



10.6. Test data for radiated emission

10.6.1 Operating condition: 802.11b Mode

10.6.1.1 Radiated Emission which fall in the Restricted Band

- Test Date : December 17, 2004
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3m
- Operating Condition : Low / High Channel
- Result : PASSED BY -5.74 dB at High Channel

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for Low Channel										
2388.17	29.00	Peak	H	27.18	1.33	-		57.51	74.0	-16.49
	30.00	Peak	V					58.51	74.0	-15.49
	18.67	Average	H					47.18	54.0	-6.82
	18.83	Average	V					47.34	54.0	-6.66
Test Data for High Channel										
2483.50	30.33	Peak	H	27.60	1.33	-		59.26	74.0	-14.74
	31.33	Peak	V					60.26	74.0	-13.74
	18.83	Average	H					47.76	54.0	-6.24
	19.33	Average	V					48.26	54.0	-5.74

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

Tested by: Y. M. Choi / Senior Engineer6.



10.6.1.2 Spurious & Harmonic Radiated Emission

- Test Date : December 17, 2004
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3m
- Result : PASSED BY -5.50 dB at High Channel

Frequency (GHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for Low Channel_Fundamental Freq.: 2.412GHz										
2.412	71.33	Peak	H	27.18	1.33			99.84	-	
	80.50	Peak	V					109.01	-	
4.824*	53.47	Peak	H	31.35	2.67	25.5		61.99	74.00	-12.01
	38.50	Average	H					47.02	54.00	-6.89
7.236*	47.30	Peak	H	35.88	5.83	25.4		63.61	74.00	-10.39
	30.15	Average	H					46.46	54.00	-7.54
Test Data for Middle Channel_Fundamental Freq.: 2.437GHz										
2.437	71.00	Peak	H	27.60	1.33			99.93	-	
	80.50	Peak	V					109.43	-	
4.874*	53.50	Peak	H	31.35	2.67	25.5		62.02	74.00	-11.98
	39.00	Average	H					47.52	54.00	-6.48
7.311*	47.95	Peak	H	35.88	5.83	25.4		64.26	74.00	-9.74
	30.50	Average	H					46.81	54.00	-7.19

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical, "*" Frequency fall in restricted band



-Continued

Frequency (GHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for High Channel_Fundamental Freq.: 2.462GHz										
2.459	72.50	Peak	H	27.60	1.33			101.43	-	
	82.83	Peak	V					111.76	-	
4.924*	55.00	Peak	H	31.60	2.67	25.5		63.77	74.00	-10.23
	39.73	Average	H					48.50	54.00	-5.50
7.386*	50.12	Peak	H	36.07	5.83	25.4		66.62	74.00	-7.38
	32.00	Average	H					48.50	54.00	-5.50

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical, "*" Frequency fall in restricted band

Tested by: Y. M. Choi / Senior Engineer6.



10.6.2 Operating condition: 802.11g Mode

10.6.2.1 Radiated Emission which fall in the Restricted Band

- Test Date : December 17, 2004
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3m
- Operating Condition : Low / High Channel
- Result : PASSED BY -4.46 dB at High Channel

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for Low Channel										
2389.92	33.67	Peak	H	27.18	1.33	-		62.18	74.0	-11.82
	39.67	Peak	V					68.18	74.0	-5.82
	20.17	Average	H					48.68	54.0	-5.32
	20.83	Average	V					49.34	54.0	-4.66
Test Data for High Channel										
2483.70	38.17	Peak	H	27.60	1.33	-		67.10	74.0	-6.90
	40.61	Peak	V					69.54	74.0	-4.46
	20.19	Average	H					49.12	54.0	-4.88
	20.50	Average	V					49.43	54.0	-4.57

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

Tested by: Y. M. Choi / Senior Engineer6.



10.6.2.2 Spurious & Harmonic Radiated Emission

- Test Date : December 17, 2004
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3m
- Result : PASSED BY -6.00 dB at High Channel

Frequency (GHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for Low Channel_Fundamental Freq.: 2.412GHz										
2.412	71.67	Peak	H	27.18	1.33			100.18	-	
	80.00	Peak	V					108.51	-	
4.824*	55.00	Peak	H	31.35	2.67	25.5		63.52	74.00	-10.48
	38.94	Average	H					47.46	54.00	-6.54
7.236*	48.55	Peak	H	35.88	5.83	25.4		64.86	74.00	-9.14
	31.37	Average	H					47.68	54.00	-6.32
Test Data for Middle Channel_Fundamental Freq.: 2.437GHz										
2.437	73.00	Peak	H	27.60	1.33			101.93	-	
	83.50	Peak	V					112.43	-	
4.874*	54.13	Peak	H	31.35	2.67	25.5		62.65	74.00	-11.35
	38.75	Average	H					47.27	54.00	-6.73
7.311*	48.00	Peak	H	35.88	5.83	25.4		64.31	74.00	-9.69
	31.53	Average	H					47.84	54.00	-6.16

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical, "*" Frequency fall in restricted band

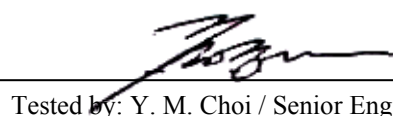


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Frequency (GHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for High Channel_Fundamental Freq.: 2.462GHz										
2.462	73.67	Peak	H	27.60	1.33			102.60	-	
	82.50	Peak	V					111.43	-	
4.924*	55.36	Peak	H	31.60	2.67			64.13	74.00	-9.87
	38.65	Average	H					47.42	54.00	-6.58
7.386*	48.30	Peak	H	36.07	5.83			64.80	74.00	-9.20
	31.50	Average	H					48.00	54.00	-6.00

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical, "*" Frequency fall in restricted band



Tested by: Y. M. Choi / Senior Engineer6.



