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

Test Report No.	**: E065R-028**
AGR No.	**: A05NA-103R1**
Applicant	**: N3 Corporation, Ltd.**
Address	**: #402 Gwangmyeong Techno Town 626-3 Chulsan 1-dong, Gwangmyeong-si, Gyeonggi-do, Korea**
Manufacturer	**: Wendeng N3 CORP Electronics Co,.Ltd.**
Address	**: Seosang Chao Mansan-Jin, Wendeng-City, Shandong-Province, China**
Type of Equipment	**: Portable Bluetooth Handsfree Kit**
FCC ID.	**: UBA-UBFREE2**
Model Name	**: UBFree2**
Serial number	**: None**
Total page of Report	**: 52 pages (including this page)**
Date of Incoming	**: February 20, 2006**
Date of issue	**: May 18, 2006**

SUMMARY

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

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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EMC Div.

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EMC Testing Dept : 307-51 Daessangryung-Ri, Chowol-Eup, Kwangju-City, Kyunggi-Do 464-860 Korea. (TEL: 82-31-765-8289 FAX: 82-31-766-2904)

ONETECH Corp. ONETECH Corp.

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1. VERIFICATION OF COMPLIANCE

APPLICANT : N3 Corporation, Ltd.

ADDRESS : #402 Gwangmyeong Techno Town 626-3 Chulsan 1-dong, Gwangmyeong-si, Gyeonggi-do, Korea

CONTACT PERSON : Mr. Jeong-Yeol, Lee / Senier Manager

TELEPHONE NO : +82-2-2618-1077

FCC ID : UBA-UBFREE2

MODEL NO/NAME : UBFree2

SERIAL NUMBER : N/A

DATE : May 18, 2006

EQUIPMENT CLASS	***DSS-Part 15 Spread Spectrum Transmitter***
KIND OF EQUIPMENT	Portable Bluetooth Handsfree Kit
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)	FCC PART 15 SUBPART C Section 15.247
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	No
FINAL TEST WAS CONDUCTED ON	3 METERS OPEN AREA TEST SITE

-. This device has shown compliance with the conducted emissions limits in 15.207 adopted under FCC 02-107 (ET Docket 98-80). The device may be marketed after July 11, 2005 and is not affected by the 15.37(j) transition provisions.

-. 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) (1)	Carrier Frequency Separation	Met the Limit / PASS
15.247 (a) (1) (iii)	Minimum Number of Hopping Channels	Met the Limit / PASS
15.247 (a) (1) (iii)	Average Time of Occupancy	Met the Limit / PASS
15.247 (b) (1)	Maximum Peak Conducted Output Power	Met the Limit / PASS
15.247 (b) (5)	Radio Frequency Exposure Level	Met the Limit / PASS
15.247 (d)	100 kHz Bandwidth Outside the Frequency Band	Met the Limit / PASS
15.247 (d)	Radiated Emission which fall in the Restricted Band	Met the Limit / PASS
15.247 (d)	Peak Power Spectral Density	Met the Limit / PASS
15.209 and 15.109	Radiated Emission Limits, General Requirement	Met the Limit / PASS
15.207 and 15.107	Conducted Limits	Met the Limit / PASS
15.203	Antenna Requirement	Met requirement / PASS

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: 2003. 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 307-51 Daessangryung-Ri, Chowol-Eup, Kwangju-City, Kyeonggi-Do, 464-080, Korea. Description details of test facilities were submitted to the Federal Communications Commission on August 30, 2005 (Registration Number: 340658), accredited by KOLAS (Korea Laboratory Accreditation Scheme, No: 85) and approved by TUV, DNV and MIC (Ministry of Information and Communications in Korea) according to the requirement of ISO17025.

3. GENERAL INFORMATION

3.1 Product Description

The N3 Corporation, Ltd., Model: UBFree2 (referred to as the EUT in this report) is a Portable Bluetooth Handsfree Kit, which simply connects to your Bluetooth phone without any cables or phone holder. Also the EUT can play music by SBC (SubBand Coding) streaming download with USB dongle in computer or Bluetooth phones with stereo headset profiles. Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Portable Device
OPERATING FREQUENCY	2.402 ~ 2.4800 GHz
OUTPUT POWER	Typ. 2dBm
ANTENNA	Multilayer Chip Antenna, M/N: ALA93102, MFR: Amotech Co., Ltd.
ANTENNA GAIN	Max. 2.0dBi
CHANNEL	79 Channels
SPREAD SPECTRUM TYPE	FHSS
LIST OF EACH OSC. OR CRY. FREQ.(FREQ.>=1MHz)	Bluetooth Hands free RF Module: 26 MHz
USED BOARD NAME	Main Board, RF Module
NUMBER OF LAYER	Main Board: 2 Layers, RF Module: 4 Layers
USED BLUETOOTH MODULE	Manufacturer: N3 Corpration, Ltd. , Model: NBM2XA-01
POWER REQUIREMENT	DC 3.7V Lithium-Polymer Battery
EXTERNAL CONNECTOR	DC INPUT, Ear Phone Jack

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

No other model differences have been mentioned.

4. EUT MODIFICATIONS

None

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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
MAIN BOARD	N3 Corporation, Ltd.	N/A	N/A
RF MODULE	N3 Corporation, Ltd.	NBM2XA-01	N/A

5.3 Peripheral equipment

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

Model	Manufacturer	Description	Connected to
UBFree2	Wendeng N3 CORP Electronics Co,.Ltd.	Portable Bluetooth Handsfree Kit(EUT)	HOST
PP05LC	DELL Computer Corp.	NOTEBOOK PC (HOST)	-
SCH-V740	Samsung	Cellular Phone with Bluetooth function	N/A
N/A	N/A	Earphone	EUT

5.4 Mode of operation during the test

The EUT was connected with a Notebook PC and then the PC controlled channel changing only. The EUT continuously transmitted max. power level at each Low, Middle, and High channel during the testing and continuously communicated with a cellular phone with Bluetooth function during the test.

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5.5 Configuration of Test System

Line Conducted Test: The power cord of the HOST was connected to LISN. All supporting equipments were connected to another LISN. Preliminary Power lines Conducted Emission tests were performed by using the procedure in ANSI C63.4/2003 7.2.3 to determine the worse operating conditions.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.4/2003 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.

5.6 Antenna Requirement

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

Antenna Construction:

The transmitter antenna of the EUT is mounted on the main board in the EUT, so no consideration of replacement by the user.

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Tests, the following operating mode was investigated

Operation Mode	The Worse operating condition (Please check one only)
Stand-by mode	
Battery Charging mode	X

According to the product specification, the device shall be operated by battery, but the battery in the EUT shall be charged by DC Input port.

6.2 General Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
Stand-by mode	
Receiving and Transmitting mode	X

7. 20dB BANDWIDTH

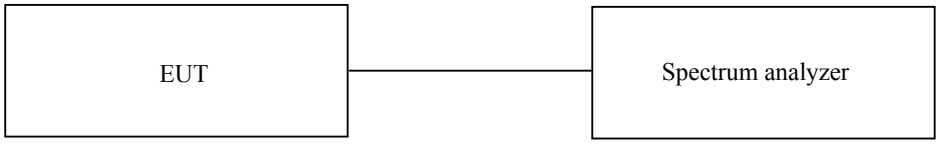
7.1 Operating environment

Temperature : 25°C

Relative humidity : 48 %

7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 10 kHz, and peak detection was used. The 20dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.



7.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due Cal
■ -	8564E	HP	Spectrum Analyzer	3650A00756	July 19, 2006

All test equipment used is calibrated on a regular basis.

7.4 Test data

-. Test Date : May 02, 2006

-. Test Result : Pass

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (kHz)	LIMIT (kHz)	MARGIN (kHz)
Low	2402	825	1000	-175
Middle	2441	825	1000	-175
High	2480	833	1000	-167

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

Tested by: Ki-Hong, Nam / Test Engineer

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Low Channel

Middle Channel

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High Channel

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8. HOPPING FREQUENCY SEPARATION

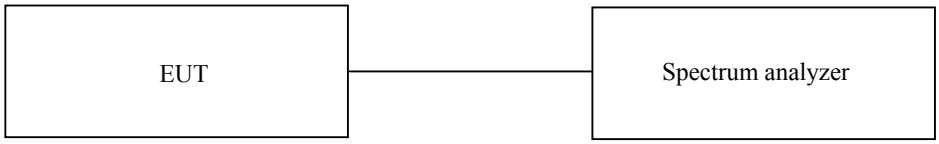
8.1 Operating environment

Temperature : 25°C

Relative humidity : 48 %

8.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The frequency span is set to 10 MHz. The analyzer is set to peak hold , then a pseudo-random hopping sequence of the transmitter is captured. The mark delta function was used to measure the frequency separation between two adjacent hopping channels.



8.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due Cal
■ -	8564E	HP	Spectrum Analyzer	3650A00756	July 19, 2006

All test equipment used is calibrated on a regular basis.

8.4 Test data

-. Test Date : May 02, 2006

-. Test Result : Pass

MEASURED VLAUE (kHz)	LIMIT, 20dB Bandwidth (kHz)	MARGIN (kHz)
1000	833	-167

Tested by: Ki-Hong, Nam / Test Engineer

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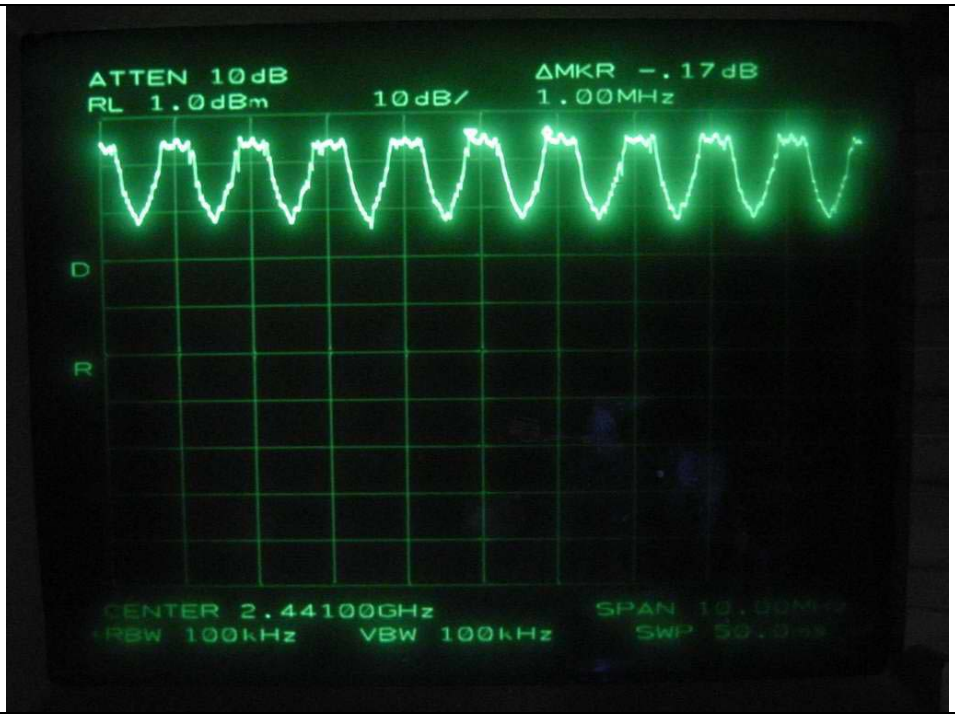

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9. NUMBER OF HOPPING CHANNELS

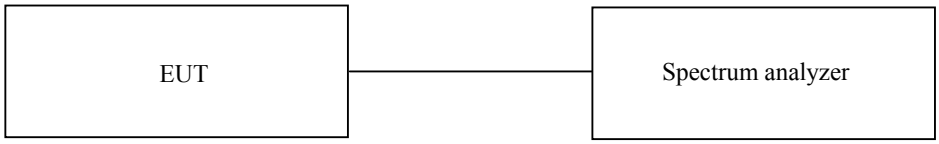
9.1 Operating environment

Temperature : 25°C

Relative humidity : 48 %

9.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The frequency span is set to 100 MHz and the resolution bandwidth is set to 1 MHz. The analyzer is set to peak hold and then complete pseudo-random hopping sequence of the transmitter is captured.



9.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due Cal
■ -	8564E	HP	Spectrum Analyzer	3650A00756	July 19, 2006

All test equipment used is calibrated on a regular basis.

9.4 Test data

-. Test Date : May 02, 2006

-. Test Result : Pass

MEASURED VLAUE (Number)	LIMIT (Number)	MARGIN (Number)
79	Minimum of 75	4

Tested by: Ki-Hong, Nam / Test Engineer

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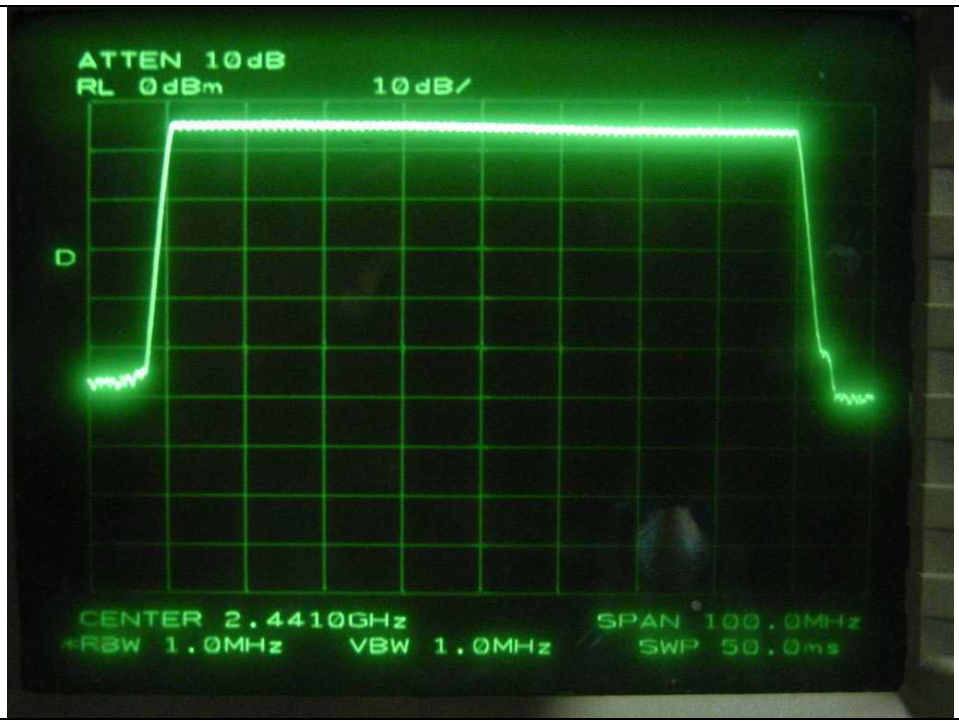
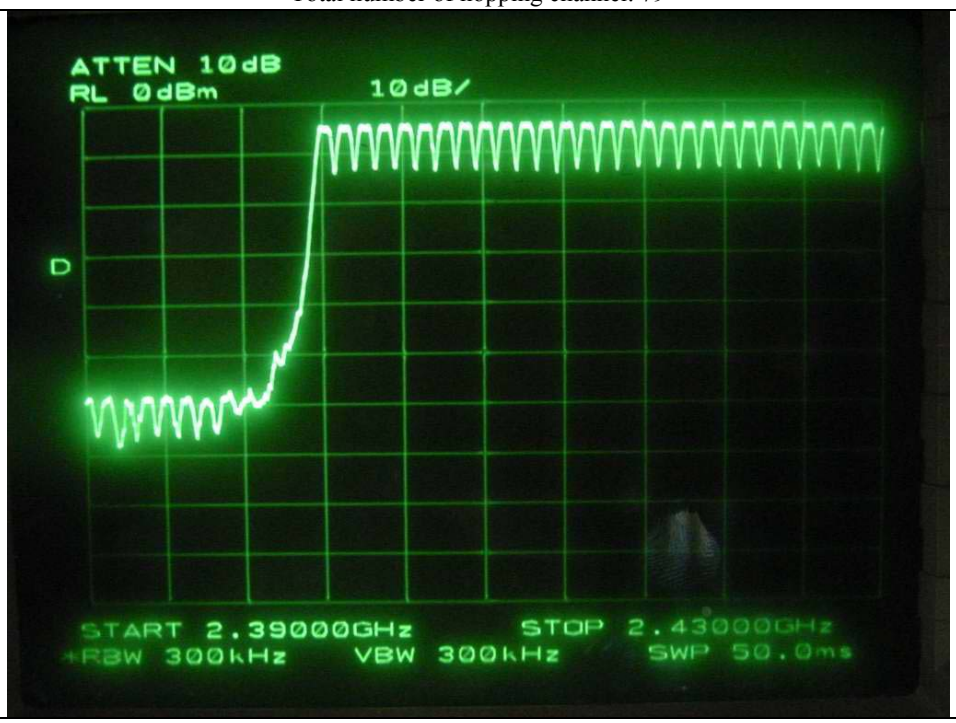


