

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

Test report file number : E05DR-047

Applicant : MTI Co., Ltd.
Address : 166-10 Garak-dong, Songpa-gu, Seoul Korea

Manufacturer : MTI Co., Ltd.
Address : 166-10 Garak-dong, Songpa-gu, Seoul Korea

Type of Equipment : WLAN Cable Access Point

FCC ID. : SQD-6220APU-ABG

Model Name : WLAN Cable Access Point 6220-APU

Serial number : None

Total page of Report : 58 pages (including this page)

Date of Incoming : December 22, 2005

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SUMMARY

The equipment complies with the regulation; **FCC Part 15 Subpart C Section 15.247 and Subpart E.**

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

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1. VERIFICATION OF COMPLIANCE

APPLICANT : MTI Co., Ltd.
ADDRESS : 166-10 Garak-dong, Songpa-gu, Seoul Korea
CONTACT PERSON : H. S. Byun / Director
TELEPHONE NO : +82-2-421-4042
FCC ID : SQD-6220APU-ABG
MODEL NO/NAME : WLAN Cable Access Point 6220-APU
SERIAL NUMBER : N/A
DATE : November 7, 2005

EQUIPMENT CLASS	<i>DTS – DIGITAL TRNSMISSION SYSTEM</i> <i>NII – Unlicensed National Information Infrastructure Tx</i>
KIND OF EQUIPMENT	WLAN Cable Access Point
THIS REPORT CONCERNS	ORIGINAL GRANT
MEASUREMENT PROCEDURES	ANSI C63.4/2003
TYPE OF EQUIPMENT TESTED	PRE-PRODUCTION
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	CERTIFICATION
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	PART 15 SUBPART C Section 15.247 and Subpart E
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	NONE
FINAL TEST WAS CONDUCTED ON	3 METER(S) OPEN AREA TEST SITE

- The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.247 (a) (2)	Minimum 6dB Bandwidth	Met the Limit / See Note 1
15.247 (b) (3)	Maximum Peak Output Power	Met the Limit / See Note 1
15.247 (b) (5)	Radio Frequency Exposure Level	Met the Limit / PASS
15.247 (c)	100 kHz Bandwidth Outside the Frequency Band	Met the Limit / PASS
15.247 (c)	Radiated Emission which fall in the Restricted Band	Met the Limit / PASS
15.247 (d)	Peak Power Spectral Density	Met the Limit / See Note 1
15.209	Radiated Emission Limits, General Requirement	Met the Limit / PASS
15.207	Conducted Limits	Met the Limit / PASS
15.203	Antenna Requirement	Met requirement / PASS
15.407 (a) (1), (2)	Maximum Conducted Output Power	Met the Limit / See Note 1
15.407 (a) (1), (2)	Peak Power Spectral Density	Met the Limit / See Note 1
15.407 (a) (6)	Peak Exclusion	Met the Limit / See Note 1
15.407 (b) (4)	Undesirable Emission Limits	Met the Limit / PASS
15.407 (b) (6)	Radiated Emission Limits, General Requirement	Met the Limit / PASS
15.407 (b) (6)	Conducted Limits	Met the Limit / PASS
15.407 (e)	Indoor Use within the 5.15 – 5.25 GHz	Not Applicable / See Note 2
15.407 (f)	Radiation Exposure Requirement	Met requirement / PASS
15.407 (g)	Frequency Stability	Met the Limit / See Note 1

Note 1. The Equipment under Test (EUT) shall be used the WLAN Module approved by modular approval has FCC ID: MXF-M930907. The module shall be inserted in to the socket on the main board in the EUT without any change, so the test was not performed, so please refer to test report for the module issued by the ADT.

Note 2. The used WLAN Module can be operated at 2412-2462MHz, 5150-5350MHz, and 5725-5850MHz and turbo function, but the Equipment under Test (EUT) shall be operated at 2412-2462 and 5725-5825MHz, because the EUT disable 5150-5350 operating frequency band and turbo function via firmware.

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in section 2.1.

2.5 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.4/2001. Radiated testing was performed at a distance of 3 meters from EUT to the antenna.

2.6 Test Facility

The Electromagnetic compatibility measurement facilities are located on at 426-1 Daessangryung-Ri, Chowol-Myeon, Gwangju-Si, Gyeonggi-Do 464-080 Korea. Description details of test facilities were submitted to the Federal Communications Commission on January 18, 2002 (Registration Number: 92819 and 340658), accredited by KOLAS (Korea Laboratory Accreditation Scheme, No: 85) and approved by TUV, DNV, SEMKO and MIC (Ministry of Information and Communications in Korea) according to the requirement of ISO17025.

3. GENERAL INFORMATION

3.1 Product Description

The MTI Co., Ltd., Model WLAN Cable Access Point 6220-APU (referred to as the EUT in this report) is a Wireless LAN Cable Access Point, which is an outdoor hardened, standard mountable access point solution designed to extend the reach of the cable operators' hybrid fiber coax network utilizing wireless technologies from existing rights of ways. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Base Station Equipment
OPERATING FREQUENCY	2412-2462 MHz and 5725 ~5825 MHz
OUTPUT POWER	802.11b: 19dBm±1.5dB, 802.11g: 15dBm±1.5dB 802.11a: 12dBm±1.5dB
DATA TRANSFER RATE	802.11b: Max. 11Mbps 802.11g: Max. 54Mbps 802.11a: Max. 54Mbps
CHANNEL	802.11b/g: 11 Channels, 802.11a: 7 Channels
MODULATION TYPE	802.11b: DSSS, 802.11a/g: OFDM
USED ANTENNA & GAIN	Panel Antenna, 14 dBi for 802.11 b/g Bidirectional Antenna, 9 dBi for 802.11 b/g Omni Directional Antenna, 7 dBi for 802.11 b/g Panel Antenna, 22 dBi for 802.11a
USED WLAN MODULE	MFR: Gemtek Technology Co., Ltd.
	Model No: WMIA-123AG FCC ID: MXF-M930907
LIST OF EACH OSC. OR CRYSTAL. FREQ.(FREQ.>=1MHz)	4 MHz, 14.3 MHz and 2 X 25 MHz
NUMBER OF LAYER	Access Point Module: 6 Layers, Cable Modem Module: 4 Layers PSU Module: 2 Layers, HFC Filter Module: 2 Layers
POWER REQUIREMENT	AC60V 15A
EXTERNAL CONNECTOR	Antenna Port, Cable Modem Port and Monitor Port

3.2 Alternative type(s)/model(s); also covered by this test report.

- None

4. EUT MODIFICATIONS

- None

5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
AP Board	MTI Co., Ltd.	AP6220-B4-RN2	N/A
CATV Board	MTI Co., Ltd.	CM6220-B4-R1	N/A
CATV Ant. Board	MTI Co., Ltd.	AP-1046F	N/A
LED BOARD	A-PRO Co., Ltd	AP1046SP4A	N/A
Power Board	MTI Co., Ltd.	PCB1046MRevC	N/A
MPCI WLAN Card	Gemtek Technology Co., Ltd	WMIA-123AG	MXF-M930907

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	FCC ID	Description	Connected to
WLAN Cable Access Point 6220-APU	MTI Co., Ltd.	SQD-6220APU-ABG	WLAN Cable Access Point (EUT)	HOST
UBR7223	Cisco	N/A	CMTS	EUT
SSW-04900NBC	N/A	N/A	CATV Power Supply	HOST
N/A	N/A	N/A	Power Insert	HOST

5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting and receiving mode is programmed. For final testing, WLAN was set at Low Channel, Middle Channel, and High Channel with applicable all transfer data rate. The EUT has 3 different type antennas, so each antenna was used for the following test mode, but the worst emissions were recorded in this test report. The set frequency and data transfer rate for the testing is as follows.

Operating Mode	Low Channel	Middle Channel	High Channel	Data Transfer Rate
802.11b	2412 MHz	2437MHz	2462MHz	1, 2, 5.5, and 11 Mbps
802.11g	2412 MHz	2437MHz	2462MHz	6, 9, 12, 18, 24, 36, 48, and 54Mbps
802.11a	5745MHz	5785MHz	5805MHz	6, 9, 12, 18, 24, 36, 48, and 54Mbps

5.4 Configuration of Test System

Line Conducted Test: It is not need to test this requirement, because the EUT shall be operated by DC Voltage and does not connected to public mains network directly.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.4/2001 8.3.1.1 and 13.1.4.1 to determine the worse operating conditions. Final radiated emission tests were conducted at 3meter open area test site.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

6. USED ANTENNA

6.1 Antenna Specification

One of following antennas shall be used with the EUT and each antenna was tested with the EUT.

Antenna Type	Model No	Frequency Range	Antenna Gain	Manufacturer
Panel Antenna	NTI-2407	2400 – 2483 MHz	14dBi	MTI Co., Ltd
Bidirectional Antenna	NTA-2412	2400 – 2483 MHz	9 dBi	MTI Co., Ltd
Omni Directional Antenna	NTA-2400	2400 – 2483 MHz	7 dBi	MTI Co., Ltd
Panel Antenna	MT-485028/N	5150 – 5875 MHz	22 dBi	MTI Co., Ltd

6.2 Antenna Requirement

The intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device according to section 15.203.

Antenna Construction:

The transmitter antenna of the EUT is intended to mount to the EUT Enclosure, so no consideration of replacement by the user.

7. MAXIMUM PEAK OUTPUT POWER

7.1 Limit and Result

According to the FCC Rule Section 15.247 and Subpart E, the transmitting antennas of directional gain greater than 6dBi were used, the peak output power from the intentional radiator was reduced below 1W by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Operating Mode	Peak Output Power form the Module	Max. Antenna Gain	Limit	Margin
802.11b	16.2dBm	14dBi	22dBm	-5.8dB
802.11g	14.2dBm	14dBi	22dBm	-7.8dB
802.11a	12.1dBm	22dBi	14dBm	-1.9dB

Regarding Peak Output Power value from the Module, please refer to test report for the module has FCC ID: MXF-M930907 issued by the ADT.

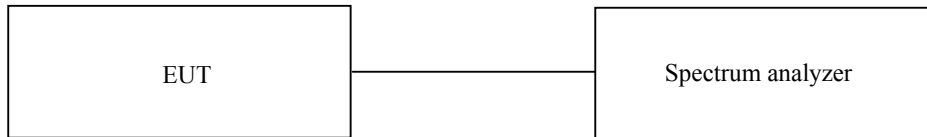
8. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

8.1 Operating environment

Temperature : 13°C
Relative humidity : 53 %

8.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution and video bandwidth is set to 100 kHz, and peak detection was used.



8.3 Test data

Please refer to test report issued by the ADT.

8.4 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3meters, open-field test site. The EUT was placed on a non-conductive turntable approximately 0.8 meters above the ground plane.