10.6.3 Operating condition: 802.11a Mode

10.6.3.1 Spurious & Harmonic Radiated Emission

- Test Date : December 17, 2004
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3m
- Result : PASSED BY -6.42 dB at High Channel

Frequency (GHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for Low Channel_Fundamental Freq.: 2.412GHz										
5.745	53.50	Peak	H	32.31	2.67			88.48	-	
	66.83	Peak	V					101.81	-	
11.490*	43.44	Peak	H	39.21	4.66	28.84		58.47	74.00	-15.53
	32.11	Average	H					47.14	54.00	-6.86
17.230	42.30	Peak	H	39.75	7.75	28.84		60.96	81.81	-20.85
	30.96	Average	H					49.62	61.81	-12.19
Test Data for Middle Channel_Fundamental Freq.: 2.437GHz										
5.785	54.33	Peak	H	31.31	2.67			89.31	-	
	68.17	Peak	V					103.15	-	
11.570*	42.38	Peak	H	39.21	4.66	28.84		57.41	74.00	-16.59
	32.46	Average	H					47.49	54.00	-6.51
17.355	42.30	Peak	H	39.75	7.75	28.84		60.96	83.15	-21.19
	31.19	Average	H					49.85	63.15	-13.3

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical, "*" Frequency fall in restricted band



-Continued

Frequency (GHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for High Channel_Fundamental Freq.: 2.462GHz										
5.805	53.33	Peak	H	32.40	2.67			88.40	-	
	68.50	Peak	V					103.57	-	
11.610*	42.76	Peak	H	38.92	4.66	28.84		57.50	74.00	-16.50
	32.84	Average	H					47.58	54.00	-6.42
17.415	43.34	Peak	H	41.63	7.75	28.84		63.88	83.57	-19.69
	29.74	Average	H					50.28	63.57	-13.29

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical, "*" Frequency fall in restricted band

Tested by: Y. M. Choi / Senior Engineer6.



10.7. Test data for co-location

10.7.1 Radiated Emission which fall in the Restricted Band

- Test Date : December 18, 2004
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Frequency range : 1 GHz ~ 40GHz
- Measurement distance : 3m
- Result : PASSED BY -5.57 dB
- Operating Condition : 802.11g and 802.11a was simultaneously operated at their low and high channel

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Worst case restricted band 802.11b: 2437MHz, Max Power + 802.11a ON @5260 MHz, Max Power										
2389.30	29.93	Peak	H	27.18	1.33			58.44	74.0	-15.56
	30.50	Peak	V					59.01	74.0	-14.99
	18.16	Average	H					46.07	54.0	-7.93
	18.57	Average	V					47.08	54.0	-6.92
2486.30	30.25	Peak	H	27.60	1.33			59.18	74.0	-14.82
	30.96	Peak	V					59.89	74.0	-14.11
	18.23	Average	H					47.16	54.0	-6.84
	19.17	Average	V					48.10	54.0	-5.90
Worst case restricted band 802.11b: 2437MHz, Max Power + 802.11a ON @5745 MHz, Max Power										
2390.10	30.00	Peak	H	27.18	1.33			58.51	74.0	-15.49
	31.00	Peak	V					59.51	74.0	-14.49
	18.70	Average	H					47.21	54.0	-6.79
	18.95	Average	V					47.46	54.0	-6.54
2486.70	30.50	Peak	H	27.60	1.33			59.43	74.0	-14.57
	31.70	Peak	V					60.63	74.0	-13.37
	18.90	Average	H					47.83	54.0	-6.17
	19.50	Average	V					48.43	54.0	-5.57

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical,

Tested by: Y. M. Choi / Senior Engineer.



10.7.2 Spurious & Harmonic Radiated Emission

- Test Date : December 18, 2004
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3m
- Result : PASSED BY -5.19 dB
- Operating Condition : 802.11g and 802.11a was simultaneously operated at their max power

Frequency (GHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Worst case harmonic 802.11b: 2437MHz, Max Power + 802.11a ON @5260 MHz, Max Power										
4.874	53.95	Peak	H	31.35	2.67	25.50		62.47	74.00	-11.53
	39.00	Peak	V					47.52	54.00	-6.48
7.311	47.36	Peak	V	35.88	5.83	25.40		63.67	74.00	-10.33
	29.78	Average	V					46.09	54.00	-7.91
Worst case harmonic 802.11b: 2437MHz, Max Power + 802.11a ON @5745 MHz, Max Power										
4.874	54.30	Peak	V	31.35	2.67	25.50		62.47	74.00	-11.53
	39.10	Average	V					47.52	54.00	-6.48
7.311	47.50	Peak	V	35.88	5.83	25.40		63.67	74.00	-10.33
	30.10	Average	V					46.09	54.00	-7.91
11.49	43.10	Peak	H	39.21	4.66	28.84		58.13	74.00	-15.87
	31.90	Average	V					46.93	54.00	-7.07
17.23	41.90	Peak	V	39.75	7.75	28.84		60.56	74.00	-23.44
	30.15	Average	V					48.81	54.00	-5.19

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical,

Tested by: Y. M. Choi / Senior Engineer6.