Total number of hopping channel: 79



Number of hopping channel: 28

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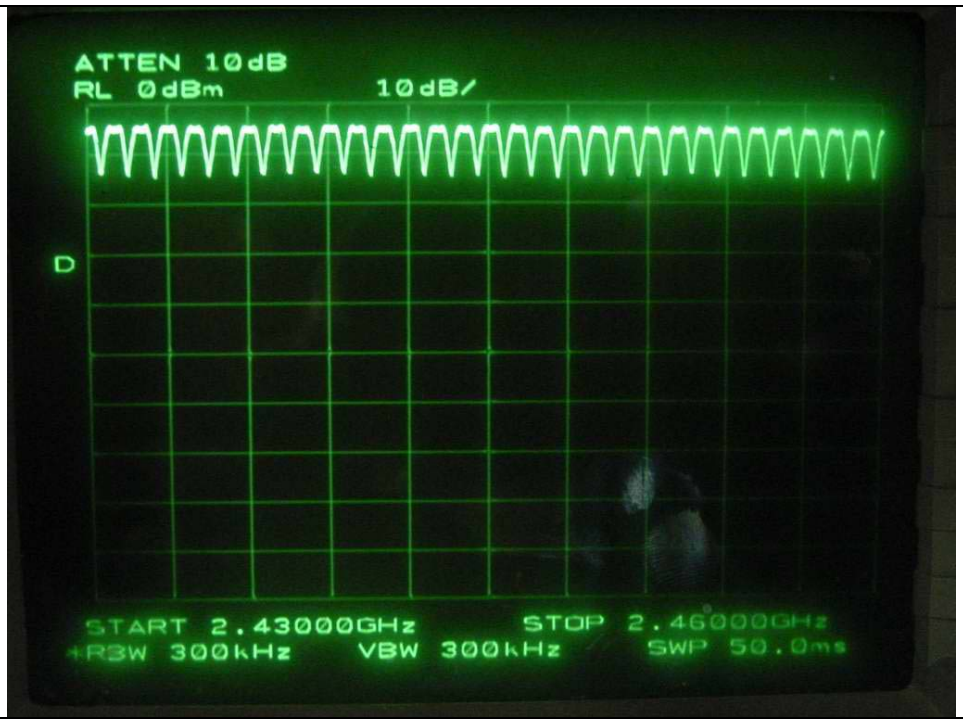
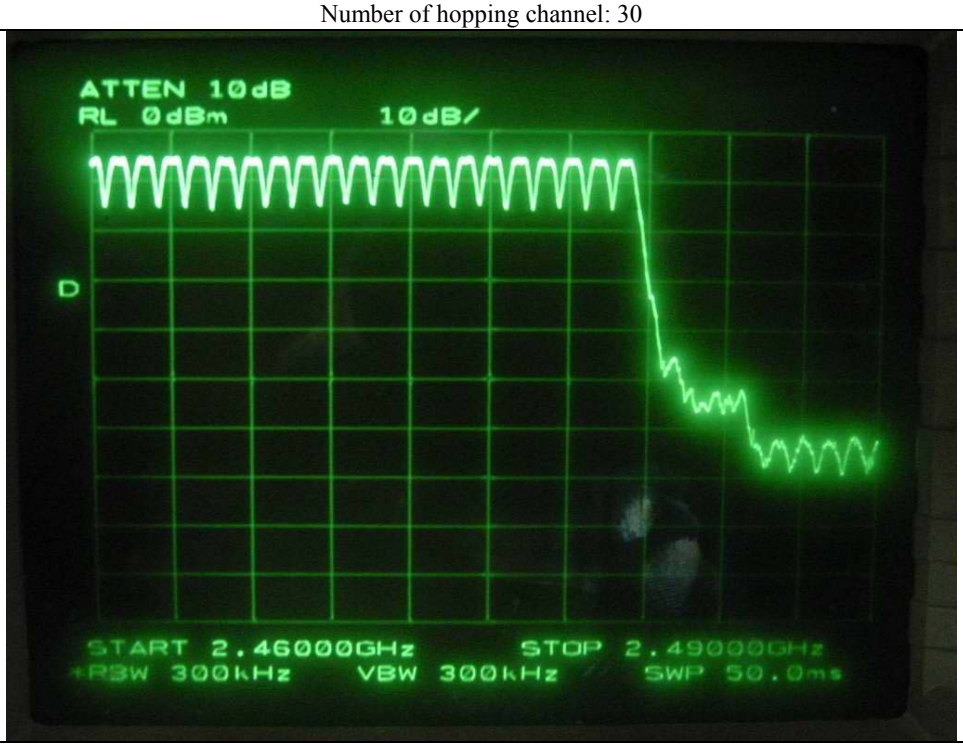


Number of hopping channel: 30



Number of hopping channel: 21

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10. TIME OF OCCUPANCY

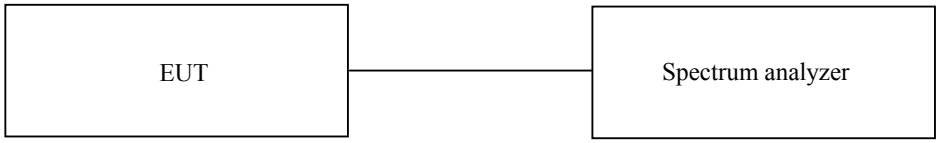
10.1 Operating environment

Temperature : 25°C

Relative humidity : 48 %

10.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The transmitter is set to operate in its normal frequency hopping mode. The center frequency of the spectrum analyzer is set to one of hopping channels near the center of the operating band and span is set to zero Hz. The sweep time is set to display one complete pulse. The mark delta function is used to measure the duration of the pulses.



10.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due Cal
■ -	8564E	HP	Spectrum Analyzer	3650A00756	July 19, 2006

All test equipment used is calibrated on a regular basis.

10.4 Test data

-. Test Date : May 02, 2006

The system makes worst case 1600 hops per second or 1 time slot has a length of 625us with 79 channels.

For DH1 packet type, the EUT needs 1 time slot for transmitting and 1 time slot for receiving and DH3 packet type, the EUT needs 3 times slots for transmitting and 1 time slot for receiving, and DH5 packet needs 5times slots for transmitting and 1 time slot for receiving. So The EUT has each channel for 10.13 times per second (=1600/2/79) for DH1, and 5.06 times (=1600/4/79) for DH3, and 3.38 times (= 1600/6/79) for DH5.

Packet Type	Pulse Time (ms)	Hops per second with channels	Period Time (ms)	Total Dwell Time (ms)	Limit (ms)	Test Result
DH1	0.5833	10.13	31.6	186.62	400	PASS
DH3	1.8500	5.06	31.6	295.81	400	PASS
DH5	3.3000	3.38	31.6	352.47	400	PASS

Total dwell time is calculated as following.

Total Dwell Time = Pulse time * Hops per second with channels * period time

Tested by: Ki-Hong, Nam / Test Engineer

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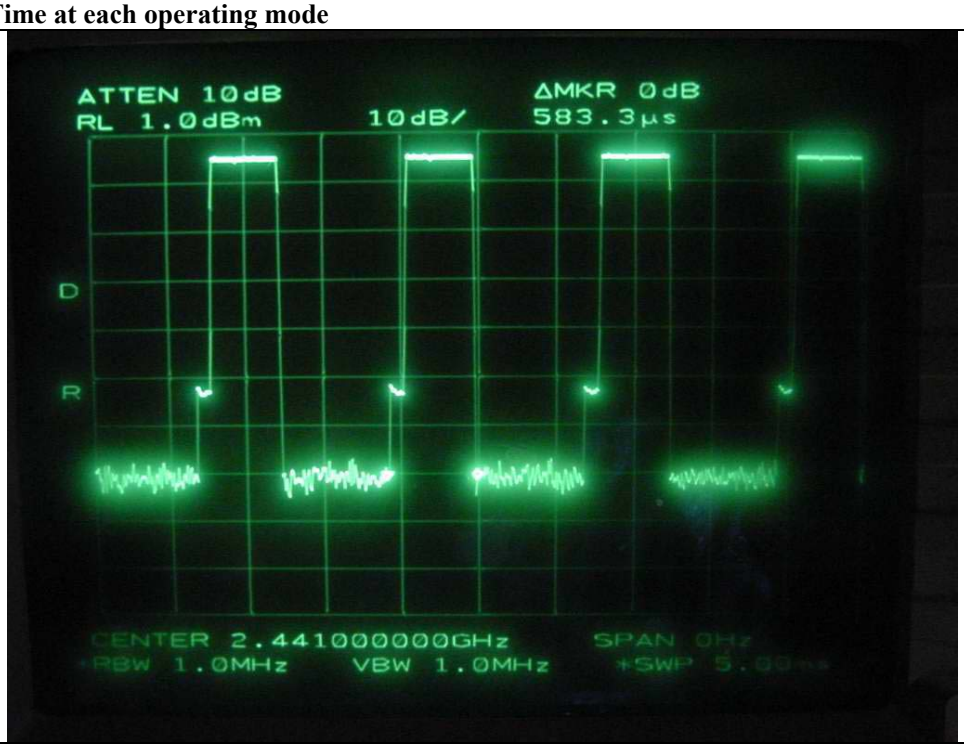
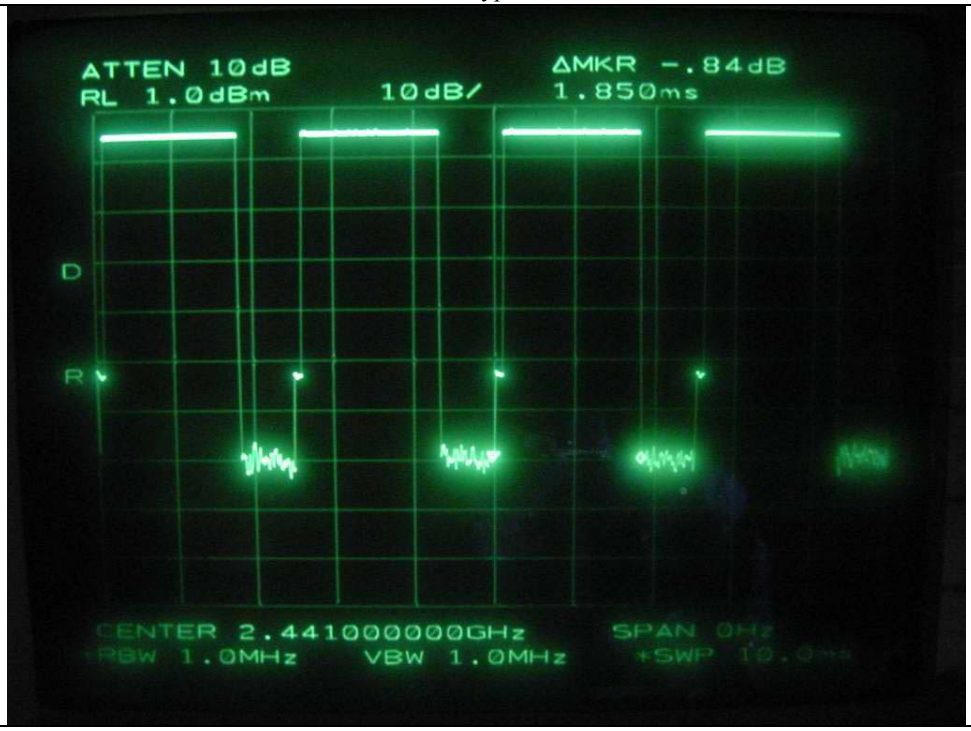
10.5 Pulse Time at each operating mode



Packet Type: DH1



Packet Type: DH3

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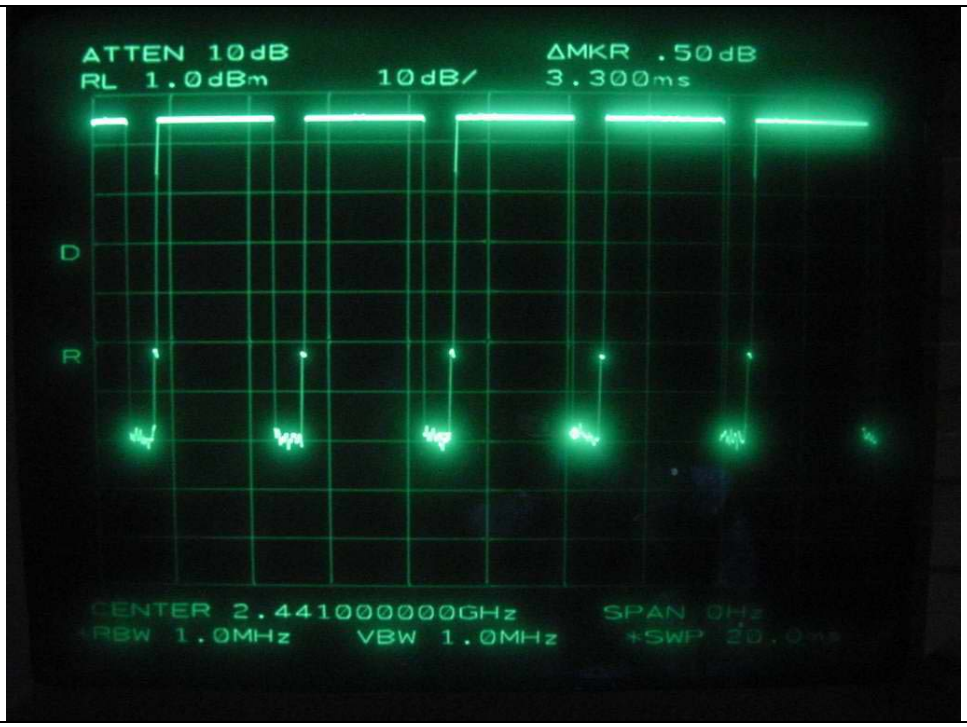


Packet Type: DH5

11. MAXIMUM PEAK OUTPUT POWER

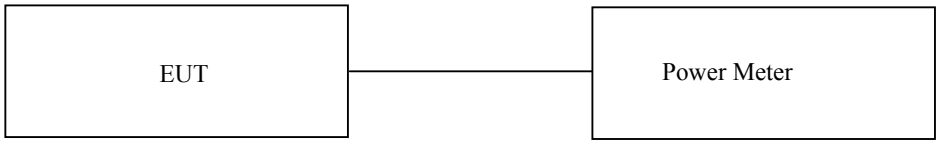
11.1 Operating environment

Temperature : 25°C

Relative humidity : 48 %

11.2 Test set-up

The maximum peak output power was measured with the power meter connected to the antenna output of the EUT. The EUT was operating in transmit mode at the appropriate center frequency.