The frequency spectrum from 30MHz to 25GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 and 4.0 meters in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

8.5 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due Cal.
■ -	8564E	Hewlett-Packard	Spectrum Analyzer	3650A00756	July 19, 2006
■ -	8449B	Hewlett-Packard	Preamplifier	3008A00833	June 19, 2006
□ -	83051A	Agilent	Preamplifier	3950M00201	June 10, 2005
■ -	F-40-5000-RF	RLC Electronics	Highpass Filter	0425	June 19, 2006
■ -	MA220	HD	Turn Table	N/A	N/A
■ -	HD240	HD	Antenna Mast	N/A	N/A
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	June 6, 2006
■ -	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.

8.6. Test data for radiated emission

8.6.1 Operating condition: 802.11b Mode with Panel Antenna

8.6.1.1 Radiated Emission which fall in the Restricted Band

- Operating Condition: Low Channel

- Test Date : December 27, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Measurement distance : 3m
- Result : PASSED BY -2.53dB at 1 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Data Transfer Rate: 1 Mbps									
2390.00	31.83	Peak	H	27.64	1.33	-	60.80	74.00	-13.20
	20.33	Average					49.30	54.00	-4.70
	35.33	Peak	V				64.30	74.00	-9.70
	22.50	Average					51.47	54.00	-2.53
Data Transfer Rate: 5.5 Mbps									
2390.00	31.50	Peak	H	27.64	1.33	-	60.47	74.00	-13.53
	20.17	Average					49.14	54.00	-4.86
	35.10	Peak	V				64.07	74.00	-9.93
	22.50	Average					51.47	54.00	-2.53
Data Transfer Rate: 11 Mbps									
2390.00	31.50	Peak	H	27.64	1.33	-	60.47	74.00	-13.53
	20.10	Average					49.07	54.00	-4.93
	35.23	Peak	V				64.20	74.00	-9.80
	22.40	Average					51.37	54.00	-2.63

Tabulated test data for Restricted Band

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

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Tested by: Ki-Hong, Nam / Test Engineer



Peak Horizontal



Average Horizontal



Peak Vertical



Average Vertical

-.Operating Condition : High Channel

- Test Data : December 27, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Measurement distance : 3m
- Result : PASSED BY -2.91dB at 1 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Data Transfer Rate: 1 Mbps									
2483.50	31.50	Peak	H	27.64	1.33	-	60.42	74.00	-13.58
	20.33	Average					49.25	54.00	-4.75
	33.17	Peak	V				62.09	74.00	-11.91
	22.17	Average					51.09	54.00	-2.91
Data Transfer Rate: 5.5 Mbps									
2483.50	31.33	Peak	H	27.64	1.33	-	60.25	74.00	-13.75
	20.15	Average					49.07	54.00	-4.93
	32.67	Peak	V				61.59	74.00	-12.41
	22.10	Average					51.02	54.00	-2.98
Data Transfer Rate: 11 Mbps									
2483.50	31.50	Peak	H	27.64	1.33	-	60.42	74.00	-13.58
	20.10	Average					49.02	54.00	-4.98
	33.00	Peak	V				61.92	74.00	-12.08
	22.10	Average					51.02	54.00	-2.98

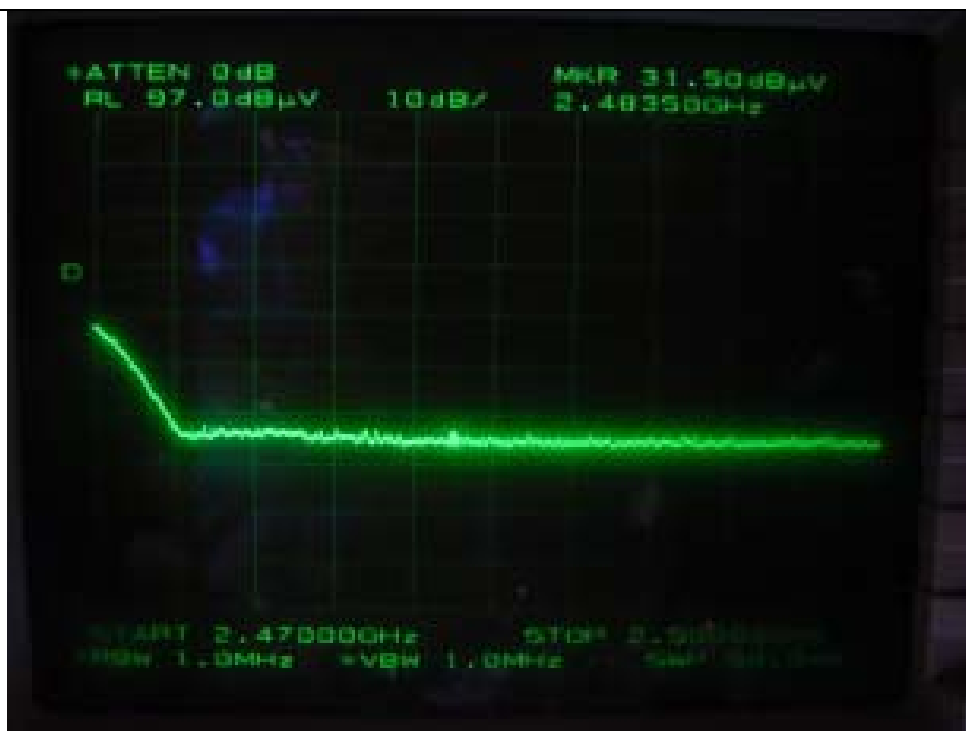
Tabulated test data for Restricted Band

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

Each data transfer rates were tested, but the worst data was collected at the above tabulated test data.

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Tested by: Ki-Hong, Nam / Test Engineer



Peak Horizontal



Average Horizontal



Peak Vertical



Average Vertical

8.6.1.2 Spurious & Harmonic Radiated Emission

- Test Date : December 27, 2005
- 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 -15.12 dB at Middle Channel with 1 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for Low Channel									
4824.00*	38.50	Peak	H	31.30	2.62	25.4	47.01	74.00	-26.99
	28.17	Average					36.68	54.00	-17.32
	38.83	Peak	V				47.34	74.00	-26.66
	28.83	Average					37.34	54.00	-16.66
Test Data for Middle Channel									
4874.00*	40.17	Peak	H	31.37	2.58	25.4	48.72	74.00	-25.28
	30.17	Average					38.72	54.00	-15.28
	41.17	Peak	V				49.72	74.00	-24.28
	30.33	Average					38.88	54.00	-15.12
Test Data for High Channel									
4924.00*	38.67	Peak	H	31.44	2.55	25.4	47.26	74.00	-26.74
	27.17	Average					35.76	54.00	-18.24
	39.00	Peak	V				47.59	74.00	-26.41
	27.83	Average					36.42	54.00	-17.58
Other Frequencies were not observed up to 25GHz.									

Tabulated test data

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

All data transfer rates were tested at each channel, but the worst emissions were recorded in this test report.