11. PEAK POWER SPECTRUL DENSITY

11.1 Operating environment

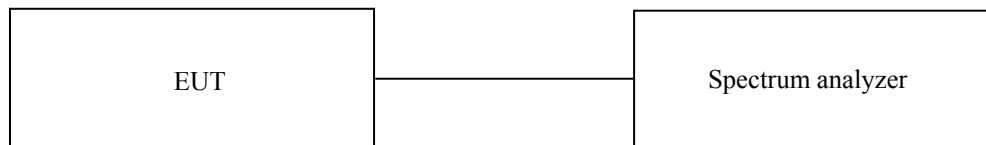
Temperature : 26°C

Relative humidity : 43 %

11.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 3 kHz, the video bandwidth is set to 3 times the resolution bandwidth, and sweep time was set to span / 3 kHz. The sweep time was allowed to be longer than span / 3 kHz for a full response of the mixer in the spectrum analyzer.

The maximum level from the EUT in a 3 kHz bandwidth was measured with above condition.



11.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Due Cal
■ - 8564E	HP	Spectrum Analyzer	3650A00756	July 10, 2004

All test equipment used is calibrated on a regular basis.

**11.4 Test data****11.4.1 Test data for 802.11b**

-. Test Date : December 16, 2004

-. Test Result : Pass

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2412	-4.33	8	-12.33
Middle	2437	-4.00	8	-12.00
High	2462	-4.17	8	-12.17

Remark: See next page for an overview sweep performed with peak detector.

11.4.2 Test data for 802.11g

-. Test Date : December 16, 2004

-. Test Result : Pass

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2412	-9.17	8	-17.17
Middle	2437	-6.67	8	-14.67
High	2462	-7.17	8	-15.17

11.4.2 Test data for 802.11a

-. Test Date : December 16, 2004

-. Test Result : Pass

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	5745	-14.83	8	-21.83
Middle	5785	-14.67	8	-22.67
High	5805	-15.00	8	-23.00

Tabulated test data for Peak Power Spectral Density.

Remark: See next page for measurement data.

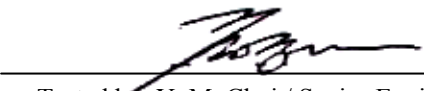

Tested by: Y. M. Choi / Senior Engineer6.