11.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due Cal
■ -	8564E	HP	Spectrum Analyzer	3650A00756	July 19, 2006

All test equipment used is calibrated on a regular basis.

8.4 Test data

-. Test Date : May 02, 2006

-. Test Result : Pass

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2402	-4.33	30.0	-34.33
Middle	2441	-3.83	30.0	-33.83
High	2480	-5.00	30.0	-35.00

Tested by: Ki-Hong, Nam / Test Engineer

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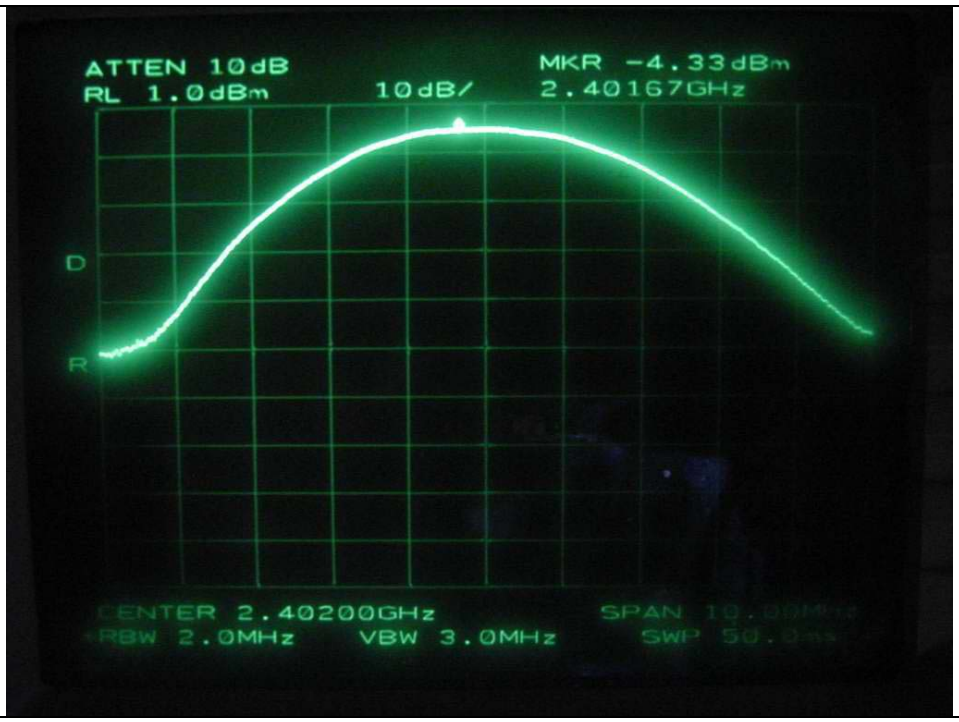
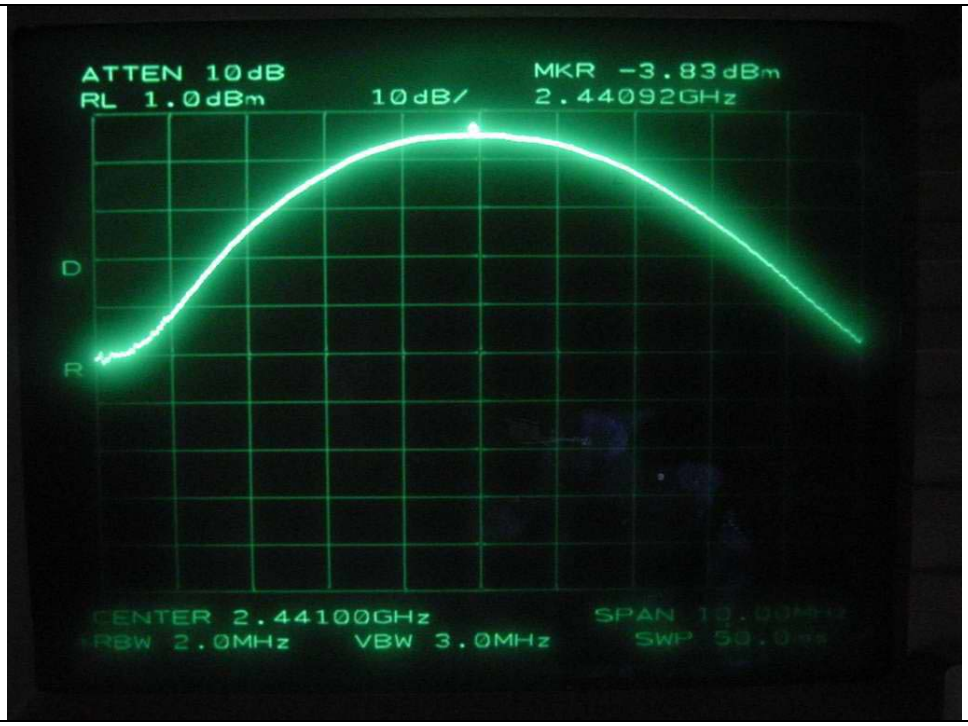


Low Channel



Middle Channel

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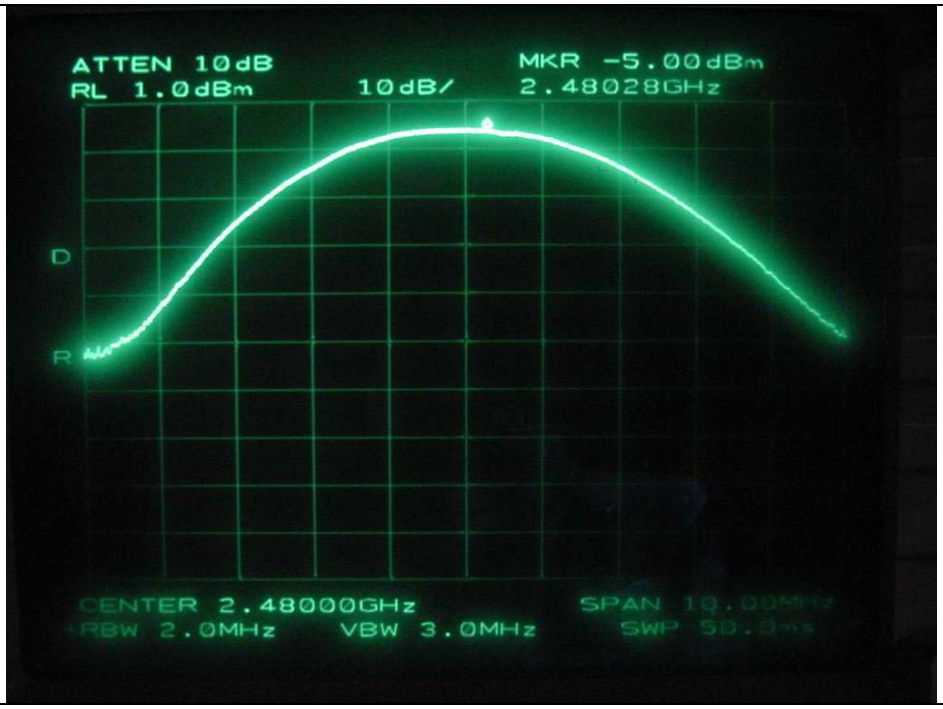

High Channel

12. RADIO FREQUENCY EXPOSURE

12.1 RF Exposure Limit

According to the FCC rule §1.1310, the limit for General Population/Uncontrolled exposure is 1mW/cm² for the device operating 1,500~100,000 MHz.

12.2 EUT Description

Kind of EUT	Portable Bluetooth Handsfree Kit
Operating Frequency Band	☐ WLAN: 2412 ~ 2462 MHz ☐ WLAN: 5180 ~ 5320 MHz / 5500 ~ 5700 MHz ☐ WLAN: 5745 ~ 5825 MHz ■ Bluetooth: 2402 ~ 2480MHz
Device Category	■ Portable (<20cm separation) ☐ Mobile (>20cm separation) ☐ Others
Max. Output Power	-3.83 dBm (0.414mW) @2441MHz
Used Antenna	Single Antenna
Used Antenna Gain	2.00dBi
Exposure Evaluation Applied	☐ MPE ☐ SAR ■ N/A

12.3 Test Result

According to the rule, §1.1307(b) (1) and §2.1093, portable devices using Bluetooth technology according to §15.247 are exempt from the regulation.

Also, SAR evaluation is not required for the PORTABLE Device while its maximum output power is lower than threshold: 60/f(GHz) = 60/2.441 = 24.58mW.

SO, THE DEVICE MEETS THE RF EXPOSURE REQUIREMENT.

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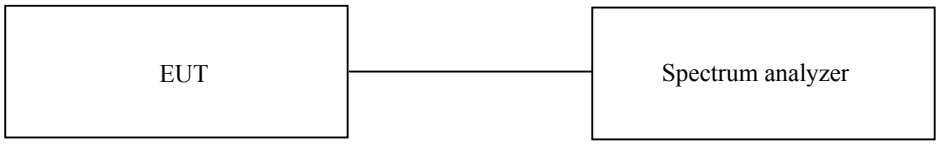
13. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

13.1 Operating environment

Temperature	:	23 °C
Relative humidity	:	41 %

13.2 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.



13.3 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.

13.4 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 10, 2006
■ -	83051A	Agilent	Preamplifier	3950M00201	June 10, 2006
■ -	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.

13.5. Test data

13.5.1. Test data for conducted emission

Low Channel

High Channel

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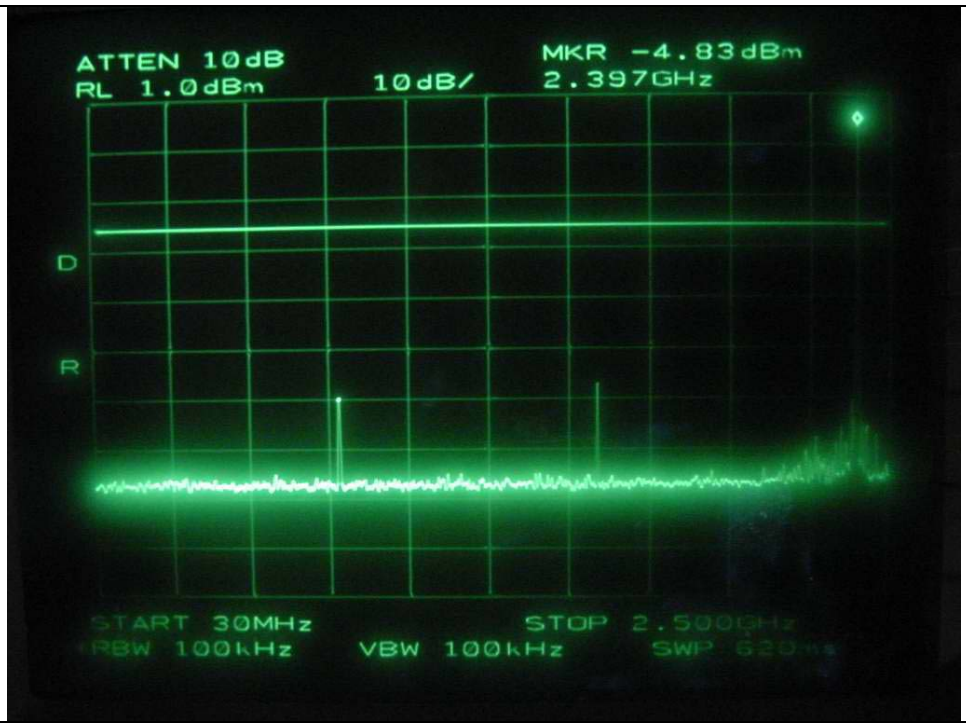
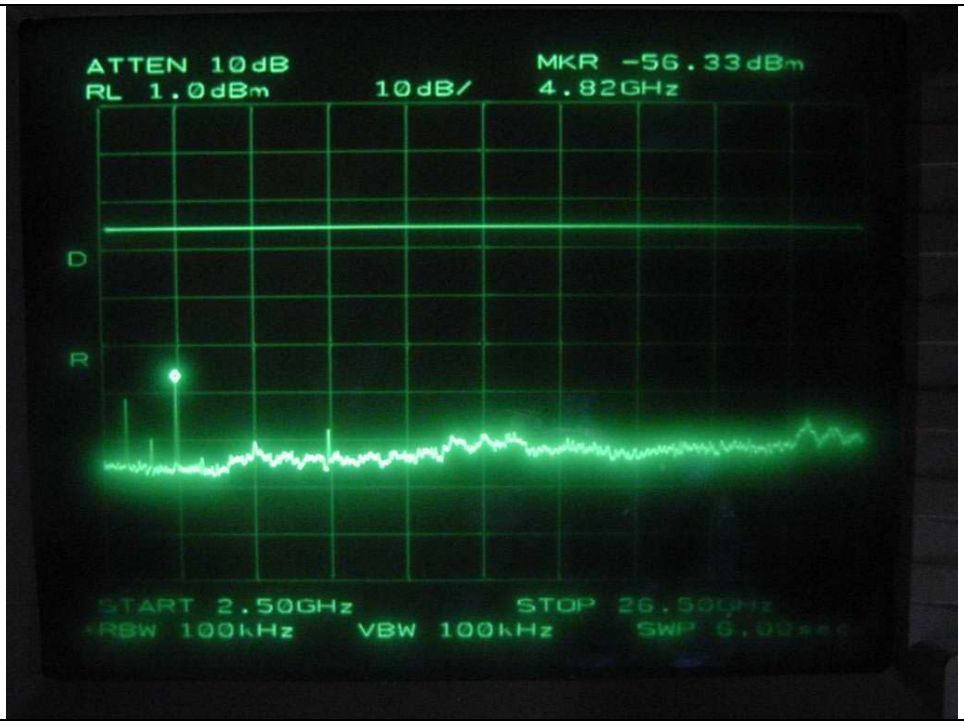