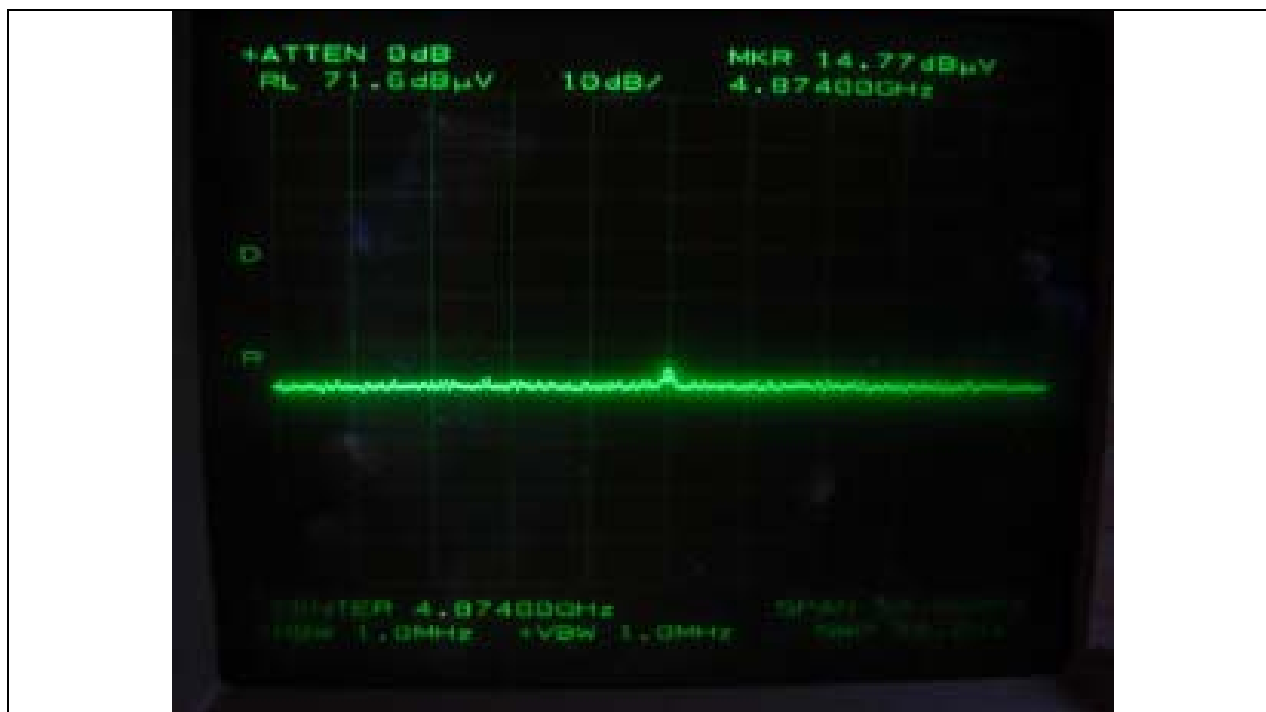
Tested by: Ki-Hong, Nam / Test Engineer



Low Channel: Peak Horizontal



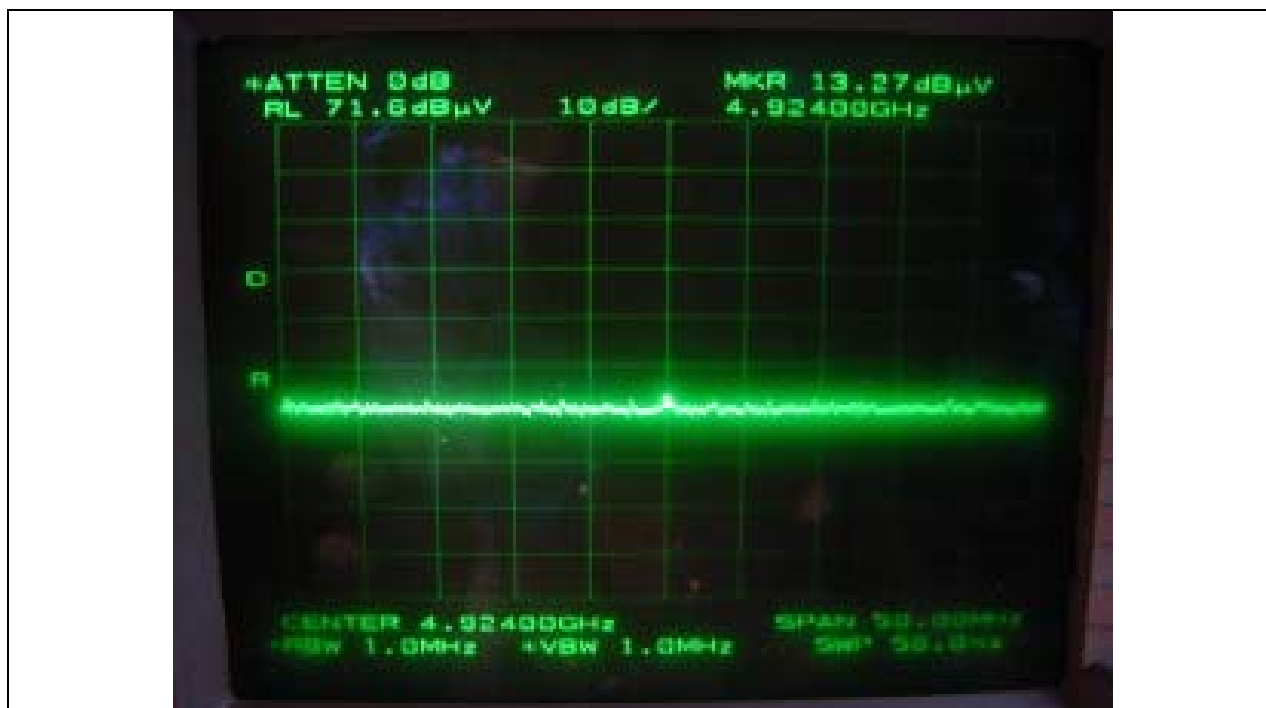
Low Channel: Peak Vertical



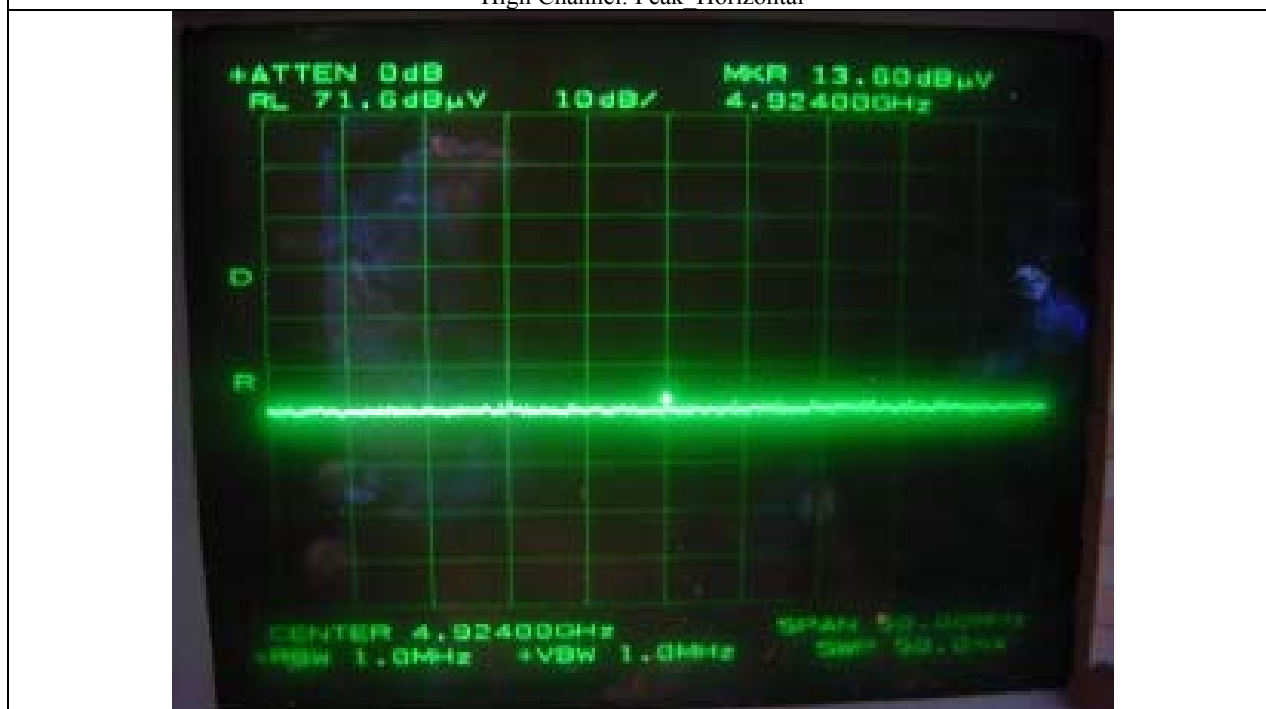
Middle Channel: Peak Horizontal



Middle Channel: Peak Vertical



High Channel: Peak Horizontal



High Channel: Peak Vertical

8.6.2 Operating condition: 802.11b Mode with Bidirectional Antenna

8.6.2.1 Radiated Emission which fall in the Restricted Band

- Operating Condition: Low Channel

- Test Date : December 28, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Measurement distance : 3m
- Result : PASSED BY -3.36dB at 1 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Data Transfer Rate: 1 Mbps									
2390.00	31.83	Peak	H	27.64	1.33	-	60.80	74.00	-13.20
	20.33	Average					49.30	54.00	-4.70
	33.67	Peak	V				62.64	74.00	-11.36
	21.67	Average					50.64	54.00	-3.36
Data Transfer Rate: 5.5 Mbps									
2390.00	31.67	Peak	H	27.64	1.33	-	60.64	74.00	-13.36
	20.17	Average					49.14	54.00	-4.86
	32.33	Peak	V				61.30	74.00	-12.70
	21.50	Average					50.47	54.00	-3.53
Data Transfer Rate: 11 Mbps									
2390.00	31.50	Peak	H	27.64	1.33	-	60.47	74.00	-13.53
	20.10	Average					49.07	54.00	-4.93
	33.00	Peak	V				61.97	74.00	-12.03
	21.33	Average					50.30	54.00	-3.70

Tabulated test data for Restricted Band

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

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Tested by: Ki-Hong, Nam / Test Engineer

-.Operating Condition : High Channel

- Test Data : December 28, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Measurement distance : 3m
- Result : PASSED BY -3.58dB at 1 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Data Transfer Rate: 1 Mbps									
2483.50	31.50	Peak	H	27.59	1.33	-	60.42	74.00	-13.58
	20.33	Average					49.25	54.00	-4.75
	32.00	Peak	V				60.92	74.00	-13.08
	21.50	Average					50.42	54.00	-3.58
Data Transfer Rate: 5.5 Mbps									
2483.50	31.33	Peak	H	27.59	1.33	-	60.25	74.00	-13.75
	20.17	Average					49.09	54.00	-4.91
	31.67	Peak	V				60.59	74.00	-13.41
	21.17	Average					50.09	54.00	-3.91
Data Transfer Rate: 11 Mbps									
2483.50	31.10	Peak	H	27.59	1.33	-	60.02	74.00	-13.98
	20.10	Average					49.02	54.00	-4.98
	31.50	Peak	V				60.42	74.00	-13.58
	21.33	Average					50.25	54.00	-3.75

Tabulated test data for Restricted Band

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

Each data transfer rates were tested, but the worst data was collected at the above tabulated test data.

기홍

Tested by: Ki-Hong, Nam / Test Engineer

8.6.2.2 Spurious & Harmonic Radiated Emission

- Test Date : December 28, 2005
- 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 -18.35 dB at Middle Channel with 1 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for Low Channel									
4824.00*	36.83	Peak	H	31.30	2.62	25.4	45.34	74.00	-28.66
	26.17	Average					34.68	54.00	-19.32
	37.00	Peak	V				45.51	74.00	-28.49
	26.33	Average					34.84	54.00	-19.16
Test Data for Middle Channel									
4874.00*	37.33	Peak	H	31.37	2.58	25.4	45.88	74.00	-28.12
	27.00	Average					35.55	54.00	-18.45
	37.25	Peak	V				45.80	74.00	-28.20
	27.10	Average					35.65	54.00	-18.35
Test Data for High Channel									
4924.00*	36.67	Peak	H	31.44	2.55	25.4	45.26	74.00	-28.74
	26.00	Average					34.59	54.00	-19.41
	36.83	Peak	V				45.42	74.00	-28.58
	26.10	Average					34.69	54.00	-19.31
Other Frequencies were not observed up to 26GHz.									

Tabulated test data

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

All data transfer rates were tested at each channel, but the worst emissions were recorded in this test report.

Tested by: Ki-Hong, Nam / Test Engineer

8.6.3 Operating condition: 802.11b Mode with Omni-directional Antenna

8.6.3.1 Radiated Emission which fall in the Restricted Band

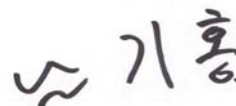
- Operating Condition: Low Channel

- Test Date : December 28, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Measurement distance : 3m
- Result : PASSED BY -4.70 dB at 1 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Data Transfer Rate: 1 Mbps									
2390.00	31.00	Peak	H	27.64	1.33	-	59.97	74.00	-14.03
	20.00	Average					48.97	54.00	-5.03
	31.83	Peak	V				60.80	74.00	-13.20
	20.33	Average					49.30	54.00	-4.70
Data Transfer Rate: 5.5 Mbps									
2390.00	30.90	Peak	H	27.64	1.33	-	59.87	74.00	-14.13
	19.67	Average					48.64	54.00	-5.36
	31.50	Peak	V				60.47	74.00	-13.53
	19.93	Average					48.90	54.00	-5.10
Data Transfer Rate: 11 Mbps									
2390.00	31.00	Peak	H	27.64	1.33	-	59.97	74.00	-14.03
	19.50	Average					48.47	54.00	-5.53
	31.33	Peak	V				60.30	74.00	-13.70
	19.95	Average					48.92	54.00	-5.08

Tabulated test data for Restricted Band

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



Tested by: Ki-Hong, Nam / Test Engineer

-Operating Condition : High Channel

- Test Data : December 28, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Measurement distance : 3m
- Result : PASSED BY -4.25dB at 1 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Data Transfer Rate: 1 Mbps									
2483.50	31.33	Peak	H	27.59	1.33	-	60.25	74.00	-13.75
	20.17	Average					49.09	54.00	-4.91
	32.50	Peak	V				61.42	74.00	-12.58
	20.83	Average					49.75	54.00	-4.25
Data Transfer Rate: 5.5 Mbps									
2483.50	30.90	Peak	H	27.59	1.33	-	59.82	74.00	-14.18
	19.83	Average					48.75	54.00	-5.25
	31.50	Peak	V				60.42	74.00	-13.58
	20.00	Average					48.92	54.00	-5.08
Data Transfer Rate: 11 Mbps									
2483.50	30.95	Peak	H	27.59	1.33	-	59.87	74.00	-14.13
	19.67	Average					48.59	54.00	-5.41
	31.00	Peak	V				59.92	74.00	-14.08
	20.17	Average					49.09	54.00	-4.91

Tabulated test data for Restricted Band

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

Each data transfer rates were tested, but the worst data was collected at the above tabulated test data.