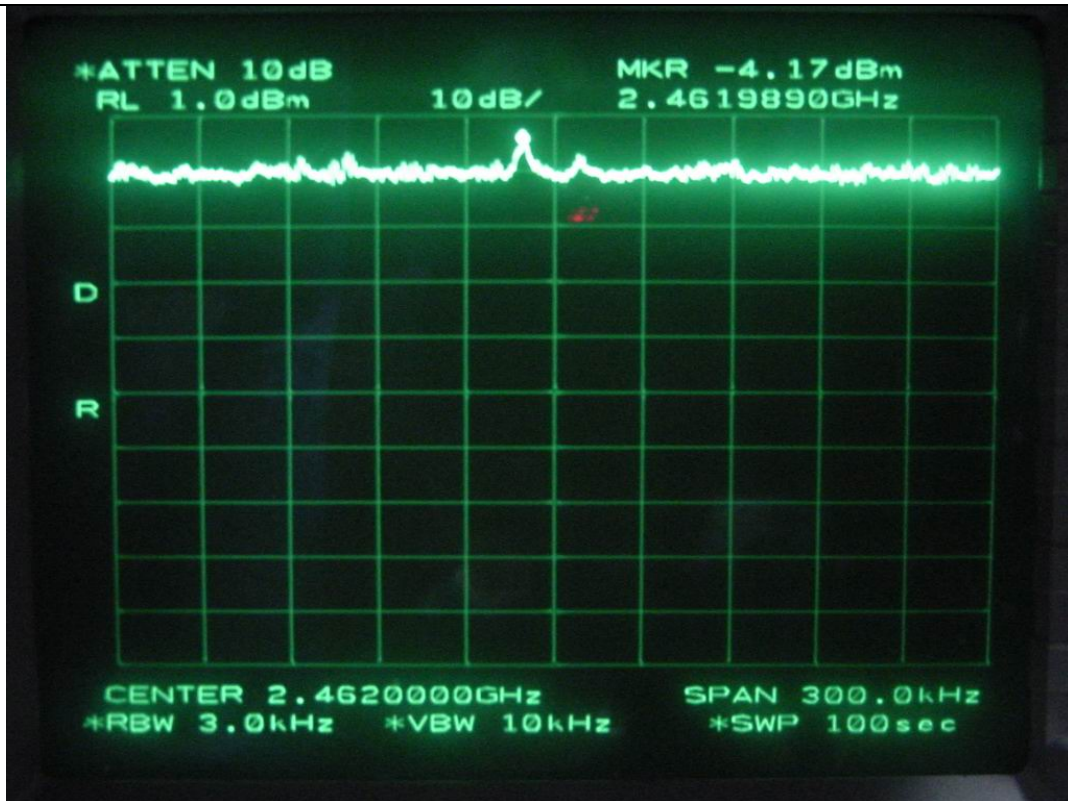
Photo of test data for 802.11b



Low Channel



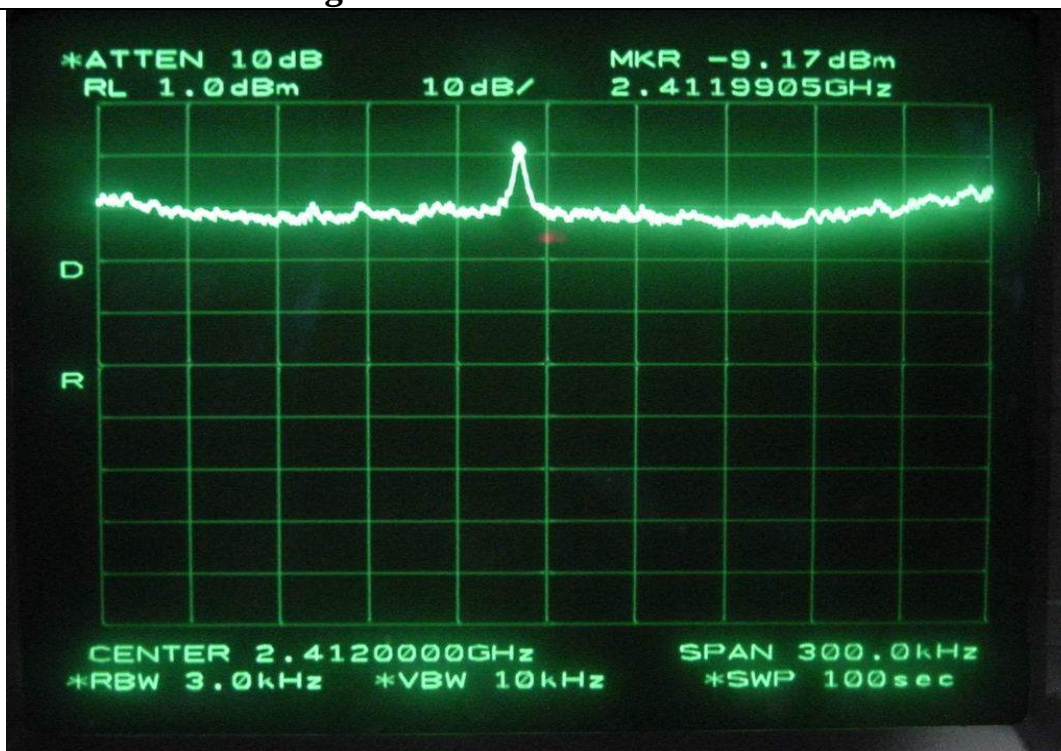
Middle Channel



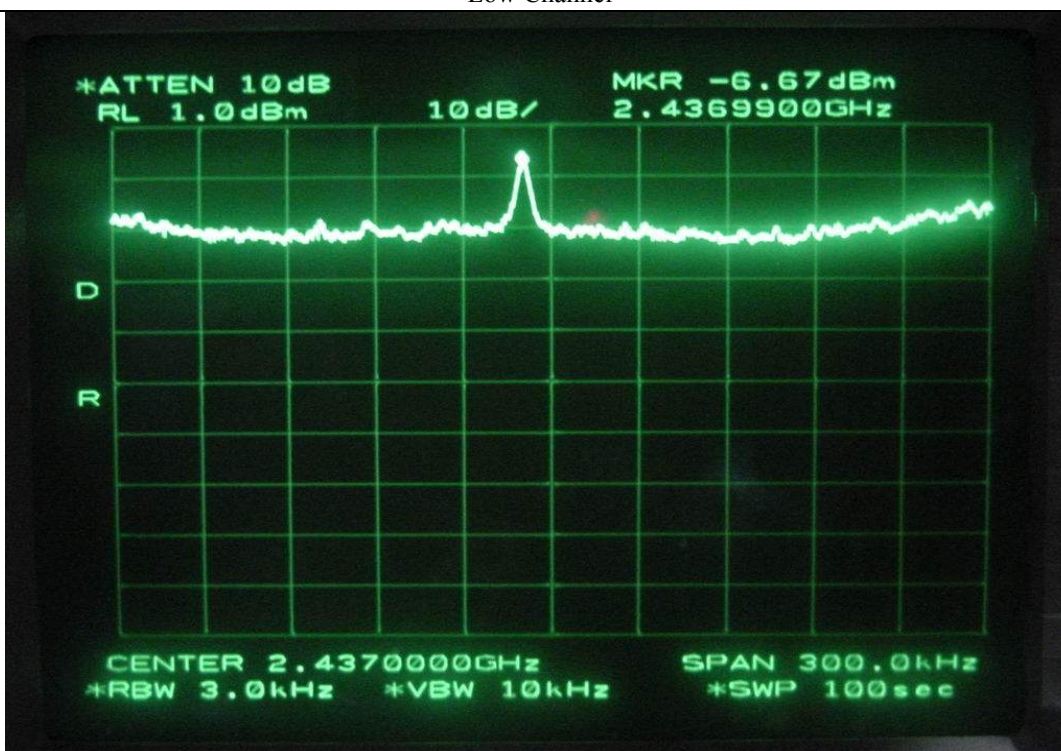
High Channel



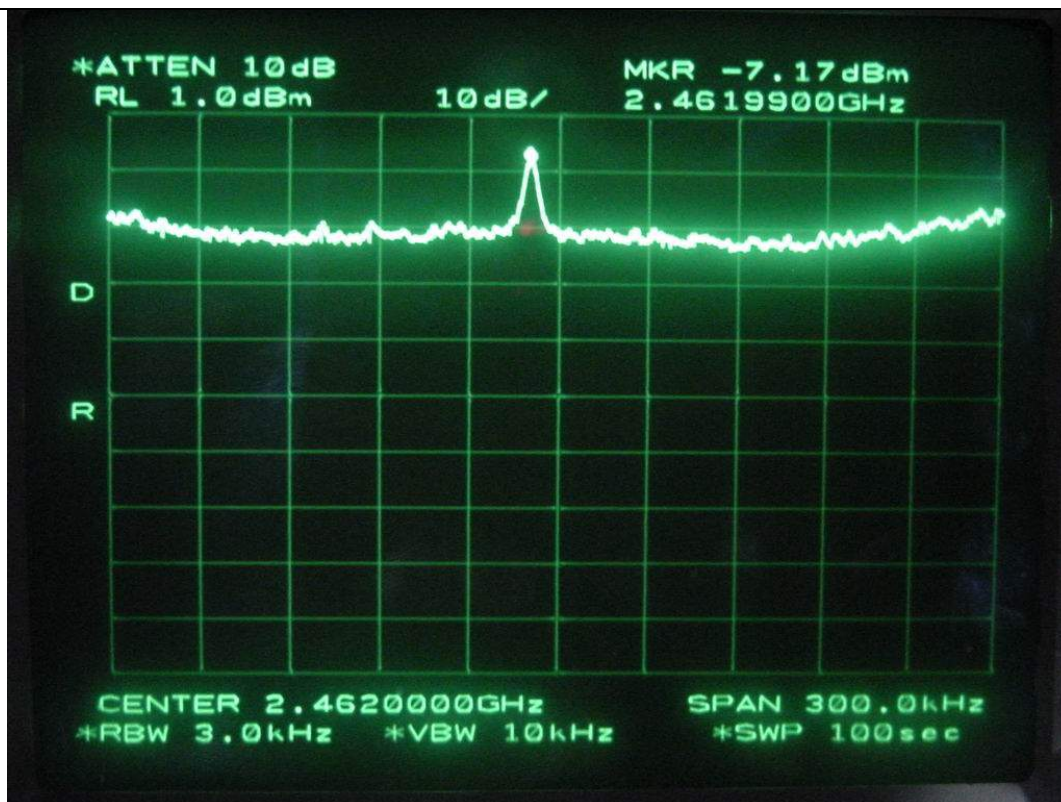
Photo of test data for 802.11g



Low Channel



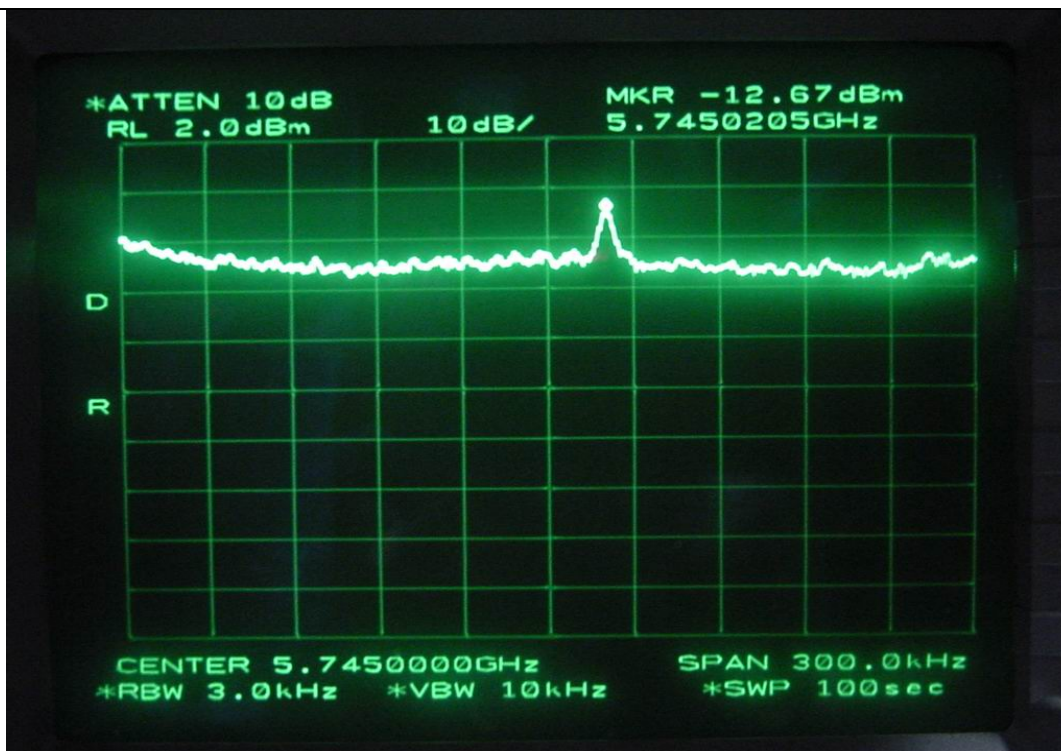