Low Channel



Low Channel

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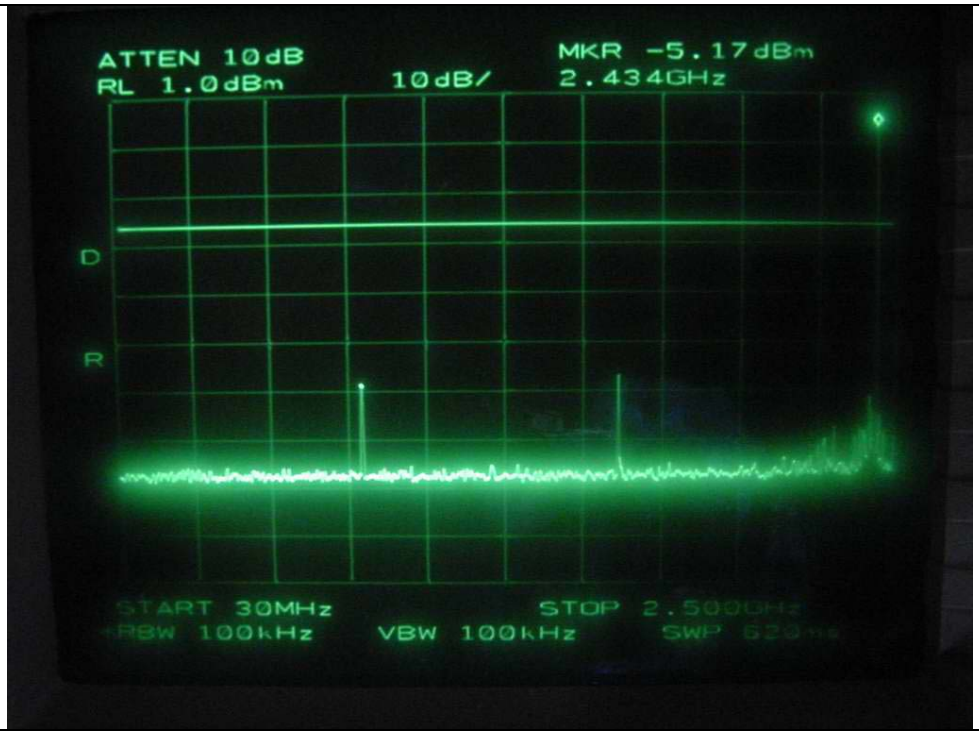
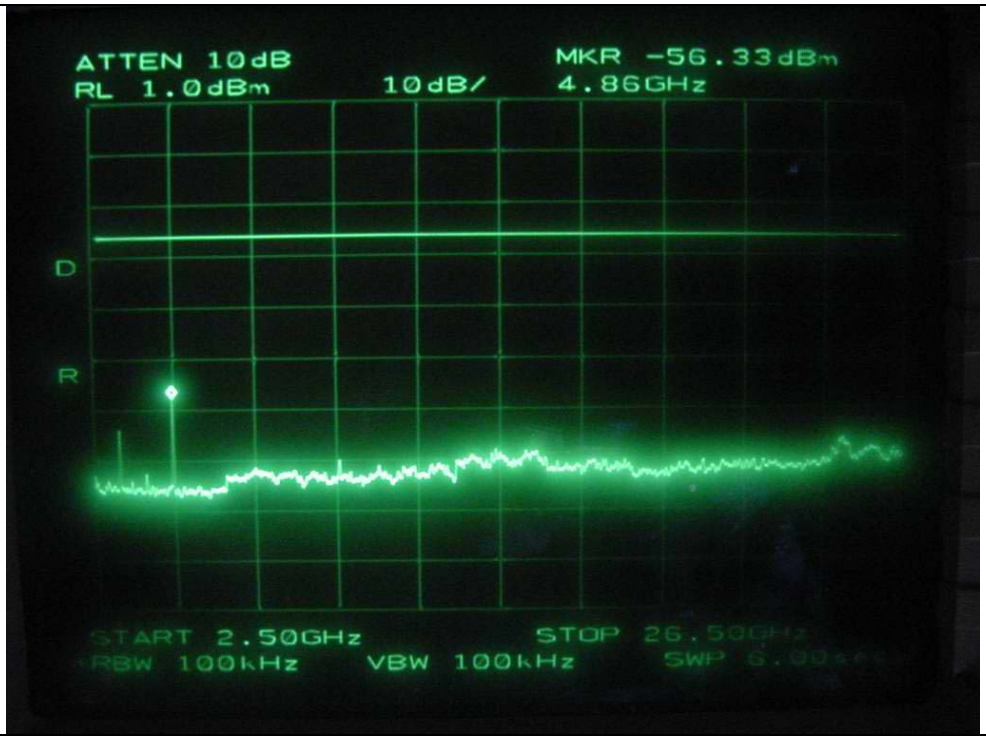


Middle Channel



Middle Channel

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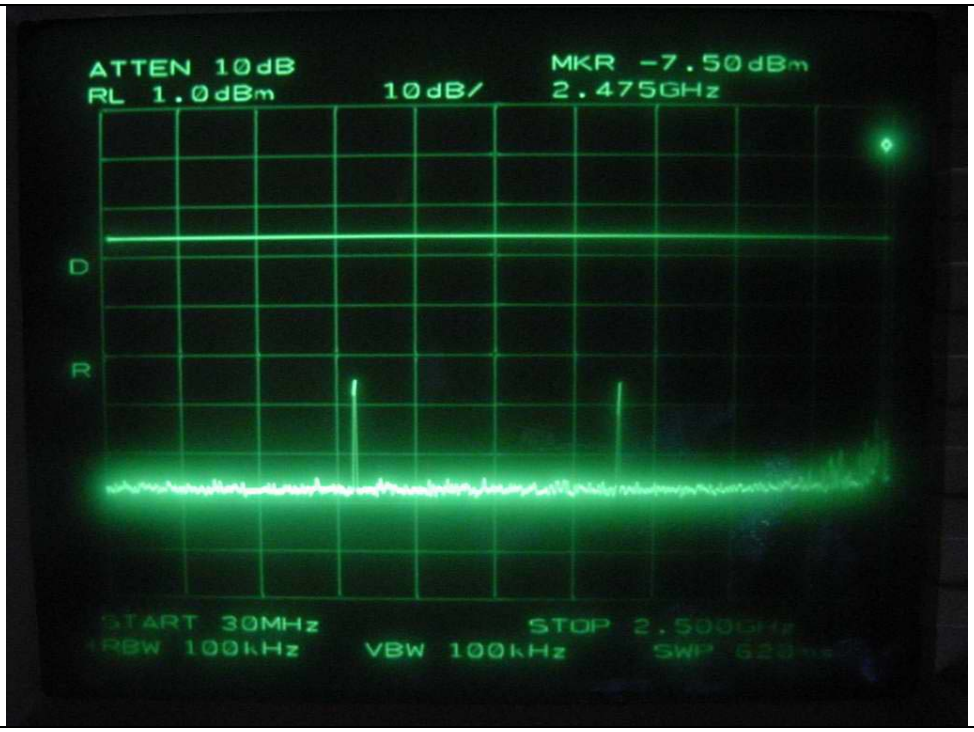
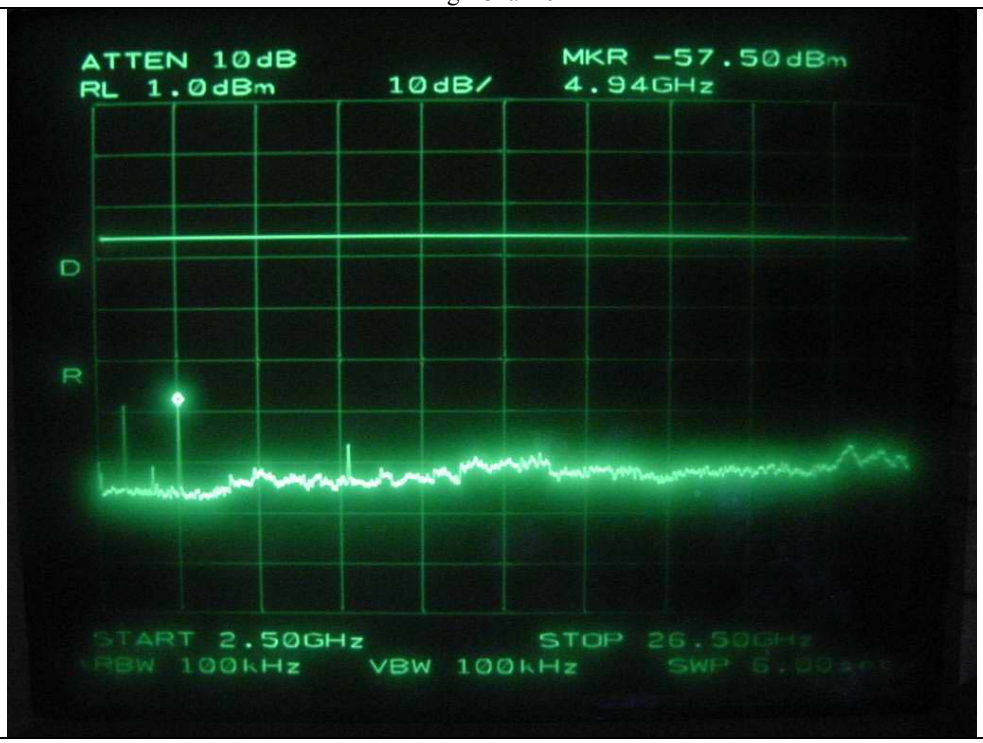
EMC Testing Dept : 307-51 Daessangryung-Ri, Chowol-Eup, Kwangju-City, Kyunggi-Do 464-860 Korea. (TEL: 82-31-765-8289 FAX: 82-31-766-2904)



High Channel



High Channel

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13.5.2. Test data for radiated emission

13.5.2.1. Radiated Emission which fall in the Restricted Band

-. Operating Condition: Low Channel

-. Test Date : May 09, 2006

-. 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 –26.13dB

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									
2389..47	35.33	Peak	H	27.64	1.33	26.10	38.20	74.00	-35.80
	24.50	Average					27.37	54.00	-26.63
	35.50	Peak	V				38.37	74.00	-35.63
	25.00	Average					27.87	54.00	-26.13

Tabulated test data for Restricted Band

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

Tested by: Ki-Hong, Nam / Test Engineer

HEAD OFFICE : #505 SK APT. Factory 223-28, Sangdaewon 1 Dong, Jungwon-Gu, Seongnam-City, Kyunggi-Do, 462-705, Korea (TEL: 82-31-746-8500 FAX: 82-31-746-8700)

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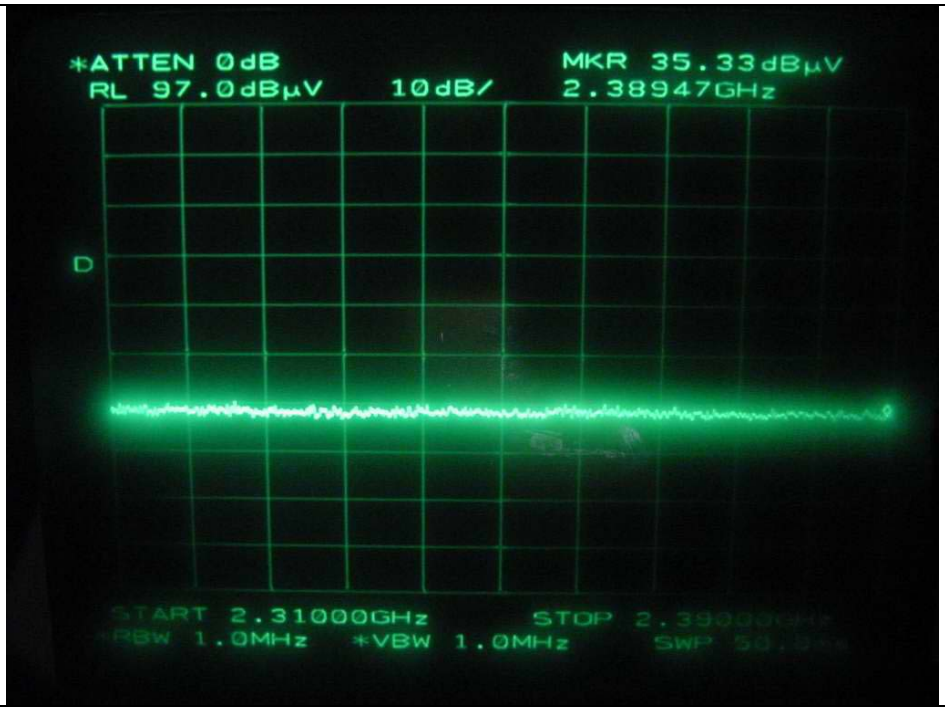
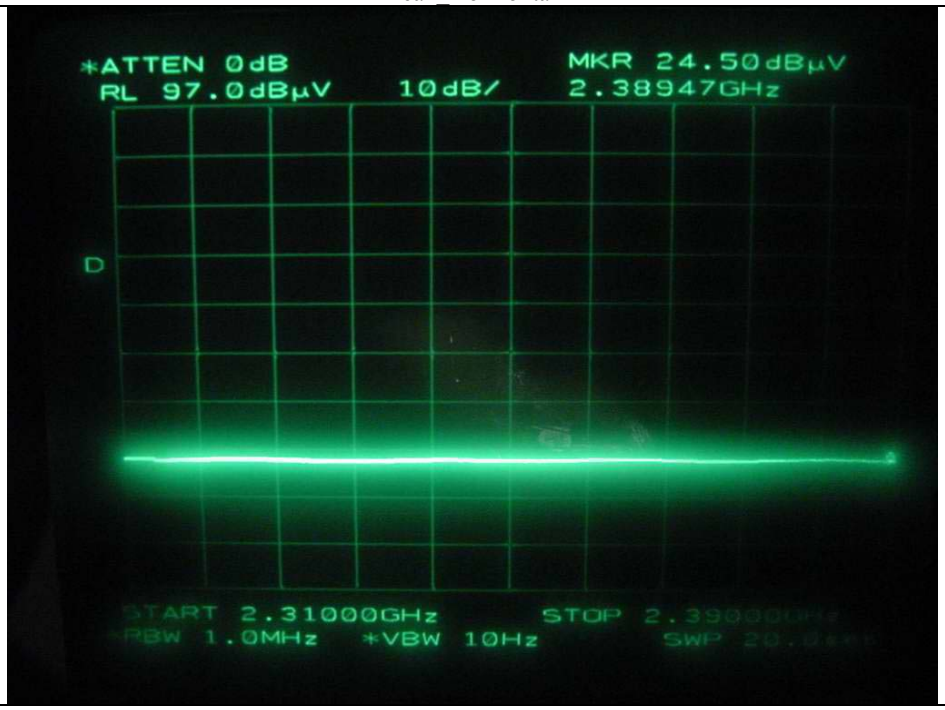