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Tested by: Ki-Hong, Nam / Test Engineer

8.6.3.2 Spurious & Harmonic Radiated Emission

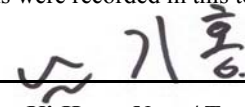
- Test Date : December 28, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Frequency range : 1 GHz ~ 26 GHz
- Measurement distance : 3m
- Result : PASSED BY -19.99 dB at Low Channel with 1 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for Low Channel									
4824.00*	36.50	Peak	H	31.30	2.62	25.4	45.01	74.00	-28.99
	25.50	Average					34.01	54.00	-19.99
	36.00	Peak	V				44.51	74.00	-29.49
	25.00	Average					33.51	54.00	-20.49
Test Data for Middle Channel									
4874.00*	36.00	Peak	H	31.37	2.58	25.4	44.55	74.00	-29.45
	24.67	Average					33.22	54.00	-20.78
	35.95	Peak	V				44.50	74.00	-29.50
	25.90	Average					34.45	54.00	-19.55
Test Data for High Channel									
4924.00*	36.67	Peak	H	31.44	2.55	25.4	45.26	74.00	-28.74
	25.17	Average					33.76	54.00	-20.24
	36.30	Peak	V				44.89	74.00	-29.11
	25.17	Average					33.76	54.00	-20.24
Other Frequencies were not observed up to 26GHz.									

Tabulated test data

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

All data transfer rates were tested at each channel, but the worst emissions were recorded in this test report.


Tested by: Ki-Hong, Nam / Test Engineer

8.7.1 Operating condition: 802.11g Mode with Panel Antenna

8.7.1.1 Radiated Emission which fall in the Restricted Band

- Operating Condition : Low Channel

- Test Date : December 27, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Measurement distance : 3m
- Result : PASSED BY -1.86dB at 6 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Data Transfer Rate: 6 Mbps									
2390.00	31.33	Peak	H	27.64	1.33	-	60.30	74.00	-13.70
	20.50	Average					49.47	54.00	-4.53
	34.83	Peak	V				63.80	74.00	-10.20
	23.17	Average					52.14	54.00	-1.86
Data Transfer Rate: 24 Mbps									
2490.00	31.00	Peak	H	27.64	1.33	-	59.97	74.00	-14.03
	20.10	Average					49.07	54.00	-4.93
	34.67	Peak	V				63.64	74.00	-10.36
	23.10	Average					52.07	54.00	-1.93
Data Transfer Rate: 54 Mbps									
2490.00	31.20	Peak	H	27.64	1.33	-	60.17	74.00	-13.83
	20.17	Average					49.14	54.00	-4.86
	34.33	Peak	V				63.30	74.00	-10.70
	23.00	Average					51.97	54.00	-2.03

Tabulated test data for Restricted Band

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

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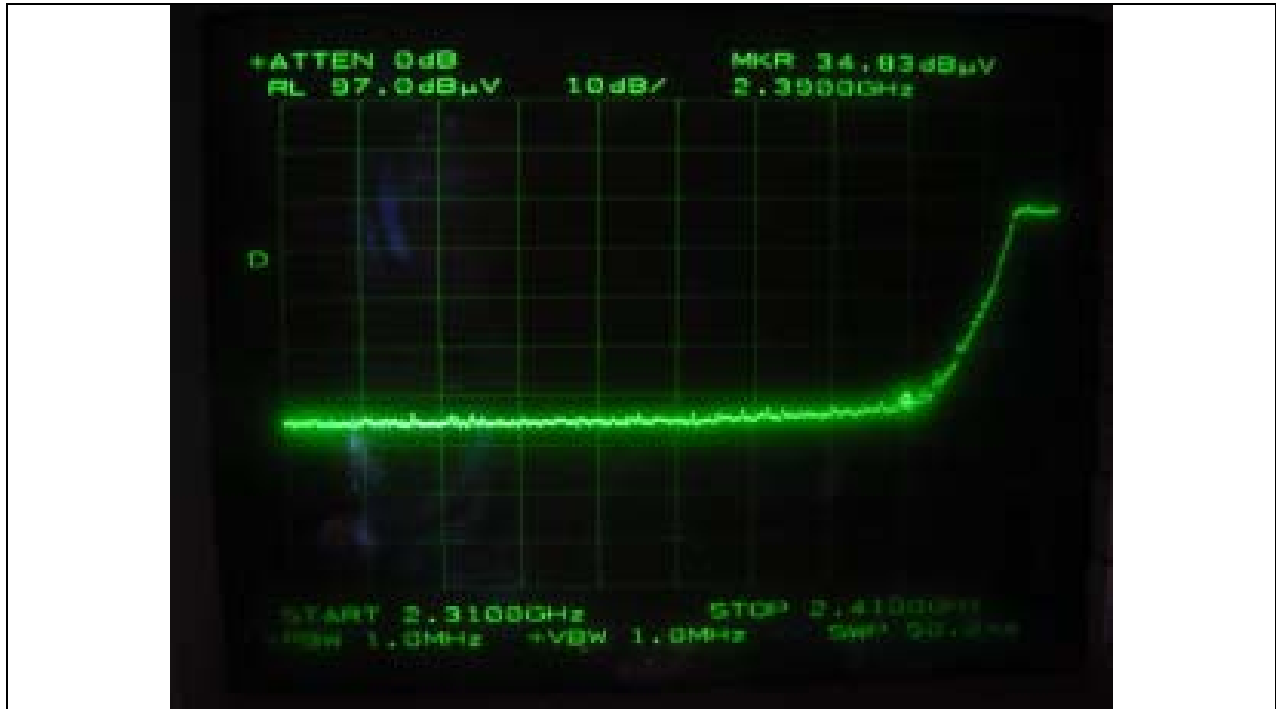
Tested by: Ki-Hong, Nam / Test Engineer



Peak Horizontal



Average Horizontal



Peak_Vertical



Average_Vertical

-. Operating Condition : High Channel

- Test Date : December 27, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Measurement distance : 3m
- Result : PASSED BY -3.08dB at 6 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Data Transfer Rate: 6 Mbps									
2483.50	31.67	Peak	H	27.59	1.33	-	60.59	74.00	-13.41
	20.33	Average					49.25	54.00	-4.75
	34.33	Peak	V				63.25	74.00	-10.75
	22.00	Average					50.92	54.00	-3.08
Data Transfer Rate: 24 Mbps									
2483.50	31.33	Peak	H	27.59	1.33	-	60.25	74.00	-13.75
	20.15	Average					49.07	54.00	-4.93
	34.00	Peak	V				62.92	74.00	-11.08
	21.83	Average					50.75	54.00	-3.25
Data Transfer Rate: 54 Mbps									
2483.50	31.33	Peak	H	27.59	1.33	-	60.25	74.00	-13.75
	20.20	Average					49.12	54.00	-4.88
	34.00	Peak	V				62.92	74.00	-11.08
	21.83	Average					50.75	54.00	-3.25

Tabulated test data for Restricted Band

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

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Tested by: Ki-Hong, Nam / Test Engineer



Peak Horizontal



Average Horizontal



Peak Vertical



Average Vertical

8.7.1.2 Spurious & Harmonic Radiated Emission

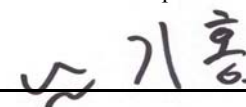
- Test Date : December 27, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Frequency range : 1 GHz ~ 26 GHz
- Measurement distance : 3m
- Result : PASSED BY -15.20 dB at Low Channel with 6 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for Low Channel									
4824.00*	37.50	Peak	H	31.30	2.62	25.40	46.01	74.00	-27.99
	27.00	Average					35.51	54.00	-18.49
	39.83	Peak	V				48.34	74.00	-25.66
	27.50	Average					36.01	54.00	-17.99
Test Data for Middle Channel									
4873.75*	39.00	Peak	H	31.44	2.58	25.40	47.63	74.00	-26.37
	29.50	Average					38.13	54.00	-15.87
	39.67	Peak	V				48.30	74.00	-25.70
	30.17	Average					38.80	54.00	-15.20
Test Data for High Channel									
4923.83*	36.33	Peak	H	31.44	2.55	25.40	44.92	74.00	-29.08
	26.00	Average					34.59	54.00	-19.41
	37.50	Peak	V				46.09	74.00	-27.91
	26.83	Average					35.42	54.00	-18.58
Other Frequencies were not observed up to 25GHz.									

Tabulated test data for Restricted Band

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

Each data transfer rates were tested, but the worst emissions were recorded in this test report.