Middle Channel



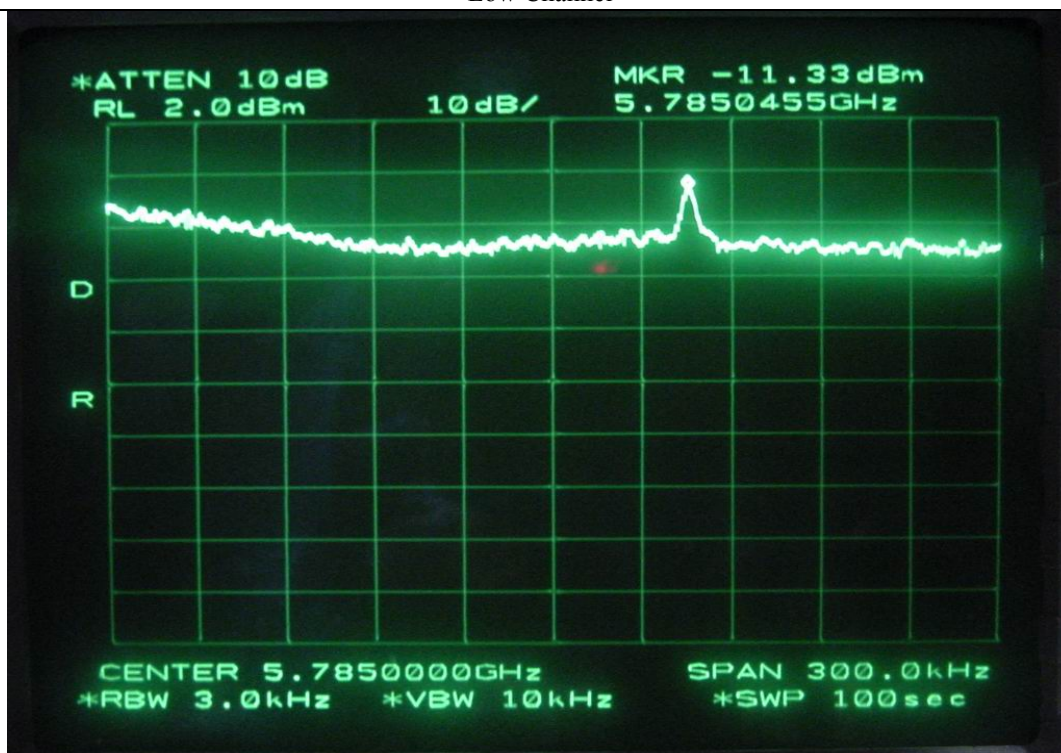
High Channel



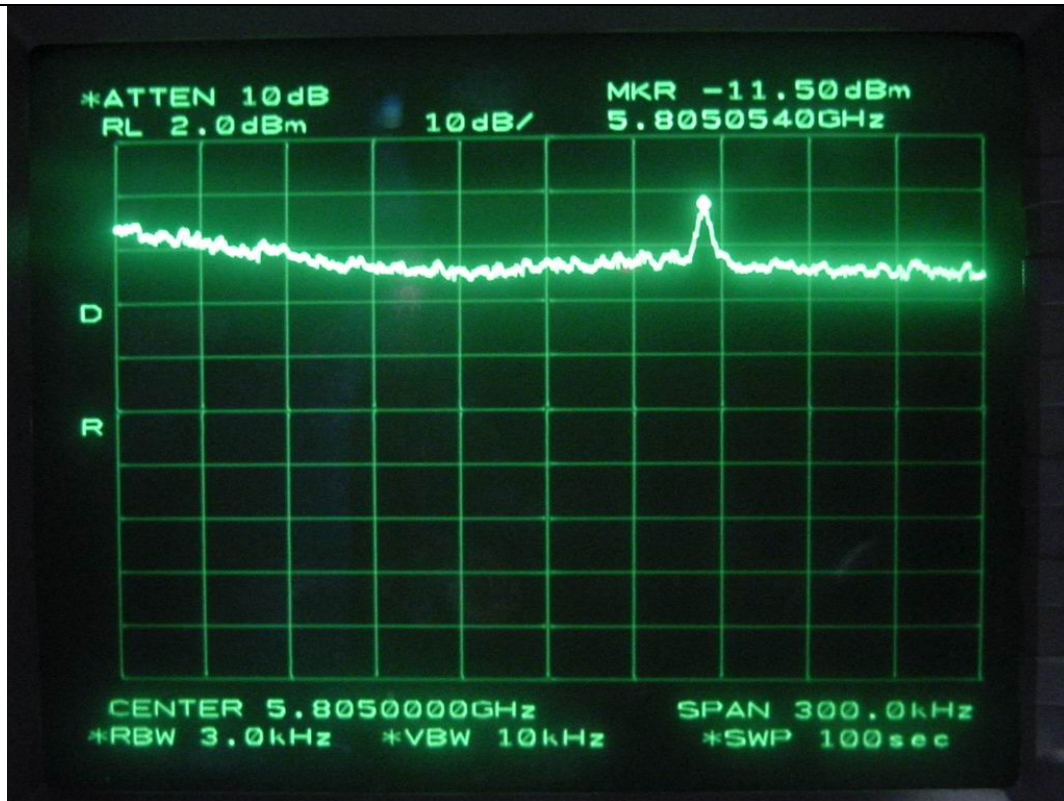
Photo of test data for 802.11a



Low Channel



Middle Channel



High Channel



12. RADIATED EMISSION TEST, GENERAL REQUIREMENT

12.1 Operating environment

Temperature : 14°C

Relative humidity : 39 %

12.2 Test set-up

The radiated emissions measurements were on the 3 meters, open-field test site. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30MHz to 1000MHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 and 4.0 meters in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