Peak_Horizontal



Average_Horizontal

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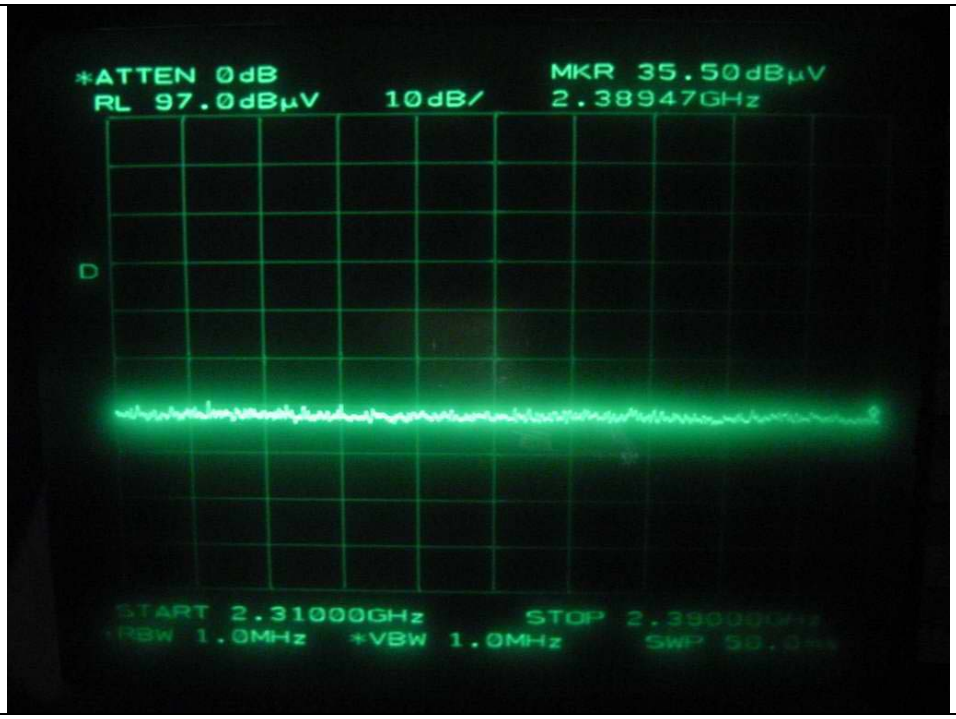
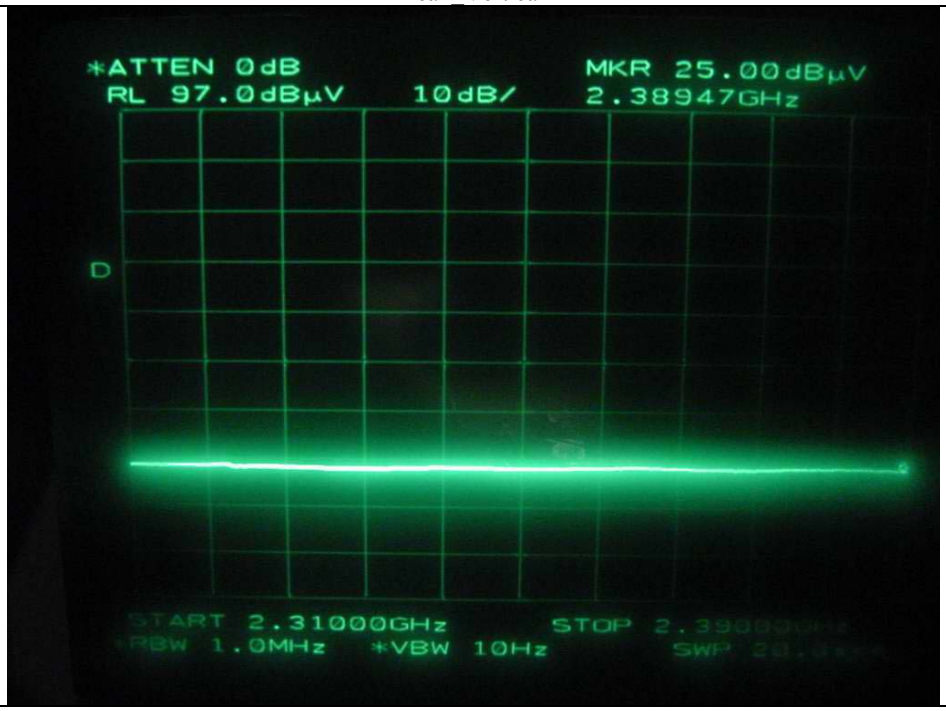


Peak_Vertical



Average_Vertical

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EMC Testing Dept : 307-51 Daessangryung-Ri, Chowol-Eup, Kwangju-City, Kyunggi-Do 464-860 Korea. (TEL: 82-31-765-8289 FAX: 82-31-766-2904)

-. Operating Condition: High Channel

-. Test Date : May 09, 2006

-. 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 –27.36dB

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	32.33	Peak	H	27.59	1.33	26.10	35.15	74.00	-38.86
	23.83	Average					26.65	54.00	-27.36
	34.33	Peak	V				37.15	74.00	-36.86
	23.67	Average					26.49	54.00	-27.52

Tabulated test data for Restricted Band

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

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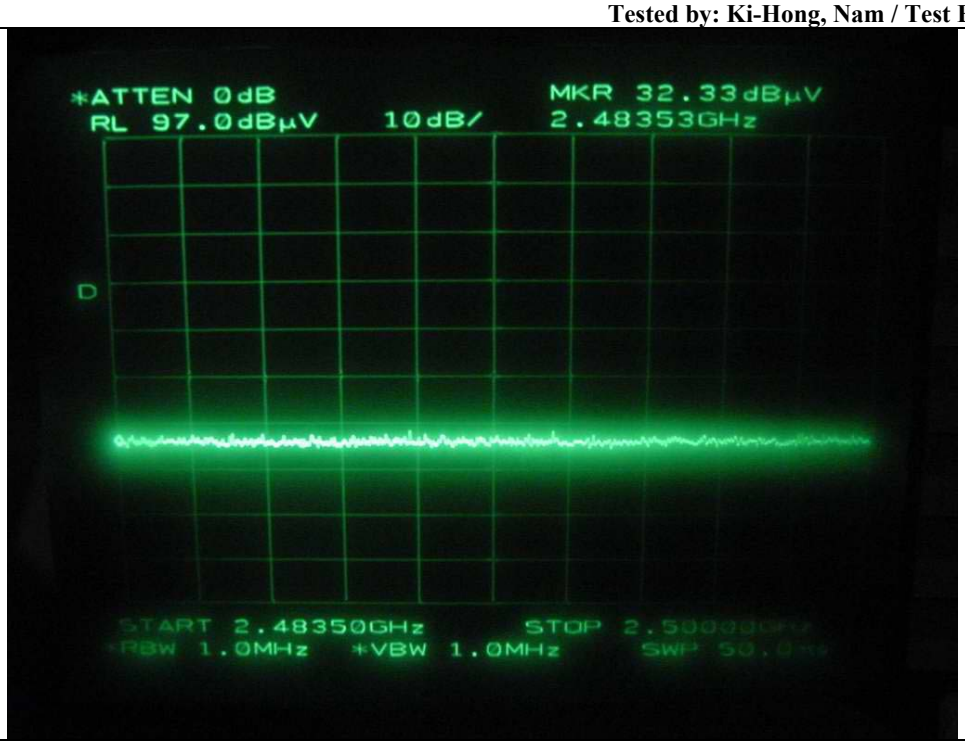
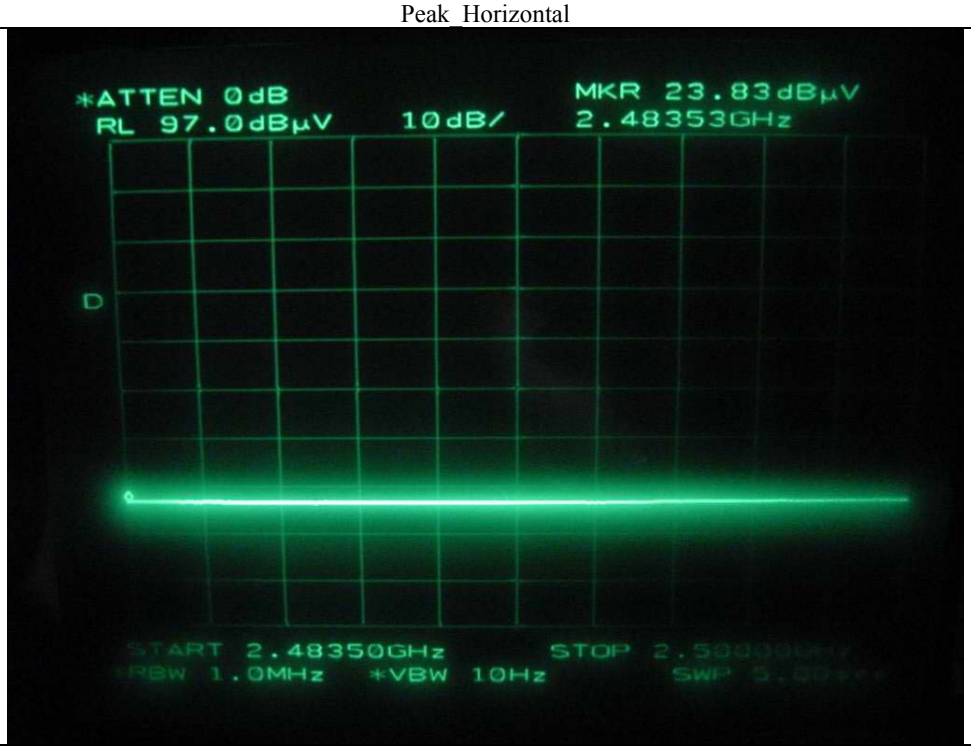
Tested by: Ki-Hong, Nam / Test Engineer



Peak_Horizontal



Average_Horizontal

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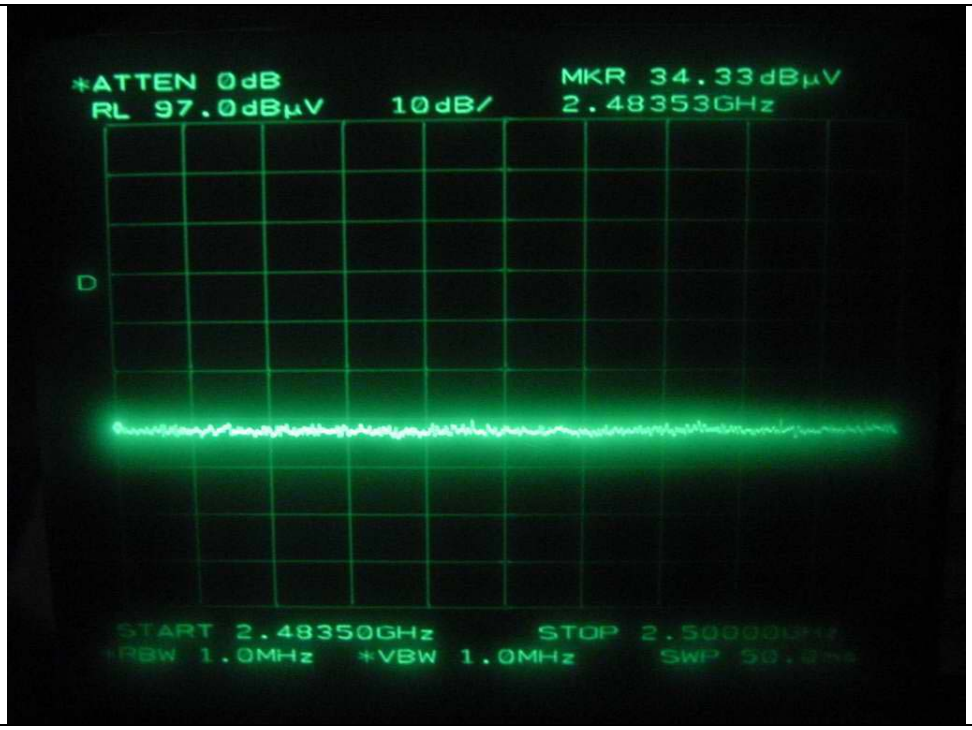
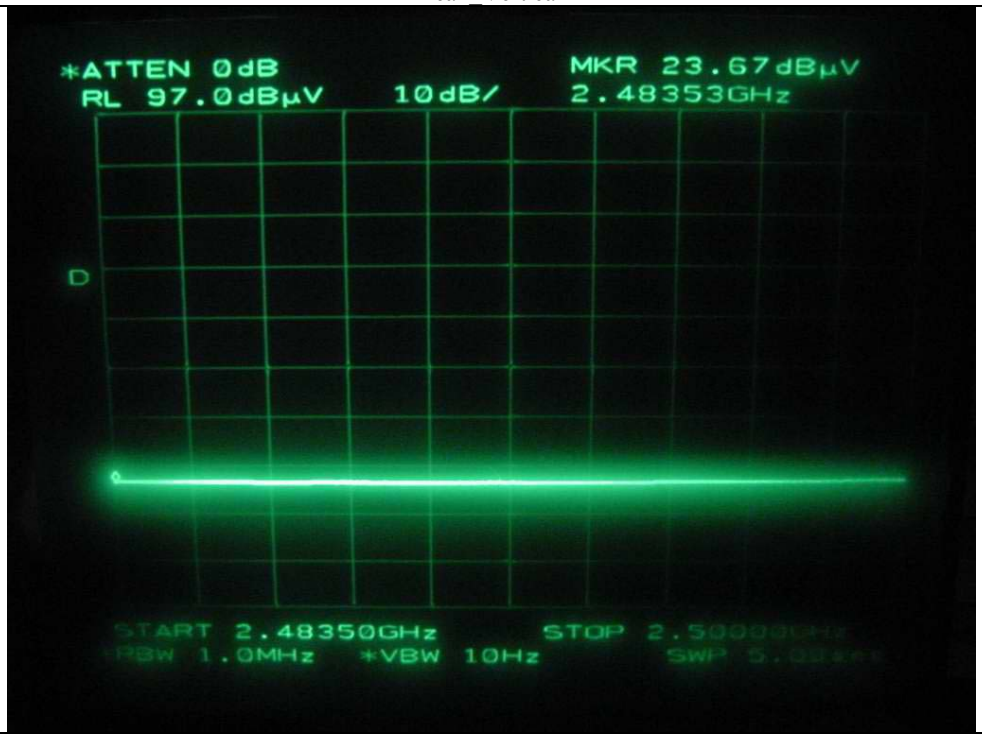