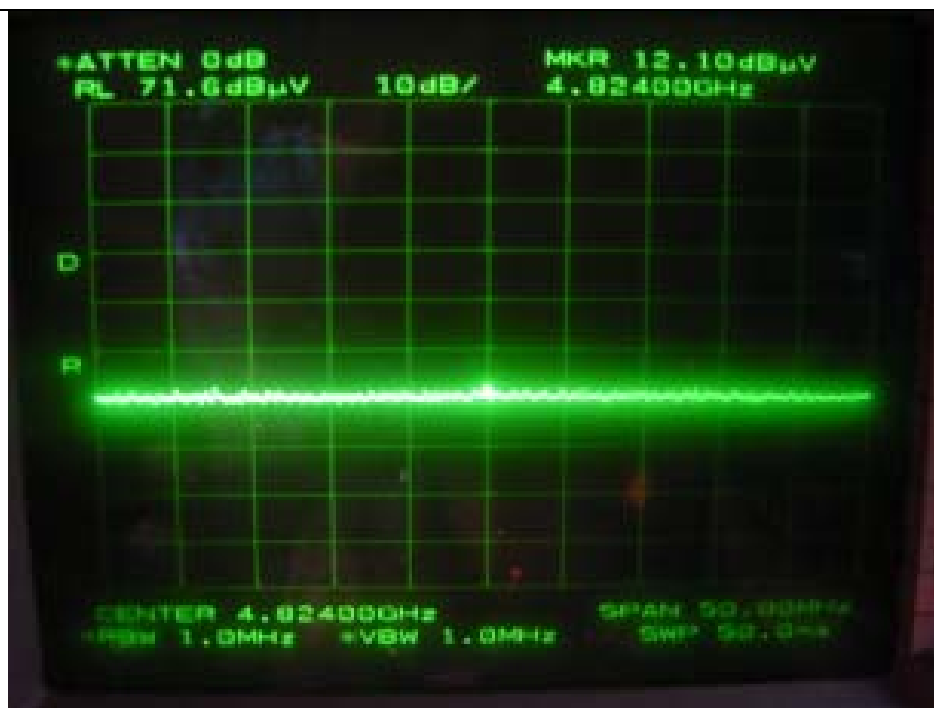

Tested by: Ki-Hong, Nam / Test Engineer

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(TEL: 82-31-746-8500 FAX: 82-31-746-8700)

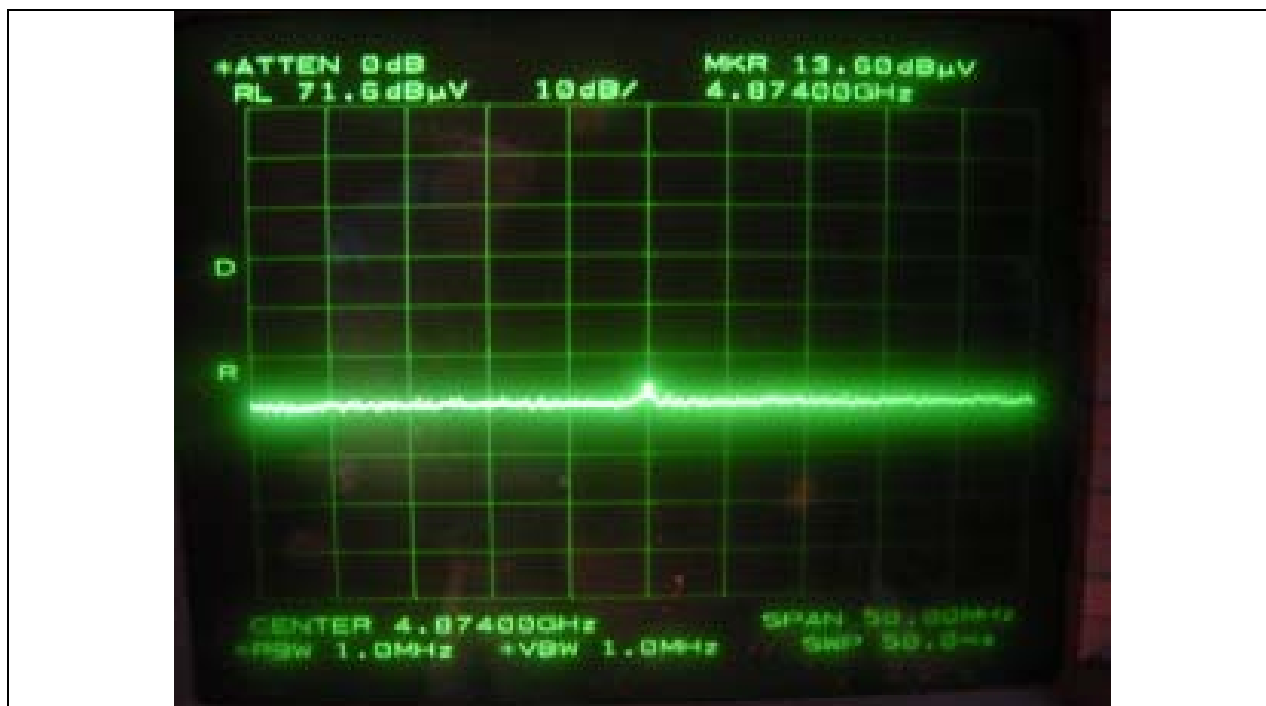
EMC Testing Dept : 426-1 Daessangryung-Ri, Chowol-Myun, Kwangju-Kun, Kyunggi-Do 464-860 Korea. (TEL: 82-31-765-8289 FAX: 82-31-766-2904)



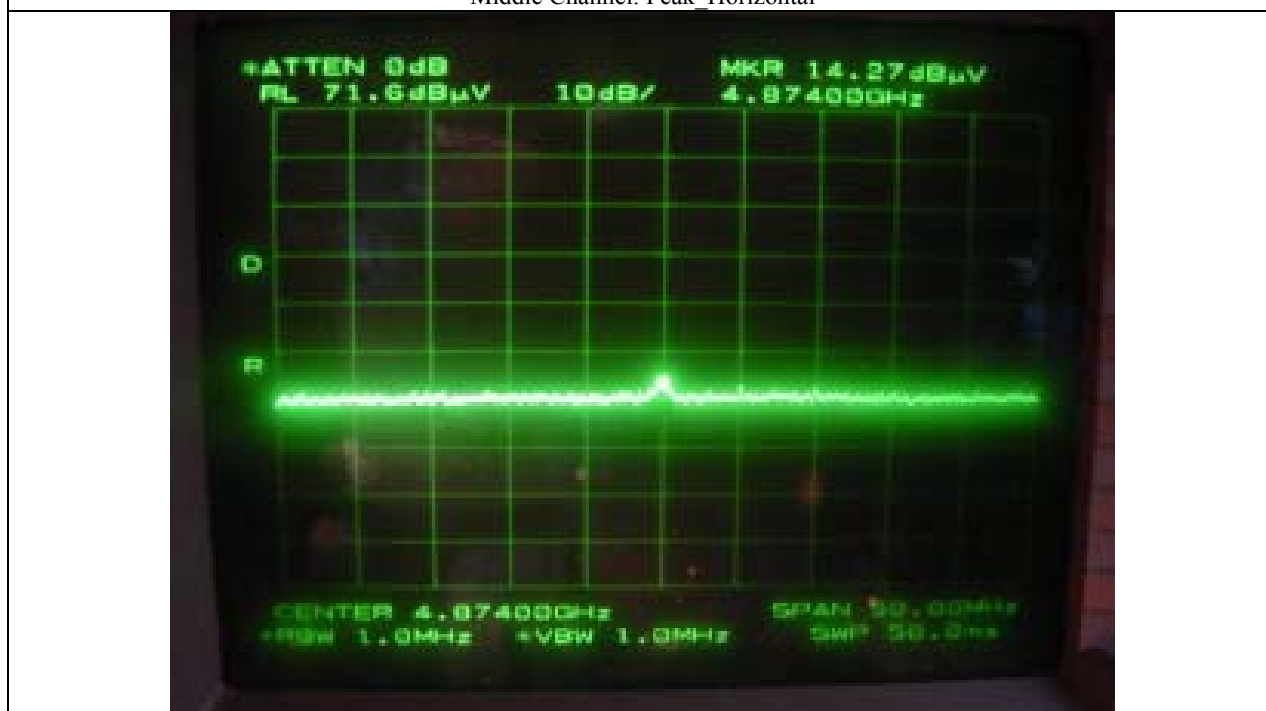
Low Channel: Peak Horizontal



Low Channel: Peak Vertical



Middle Channel: Peak Horizontal



Middle Channel: Peak Vertical



8.7.2 Operating condition: 802.11g Mode with Bidirectional Antenna

8.7.2.1 Radiated Emission which fall in the Restricted Band

- Operating Condition : Low Channel

- Test Date : December 28, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Measurement distance : 3m
- Result : PASSED BY -3.53dB at 6 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Data Transfer Rate: 6 Mbps									
2390.00	32.00	Peak	H	27.64	1.33	-	60.97	74.00	-13.03
	20.33	Average					49.30	54.00	-4.70
	32.83	Peak	V				61.80	74.00	-12.20
	21.50	Average					50.47	54.00	-3.53
Data Transfer Rate: 24 Mbps									
2390.00	31.67	Peak	H	27.64	1.33	-	60.64	74.00	-13.36
	20.10	Average					49.07	54.00	-4.93
	32.33	Peak	V				61.30	74.00	-12.70
	21.17	Average					50.14	54.00	-3.86
Data Transfer Rate: 54 Mbps									
2390.00	31.50	Peak	H	27.64	1.33	-	60.47	74.00	-13.53
	20.17	Average					49.14	54.00	-4.86
	32.33	Peak	V				61.30	74.00	-12.70
	21.17	Average					50.14	54.00	-3.86

Tabulated test data for Restricted Band

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

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Tested by: Ki-Hong, Nam / Test Engineer

-. Operating Condition : High Channel

- Test Date : December 28, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Measurement distance : 3m
- Result : PASSED BY -4.25dB at 6 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Data Transfer Rate: 6 Mbps									
2483.50	31.67	Peak	H	27.59	1.33	-	60.59	74.00	-13.41
	20.33	Average					49.25	54.00	-4.75
	32.50	Peak	V				61.42	74.00	-12.58
	20.83	Average					49.75	54.00	-4.25
Data Transfer Rate: 24 Mbps									
2483.50	31.67	Peak	H	27.59	1.33	-	60.59	74.00	-13.41
	20.33	Average					49.25	54.00	-4.75
	32.33	Peak	V				61.25	74.00	-12.75
	20.67	Average					49.59	54.00	-4.41
Data Transfer Rate: 54 Mbps									
2483.50	31.50	Peak	H	27.59	1.33	-	60.42	74.00	-13.58
	20.10	Average					49.02	54.00	-4.98
	32.33	Peak	V				61.25	74.00	-12.75
	20.17	Average					49.09	54.00	-4.91

Tabulated test data for Restricted Band

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

기홍

Tested by: Ki-Hong, Nam / Test Engineer

8.7.2.2 Spurious & Harmonic Radiated Emission

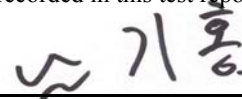
- Test Date : December 28, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Frequency range : 1 GHz ~ 26 GHz
- Measurement distance : 3m
- Result : PASSED BY -18.20dB at Middle Channel with 6 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for Low Channel									
4824.00*	37.17	Peak	H	31.30	2.62	25.40	45.68	74.00	-28.32
	25.50	Average					34.01	54.00	-19.99
	37.83	Peak	V				46.34	74.00	-27.66
	26.50	Average					35.01	54.00	-18.99
Test Data for Middle Channel									
4924.00*	36.83	Peak	H	31.44	2.58	25.40	45.46	74.00	-28.54
	25.67	Average					34.30	54.00	-19.70
	37.50	Peak	V				46.13	74.00	-27.87
	27.17	Average					35.80	54.00	-18.20
Test Data for High Channel									
4923.83*	36.50	Peak	H	31.44	2.55	25.40	45.09	74.00	-28.91
	25.33	Average					33.92	54.00	-20.08
	36.83	Peak	V				45.42	74.00	-28.58
	25.67	Average					34.26	54.00	-19.74
Other Frequencies were not observed up to 26GHz.									