Test set-up photos are included in appendix VI.

12.3 Measurement uncertainty

Radiated emission electric field intensity, 30 MHz ~ 200 MHz : ±4.3 dB

Radiated emission electric field intensity, 200 MHz ~ 1000 MHz : ±4.1 dB

12.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due Cal.
■ -	ESVS10	Rohde & Schwarz	EMI Test Receiver	827864/005	Nov. 01, 2005
■ -	85650A	Hewlett Packard	Quasi-Peak Adapter	3107A01542	July 10, 2005
■ -	8568B	Hewlett-Packard	Spectrum Analyzer	3109A05456	July 10, 2005
■ -	85685A	Hewlett-Packard	RF Preselector	3107A01264	July 10, 2005
□ -	8449B	Hewlett-Packard	RF Amplifier	3008A00833	June 10, 2005
□ -	8447F	Hewlett-Packard	RF Amplifier	3113A04554	June 10, 2005
■ -	MA220	HD	Turn Table	N/A	N/A
■ -	HD240	HD	Antenna Mast	N/A	N/A
■ -	3104C	EMCO	Biconical Antenna	9109-4441	July 11, 2005
■ -	3146	EMCO	Log Periodic Antenna	9109-3214	July 11, 2005
■ -	YSE 500B	YoungShin Eng.	Frequency Converter	950413001	N/A
■ -	ETCR-10	DaeHa	Automatic Voltage Com.	N/A	N/A

All test equipment used is calibrated on a regular basis.



12.5 Test data

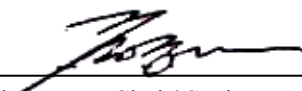
- . Test Date : October 29, 2004
-. Resolution bandwidth : 120 kHz
-. Frequency range : 30MHz ~ 1000MHz
-. Measurement distance : 3m
-. Operating Condition : 802.11 b + g + a Mode
-. Test result : Passed by -4.78 dB at 658.80 MHz

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
200.00	16.60	H	16.07	2.20	34.87	43.52	-8.65
250.00	20.60	H	17.17	2.60	40.37	46.02	-5.65
300.00	16.90	H	20.04	2.90	39.84	46.02	-6.18
591.24	18.20	H	18.32	4.06	40.58	46.02	-5.44
658.80	17.20	V	19.82	4.22	41.24	46.02	-4.78

Tabulated test data for Radiated Electromagnetic Field

Remark: "H": Horizontal, "V": Vertical

802.11b, 802.11g and 802.11a each modes were tested, but the worst emissions were recorded in this test report.


Tested by: Y. M. Choi / Senior Engineer6.



13. CONDUCTED EMISSION TEST

13.1 Operating environment

Temperature : 20°C

Relative humidity : 34 %

13.2 Test set-up

The conducted emission measurements of power line were performed in a shielded room. The EUT was placed on a wooden table, 0.8 meters height above the floor. Power was fed to the EUT through a 50 ohm/ 50 microhenry Line Impedance Stabilization Network (LISN). The ground plane was electrically bonded to the shield room ground system and all power lines entering the shield room were filtered.

13.3 Measurement uncertainty

Conducted emission, quasi-peak detect : ±3.0 dB

Conducted emission, average detect : ±3.0 dB

13.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due Cal.
■ -	ESHS10	Rohde & Schwarz	EMI Test Receiver	834467/007	Apr. 29, 2005
■ -	3825/2	EMCO	AMN	9109-1869	Oct. 20, 2005
■ -	N/A	HanKook Shield room	Shield Room	N/A	N/A
■ -	YSE 500B	YoungShin Eng.	Frequency Converter	950413001	N/A
■ -	ETCR-10	DaeHa	Automatic Voltage Com.	N/A	N/A

All test equipment used is calibrated on a regular basis.