Peak_Vertical



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Average_Vertical

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13.5.2.2. Spurious & Harmonic Radiated Emission

-. Test Date : May 09, 2006

-. 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 –22.97 dB at Middle 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										
2402.00	59.00	Peak	H	27.62	1.33	-	-	87.95	-	-
	57.33	Peak	V					86.28	-	-
4804.00*	35.50	Peak	H	31.27	2.63	26.10	-	40.30	74.00	-33.71
	22.67	Average	H					30.47	54.00	-23.54
	32.33	Peak	V					40.13	74.00	-33.88
	23.17	Average	V					30.97	54.00	-23.04
Test Data for Middle Channel										
2441.00	58.50	Peak	H	27.60	1.33	-	-	87.43	-	-
	57.33	Peak	V					86.26	-	-
4882.00*	32.67	Peak	H	31.38	2.58	26.10	-	40.53	74.00	-33.47
	23.17	Average	H					31.03	54.00	-22.97
	33.00	Peak	V					40.86	74.00	-33.14
	22.83	Average	V					30.69	54.00	-23.31

Tabulated test data for Restricted Band

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

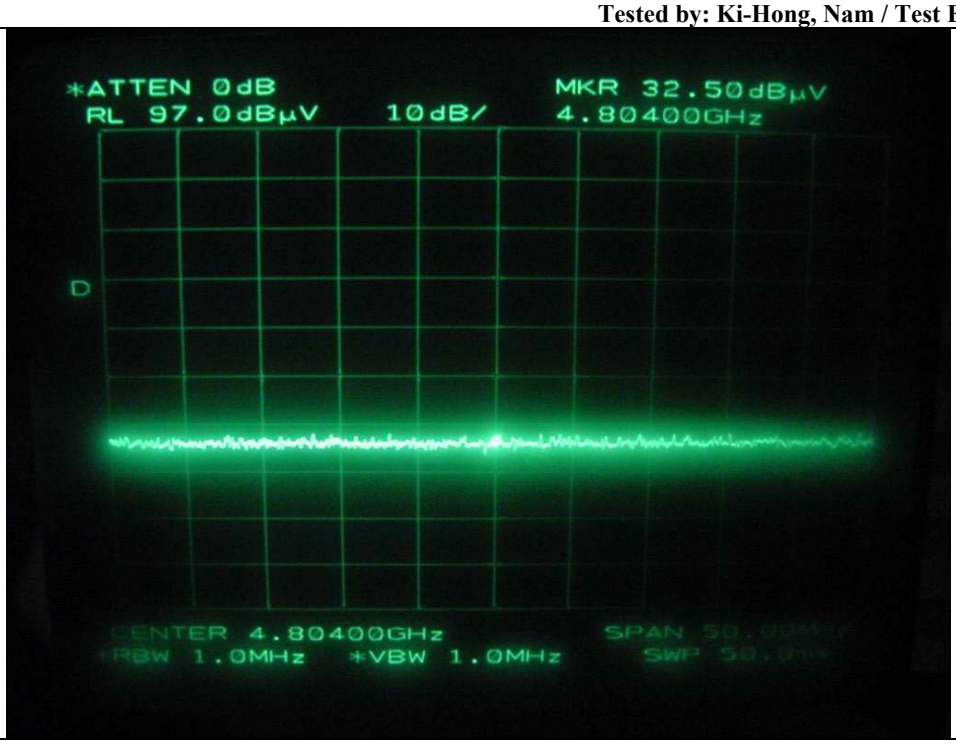
-Continued

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 High Channel										
2480.00	57.50	Peak	H	27.59	1.33	-	-	86.42	-	-
	57.00	Peak	V					85.92	-	-
4960.00*	32.83	Peak	H	31.49	2.53	26.10	-	40.75	74.00	-33.25
	22.50	Average	H					30.42	54.00	-23.58
	33.17	Peak	V					41.09	74.00	-32.91
	22.83	Average	V					30.75	54.00	-23.25

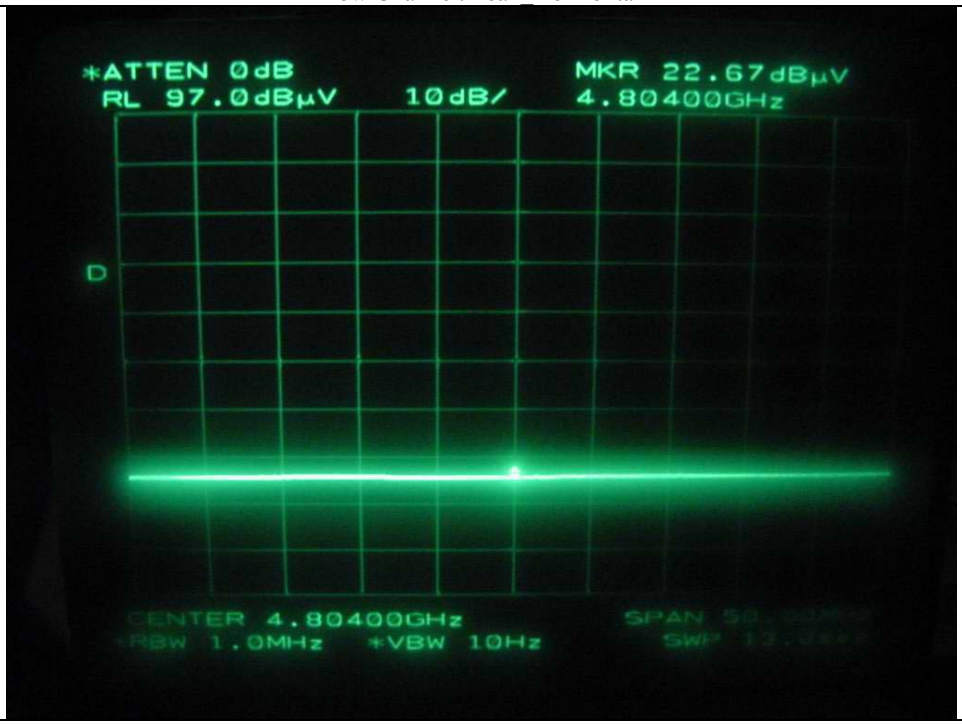
Tabulated test data for Restricted Band

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

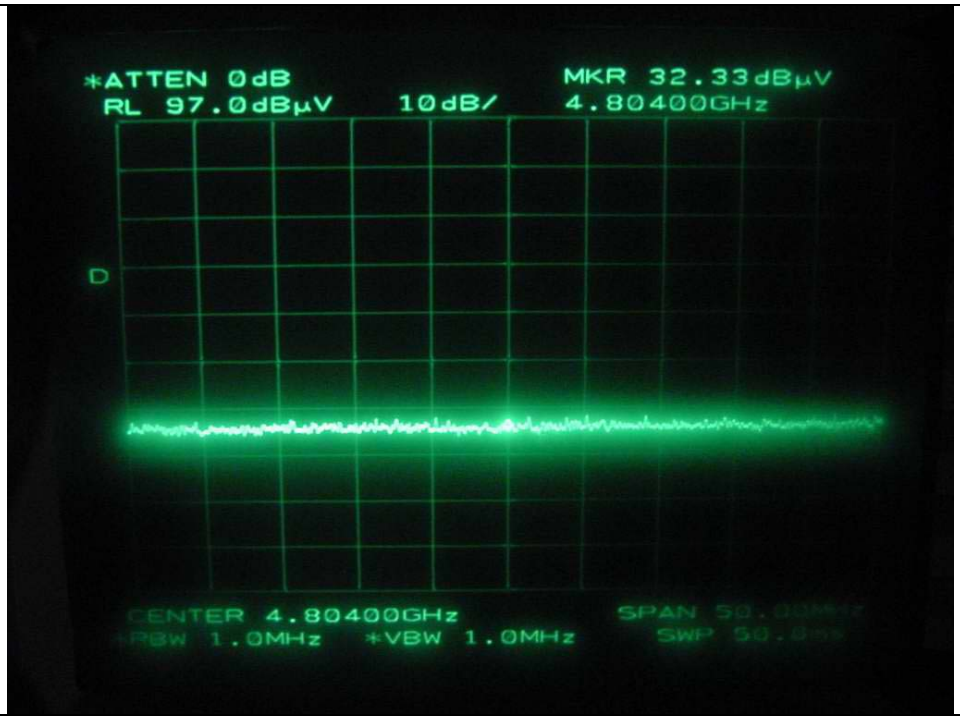
Tested by: Ki-Hong, Nam / Test Engineer



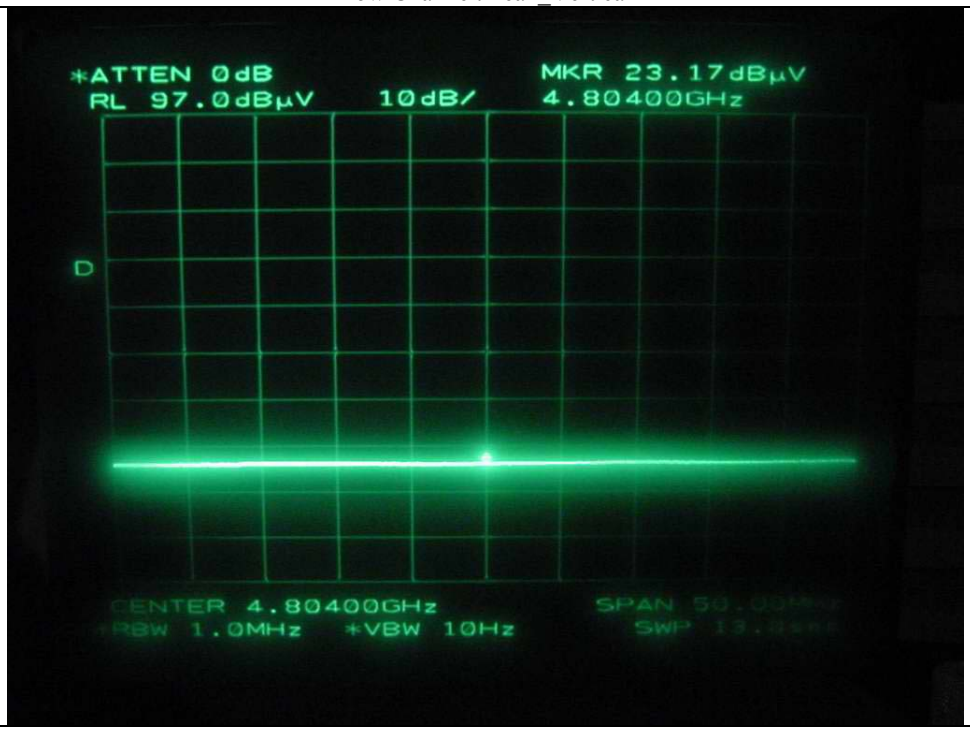
Low Channel: Peak_Horizontal



Low Channel: Average_Horizontal



Low Channel: Peak_Vertical



Low Channel: Average_Vertical

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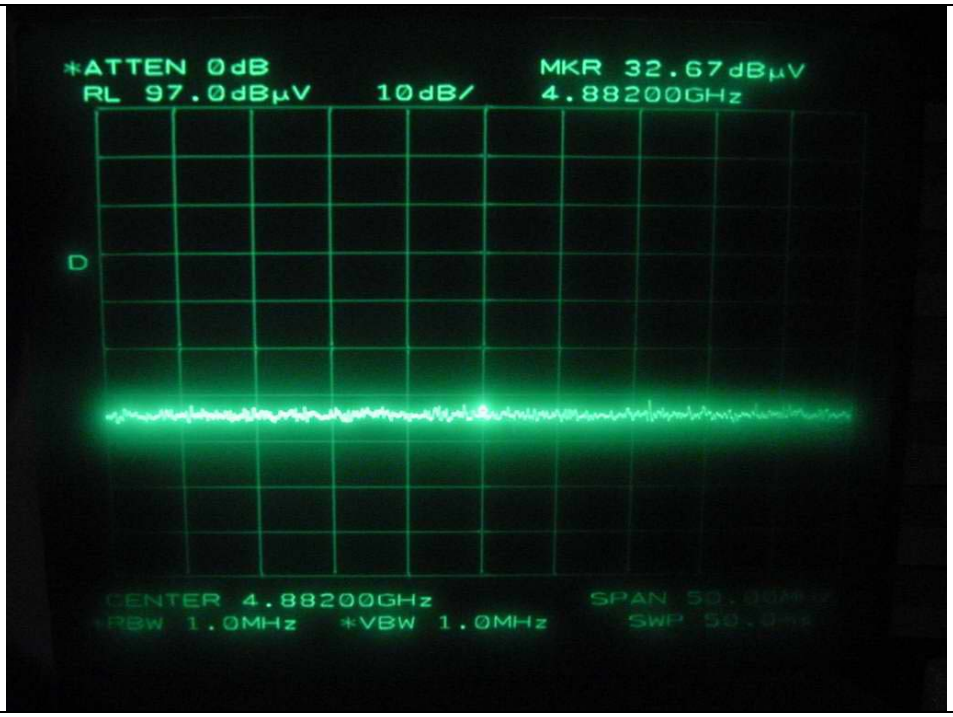
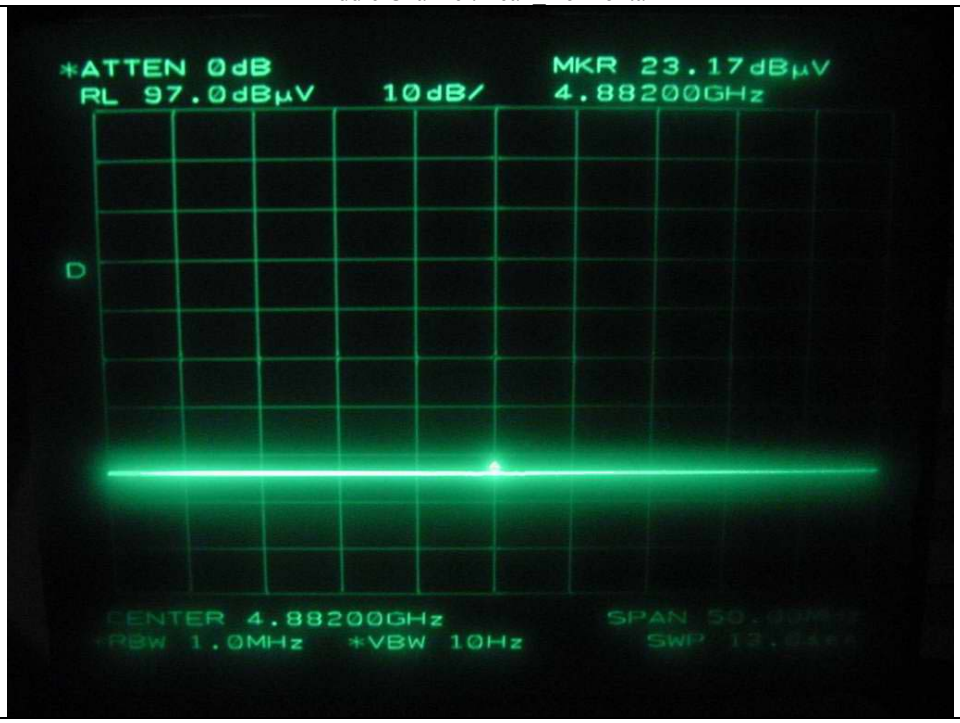