Tabulated test data for Restricted Band

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

All data transfer rate was measured at each channel, but the worst emissions were recorded in this test report.



Tested by: Ki-Hong, Nam / Test Engineer

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EMC Testing Dept : 426-1 Daessangryung-Ri, Chowol-Myun, Kwangju-Kun, Kyunggi-Do 464-860 Korea. (TEL: 82-31-765-8289 FAX: 82-31-766-2904)

8.7.3 Operating condition: 802.11g Mode with Omni directional Antenna

8.7.3.1 Radiated Emission which fall in the Restricted Band

- Operating Condition : Low Channel

- Test Date : December 28, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Measurement distance : 3m
- Result : PASSED BY -4.70dB at 6 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Data Transfer Rate: 6 Mbps									
2390.00	31.00	Peak	H	27.64	1.33	-	59.97	74.00	-14.03
	20.17	Average					49.14	54.00	-4.86
	31.33	Peak	V				60.30	74.00	-13.70
	20.33	Average					49.30	54.00	-4.70
Data Transfer Rate: 24 Mbps									
2390.00	30.00	Peak	H	27.64	1.33	-	58.97	74.00	-15.03
	19.67	Average					48.64	54.00	-5.36
	30.67	Peak	V				59.64	74.00	-14.36
	19.83	Average					48.80	54.00	-5.20
Data Transfer Rate: 54 Mbps									
2390.00	30.83	Peak	H	27.64	1.33	-	59.80	74.00	-14.20
	19.67	Average					48.64	54.00	-5.36
	31.00	Peak	V				59.97	74.00	-14.03
	19.95	Average					48.92	54.00	-5.08

Tabulated test data for Restricted Band

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

기홍

Tested by: Ki-Hong, Nam / Test Engineer

-. Operating Condition : High Channel

- Test Date : December 28, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Measurement distance : 3m
- Result : PASSED BY -4.25dB at 6 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Data Transfer Rate: 6 Mbps									
2483.50	31.67	Peak	H	27.59	1.33	-	60.59	74.00	-13.41
	20.33	Average					49.25	54.00	-4.75
	31.83	Peak	V				60.75	74.00	-13.25
	20.50	Average					49.42	54.00	-4.58
Data Transfer Rate: 24 Mbps									
2483.50	31.00	Peak	H	27.59	1.33	-	59.92	74.00	-14.08
	19.83	Average					48.75	54.00	-5.25
	31.17	Peak	V				60.09	74.00	-13.91
	19.89	Average					48.81	54.00	-5.19
Data Transfer Rate: 54 Mbps									
2483.50	31.33	Peak	H	27.59	1.33	-	60.25	74.00	-13.75
	20.00	Average					48.92	54.00	-5.08
	31.50	Peak	V				60.42	74.00	-13.58
	19.83	Average					48.75	54.00	-5.25

Tabulated test data for Restricted Band

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

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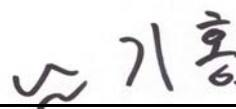
8.7.3.2 Spurious & Harmonic Radiated Emission

- Test Date : December 28, 2005
- 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 ~ 26 GHz
- Measurement distance : 3m
- Result : PASSED BY -19.82 dB at Low Channel with 6 Mbps data transfer rate

Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Test Data for Low Channel									
4824.00*	36.83	Peak	H	31.30	2.62	25.40	45.34	74.00	-28.66
	25.50	Average					34.01	54.00	-19.99
	36.33	Peak	V				44.84	74.00	-29.16
	25.67	Average					34.18	54.00	-19.82
Test Data for Middle Channel									
4924.00*	36.50	Peak	H	31.44	2.58	25.40	45.13	74.00	-28.87
	25.33	Average					33.96	54.00	-20.04
	36.15	Peak	V				44.78	74.00	-29.22
	25.13	Average					33.76	54.00	-20.24
Test Data for High Channel									
4923.83*	36.70	Peak	H	31.44	2.55	25.40	45.29	74.00	-28.71
	25.10	Average					33.69	54.00	-20.31
	36.00	Peak	V				44.59	74.00	-29.41
	25.00	Average					33.59	54.00	-20.41
Other Frequencies were not observed up to 26GHz.									

Tabulated test data for Restricted Band

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



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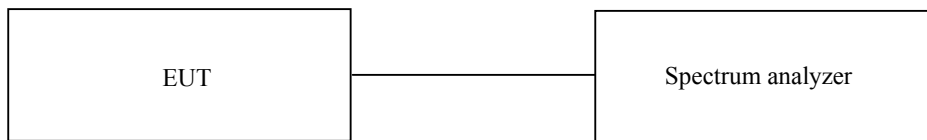
9. UNDESIRABLE EMISSIONS

9.1 Operating environment

Temperature : 13°C
Relative humidity : 53 %

9.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. For measurements above 1GHz, the resolution and video bandwidth is set to 1 MHz for peak measurement and video bandwidth is set to 10 Hz for average measurement.



9.3 Test data

Please refer to test report issued by the ADT.

9.4 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3meters, open-field test site. The EUT was placed on a non-conductive turntable approximately 0.8 meters above the ground plane.

The frequency spectrum from 30MHz to 40GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 and 4.0 meters in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

9.5 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due Cal.
■ -	8564E	Hewlett-Packard	Spectrum Analyzer	3650A00756	July 19, 2006
■ -	8449B	Hewlett-Packard	Preamplifier	3008A00833	June 19, 2006
□ -	83051A	Agilent	Preamplifier	3950M00201	June 10, 2005
■ -	F-40-5000-RF	RLC Electronics	Highpass Filter	0425	June 19, 2006
■ -	MA220	HD	Turn Table	N/A	N/A
■ -	HD240	HD	Antenna Mast	N/A	N/A
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	June 6, 2006
■ -	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.

9.6 Test Data for Radiated Emission

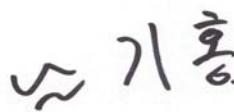
9.6.1 Radiated Emission which fall in the Restricted Band

- Test Date : December 20, 2005
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10Hz for Average Mode
- Operating Frequency : 5725 – 5850MHz
- Measurement distance : 3m
- Result : PASSED

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)
It was not observed any emissions from the EUT.										

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical



Tested by: Ki-Hong, Nam / Test Engineer

9.6.2 Spurious & Harmonic Radiated Emission

9.6.2.1 Operating channel: Low channel

- Test Date : December 20, 2005
- 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 -14.25 dB at 6Mbps Data Transfer Rate

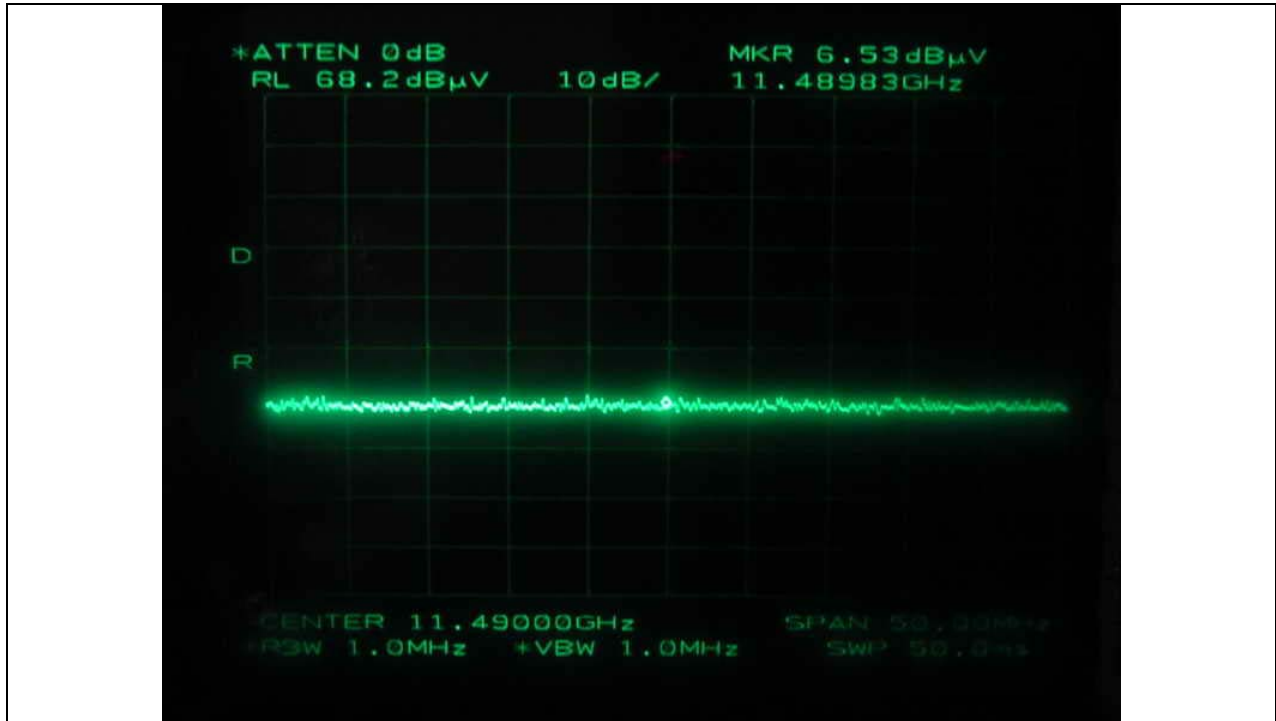
Frequency (GHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Data Transfer Rate: 6 Mbps										
11.49*	36.50	Peak	V	39.22	4.66	28.8		51.58	74.00	-22.42
	24.67	Average	H					39.75	54.00	-14.25
Other Frequencies were not observed up to 25GHz.										
Data Transfer Rate: 18 Mbps										
11.49*	36.33	Peak	V	39.22	4.66	28.8		51.41	74.00	-22.59
	24.50	Average	H					39.58	54.00	-14.42
Other Frequencies were not observed up to 25GHz.										
Data Transfer Rate: 54 Mbps										
11.49*	36.33	Peak	V	39.22	4.66	28.8		51.41	74.00	-22.59
	24.50	Average	H					39.58	54.00	-14.42
Other Frequencies were not observed up to 25GHz.										

