 260	8.70	100	2.37	0.002 5
			5 300	7.68	100	2.37	0.002 0
			5 320	7.10	100	2.37	0.001 8
		Lower Band	5 500	8.57	100	2.37	0.002 5
			5 600	7.52	100	2.37	0.001 9
			5 700	12.11	100	2.37	0.005 6
	ANT0+ANT1 (Calculated)	Upper Band	5 260	10.29	100	2.37	0.003 7
			5 300	9.49	100	2.37	0.003 1
			5 320	9.10	100	2.37	0.002 8
		Lower Band	5 500	11.65	100	2.37	0.005 0
			5 600	11.02	100	2.37	0.004 3
			5 700	15.09	100	2.37	0.011 1

Operation Mode	Antenna	Channel	Channel Frequency (㎒)	Output Average Power to Antenna (dB m)	Duty Cycle (%)	Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)
DFS 11n_HT40	ANT0	Upper Band	5 270	3.84	100	1.47	0.000 7
			5 310	3.88	100	1.47	0.000 7
		Lower Band	5 510	7.09	100	1.47	0.001 4
			5 670	8.28	100	1.47	0.001 9
	ANT1	Upper Band	5 270	7.09	100	2.37	0.001 8
			5 310	6.06	100	2.37	0.001 4
		Lower Band	5 510	7.28	100	2.37	0.001 8
			5 670	7.16	100	2.37	0.001 8
	ANT0+ANT1 (Calculated)	Upper Band	5 270	8.77	100	2.37	0.002 6
			5 310	8.12	100	2.37	0.002 2
		Lower Band	5 510	10.20	100	2.37	0.003 6
			5 670	10.77	100	2.37	0.004 1

Note :
1. The power density Pd (5th column) at a distance of 20 ㎝ calculated from the friis transmission formula is far below the limit.
2. Formula : ANT0+ANT1 (Calculated) = 10log{10^(ANT0/10)+ 10^(ANT1/10)}

2.1.4. The highest MPE power density of 2.4 GHz band and 5 GHz band respectively

Band (㎒)	Operation Mode	Antenna	Channel Frequency (㎒)	Output Average Power to Antenna (dB m)	Duty Cycle (%)	Antenna Gain (dB i)	Power Density at 20 ㎝ (㎽/㎠)
2 412 - 2 462	11n-HT40	ANT0+ANT1 (Calculated)	2 452	16.77	100	2.92	0.018 5
5 745 - 5 825	11n-HT40	ANT0+ANT1 (Calculated)	5 755	15.10	100	2.48	0.011 4
5 180 - 5 700	11n-HT20	ANT0+ANT1 (Calculated)	5 180	11.39	100	2.13	0.004 5
Combined				19.72	100	2.92	0.036 5

Formula : Combined = 10log{10^(N1/10)+10^(N2/10)+10^(N3/10)}

N1 : The highest output average power to antenna of 2 412 - 2 462 MHz band
N2 : The highest output average power to antenna of 5 745 - 5 825 MHz band
N3 : The highest output average power to antenna of 5 180 - 5 700 MHz band