Middle Channel: Peak_Horizontal



Middle Channel: Average_Horizontal

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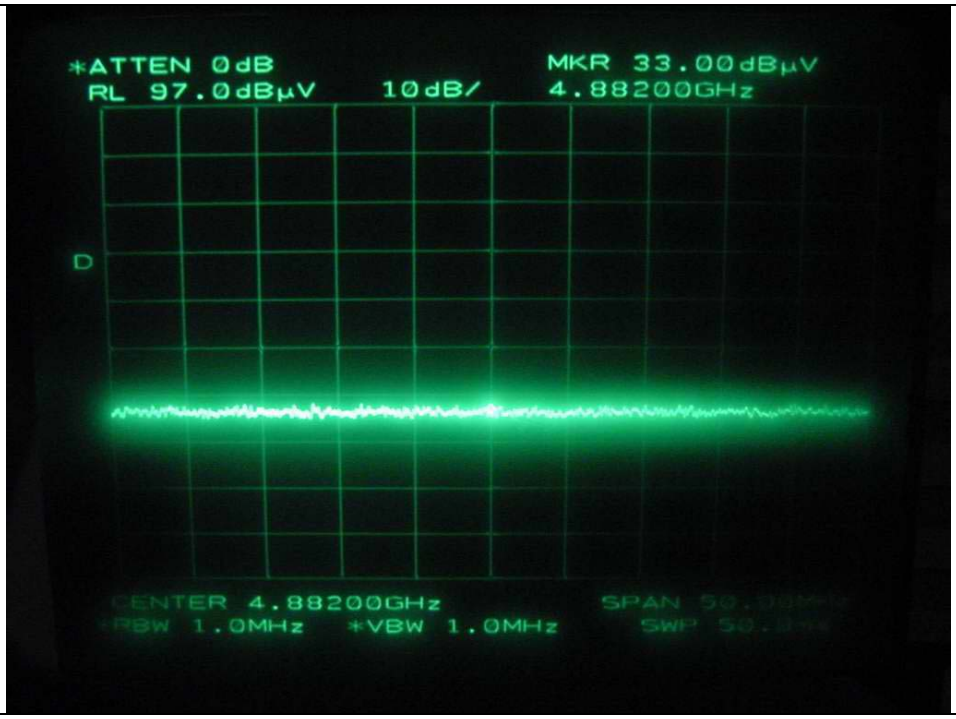
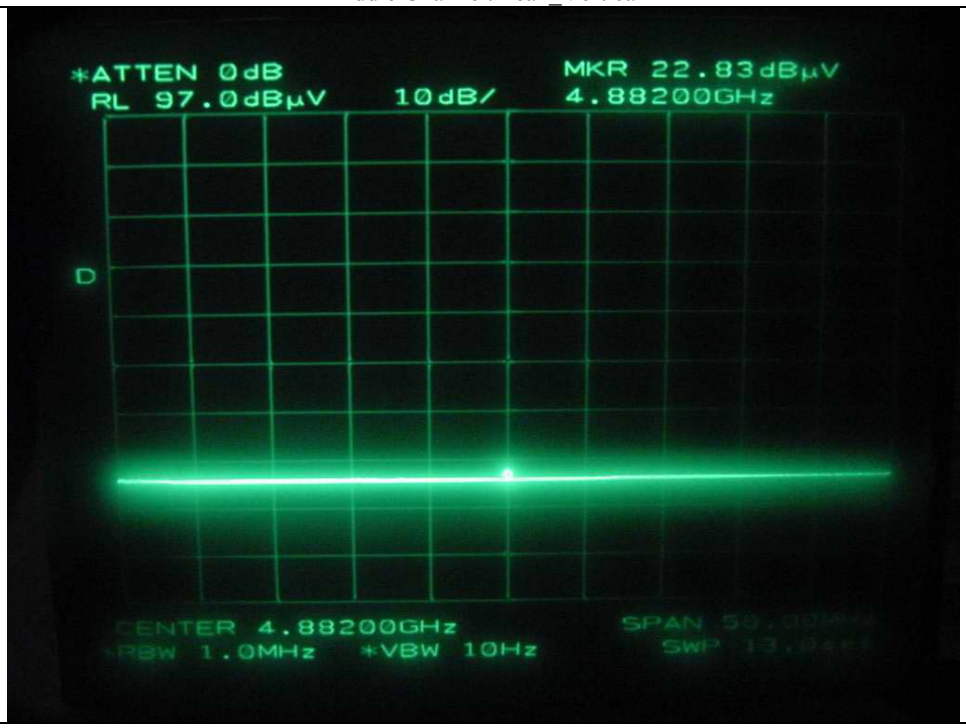


Middle Channel: Peak_Vertical



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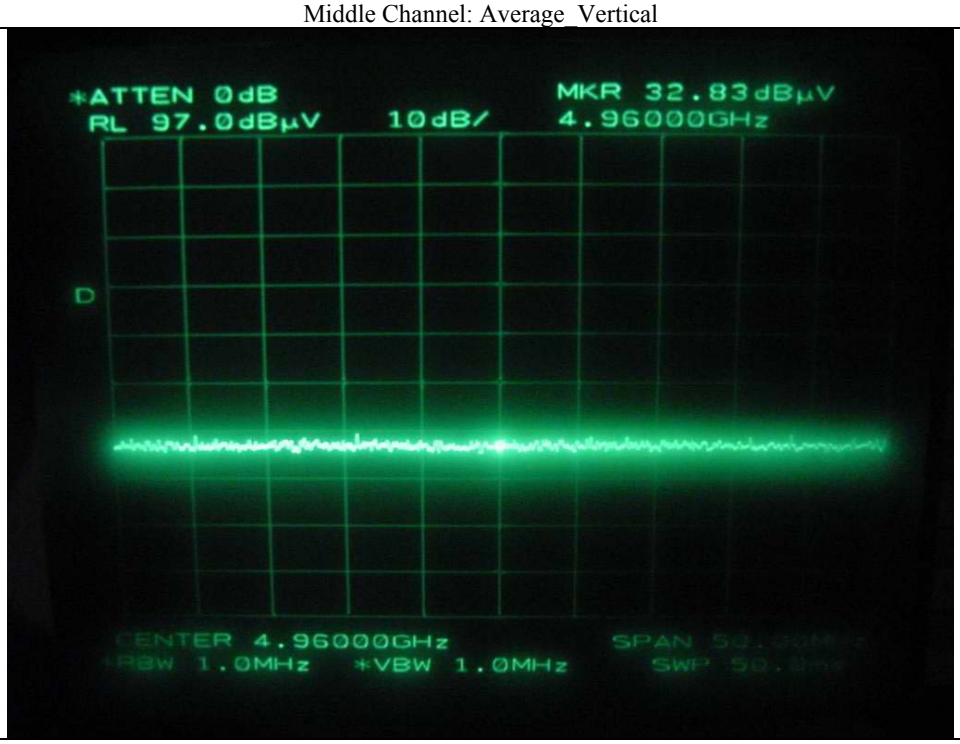
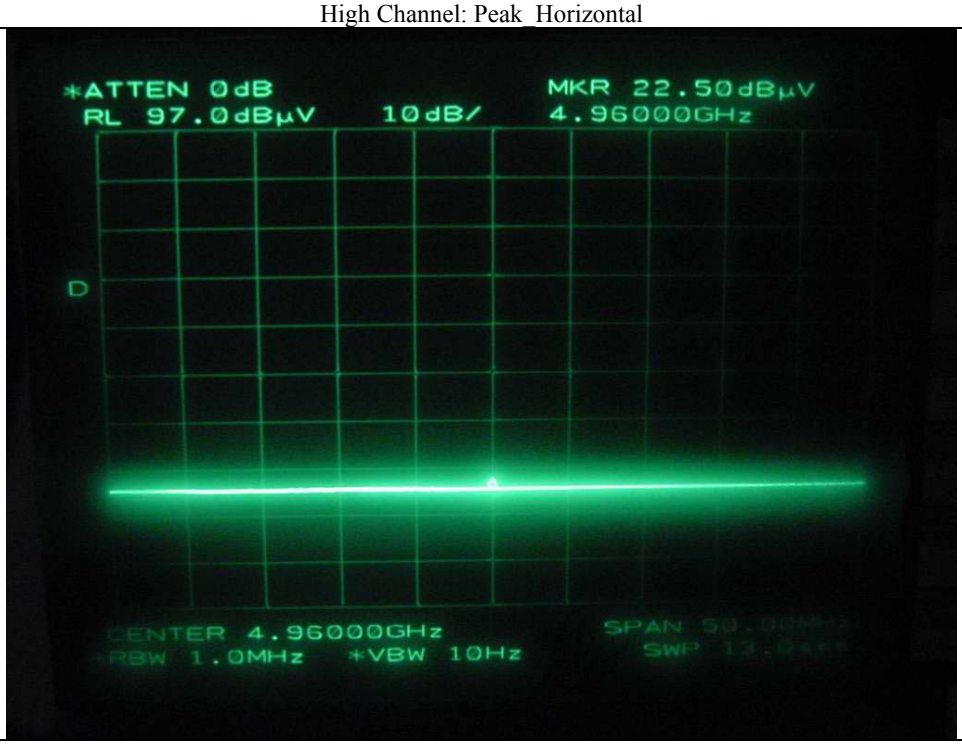
Middle Channel: Average_Vertical



High Channel: Peak_Horizontal



High Channel: Average_Horizontal

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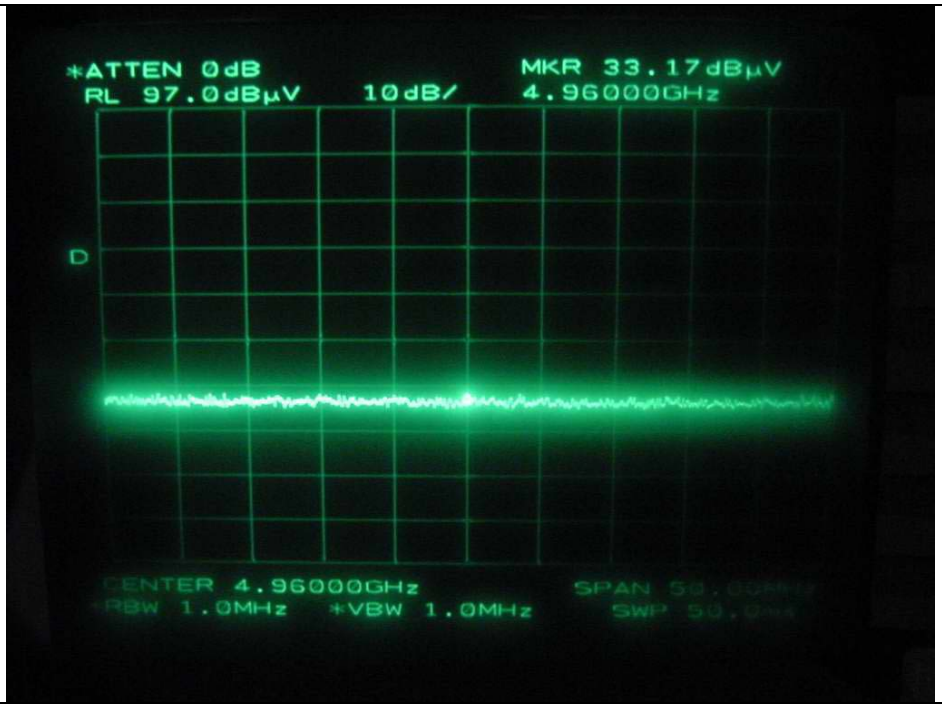
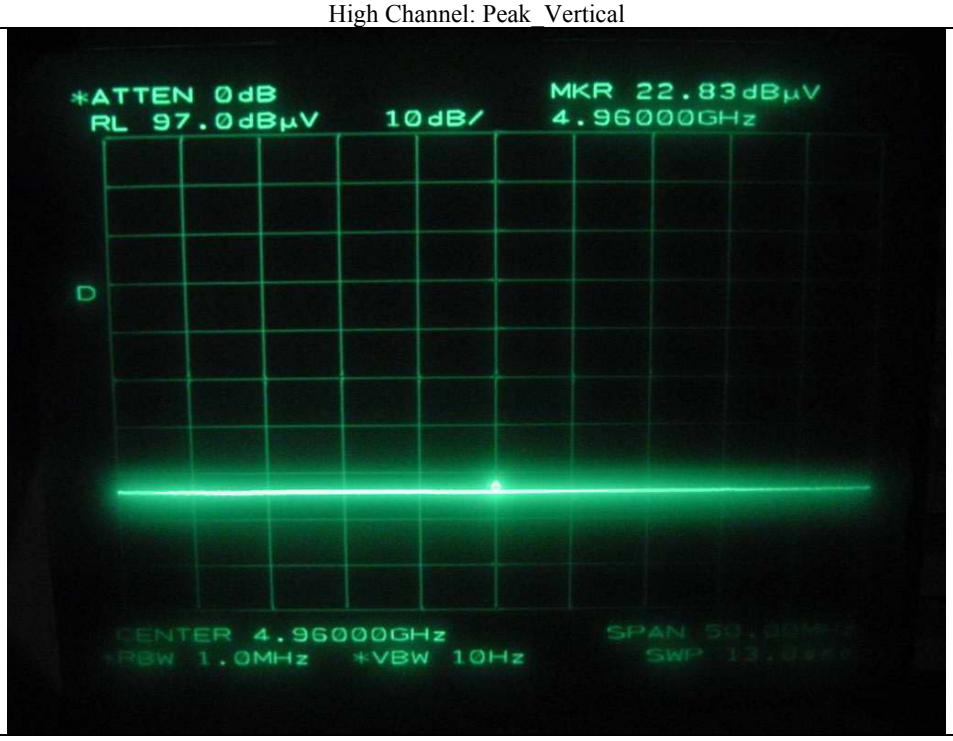


High Channel: Peak_Vertical



High Channel: Average_Vertical

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14. PEAK POWER SPECTRUL DENSITY

14.1 Operating environment

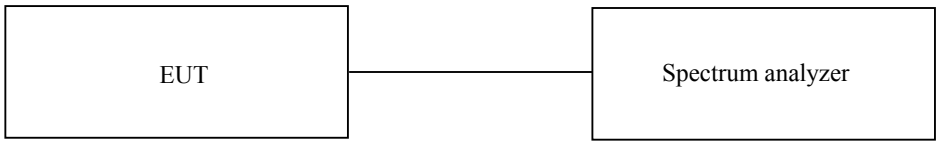
Temperature : 25°C

Relative humidity : 48 %

14.2 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 same as above resolution, 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.