Tabulated test data for Restricted Band

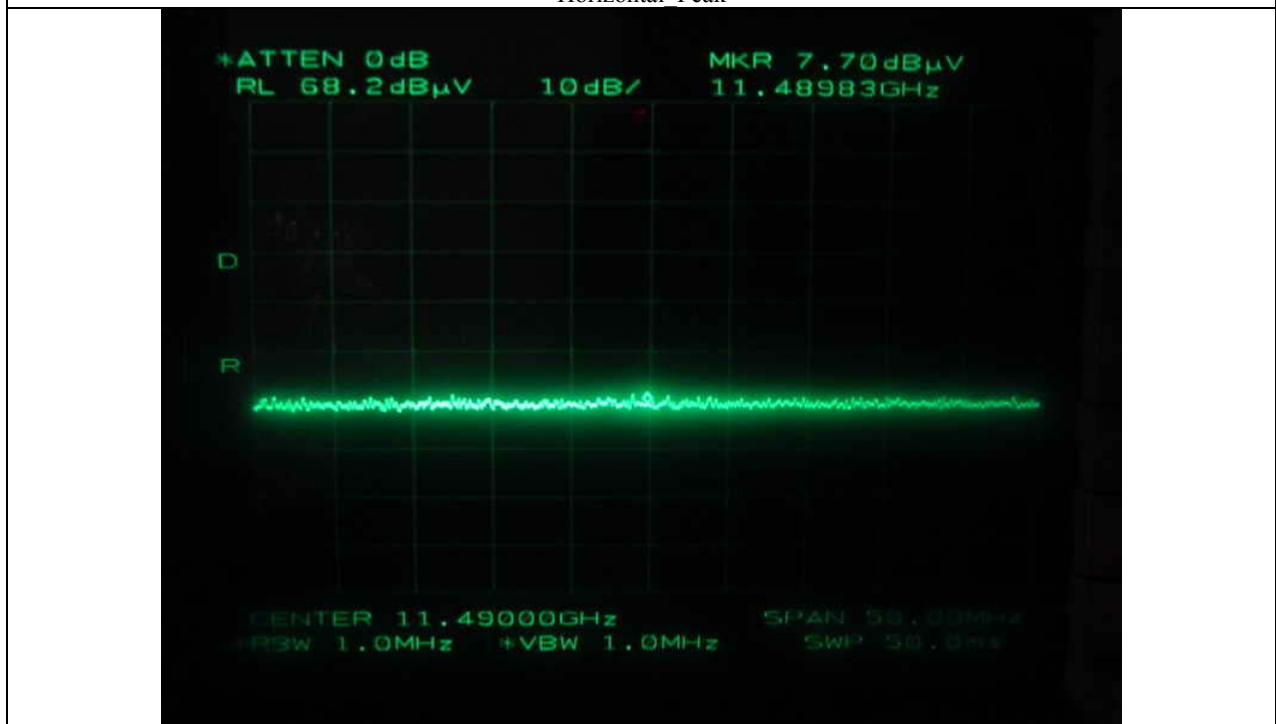
Remark: "H": Horizontal, "V": Vertical, "*" Frequency fall in restricted band

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Tested by: Ki-Hong, Nam / Test Engineer



Horizontal Peak



Vertical Peak

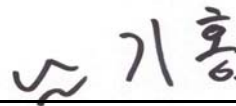
9.6.2.2 Operating channel: Middle channel

- Test Date : December 20, 2005
- 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 -13.56 dB at 6Mbps Data Transfer Rate

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)
Data Transfer Rate: 6 Mbps										
11.57*	36.17	Peak	H	39.13	4.61	28.8		51.11	74.00	-22.89
	25.50	Average	H					40.44	54.00	-13.56
Other Frequencies were not observed up to 25GHz.										
Data Transfer Rate: 18 Mbps										
11.57*	36.10	Peak	H	39.13	4.61	28.8		51.04	74.00	-22.96
	25.20	Average	H					40.14	54.00	-13.86
Other Frequencies were not observed up to 25GHz.										
Data Transfer Rate: 54 Mbps										
11.57*	35.90	Peak	H	39.13	4.61	28.8		50.84	74.00	-23.16
	25.30	Average	H					40.24	54.00	-13.76
Other Frequencies were not observed up to 25GHz.										

Tabulated test data for Restricted Band

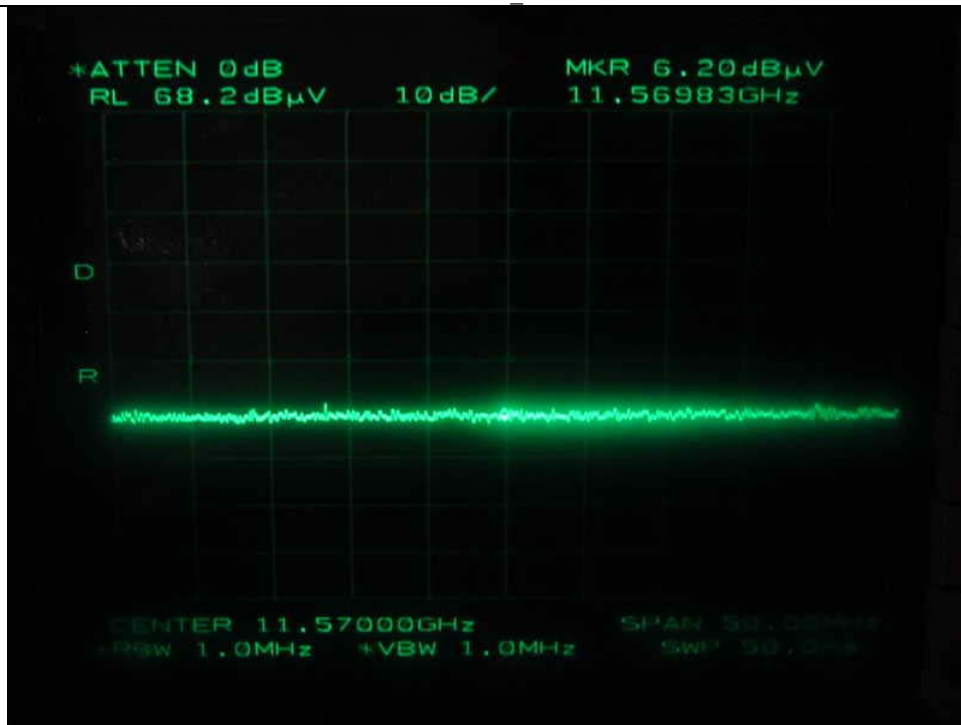
Remark: "H": Horizontal, "V": Vertical, "*" Frequency fall in restricted band



Tested by: Ki-Hong, Nam / Test Engineer



Horizontal Peak



Vertical Peak

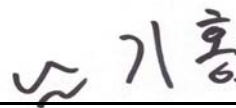
9.6.2.3 Operating channel: High channel

- Test Date : December 20, 2005
- 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 -13.30 dB at 6Mbps Data Transfer Rate

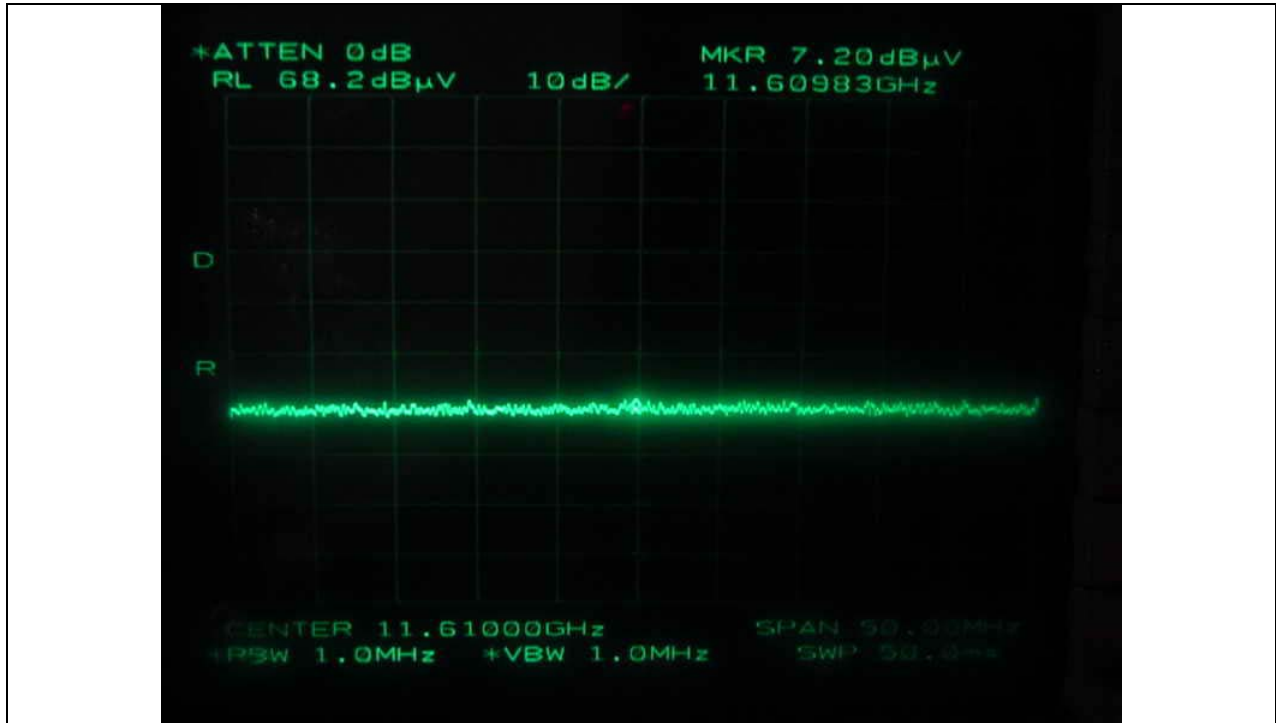
Frequency (GHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Dist. Factor	Total (dBuV/m)	Limits (dBuV/m)	Margin (dB)
Data Transfer Rate: 6 Mbps										
11.61*	36.00	Peak	H	39.08	4.59	28.8		50.87	74.00	-23.13
	25.83	Average	V					40.70	54.00	-13.30
Other Frequencies were not observed up to 25GHz.										
Data Transfer Rate: 18 Mbps										
11.61*	35.84	Peak	H	39.08	4.59	28.8		50.71	74.00	-23.29
	25.63	Average	H					40.50	54.00	-13.50
Other Frequencies were not observed up to 25GHz.										
Data Transfer Rate: 54 Mbps										
11.61*	36.00	Peak	H	39.08	4.59	28.8		50.87	74.00	-23.13
	25.50	Average	V					40.37	54.00	-13.63
Other Frequencies were not observed up to 25GHz.										

Tabulated test data for Restricted Band

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



Tested by: Ki-Hong, Nam / Test Engineer



Horizontal Peak



Vertical Peak

10. MAXIMUM PERMISSIBLE EXPOSURE

10.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment is 1mW/cm².