13.5 Test data

- Test Date : October 21, 2004
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15MHz ~ 30MHz
- Operating Condition : 802.11 b + g + a Mode
- Test Result : PASSED BY -3.33 dB at 2.220 MHz with Peak Detector

Frequency (MHz)	Line	Quasi-Peak (dBuV)			Margin (dB)	Average (dBuV)		Margin (dB)
		Emission level	Detect Mode	Limits		Emission level	Limits	
0.15	N	54.20	P	66.00	-11.80			
0.515	N	45.87	P	56.00	-10.13			
0.74	N	46.13	P	56.00	-9.87	30.32	46.00	-15.68
0.87	N	45.86	P	56.00	-10.14			
0.965	H	45.16	P	56.00	-10.84			
2.220	N	52.67	P	56.00	-3.33	33.18	46.00	-12.82
2.255	H	51.67	P	56.00	-4.33	29.41	46.00	-16.59
2.740	N	45.10	P	56.00	-10.90			

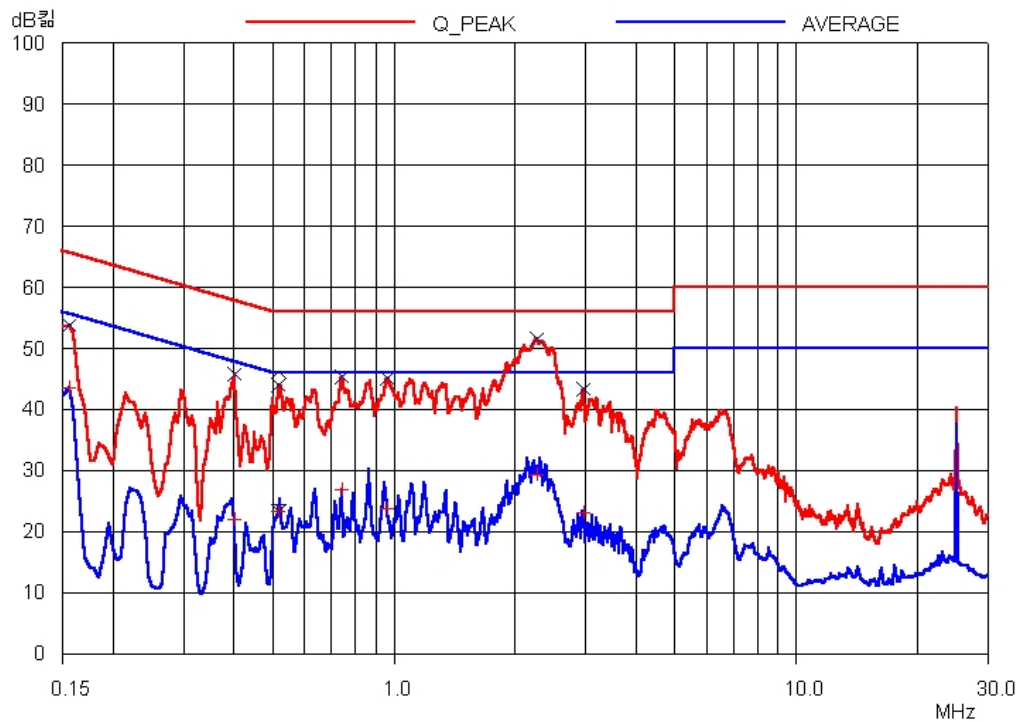
Line Conducted Emissions Tabulated Data

Remark : "H": Hot Line, "N": Neutral line, "P": Peak detect.

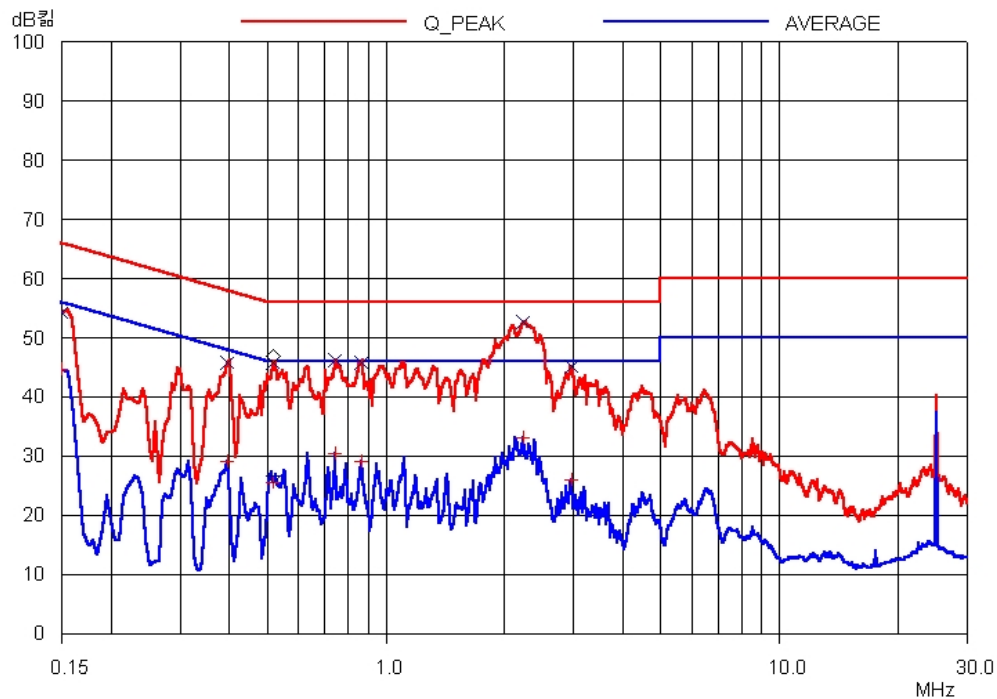
802.11b, 802.11g and 802.11a each modes were tested, but the worst emissions were recorded in this test report.

See next page for an overview sweep performed with peak and average detector.


Tested by: Y. M. Choi / Senior Engineer6.



HOT LINE



NEUTRAL LINE