14.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due Cal
■ -	8564E	HP	Spectrum Analyzer	3650A00756	July 19, 2006

All test equipment used is calibrated on a regular basis.

14.4 Test data

-. Test Date : May 02, 2006

-. Result : PASSED BY –23.67 dB at Middle Channel

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2402	-16.00	8.0	-24.00
Middle	2441	-15.67	8.0	-23.67
High	2480	-17.33	8.0	-25.33

Tabulated test data for Peak Power Spectral Density.

Remark: See next page for measurement data.

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Tested by: Ki-Hong, Nam / Test Engineer

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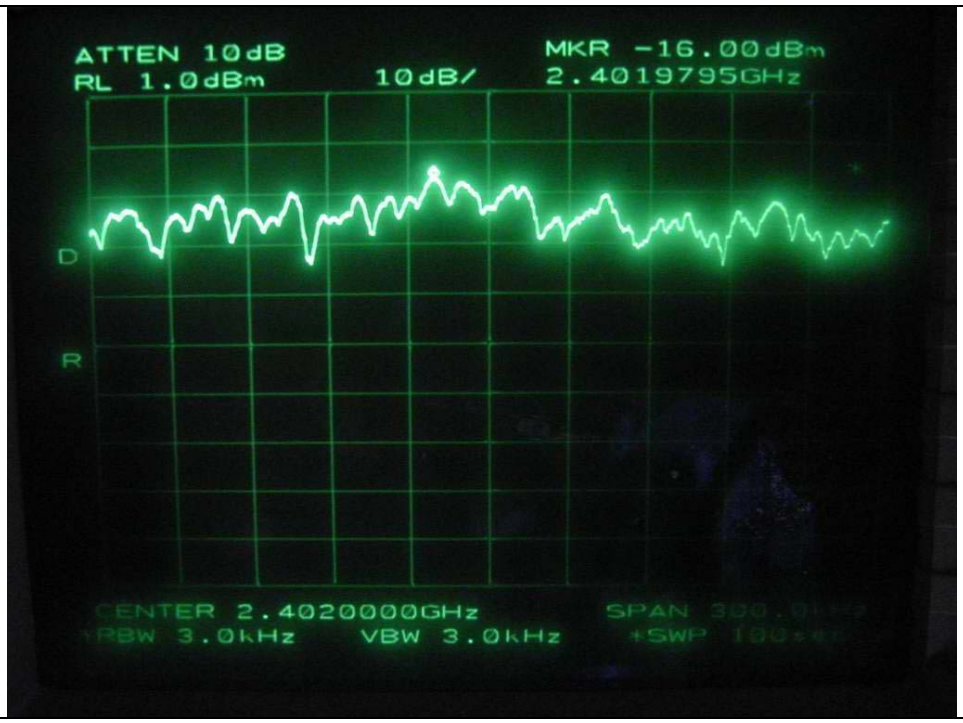
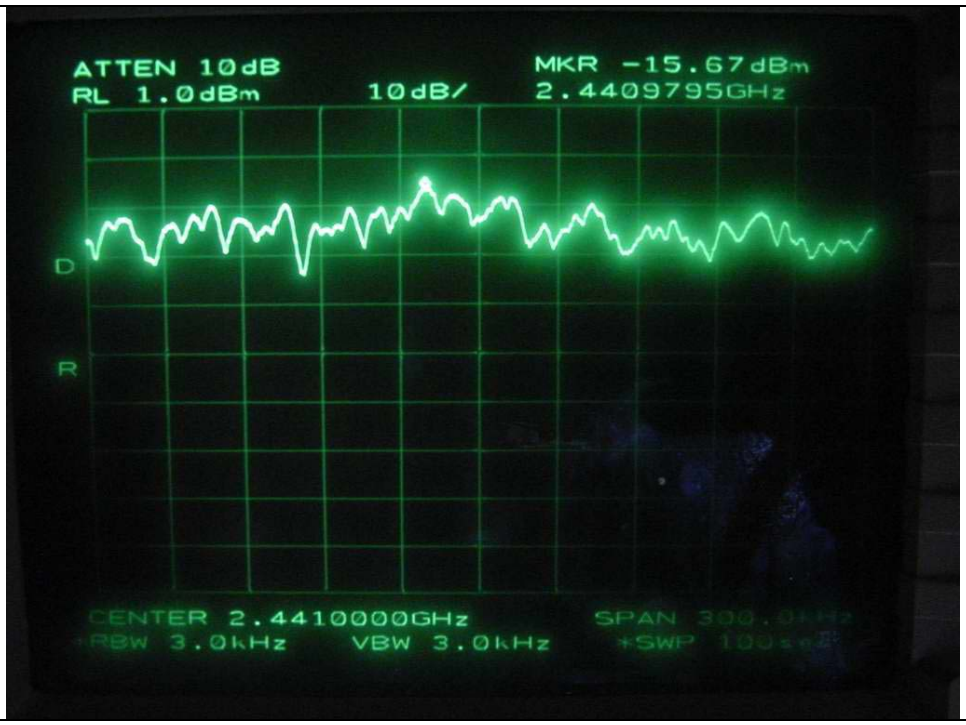
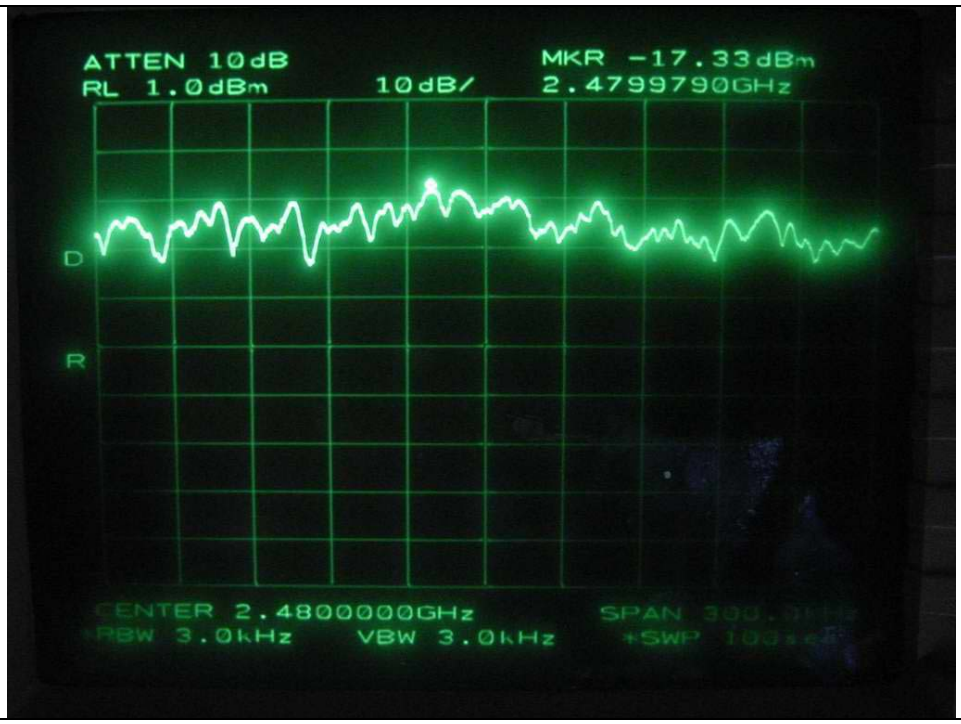


Low Channel



Middle Channel



High Channel

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15. RADIATED EMISSION TEST, GENERAL REQUIREMENT

15.1 Operating environment

Temperature : 23°C

Relative humidity : 42 %

15.2 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.

15.3 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

15.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due Cal.
■ -	ESVS10	Rohde & Schwarz	EMI Test Receiver	827864/005	Dec. 20, 2006
■ -	85650A	Hewlett Packard	Quasi-Peak Adapter	3107A01550	July. 18, 2006
■ -	8568B	Hewlett-Packard	Spectrum Analyzer	2445A00947	July. 18, 2006
■ -	85685A	Hewlett-Packard	RF Preselector	3650A00756	July. 18, 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	Feb. 13, 2007
■ -	UHALP9018A	Schwarz beck	Log Periodic Antenna	62281001	Feb. 13, 2007
■ -	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.

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15.5 Test data

-. Test Date : May 03, 2006

-. Resolution bandwidth : 120 kHz

-. Frequency range : 30MHz ~ 1000MHz

-. Measurement distance : 3m

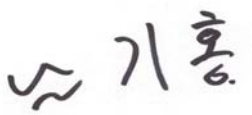
-. Operating Condition : Max Transmitting Mode at Low / Middle / High Channel

-. Result : PASSED BY –8.92 dB at 49.38 MHz

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
49.38	18.20	H	11.36	1.52	31.08	40.00	-8.92
72.63	17.30	V	5.78	1.55	24.63	40.00	-15.37
115.27	15.36	H	12.05	1.95	29.36	43.52	-14.16
200.55	14.70	H	16.20	2.80	33.70	43.52	-9.82
350.74	16.30	V	16.06	4.20	36.56	46.02	-9.46
558.12	10.60	H	19.63	5.30	35.33	46.02	-10.49

Tabulated test data for Radiated Electromagnetic Field

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



Tested by: Ki-Hong, Nam / Test Engineer

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16. CONDUCTED EMISSION TEST

16.1 Operating environment

Temperature : 21°C

Relative humidity : 49 %

16.2 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.

16.3 Measurement uncertainty

Conducted emission, quasi-peak detect : ±3.0 dB

Conducted emission, average detect : ±3.0 dB

16.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Due Cal.
■ -	ESHS10	Rohde & Schwarz	EMI Test Receiver	834467/007	May 15, 2007
■ -	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.

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16.5 Test data

-. Test Date : September 06, 2005

-. Resolution bandwidth : 9 kHz

-. Frequency range : 0.15MHz ~ 30MHz

-. Operating Condition : Battery Charging Mode

-. Result : PASSED BY – 8.70 dB at 0.785 MHz with peak detector mode

Frequency (MHz)	Line	Quasi-Peak (dBuV)			Margin (dB)	Average (dBuV)		Margin (dB)
		Emission level	Detect Mode	Limits		Emission level	Limits	
0.165	N	45.03	P	65.21	-20.18	32.51	55.21	-22.70
0.335	H	46.53	P	59.33	-12.80	27.18	49.33	-22.15
0.450	N	46.42	P	56.88	-10.46	23.20	46.88	-23.68
0.730	N	46.56	P	56.00	-9.44	26.61	46.00	-19.39
0.785	H	47.30	P	56.00	-8.70	27.57	46.00	-18.43
1.230	H	46.15	P	56.00	-9.85	21.93	46.00	-24.07

Line Conducted Emissions Tabulated Data

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

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

Tested by: Ki-Hong, Nam / Test Engineer

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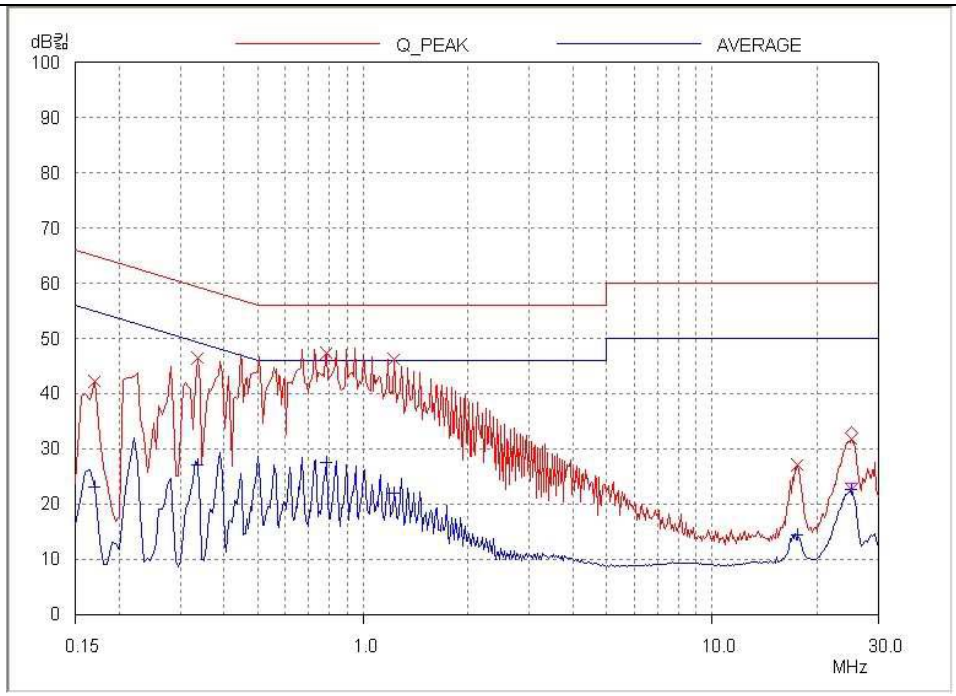
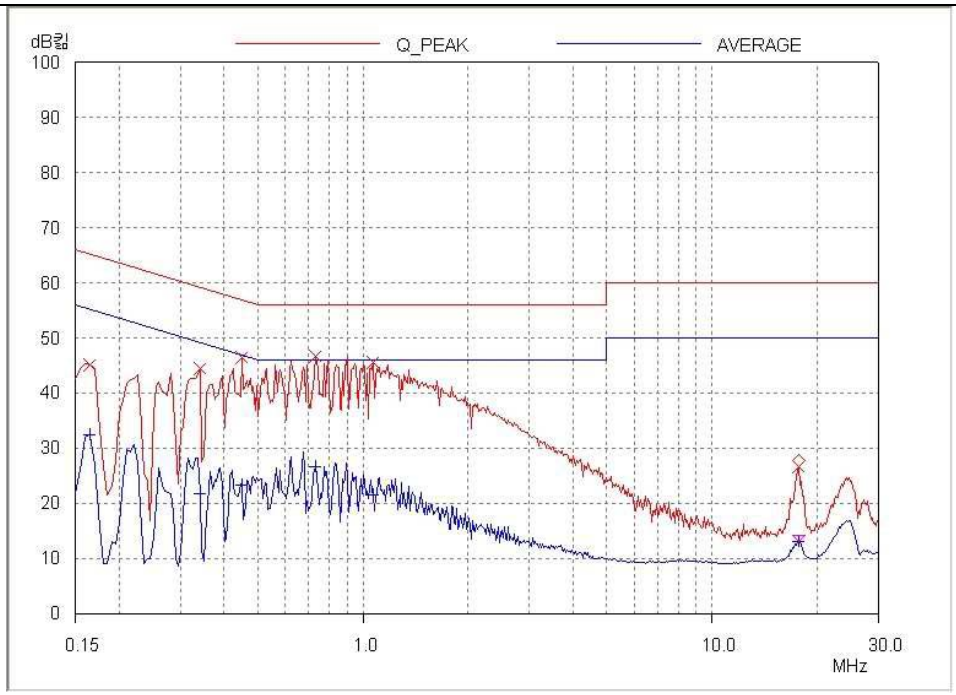


HOT LINE



NEUTRAL LINE

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