The electric field generated for a 1mW/cm² exposure is calculated as follows:

$$E = \sqrt{(30 * P * G) / d}, \text{ and } S = E^2 / Z = E^2 / 3770, \text{ because } 1\text{mW} / \text{cm}^2 = 10\text{W} / \text{m}^2$$

Where

E = Electric field strength in Volts/m, P = Power in watts, G = Numeric antenna gain,

and d = distance in meter

S = Power density in mW/cm², Z = Impedance of free space, 377Ω

Combining equations and rearranging the terms to express the distance as a function of the remaining variable

$$S = (30 * P * G) / 3770d^2$$

Changing to units of mW and cm, using P (mW) = P (W) / 1000, d (cm) = d (m)/100,

$$S = 30 * (P/1000) * G / (3770 * (d/100)^2) = 0.0796 * P * G / d^2$$

Where

d = distance in cm, P = Power in mW, G = Numeric antenna gain, and S = Power density in mW/cm²

10.2 Calculated Power Density at 20cm

According to above equation, the following result was obtained and the limit for maximum value of power density,

S is 1.0 mW/cm² according to the rule 1.1310 Table 1 B.

Operating Mode	Peak Output Power		Antenna Gain		Minimum Separation Distance	Power Density @ 20 cm	Power Density Limit
	(dBm)	(mW)	dBi	Numeric		(mW/cm ²)	(mW/cm ²)
802.11b	16.2	41.687	14.0	9.12	20.0	0.076	1.0
802.11g	14.2	26.303	14.0	6.48		0.034	
802.11a	12.0	16.069	22.0	14.23		0.046	

According to the User's guide, the separation between the EUT and a person shall be at least 20cm, so the EUT meets the MPE requirement.

Following Caution on the manual will be described.

“CAUTION: Exposure to Radio Frequency Radiation.

Antenna shall be mounted in such a manner to minimize the potential for human contact during normal operation. The antenna should not be contacted during operation to avoid the possibility of exceeding the FCC radio frequency exposure limit.”

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11. RADIATED EMISSION TEST, GENERAL REQUIREMENT

11.1 Operating environment

Temperature : 12°C

Relative humidity : 49 %

11.2 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.

11.3 Measurement uncertainty

Radiated emission electric field intensity, 30 MHz ~ 300 MHz : ±4.3 dB

Radiated emission electric field intensity, 300 MHz ~ 1000 MHz : ±4.1 dB

11.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due Cal.
■ -	ESVS10	Rohde & Schwarz	EMI Test Receiver	827864/005	Dec. 13, 2005
■ -	85650A	Hewlett Packard	Quasi-Peak Adapter	3107A01542	Mar. 28, 2006
■ -	8568B	Hewlett-Packard	Spectrum Analyzer	3109A05456	Mar. 28, 2006
■ -	85685A	Hewlett-Packard	RF Preselector	3107A01264	Mar. 28, 2006
■ -	8564E	Hewlett-Packard	Spectrum Analyzer	3650A00756	July 19, 2006
■ -	83051A	Hewlett-Packard	Microwave Preamplifier	3950M00201	June 10, 2006
□ -	8449B	Hewlett-Packard	RF Amplifier	3008A00833	June 10, 2006
□ -	8447F	Hewlett-Packard	RF Amplifier	3113A04554	June 10, 2006
■ -	MA220	HD	Turn Table	N/A	N/A
■ -	HD240	HD	Antenna Mast	N/A	N/A
■ -	VHA9103	Schwarz beck	Biconical Antenna	91031852	Jan. 30, 2006
■ -	UHALP9018A	Schwarz beck	Log Periodic Antenna	62281001	Feb. 1, 2006
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	June 6, 2006
■ -	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.

11.5 Test data

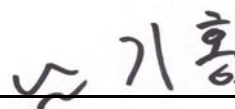
- Test Date : December 21, 2005
- Resolution bandwidth : 120 kHz
- Frequency range : 30MHz ~ 1000MHz
- Measurement distance : 3m
- Operating Condition : Tx Mode
- Test result : Passed by -10.72 dB at 650.00 MHz

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
363.35	15.00	V	14.64	4.25	33.89	46.02	-12.13
371.00	15.20	H	14.81	4.28	35.29	46.02	-10.73
426.33	13.60	V	16.15	4.45	34.20	46.02	-11.82
529.00	11.30	V	17.94	5.33	34.62	46.02	-11.40
542.62	10.50	V	18.28	5.33	34.11	46.02	-11.91
650.00	10.33	H	19.27	5.70	35.30	46.02	-10.72

Tabulated test data for Radiated Electromagnetic Field

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

Each mode for 802.11b, 802.11g and 802.11a was tested, but the worst emissions were recorded in this test report.



Tested by: Ki-Hong, Nam / Test Engineer

12. CONDUCTED EMISSION TEST

12.1 Operating environment

Temperature : 21°C

Relative humidity : 41 %

12.2 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.

12.3 Measurement uncertainty

Conducted emission, quasi-peak detect : ±3.0 dB

Conducted emission, average detect : ±3.0 dB

12.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due Cal.
■ -	ESHS10	Rohde & Schwarz	EMI Test Receiver	834467/007	May 19, 2006
■ -	NSLK8128	Schwarz beck	AMN	8128-216	June 7, 2006
■ -	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.

12.5 Test data

- Test Date : December 28, 2005
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15MHz ~ 30MHz
- Test Result : PASSED BY -22.06dB at 21.95 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	43.37	P	66.00	-22.63	-	-	-
0.205	H	39.31	P	63.41	-24.10	-	-	-
1.445	H	26.57	P	56.00	-29.43	-	-	-
21.905	N	34.45	P	60.00	-25.55	-	-	-
21.95	H	37.94	P	60.00	-22.06	-	-	-
29.90	H	31.94	P	60.00	-28.06	-	-	-

Line Conducted Emissions Tabulated Data

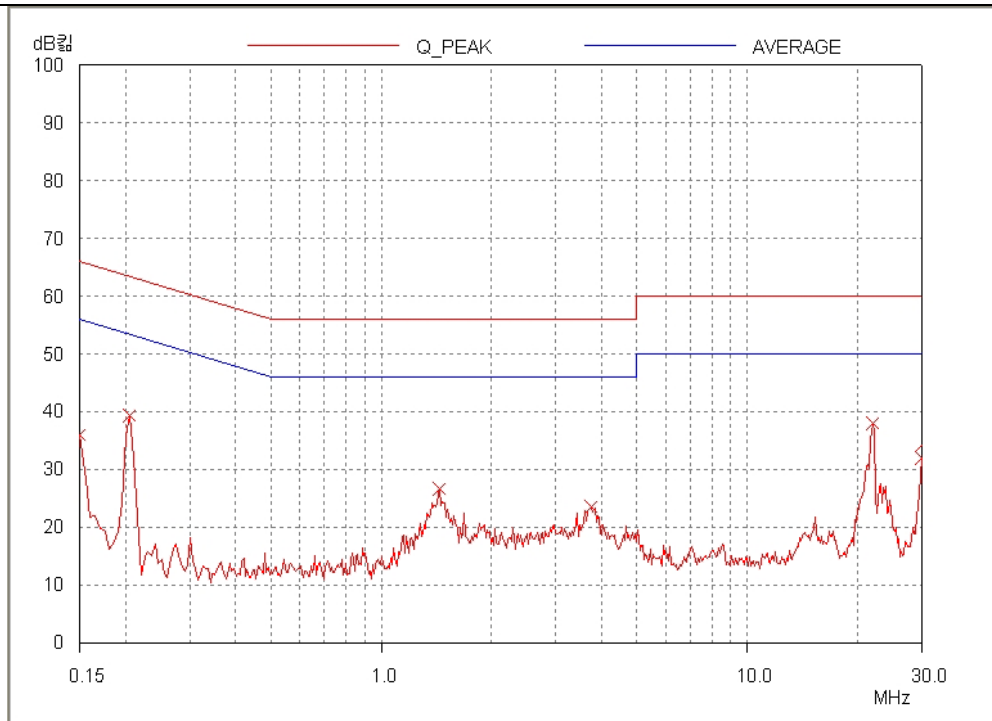
Remark : "H": Hot Line, "N": Neutral line, "P": Peak detect.

Each mode for 802.11b, 802.11g and 802.11a was tested, but the worst emissions were recorded in this test report.

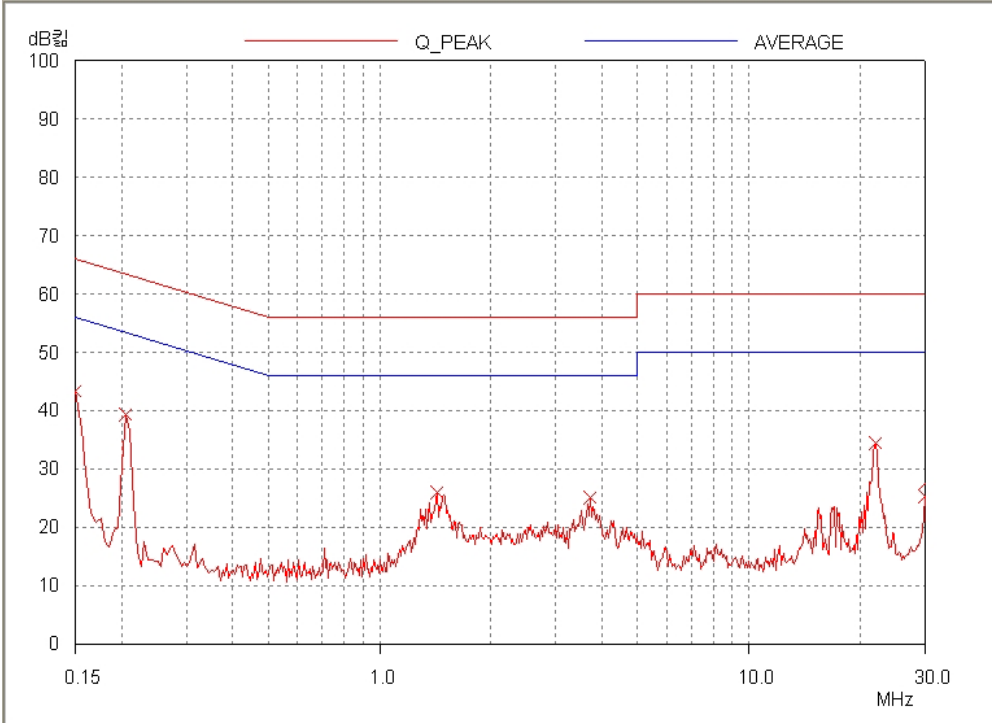
See next page for an overview sweep performed with peak mode detector.

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Tested by: Ki-Hong, Nam / Test Engineer



HOT LINE



NEUTRAL LINE